Welcome to the TS3989EN Troubleshooting Manual. We make every effort to keep our service information current and accurate. Because of the time lag involved with writing and printing processes, the transmission TCM may report a code that has not yet been added to this document. If you encounter a code that is not yet in this publication, please call the Allison Transmission Technical Assistance Center at 1-800-252-5283.

Go to the Table of Contents

Troubleshooting Manual

2005 DECEMBER

TS3989EN

Allison Transmission

VOCATIONAL MODELS

3000 VOCATIONAL MODELS

3000 HS	3500 RDS			B 300(P)(R)
3000 RDS	3500 EVS			B 400(P)(R)
3000 EVS				T 200
3000 MH				T 300
3000 PTS				
3000 TRV				
3200 SP	3500 SP	3700 SP		
3200 TRV				

4000 VOCATIONAL MODELS

4000 EVS	4500 EVS	4700 EVS	4800 EVS	B 500
4000 HS	4500 HS	4700 RDS		B 500P
4000 MH	4500 RDS			B 500R
4000 RDS	4500 SP			B 500PR
4000 TRV	4500 TRV			T 425
				T 450

Allison Transmission, General Motors Corporation
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www.allisontransmission.com

Printed in USA

FOREWORD — How to Use This Manual

This manual provides troubleshooting information for the 3000 and 4000 Product Families Transmissions. Service Manuals SM4013EN and SM4014EN, plus Parts Catalogs PC2150EN and PC2456EN may be used in conjunction with this manual.

This manual includes:

- Description of the 3000 and 4000 Product Families Allison 4TH Generation Electronic Control system.
- Description of the electronic control system components.
- Description of diagnostic codes, system responses to faults, and troubleshooting.
- Wire, terminal, and connector repair information.

Specific instructions for using many of the available or required service tools and equipment are not included in this manual. The service tool manufacturer will furnish instructions for using the tools or equipment.

Additional information may be published from time to time in Service Information Letters (SIL) and will be included in future revisions of this and other manuals. Please use these SILs to obtain up-to-date information concerning Allison Transmission products.

This publication is revised periodically to include improvements, new models, special tools, and procedures. A revision is indicated by a new date on the title page and in the lower left corner of the rear cover. Check with your Allison Transmission service outlet for the currently applicable publication. Additional copies of this publication may be purchased from authorized Allison Transmission service outlets. Look in your telephone directory under the heading of Transmissions — Truck, Tractor, etc.

Take time to review the Table of Contents and the manual. Reviewing the Table of Contents will aid you in quickly locating information.

NOTE: ***Allison Transmission is providing for service of wiring harnesses and wiring harness components as follows:***

- ***Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission (AT) is responsible for warranty on these parts.***
- ***Repair parts for the external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes AT, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI will have parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:***

St. Clair Technologies, Inc.
920 Old Glass Road
Wallaceburg, Ontario, N8A 4L8
Phone: 519-627-1673
Fax: 519-627-4227

St. Clair Technologies, Inc.
Calle Damanti S/N Col
Guadalupe—Guaymas
Sonora, Mexico 85440
Phone: 011-526-2222-43834
Fax: 011-526 2222-43553

IMPORTANT SAFETY NOTICE

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions used in this manual. These warnings and cautions advise against using specific service procedures 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. Consequently, Allison Transmission has not undertaken any such broad evaluation. Accordingly, ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ALLISON TRANSMISSION MUST first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service procedures used.

Also, be sure to review and observe WARNINGS, CAUTIONS, and NOTES provided by the vehicle manufacturer and/or body builder before servicing the Allison transmission in that vehicle.

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

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

WARNINGS, CAUTIONS, AND NOTES

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

WARNING!	**Is used when an operating procedure, practice, etc., which, if not correctly followed, could result in injury or loss of life.**

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

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

TRADEMARKS USED IN THIS MANUAL

The following trademarks are the property of the companies indicated:

- Allison DOC™ is a trademark of General Motors Corporation.
- DEXRON® is a registered trademark of General Motors Corporation.
- LPS® Cleaner is a registered trademark of LPS Laboratories.
- Loctite® is a registered trademark of the Loctite Corporation.
- MagiKey® is a registered trademark of NEXIQ Technologies, Inc.
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- TranSynd™ is a trademark of Castrol Ltd.

SHIFT SELECTOR TERMS AND DISPLAY INDICATIONS

Shift selector terms and displays are represented in this manual as follows:

- Button Names — ↑, ↓, "display mode", **MODE**, etc.
- Transmission Ranges — **D** (Drive), **N** (Neutral), **R** (Reverse), **1** (First), **2** (Second), etc.
- Displays — "**o**, **L**"; "**o**, **K**", etc. (Display occurs one character at a time.)

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APPENDICES

SECTION 1—GENERAL DESCRIPTION

1–1. TRANSMISSION

The Allison 4th Generation Controls feature closed-loop clutch control to provide superior shift quality over a wide range of operating conditions. The 3000 and 4000 Product Families transmissions configurations can be programmed to have up to six forward ranges, neutral, and one reverse range. The MD 3070, 3700 SP, HD 4070/4076, 4700 RDS, 4700/4800 EVS, 4700/4800 SP have up to seven forward ranges and one reverse.

Figure 1–1 is a block diagram of the basic system inputs and outputs.

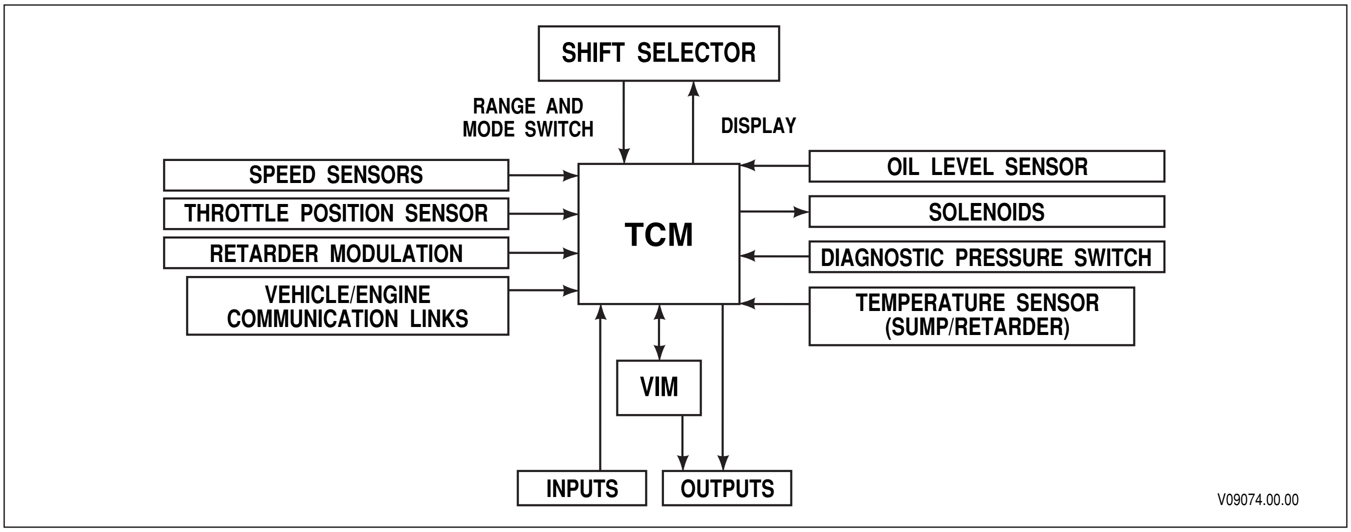

Figure 1–1. Transmission Control Module

Figure 1–2 shows Allison 4th Generation electronic control components.

Allison 4th Generation Controls consist of the following elements:

- Remote 12V or 12/24V Max Feature Sealed Transmission Control Module (TCM)
- Remote Pushbutton or Lever Shift Selector
- Optional Secondary Shift Selector
- Throttle Position Sensor (TPS) (or electronic engine throttle data or PWM signal)
- Engine, Turbine, and Output Speed Sensors
- Control Module (Electro-Hydraulic Valve Body)
- Wiring Harnesses
- Vehicle Interface Module (VIM)
- Autodetect Feature
- TransID Feature
- Optional Retarder Controls
- Optional Engine Coolant Temperature Input.

NOTE:
- ***All external harnesses are OEM supplied.***
- ***The VIM is an OEM option.***

GENERAL DESCRIPTION

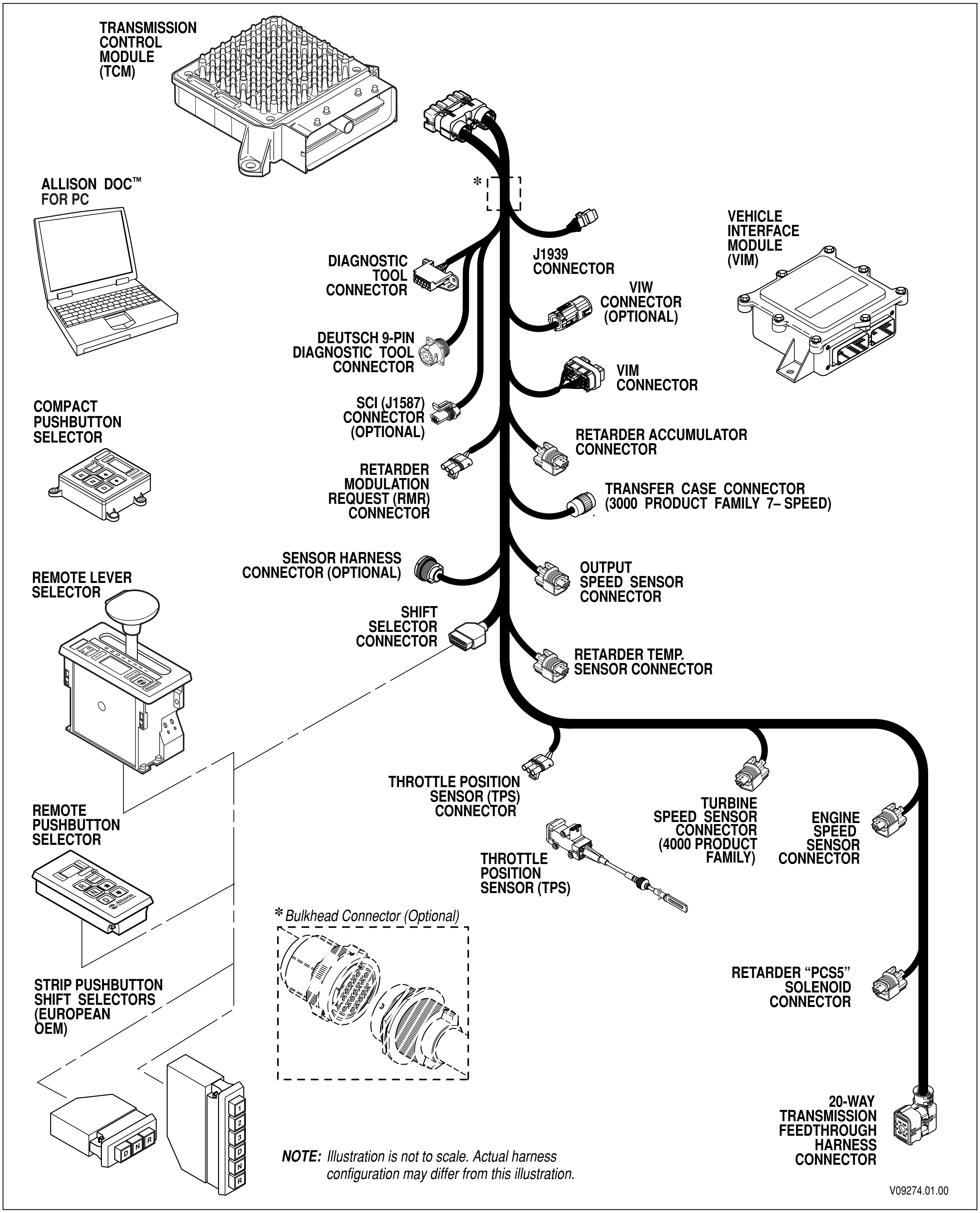

Figure 1–2. Typical Allison 4th Generation Control Components

GENERAL DESCRIPTION

1–2. TRANSMISSION CONTROL MODULE (TCM)

The electronic control of the transmission is performed by a microcomputer. The microcomputer is an independent controller and is referred to as a Transmission Control Module (TCM). TCMs are available in both 12V and 12/24V configurations to match the configuration of the vehicle electrical system.

The TCM (Figure 1–3) contains the microcomputer which is the brain of the control system. The TCM receives and processes information defining:

- Shift selector
- Throttle position
- Sump/retarder temperature
- Pressure switch state
- Engine speed
- Turbine speed
- Transmission output speed.

The TCM uses the information to:

- Control transmission solenoids
- Supply system status
- Provide diagnostic information.

Each TCM has a date code laser etched on the outer case of the TCM. This is the date when the TCM passed final testing. This date is commonly used to denote the change configuration level of the TCM. It is normal for the TCM date displayed electronically to be a few days prior to the date shown on the label.

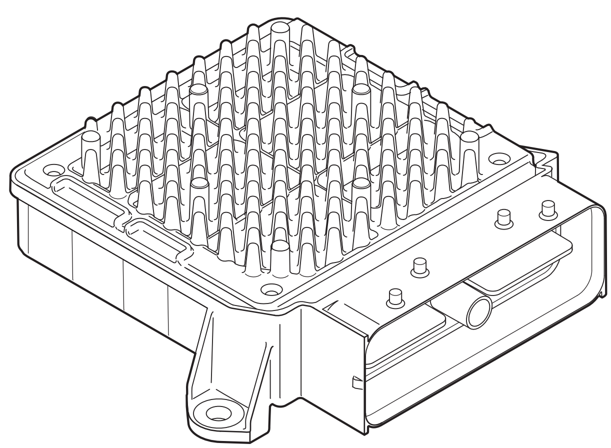

Figure 1–3. Transmission Control Module (TCM)

GENERAL DESCRIPTION

1–3. SHIFT SELECTOR

Pushbutton and lever shift selectors for the Allison 4th Generation Series are remote mounted from the TCM and communicate to the TCM via the J1939 communications data link. All shift selectors except the strip-type pushbutton have a dual digit vacuum fluorescent (VF) display and a mode indicator (LED). During normal transmission operation, illumination of the LED indicator shows that a secondary or special operating condition has been selected by pressing the **MODE** button. During diagnostic display mode, illumination of the LED indicator shows that the displayed diagnostic code is active. Display brightness is regulated by the same vehicle potentiometer that controls dash light display brightness. More information on both types of shift selectors is continued below.

A. Pushbutton Shift Selector *(Figure 1–4)*

There are three full-function pushbutton shift selectors and a strip pushbutton shift selector. Strip pushbutton shift selectors are used primarily by non-North American OEMs. A full-function shift selector has a **MODE** button and diagnostic display capability through the dual digit vacuum fluorescent (VF) display. The strip pushbutton shift selector does not have a **MODE** button, diagnostic capability, or adjustable illumination. The full-function pushbutton shift selector has six (6) pushbuttons which are **R** (Reverse), **N** (Neutral), **D** (Drive), ↓ (Down), ↑ (Up), and **MODE**. Manual forward range downshifts and upshifts are made by pressing the ↓ (Down) or ↑ (Up) arrow buttons after selecting **D** (Drive). The **N** (Neutral) button has a raised lip to aid in finding it by touch. The **MODE** button is pressed to select a secondary or special operating condition, such as ECONOMY shift schedule. Diagnostic information is obtained by pressing the ↑ (Up) and ↓ (Down) arrow buttons at the same time.

The strip pushbutton shift selector has either three or six range selection positions as shown in Figure 1–4. When a strip pushbutton shift selector is used, diagnostic information must be obtained by using the Allison DOC™ For PC–Service Tool, or a customer-furnished remote display.

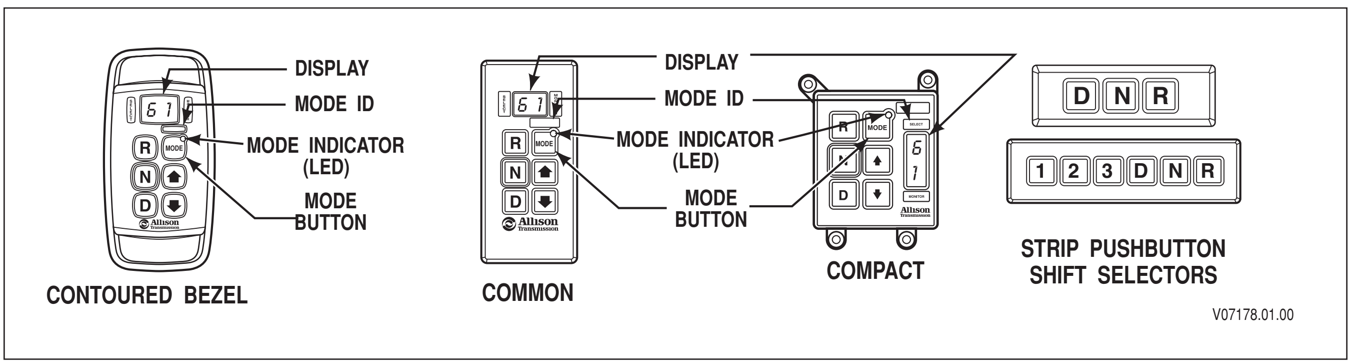

Figure 1–4. Typical Pushbutton Shift Selectors

GENERAL DESCRIPTION

B. Lever Shift Selector *(Figure 1–5)*

The lever shift selector can have as many as six forward range positions (seven for the 7-speed models), as well as **R** (Reverse) and **N** (Neutral). There is a hold override button which **must be pressed** and held in order to move between certain selector positions. The hold override button **must be pressed** when shifting between **R**, **N,** and **D**. The hold override button is released when the desired selector position is reached. The selector lever can be moved freely between **D** and the numbered forward ranges without pressing the hold override button. The lever selector can be chosen with the lever on the left side or on the right side and with the **R** (Reverse) position toward the front or toward the rear of the selector. Diagnostic and oil level (if sensor is present) information is obtained from the LED display by pressing the “display mode” button.

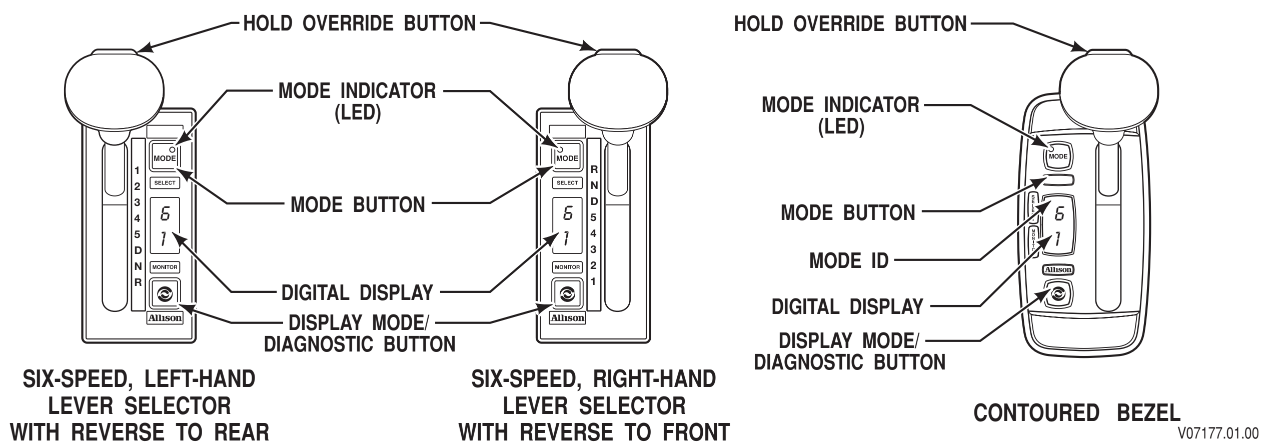

Figure 1–5. Typical Lever Shift Selector

1–4. THROTTLE POSITION SENSOR *(Figure 1–6)*

The Throttle Position Sensor (TPS) can be mounted to the engine, chassis, or transmission. The TPS contains a pull actuation cable and a potentiometer. One end of the cable is attached to the engine fuel lever and the other, inside a protective housing, to the TPS potentiometer. Output voltage from the TPS is directed to the TCM through the external harness. The voltage signal indicates the throttle position and, in combination with other input data, determines shift timing.

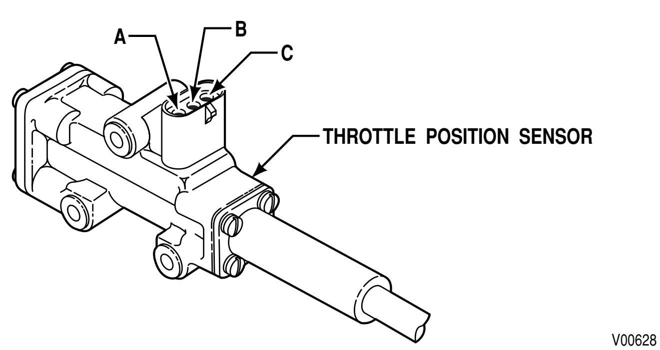

Figure 1–6. Throttle Position Sensor (Without Mounting Brackets)

GENERAL DESCRIPTION

1–5. SPEED SENSORS *(Figure 1–7)*

Three speed sensors—engine speed, turbine speed, and output speed—provide information to the TCM. The engine speed signal is generated by ribs on the shell of the torque converter pump. The turbine speed signal is generated by the rotating-clutch housing spline contours. The output speed signal is generated by a toothed member attached to the output shaft (except for the 3000 Product Family 7-speed models, where the toothed member is the transfer case idler gear). The speed ratios between the various speed sensors allow the TCM to determine if the transmission is in the selected range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the smoothest shifts possible. Hydraulic problems are detected by comparing the speed sensor information for the current range to that range's speed sensor information stored in the TCM memory.

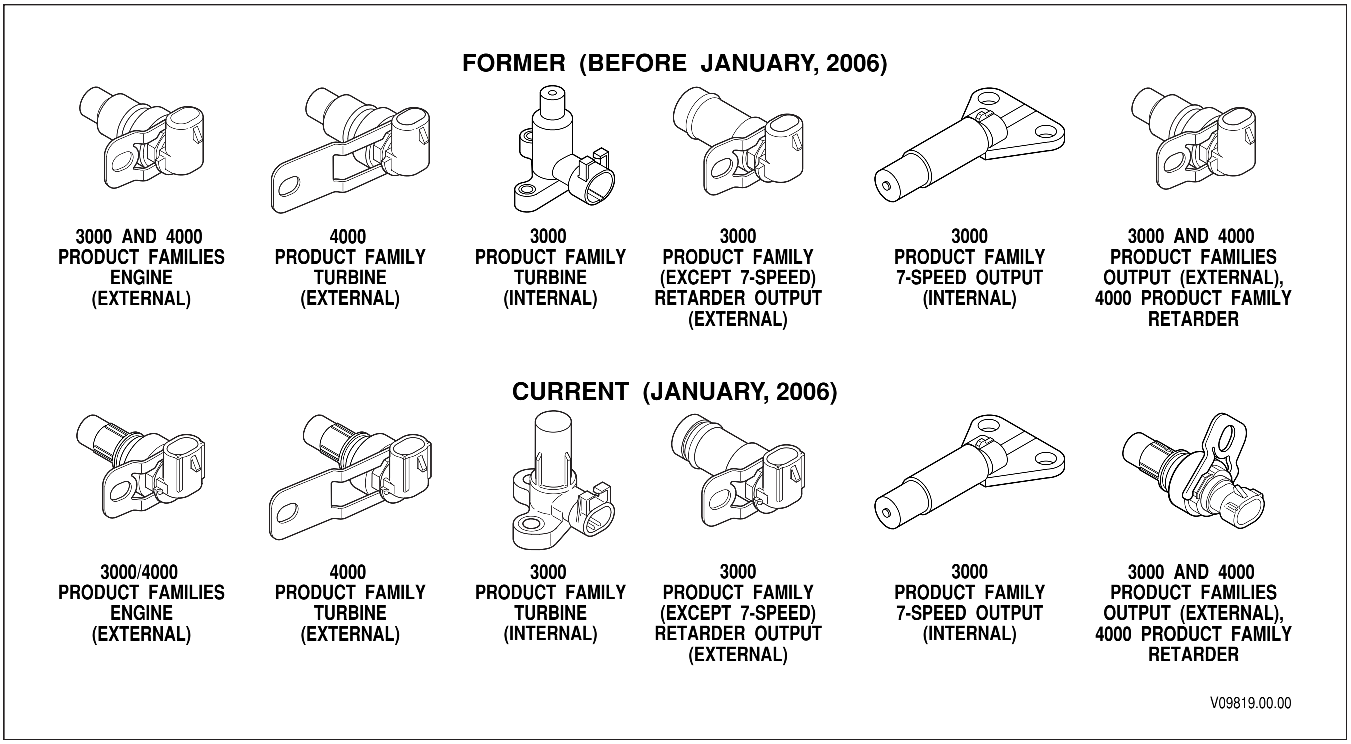

Figure 1–7. Speed Sensors

GENERAL DESCRIPTION

1–6. CONTROL MODULE *(Figure 1–8)*

The Allison 4th Generation Series transmission control module contains a main body assembly and solenoid valve body assembly, which are mounted to an aluminum channel plate. The TCM issues commands to various solenoids in the two valve bodies to govern fluid flow to the clutches (including torque converter clutch). The solenoids produce an output pressure that is proportional to current from the TCM. Hence, the solenoids are referred to as pressure control solenoids (PCS).

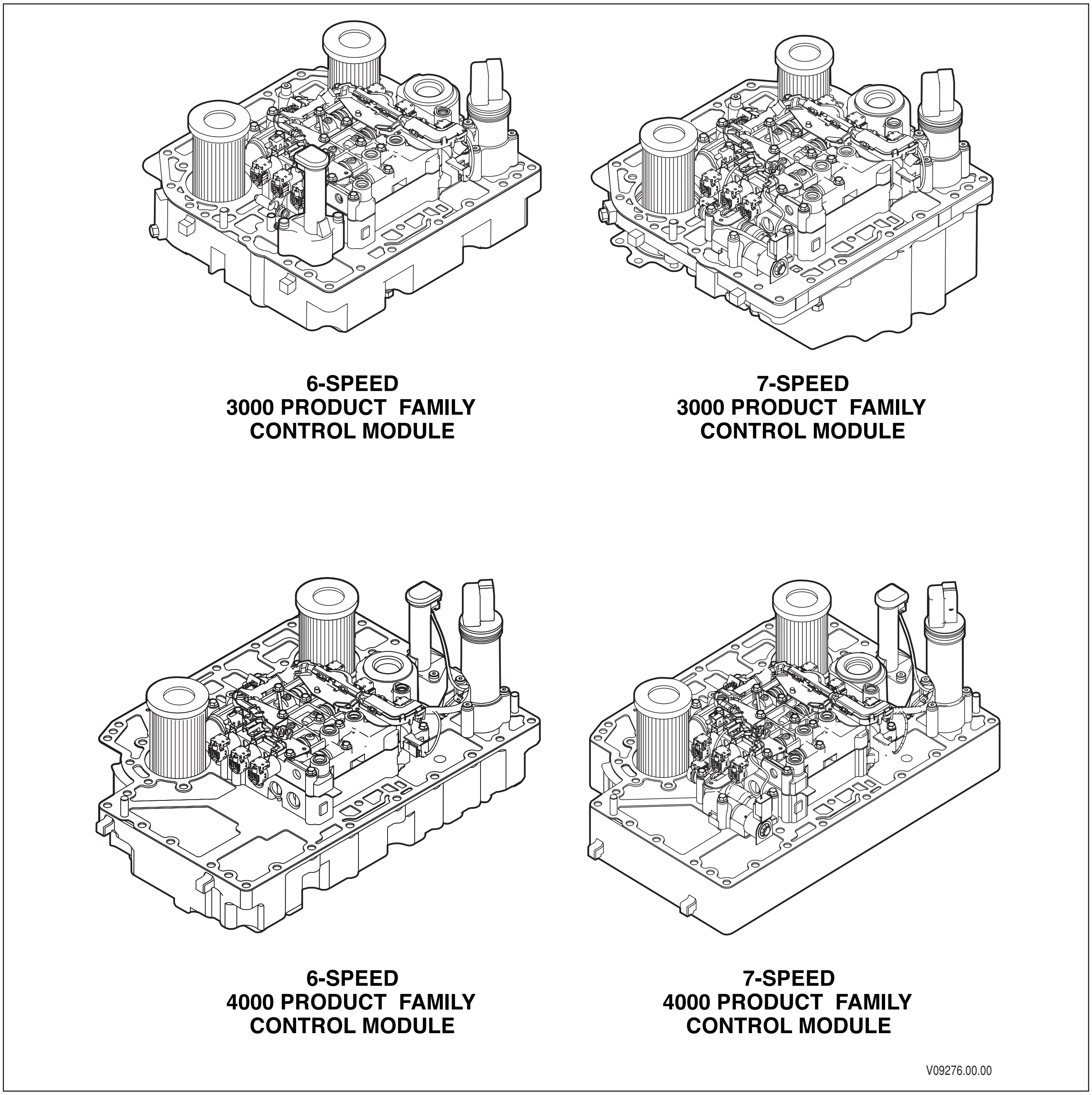

Figure 1–8. Allison 4th Generation Control Modules

GENERAL DESCRIPTION

The main valve body assembly contains the following:

- Main pressure regulator valve
- Control main regulator valve
- Converter flow valve
- Lube regulator valve
- Converter regulator valve
- Exhaust backfill valve
- Two latching logic valves
- On/Off solenoid SS1.

The solenoid valve body assembly contains the following:

- Pressure control solenoid MAIN MOD
- PCS1 (A trim)
- PCS2 (B trim)
- PCS3 (C trim)
- PCS4 (D trim)
- TCC (lockup)
- Diagnostic pressure switch PS1
- Five solenoid regulator valves
- One diagnostic valve.

The low valve body assembly (in 3000 and 4000 Product Families 7-speed models) contains solenoid PCS6 (C6) and one ON/OFF solenoid SS2 (C6 enable). Refer to the appropriate service manual for valve locations.

The Allison 4th Generation controls system includes a main modulation solenoid. Modulated main pressure results in improved cooler flow and reduced pump losses when throttle position and output speed is low. The Allison 4th Generation Controls TCM commands the main mod solenoid ON when all of the following conditions are simultaneously met:

- Sump temperature is greater than 30ºC (86ºF) and less than 150ºC (302ºF) [greater than –5ºC (23ºF) and less than 225ºC (437ºF) for 4700 and 4800 model transmissions].
- Engine speed less than 1200 rpm in all ranges except neutral. There are no restrictions on engine speed in neutral.
- Throttle percentage less than 15 percent in reverse, low (7-speed), first, or second range. Main mod may be commanded ON in neutral at any throttle position.
- Output speed is less than 250 rpm in neutral, reverse, low (7-speed), first, or second range.
- The PTO input to the TCM indicates the PTO is OFF.
- Shift not in progress.

The TCM may activate the main mod solenoid for improved clutch control and transmission response during other unusual operating situations.

A temperature sensor (thermistor) is located in the internal wiring harness. Changes in sump fluid temperature are indicated by changes in sensor resistance, which changes the signal sent to the TCM. Refer to the chart in Appendix Q.

The oil level sensor (OLS) is a float type device mounted on the control module channel plate. The OLS senses transmission fluid level by electronically measuring the buoyancy forces on the float. The sensor operates on 5VDC supplied by the TCM. The oil level sensor is available on any 3000 and 4000 Product Families transmissions except the 3000 7-speed transmissions.

GENERAL DESCRIPTION

The diagnostic pressure switch PS1 is mounted on the solenoid valve body assembly and performs the following two functions:

- When the C5 clutch is filled, PS1 senses PCS2 solenoid regulator valve position to verify proper C3 clutch control in reverse, neutral, and first range.
- When the C5 clutch is exhausted, as in second through sixth ranges, PS1 verifies the position of the C1 and C2 latch valves.

The turbine speed sensor is also mounted on the control module for the 3000 Product Family transmissions. The turbine speed sensor is directed at the rotating-clutch housing. The turbine speed sensor on the 4000 Product Family transmission is located on the outside of the main housing.

1–7. WIRING HARNESSES

A. External Wiring Harness *(Figure 1–9)*

The TCM uses a single 80-way connector, which is used to receive input from the following:

Transmission	TPS	Diagnostic tool connector
Engine	Vehicle interface module (VIM)	Retarder
Turbine	Retarder control module	Retarder temperature sensor
Output speed sensor	Shift selector	Accumulator

Many harnesses will include a bulkhead fitting to separate cab and chassis components. Also, many different styles and materials for harnesses are likely to be encountered.

NOTE: Allison Transmission is providing for service of wiring harnesses and wiring harness components as follows:

- ***Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.***
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St. Clair Technologies, Inc.
920 Old Glass Road
Wallaceburg, Ontario, Canada N8A 4L8
Phone: 519-627-1673
Fax: 519-627-4227

St. Clair Technologies, Inc.
Calle Damanti S/N Col
Guadalupe—Guaymas
Sonora, Mexico 85440
Phone: 011-526 2222-43834
Fax: 011-526-2222-43553

- ***SCTI is the source for external harness repair parts.***

GENERAL DESCRIPTION

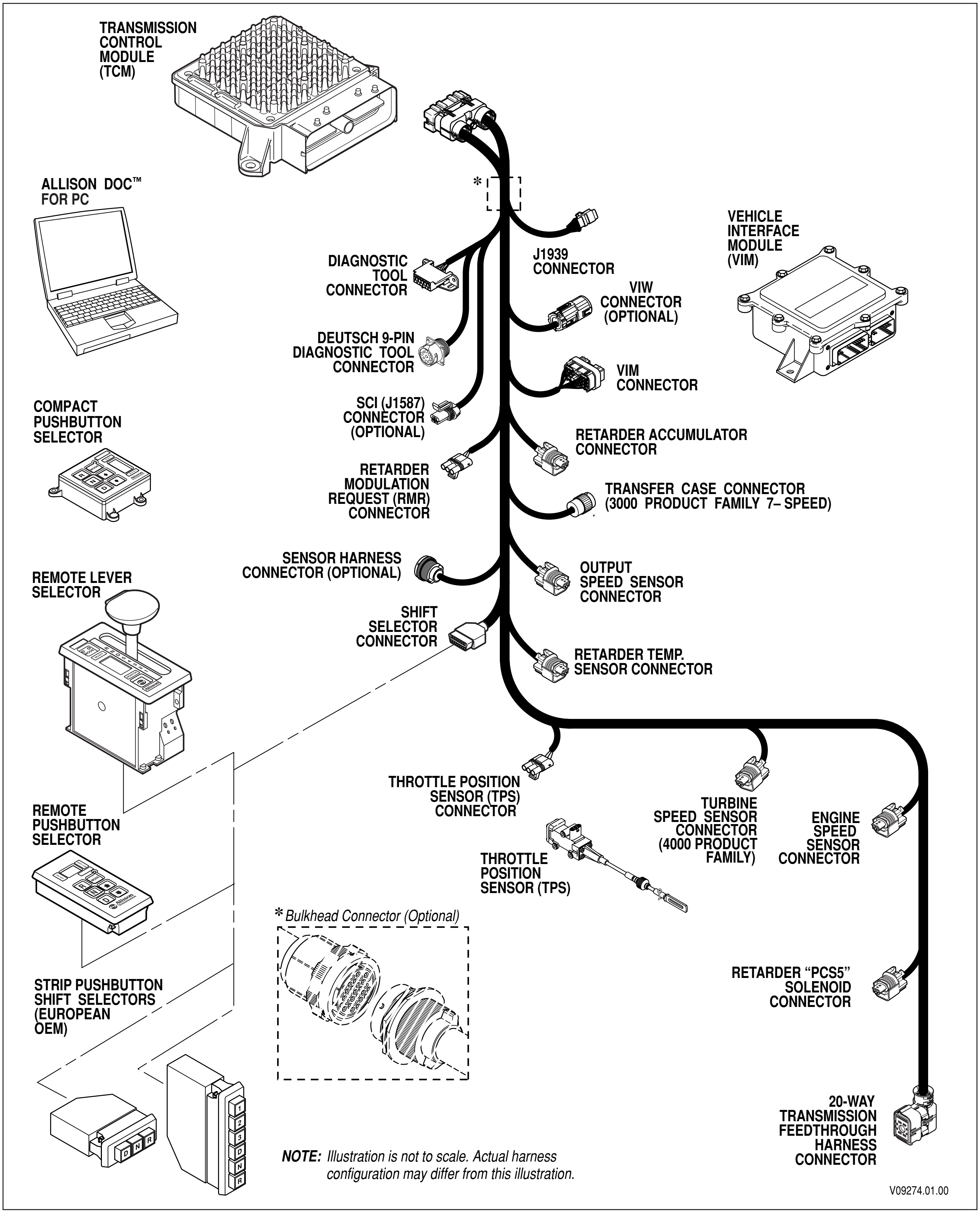


Figure 1–9. Typical 4th Generation Electronic Controls External Wiring Harnesses

GENERAL DESCRIPTION

B. Internal Wiring Harness *(Figure 1–10)*

The internal wiring harness provides connection between the following:

- External harness
- Pressure control and shift solenoids
- Oil level sensor
- Diagnostic pressure switch
- Temperature sensor
- Turbine speed sensor.

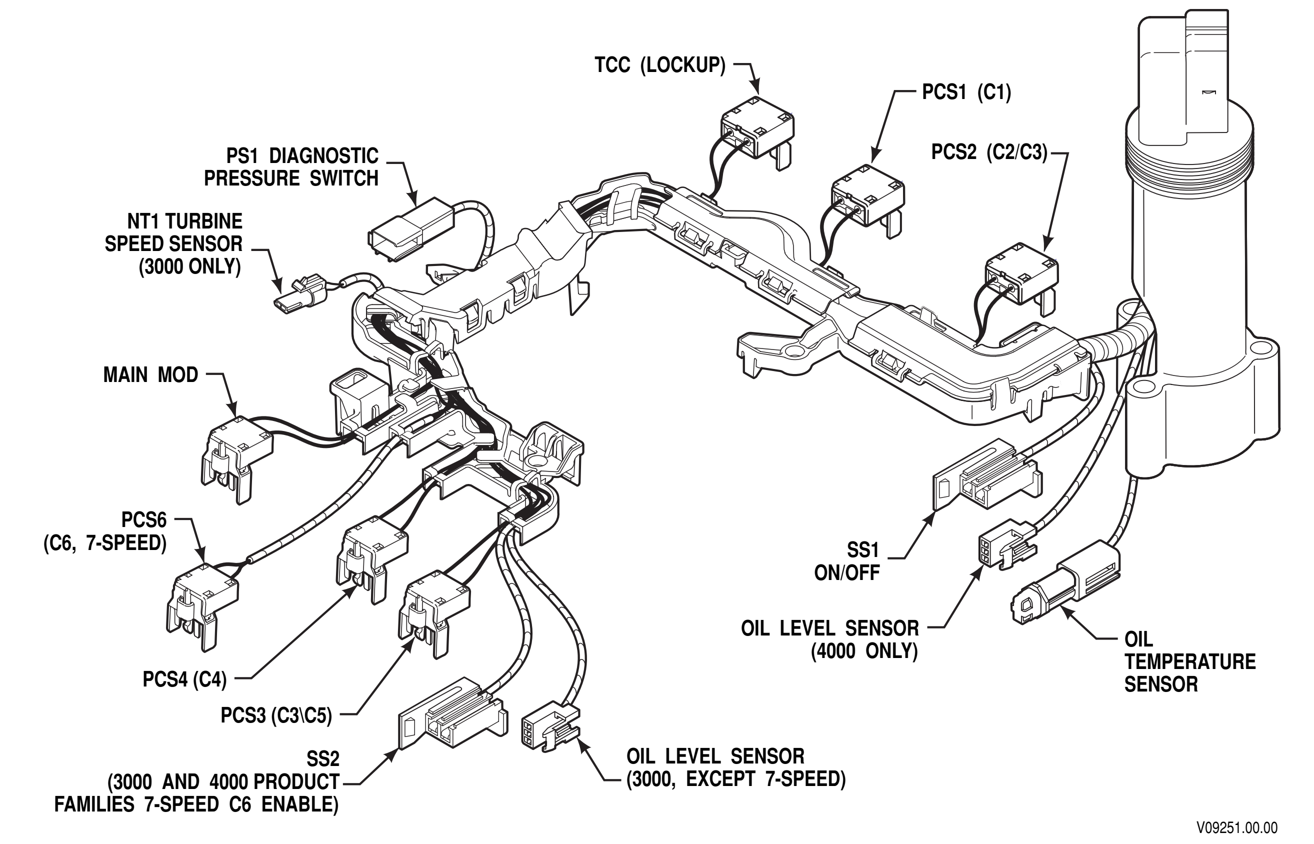


Figure 1–10. Allison 4th Generation Internal Wiring Harness

GENERAL DESCRIPTION

1–8. VEHICLE INTERFACE MODULE *(Figure 1–11)*

The vehicle interface module (VIM) provides relays, fuses, and connection points for interface with the output side of the vehicle electrical system. VIMs are available for both 12V and 24V electrical systems. The VIM for 12V systems uses all 12V relays. The VIM for 24V systems has all 24V relays. Refer to the appropriate parts catalog for the transmission assembly number that you are servicing for detailed parts information. Refer to Pages D–15 and D–16 for VIM wire number and terminal information.

Some OEMs may provide their own equivalent for the VIM which performs the same functions as the VIM shown in Figure 1–11.

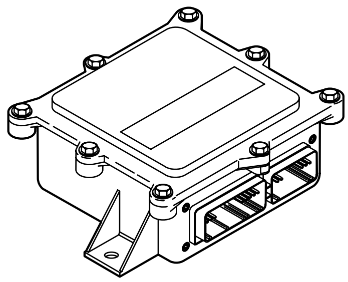


Figure 1–11. Vehicle Interface Module (VIM)

1–9. AUTODETECT FEATURE

Autodetect is active on the first 25 engine starts and, in the case of throttle source detection logic, may continue past 25 ignition cycles until a valid source is determined (details follow in A through D below). Autodetect takes place within the first 30 seconds of each engine start monitored. Autodetect searches for the presence of the following transmission components or data inputs in the priority listed:

Retarder	Present, Not Present
Oil Lever Sensor (OLS)	Present, Not Present
Throttle	TPS, J1587, J1939
Engine Coolant Temperature	Sensor, J1939, J1587

Even after autodetect has been completed, it can be reset to monitor an additional group of engine starts. Reset may be necessary if a device known to be present is not detected or if an autodetectable component or sensor was added after the initial vehicle build. Reset is accomplished by using Allison DOC™ For PC–Service Tool. To use the Allison DOC™ For PC–Service Tool, select “RESET AUTODETECT” to search for all four devices. Select “RESET AUTODETECT RETARDER” to search for a retarder only. Selecting “RESET ADAPTIVE SHIFT PARAMETERS” **will not reset** autodetect logic.

The Allison DOC™ For PC–Service Tool can also be used to override autodetect and manually enter the component or sensor to be recognized by the TCM by changing appropriate “customer modifiable constants” (CMC). The four items above are the only CMCs that are autodetectable. Other CMCs can be changed at any time and are not related to autodetect. Consult the Allison DOC™ User’s Guide, GN3433EN, for, detailed instructions related to Allison 4th Generation Controls CMC. Additional details for each of the four autodetectable features are given below.

GENERAL DESCRIPTION

A. Retarder

Autodetect searches for the presence of pressure control solenoid 5 (PCS5) to the retarder during the first 35 engine ignition cycles. Retarder autodetect will countdown for a maximum of 35 ignition cycles while recording detections of a retarder. A retarder will be identified as present and the retarder autodetect logic will stop once it is detected for three consecutive ignition cycles. If the ignition cycle counter completes the 35 cycles before there are three consecutive detections of a retarder, the software will log that there is no retarder and the retarder autodetect logic will stop. If the autodetect logic is not satisfied during the first 35 engine starts, the retarder is not detected and will not function on subsequent engine starts.

WARNING:	**If a retarder is present but is not detected by autodetect, the retarder will not function. Be sure to check for proper functioning immediately after the 35th engine start. If the retarder is not functioning, check PCS5 solenoid for an open, short-to-ground, or short-to-battery condition. Use the Allison DOC™ For PC–Service Tool to reset retarder autodetect or to manually select the presence of the retarder after the PCS5 circuit is repaired.**

B. Oil Level Sensor (OLS)

NOTE: ***If an OLS is known to be present, but has not been detected, a possible cause is that the transmission fluid level is too low. Check the fluid level before beginning the OLS troubleshooting.***

Oil level sensor autodetect will countdown for a maximum of 25 engine starts while recording detections of an OLS. The TCM monitors the OLS input voltage on wire 116. OLS input voltage **must exceed** a predetermined level for the TCM to record a detection. Additionally, OLS detection **must occur** within 12.5 seconds on any given engine start. An OLS will be identified as present and the OLS autodetect logic will stop once it is detected during any single engine start.

If the engine start counter completes 25 cycles before TCM records one detection of an OLS, the software will log that there is no OLS present and the OLS autodetect logic will stop. Then the TCM concludes that no OLS is present.

No OLS diagnostics take place until the OLS is detected. Frequently check for the presence of oil level diagnostics if the transmission is known to contain an OLS. If an OLS is known to be present, but has not been detected, troubleshooting the OLS circuit is required. After the OLS circuit is repaired, reset autodetect or manually select the OLS function using the Allison DOC™ For PC–Service Tool.

C. Throttle Source

Throttle autodetect will increment a counter for a throttle source on each engine start during which the possible throttle source is detected. When the counter for any of the sources indicates five consecutive detections, the software will set a “confidence flag” to indicate that this is an available throttle source. Multiple throttle sources can be detected on a single engine start and multiple confidence flags can be set. There is no limit to the number of engine starts for autodetection of the throttle source until a confidence flag is set for a source. Once a confidence flag is set for any one of the sources, a counter begins to countdown for 15 additional engine starts. During the entire autodetect period, the software will use the highest priority source as the throttle source if multiple sources are detected before any confidence flags are set. Once a confidence flag is set, that source is used as the source for the throttle signal. When the countdown period is complete, the software will use the highest priority throttle source having a confidence flag set and the autodetect logic will stop.

D. Engine Coolant Temperature

Engine coolant temperature sensor autodetect will countdown for a total of 25 engine starts while recording detections of engine coolant temperature sources. A “confidence flag” will be set once a source is detected for five consecutive engine starts. Multiple sources detected before a confidence flag is set or multiple confidence flags will result in the highest priority source being used as the engine coolant temperature source. Multiple sources can be detected on a single engine start cycle.

1–10. TRANSID (TID)

The TransID feature enables the TCM to recognize various transmission hardware configurations and select an appropriate software calibration. However, if a matching calibration does not exist in memory, the TCM registers a diagnostic code. Furthermore, TID only works when the controller and transmission have the same generation controls. Thus, TID will not allow an Allison 4th Generation TCM to recognize a transmission with WTEC III controls, nor will TID allow a WTEC III ECU to recognize a transmission with Allison 4th Generation Controls.

The TCM senses the transmission configuration using TID wire 176. In initial versions of Allison 4th Generation Controls, wire 176 is connected to high side driver 1 (HSD1), wire 111, in the internal wiring harness. HSD1 supplies power to PCS6 and MAIN MOD solenoids. This wiring configuration is designated TID A.

Whenever a TID level change is to be made, the new TID level calibration will be added to the PROM Calibration Configurator System (PCCS) before the change (s) is (are) made in production to the transmissions. All TCMs programmed and sold after that date will be loaded with the new TID calibration. These TCMs will contain calibrations for the new level transmission and all previous TID levels and will automatically load the correct calibration for the transmission based on the TID signal sensed by Autodetect during the first 25 engine starts.

SECTION 2—DEFINITIONS AND ABBREVIATIONS

2–1. CHECK TRANS LIGHT

When the TCM detects a serious fault, the **CHECK TRANS** light (usually located on the vehicle instrument panel) illuminates and action is automatically taken to protect operator, vehicle, and the transmission. A diagnostic trouble code (DTC) will nearly always be registered when the **CHECK TRANS** light is on; however, not all diagnostic codes will turn on the **CHECK TRANS** light. Codes related to the **CHECK TRANS** light are detailed in the diagnostic trouble code chart (refer to Section 6).

Illumination of the **CHECK TRANS** light indicates that a condition was detected that requires service attention. Operation may or may not be restricted. Even when operation is restricted, the vehicle can be operated to reach a service assistance location. Depending upon the cause for the **CHECK TRANS** light illumination, the TCM may or may not respond to shift selector requests. The transmission may be locked in a range. That range will be shown on the shift selector display. Both upshifts and downshifts may be restricted when the **CHECK TRANS** light is illuminated. Seek service assistance as soon as possible.

Each time the engine is started, the **CHECK TRANS** light illuminates briefly and then goes off. This momentary lighting shows the light circuit is working properly. If the light does not come on during engine start, request service immediately.

2–2. ALLISON TRANSMISSION DIAGNOSTIC TOOL

Allison DOC™ (Diagnostic Optimized Connection) For PC–Service Tool is a PC-based diagnostic tool for use with 3000 and 4000 Product Families transmissions. The Allison DOC™ For PC–Service Tool is a full-feature diagnostic software application supporting the Allison 4th Generation Control System. When installed on the user's own PC, it will allow the technician to acquire data from the transmission's control system and through the use of embedded troubleshooting manuals, conduct systematic troubleshooting of transmission complaints.

Basic Features

Allison DOC™ For PC–Service Tool uses a Windows style graphical user interface (GUI) and includes:

- User selected views of multiple transmission parameters
- Active and historical diagnostic trouble codes (DTCs)
- Graphical instrument panel view of transmission parameters
- Strip chart function
- User configurable Snapshot function
- User configurable Print function
- Code driven links to embedded Allison 4th Generation Control System Troubleshooting Manuals
- Reprogramming capability (available after satisfying Allison Transmission training certification requirements)
- Demo Mode which allows the user to practice the program without being connected to a vehicle
- New animated screen by screen help support (found in Help, Video-based training materials, Allison DOC™ For PC–Service Tool Training Videos)
- Application Configuration—This menu function serves as the platform for three different features:
  (1) General tab, which allows the user to select language (English only at this time), and unit of measure.
  (2) TCM Reprogramming tab, used to enable the reprogramming capability of the Allison DOC™ For PC–Service Tool.
  (3) Update Application tab, will access a web URL that will contain minor updates for the diagnostic tool to support changes in the various transmission control systems.
- Data Bus Viewer allows the user to capture (see and save) the raw data transmitted on the various vehicle data buses supported by Allison DOC™ For PC–Service Tool (J1939, and J1850)

DEFINITIONS AND ABBREVIATIONS

- Printed user's manual and laminated Job Aid Card
- Adobe® Acrobat® 5.0 bundled on the CD for reading the Troubleshooting Manual
- Microsoft® Media Player® 6.4 and 7.0 bundled on the CD for displaying various and updated training videos (available from the application Help menu).

PC Platform Definition

Allison DOC™ For PC–Service Tool has been tested with and is known to operate on PCs with the following configurations*:

- Operating System: Microsoft® Windows® XP Professional, and Windows® 2000 (SP4 or later)
- CPU: Pentium® III, 800MHz, or Pentium® 4, 2.0 GHz (Recommended)
- RAM: 128MB RAM, or 256MB RAM or greater (Recommended)
- Internet connection capability (Internet Explorer 5.0 or greater)
- Hard Drive: 20GB ATA, or 40GB ULTRA ATA/66 or greater (Recommended)
- One USB port V1.1, or USB 2.0 (Recommended) [1]
- CD-ROM: 16x, or 48x Max. Speed or greater (Recommended).

NOTE:

1. ***The Allison DOC™ For PC–Service Tool will not function correctly on PCs not meeting the above listed definition and will not be supported.***
2. ***PCCS does not support Windows® NT® or ME® when recalibrating 3000 and 4000 Product Families transmissions.***
3. ***PCCS is a separate, stand-alone software application.***
4. ***For the latest requirements, please refer to www.allisontransmission.com***

NOTE: Additional information available in Appendix N.

1. A serial port (COM1) is required to support the legacy CEC1 controller and for J1850 communications. More information will be provided in future SILs.

DEFINITIONS AND ABBREVIATIONS

2–3. ABBREVIATIONS

A/N	Assembly Number
ABS	Anti-lock Brake System—OEM-provided means to detect and prevent wheel stoppage to enhance vehicle handling. Retarder and engine brakes will not apply when ABS is active.
Amp	Unit of electrical current
API	Application Program Interface
AT	Allison Transmission
C1...C6	Clutch 1....Clutch 6
CAN	Controller Area Network—A network for all SAE J1939 communications in a vehicle (engine, transmission, ABS, etc.)
CIN	Calibration Identification Number
CMC	Customer Modified Constant
CPA	Connector Position Assurance
CT	Closed Throttle
DMM	Digital Multimeter
DNA	Does Not Adapt—Adaptive shift control is disabled
DNS	DO NOT SHIFT—Refers to the DO NOT SHIFT diagnostic response during which the CHECK TRANS light is illuminated and the transmission will not shift and will not respond to the Shift Selector
DOC	Diagnostic Optimized Connection
DPA	Dearborn Protocol Adapter
DTC	Diagnostic Trouble Code
DVOM	Digital Volt/Ohmmeter
ECM	Engine Control Module
EMI	ElectroMagnetic Interference
FBO	Feature Based Ordering
FCC	Federal Communications Commission
GPI	General Purpose Input—Input signal to the TCM to request a special operating mode or condition
GPO	General Purpose Output—Output signal from the TCM to control vehicle components (such as PTOs, backup lights, etc.) or allow a special operating mode or condition
GUI	Graphical User Interface
HSD	High Side Driver
J1587	Engine/transmission serial data communications link
J1939	High-speed vehicle serial data communications link
LED	Light-Emitting Diode—Electronic device used for illumination
LRTP	Low Range Torque Protection

DEFINITIONS AND ABBREVIATIONS

2–3. ABBREVIATIONS *(cont'd)*

LSD	Low Side Driver
MB	Mega Byte
NNC	Neutral No Clutches—Neutral commanded with no clutches applied
NVL	Neutral Very Low—The TCM has sensed turbine speed below 150 rpm when output speed is below 100 rpm and engine speed is above 400 rpm when N (Neutral) was selected. This is usually caused by a dragging C1 or C3 clutch or a failed turbine speed sensor. NVL is attained by turning D solenoid "ON" (in addition to E solenoid) and the C4 and C5 clutches are applied to lock the transmission output.
OEM	Original Equipment Manufacturer—Maker of vehicle or equipment
Ohm	Unit of electrical resistance
OL	Over Limit or Oil Level—For Over Limit see "∞". Indicates Oil Level is being displayed on a shift selector
OLS	Oil Level Sensor—Electronic device (optional) on control module for indicating transmission fluid level
PC	Personal Computer
PCCS	PROM Calibration Configurator System
PCS	Pressure Control Solenoid
PLR	Primary Lock Reinforcement (Connector)
P/N	Part Number
PROM	Programmable Read Only Memory
PSS	Primary Shift Selector—Main shift selector in a two-selector control system.
PTO	Power Takeoff
PWM	Pulse Width Modulation
RELS	Reduced Engine Load at Stop
RFI	Radio Frequency Interference
RMR	Retarder Modulation Request—Signal from a retarder control device
RPR	Return to Previous Range—Diagnostic response in which the transmission is commanded to return to previously commanded range
SCI	Serial Communication Interface—Used to transmit data and messages between the diagnostic tool and the TCM and other systems such as electronically-controlled engines.
SCTI	St. Clair Technologies, Inc.
SEM	Shift Energy Management
S/N	Serial Number
SOH	State Of Health
SOL OFF	All SOLenoids OFF
SPI	Serial Peripheral Interface—The means of communication between the microprocessor and the interface circuits

DEFINITIONS AND ABBREVIATIONS

2–3. ABBREVIATIONS *(cont'd)*

SS	Shift Solenoid
SSS	Secondary Shift Selector—Alternate shift selector in a two-selector control system
TCC	Torque Converter Clutch
TCM	Transmission Control Module
TFT	Transmission Fluid Temperature
TID	TransID—A feature which allows the TCM to know the transmission configuration and provide the corresponding calibration required
TPA	Terminal Position Assurance
TPS	Throttle Position Sensor—Potentiometer for signaling the position of the engine fuel control lever
V	Version—Abbreviation used in describing TCM software levels
VDC	Volts Direct Current (DC)
VF	Vacuum Fluorescent
VIM	Vehicle Interface Module—A watertight box containing relays and fuses—interfaces the transmission electronic control system with components on the vehicle
VIW	Vehicle Interface Wiring—Interfaces TCM programmed input and output functions with the vehicle wiring
Volt	Unit of electrical force
WOT	Wide Open Throttle
∞	Infinity—Condition of a circuit with higher resistance than can be measured, effectively an open circuit

SECTION 3—BASIC KNOWLEDGE

3–1. BASIC KNOWLEDGE REQUIRED

To service Allison 4th Generation Controls, the technician must understand basic electrical concepts. Most troubleshooting checks consist of checking resistance, continuity, and checking for shorts between wires and to ground. Technicians need to know how to use a digital volt/ohmmeter (DVOM) to make resistance and continuity checks. The technician should be able to use jumper wires and breakout harnesses and connectors. Technicians unsure of making the required checks should ask questions of experienced personnel or find instruction.

The technician should also have the mechanical aptitude required to connect pressure gauges or transducers to identified pressure ports used in the troubleshooting process. Pressure tap locations and pressure values are shown in Appendix B—Checking Clutch Pressures.

Input power, ground, neutral start circuitry, etc., can cause problems with electronic controls or vehicle functioning and may not generate a diagnostic code. A working knowledge of the Allison 4th Generation Controls vehicle installation is necessary in troubleshooting installation-related problems.

Refer to Section 8 for information concerning performance complaints (non-code) troubleshooting. A complete wiring schematic is shown in Appendix J. Refer to the Allison 4th Generation Controls and General Information Sales Tech Data Book for information concerning electronic controls installation and the Installation Checklist. Reliable transmission operation and performance depend upon a correctly installed transmission. Review the Installation Checklist in the 3000 and 4000 Product Families transmissions Tech Data Books for proper installation.

NOTE: ***Allison Transmission is providing for service of wiring harnesses and wiring harness components as follows:***

- ***Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.***
- ***Repair parts for the external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes Allison Transmission, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI will have parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:***

St. Clair Technologies, Inc.
920 Old Glass Road
Wallaceburg, Ontario, Canada N8A 4L8
Phone: 519-627-1673
Fax: 519-627-4227

St. Clair Technologies, Inc.
Calle Damanti S/N Col
Guadalupe—Guaymas
Sonora, Mexico 85440
Phone: 011-526 2222-43834
Fax: 011-526-2222-43553

3–2. USING THE TROUBLESHOOTING MANUAL

Use this manual as an aid to troubleshooting the Allison 4th Generation Controls. Every possible problem and its solution cannot be encompassed by any manual. However, this manual does provide a starting point from which most problems can be resolved.

Once a problem solution is discovered in the manual do not look further for other solutions. It is necessary to determine *why* a problem occurred. The root cause of a problem as well as the symptom **must be** corrected to be sure of trouble-free operation. For example, taping a wire that has been rubbing on a frame rail will not correct the problem unless the rubbing contact is eliminated.

BASIC KNOWLEDGE

3–3. SYSTEM OVERVIEW

Allison 4th Generation Control functions are controlled by the TCM. The TCM reads the following to determine when to command a shift:

- Shift selector range selection
- Output speed
- Throttle position.

In order to control the oncoming and off-going clutches during a shift, the TCM monitors:

- Turbine speed
- Output speed
- Throttle position.

When the TCM detects an electrical fault, it logs a diagnostic code indicating the faulty circuit and may alter the transmission operation to prevent or reduce damage.

When the TCM detects a non-electrical problem while trying to make a shift, the TCM may try that shift a second or third time before setting a diagnostic code. Once that shift has been retried, and a fault is still detected, the TCM sets a diagnostic code and holds the transmission in a fail-to-range mode of operation.

3–4. IMPORTANT INFORMATION IN THE TROUBLESHOOTING PROCESS

A. Before Beginning Troubleshooting

Before beginning the troubleshooting process, read and understand the following:

- Allison Transmission recommended wire numbers (i.e. 158) all use a “1” for the first digit and the pin-out information at the TCM for the second and third digits.
- Shut off the engine and ignition before any harness connectors are disconnected or connected.
- Remember to do the following when checking for shorts and opens:
  - — Minimize movement of wiring harnesses when looking for shorts. Shorts involve wire-to-wire or wire-to-ground contacts and moving the harnesses may eliminate the problem.
  - — Wiggle connectors, harnesses, and splices when looking for opens. This simulates vehicle movements which occur during actual operation.
- When disconnecting a harness connector, be sure the pulling force is applied to the connector itself and **not the wires** extending from the connector.
- Resistance checks involving wiring between the TCM connector and other components adds about one Ohm of resistance to the component resistance shown.
- Inspect all connector terminals for damage. Terminals may have been bent or lost the necessary tension to maintain firm contact.
- Clean dirty terminals or connectors with isopropyl alcohol and a cotton swab, or a good quality, non-residue, non-lubricating, cleaning solvent such as LPS Electro Contact Cleaner® or LPS NoFlash Electro Contact Cleaner®.

BASIC KNOWLEDGE

CAUTION:

The cleaning solvent must not be:

- **Chlorine based**
- **Contain petroleum distillates**
- **Conduct electricity.**

The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. Refer to SIL 17-TR-94, latest revision, for detailed information on the recommended cleaners.

CAUTION: **Care should be taken when welding on a vehicle equipped with electronic controls. Refer to Appendix G, Paragraph 1–1.**

- Diagnostic codes displayed after system power is turned on with a harness connector disconnected, can be ignored and cleared from memory. Refer to Section 6, Diagnostic Codes, for the code clearing procedure.

NOTE: *Turn off the vehicle HIGH IDLE switch, if present, before shifting from N (Neutral) to D (Drive). D (Drive) or R (Reverse) will not be attained unless the shift is made with the engine at idle. Also, be aware of other interlocks that would prevent attaining D (Drive) or R (Reverse). Examples are “wheelchair lift not stored” and “service brakes not applied” (service brake interlock present).*

B. Cold Weather Starts

All Highway Series transmissions are programmed to restrict full operation until specific fluid temperatures are reached. Refer to the Table 3–1 for temperature restrictions.

Table 3–1. Minimum Fluid Operating Temperatures

Sump Fluid Temperature	CHECK TRANS Light	Operation
–32ºC to –7ºC (–25ºF to 19ºF)	OFF	Neutral, Reverse, Second
–7ºC (19ºF)	OFF	Full operation in all ranges

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

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

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

Transmission operation at cold ambient temperatures may require preheating or the use of a lower viscosity transmission fluid.

BASIC KNOWLEDGE

C. High Fluid Temperature

The transmission is considered to be overheated when any of the temperatures in Table 3–2 are exceeded:.

Table 3–2. Overheated Transmission Fluid Temperatures

Location of Fluid	Temperature
Sump fluid	121ºC (250ºF)
Fluid to cooler	149ºC (300ºF)
Retarder out fluid	165ºC (330ºF)

If the transmission overheats during normal operation, measure the fluid level in the transmission. Refer to the Transmission Fluid Check procedure in the appropriate transmission mechanic's tips manual.

CAUTION:	**The engine should never be operated for more than ten (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.**

If the engine temperature gauge indicates a high temperature, the transmission is probably overheated. Stop the vehicle and inspect the cooling system. If it appears to functioning p[roperly, run the engine at 1200–1500 rpm with the transmission in **N** (Neutral). This should reduce the transmission and engine temperature to normal operating levels in two to three minutes. If temperatures do not decrease, reduce the engine rpm.

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

3–5. BEGINNING THE TROUBLESHOOTING PROCESS

NOTE: ***Whenever a transmission is overhauled, exchanged, or has undergone internal repairs, the TCM MUST BE RESET TO FACTORY VALUES by selecting "Reset To Unadapted Shifts" (all), and "Reset Autodetect Information" in Allison DOC™ For PC–Service Tool.***

1. Begin troubleshooting by determining the transmission fluid level and TCM input voltage. Remember that some problems may be temperature related. Do troubleshooting at the temperature level where the problem occurs. Check diagnostic codes by:
   - Using the shift selector display (see Paragraph 6–2 for code reading).
   - Using the Allison DOC™ For PC–Service Tool.
2. When a problem exists but a diagnostic code is not indicated, refer to the Performance Complaint Section (Section 8) for a listing of various electrical and hydraulic problems, their causes, and remedies.

BASIC KNOWLEDGE

3. If a diagnostic code is found in the TCM memory, record all available code information and clear the active indicator. Refer to Section 6.

4. Test drive the vehicle to confirm a diagnostic code or performance complaint.

   - If the code reappears, refer to the Diagnostic Code section (Section 6) and the appropriate code chart. The Diagnostic Code section lists diagnostic codes and their description. Locate the appropriate troubleshooting chart and follow the instructions.
   - If the code does not reappear, it may be an intermittent problem. Use the Allison DOC™ For PC–Service Tool and the code display procedure described in Section 6. The code display procedure will indicate the number of times the diagnostic code has occurred. Refer to the troubleshooting chart for the possible cause(s) of the problem.
   - Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.

5. If difficulties arise, you have unanswered questions, or if you are unable to quickly identify the root cause during troubleshooting, please contact the Technical Assistance Center (TAC):

   Technical Assistance Center
   PO Box 894, Mail Code 462-470-PF9
   Indianapolis, IN 46206-0894
   Phone: 1-800-252-5283

NOTE: Information concerning specific items is contained in the appendices located in the back of this manual. The appendices are referred to throughout the manual.

3–6. TCM DIAGNOSTIC PROCEDURE

- Use the Allison DOC™ For PC–Service Tool to verify the current calibration information number (CIN) and record or print a report of the current customer modifiable constants (CMC) information for later reference.
- Remove the 80-way connector from the suspect TCM; inspect the connector for damaged or bent pins.
- Replace the TCM with a known, good TCM from a similar vehicle.

NOTE: If using a TCM from another vehicle is unavoidable, the TCM MUST BE set to factory values and the vehicle MUST BE driven carefully to adapt the shifts to the test vehicle. Refer to SIL 16-WT-96 for the correct procedure. Be sure to reset the Adaptive Shift parameters and Autodetect information when it is installed in the original vehicle.

- If the replacement TCM corrects the original complaint, reinstall the original TCM to verify that the complaint returns. If the complaint is confirmed. install a new TCM.
- If the complaint does not return, leave the original TCM installed. Disconnecting and reconnecting the TCM can often correct faulty wiring harness connections that may have been present.
- Clear any diagnostic codes that may be present and test drive the vehicle to confirm the repair.

NOTE: All Allison 4th Generation Controls TCMs are designed to be isolated from the vehicle chassis ground. Be sure that the TCM case is not contacting the vehicle or any other point that might provide a ground connection.

BASIC KNOWLEDGE

3–7. RESETTING OF TCM PARAMETERS TO SUPPORT ENGINE UPDATE

Shift Energy Management (SEM) Autoselect feature may be used on certain transmissions. Autoselect is deactivated following the first 20 engine starts where engine and transmission communication are present. If during the first 20 starts the TCM recognizes an engine to be on its list of certified engines, it will lock to the SEM active state. If the engine is not supported, the TCM will lock to a non-SEM state.

NOTE: Most engine upgrades are same type/rating; under normal circumstances there should be no reason to reset the TCM Autoselect.

However, there may be a small chance that transmission performance, shift quality, or codes may result from the use of different models within the same engine family or when a recalibration of engine software has taken place. If a vehicle receives upgraded engine hardware or software it may become necessary to reactivate the Autoselect feature to redetect the engine current SEM status.

NOTE: Once TCM Autoselect locks, the only way to reactivate is to perform a reset procedure (refer to Paragraph 3–8).

3–8. RESETTING TCM AUTOSELECT

Verify a new engine rating by checking the engine data tag. The engine **must be** compatible with the transmission rating. If engine rating **is not** compatible, the vehicle **must be** returned to the OEM for engine recalibration. If the rating is correct for the transmission, perform the following steps.

Allison DOC™ for PC–Service Tool is used to reset Autoselect function as follows:

- Display the Action Request menu.
- On the drop down menu, select Reset SEM Autodetect.
- Click on the **OK** button.

The TCM is now reset to Autoselect and will start looking for supporting engine software. Drive the vehicle; confirm DTCs have not returned.

NOTE: Transmission shifts will now be in the unadaptive (base) state, so it will be necessary to drive the vehicle to allow shift to converge.

SECTION 4—WIRE TEST PROCEDURES

4–1. TESTING FOR OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND
(Use Digital Volt/Ohmmeter J 34520-A and Jumper Wire Set J 39197)

NOTE: Please refer to Paragraph 3–5 to begin the troubleshooting process.

1. Make sure all connectors are tightly connected and re-test the circuit.
2. Disconnect and inspect all connectors.

CAUTION:

Observe the following assembly precautions when mating TCM 80-way Cam-Assist connectors (used in GM truck applications):

- **Bring the connector to the TCM “squared up”, not at an angle.**
- **Keep hands away from the handle, squarely press the connector onto the TCM until the cam lever handle moves of its own accord approximately ¾ inch.**
- **Gently complete mating the connector to the TCM by moving the cam lever handle to the locked position.**
- **Slide the CPA into the secondary lock.**

Failure to do so could cause damage to the internal latching mechanism.

3. Thoroughly clean corroded or dirty terminals. If dirty or corroded terminals are the probable cause of the problems, reconnect the clean connectors and operate the vehicle normally. If the problem recurs, proceed with Step (4).

CAUTION:

The cleaning solvent must not be:

- **Chlorine based**
- **Contain petroleum distillates**
- **Conduct electricity.**

The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. Refer to SIL 17-TR-94, latest revision, for detailed information on the recommended cleaners.

4. Review the Allison 4th Generation Controls wire numbering system described in Paragraph 3–4.
5. If all connectors are clean and connected correctly, determine which wires in the chassis harness are indicated by the diagnostic code. For example, Code P0960, indicates an open in the pressure control solenoid circuit, wires 111 and 174.

   a. Test continuity of wires 111 and 174 by performing the following (Figure 4–1):

   (1) Disconnect the 80-way connector from the TCM and disconnect the harness from the transmission main connector. At one end of the harness, using jumper wire kit J 39197, connect wires 111 and 174 to each other, being careful not to distort the terminals. Jumpering the wires together creates a circuit between wires 111 and 174.

CAUTION:

Do not insert test probes larger than 0.81 mm into the TCM 80-way and transmission 20-way connectors. Use the gray-colored 150 Series Metripack Flexible Male Connector probe contained in Jumper Wire Kit J 39197 when testing the TCM and transmission mating connectors. Failure to do so may distort the socket terminals inside the connectors and cause them to lose the necessary tension to maintain firm contact.

WIRE TEST PROCEDURES

(2) On the opposite end of the harness, test the continuity of the jumpered pair. No continuity in a jumpered pair circuit (infinite resistance reading) indicates an open in the wire being tested. Locate and repair the damaged portion of the wire.

b. If the continuity test is good (0–2 Ohms resistance), remove the jumpers. Check the harness for shorts between wires and shorts-to-ground by performing the following (Figure 4–2):

(1) At the TCM end of the harness, touch one probe of a DVOM to one wire of the circuit being tested and touch the other probe to each terminal in the same connector, then touch the probe to chassis ground and to the transmission main housing. Do this for both wires in the circuit being tested.

(1) If at any time the DVOM shows zero to low resistance, or the meter's continuity beeper sounds, there is a short between the two points being probed—wire-to-wire or wire-to-ground. Isolate and repair the short.

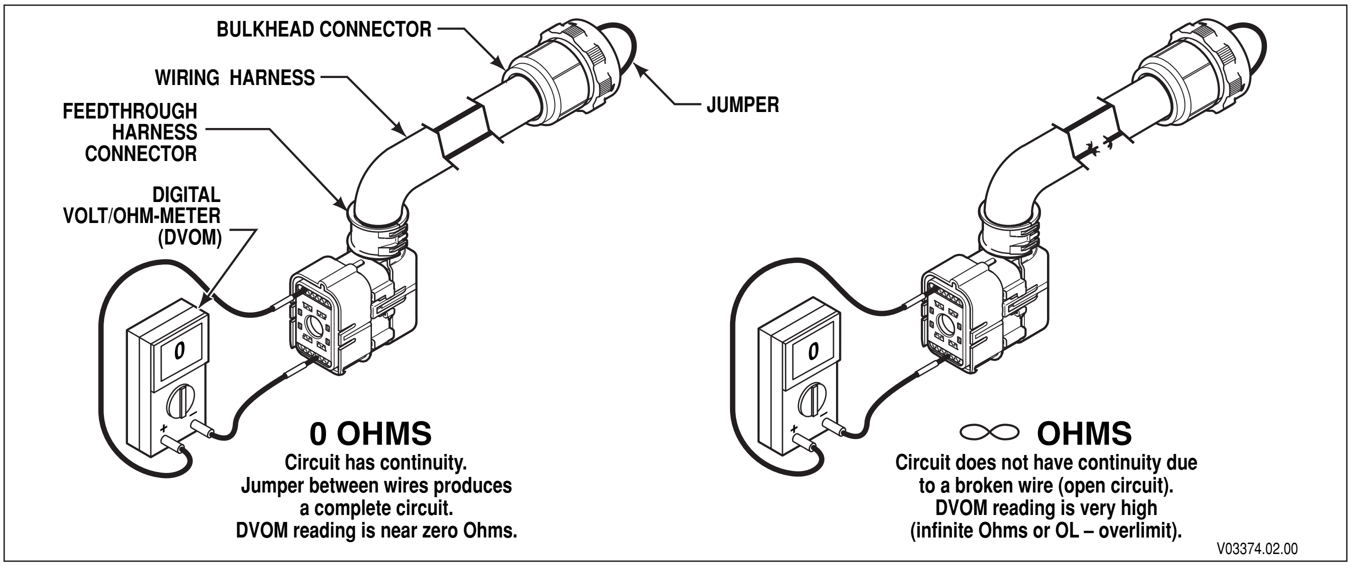


Figure 4–1. Open Circuit

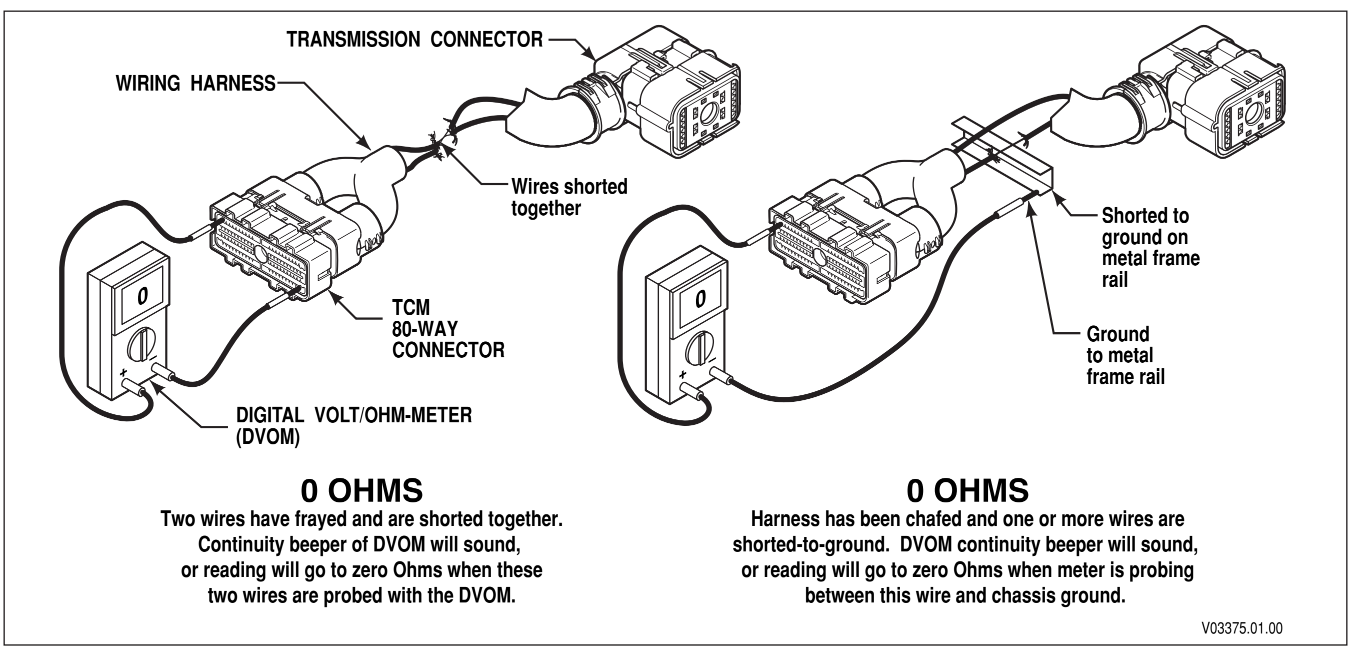


Figure 4–2. Short Between Wires and to Ground

WIRE TEST PROCEDURES

4–2. TESTING AT TRANSMISSION FEEDTHROUGH CONNECTOR FOR INTERNAL HARNESS OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND

1. Disconnect the external wiring harness from the transmission.
2. Inspect the connectors. Any terminals which are corroded or dirty **must be** thoroughly cleaned.

CAUTION:	**The cleaning solvent must not be:** • **Chlorine based** • **Contain petroleum distillates** • **Conduct electricity.** **The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. Refer to SIL 17-TR-94, latest revision, for detailed information on the recommended cleaners.**

3. If the connectors are clean and connected correctly, determine which wires in the harness to test. Use the diagnostic code system schematic to locate the wire terminals. For this example, Code P0960 indicates an open in the Main Mod solenoid circuit, wires 111 and 174 (Figures 4–3 and 4–4).

   a. At the transmission connector, test the resistance of Main Mod solenoid circuit. Resistance of a solenoid circuit should be 4.0 to 7.8 Ohms, covering a temperature range of –20°C to 140°C (–4°F to 284°F). Refer to Solenoid Resistance vs. Temperature chart in Appendix K. No continuity in the circuit (infinite resistance) indicates an open in the internal harness, the feedthrough connector, or the solenoid coil. Locate and repair the open in the internal harness or replace the internal harness, replace the feedthrough connector, or the solenoid.

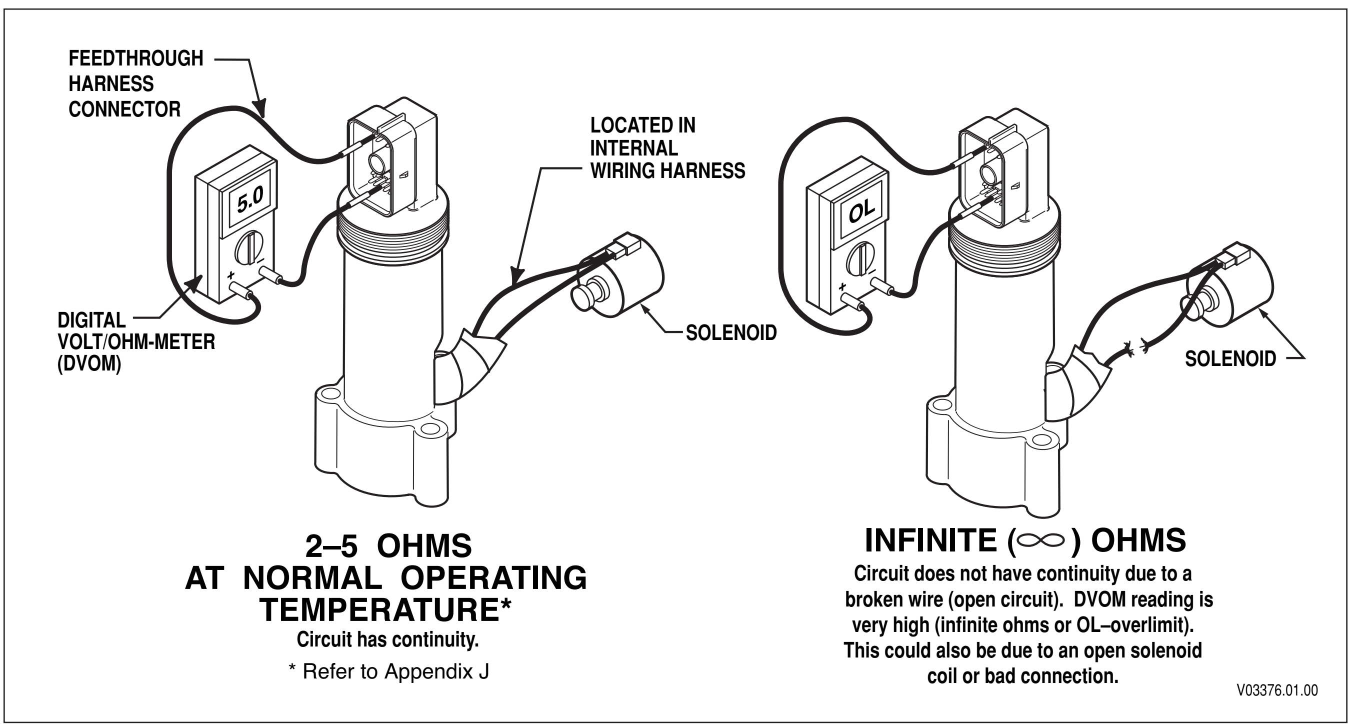


Figure 4–3. Checking Continuity

WIRE TEST PROCEDURES

b. If the resistance test is good, test the harness for shorts between wires and to ground by performing the following (Figure 4–4):

(1) At the transmission connector, touch one probe of the DVOM to one wire of the circuit being tested and touch the other probe to each terminal in the connector and to chassis ground and the transmission main housing. Do this for both wires in the circuit being tested.

(2) If the DVOM shows zero to low resistance, or the continuity beeper sounds, there is a short between the two points being probed, wire-to-wire or wire-to-ground. An indication of a short may be caused by a splice to the wire being checked. Review the wiring diagram in Appendix J for splice locations. If the short is not a splice, then isolate and repair the short.

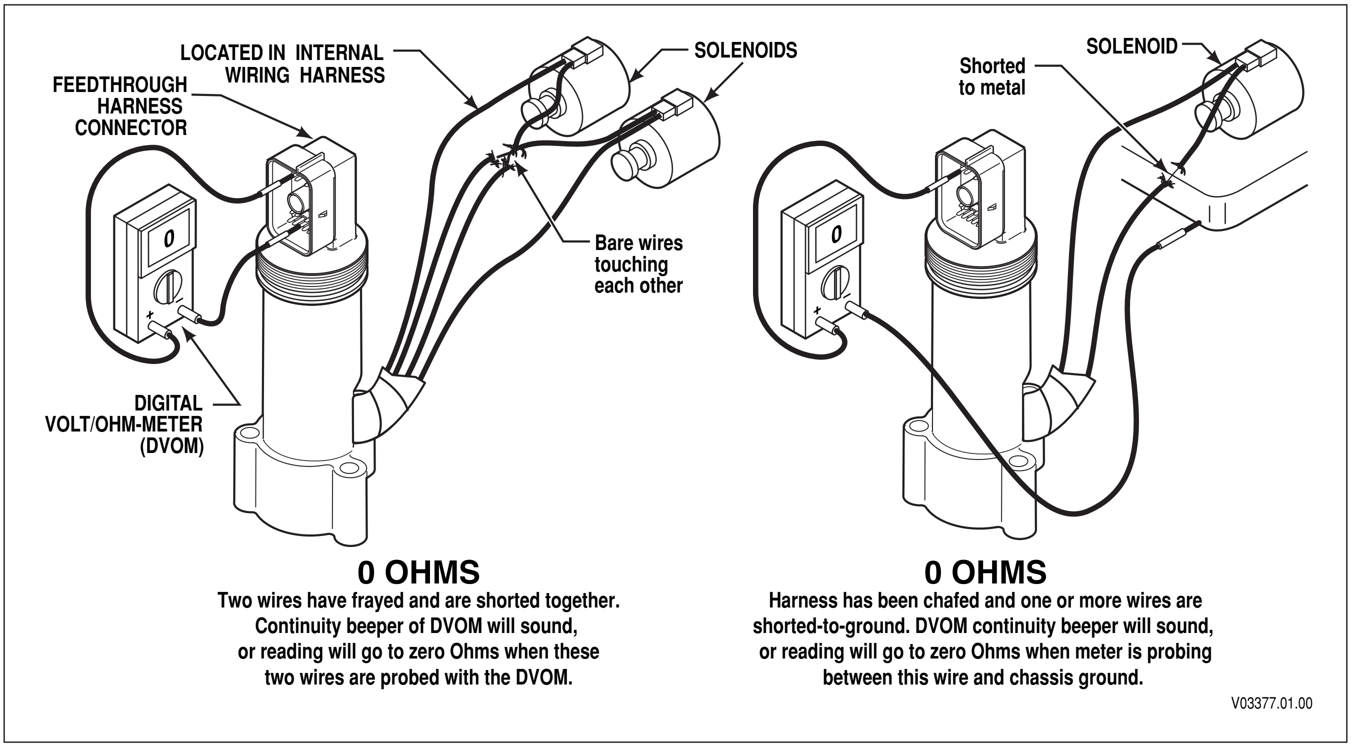


Figure 4–4. Short Between Wires and to Ground

NOTE: ***When conducting circuit tests that include the external harness, add one (1) Ohm to the values shown. Speed sensor resistance is 270–330 Ohms. PS1 diagnostic pressure switch resistance is two (2) Ohms maximum when switch is closed and 20,000 Ohms minimum when switch is open.***

SECTION 5—OIL LEVEL SENSOR (OLS)

5–1. INTRODUCTION

The oil level sensor (Figure 5–1) provides a means of electronically checking the transmission fluid level from:

- The shift selector display
- Allison DOC™ For PC–Service Tool
- A customer-furnished remote display.

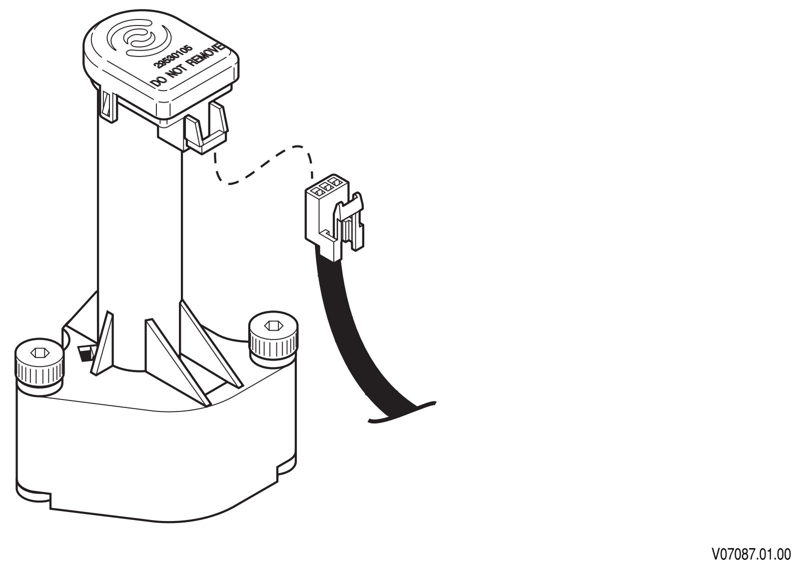


Figure 5–1. Oil Level Sensor

The Allison 4th Generation Controls oil level sensor (OLS) is a one-piece unit with a molded 3-terminal connector built into the sensor housing (see Figure 5–1 and SIL 19-WT-99 for more details). The internal wiring harnesses have been designed to include the 3-terminal connector for the OLS.

NOTE: The OLS is standard on all 3000 and 4000 Product Families transmissions except 3000 Product Family 7-speed transmissions.

Figure 5–2 shows the position and orientation of the OLS on the control modules of the 3000 and 4000 Product Families transmissions. The OLS **must be** correctly positioned so the internal harness connector reaches the connector on the sensor. The control module must fit onto the transmission main case without interference. The one piece design reduces the complexity of the manufacturing and installation of the sensor. The current OLS uses shoulder bolts and Viton® ferrules to provide vibration dampening in the mounting.

OIL LEVEL SENSOR (OLS)

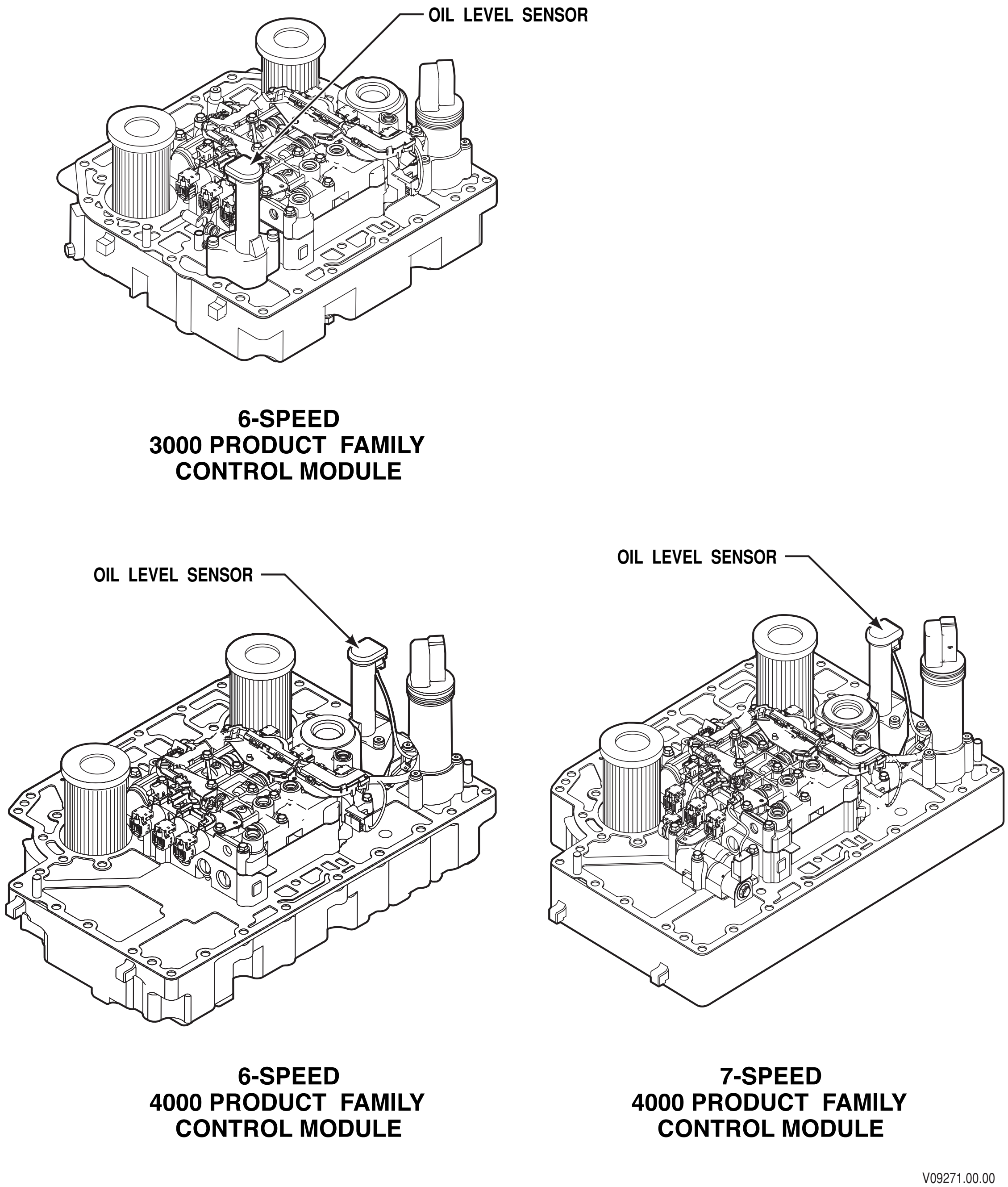


Figure 5–2. Current Oil Level Sensor Orientation

OIL LEVEL SENSOR (OLS)

5–2. ELECTRONIC FLUID LEVEL READING (SHIFT SELECTOR)

CAUTION:	**A low or high fluid level causes overheating and irregular shift patterns. An incorrect fluid level can damage the transmission.**

NOTE: ***The pushbutton and lever shift selectors can display two characters at a time. The strip pushbutton shift selector does not have diagnostic or display capability. Allison DOC™ For PC–Service Tool or a customer-furnished remote display must be used to obtain fluid level information when using the strip pushbutton shift selector.***

A. Fluid Level Reading Procedure

1. Park the vehicle on a level surface and shift to **N** (Neutral). Apply the parking brake.
2. On the Pushbutton shift selector, simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons once.
3. On the Lever shift selector, press the “display mode” button once.
4. For a strip pushbutton shift selector, refer to Allison publication GN3433EN, User Guide for Allison DOC™ For PC–Service Tool.

NOTE: ***The TCM may delay the fluid level reading until the following conditions are met:***

- ***The fluid temperature is between 60°C (140°F) and 104°C (220°F).***
- ***The transmission is in N (Neutral).***
- ***The vehicle has been stationary for approximately two minutes to allow the fluid to settle.***
- ***The engine is at idle (below 1000 rpm—not “fast” idle).***

See “Invalid for Display” information in Steps (8) and (9).

5. Correct fluid level is reported when **o L** is displayed (**o L** indicates the Oil Level Check Mode), followed by **o K**. The **o K** display indicates the fluid level is within the proper fluid level zone. The sensor display and the transmission dipstick may not agree exactly because the oil level sensor compensates for fluid temperature.

   Example: **o L**; **o K**—Indicates correct fluid level.

6. Low fluid level is reported when **o L** is displayed, followed by **L o** and a number. **L o** indicates a low fluid level and the number is the number of quarts of fluid the transmission requires.

   Example: **o L**; **L o**; **2**—Indicates two (2) additional quarts of fluid will bring the fluid level within the proper fluid level.

OIL LEVEL SENSOR (OLS)

7. High fluid level is reported when **o L** is displayed, followed by **H I** and a number. **H I** indicates high fluid level and the number shows how many quarts the transmission is overfilled.

   Example: **o L**, **H I**, **1**—Indicates one quart of fluid above the full level.

8. An Invalid for Display condition is reported when **o L** is displayed, followed by "–" and a number display. The displayed number is a fault code and indicates improper conditions or a system malfunction.

   Example: **o L**, –, **7 0**—Indicates an Invalid for Display condition and fault code 70.

9. Invalid for Display is activated when conditions do not allow the fluid level to be checked electronically. Review the following codes and conditions, and correct as necessary.

Table 5–1. Invalid for Display Codes

CODE		CAUSE OF CODE
X*	—	Settling time too short
5 0	—	Engine speed (rpm) too low
5 9	—	Engine speed (rpm) too high
6 5	—	**N** (Neutral) must be selected
7 0	—	Sump fluid temperature too low
7 9	—	Sump fluid temperature too high
8 9	—	Output shaft rotation
9 5	—	Sensor failure**

* A number between 8 and 1 that flashes during the count-down period.
** Speed sensor, throttle sensor, temperature sensor, or oil level sensor.

10. To exit the fluid level display mode:

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

OIL LEVEL SENSOR (OLS)

5–3. ELECTRONIC FLUID LEVEL READING (ALLISON DOC™ FOR PC–SERVICE TOOL)

Allison DOC™ For PC–Service Tool can also be used to electronically read the transmission's fluid level (refer to Allison publication GN3433EN, User Guide for Allison DOC™ For PC–Service Tool for further information).

CAUTION:	**A low or high fluid level causes overheating and irregular shift patterns and, if not corrected, can damage the transmission.**

A. Fluid Level Check Procedure

1. Connect the Allison DOC™ For PC–Service Tool to the diagnostic tool connector (Figure 1–2).
2. Select **Diagnostic** button.
3. Scroll down the Diagnostic Data List to "Custom Data Monitor" display.
4. Select "oil level deviation."
5. Read the fluid level deviation, repeat the reading to confirm the first reading.

NOTE: The TCM may delay the fluid level reading until the following conditions are met:

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

The reason for a delayed fluid level reading is indicated on the Allison DOC™ For PC–Service Tool by one of the following diagnostic messages.

Table 5–2. Diagnostic Message

O L	—	SETTLING TIME (8 down to 1)
O L	—	ENGINE SPEED LO
O L	—	ENGINE SPEED HI
O L	—	SELECT **N** (NEUTRAL)
O L	—	SUMP TEMP LO
O L	—	SUMP TEMP HI
O L	—	OUTPUT SPEED HI
O L	—	CHECK CODES

SECTION 6—DIAGNOSTIC TROUBLE CODES (DTC)

6–1. DIAGNOSTIC CODE MEMORY

Diagnostic codes are logged in a list in memory (sometimes referred to as the queue), listing the most recently occurring code first and logging all active and inactive codes. The codes contained in the list have information recorded as shown in the table below (codes are examples). Access to the code list position, DTC, and active indicator is through the shift selector display. The shift selector will display only five codes, beginning with the most recent active followed by the most recent inactive DTCs. Access to DTC, Active indicator, Historic indicator, Check Trans indicator, Failure Record indicator, and Description is through the Allison DOC™ For PC–Service Tool. Further details on the use of the Allison DOC™ For PC–Service Tool are presented in GN3433EN User Guide furnished with each tool.

Table 6–1. Code List

Code List Position*	DTC	Active**	Historic	Check Trans	Failure Record	Description
d1	P0880	Y	Y	N	Y	TCM Power Input Signal
d2	P2723	Y	Y	Y	Y	Pressure Control Solenoid 1 Stuck Off
d3	P0727	N	Y	N	Y	Engine Speed Input Circuit No Signal
d4	P0610	N	Y	N	Y	TCM Vehicle Options (TransID) Error
d5	—	—	—	—	—	—

* Displayed on shift selector only, d = diagnostic
** On shift selector, Y = Mode indicator (LED) illuminated

The following paragraphs define the different parts of the code list.

A. **Code List Position (shift selector only).** The position which a code occupies in the code list. Positions are displayed as “d1” through “d5” (Code List Position 1 through Code List Position 5).

B. **DTC.** The diagnostic trouble code number referring to the general condition or area of fault detected by the TCM. “Double click” on the numerical code in the DTC column to link to the specific troubleshooting instructions for the DTC.

C. **Active Indicator.** Indicates when a diagnostic code is active. The MODE indicator LED on the shift selector is illuminated or the diagnostic tool displays **Y** when DTC is active.

D. **Historic Indicator.** Indicates when the DTC has met sufficient criteria to be stored in long term memory. “Sufficient criteria” may mean the DTC occurred over a specific span of time or over multiple test cycles.

E. **Check Trans Indicator.** Indicates when the TCM is requesting the **CHECK TRANS** light as a result of the DTC.

F. **Failure Records Indicator.** Indicates when Failure Records are present. “Double click” on **Y** in the Failure Records column to display failure record information.

G. **Description.** Provides a brief description of the DTC. “Double click” on the DTC description to link to the specific troubleshooting instructions for the DTC.

DIAGNOSTIC TROUBLE CODES (DTC)

6–2. CODE READING AND CODE CLEARING

Diagnostic codes can be read and cleared by the following methods:

- Allison DOC™ For PC–Service Tool.
- Diagnostic display mode on the shift selector.

The use of Allison DOC™ For PC–Service Tool is described in Allison publication GN3433EN, User Guide, that is furnished with each tool. The method of reading and clearing codes described in this section refers to entering the diagnostic display mode of the shift selector.

The diagnostic display mode may be entered for viewing of codes at any speed. Active codes can only be cleared when the output speed = 0 and no output speed sensor failure is active.

A. **Reading Codes.** Enter the diagnostic display mode by pressing the ↑ (Up) and ↓ (Down) arrow buttons at the same time on a pushbutton selector, or by momentarily pressing the **MODE** button on a lever shift selector.

NOTE: ***If a DO NOT SHIFT condition is present (CHECK TRANS light illuminated) at this time, the shift selector may or may not respond to requested range changes.***

NOTE: ***If an oil level sensor is present, then fluid level will be displayed first. Diagnostic code display is achieved by simultaneously depressing the ↑ (Up) and ↓ (Down) arrow buttons a second time or the MODE button a second time.***

The code list or queue position is the first item displayed, followed by the DTC. Each item is displayed for about one second. The display cycles continuously until the next code list position is accessed by pressing the **MODE** button. The following example shows how DTC C1312 is displayed on the pushbutton and lever shift selectors:

SELECT	MONITOR
d	1
	C
1	3
1	2

To view the second, third, fourth, and fifth positions (d2, d3, d4, and d5), momentarily press the **MODE** button as explained above.

Momentarily press the **MODE** button after the fifth position is displayed to restart the sequence of code list positions.

An active code is indicated by the illumination of the LED indicator when a code position is displayed while in the diagnostic display mode. In the normal operating mode, the LED indicator illuminates to show a secondary mode operation.

Any code position which does not have a diagnostic code logged will display "–" for the DTC. No diagnostic codes are logged after an empty code position.

B. **Clearing Active Indicators.** A diagnostic code's active indicator can be cleared, which allows the code inhibit to be cleared but remains in the queue as inactive.

The active indicator clearing methods are:

1. Power down—All active indicators are cleared at TCM power down.

DIAGNOSTIC TROUBLE CODES (DTC)

2. Self-clearing—Some codes will clear their active indicator when the condition causing the code is no longer detected by the TCM.
3. Manual—Some active indicators can be cleared manually, while in the diagnostic display mode, after the condition causing the code is corrected.

CAUTION:	**If an active indicator is cleared while the transmission is locked in a forward range or reverse (fail-to-range), the transmission will remain in the forward range or reverse after the clearing procedure is completed. Neutral must be manually selected.**

C. **Manually Clearing Codes and Active Indicators from the Code List.** To clear active indicators or all codes:

1. Enter the diagnostic display mode.
2. Press and hold the **MODE** button for approximately ten seconds until the LED indicator flashes. All active and inactive indicators are cleared. All active indicators will be cleared at TCM power down.
3. Codes that cannot be manually cleared will remain.

D. **Exiting the diagnostic display mode.** Exit the diagnostic display mode using one of the following procedures:

1. On a pushbutton shift selector, press the ↑ (Up) and ↓ (Down) arrow buttons at the same time or press any range button, **D**, **N**, or **R**. The shift (**D**, **N**, or **R**) is commanded if not inhibited by an active code.
2. On a lever shift selector, momentarily press the **MODE** button or move the shift lever to any shift position other than the one it was in when the diagnostic display mode was activated. If the shift is inhibited, the TCM will continue to command the current transmission range attained and the lever should be returned to its original position.
3. Wait until timeout (approximately 10 minutes) and the system will automatically return to the normal operating mode.
4. Turn off power to the TCM (turn off the vehicle engine at the ignition switch).

6–3. DIAGNOSTIC CODE RESPONSE

The following TCM responses to a fault provide for safe transmission operation:

- **D**o **N**ot **S**hift (DNS) Response
  - — Release lockup clutch and inhibit lockup operation.
  - — Inhibit all shifts.
  - — Turn on the **CHECK TRANS** light.
  - — Display the range attained.
  - — Ignore any range selection inputs from the pushbutton or lever shift selector.
- **D**o **N**ot **A**dapt (DNA) Response
  - — The TCM stops adaptive shift control while the code is active. Do not adapt shifts when a code with the DNA response is active.

DIAGNOSTIC TROUBLE CODES (DTC)

- **SOL**enoid **OFF** (SOL OFF) Response
  - — All solenoids are commanded off (turning solenoids PCS1 and PCS2 off electrically causes them to be on hydraulically).
- **R**eturn to **P**revious **R**ange (RPR) Response
  - — When the speed sensor ratio or PS1 pressure switch tests associated with a shift are not successful, the TCM commands the same range as commanded before the shift.
- **N**eutral **N**o **C**lutches (NNC) Response
  - — When certain speed sensor ratio or PS1 pressure switch tests are not successful, the TCM commands a neutral condition with no clutches applied.

6–4. SHIFT SELECTOR DISPLAYS RELATED TO ACTIVE CODES

- "Cateye"—The forward slash segment and the middle horizontal segments (-/-) may be on under the following conditions:
  - — Lost communication between the TCM and shift selector (U0103 or U0291)
  - — J1939 Controlled Area Network (CAN) problems
  - — Invalid data from shift selector (U0592 or U0404)
- All Segments Displayed—All display segments will be illuminated during shift selector initialization. Low supply voltage can cause the shift selector to fail to complete initialization.

6–5. DIAGNOSTIC CODE LIST AND DESCRIPTION

Table 6–2. Diagnostic Troubleshooting Codes (DTC) and Descriptions

DTC	Description	CHECK TRANS Light	Inhibited Operation Description
C1312	Retarder Request Sensor Failed Low	No	May inhibit retarder operation if not using J1939 datalink
C1313	Retarder Request Sensor Failed High	No	May inhibit retarder operation if not using J1939 datalink
P0122	Pedal Position Sensor Low Voltage	No	Use default throttle values. Freezes shift adapts.
P0123	Pedal Position Sensor High Voltage	No	Use default throttle values. Freezes shift adapts.
P0218	Transmission Fluid Over Temperature	No	Use hot mode shift schedule. Holds fourth range. TCC is inhibited. Freezes shift adapts.
P0602	TCM Not Programmed	Yes	Lock in Neutral
P0610	TCM Vehicle Options (TransID) Error	Yes	Use TID A calibration
P0613	TCM Processor	No	All solenoids off
P0614	Torque Control Data Mismatch—ECM/TCM	Yes	Allows operation only in reverse and second range.
P0634	TCM Internal Temperature Too High	Yes	SOL OFF (hydraulic default)
P063E	Auto Configuration Throttle Input Not Present	Yes	Use default throttle values

DIAGNOSTIC TROUBLE CODES (DTC)

Table 6–2. Diagnostic Troubleshooting Codes (DTC) and Descriptions *(cont'd)*

DTC	Description	CHECK TRANS Light	Inhibited Operation Description
P063F	Auto Configuration Engine Coolant Temp Input Not Present	No	None
P0658	Actuator Supply Voltage 1 (HSD1) Low	Yes	DNS, SOL OFF (hydraulic default)
P0659	Actuator Supply Voltage 1 (HSD1) High	Yes	DNS, SOL OFF (hydraulic default)
P0702	Transmission Control System Electrical (TransID)	Yes	Uses TID A calibration
P0703	Brake Switch Circuit Malfunction	No	No Neutral to Drive shifts for refuse packer. TCM inhibits retarder operation if a TPS code is also active.
P0708	Transmission Range Sensor Circuit High Input	Yes	Ignore defective strip selector inputs
P070C	Transmission Fluid Level Sensor Circuit—Low Input	No	None
P070D	Transmission Fluid Level Sensor Circuit—High Input	No	None
P0711	Transmission Fluid Temperature Sensor Circuit Performance	Yes	Use default sump temp
P0712	Transmission Fluid Temperature Sensor Circuit Low Input	Yes	Use default sump temp
P0713	Transmission Fluid Temperature Sensor Circuit High Input	Yes	Use default sump temp
P0716	Turbine Speed Sensor Circuit Performance	Yes	DNS, Lock in current range
P0717	Turbine Speed Sensor Circuit No Signal	Yes	DNS, Lock in current range
P0719	Brake Switch ABS Input Low	No	TCM assumes ABS is OFF
P071A	RELS Input Failed On	Yes	Inhibit RELS operation
P071D	General Purpose Input Fault	Yes	None
P0721	Output Speed Sensor Circuit Performance	Yes	DNS, Lock in current range
P0722	Output Speed Sensor Circuit No Signal	Yes	DNS, Lock in current range
P0726	Engine Speed Sensor Circuit Performance	No	Default to turbine speed
P0727	Engine Speed Sensor Circuit No Signal	No	Default to turbine speed
P0729	Incorrect 6th Gear Ratio	Yes	DNS, Attempt 5th, then 3rd
P0731	Incorrect 1st Gear Ratio	Yes	DNS, Attempt 2nd, then 5th
P0732	Incorrect 2nd Gear Ratio	Yes	DNS, Attempt 3rd, then 5th
P0733	Incorrect 3rd Gear Ratio	Yes	DNS, Attempt 4th, then 6th
P0734	Incorrect 4th Gear Ratio	Yes	DNS, Attempt 5th, then 3rd
P0735	Incorrect 5th Gear Ratio	Yes	DNS, Attempt 6th, then 3rd, then 2nd
P0736	Incorrect Reverse Gear Ratio	Yes	DNS, Lock in Neutral
P0741	Torque Converter Clutch System Stuck Off	Yes	None
P0776	Pressure Control Solenoid 2 Stuck Off	Yes	DNS, RPR
P0777	Pressure Control Solenoid 2 Stuck On	Yes	DNS, RPR

DIAGNOSTIC TROUBLE CODES (DTC)

Table 6–2. Diagnostic Troubleshooting Codes (DTC) and Descriptions *(cont'd)*

DTC	Description	CHECK TRANS Light	Inhibited Operation Description
P0796	Pressure Control Solenoid 3 Stuck Off	Yes	DNS, RPR
P0797	Pressure Control Solenoid 3 Stuck On	Yes	DNS, RPR
P0842	Transmission Pressure Switch 1 Circuit Low	Yes	DNS, Lock in current range
P0843	Transmission Pressure Switch 1 Circuit High	Yes	DNS, Lock in current range
P0880	TCM Power Input Signal	No	None
P0881	TCM Power Input Signal Performance	No	None
P0882	TCM Power Input Signal Low	Yes	DNS, SOL OFF (hydraulic default)
P0883	TCM Power Input Signal High	No	None
P0894	Transmission Component Slipping	Yes	DNS, Lock in first
P0960	Pressure Control Solenoid Main Mod Control Circuit Open	Yes	None
P0962	Pressure Control Solenoid Main Mod Control Circuit Low	Yes	DNS, SOL OFF (hydraulic default)
P0963	Pressure Control Solenoid Main Mod Control Circuit High	Yes	None
P0964	Pressure Control Solenoid 2 (PCS2) Control Circuit Open	Yes	DNS, SOL OFF (hydraulic default)
P0966	Pressure Control Solenoid 2 (PCS2) Control Circuit Low	Yes	DNS, SOL OFF (hydraulic default)
P0967	Pressure Control Solenoid 2 (PCS2) Control Circuit High	Yes	DNS, SOL OFF (hydraulic default)
P0968	Pressure Control Solenoid 3 (PCS3) Control Circuit Open	Yes	DNS, SOL OFF (hydraulic default)
P0970	Pressure Control Solenoid 3 (PCS3) Control Circuit Low	Yes	DNS, SOL OFF (hydraulic default)
P0971	Pressure Control Solenoid 3 (PCS3) Control Circuit High	Yes	DNS, SOL OFF (hydraulic default)
P0973	Shift Solenoid 1 (SS1) Control Circuit Low	Yes	DNS, SOL OFF (hydraulic default)
P0974	Shift Solenoid 1 (SS1) Control Circuit High	Yes	DNS, SOL OFF (hydraulic default)
P0975	Shift Solenoid 2 (SS2) Control Circuit Open	Yes	7-speed: Allow 2 through 6, N, R
P0976	Shift Solenoid 2 (SS2) Control Circuit Low	Yes	7-speed: Allow 2 through 6, N, R. Inhibit TCC operation
P0977	Shift Solenoid 2 (SS2) Control Circuit High	Yes	7-speed: Allow 2 through 6, N, R
P0989	Retarder Pressure Sensor Failed Low	No	None
P0990	Retarder Pressure Sensor Failed High	No	None
P1739	Incorrect Low Gear Ratio	Yes	Command 2nd and allow shifts 2 through 6, N, R
P1891	Throttle Position Sensor PWM Signal Low Input	No	Use default throttle values
P1892	Throttle Position Sensor PWM Signal High Input	No	Use default throttle values
P2184	Engine Coolant Temperature Sensor Circuit Low Input	No	Use default engine coolant values

DIAGNOSTIC TROUBLE CODES (DTC)

Table 6–2. Diagnostic Troubleshooting Codes (DTC) and Descriptions *(cont'd)*

DTC	Description	CHECK TRANS Light	Inhibited Operation Description
P2185	Engine Coolant Temperature Sensor Circuit High Input	No	Use default engine coolant values
P2637	Torque Management Feedback Signal (SEM)	Yes	Inhibit SEM
P2641	Torque Management Feedback Signal (LRTP)	Yes	Inhibit LRTP
P2670	Actuator Supply Voltage 2 (HSD2) Low	Yes	DNS, SOL OFF (hydraulic default)
P2671	Actuator Supply Voltage 2 (HSD2) High	Yes	DNS, SOL OFF (hydraulic default)
P2685	Actuator Supply Voltage 3 (HSD3) Low	Yes	DNS, SOL OFF (hydraulic default)
P2686	Actuator Supply Voltage 3 (HSD3) High	Yes	DNS, SOL OFF (hydraulic default)
P2714	Pressure Control Solenoid 4 (PCS4) Stuck Off	Yes	DNS, RPR
P2715	Pressure Control Solenoid 4 (PCS4) Stuck On	Yes	DNS, SOL OFF (hydraulic default)
P2718	Pressure Control Solenoid 4 (PCS4) Control Circuit Open	Yes	DNS, SOL OFF (hydraulic default)
P2720	Pressure Control Solenoid 4 (PCS4) Control Circuit Low	Yes	DNS, SOL OFF (hydraulic default)
P2721	Pressure Control Solenoid 4 (PCS4) Control Circuit High	Yes	DNS, SOL OFF (hydraulic default)
P2723	Pressure Control Solenoid 1 (PCS1) Stuck Off	Yes	DNS, RPR
P2724	Pressure Control Solenoid 1 (PCS1) Stuck On	Yes	DNS, RPR
P2727	Pressure Control Solenoid 1 (PCS1) Control Circuit Open	Yes	DNS, SOL OFF (hydraulic default)
P2729	Pressure Control Solenoid 1 (PCS1) Control Circuit Low	Yes	DNS, SOL OFF (hydraulic default)
P2730	Pressure Control Solenoid 1 (PCS1) Control Circuit High	Yes	DNS, SOL OFF (hydraulic default)
P2736	Pressure Control Solenoid 5 (PCS5) Control Circuit Open	Yes	Inhibit retarder operation
P2738	Pressure Control Solenoid 5 (PCS5) Control Circuit Low	Yes	Allow 2 through 6, N, R. Inhibit retarder and TCC operation
P2739	Pressure Control Solenoid 5 (PCS5) Control Circuit High	Yes	Inhibit retarder operation
P2740	Retarder Oil Temperature Hot	No	None
P2742	Retarder Oil Temperature Sensor Circuit—Low Input	No	Use default retarder temp values
P2743	Retarder Oil Temperature Sensor Circuit—High Input	No	Use default retarder temp values
P2761	TCC PCS Control Circuit Open	Yes	Inhibit TCC operation
P2763	TCC PCS Control Circuit High	Yes	Inhibit TCC operation
P2764	TCC PCS Control Circuit Low	Yes	7-speed: allow 2 through 6, N, R. Inhibit TCC operation
P278A	Kickdown Input Failed ON	No	Inhibit kickdown operation
P2793	Gear Shift Direction Circuit	Yes	Ignores PWM input from shift selector
P2808	Pressure Control Solenoid 6 (PCS6) Stuck Off	Yes	DNS, RPR

DIAGNOSTIC TROUBLE CODES (DTC)

Table 6–2. Diagnostic Troubleshooting Codes (DTC) and Descriptions *(cont'd)*

DTC	Description	CHECK TRANS Light	Inhibited Operation Description
P2809	Pressure Control Solenoid 6 (PCS6) Stuck On	Yes	DNS, RPR
P2812	Pressure Control Solenoid 6 (PCS6) Control Circuit Open	Yes	DNS, SOL OFF (hydraulic default)
P2814	Pressure Control Solenoid 6 (PCS6) Control Circuit Low	Yes	DNS, SOL OFF (hydraulic default)
P2815	Pressure Control Solenoid 6 (PCS6) Control Circuit High	Yes	DNS, SOL OFF (hydraulic default)
U0001	Hi Speed CAN Bus Reset Counter Overrun (IESCAN)	No	Use default values, inhibit SEM
U0010	CAN BUS Reset Counter Overrun	No	Use default values, inhibit SEM
U0100	Lost Communications with ECM/PCM (J1587)	Yes	Use default values
U0103	Lost Communication With Gear Shift Module (Shift Selector) 1	Yes	Maintain range selected, observe gear shift direction circuit
U0115	Lost Communication With ECM	Yes	Use default values
U0291	Lost Communication With Gear Shift Module (Shift Selector) 2	Yes	Maintain range selected, observe gear shift direction circuit
U0304	Incompatible Gear Shift Module 1 (Shift Selector) ID	Yes	Ignore shift selector inputs
U0333	Incompatible Gear Shift Module 2 (Shift Selector) ID	Yes	Ignore shift selector inputs
U0404	Invalid Data Received From Gear Shift Module (Shift Selector) 1	Yes	Maintain range selected, observe gear shift direction circuit
U0592	Invalid Data Received From Gear Shift Module (Shift Selector) 2	Yes	Maintain range selected, observe gear shift direction circuit

TRANSMISSION COMPONENT WIRING DIAGRAMS AND DIAGNOSTICS

DIAGNOSTIC TROUBLE CODES (DTC)

NOTES

DIAGNOSTIC TROUBLE CODES (DTC)

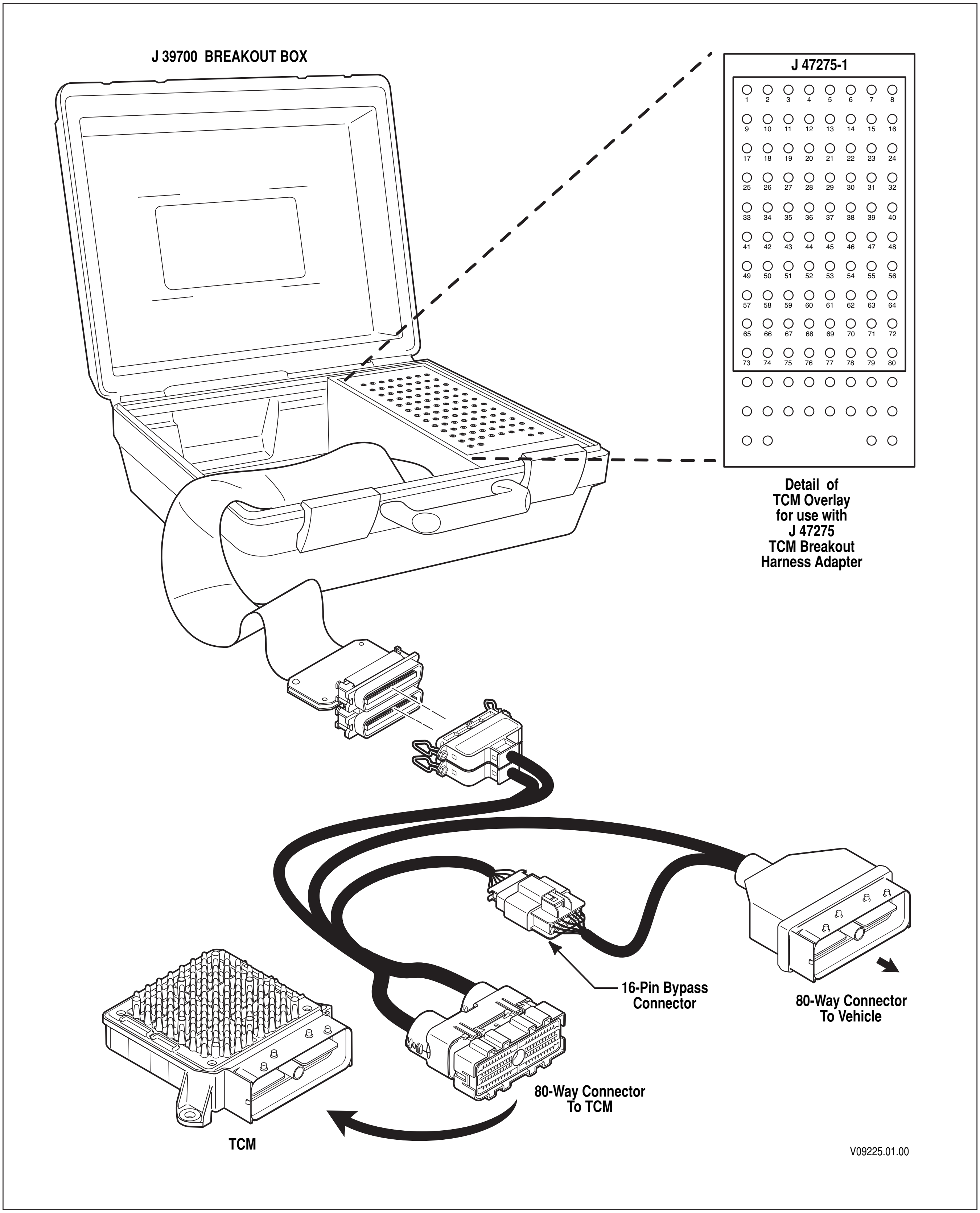


Figure 6–1. J 39700 Breakout Box and J 47275 TCM Breakout Harness Adapter

DIAGNOSTIC TROUBLE CODES (DTC)

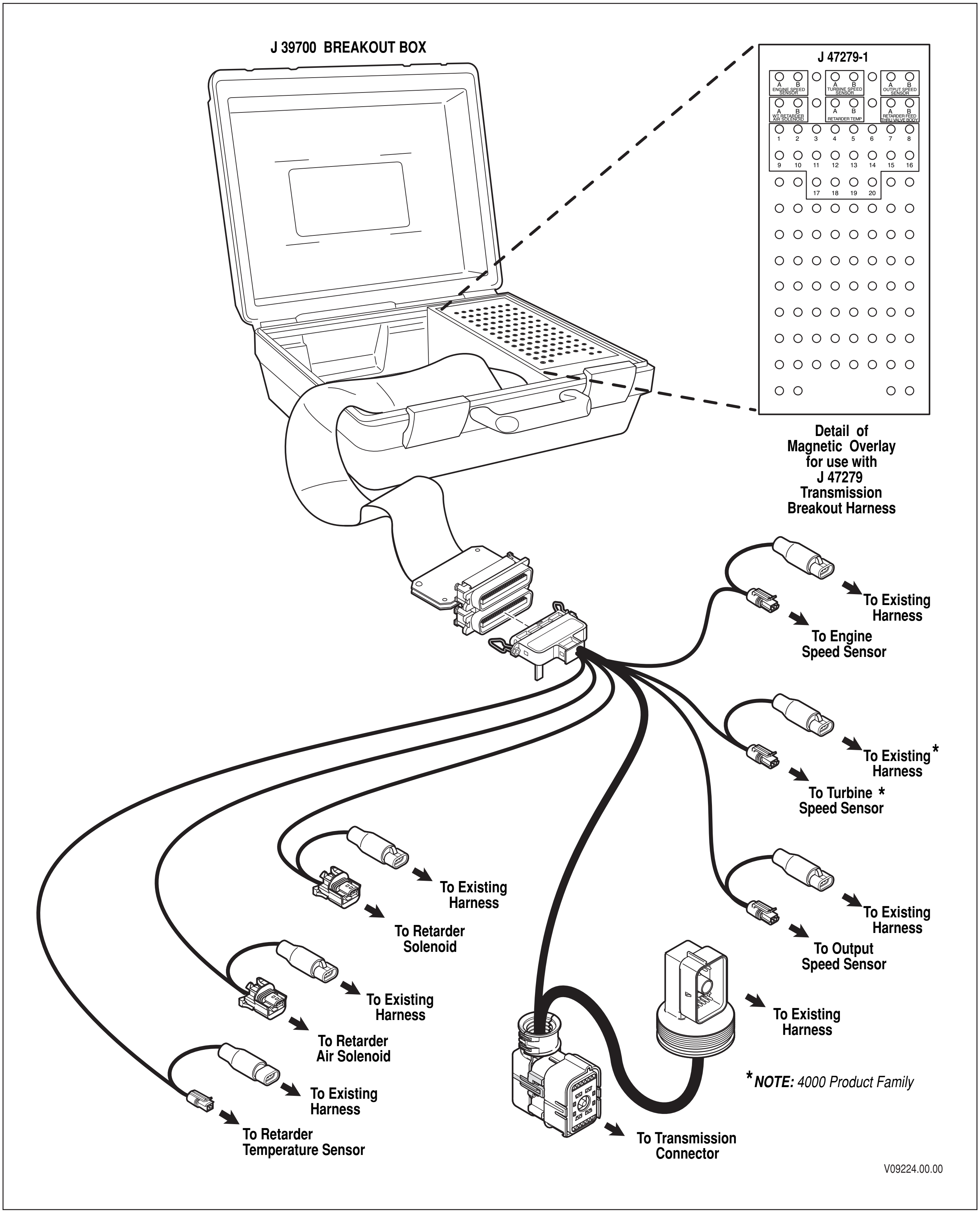


Figure 6–2. J 39700 Breakout Box and J 47279 Transmission Breakout Harness

DIAGNOSTIC TROUBLE CODES (DTC)

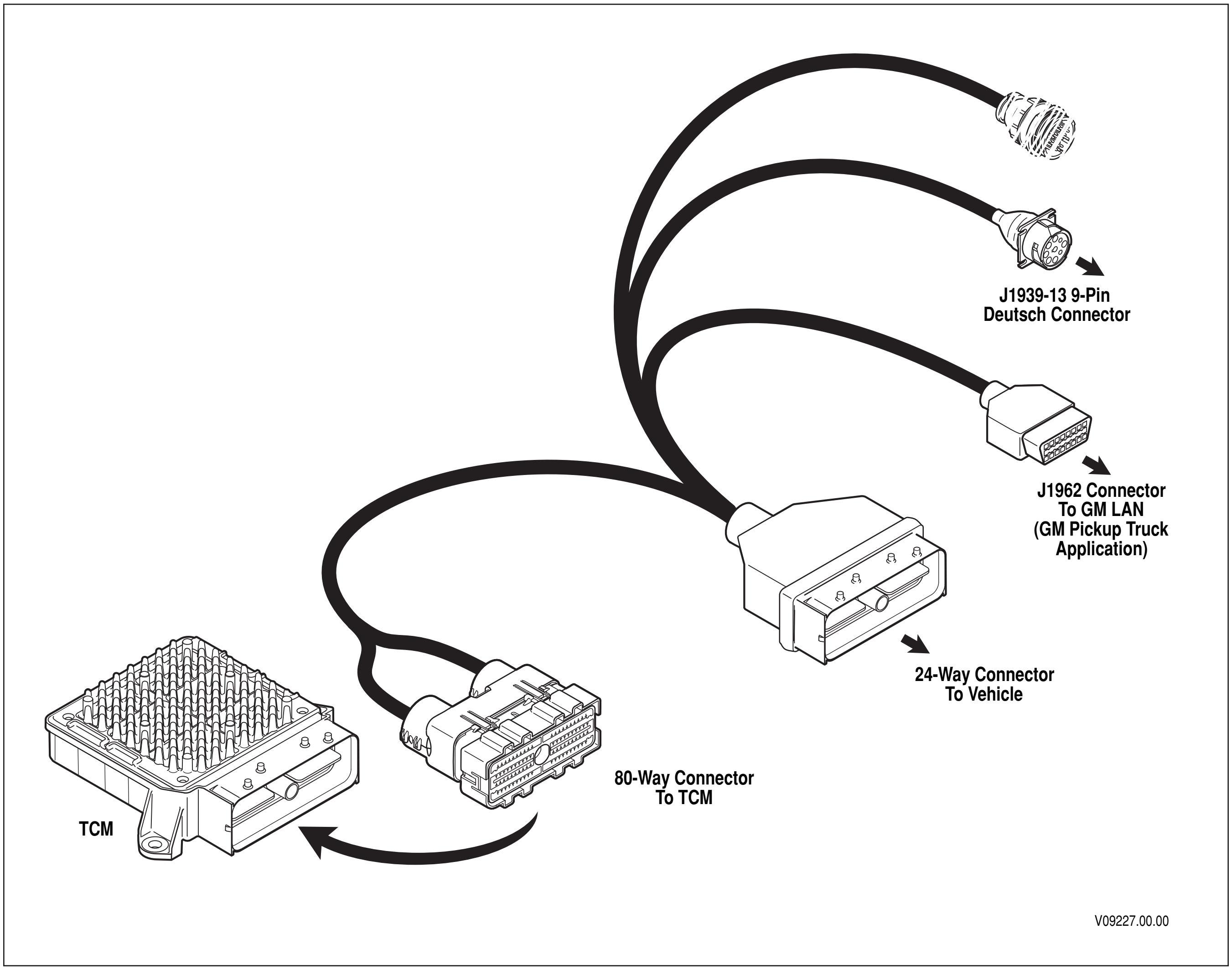


Figure 6–3. J 47276 "T" Breakout and TCM Reflashing Harness

DIAGNOSTIC TROUBLE CODES (DTC)

6–6. DIAGNOSTIC CODE TROUBLESHOOTING

A. Beginning The Troubleshooting Process

1. Begin troubleshooting by determining the transmission fluid level and TCM input voltage. Access diagnostic codes by using:
   - The shift selector display.
   - Allison DOC™ For PC–Service Tool.
2. When a problem exists but a diagnostic code is not indicated, refer to Section 8, General Troubleshooting of Performance Complaints for a listing of various electrical and hydraulic problems, their causes, and remedies.
3. If a diagnostic code is found in the TCM memory, record all available code information and clear the active indicator. Read TCM freeze frame data using Allison DOC™ For PC–Service Tool. Refer to Section 6–2.
4. Test drive the vehicle to confirm a diagnostic code or performance complaint.
   - If the code reappears, refer to Section 6–5, Table 6–2. Table 6–2 lists diagnostic codes and their description.
   - If the code does not reappear, it may be an intermittent problem. Use Allison DOC™ For PC–Service Tool or the code display procedure described in Section 6–2.
   - The code display procedure will indicate the number of times the diagnostic code has occurred. Refer to Section 8, General Troubleshooting of Performance Complaints, for the possible cause(s) of the problem.
   - Use pressure gauges as necessary to evaluate hydraulic conditions.
   - Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.
5. If difficulties arise, you have unanswered questions, or if you are unable to quickly identify the root cause during troubleshooting, please contact the Technical Assistance Center (TAC):

   Technical Assistance Center

   PO Box 894, Mail Code 462-470-PF9

   Indianapolis, IN 46206-0894

   Phone: 1-800-252-5283

NOTE: Information concerning specific items is contained in the appendices located in the back of this manual. The appendices are referred to throughout the manual.

B. Solenoid Locations

Solenoid locations in the control module are as illustrated in Figure 6–3. Refer to Figure 6–3 as necessary when using the diagnostic code schematics.

C. Diagnostic Code Schematics

The diagnostic code schematics in this section show wiring for both the optional oil level sensor and retarder, where applicable. If your transmission is not equipped with an oil level sensor or retarder, disregard the portions of the schematic pertaining to those optional pieces of equipment. Refer to the appropriate transmission service manual for solenoid replacement procedures.

DIAGNOSTIC TROUBLE CODES (DTC)

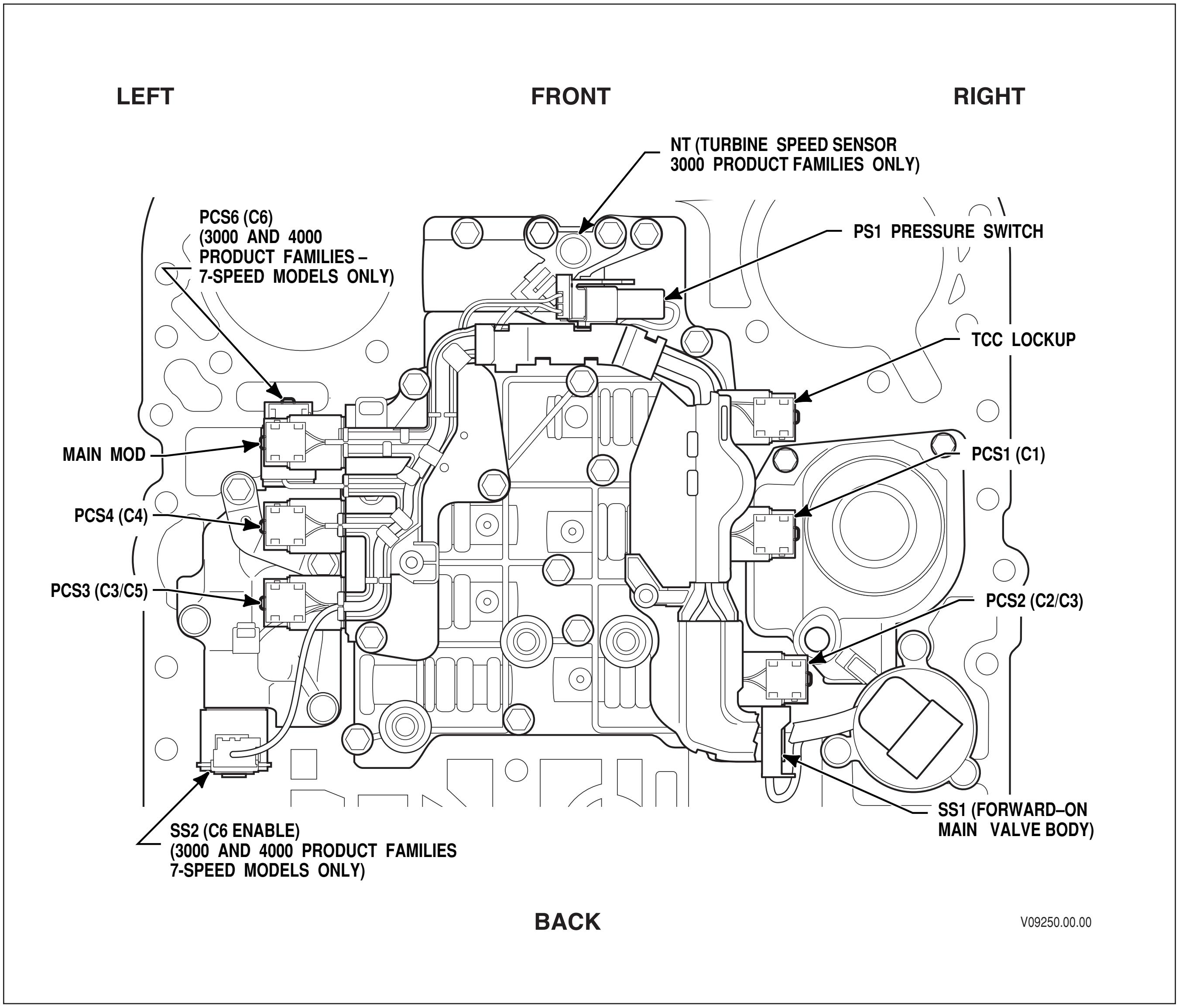
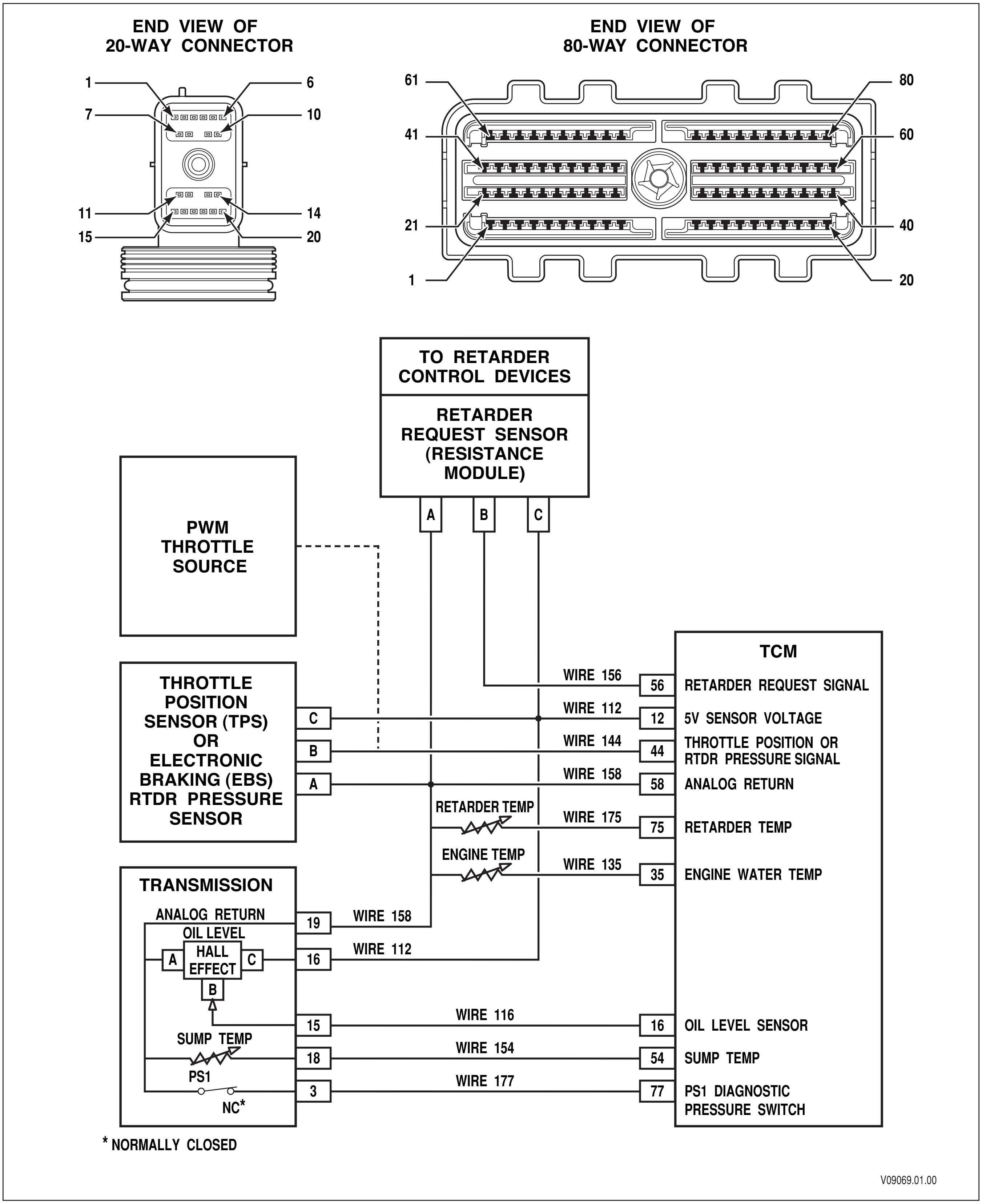


Figure 6–4. Control Module Solenoid Location

DIAGNOSTIC TROUBLE CODES (DTC)

DTC C1312 Retarder Request Sensor Failed Low



DIAGNOSTIC TROUBLE CODES (DTC)

DTC C1312 Retarder Request Sensor Failed Low

Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive a retarder request signal from a retarder request sensor, sometimes called a resistance module. The TCM is connected to the retarder request sensor by:

- a reference voltage wire,
- retarder request signal wire, and
- analog ground wire.

The TCM provides a 5V reference voltage to the retarder request sensor. A voltage divider network in the sensor produces a retarder request signal in response to inputs from the retarder control device(s). The TCM interprets this signal as a percent retarder requested.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm.

Conditions for Setting the DTC

DTC C1312 sets if the TCM is calibrated to receive the retarder request signal, and the signal voltage is less than 0.3V for five seconds.

Actions Taken When the DTC Sets

When DTC C1312 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- TCM may inhibit retarder operation, if not using the J1939 Datalink for retarder request signal.

Conditions for Clearing DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC C1312 indicates the TCM has detected a voltage signal from the retarder request sensor in the low error zone. The code can be caused by:
  - — Faulty wiring.
  - — Faulty connections to the retarder request sensor or retarder control device.
  - — A faulty retarder request sensor (resistance module).
  - — A faulty retarder control device.
  - — A faulty TCM.
- DTC C1312 can be caused by an open or short-to-ground in either the 5V reference wire 112 or retarder request signal wire 156. The retarder request sensor shares a common 5V reference voltage with the transmission oil level sensor (OLS) and throttle position sensor (TPS) on wire 112. An open or short-to-ground in the common 5V reference causes a “sensor failed low” code for the other devices as well. An open or short-to-ground on wire 156 will cause a DTC C1312 only.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for an active DTC.
3. This step tests for defective wiring in external harness.
5. This step tests for retarder request sensor functionality.
6. This step tests for proper 5V reference voltage at the TCM with OEM harness disconnected.

DTC C1312 Retarder Request Sensor Failed Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTC and drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the retarder request sensor voltage is below a set voltage for a set period of time. It may also indicate an open or short-to-ground in either the 5V reference wire 112 or retarder request signal wire 156.*** Did DTC C1312 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Turn OFF the ignition. 2. Inspect the routing of 5V reference wire 112, retarder request signal wire 156, and analog return (ground) wire 158 between the TCM and the retarder request sensor. 3. Disconnect the 80-way connector from the TCM. 4. Install the OEM-side of the 80-way connector to J 47275 TCM Breakout. Leave the TCM disconnected. 5. Disconnect the transmission 20-way connector, RMR connector, and TPS connector, if installed. 6. Test for opens or shorts-to-ground on wires 112 and 156. Was chafing or wire damage found?		*Go to Step 4*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC C1312 Retarder Request Sensor Failed Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
5	1. Turn OFF the ignition. 2. Reconnect the TCM to J 47275 TCM Breakout. 3. Reconnect the RMR connector, transmission 20-way connector, and TPS connector, if installed. 4. Turn ON the ignition. 5. At J 47275-1 TCM overlay, connect a DVOM and measure voltage between pins 56 and 58 for each position of each retarder control device used on the vehicle. If two resistance modules are used, disconnect one of them when measuring voltage signals from the other. Are the voltages within the specified values?	Refer to Table 6–3	*Go to Step 10*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the 16-pin bypass connector on J 47275 TCM Breakout. 3. Turn ON the ignition. 4. At J 47275-1 TCM Overlay, connect a DVOM and measure voltage between pins 12 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 7*	*Go to Step 10*
7	Replace the retarder request sensor (resistance module). Is replacement complete?		*Go to Step 8*	
8	After replacing the retarder request sensor, perform the following: 1. Turn ON the ignition. 2. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 3. At J 47275-1 TCM overlay, connect a DVOM and measure voltage between pins 56 and 58 for each position of each retarder control device used on the vehicle. If two resistance modules are used, disconnect one of them when measuring voltage signals from the other. Are voltages within specified values?	Refer to Table 6–3	*Go to Step 11*	*Go to Step 9*
9	Replace the retarder control device. Is replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC C1312 Retarder Request Sensor Failed Low *(cont'd)*

Step	Action	Value(s)	Yes	No
11	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor retarder request signal. 3. Drive the vehicle under conditions noted in failure records. 4. Confirm with the service tool in the test passed section that the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

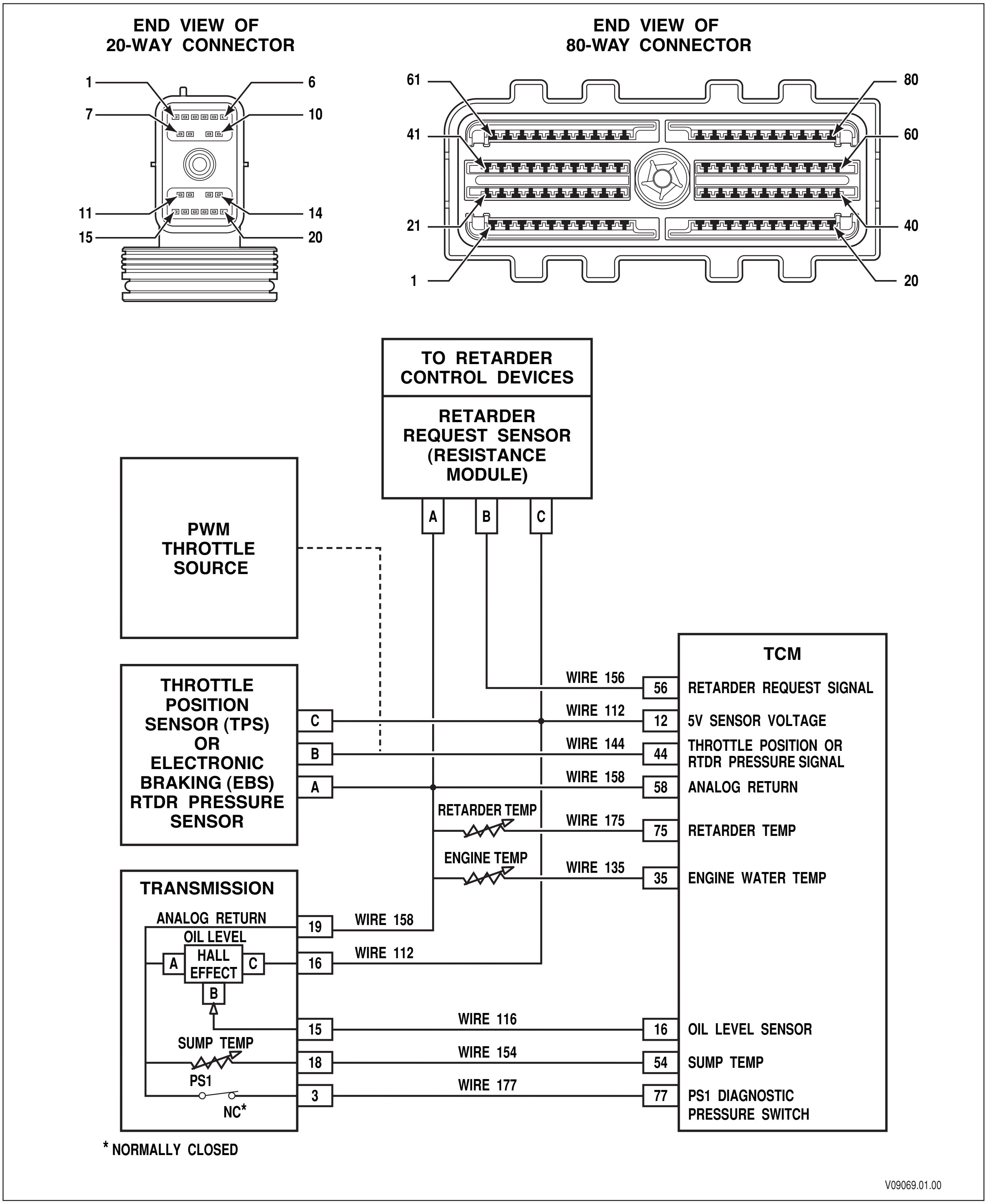
Table 6–3. Voltage/Resistance

	Resistance Test in Resistance Module*		Voltage Signal**		Wiring to Control Device
Description	**Terminals**	**Resistance KΩ +/– 5%**	**% Retarder Application**	**Voltage +/– 0.2V**	**Device Terminal**
Auto Full On	A to C	12	100	3.6	No connections
Pressure Switch	A to C	32			
Full On			0	1.1	A
High			100	3.6	B
3-Step E-10R	A to C	32	0	1.1	A
Bendix Pedal			32	1.9	B
			58	2.8	C
			100	3.6	D
6-Step Hand Lever	A to C	32			
OFF			0	1.1	+
Position 1			14	1.5	1
Position 2			28	1.9	2
Position 3			45	2.3	3
Position 4			65	2.8	4
Position 5			82	3.2	5
Position 6			100	3.6	6
Auto 1/2 ON	A to C	12	50	2.4	No connections
3 Pressure Switches	A to C	32	0	1.1	
Low			32	1.9	A and B
Medium			68	2.8	A and B
High			100	3.6	A and B
Auto 1/2 ON	A to C	21.4			
2 Pressure Switches					
Auto			32	1.9	A
Medium			68	2.8	B
High			100	3.6	A and B
Dedicated Pedal	No Check	Interface not a resistance module	0 100	0.7–1.2 3.4–3.5	A B C

* Resistance module **must be** disconnected from the wiring harness and retarder control devices.
** These voltages may be measured between TCM pins 56 and 58 using J 47275 TCM Breakout.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC C1313 Retarder Request Sensor Failed High



DIAGNOSTIC TROUBLE CODES (DTC)

DTC C1313 Retarder Request Sensor Failed High

Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive a retarder request signal from a retarder request sensor, sometimes called a resistance module. The TCM is connected to the retarder request sensor by:

- a reference voltage wire,
- retarder request signal wire, and
- analog ground wire.

The TCM provides a 5V reference voltage to the retarder request sensor. A voltage divider network in the sensor produces a retarder request signal in response to inputs from the retarder control device(s). The TCM interprets this signal as a percent retarder requested.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm.

Conditions for Setting the DTC

DTC C1313 sets if the TCM is calibrated to receive the retarder request signal, and the signal voltage is greater than 4.7V for 5 seconds.

Actions Taken When the DTC Sets

When DTC C1313 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- TCM may inhibit retarder operation, if not using the J1939 Datalink for retarder request signal.

Conditions for Clearing DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC C1313 indicates the TCM has detected a voltage signal from the retarder request sensor in the high error zone. The code can be caused by:
  - — Faulty wiring.
  - — Faulty connections to the retarder request sensor or retarder control device.
  - — A faulty retarder request sensor (resistance module).
  - — A faulty retarder control device.
  - — A faulty TCM.
- DTC C1313 can be caused by a short-to-battery in the 5V reference wire 112 or retarder request signal wire 156. DTC C1313 can also be caused by an open in analog return wire 158. The retarder request sensor shares a common 5V reference voltage with the transmission oil level sensor (OLS) and throttle position sensor (TPS) on wire 112. A short-to-battery in the 5V reference wire 112 or open in analog return wire 158 causes a "sensor failed high" code for the other devices as well. A short-to-battery in retarder request signal wire 156 will produce a DTC C1313 only.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for an active DTC.
3. This step tests for defective wiring in external harness.
5. This step tests for retarder request sensor functionality.
6. This step tests for proper 5V reference voltage at the TCM with OEM harness disconnected.

DTC C1313 Retarder Request Sensor Failed High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTC and drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the retarder request sensor voltage is above a set voltage for a set period of time. It may also indicate a short-to-battery on 5V reference wire 112 or an open on analog return wire 158.*** Did DTC C1313 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Turn OFF the ignition. 2. Inspect the routing of 5V reference wire 112, retarder request signal wire 156, and analog return (ground) wire 158 between the TCM and the retarder request sensor. 3. Disconnect the 80-way connector from the TCM. 4. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 5. Disconnect the transmission 20-way connector, RMR connector, and TPS connector, if installed. 6. Test for shorts-to-battery on wires 112 and 156, and opens on wire 158. Was chafing or wire damage found?		*Go to Step 4*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC C1313 Retarder Request Sensor Failed High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
5	1. Turn OFF the ignition. 2. Reconnect the TCM to J 47275 TCM Breakout. 3. Reconnect the RMR connector, transmission 20-way connector, and TPS connector, if installed. 4. Turn ON the ignition. 5. At J 47275-1 TCM Overlay, connect a DVOM and measure voltage between pins 56 and 58 for each position of each retarder control device used on the vehicle. If two resistance modules are used, disconnect one of them when measuring voltage signals from the other. Are the voltages within the specified values?	Refer to Table 6–4	*Go to Step 10*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the 16-pin bypass connector on J 47275 TCM Breakout. 3. Turn ON the ignition. 4. At J 47275-1 TCM Overlay, connect a DVOM and measure voltage between pins 12 and 58. Is the voltage within the specified value?	4.7–5.0V	*Go to Step 7*	*Go to Step 10*
7	Replace the retarder request sensor (resistance module). Is replacement complete?		*Go to Step 8*	
8	After replacing the retarder request sensor, perform the following: 1. Turn ON the ignition. 2. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 3. At J 47275-1 TCM Overlay, connect a DVOM and measure voltage between pins 56 and 58 for each position of each retarder control device used on the vehicle. If two resistance modules are used, disconnect one of them when measuring voltage signals from the other. Are voltages within specified values?	Refer to Table 6–4	*Go to Step 11*	*Go to Step 9*
9	Replace the retarder control device. Is replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC C1313 Retarder Request Sensor Failed High *(cont'd)*

Step	Action	Value(s)	Yes	No
11	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor retarder request signal. 3. Drive the vehicle under conditions noted in failure records. 4. Confirm with the service tool in the test passed section that the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

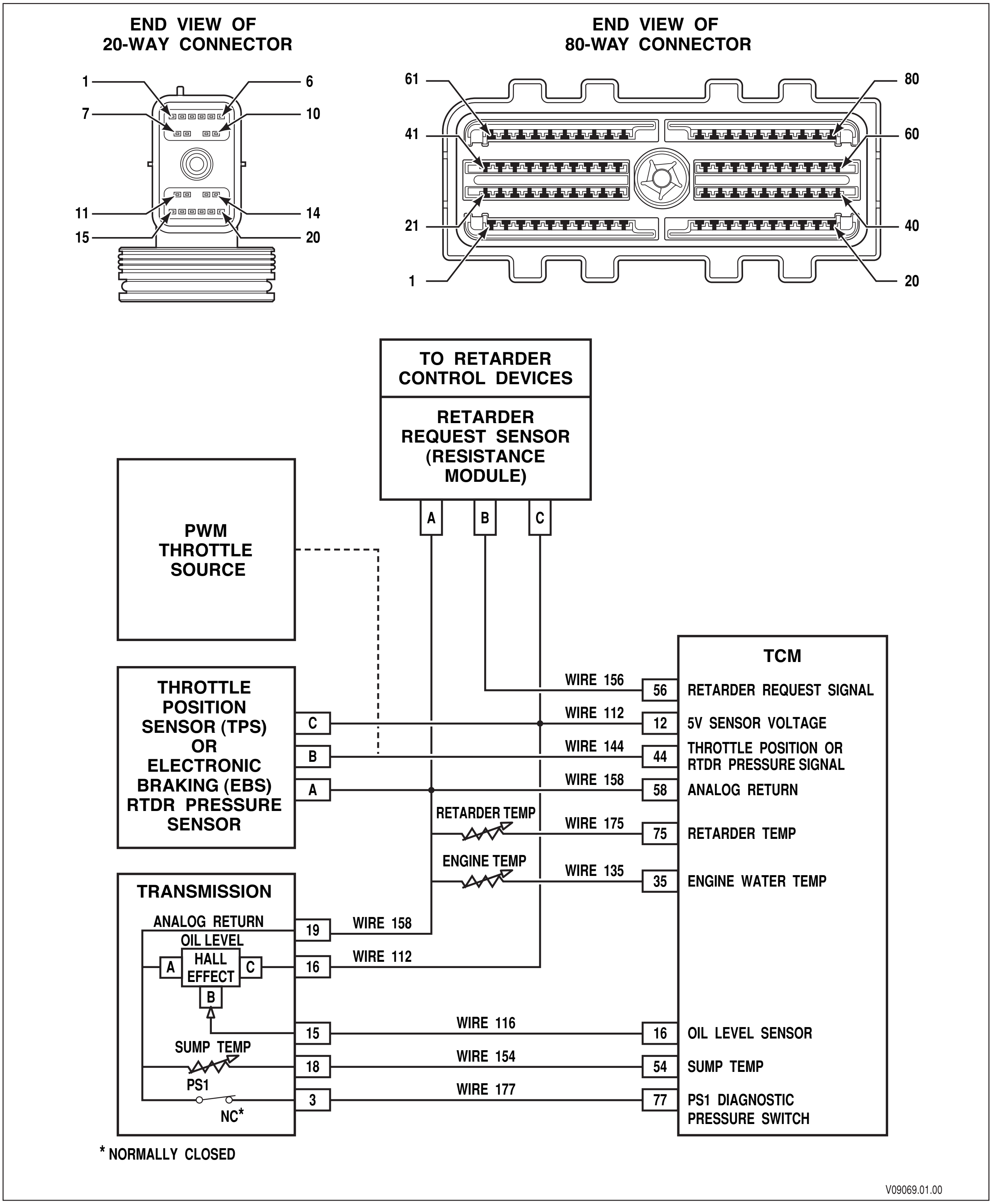
Table 6–4. Voltage/Resistance

	Resistance Test in Resistance Module*		Voltage Signal**		Wiring to Control Device
Description	**Terminals**	**Resistance KΩ +/– 5%**	**% Retarder Application**	**Voltage +/– 0.2V**	**Device Terminal**
Auto Full On	A to C	12	100	3.6	No connections
Pressure Switch	A to C	32			
Full On			0	1.1	A
High			100	3.6	B
3-Step E-10R	A to C	32	0	1.1	A
Bendix Pedal			32	1.9	B
			58	2.8	C
			100	3.6	D
6-Step Hand Lever	A to C	32			
OFF			0	1.1	+
Position 1			14	1.5	1
Position 2			28	1.9	2
Position 3			45	2.3	3
Position 4			65	2.8	4
Position 5			82	3.2	5
Position 6			100	3.6	6
Auto 1/2 ON	A to C	12	50	2.4	No connections
3 Pressure Switches	A to C	32	0	1.1	
Low			32	1.9	A and B
Medium			68	2.8	A and B
High			100	3.6	A and B
Auto 1/2 ON	A to C	21.4			
2 Pressure Switches					
Auto			32	1.9	A
Medium			68	2.8	B
High			100	3.6	A and B
Dedicated Pedal	No Check	Interface not a resistance module	0 100	0.7–1.2 3.4–3.5	A B C

* Resistance module **must be** disconnected from the wiring harness and retarder control devices.
** These voltages may be measured between TCM pins 56 and 58 using J 47275 TCM Breakout.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0122 Pedal Position Sensor Low Voltage



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0122 Pedal Position Sensor Low Voltage

Circuit Description

The Transmission Control Module (TCM) may receive input on throttle position from either a Throttle Position Sensor (TPS) or a signal transmitted by the engine electronic controls.

Vehicles not equipped with electronically-controlled engines have a TPS attached to the engine fuel control linkage. The TPS continuously sends the exact throttle position to the transmission TCM.

The TPS is a sliding resistor sensor (potentiometer) actuated by a mechanical linkage. The TCM delivers a constant voltage to one terminal of the TPS resistive strip. The other TPS terminal connects to ground. The resistor contacts of the TPS provide a regulated voltage signal input to the TCM.

When actuated by the mechanical throttle cable, the contacts of the resistor move along the resistive strip. As the contacts slide along the resistive strip, a voltage is sent to the TCM. At each increment of 0.78 mm (0.007 inch) along the resistive strip, the contacts deliver a different voltage to the TCM. The different voltages are interpreted as throttle sensor movement. The TCM converts travel distance (mm) into throttle opening percentage.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm.
- DTC P0122 Pedal Position Sensor Circuit High Voltage is not active.

Conditions for Setting the DTC

DTC P0122 sets when the TCM detects a throttle position sensor voltage less than 0.55V for 5 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC P0122 is stored in the TCM memory.
- The TCM uses the default throttle value, based on engine torque and speed.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS LIGHT

The Allison DOC™ For PC–Service Tool may be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without the DTC recurring.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.

DIAGNOSTIC TROUBLE CODES (DTC)

- DTC P0122 can be caused by an open or short-to-ground in either the 5V reference wire 112 or TPS signal wire 144. The TPS shares a common 5V reference voltage wire 112 with the optional transmission oil level sensor (OLS) and retarder request sensor. An open or short-to-ground in the common 5V reference causes a "sensor failed low" code for the other devices as well. An open or short-to-ground on wire 144 will cause a DTC P0122 only.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper adjustment of TPS.
3. This step tests for the proper ignition voltage.
4. This step tests for the proper TCM 5V reference voltage.
5. This step tests for dead spots in the potentiometer.
6. This step tests for abnormal TPS resistance.
7. This step tests for proper resistance of the TPS circuit.
8. This step tests for an open or short-to-ground in TPS signal wire 144.
9. This step tests for proper 5V reference voltage at TCM without OEM harness.
10. This step tests for an open or short-to-ground on 5V reference wire 112.

DTC P0122 Pedal Position Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Refer to Appendix F to check for proper TPS adjustment. Is the TPS adjusted properly?		*Go to Step 3*	*Adjust TPS to proper setting. Go to Step 12*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC failure record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (refer to DTC P0882 and DTC P0883)*
4	1. Turn OFF the ignition. 2. Disconnect the 80-way connector from the TCM and install the J 47275 TCM Breakout between the TCM and the OEM-side connector. 3. With the engine OFF, turn the ignition to the ON position. 4. Using a DVOM, measure the voltage between pins 12 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 5*	*Go to Step 9*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0122 Pedal Position Sensor Low Voltage *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. With the engine OFF and the ignition in the ON position, monitor TPS percentage with Allison DOC™ For PC–Service Tool. 2. Slowly increase the throttle from idle to full throttle position. 3. Watch for a steady increase in TPS percentage. Was the throttle percentage steady and without interruptions?		*Go to Diagnostic Aids*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Disconnect the TPS connector. 3. Using a DVOM, measure the resistance between TPS pins A and C. Is resistance within the specified value?	9000–15,000 Ohms	*Go to Step 7*	*Go to Step 11*
7	1. Reconnect the TPS connector. 2. Disconnect the J 47275 TCM Breakout from the TCM. Leave the OEM 80-way connector mated to the J 47275 TCM Breakout. 3. Using a DVOM, measure resistance between 80-way connector pins 12 and 58. Is resistance within the specified value?	9000–15,000 Ohms	*Go to Step 8*	*Go to Step 10*
8	1. Turn OFF the ignition. 2. Disconnect the TPS connector. 3. Using a DVOM at J47275-1 TCM Overlay, test for opens, wire-to-wire shorts, and shorts-to-ground at pin 44. Were any opens, wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 10*	*Go to Step 11*
9	1. Turn OFF the ignition. 2. Disconnect the 16-pin bypass connector on J 47275 TCM breakout. 3. Turn ON the ignition. 4. Using a DVOM at J 47275-1 TCM Overlay, measure voltage between pins 12 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 10*	*Go to Step 13*
10	1. Turn OFF the ignition. 2. Disconnect the J 47275 TCM Breakout from the TCM. Leave the OEM 80-way connector mated to the J 47275 TCM Breakout. 3. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 4. Disconnect the TPS connector, transmission 20-way connector, and RMR device, if installed. 5. Using a DVOM at J 47275-1 TCM Overlay, test for opens, wire-to-wire shorts, and shorts-to-ground at pin 12. 6. Test for opens at pin 58. Were any opens, wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 11*	*Go to Diagnostic Aids*

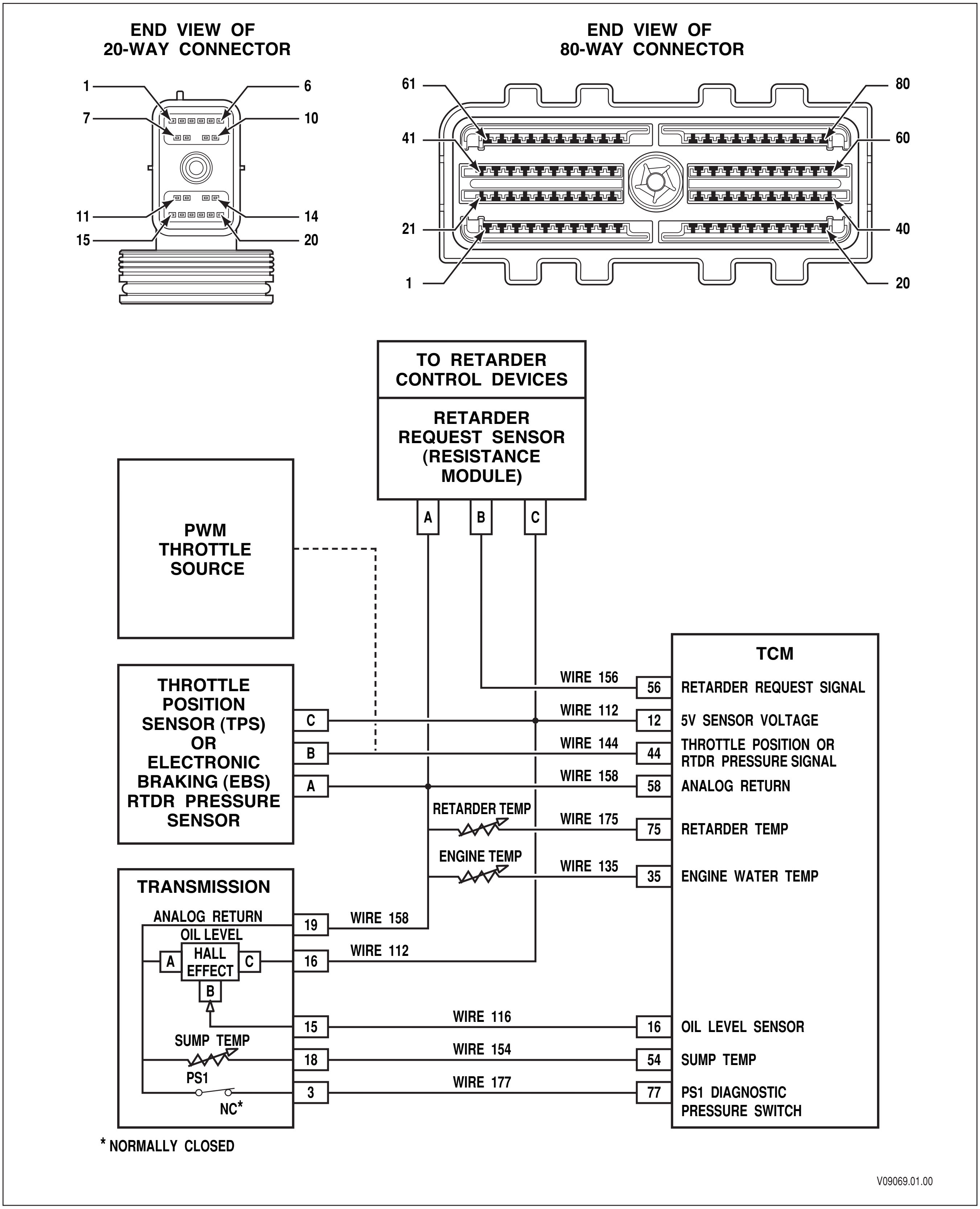
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0122 Pedal Position Sensor Low Voltage *(cont'd)*

Step	Action	Value(s)	Yes	No
11	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Repair the vehicle wiring harness. Is the repair complete?		*Go to Step 14*	
12	Replace the throttle position sensor. Is the replacement complete?		*Go to Step 14*	
13	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is the replacement complete?		*Go to Step 14*	
14	In order to verify your repair: 1. Clear the DTC. 2. Operate the vehicle under normal driving conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0123 Pedal Position Sensor High Voltage



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0123 Pedal Position Sensor High Voltage

Circuit Description

The Transmission Control Module (TCM) receives input on throttle position from either a Throttle Position Sensor (TPS) or a signal transmitted by the engine electronic controls.

Vehicles not equipped with electronically-controlled engines have a TPS attached to the engine fuel control linkage. The TPS continuously sends the exact throttle position to the transmission TCM.

The TPS is a sliding resistor sensor (potentiometer) actuated by a mechanical linkage. The TCM delivers a constant voltage to one terminal of the TPS resistive strip. The other TPS terminal connects to ground. The resistor contacts of the TPS are connected to provide a regulated voltage signal input to the TCM.

When actuated by the mechanical throttle cable, the contacts of the resistor move along the resistive strip. As the contacts slide along the resistive strip, a voltage is sent to the TCM. At each increment of 0.78 mm (0.007 inch) along the resistive strip, the contacts deliver a different voltage to the TCM. The different voltages are interpreted as throttle sensor movement. The TCM converts travel distance (mm) into throttle opening percentage.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less the 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm.
- DTC P0123 Throttle/Pedal Position Sensor/Switch A Circuit Low Input is not active.

Conditions for Setting the DTC

DTC P0123 sets when the TCM detects a throttle position sensor voltage greater than 4.75V for 5 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC P0123 is stored in the TCM history.
- The TCM uses the default throttle value, based on engine torque and speed.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS LIGHT

The Allison DOC™ For PC–Service Tool may be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without the DTC recurring.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.

DIAGNOSTIC TROUBLE CODES (DTC)

- DTC P0123 can be caused by a short-to-battery in either the 5V reference wire 112 or TPS signal wire 144. DTC P0123 can also be caused by an open in analog return wire 158. The TPS shares a common 5V reference voltage wire 112 with the transmission oil level sensor (OLS) and retarder request sensor. A short-to-battery in 5V reference wire or open in analog return wire 158 causes a "sensor failed high" code for the other devices as well. A short-to-battery on TPS signal wire 144 will produce a DTC P0123 only.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper adjustment of TPS.
3. This step tests for the proper ignition voltage.
4. This step tests for the proper TCM 5V reference voltage.
5. This step tests for dead spots in the potentiometer.
6. This step tests for abnormal TPS resistance.
7. This step tests for proper resistance of the TPS circuit.
8. This step tests for a short-to-battery in TPS signal wire 144.
9. This step tests for proper 5V reference voltage at TCM without OEM harness.
10. This step tests for a short-to-battery in 5V reference wire 112 or open in analog return wire 158.

DTC P0123 Pedal Position Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Refer to Appendix F to determine proper TPS adjustment. Is the TPS adjusted properly?		*Go to Step 3*	*Adjust TPS to proper setting. Go to Step 14*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC failure record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (refer to DTC P0882 and DTC P0883)*
4	1. Turn OFF the ignition. 2. Disconnect the 80-way connector from the TCM and install the J 47275 TCM Breakout between the TCM and the OEM-side connector. 3. With the engine OFF, turn the ignition to the ON position. 4. Using a DVOM, measure the voltage between pins 12 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 5*	*Go to Step 9*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0123 Pedal Position Sensor High Voltage *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. With the engine OFF and the ignition in the ON position, monitor TPS percentage with Allison DOC™ For PC–Service Tool. 2. Slowly increase the throttle from idle to full throttle position. 3. Watch for a steady increase in TPS percentage. Was TPS percentage steady and without interruptions?		*Go to Step 6*	*Go to Step 12*
6	1. Turn OFF the ignition. 2. Disconnect the TPS connector. 3. Using a DVOM, measure the resistance between TPS pins A and C. Is resistance within the specified value?	9000–15,000 Ohms	*Go to Step 7*	*Go to Step 11*
7	1. Reconnect the TPS connector. 2. Disconnect the J 47275 TCM Breakout from the TCM. Leave the OEM 80-way connector mated to the J 47275 TCM Breakout. 3. Using a DVOM, measure resistance between 80-way connector pins 12 and 58. Is resistance within the specified value?	9000–15,000 Ohms	*Go to Step 8*	*Go to Step 10*
8	1. Turn OFF the ignition. 2. Disconnect the TPS connector. 3. Using a DVOM at J 47275-1 TCM Overlay, test for wire-to-wire shorts and shorts-to-battery at pin 44. Were any wire-to-wire shorts or shorts-to-battery found?		*Go to Step 9*	*Go to Step 11*
9	1. Turn OFF the ignition. 2. Disconnect the 16-pin bypass connector on J 47275 TCM breakout. 3. Turn ON the ignition. 4. Using a DVOM at J 47275-1 TCM Overlay, measure voltage between pins 12 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 10*	*Go to Step 13*
10	1. Turn OFF the ignition. 2. Disconnect the J 47275 TCM Breakout from the TCM. Leave the OEM 80-way connector mated to the J 47275 TCM Breakout. 3. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 4. Disconnect the TPS connector, transmission 20-way connector, and RMR connector, if installed. 5. Using a DVOM at J 47275-1 TCM Overlay, test for opens, wire-to-wire shorts, and shorts-to-ground at pin 12. 6. Test for opens at pin 58. Were any opens, wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 11*	*Go to Diagnostic Aids*

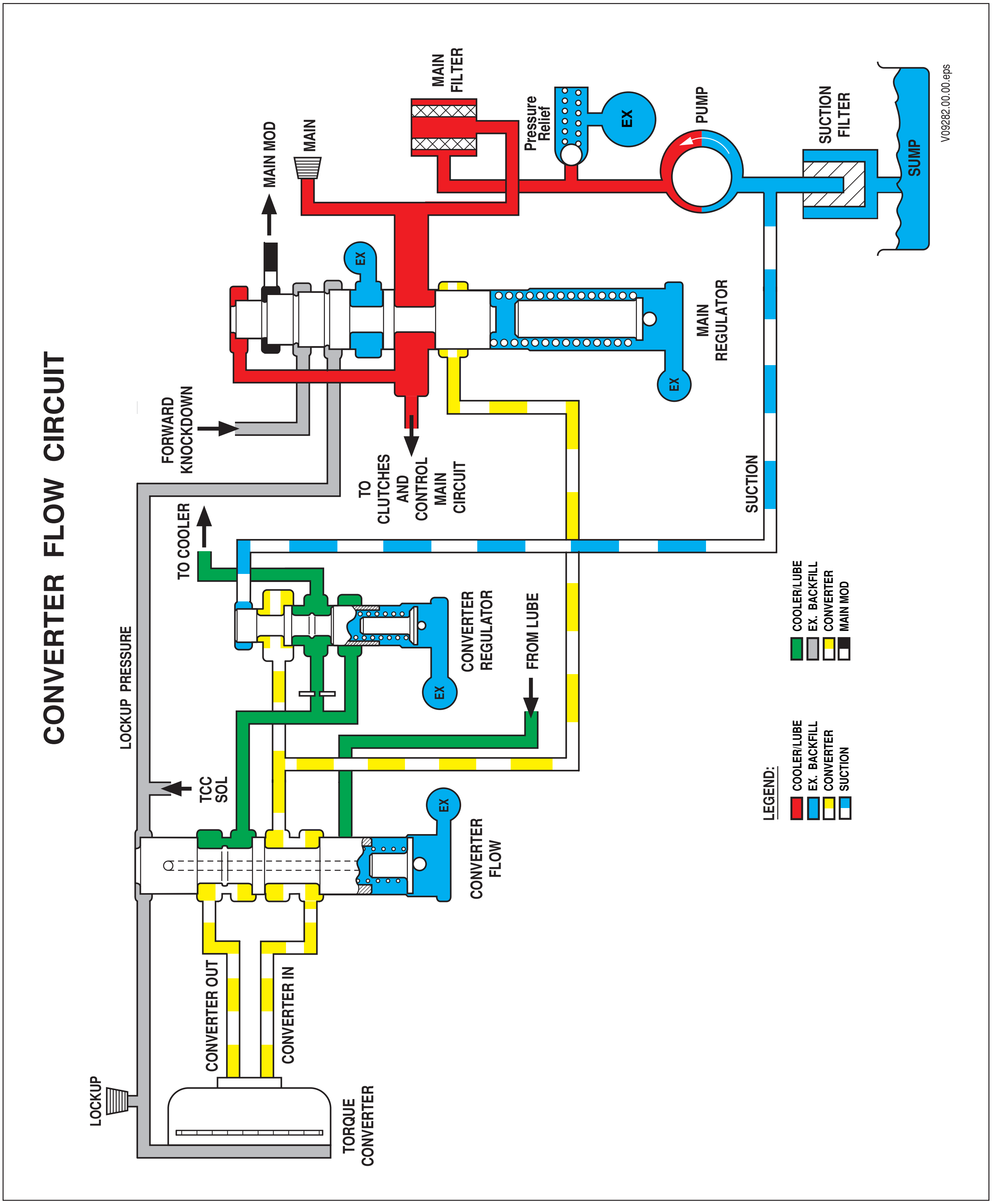
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0123 Pedal Position Sensor High Voltage *(cont'd)*

Step	Action	Value(s)	Yes	No
11	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Repair the vehicle wiring harness. Is the repair complete?		*Go to Step 14*	
12	Replace the throttle position sensor. Is the replacement complete?		*Go to Step 14*	
13	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is the replacement complete?		*Go to Step 14*	
14	In order to verify your repair: 1. Clear the DTC. 2. Operate the vehicle under normal driving conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0218 Transmission Fluid Over-Temperature



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0218 Transmission Fluid Over-Temperature

Circuit Description

Transmission fluid flow starts in the transmission sump. Fluid is drawn into the oil pump assembly through the suction filter and internal passages in the main housing and front support. The gerotor gear set in the oil pump assembly turns at engine speed and pressurizes the fluid. The main regulator valve regulates the discharge pressure at the oil pump. Pressurized fluid returns to the hydraulic control module where it is directed to the clutch apply circuits and the control main regulator valve. Control main pressure is used to stroke solenoid regulator valves, which apply and release transmission clutches in response to solenoid commands from the Transmission Control Module (TCM).

The main pump produces substantially more fluid flow than is required by the clutch apply circuit. Surplus oil pressure (overage) at the main regulator valve is relieved into the converter flow circuit. The converter flow circuit routes pressurized fluid to the torque converter via the converter flow valve and the converter regulator valve. Hot fluid leaving the torque converter is routed back through the converter flow valve into cooler lines that run to the transmission oil cooler in the vehicle cooling system. The cooled fluid is returned to the transmission and enters the transmission lubrication circuit. The lube regulator valve regulates the proper lubrication pressure and directs excess fluid back to the sump. The transmission fluid temperature sensor is part of the internal wiring harness and measures the sump temperature.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- Engine is running. If engine runtime is less than 10 minutes, then engine coolant temperature must be above 20°C (68°F) for more than 20 seconds.

Conditions for Setting the DTC

The TCM detects transmission fluid temperature greater than 126.85°C (260°F) value for more than 10 seconds.

Actions Taken When the DTC Sets

When DTC P0218 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- The TCM freezes shift adapts (DNA).
- TCM defaults to “hot mode” shift schedule where fourth range is held and TCC is inhibited to increase engine speed and improve cooler flow.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

The TCM cancels the DTC default actions when the fault no longer exists and the DTC passes test.

Diagnostic Aids

- The Allison DOC™ For PC–Service Tool transmission fluid temperature should rise steadily during warm-up cycles and then stabilize.
- DTC P0218 may set after DTC P0711 (not active) has set. Follow the diagnostic table for DTC P0711 before proceeding to the diagnostic table for P0218. Repairing the condition that set DTC P0711 will likely eliminate DTC P0218.
- A stuck autoflow valve can cause overheating in retarder-equipped transmissions. Refer to section 8 for general troubleshooting of performance complaints.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level and condition.
3. This step monitors the status of DTC P0218.
4. This step verifies which condition has set the DTC P0218.
5. This step tests for proper resistance value in entire circuit.
6. This step tests for wire-to-wire shorts, shorts-to-ground, or an open on wire 154.
7. This step tests the resistance value of the internal harness and sump temperature sensor.
9. This step tests the resistance value of the internal sump temperature sensor.
12. This step tests to determine source of overheat—the engine or transmission.
13. This step tests for proper cooler pressure drop.
14. This step tests for stuck stator.
15. This step inspects vehicle's engine and transmission cooling systems.

DTC P0218 Transmission Fluid Over-Temperature

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure. Refer to the appropriate mechanic's tips. Is transmission fluid level correct?		*Go to Step 3*	*Go to mechanic's tips*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Install temperature gauges for transmission temperature and engine water temperature. 3. Turn ON the ignition. 4. Record the failure records. 5. Clear the DTCs. 6. Drive the vehicle and monitor the sump temperature on Allison DOC™ For PC–Service Tool. Did DTC P0218 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	Compare the manual temperature gauge reading to the Allison DOC™ For PC–Service Tool transmission temperature when the DTC is set. Does the manual temperature gauge confirm the transmission fluid temperature actually is hot when DTC P0218 is produced?		*Go to Step 12*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0218 Transmission Fluid Over-Temperature *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM. 3. Connect J 47425 TCM Breakout to the OEM connector. Leave the TCM disconnected. The TCM should not be connected to properly perform this test. 4. Using a DVOM at J 47275-1 TCM Overlay, measure the resistance between pins 54 and 58. Is the resistance within the specified value?	3511–3653 Ohms at 20°C (68°F) Refer to Appendix Q	*Go to Step 6*	*Go to Step 7*
6	1. Disconnect the transmission 20-way connector, TPS, and RMR, if installed. 2. At J 47275-1 TCM Overlay connect a DVOM, test for opens, wire-to-wire shorts, and shorts-to-ground at pin 54 and 58. Were any wiring defects found?		*Go to Step 8*	*Go to Step 16*
7	1. Disconnect the 20-way connector at the transmission and install J 47279 Transmission Breakout. Connect only the J 47279 Transmission Breakout to the transmission; the vehicle side of the harness should not be connected for this test. 2. At J 47279-1 Transmission Overlay, using a DVOM, measure resistance at main transmission connector pins 18 and 19. Is the resistance within the specified value?	3511–3653 Ohms at 20°C (68°F) Refer to Appendix Q	*Go to Step 8*	*Go to Step 9*
8	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 17*	
9	1. Remove the hydraulic control module assembly. 2. Disconnect the sump thermistor from the internal wiring harness. 3. Using a DVOM, measure thermistor resistance at pins A and B. Is resistance within the specified values?	3511–3653 Ohms at 20°C (68°F) Refer to Appendix Q	*Go to Step 10*	*Go to Step 11*
10	Replace the internal harness (refer to mechanic's tips). Is the replacement complete?		*Go to Step 17*	
11	Replace the sump thermistor (refer to mechanic's tips). Is replacement complete?		*Go to Step 17*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0218 Transmission Fluid Over-Temperature *(cont'd)*

Step	Action	Value(s)	Yes	No
12	1. Use temperature gauge readings obtained in Step 4 above. 2. Compare engine water temperature to transmission fluid temperature. Did the transmission become hot before the engine?		*Go to Step 13*	*Go to Step 15*
13	1. Install pressure gauges in the "To" and "From" cooler lines. 2. Start the engine. 3. Subtract "From Cooler" from "To Cooler" pressure to obtain pressure drop across the transmission oil cooler. 4. Verify cooler pressure drop satisfies limits of Table 6–5 (4000 Product Family) or Table 6–6 (3000 Product Family). Is cooler pressure drop within specified values?	Refer to Table 6–5 for 4000 Product Family. Refer to Table 6–6 for 3000 Product Family	*Go to Step 14*	*Go to Step 15*
14	Check for a possible torque converter stator malfunction. A stuck stator would be indicated by no cool-down in Neutral after stalling the transmission. Refer to appropriate service manual for Stall Test Procedures. Did you find and correct the condition?		*Go to Step 17*	*Go to Section 8, General Troubleshooting of Performance Complaints*
15	1. Inspect the engine cooling system for the following conditions: • Air flow restrictions • Air flow blockage • System fluid level and condition • Debris 2. Inspect the transmission cooling system for the following conditions: • Air flow restrictions • Air flow blockage • System fluid level and condition • Damaged cooler lines and hoses Did you find and correct the condition?		*Go to Step 17*	
16	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 17*	
17	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor the transmission fluid temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant change in TFT. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0218 Transmission Fluid Over-Temperature

External Hydraulic Circuit Characteristics

Basic, PTO, 93°C (200°F) Sump Temperature

Table 6–5. 4000 Product Family

CONVERTER OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
	Flow		Pressure Drop	
Input rpm	L/s	gpm	kPa	psi
600	0.22	3.4	0	0
900	0.38	6.1	0	0
1200	0.55	8.7	0	0
1500	0.80	12.7	0	0
1800	1.03	16.4	0	0
2100	1.13	18.0	0	0
2300	1.20	19.0	0	0
CONVERTER OPERATION COOLER FLOW AT MAXIMUM ALLOWABLE PRESSURE DROP				
600	0.20	3.2	31.0	4.5
900	0.37	5.8	63.0	9.1
1200	0.55	8.7	108.0	15.7
1500	0.77	12.2	167.0	24.2
1800	0.92	14.5	231.0	30.9
2100	0.97	15.3	238.0	34.5
2300	1.00	15.9	250.0	36.3

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0218 Transmission Fluid Over-Temperature

External Hydraulic Circuit Characteristics

Basic, PTO, 93°C (200°F) Sump Temperature

Table 6–6. 3000 Product Family

Input rpm	Flow L/s	Flow gpm	Pressure Drop kPa	Pressure Drop psi
CONVERTER OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
600	0.10	1.6	0	0
800	0.23	3.7	0	0
1200	0.47	7.4	0	0
1400	0.61	9.7	0	0
1600	0.74	11.7	0	0
2000	0.94	14.9	0	0
2400	1.19	18.9	0	0
3200	1.28	20.3	0	0
CONVERTER OPERATION MAXIMUM ALLOWABLE PRESSURE DROP				
600	0.10	1.6	10.0	1.5
800	0.23	3.5	40.0	5.8
1200	0.45	7.1	159.0	23.1
1400	0.57	9.0	252.0	36.6
1600	0.67	10.6	338.0	49.0
2000	0.80	12.7	481.0	69.8
2400	0.85	13.5	549.0	79.6
3200	0.85	13.5	549.0	79.6
LOCKUP OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
600	0.10	1.6	0	0
800	0.23	3.7	0	0
1200	0.50	7.9	0	0
1400	0.63	10.0	0	0
1600	0.77	12.2	0	0
2000	0.95	15.1	0	0
2400	1.12	17.8	0	0
2800	1.22	19.3	0	0
3200	1.28	20.3	0	0
LOCKUP OPERATION MAXIMUM ALLOWABLE PRESSURE DROP				
600	0.10	1.6	5.0	0.7
800	0.23	3.7	46.0	6.7
1200	0.48	7.6	148.0	21.5
1400	0.62	9.8	247.0	35.8
1600	0.73	11.6	346.0	50.2
2000	0.90	14.3	561.0	81.4
2400	1.07	17.0	737.0	106.9
2800	1.10	17.4	770.0	111.7
3200	1.10	17.4	791.0	114.7

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0602 TCM Not Programmed

NO SCHEMATIC FOR THIS DTC

Circuit Description

At power up and after clearing codes, the Transmission Control Module (TCM) performs a self-test to determine if the calibration in memory is valid.

Conditions for Running the DTC

This test will run before any TCM functions.

Conditions for Setting the DTC

DTC P0602 sets if the TCM determines the present calibration is invalid.

Actions Taken When the DTC Sets

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM returns to the boot program, and waits to be recalibrated.
- TCM inhibits shifts to range.

Conditions for Clearing the DTC/CHECK TRANS Light

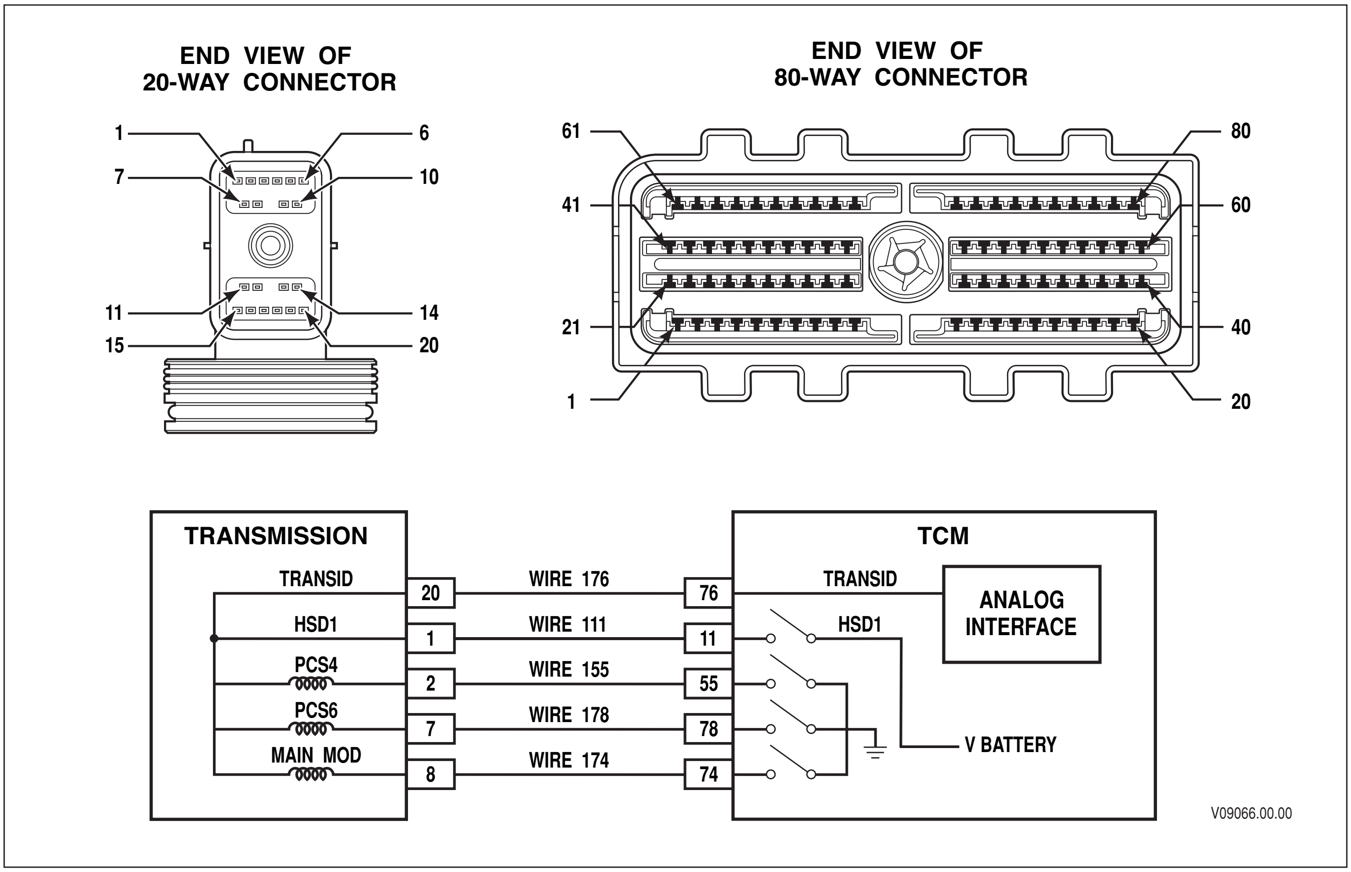
The TCM must be recalibrated.

DTC P0602 TCM Not Programmed

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. If DTC P0602 is present, the TCM **must be** recalibrated. Is recalibration complete?		*Go to Step 4*	
3	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 4*	
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the vehicle. Did the DTC return?		*Go to Step 3*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0610 TCM Vehicle Options (TransID) Error



Circuit Description

The TransID (TID) feature enables the TCM to recognize various transmission hardware configurations and select an appropriate software calibration. The TCM senses the transmission configuration using TID wire 176. In initial versions of 4th Generation Controls, wire 176 is connected to High Side Driver 1 (HSD1), wire 111, in the internal wiring harness. HSD1 supplies power to the Main Mod solenoid, and Pressure Control Solenoids (PSC) 4 and 6. This wiring configuration is designated TID A.

Conditions for Running the DTC

The test is enabled by the TCM calibration.

Conditions for Setting the DTC

DTC P0610 sets if the TCM determines the controls are incompatible with transmission hardware.

Actions Taken When the DTC Sets

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM uses a TID A calibration.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

DTC P0610 TCM Vehicle Options (TransID) Error

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition. 3. Using Allison DOC™ For PC–Service Tool, determine the highest available TID level supported by the TCM calibration. 4. Consult the transmission bill of material or build history to determine the actual TID level of the transmission. 5. Compare the highest available TID level in the calibration to the actual transmission hardware. Is the highest available TID level greater than or equal to the actual TID of the transmission?		*Go to Step 3*	*Go to Step 4*
3	1. Reset Autodetect using Allison DOC™ For PC–Service Tool. 2. Monitor “TransID level Used” on Allison DOC™ For PC–Service Tool. 3. Compare the TID level indicated on Allison DOC™ For PC–Service Tool to the actual TID level of the transmission. Did the TCM detect the correct TID level?		*Go to Step 6*	*Go to Step 5*
4	Recalibrate the TCM with a TID calibration that matches the actual TID level of the transmission. Is the recalibration complete?		*Go to Step 6*	
5	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, reset Autodetect. 3. Verify the TCM detects the correct TID level. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0613 TCM Processor

NO SCHEMATIC FOR THIS DTC

Circuit Description

The Transmission Control Module (TCM) continually performs a series of processing steps known as a ‘processing loop’ during normal operation. The TCM must complete the processing loop within a specific time limit. The TCM will reset if it does not complete two consecutive loops inside a predetermined time interval.

NOTE: The presence of DTC P0613 indicates a TCM processing error has occurred. Contact the Allison Transmission Service Department at 1-800-252-5283.

Conditions for Running the DTC

This test is run during the entire ignition cycle.

Conditions for Setting the DTC

DTC P0613 sets if the TCM does not complete two processing loops within the allotted time.

Actions Taken When the DTC Sets

- When DTC P0613 is active, the TCM commands OFF all solenoids (SOL OFF). Following recovery from the processor reset, the TCM commands the range that resulted after solenoids were commanded OFF. The TCM resumes normal operation.
- The TCM does not illuminates the **CHECK TRANS** light.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0614 Torque Control Data Mismatch—ECM/TCM

NO SCHEMATIC FOR THIS DTC

Circuit Description

Shift Energy Management (SEM) allows the Transmission Control Module (TCM) to request torque reduction from the engine controller. By reducing torque, shifts can be made quicker, at a more consistent output torque which reduces clutch temperatures and increases clutch life. When an engine torque rating exceeds a predetermined value, Low Range Torque Protection (LRTP), is used. This feature limits engine torque in lower ranges to protect the transmission from damage during a stall condition.

Conditions for Running the DTC

- TCM detects a J1939 EEC1 message from the engine.
- Then, the TCM requests the J1939 component ID and engine configuration messages from the engine.
- The TCM identifies the engine as an approved “make and model” by matching the component ID with the engine configuration message.
- The test runs for 15 seconds for the first 20 engine starts after the engine is detected on the J1939 communications link.
- The “engine start” counter resets if the TCM is reprogrammed.

Conditions for Setting the DTC

DTC P0614 sets during the following conditions:

- The TCM requires a SEM engine but the engine does not support SEM, i.e., is not on the approved list.
- The TCM requires a SEM and LRTP engine but the engine does not support SEM and LRTP, i.e., is not on the approved list.
- The engine does not respond to a SEM torque reduction request message within 20 ignition cycles.
- The engine does not respond to a LRTP torque reduction request message within 20 ignition cycles.

Actions Taken When the DTC Sets

When DTC P0614 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM will allow operation in Reverse and second range only.
- TCM freezes shift adapts (DNA).
- TCM inhibits the torque converter clutch (TCC).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

3. This step verifies the engine is on the recognized list of SEM/LRTP engines.
4. This step verifies the engine supports SEM.
5. This step verifies the engine supports LRTP.

DTC P0614 Torque Control Data Mismatch—ECM/TCM

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	If a DTC U0115 is present, troubleshoot and resolve before going to the next step. Is a DTC U0115 present?		*Go to DTC U0115 and resolve before proceeding to Step 8*	*Go to Step 3*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition. 3. Refer to **Engine Hardware Status** in SEM/ LRTP AND AUTODETECT INFO display of Allison DOC™ For PC–Service Tool. Is the Engine Hardware Status recognized as a SEM/ LRTP capable engine?	Recognized Or Not Recognized	*Go to Step 4*	*Go to Step 7*
4	Refer to **SEM Validated Status** in SEM/LRTP AND AUTODETECT INFO display of Allison DOC™ For PC–Service Tool. Does the ECM support SEM?	ECM Supports SEM Or ECM Doesn’t Support SEM	*Go to Step 5*	*Go to Step 7*
5	Refer to **LRTP Validated Status** in SEM/LRTP AND AUTODETECT INFO display of Allison DOC™ For PC–Service Tool. Does the ECM support LRTP?	ECM Supports LRTP Or ECM Doesn’t Support LRTP	*Go to Step 6*	*Go to Step 7*
6	This indicates the engine torque values are above the transmission ratings set in the TCM calibration. 1. Inspect the TCM for proper calibration to support SEM and LRTP. If proper TCM calibration is installed, the engine rating is too high for the transmission. 2. Recalibrate the engine to a lower torque rating. Was one of the above conditions found and resolved?		*Go to Step 8*	
7	Turn over the vehicle to the engine manufacturer to install the proper engine software and calibration to support SEM and/or LRTP. Has the proper software and calibration been installed?		*Go to Step 8*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0614 Torque Control Data Mismatch—ECM/TCM *(cont'd)*

Step	Action	Value(s)	Yes	No
8	In order to verify your repair: 1. Using Allison DOC™ For PC–Service Tool, reset SEM AUTOSELECT. Refer to Section 3–8. 2. Clear the DTC. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0634 TCM Internal Temperature Too High

NO SCHEMATIC FOR THIS DTC

Circuit Description

The Transmission Control Module (TCM) is equipped with an internal temperature sensor mounted directly to its circuit board. The TCM will take action to protect against damage from overheat.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for more than 10 seconds.

Conditions for Setting the DTC

DTC P0634 sets if the TCM internal temperature is greater than or equal to 140°C (284°F) for 10 seconds with engine running.

Actions Taken When the DTC Sets

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM commands OFF all solenoids (SOL OFF).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

Clean the TCM if necessary. Excessive road debris will reduce the effectiveness of the heat sink on the TCM and could cause internal temperature to rise.

DTC P0634 TCM Internal Temperature Too High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition. 3. Record the failure records. 4. Clear the DTCs. 5. Drive the vehicle and monitor TCM internal temperature on Allison DOC™ For PC–Service Tool. Did DTC P0634 return?		*Go to Step 3*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0634 TCM Internal Temperature Too High *(cont'd)*

Step	Action	Value(s)	Yes	No
3	1. Inspect the TCM and surrounding area. 2. Be sure there are no high temperature components such as engine exhaust pipes mounted in the vicinity of the TCM. 3. Shield or relocate the TCM, if possible. Do you find and correct the problem?		*Go to Step 5*	*Go to Step 4*
4	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 5*	
5	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. Monitor TCM internal temperature. 3. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P063E Auto Configuration Throttle Input Not Present

NO SCHEMATIC FOR THIS DTC

Circuit Description

When first activated and during the first group of power-on cycles, the Transmission Control Module (TCM) searches for a valid throttle input. The TCM may receive throttle input from an analog throttle position sensor, a pulse-width modulated (PWM) throttle source, or over one of the SAE digital data links as accelerator pedal position and/or percent engine load. The TCM logs a DTC P063E if it fails to detect a throttle source during autodetect.

Conditions for Running the DTC

The test is enabled by the TCM calibration.

Conditions for Setting the DTC

DTC P063E sets if the TCM fails to detect throttle position information for a specified time interval.

Actions Taken When the DTC Sets

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM uses default throttle values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests to see if TCM is reading throttle information.
3. This step determines what throttle source the vehicle manufacturer intends to use.
4. This step looks for throttle information on the data link.

DTC P063E Auto Configuration Throttle Input Not Present

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P063E Auto Configuration Throttle Input Not Present *(cont'd)*

Step	Action	Value(s)	Yes	No
2	1. Turn OFF the ignition. 2. Install the Allison DOC™ For PC–Service Tool. 3. Turn ON the ignition. 4. Using Allison DOC™ For PC–Service Tool, determine the throttle source being used by the TCM. 5. Depress and release the accelerator pedal while monitoring throttle percentage on Allison DOC™ For PC–Service Tool. Does throttle percentage on Allison DOC™ For PC–Service Tool respond as expected to changes in the accelerator pedal position?		*Go to Step 7*	*Go to Step 3*
3	Consult with the engine or vehicle manufacturer. Determine if the vehicle is using a digital data link (SAE J1587, SAE J1939 or IES CAN) to communicate pedal position or percent engine load. Otherwise, determine if the vehicle is using an analog or PWM throttle position sensor. Did the vehicle manufacturer intend to communicate throttle position to the TCM over a digital data link?		*Go to Step 4*	*Go to Step 7*
4	1. Monitor Data Bus Viewer on Allison DOC™ For PC–Service Tool. 2. Depress and release the accelerator pedal while watching the Data Bus Viewer. Does accelerator pedal position information on Data Bus Viewer respond as expected to changes in accelerator pedal position?		*Go to Step 5*	*Go to Step 6*
5	Using Allison DOC™ For PC–Service Tool attempt to manually select the TCM throttle source to a data link with valid throttle information. Did the TCM detect a throttle source?		*Go to Step 8*	*Go to Step 6*
6	Coordinate with the vehicle or engine manufacturer to determine the cause of loss of throttle information on the data link. Is the repair complete?		*Go to Step 8*	
7	Coordinate with the vehicle or engine manufacturer to repair the analog or PWM throttle sensor. Is the repair complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle. 3. Using Allison DOC™ For PC–Service Tool, monitor throttle percent. 4. Verify the TCM detects a valid throttle source. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P063F Auto Configuration Engine Coolant Temp Input Not Present

NO SCHEMATIC FOR THIS DTC

Circuit Description

When first activated and during the first group of power-on cycles, the Transmission Control Module (TCM) searches for a valid engine coolant temperature input. The TCM may receive engine coolant temperature input from an analog temperature sensor, or from one of the SAE digital data links. The TCM logs a DTC P063F if it fails to detect an engine coolant temperature source during autodetect.

Conditions for Running the DTC

The test is enabled by the TCM calibration.

Conditions for Setting the DTC

DTC P063F sets if the TCM fails to detect engine coolant temperature information for a specified time interval.

Actions Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests to see if TCM is reading engine coolant information.
3. This step determines what engine coolant temperature source the vehicle manufacturer intends to use.
4. This step looks for engine coolant temperature information on the data link.

DTC P063F Auto Configuration Engine Coolant Temp Input Not Present

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Turn OFF the ignition. 2. Install the Allison DOC™ For PC–Service Tool. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, determine the engine coolant temp source being used by the TCM. 5. Allow the engine to warm-up and monitor engine coolant temp on Allison DOC™ For PC–Service Tool. Does engine coolant temperature on Allison DOC™ For PC–Service Tool slowly rise as the engine warms?		*Go to Step 7*	*Go to Step 3*

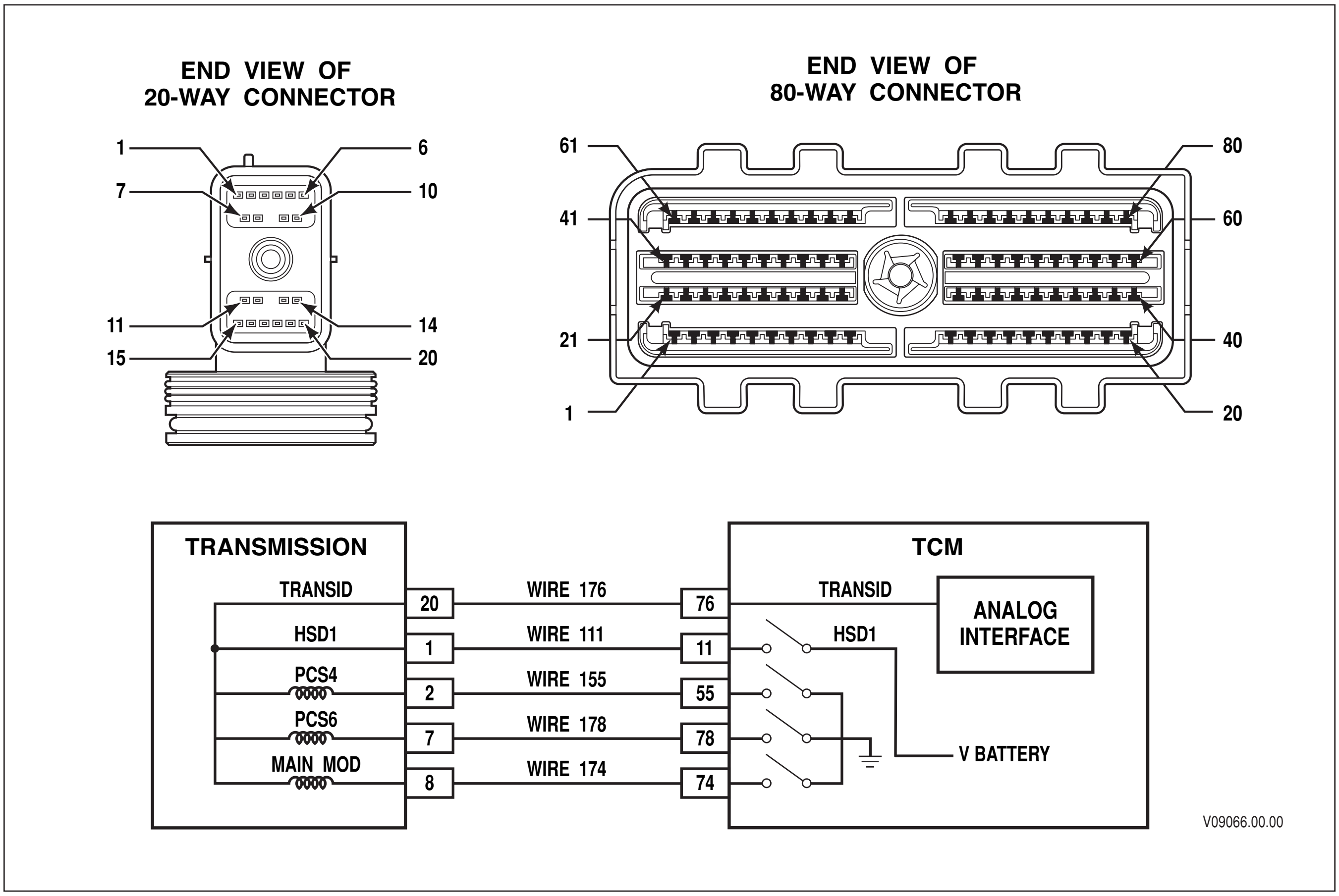
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P063F Auto Configuration Engine Coolant Temp Input Not Present *(cont'd)*

Step	Action	Value(s)	Yes	No
3	Consult with the engine or vehicle manufacturer. Determine if the vehicle is using a digital data link (SAE J1587, SAE J1939 or IES CAN) to communicate engine coolant temperature. Otherwise, determine if the vehicle is using an analog engine coolant temperature sensor. Did the vehicle manufacturer intend to communicate engine coolant temperature to the TCM over a digital data link?		*Go to Step 4*	*Go to Step 7*
4	1. Monitor Data Bus Viewer on Allison DOC™ For PC–Service Tool. 2. Allow the engine to warm-up and watch the Data Bus Viewer. Does engine coolant temperature information on Data Bus Viewer respond as expected as the engine warms?		*Go to Step 5*	*Go to Step 6*
5	Using Allison DOC™ For PC–Service Tool attempt to manually select the engine coolant temperature source to a data link with valid information. Did the TCM detect an engine coolant temperature source?		*Go to Step 8*	*Go to Step 6*
6	Coordinate with the vehicle or engine manufacturer to determine the cause of loss of engine coolant temperature information on the data link. Is the repair complete?		*Go to Step 8*	
7	Coordinate with the vehicle or engine manufacturer to repair the analog engine coolant temperature sensor. Is the repair complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle. 3. Using Allison DOC™ For PC–Service Tool, monitor engine coolant temperature. 4. Verify the TCM detects a valid engine coolant source. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0658 Actuator Supply Voltage 1 (HSD1) Low



Circuit Description

High Side Driver 1 (HSD1) supplies battery voltage to the Main Mod, PCS4 and PCS6 solenoids via wire 111. HSD1 is continuously ON during normal operation except during brief circuit tests. The TCM regulates control current to the solenoids by switching the appropriate Low Side Driver (LSD) ON and OFF. DTC P0658 indicates the TCM has detected a supply voltage in the HSD1 circuit of 6V or less. DTC P0658 could be caused by a short-to-ground in the high side wiring attached to HSD1 (wire 111).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- HSD1 is commanded ON.
- Engine speed greater than 200 rpm.

Conditions for Setting the DTC

DTC P0658 is set when the TCM detects a low voltage condition (less than 6V) in two solenoids in the HSD1 circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Actions Taken When the DTC Sets

When DTC P0658 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM commands OFF all solenoids (SOL OFF). The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for a wire-to-wire short, or short-to-ground in the wire 111 of the OEM chassis harness.
6. This step tests for wiring defects in the transmission internal harness.

DTC P0658 Actuator Supply Voltage 1 (HSD1) Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0658 Actuator Supply Voltage 1 (HSD1) Low *(cont'd)*

Step	Action	Value(s)	Yes	No
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the HSD1 electrical circuit.*** Did DTC P0658 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF ignition. 2. Disconnect the 80-way connector at the TCM. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the OEM 20-way connector from the transmission. 5. Inspect the routing of wire 111 in the chassis harness between the TCM and transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 11and and all other pins in the 80-way connector, and test for short-to-ground between pin 11 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harnesses and vehicle input/output switch repair. Harness and switch repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring or switch. Is the repair complete?		*Go to Step 9*	

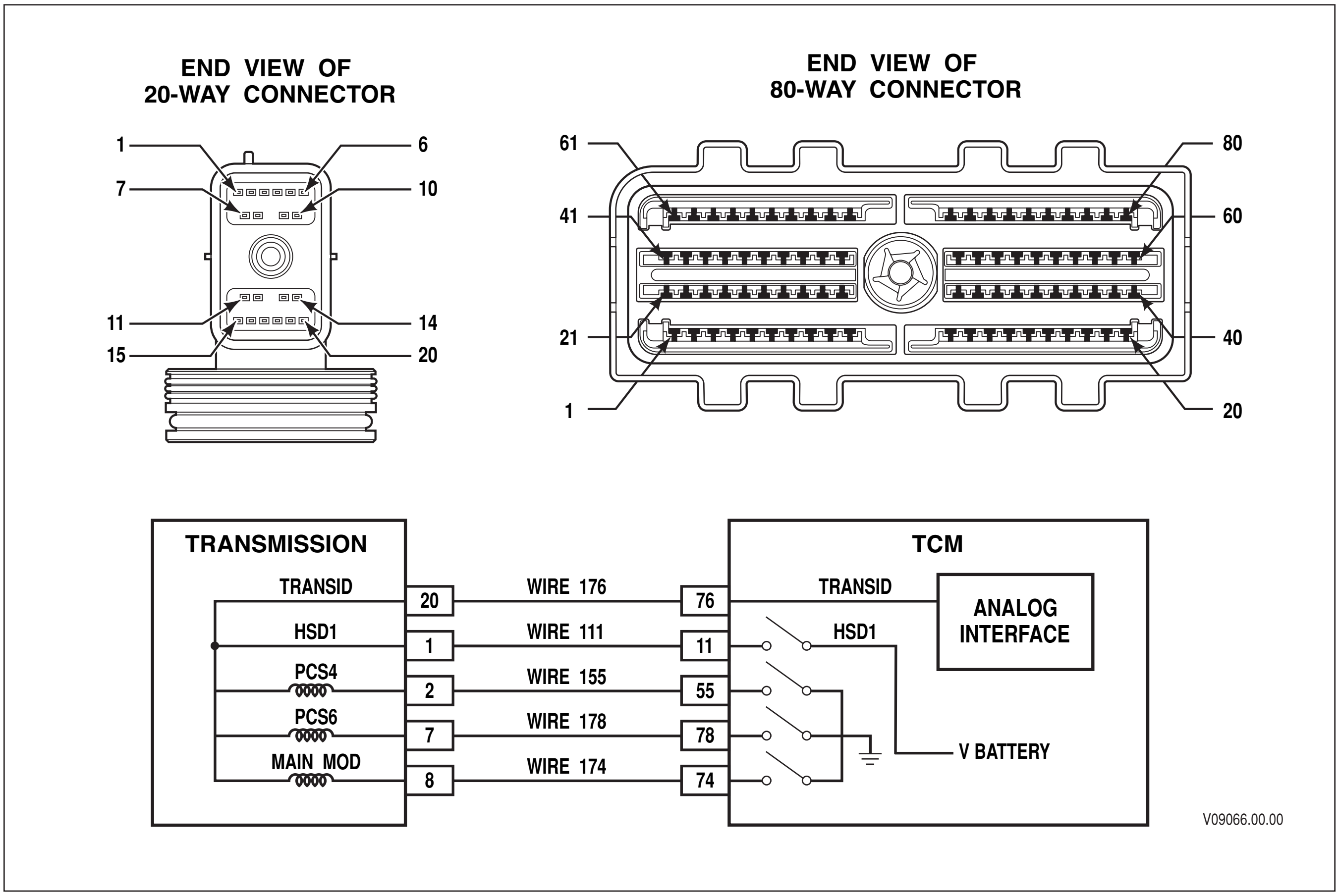
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0658 Actuator Supply Voltage 1 (HSD1) Low *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install the transmission 20-way connector to the J 47279 Transmission Breakout. Leave the OEM-side disconnected. 3. Using a DVOM at J 47279-1 Transmission Overlay, test for wire-to-wire shorts between pin 1 and all other pins in the 20-way connector, and shorts-to-ground between pin 1 and chassis ground. ***NOTE: The resistance value between pins 1 and 2, between pins 1 and 7 (7-speed models), and between pins 1 and 8 will read normal solenoid resistance. The resistance value between pin 1 and pin 20 (TID wire) will read 0 Ohms.*** Were any wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 7*	*Go to Step 8*
7	1. Remove the hydraulic control module assembly. 2. Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0659 Actuator Supply Voltage 1 (HSD1) High



Circuit Description

High Side Driver 1 (HSD1) supplies battery voltage to the Main Mod, PCS4 and PCS6 solenoids via wire 111. HSD1 is continuously ON during normal operation except during brief circuit tests. The TCM regulates control current to the solenoids by switching the appropriate Low Side Driver ON and OFF. DTC P0659 indicates the TCM has detected greater than or equal to 6V in the HSD1 circuit when HSD1 is OFF during TCM initialization. DTC P0659 could be caused by an open or short-to-battery in the high side wiring attached to HSD1 (wire 111).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- HSD1 is commanded ON.
- Engine speed greater than 200 rpm.

Conditions for Setting the DTC

DTC P0659 is set when the TCM detects a high voltage condition (> 6V) in the HSD1 circuit after two solenoids indicate a failure.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0659 Actuator Supply Voltage 1 (HSD1) High

Actions Taken When the DTC Sets

When DTC P0659 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM commands OFF all solenoids (SOL OFF). The shift selector position and hydraulic state of latch valves determines range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for an excessive voltage drop (open) in wire 111 of the OEM harness.
5. This step tests for a wire-to-wire short, or short-to-ground in the wire 111 of the OEM chassis harness.
7. This step tests for wiring defects in the transmission internal harness.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0659 Actuator Supply Voltage 1 (HSD1) High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open or short-to-battery condition in the HSD1 electrical circuit.*** Did DTC P0659 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF ignition. 2. Install J 47275 TCM Breakout to the TCM 80-way connector. 3. Install J 47279 Transmission Breakout at the transmission 20-way connector. 4. Turn ON the ignition. Leave the engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command PCS4 ON. 6. Determine the voltage drop in the HSD1 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 11 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 1 and an isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V indicates an excessive voltage loss in the OEM harness.*** Did the high-side voltage drop exceed 0.5VDC?		*Go to Step 6*	*Go to Step 5*

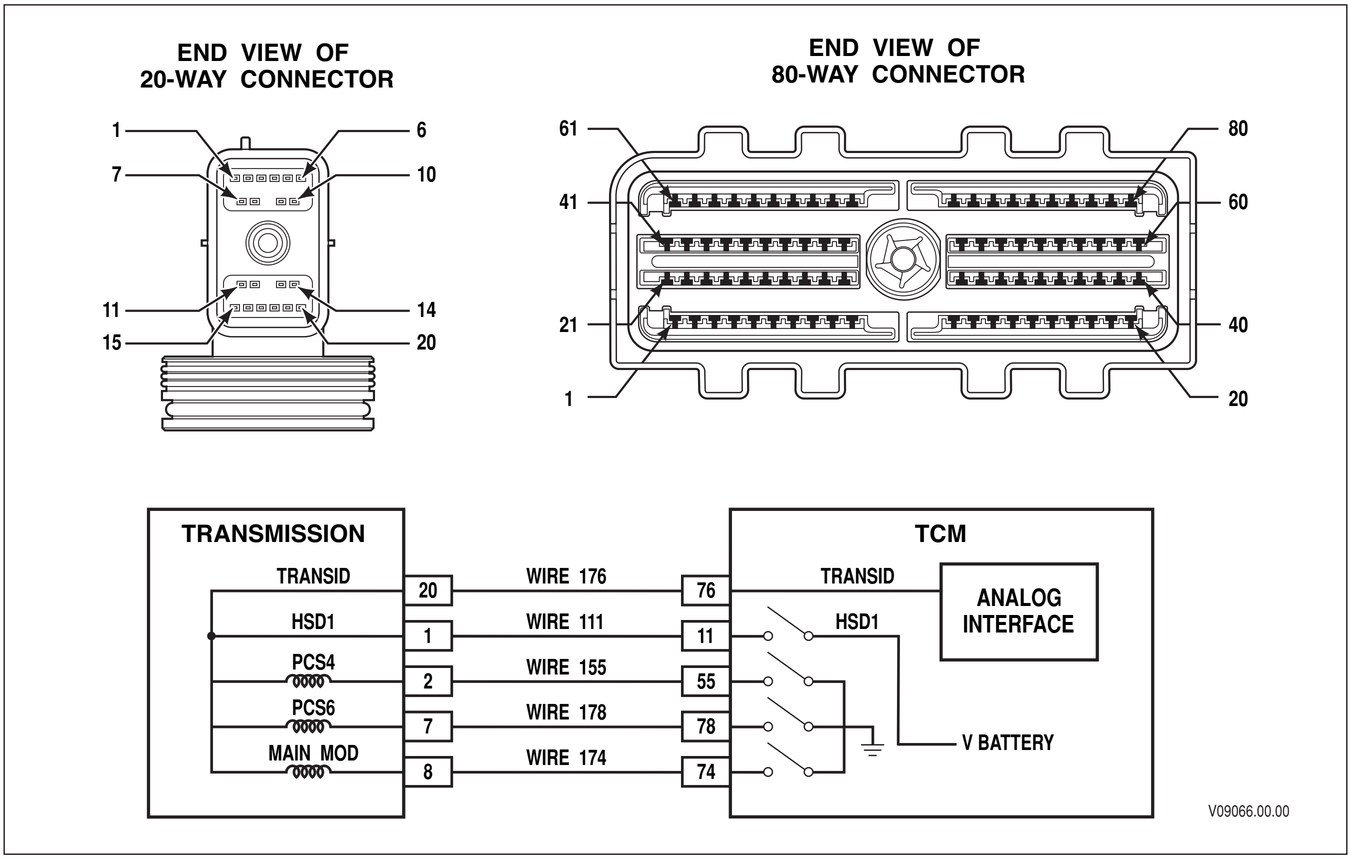
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0659 Actuator Supply Voltage 1 (HSD1) High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the TCM from J 47275 TCM Breakout. Leave the OEM-side connected. 3. Disconnect the OEM-side of the 20-way connector from the J 47279 Transmission Breakout. Leave the transmission-side connected. 4. Inspect the routing of wire 111 in the chassis harness between the TCM and the transmission connector. 5. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 11 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 6*	*Go to Step 7*
6	***NOTE: The vehicle OEM has responsibility for all external wiring harnesses and vehicle input/output switch repair. Harness and switch repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring or switch. Is the repair complete?		*Go to Step 10*	
7	1. Turn OFF the ignition. 2. Verify that the J 47279 Transmission Breakout is installed at the transmission 20-way connector and the OEM-side is disconnected. 3. Using DVOM at J 47279-1 Transmission Overlay, test for wire-to-wire shorts between pin 1 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 1 and 2, between pins 1 and 7 (7-speed models), and between pins 1 and 8 will read normal solenoid resistance. The resistance value between pins 1 and the pin 20 (TID wire) will read 0 Ohms.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	1. Remove the hydraulic control module assembly. 2. Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 10*	
9	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0702 Transmission Control System Electrical (TransID)



Circuit Description

The TransID (TID) feature enables the TCM to recognize various transmission hardware configurations and select an appropriate software calibration. The TCM senses the transmission configuration using TID wire 176. In initial versions of Allison 4th Generation Controls, wire 176 is connected to High Side Driver 1 (HSD1) via wire 111, in the internal wiring harness. HSD1 supplies the Main Mod solenoid, PCS4, and PCS6. This wiring configuration is designated TID A.

Conditions for Running the DTC

The test is enabled by the TCM calibration.

Conditions for Setting the DTC

DTC P0702 sets if the TCM is unable to determine the TransID level of the transmission.

Actions Taken When the DTC Sets

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM uses a TID A calibration.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Aids

DTC P0702 could be caused by an open circuit condition in wire 176 in the chassis harness.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests the TID circuit in the internal wiring harness.
4. This step tests the TID in the external wiring harness.

DTC P0702 Transmission Control System Electrical (TransID)

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Turn OFF the ignition. 2. Disconnect the transmission 20-way connector. 3. Using a digital multimeter (DVOM), test for continuity (0 Ohms) between pin 20 (TID wire 176) and pin 1 in the transmission 20-way connector. 4. Consult Table 6–7, at the end of this DTC, to determine the TransID configuration of the transmission. 5. Compare the continuity test results from sub-step 3 with the TID in the transmission bill of material or build history. Does the continuity test results in sub-step 3 agree with the TransID of the transmission?		*Go to Step 4*	*Go to Step 3*
3	Repair or replace the internal transmission harness. Is the repair complete?		*Go to Step 8*	
4	1. Turn OFF ignition. 2. Disconnect the 80-way connector at the TCM. 3. Install the OEM-side 80-way connector to J 47275 TCM Breakout. Leave the TCM disconnected. 4. Reconnect the transmission 20-way connector. 5. Using a digital multimeter (DVOM), test for continuity (0 Ohms) between pin 76 (TID wire) and pin 11 in the 80-way connector. 6. Consult Table 6–8, at the end of this DTC, to determine the TransID configuration of the transmission. 7. Compare the continuity test results from sub-step 5 with the TID in the transmission bill of material or build history. Does the continuity test results in sub-step 5 agree with the TransID of the transmission?		*Go to Step 6*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0702 Transmission Control System Electrical (TransID) *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harnesses and vehicle input/output switch repair. Harness and switch repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 8*	
6	1. Reset Autodetect using Allison DOC™ For PC–Service Tool. 2. Monitor "TransID Level Used" on Allison DOC™ For PC–Service Tool. 3. Compare the TransID level indicated on Allison DOC™ For PC–Service Tool to the actual TransID level of the transmission. Did the TCM detect the correct TID level?		*Go to Step 8*	*Go to Step 7*
7	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, reset Autodetect. 3. Verify the TCM detects the correct TransID level. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

Table 6–7.

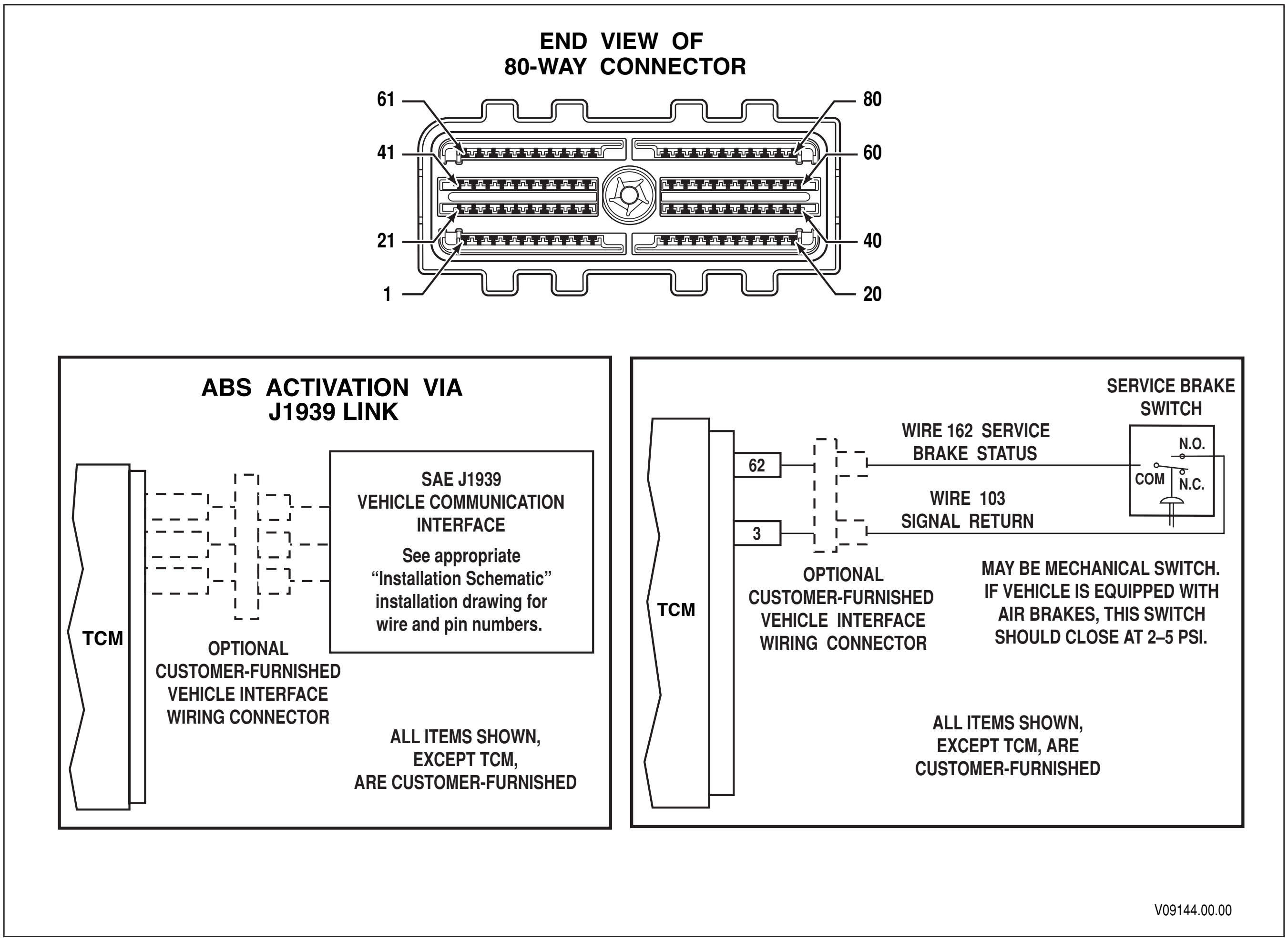
Wire 176 will be connected to the following wire in the transmission internal harness:	
TID	**Pin 20 connected to ...**
A	Pin 1 (wire 111)
B	TBD
C	TBD

Table 6–8.

Wire 176 will be connected to the following wire via the transmission internal harness:	
TID	**Pin 76 connected to ...**
A	Pin 11 (wire 111)
B	TBD

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit Malfunction



Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive a service brake status input from either an analog input wire or the digital data link. A mechanical switch attached to the brake pedal sends a signal to either the TCM directly or to another electronic controller in the vehicle. When another controller is used, the TCM receives service brake status as a digital message over the vehicle's communications data link.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0703 sets if the TCM is calibrated to receive the service brake status signal and either of the following conditions is met:

- The TCM senses three acceleration events with service brake signal ON.
- The TCM senses three deceleration events with service brake signal OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit Malfunction

Actions Taken When the DTC Sets

When DTC P0703 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- TCM inhibits Neutral to Drive shifts for refuse packer.
- TCM inhibits Retarder operation if a Throttle Position Sensor (TPS) code is also active.

Conditions for Clearing DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- When analog input wires are used, the service brake status input is active when a pressure switch is closed to complete the circuit between wire 162 and signal return wire 103. If a data link is used, the TCM receives “service brake status” as part of J1939 message parameter PGN 65265, Cruise Control/Vehicle Speed (CCVS).
- DTC P0703 indicates the TCM has detected service brake status ON for 3 acceleration events or service brake status OFF for 3 deceleration events. The code can be caused by:
  - — Faulty wiring
  - — Faulty connections to the service brake switch
  - — A faulty service brake switch
  - — Another controller improperly broadcasting service brake status on the data link when the brake switch is not installed or operating
  - — A faulty TCM.
- Inspect the wiring for poor electrical connections at the TCM and service brake switch. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- J1939 service brake status can be read on Allison DOC™ For PC–Service Tool. Monitor data link communications using Data Bus Viewer.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for an active DTC.
4. This step tests for status of analog input wire 162.
5. This step determines if service brake status is being communicated by a data link message.
6. This step tests for shorts-to-ground in wire 162.
7. This step tests for proper service brake switch function.
9. This step observes service brake switch status on the digital data link.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTC and drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the service brake signal is present for more than three acceleration/deceleration events.*** Did DTC P0703 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	Inspect vehicle for analog input wire 162. Is analog input wire 162 present?		*Go to Step 4*	*Go to Step 9*
4	1. Turn ON the ignition. 2. Using Allison DOC™ For PC–Service Tool, observe status of Service Brake input wire 162. Does wire 162 go ON when brake pedal is depressed and go OFF when brake pedal is released?		*Go to Step 5*	*Go to Step 6*
5	Using Allison DOC™ For PC–Service Tool, observe status of service brake. ***NOTE: If service brake status is ON while the service brake input wire 162 is OFF, the TCM is receiving a "brake switch status" message via the data link.*** Is the service brake status ON when wire 162 is OFF?		*Go to Step 9*	*Go to Diagnostic Aids*
6	1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to J 47275 TCM Breakout. Leave the TCM disconnected. 4. Check for short-to-ground on wire 162. Were any shorts or wiring defects found?		*Go to Step 8*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Using a DVOM, check for continuity when switch is depressed and no continuity when switch is released. Does the switch close when depressed and open when released?		*Go to Step 9*	*Go to Step 8*

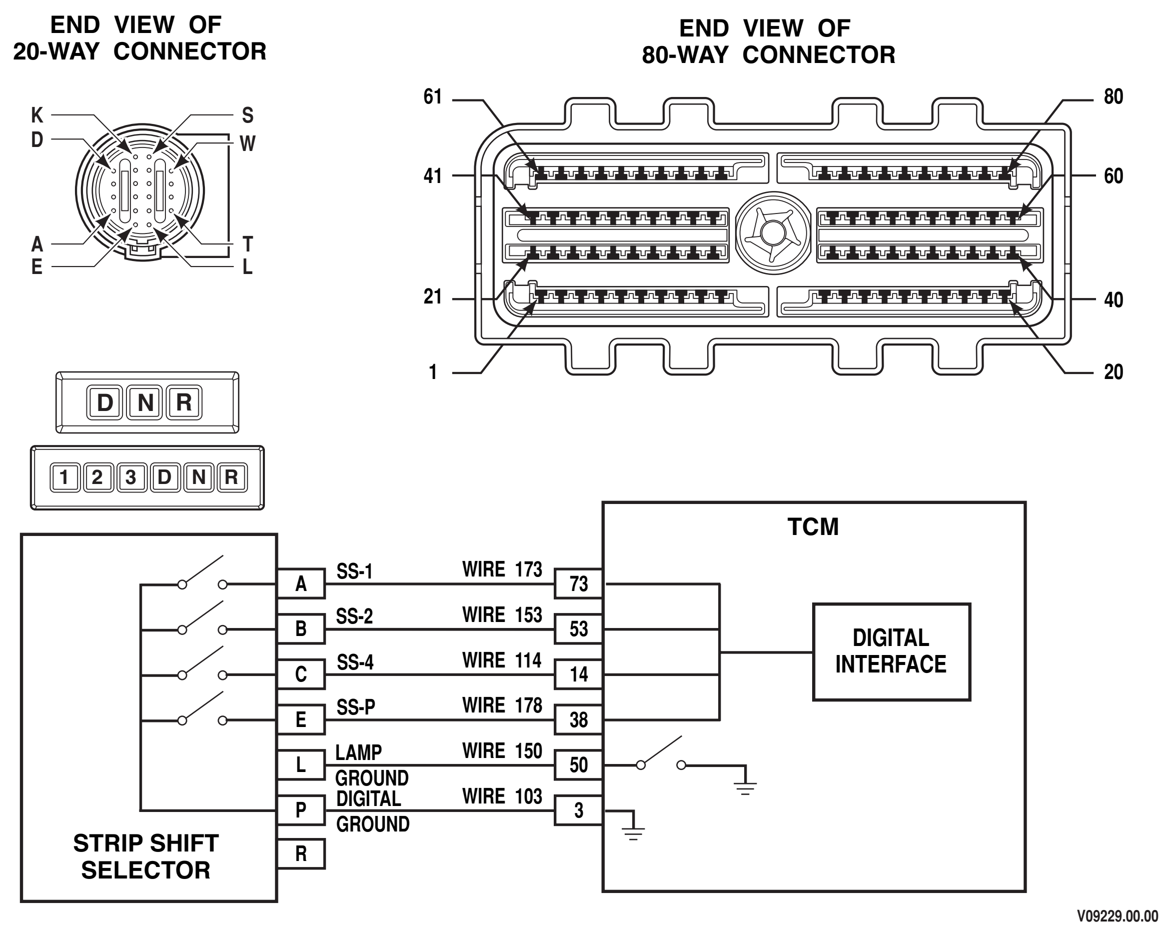
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit Malfunction *(cont'd)*

Step	Action	Value(s)	Yes	No
8	***NOTE: The vehicle OEM has responsibility for all external wiring harnesses and vehicle input/output switch repair. Harness and switch repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring or switch. Is the repair complete?		*Go to Step 11*	
9	1. Turn OFF the ignition. 2. Connect the 80-way connector, if removed in Step 6. 3. Install Allison DOC™ For PC–Service Tool. 4. Turn ON the ignition. 5. Using Allison DOC™ For PC–Service Tool Data Bus Viewer, observe status of Service Brake Switch. Consult Allison DOC™ For PC–Service Tool User's Guide (GN3433EN) for instructions on using Data Bus Viewer. On Data Bus Viewer, does brake switch show ON when brake pedal is depressed and OFF when brake pedal is released?		*Go to Diagnostic Aids*	*Go to Step 10*
10	***NOTE: Allison Transmission is not responsible for data link messages that originate in other transmission controllers. Repairs not associated with the transmission controller are not covered by Allison Transmission warranty.*** Coordinate with the vehicle or engine OEM to correct the cause of the inconsistent service brake switch status message. Is the repair complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor service brake status. 3. Drive the vehicle under conditions noted in failure records. 4. Confirm with the service tool in the test passed section that the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0708 Transmission Range Sensor Circuit High Input



Circuit Description

The 3000 and 4000 Product Family transmission control module (TCM) can receive input from a strip-type shift selector. This type of shift selector communicates with the TCM via 4-bit parallel data wires. The strip shift selector button position determines the switch state (low or high voltage) of each parallel data wire. The TCM interprets each particular combination of switch states into a specific range selection, i.e. Reverse, Neutral, and DRIVE. The TCM sets a DTC P0708 if the switch state of the four parallel data wires does not agree with a valid switch combination.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

DTC PO708 sets when the TCM detects an invalid parallel data message from a strip-type shift selector.

Actions Taken When the DTC Sets

When DTC P0708 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM ignores invalid strip shift selector inputs.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycle without failure.

Diagnostic Aids

- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  — A bent terminal
  — A backed-out terminal
  — A damaged terminal
  — Poor terminal tension
  — A chafed wire
  — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper function of the strip shift selector.
3. This step measures the switch states (low or high voltage) for each button position.
4. This step tests for wiring defects in the OEM wiring harness.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0708 Transmission Range Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition. Leave the engine OFF. 3. Record the failure records. 4. Using Allison DOC™ For PC–Service Tool, monitor "STRIP SELECTOR OUTPUT PATTERN" for the affected strip shift selector. 5. Toggle through each button position while observing the Allison DOC™ For PC–Service Tool display. Does "STRIP SELECTOR OUTPUT PATTERN" status match the actual shift selector button position?		*Go to Diagnostic Aids*	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Turn ON ignition. Leave engine OFF. 4. Using a DVOM at J 47275-1 TCM Overlay, determine the state (High or Low) of each parallel data wire by measuring the following voltages. Record voltages <1V as Low and voltages >3V as High. • Between pin 73 (SS-1) and isolated ground • Between pin 53 (SS-2) and isolated ground • Between pin 14 (SS-4) and isolated ground • Between pin 38 (SS-P) and isolated ground 5. Toggle through each strip selector button position that displays a faulty output pattern and measure voltages at pins listed in sub-step 4 above. 6. Compare the switch states (low or high voltage) obtained in sub-steps 4 and 5 with the Strip Shift Selector Parallel data in Table 6–9. 7. Note if any wire is not in the proper switch state. Do the switch states (low or high voltage) match the valid switch states shown in Table 6–9 for all button positions?	Refer to Strip Shift Selector Parallel Data Table 6–9	*Go to Diagnostic Aids*	*Go to Step 4*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0708 Transmission Range Sensor Circuit High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing the following steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Disconnect the strip shift selector. 4. Physically inspect the wiring between the strip-type shift selector and the TCM. 5. Using a DVOM at magnetic overlay, test for opens, wire-to-wire shorts, and shorts-to-ground for any wire found to be in the incorrect switch state (low or high voltage) in Step 3 above. Were any wiring defects found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external harness repair. Harness repairs performed by Allison Transmission distributors and dealers are not covered bt Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 7*	
6	Replace the shift selector. Is the replacement complete?		*Go to Step 7*	
7	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

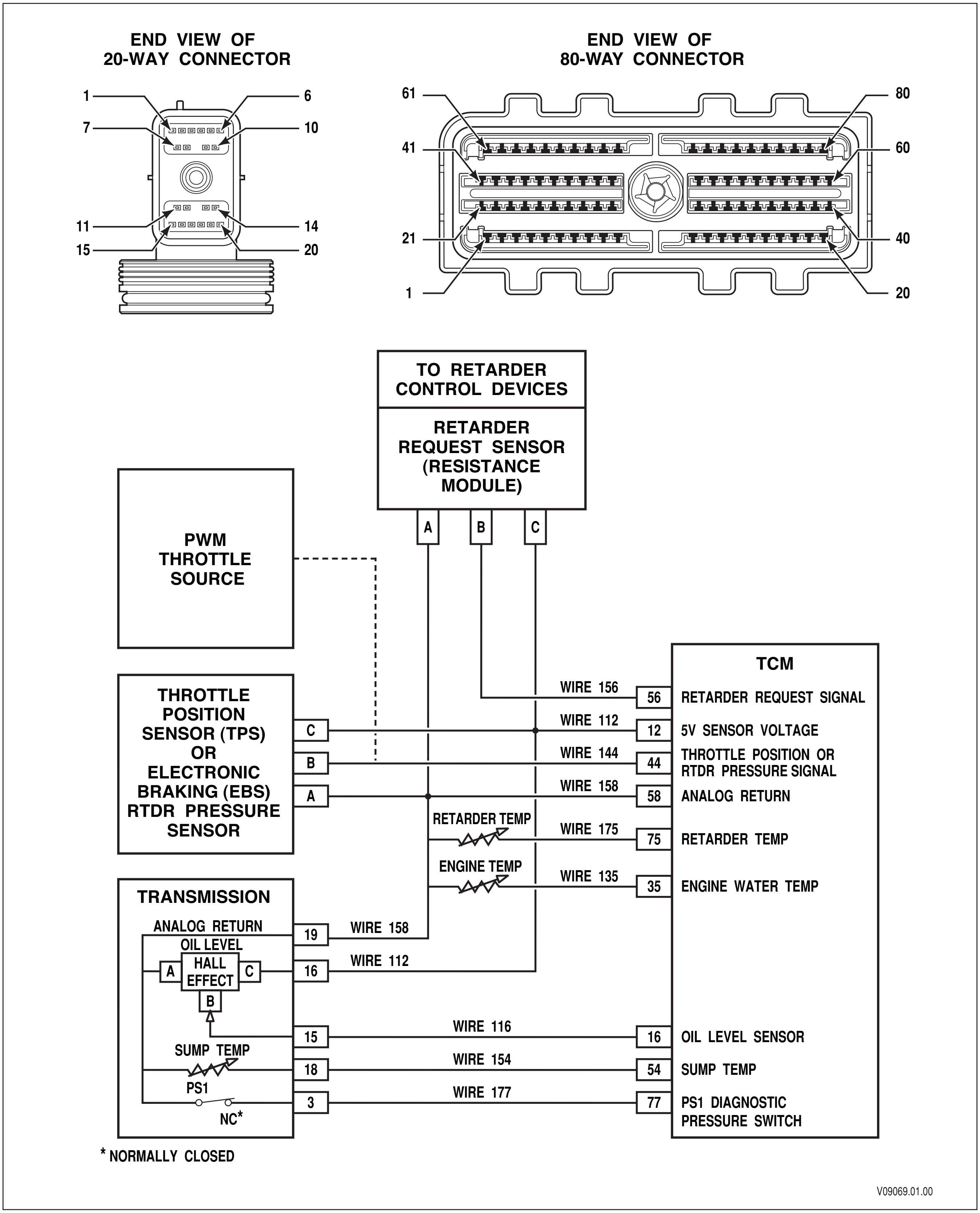
Table 6–9.

		Wire Number			
		SS-1	**SS-2**	**SS-4**	**SS-Parity**
Button	**Sel Out**	**173**	**153**	**114**	**138**
R	REVERSE	Low**	Low**	Low**	High***
N	NEUTRAL	Low**	High***	High***	High***
D	DRIVE-A	Low**	Low**	High***	Low**
3*	DRIVE-B	High***	Low**	High***	High***
2*	DRIVE-C	High***	Low**	Low**	Low**
1*	DRIVE-D	High***	High***	Low**	High***

*Six-button shift selectors only
**Low is <1V
***High is >3V

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070C Transmission Fluid Level Sensor Circuit—Low Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070C Transmission Fluid Level Sensor Circuit—Low Input

Circuit Description

The transmission control module (TCM) can be calibrated to receive a transmission fluid level signal from an oil level sensor (OLS). The TCM is connected to the OLS by:

- a reference voltage wire,
- retarder request signal wire, and
- analog ground wire.

The TCM provides a 5V reference voltage to the OLS. A microprocessor in the OLS produces a signal voltage that is proportional to the level of fluid in the transmission sump. The TCM interprets this voltage as transmission fluid level.

Conditions for Running the DTC

Engine speed is greater than 1500 rpm.

Conditions for Setting the DTC

DTC P070C sets if the TCM is calibrated to receive the OLS signal, and the signal voltage is less than 0.1V for six consecutive samples.

Actions Taken When the DTC Sets

When DTC P070C is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

- The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history.
- The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P070C indicates the TCM has detected a voltage signal from the OLS in the low error zone. The code can be caused by:
  - — Extremely low transmission fluid level
  - — Faulty external wiring harness
  - — Faulty connections to the OLS
  - — Faulty internal wiring harness
  - — Faulty OLS
  - — Faulty TCM.
- DTC P070C can be caused by an open or short-to-ground in either the 5V reference wire 112 or transmission fluid level signal wire 116. The OLS shares the common 5V reference voltage wire with the optional retarder request sensor and throttle position sensor (TPS). An open or short-to-ground in the common 5V reference wire causes a “sensor failed low” code for the other devices as well. An open or short-to ground on wire 116 will cause a DTC P070C only.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for an active DTC.
4. This step tests for proper 5V reference voltage to OLS.
5. This step tests for opens or short-to-ground on wire 112.
6. This step tests for TCM function and OLS signal circuit integrity.

DTC P070C Transmission Fluid Level Sensor Circuit—Low Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Consult mechanic's tips and perform a manual fluid check procedure. **Adjust as necessary.** Is the transmission fluid level correct?		*Go to Step 3*	*Adjust as necessary. Go to Step 3*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTC. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates the OLS signal is below a set voltage for a set number of samples. It may also indicate an open or short-to-ground in either the 5V reference wire 112 or OLS signal wire 116.*** Did DTC P070C return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Disconnect the external wiring harness from the 20-way transmission connector. 3. Turn ON the ignition. 4. Using a DVOM, measure the voltage between pin 16 (5V reference wire 112) and pin 19 (analog return wire 158) at the external harness 20-way connector. Is the voltage within specification?	4.64–5.36V	*Go to Step 6*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070C Transmission Fluid Level Sensor Circuit—Low Input *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Inspect the routing of 5V reference wire 112 and analog return wire 158 between the TCM and OLS sensor. 3. Disconnect the 80-way connector from the TCM. 4. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 5. Disconnect the TPS and RMR, if installed. 6. Test for opens and shorts-to-ground on wire 112. Was chafing or wire damage found?		*Go to Step 8*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Connect the 80-way connector. 3. Install the Allison DOC™ For PC–Service Tool. 4. Turn ON the ignition. 5. Verify the transmission 20-way connector is disconnected. 6. Observe OLS voltage on Allison DOC™ For PC–Service Tool while jumpering between pin 16 (5V reference wire 112) and pin 15 (OLS signal wire 116) in the external harness 20-way connector. Is the voltage within specifications?	4.64–5.36V	*Go to Step 9*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Inspect the routing of the OLS signal wire 116 between the TCM and OLS. 3. Disconnect the 80-way connector from the TCM. 4. Connect the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM-side disconnected. 5. Test for opens and shorts-to-ground on wire 116. Was chafing or wire damage found?		*Go to Step 8*	*Go to Step 16*
8	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 17*	
9	Inspect the transmission 20-way connector pins 15, 16, and 19 for loose or out-of-position terminals. Were any loose or out-of-position terminals founds?		*Go to Step 10*	*Go to Step 11*
10	Repair or replace any defective terminals. Is the repair complete?		*Go to Step 17*	

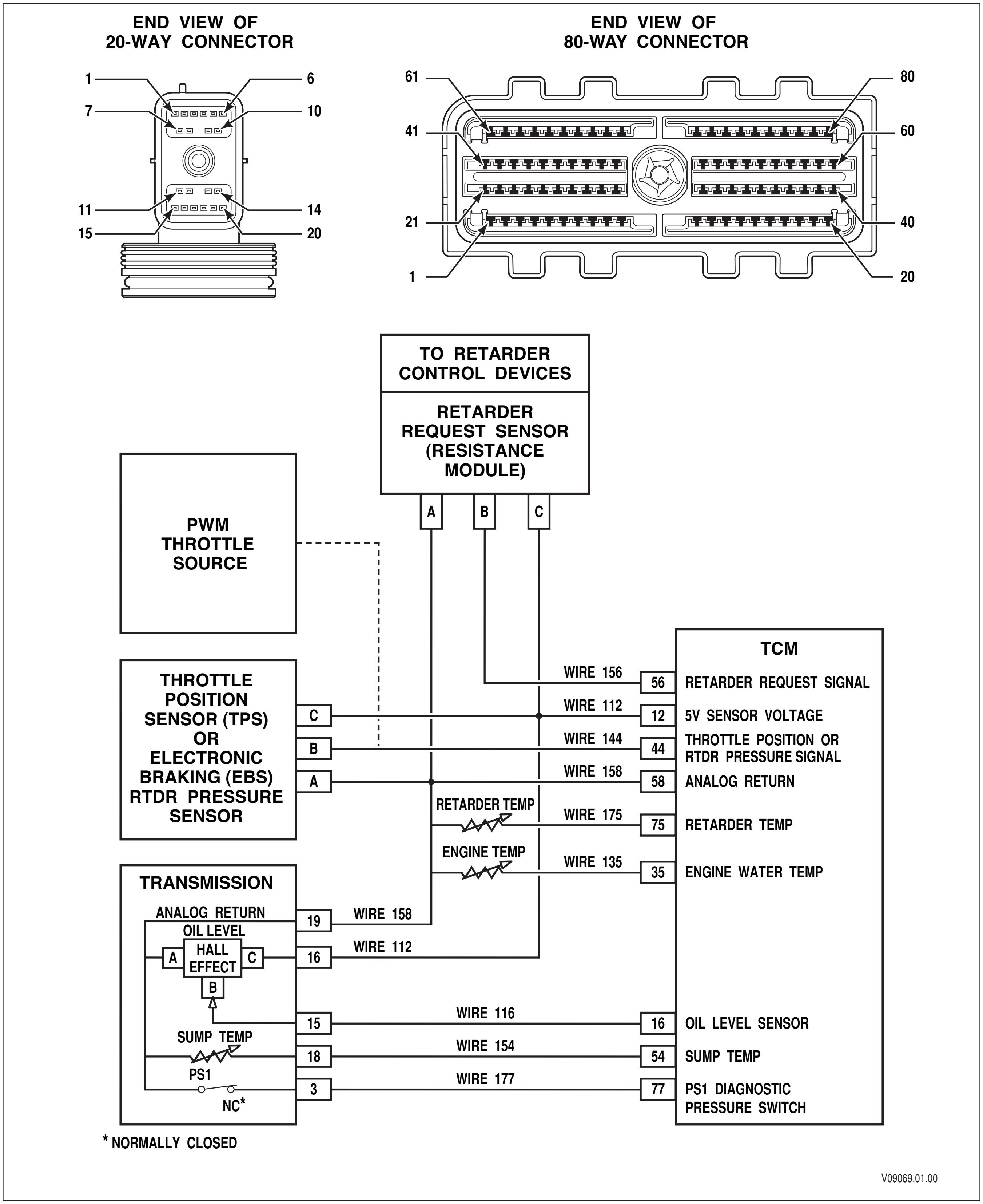
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070C Transmission Fluid Level Sensor Circuit—Low Input *(cont'd)*

Step	Action	Value(s)	Yes	No
11	1. Consult appropriate transmission service manual and remove the control module from the transmission. 2. Remove OLS from channel plate. 3. Connect the external harness at the 20-way connector. 4. Install the Allison DOC™ For PC–Service Tool. 5. Turn ON the ignition. Leave the ignition OFF. 6. Invert the OLS and observe OLS voltage. Does Allison DOC™ For PC–Service Tool OLS voltage jump to 5V?	4.64–5.36V	*Go to Step 15*	*Go to Step 12*
12	1. Inspect internal wiring harness wires 112, 116, and 158. 2. Test for opens and shorts-to-ground in wires 112 and 116 in the internal wiring harness. Were there any wiring defects?		*Go to Step 13*	*Go to Step 14*
13	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 15*	
14	Replace the OLS. Is the replacement complete?		*Go to Step 15*	
15	Install the control module to the transmission if removed in Step 11.		*Go to Step 17*	
16	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 17*	
17	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor OLS level and voltage. 3. Confirm with Allison DOC™ For PC–Service Tool in the test passed section that the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070D Transmission Fluid Level Sensor Circuit—High Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070D Transmission Fluid Level Sensor Circuit—High Input

Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive a transmission fluid level signal from an oil level sensor (OLS). The TCM is connected to the OLS by three wires: 1) a reference voltage, 2) transmission fluid level signal, and 3) analog ground. The TCM provides a 5V reference voltage to the OLS. A microprocessor in the OLS produces a signal voltage that proportional to level of fluid in the transmission sump. The TCM interprets this voltage as transmission fluid level.

Conditions for Running the DTC

Engine speed is greater than 1500 rpm.

Conditions for Setting the DTC

DTC P070D sets if the TCM is calibrated to receive the OLS signal, and the signal voltage is greater than 5.0V for 6 consecutive samples.

Actions Taken When the DTC Sets

When DTC P070D is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P070D indicates the TCM has detected a voltage signal from the OLS in the high error zone. The code can be caused by:
  - — Extremely high transmission fluid level
  - — Faulty external wiring harness
  - — Faulty connections to the OLS
  - — Faulty internal wiring harness
  - — A faulty OLS
  - — A faulty TCM.
- DTC P070D can be caused by a short-to-battery on the 5V reference wire 112 or OLS signal wire 116. DTC P070D can also be caused by an open in the analog return wire 158. The OLS shares a common 5V reference voltage wire 112 with the optional retarder request sensor and throttle position sensor (TPS). A short-to-battery on the 5V reference wire or an open in the analog return wire causes a “sensor failed high” code for the other devices as well. A short-to-battery on the OLS signal wire causes a DTC P070D only.
- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for an active DTC.
4. This step tests for proper 5V reference voltage to OLS.
5. This step tests for shorts-to-battery on wire 112 and open on wire 158.
7. This step tests for shorts-to-battery on wire 116.
9. This step tests for loose or out-of-position terminals in 20-way connector.
11. This step tests OLS functionality.
12. This step tests for a defective internal wiring harness.

DTC P070D Transmission Fluid Level Sensor Circuit—High Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Consult mechanic's tips and perform a manual fluid check procedure. **Adjust as necessary.** Is the transmission fluid level correct?		*Go to Step 3*	*Adjust as necessary. Go to Step 3*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTC. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates the OLS signal is above a set voltage for a set number of samples. It may also indicate a short-to-battery in either the 5V reference wire 112 or OLS signal wire 116, or an open in the analog return wire 158.*** Did DTC P070D return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Disconnect the external wiring harness from the 20-way transmission connector. 3. Turn ON the ignition. 4. Using a DVOM, measure the voltage between pin 16 (5V reference wire 112) and pin 19 (analog return wire 158) at the external harness 20-way connector. Is the voltage within specification?	4.64–5.36V	*Go to Step 6*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070D Transmission Fluid Level Sensor Circuit—High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Inspect the routing of 5V reference wire 112 and analog return wire 158 between the TCM and OLS sensor. 3. Disconnect the 80-way connector from the TCM. 4. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 5. Disconnect the TPS and RMR, if installed. 6. Test for shorts-to-battery and pin-to-pin shorts on wire 112. 7. Test for an open in wire 158. Was chafing or wire damage found?		*Go to Step 8*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Reconnect the TCM 80-way connector. 3. Install the Allison DOC™ For PC–Service Tool. 4. Turn ON the ignition. 5. Verify the transmission 20-way connector is disconnected. 6. Observe OLS voltage on Allison DOC™ For PC–Service Tool. Is voltage approximately 0V?	<0.32V	*Go to Step 9*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Inspect the routing of the OLS signal wire 116 between the TCM and OLS. 3. Disconnect the 80-way connector from the TCM. 4. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 5. Test for shorts-to-battery and pin-to-pin shorts in wire 116. Was chafing or wire damage found?		*Go to Step 8*	*Go to Step 16*
8	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 17*	
9	Inspect the transmission 20-way connector pins 15, 16, and 19 for loose or out-of-position terminals. Were any loose or out-of-position terminals found?		*Go to Step 10*	*Go to Step 11*
10	Repair or replace any defective terminals. Is the repair complete?		*Go to Step 17*	

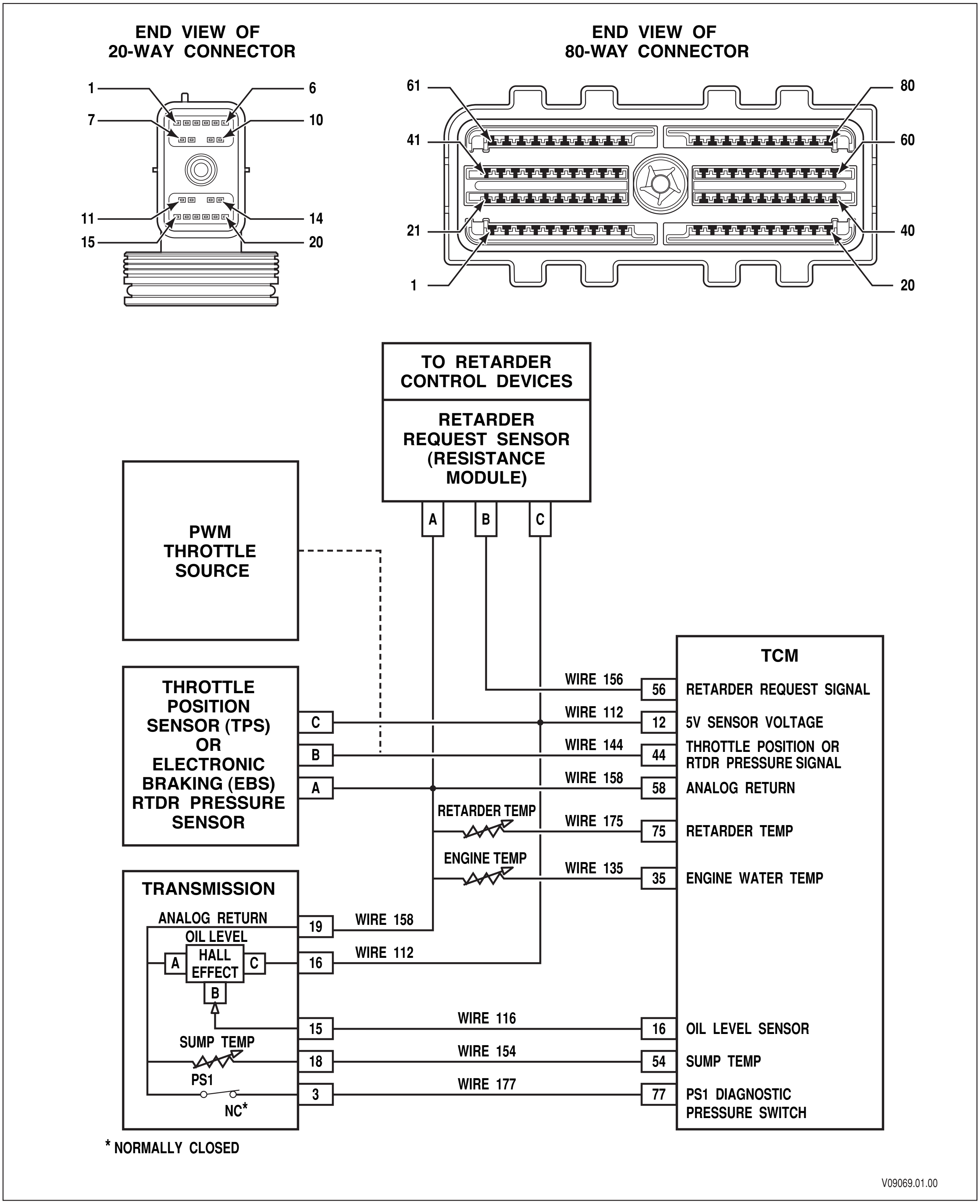
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070D Transmission Fluid Level Sensor Circuit—High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
11	1. Consult appropriate transmission service manual and remove the control module from the transmission. 2. Remove OLS from channel plate. 3. Reconnect the external harness at the 20-way connector. 4. Install the Allison DOC™ For PC–Service Tool. 5. Turn ON the ignition. Leave the engine OFF. 6. Remove the OLS up away from any transmission fluid and observe OLS voltage on Allison DOC™ For PC–Service Tool. Is the voltage in specification?	<0.32V	*Go to Step 15*	*Go to Step 12*
12	1. Inspect internal wiring harness wires 112, 116, and 158. 2. Test for pin-to-pin shorts in wire 112 and 116 or opens in wire 158 in the internal wiring harness. Were there any wiring defects?		*Go to Step 13*	*Go to Step 14*
13	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 15*	
14	Replace the OLS. Is the replacement complete?		*Go to Step 15*	
15	Reinstall the control module to the transmission if removed in Step 11. Is the reinstallation complete?		*Go to Step 17*	
16	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 17*	
17	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor OLS level and voltage. 3. Confirm with the service tool in the test passed section that the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0711 Transmission Fluid Temperature Sensor Circuit Performance



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0711 Transmission Fluid Temperature Sensor Circuit Performance

Circuit Description

The Transmission Fluid Temperature (TFT) sensor is incorporated into the internal wiring harness. The TFT sensor is a thermistor that changes its resistance value based on the temperature of the transmission fluid. The Transmission Control Module (TCM) supplies a 5V reference voltage signal to the TFT sensor and measures the voltage drop in the circuit. When the transmission is cold, the sensor resistance is high and the TCM detects high signal voltage. As the transmission fluid temperature warms to normal operating temperature, the resistance and the signal voltage decrease. The TCM uses this information to control shift quality.

If the TCM detects the TFT sensor resistance has no change or an unrealistic change in a short amount of time, or multiple changes within seconds, DTC P0711 sets.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- Engine is running.
- A valid startup temperature is detected.

Conditions for Setting the DTC

One of the following conditions occur:

- The TCM detects a temperature change that is under a calibration limit when compared to samples of the minimum and maximum temperature values.
- The TFT has an unrealistic temperature change of more than 10°C (50°F) for 10 occurrences.
- The temperature from start-up changes by 40°C (104°F) or more within a duration of 6 or more seconds.

Actions Taken When the DTC Sets

When DTC P0711 is active, the following conditions will occur:

- The **CHECK TRANS** light is illuminated.
- DTC is stored in TCM history.
- TCM uses calibration default for temperature values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Review Appendix A for diagnosing intermittent electrical fault conditions.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.
- Transmission fluid temperature on Allison DOC™ For PC–Service Tool should rise steadily during warmup cycles and then stabilize.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level and condition.
3. This step verifies which condition has set the DTC P0711.
4. This step tests for the proper 5V reference voltage at TCM with OEM harness connected.
5. This step tests for proper 5V reference voltage at TCM without OEM harness.
6. This step tests for wire-to-wire shorts, shorts-to-ground, or an open condition on wire 154.
7. This step tests for proper system circuit resistance value.
8. This step tests the resistance value of the internal harness and TFT sensor.
10. This step tests the resistance value of the internal TFT sensor.

DTC P0711 Transmission Fluid Temperature Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to the appropriate mechanic’s tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic’s tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. With the engine OFF, turn ON the ignition. 3. Record the failure record. 4. Clear the DTCs. 5. Monitor the TFT on Allison DOC™ For PC–Service Tool. 6. Drive the vehicle and observe Allison DOC™ For PC–Service Tool for one of the following conditions: • No Transmission temperature change. • An unrealistic transmission temperature change of greater than 1.5°C (2.7°F) in one second. Did either of the fail conditions occur?	1.5°C (2.7°F) per second	*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0711 Transmission Fluid Temperature Sensor Circuit Performance *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout at the TCM. 3. Disconnect the transmission 20-way connector. 4. Turn ON the ignition. 5. At J 47275-1 TCM Overlay, connect a DVOM. Measure voltage between pin 54 and pin 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 7*	*Go to Step 5*
5	1. Turn OFF the ignition. 2. Disconnect the 16-pin bypass connector on the J 47275 TCM Breakout. 3. Turn ON the ignition. 4. Using a DVOM at J 47275-1 TCM Overlay, measure voltage between pin 54 and pin 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 6*	*Go to Step 13*
6	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Disconnect the transmission 20-way connector, if it was not disconnected in Step 4. 4. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 5. Using a DVOM at J 47275-1 TCM Overlay, test for opens, pin-to-pin shorts, or shorts-to-ground on wire 154. Were any wiring defects found?		*Go to Step9*	*Go to Diagnostic Aids*
7	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Connect the transmission 20-way connector. 4. At J 47275-1 TCM Overlay, connect a DVOM. Measure resistance between pin 54 and pin 58. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Diagnostic Aids*	*Go to Step 8*
8	1. Disconnect the 20-way connector at the transmission and install J 47279 Transmission Breakout. Connect only the J 47279 Transmission Breakout to the transmission. The vehicle side of the harness should not be connected for this test. 2. At J 47279-1 Transmission Overlay, connect a DVOM. Measure resistance between pin 18 and pin 19 in transmission 20-way connector. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Step 9*	*Go to Step 10*

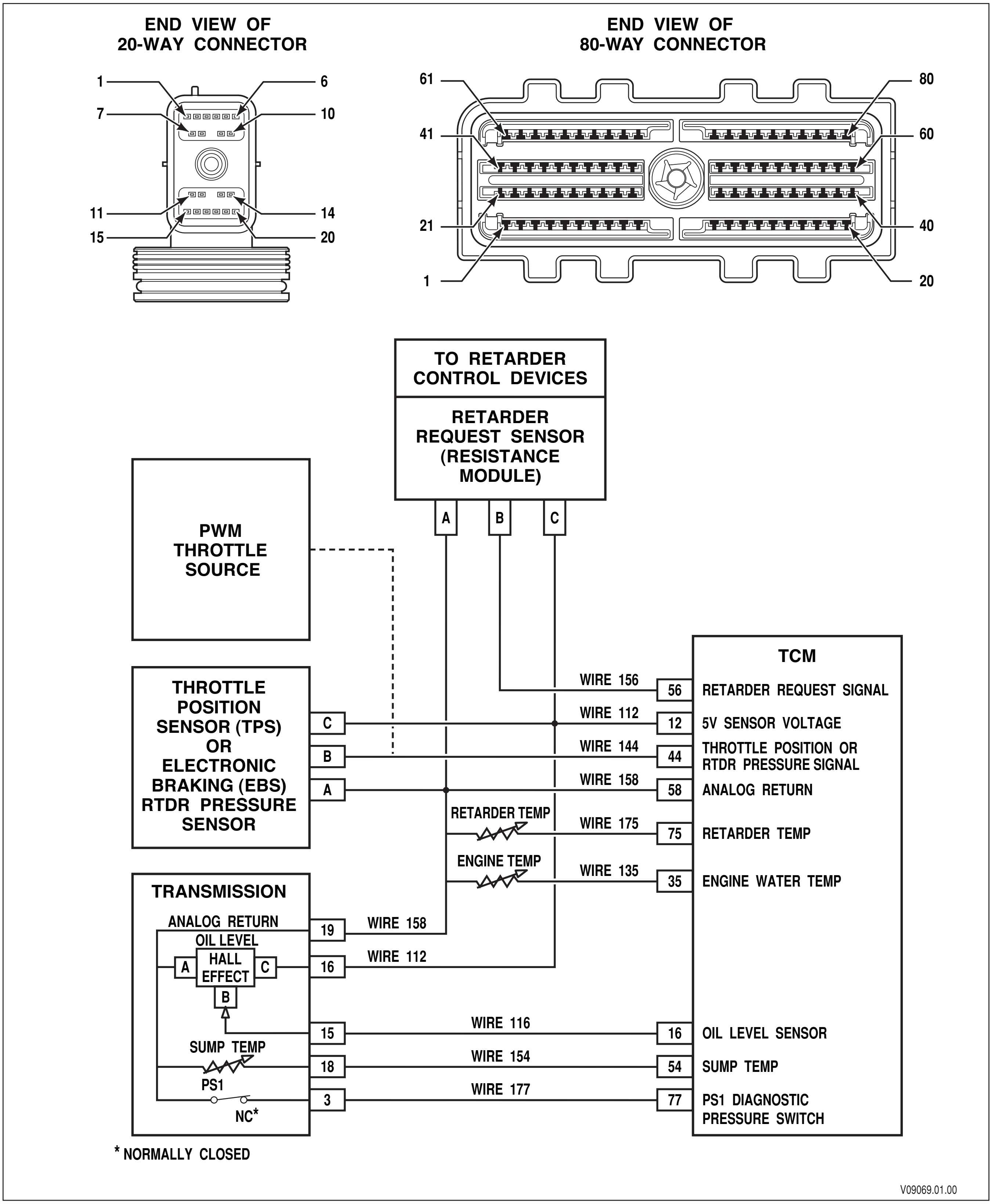
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0711 Transmission Fluid Temperature Sensor Circuit Performance *(cont'd)*

Step	Action	Value(s)	Yes	No
9	***NOTE: The vehicle OEM has responsibility for all external wiring harnesses repair. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 14*	
10	1. Remove the hydraulic control module assembly. 2. Disconnect the sump thermistor from the internal wiring harness. 3. Using a DVOM, measure thermistor resistance at pins A and B. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Step 11*	*Go to Step 12*
11	Replace the internal harness (refer to appropriate mechanic's tips). Is the replacement complete?		*Go to Step 14*	
12	Replace the sump thermistor (refer to appropriate mechanic's tips). Is the replacement complete?		*Go to Step 14*	
13	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 14*	
14	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor the transmission fluid temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant changes in TFT. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0712 Transmission Fluid Temperature Sensor Circuit Low Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0712 Transmission Fluid Temperature Sensor Circuit Low Input

Circuit Description

The Transmission Fluid Temperature (TFT) sensor is incorporated into the internal wiring harness. The TFT sensor is a thermistor that changes its resistance value based on the temperature of the transmission fluid. The Transmission Control Module (TCM) supplies a 5V reference voltage signal to the TFT sensor and measures the voltage drop in the circuit. When the transmission is cold, the sensor resistance is high and the TCM detects high signal voltage. As the transmission fluid temperature warms to normal operating temperature, the resistance and the signal voltage decrease. The TCM uses this information to control shift quality.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- When engine coolant temperature sensor is present, engine is running. If engine runtime is less than 10 minutes, then engine coolant temperature must be above 20°C (68°F) for more than 20 seconds.

Conditions for Setting the DTC

The TCM detects transmission fluid temperature greater than a calibrated value for more than 2.5 seconds.

NOTE: ***The TCM is detecting voltage. An extremely low input voltage implies low thermistor resistance, which corresponds to an unrealistically high transmission fluid temperature measurement.***

Actions Taken When the DTC Sets

When DTC P0712 is active, the following conditions will occur:

- The **CHECK TRANS** light is illuminated.
- DTC is stored in TCM history.
- TCM uses calibration default for temperature values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Review Appendix A for diagnosing intermittent electrical fault conditions.
- Inspect the wiring for poor electrical connections at the TCM and service brake switch. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

DIAGNOSTIC TROUBLE CODES (DTC)

- You may have to drive the vehicle in order to experience a fault.
- DTC P0712 may be caused by a short-to-ground on wire 154.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level and condition.
3. This step verifies which condition has set the DTC P0712.
4. This step tests for the proper 5V reference voltage at TCM with OEM harness connected.
5. This step tests for wire-to-wire shorts, shorts-to-ground, or an open on wire 154.
6. This step tests for 5V reference voltage without OEM harness.
7. This step tests for proper system circuit resistance value.
8. This step tests the resistance value of the internal harness and TFT sensor.
10. This step tests the resistance value of the internal TFT sensor.

DTC P0712 Transmission Fluid Temperature Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. With the engine OFF, turn ON the ignition. 3. Record the failure record. 4. Clear the DTCs. 5. Monitor the TFT on Allison DOC™ For PC–Service Tool. 6. Drive the vehicle and observe Allison DOC™ For PC–Service Tool for an unrealistically high temperature condition. Is the Allison DOC™ For PC–Service Tool transmission fluid temperature greater than 128°C (262°F)?	>128°C (262°F)	*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout at the TCM. 3. Disconnect the transmission 20-way connector. 4. Turn ON the ignition. 5. At J 47275-1 TCM Overlay, connect a DVOM. Measure voltage between pins 54 and 58. Is the voltage within the specified value?	4.75 to 5.0V	*Go to Step 6*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0712 Transmission Fluid Temperature Sensor Circuit Low Input *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the engine. 2. Disconnect the 16-pin bypass connector on the J 47275 TCM Breakout. 3. Turn ON the ignition. 4. Using a DVOM at J 47275-1 TCM Overlay, measure voltage between pin 54 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 6*	*Go to Step 13*
6	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Disconnect the transmission 20-way connector, if it was not disconnected in Step 4. 4. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 5. Using a DVOM at J 47275-1 TCM Overlay, test for pin-to-pin shorts, or shorts-to-ground on wire 154. Were any wiring defects found?		*Go to Diagnostic Aids*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Connect the transmission 20-way connector. 4. At J 47275-1 TCM Overlay, connect a DVOM. Measure resistance between pin 54 to pin 58. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Diagnostic Aids*	*Go to Step 8*
8	1. Disconnect the 20-way connector at the transmission and install J 47279 Transmission Breakout. Connect only the J 47279 Transmission Breakout to the transmission. The vehicle side of the harness should not be connected for this test. 2. At J 47279-1 Transmission Overlay, connect a DVOM. Measure resistance between pin 18 and pin 19 in transmission 20-way connector. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Step 9*	*Go to Step 10*
9	***NOTE: The vehicle OEM has responsibility for all external wiring harnesses repair. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 14*	
10	1. Remove the hydraulic control module assembly. 2. Disconnect the sump thermistor from the internal wiring harness. 3. Using a DVOM, measure thermistor resistance at pins A and B. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Step 11*	*Go to Step 12*

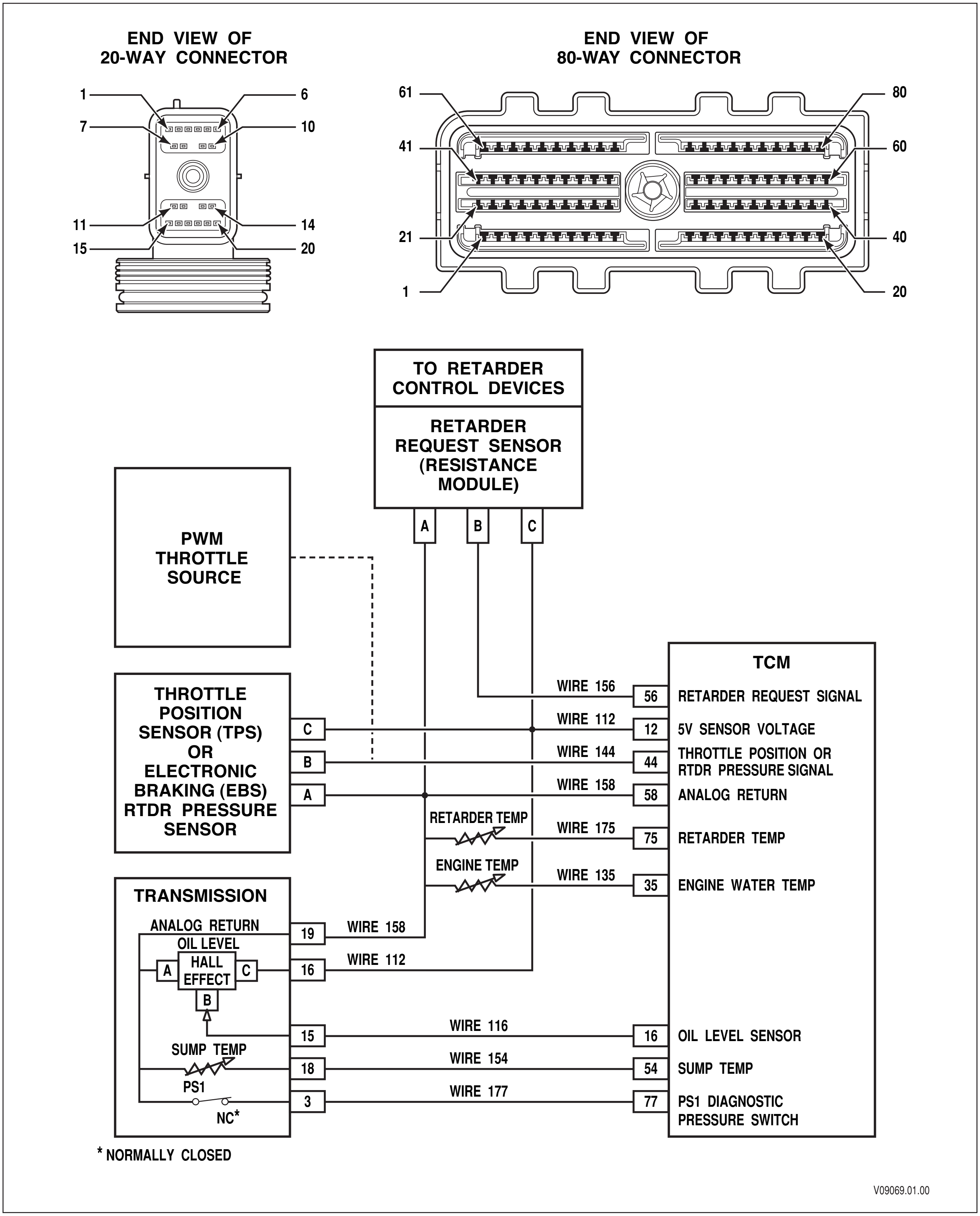
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0712 Transmission Fluid Temperature Sensor Circuit Low Input *(cont'd)*

Step	Action	Value(s)	Yes	No
11	Replace the internal harness (refer to appropriate mechanic's tips). Is the replacement complete?		*Go to Step 14*	
12	Replace the sump thermistor (refer to appropriate mechanic's tips). Is the replacement complete?		*Go to Step 14*	
13	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 14*	
14	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor the transmission fluid temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant changes in TFT. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input

Circuit Description

The Transmission Fluid Temperature (TFT) sensor is incorporated into the internal wiring harness. The TFT sensor is a thermistor that changes its resistance value based on the temperature of the transmission fluid. The Transmission Control Module (TCM) supplies a 5V reference voltage signal to the TFT sensor and measures the voltage drop in the circuit. When the transmission is cold, the sensor resistance is high and the TCM detects high signal voltage. As the transmission fluid temperature warms to normal operating temperature, the resistance and the signal voltage decrease. The TCM uses this information to control shift quality.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- When engine coolant temperature sensor is present, engine is running. If engine runtime is less than 10 minutes, then engine coolant temperature must be above 20ºC (68ºF) for more than 20 seconds.

Conditions for Setting the DTC

The TCM detects transmission fluid temperature less than or equal to a calibrated value for more than 2.5 seconds.

NOTE: The TCM is detecting voltage. A high input voltage implies high thermistor resistance, which corresponds to an extremely cold transmission fluid temperature measurement.

Actions Taken When the DTC Sets

When DTC P0713 is active, the following conditions will occur:

- The **CHECK TRANS** light is illuminated.
- DTC is stored in TCM history.
- TCM uses calibration default for temperature values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0713 may be caused by a short-to-battery on wire 154. If DTC P0713 is accompanied by a DTC P2185 and/or P2743, the problem is most likely a short-to-battery on wire 154, wire 135, or wire 175.
- DTC code P0713 may also be caused by an open in wire 154 or 158.
- Review Appendix A for diagnosing intermittent electrical fault conditions.
- Inspect the wiring for poor electrical connections at the TCM and service brake switch. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level and condition.
3. This step verifies which condition has set the DTC P0712.
4. This step tests for the proper 5V reference voltage at TCM with OEM harness connected.
5. This step tests for proper 5V reference voltage at TCM without the OEM harness.
6. This step tests for wiring defects in external harness.
7. This step tests for proper system circuit resistance value.
8. This step tests the resistance value of the internal harness and TFT sensor.
10. This step tests the resistance value of the internal TFT sensor.

DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. With the engine OFF, turn ON the ignition. 2. Record the failure record. 3. Clear the DTCs. 4. Monitor the TFT on Allison DOC™ For PC–Service Tool. 5. Drive the vehicle and observe Allison DOC™ For PC–Service Tool for an unrealistically low temperature condition. Is the Allison DOC™ For PC–Service Tool transmission fluid temperature less than –45°C (–49°F)?	–45°C (–49°F)	*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout at the TCM. 3. Disconnect the transmission 20-way connector. 4. Turn ON the ignition. 5. Using a DVOM at J 47275-1 TCM Overlay, measure voltage between pins 54 and 58. Is the voltage within the specified value?	4.75 to 5.0V	*Go to Step 7*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the 16-pin bypass connector on J 47275 TCM Breakout. 3. Turn ON the ignition. 4. Using a DVOM at J 47275-1 TCM Overlay, measure voltage between pin 54 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 6*	*Go to Step 13*
6	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 4. Disconnect the transmission 20-way connector. 5. Disconnect the engine coolant temperature sensor and retarder temperature sensor. 6. Using a DVOM at J 47275-1 TCM Overlay, test for opens in wires 154 and 158. 7. Also test for wire-to-wire shorts or shorts-to-battery on wire 135, wire 154, or wire 175. Were any wiring defects found?		*Go to Step 9*	*Go to Diagnostic Aids*
7	1. Turn OFF the ignition. 2. Verify the OEM-side harness is connected to the J 47275 TCM Breakout. Leave the TCM disconnected. 3. Reconnect the transmission 20-way connector. 4. Using a DVOM at J 47275-1 TCM Overlay, measure the resistance between pin 54 and 58. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Diagnostic Aids*	*Go to Step 8*
8	1. Disconnect the 20-way connector at the transmission and install J 47279 Transmission Breakout. Connect the J 47279 Transmission Breakout to the transmission only. The vehicle side of the harness should not be connected for this test. 2. Using a DVOM at J 47279-1 Transmission Overlay, measure resistance between pins 18 and 19 in the 20-way connector. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Step 9*	*Go to Step 10*
9	***NOTE: The vehicle OEM has responsibility for all external wiring harnesses repair. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 14*	

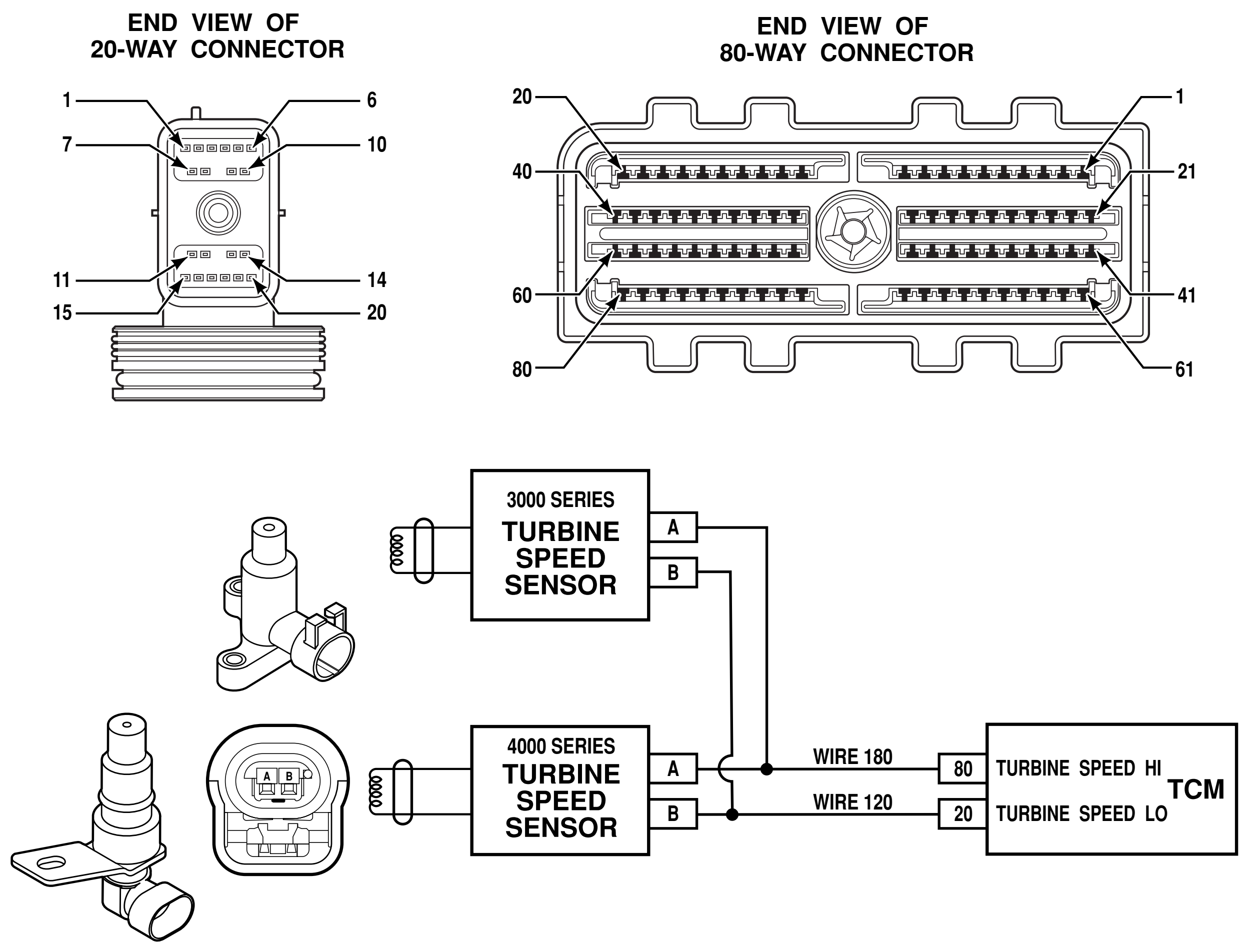
DIAGNOSTIC TROUBLE CODES (DTC)

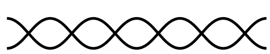
DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
10	1. Remove the hydraulic control module assembly. 2. Disconnect the sump thermistor from the internal wiring harness. 3. Using a DVOM, measure thermistor resistance at pins A and B. Is the resistance within the specified value?	3511–3653 Ohm at 20°C (68°F) Refer to Appendix Q	*Go to Step 11*	*Go to Step 12*
11	Replace the internal harness (refer to appropriate mechanic's tips). Is the replacement complete?		*Go to Step 14*	
12	Replace the sump thermistor (refer to appropriate mechanic's tips). Is the replacement complete?		*Go to Step 14*	
13	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 14*	
14	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor the transmission fluid temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant changes in TFT. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0716 Turbine Speed Sensor Circuit Performance





SPEED SENSOR CIRCUITS
Use twisted pairs of wires

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	TEMP (˚F)	TEMP (˚C)
250	200	–40	–40
340	300	68	20
450	400	230	110

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DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0716 Turbine Speed Sensor Circuit Performance

Circuit Description

Speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member. Two signal wires extend from one end of the housing and an exposed end of the pole piece is at the opposite end of the housing. The permanent magnet produces lines of flux around the pole piece. As a ferrous object (a rib on the rotating clutch drum) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The Transmission Control Module (TCM) calculates the frequency of these AC pulses and converts it to a speed value. The AC voltage generated varies from 150mV at low speed to 15V at high speed. The signal wires from the sensor are formed as twisted pairs to cancel magnetically induced fields. The cable is also shielded to protect from voltage-related fields. Using two-wire differential input at the TCM eliminates noise from other sources.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Turbine speed is above 200 rpm.
- Shift is complete and range attained is not neutral.
- For fire truck vocation, pump not pumping.

Conditions for Setting the DTC

DTC P0716 is set when one of the following three conditions occur:

- Unrealistic large changes in turbine speed. Failure is set if an unrealistic change in transmission turbine speed is detected at or above 800 rpm for 0.15 seconds.
- Noisy turbine speed. Noise is determined with two counters. A low counter is incremented when turbine speed change is below 800 rpm for 2.0 seconds. A high counter is incremented when turbine speed change is above 800 rpm. When both counters accumulate 5 events, a failure is set.
- Wires to speed sensors swapped. Failure is set if commanded range is not Neutral and oncoming clutch control is complete, and engine and turbine speed are greater than 100 rpm.

Actions Taken When the DTC Sets

When DTC P0716 is active, the following conditions will occur:

- If failure occurs while in a forward range and a shift has been completed, the transmission will remain in the current range.
- If failure occurs while in a forward range and a shift is in progress, the transmission will return to the previous range, except in post-shift state, then the transmission will continue to the commanded range.
- DTC P0716 is stored in TCM history.
- The **CHECK TRANS** light illuminates.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and service brake switch. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect the Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - Intermittent wiring connection
  - Excessive vibration (driveline or engine torsionals)
  - Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).
- Install a known good speed sensor and see if normal function is restored to rule out an internal short or open in the sensor removed.
- Check that the speed sensor wiring consists of twisted pairs at the rate of 12 to 16 twists per 300 mm. These twists must extend the entire length of the wiring harness to within at least 50 mm of the speed sensor connector.
- Install a known good TCM, if available. If the DTC does not return, reinstall the old TCM to verify the repair.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper ignition voltage.
3. This step tests for proper turbine speed sensor resistance at the TCM side of the harness.
4. This step tests for turbine speed sensor resistance.

DTC P0716 Turbine Speed Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Install the Allison DOC™ For PC–Service Tool. 1. Start the engine. 2. Record the failure records. 3. Clear the DTCs. 4. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is voltage within specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems (refer to DTC P0882 and P0883)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0716 Turbine Speed Sensor Circuit Performance *(cont'd)*

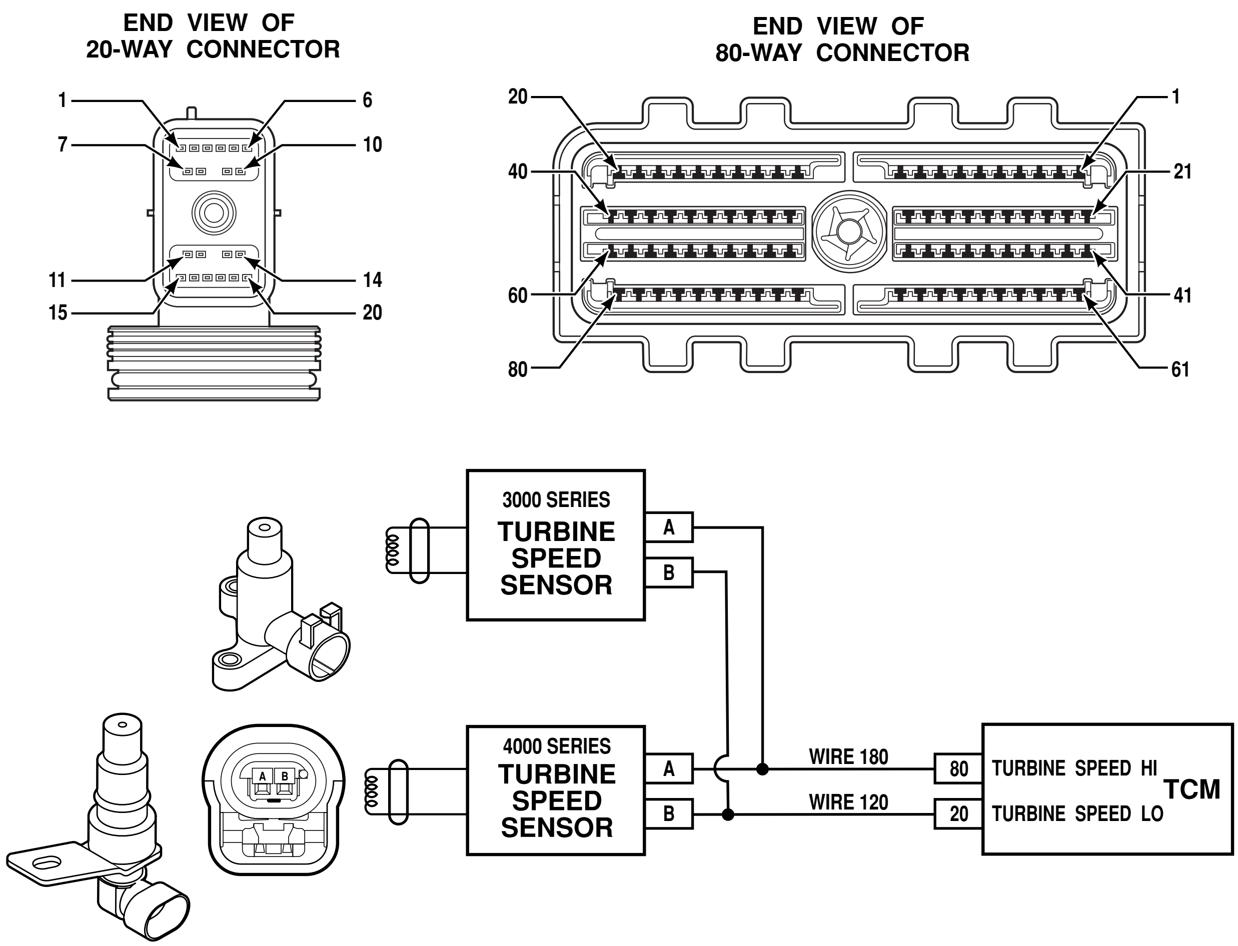
Step	Action	Value(s)	Yes	No
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Using a DVOM, measure resistance between terminal pin 20 and terminal 80 at the OEM-side of the 80-way connector. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–10	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the turbine speed sensor. 2. Using a DVOM, check the resistance between the speed sensor terminals. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–10	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 7*	
6	Replace the turbine speed sensor (refer to appropriate service manual). Is replacement complete?		*Go to Step 7*	
7	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor turbine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

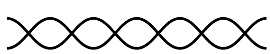
Table 6–10. Speed Sensor Temperature Resistance

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0717 Turbine Speed Sensor Circuit No Signal





SPEED SENSOR CIRCUITS
Use twisted pairs of wires

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	TEMP (˚F)	TEMP (˚C)
250	200	–40	–40
340	300	68	20
450	400	230	110

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DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0717 Turbine Speed Sensor Circuit No Signal

Circuit Description

Speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member. Two signal wires extend from one end of the housing and an exposed end of the pole piece is at the opposite end of the housing. The permanent magnet produces lines of flux around the pole piece. As a ferrous object (a rib on the rotating clutch drum) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The Transmission Control Module (TCM) calculates the frequency of these AC pulses and converts it to a speed value. The AC voltage generated varies from 150mV at low speed to 15V at high speed. The signal wires from the sensor are formed as twisted pairs to cancel magnetically induced fields. The cable is also shielded to protect from voltage-related fields. Using two-wire differential input at the TCM eliminates noise from other sources.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- For fire truck vocation, pump not pumping.
- Shifting complete.
- Reverse-to-Neutral shift not in progress.
- Engine running.
- Range attained is not Neutral.
- No hydraulic default condition due to loss of ignition voltage.
- Transmission fluid temperature above –1.1°C (30°F).
- For low turbine speed test:
  - — Transmission output speed greater than or equal to 150 rpm, or
  - — Transmission output speed greater than or equal to 150 rpm and engine speed greater than or equal to 400 rpm.

Conditions for Setting the DTC

DTC P0717 is set when one of the following conditions occur:

- Unrealistic large change in turbine speed. A failure pending is set if the TCM detects a change in turbine speed of more than 800 rpm. The transmission locks in current range in response to a failure pending condition.
- Unrealistic low value in turbine speed. A failure pending is set if turbine speed is detected below 61 rpm. A failure is set when turbine speed is below 61 rpm and output speed is detected above 500 rpm for more than 1 second.

Actions Taken When the DTC Sets

When DTC P0717 is active, the following conditions will occur:

- If failure occurs while in a forward range and a shift has been completed, the transmission will remain in the current range.
- If failure occurs while in a forward range and a shift is in progress, the transmission will return to the previous range, except in post-shift state, then the transmission will continue to the commanded range.
- DTC P0717 is stored in TCM history.

DIAGNOSTIC TROUBLE CODES (DTC)

- The **CHECK TRANS** light illuminates.
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and service brake switch. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect the Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).
- Install a known good speed sensor and see if normal function is restored to rule out an internal short or open in the sensor removed.
- Check that the speed sensor wiring consists of twisted pairs at the rate of 12 to 16 twists per 300 mm. These twists must extend the entire length of the wiring harness to within at least 50 mm of the speed sensor connector.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests ignition voltage.
3. This step tests for proper turbine speed sensor resistance at the TCM side of the harness.
4. This step tests for turbine speed sensor resistance.

DTC P0717 Turbine Speed Sensor Circuit No Signal

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0717 Turbine Speed Sensor Circuit No Signal *(cont'd)*

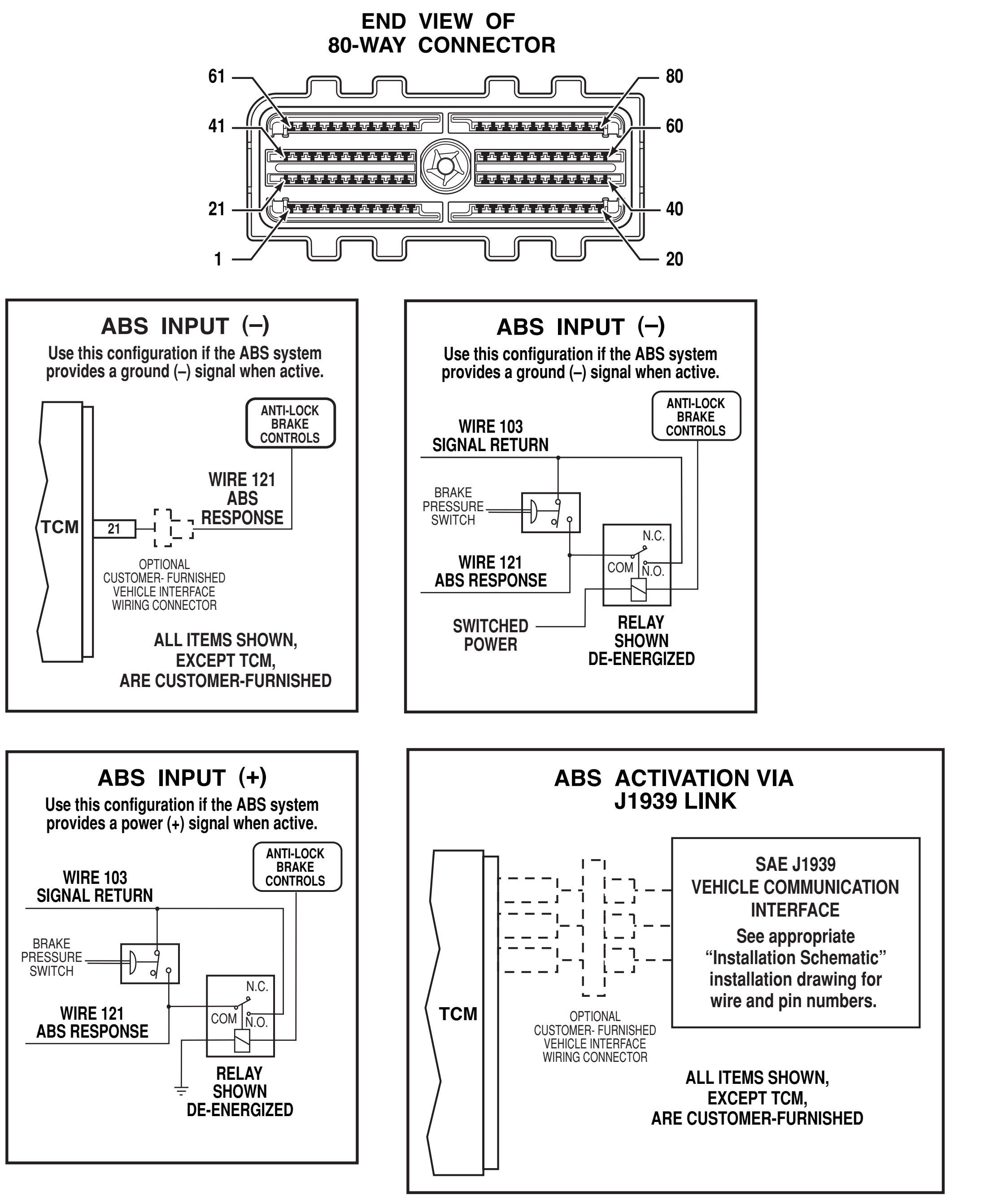
Step	Action	Value(s)	Yes	No
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTCs. 5. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is voltage within specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems (refer to DTC P0882 and P0883)*
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Using a DVOM, measure resistance between terminal 20 and terminal 80 in the OEM-side of the 80-way connector. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–11	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the turbine speed sensor. 2. Using a DVOM, check the resistance between the speed sensor terminals. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–11	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 7*	
6	Replace the turbine speed sensor (refer to appropriate service manual). Is replacement complete?		*Go to Step 7*	
7	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor turbine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

Table 6–11. Speed Sensor Temperature Resistance

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0719 Brake Switch ABS Input Low



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DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0719 Brake Switch ABS Input Low

Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive an anti-lock brake input from either an analog input wire or the digital data link. A switched relay activated by the anti-lock brake system (ABS) controller may provide a direct input to the TCM, or the TCM can receive ABS status as a digital message over the vehicle's communications data link.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0719 sets if the TCM is calibrated to receive the ABS status signal and the TCM senses one acceleration event with the ABS status ON.

Actions Taken When the DTC Sets

When DTC P0719 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- TCM may disengage the torque converter clutch (TCC).
- The TCM uses the default assumption that ABS is OFF.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- When an analog input wire is used, the ABS signal is received on wire 121. The ABS controller may directly pull wire 121 to ground or use a relay to complete a circuit between wire 121 and wire 103. If a data link is used, the TCM receives ABS status as part of J1939 message parameter PGN 61441, Electronic Brake Controller 1 (EBC1).
- DTC P0719 indicates the TCM has detected ABS status ON for a single acceleration event. The code can be caused by:
  - — Faulty wiring
  - — Faulty connections to the ABS relay
  - — A faulty ABS relay
  - — Another controller improperly broadcasting ABS status on the data link when ABS is not installed or operating
  - — A fault in the ABS system itself
  - — A faulty TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect the wiring for poor electrical connections at the TCM and service brake switch. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- J1939 ABS status can be read on Allison DOC™ For PC–Service Tool. Monitor data link communications using Data Bus Viewer.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for an active DTC.
3. This step determines if ABS status is being communicated by a data link message.

DTC P0719 Brake Switch ABS Input Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTCs and drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the ABS signal is present for more than a single acceleration event.*** Did DTC P0719 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	Using Allison DOC™ For PC–Service Tool Data Bus Viewer, observe status of ABS. Consult Allison DOC™ For PC–Service Tool User's Guide (GN3433EN) for instructions on using Data Bus Viewer. Is J1939 ABS status ON during acceleration events?		*Go to Step 4*	*Go to Step 5*
4	***NOTE: Allison Transmission is not responsible for data link messages that originate in other controllers. Repairs not associated with the transmission controller are not covered by Allison Transmission warranty.*** Coordinate with the vehicle or engine OEM to correct the cause of the inconsistent J1939 ABS status message. Is the repair complete?		*Go to Step 8*	

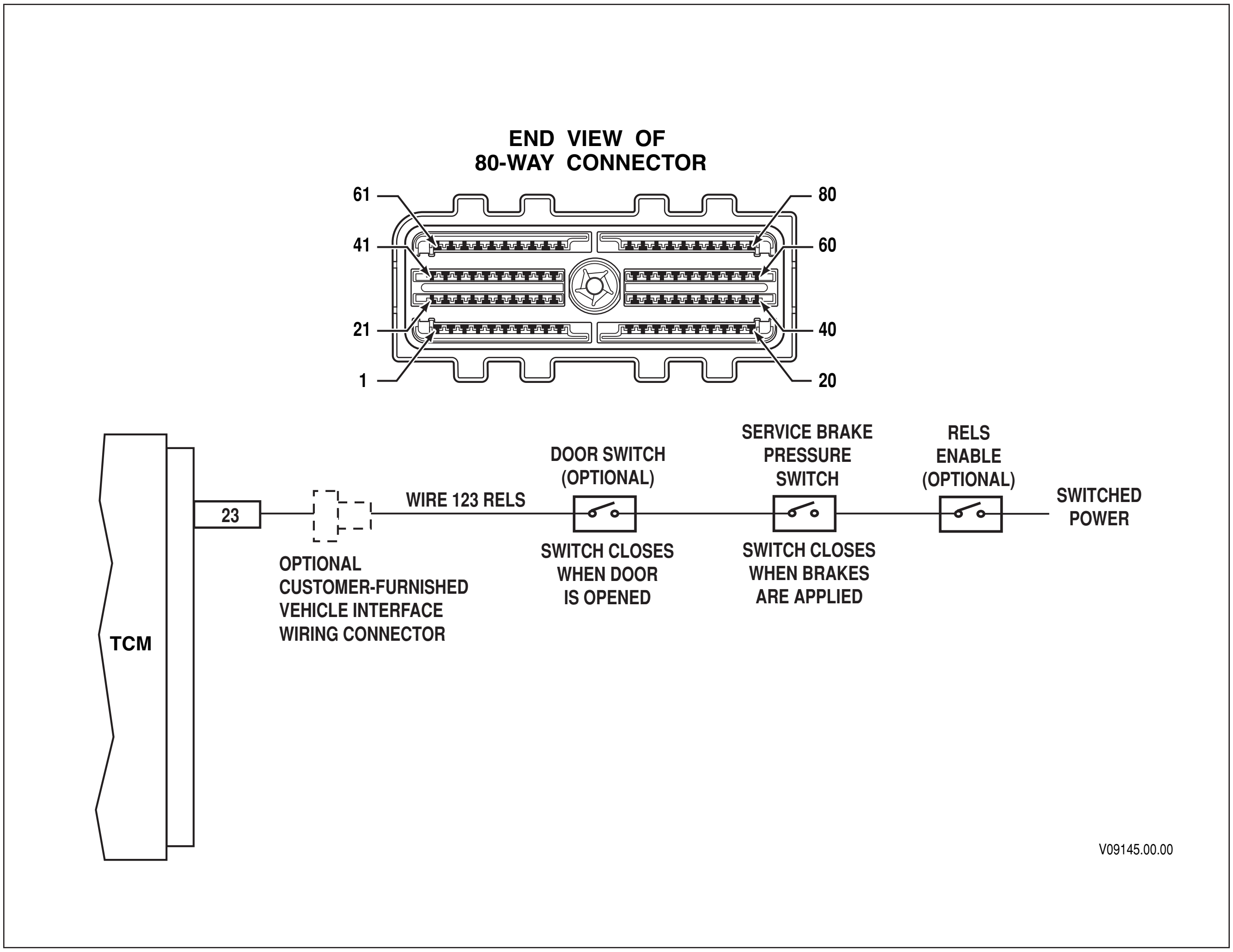
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0719 Brake Switch ABS Input Low *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Remove the ABS input wire (121) from the 80-way connector. 2. Clear code and test drive vehicle. Did the code return?		*Go to Step 7*	*Go to Step 6*
6	Return vehicle to OEM for troubleshooting of wiring leading to ABS controller. Was the problem found and corrected?		*Go to Step 8*	
7	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Clear the DTC. 2. Use to Allison DOC™ For PC–Service Tool monitor ABS status. 3. Drive the vehicle under conditions noted in failure records. 4. Confirm with the service tool in the test passed section that the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071A RELS Input Failed On



Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive an input from the service brakes to activate and deactivate the Reduced Engine Load at Stop (RELS) feature. The input signal consists of switched power provided through a normally open service brake pressure switch. The switch closes when brakes are applied to supply switched power to the RELS input pin at the TCM. Supplemental controls such as a door switch or RELS enable switch may be wired in series with the brake switch.

When RELS is active, the TCM automatically commands transmission operation at a reduced load state similar to neutral. The vehicle must be at a stop with the service brakes applied and the throttle closed. RELS is de-activated when the service brake pressure switch is opened and switched power is removed from the RELS input pin at the TCM. The service brake input on SAE J1939 communications link CANNOT be used as an input for RELS.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071A RELS Input Failed On

Conditions for Setting the DTC

Both of the following conditions **must be met** for the DTC to be set:

- DTC P071A sets if the TCM is calibrated to receive the RELS input signal.
- RELS input is active during one acceleration event.

Actions Taken When the DTC Sets

When DTC P071A is active, the following conditions will occur:

- The **CHECK TRANS** light is illuminated.
- DTC is stored in TCM history.
- TCM inhibits RELS operation.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- The RELS function is active when a service brake pressure switch is closed to supply switched power on wire 123 to pin 23 at the TCM.
- DTC P071A indicates the TCM has detected a RELS input signal during one acceleration event. The code can be caused by:
  - — Faulty wiring
  - — Faulty connections to service brake switch
  - — A faulty service brake switch
  - — Faulty TCM.
- Inspect the wiring for poor electrical connections at the TCM and service brake pressure switch. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for an active DTC.
3. This step tests for status of analog input wire 123.
4. This step tests for the presence of ignition voltage on wire 123.
5. This step tests for proper service brake switch function.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071A RELS Input Failed On

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTCs and drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the RELS input is on during one acceleration event.*** Did DTC P071A return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Turn ON the ignition. 2. Using Allison DOC™ For PC–Service Tool, observe status of RELS input wire 123. Does wire 123 go ON when service brakes are applied and go OFF when service brakes are released?		*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Connect TCM and OEM-side connectors to the J 47275 TCM Breakout. 4. Turn ON the ignition. 5. Release service brakes. ***NOTE: Ignition voltage should not be present at TCM pin 23 when brakes are released.*** 6. At J 47275-1 TCM Overlay, connect a DVOM and measure voltage between pins 23 and an isolated ground. Is ignition voltage present at pin 23 when service brakes are released?		*Go to Step 5*	*Go to Step 8*
5	1. Turn OFF the ignition. 2. Using a DVOM, check for continuity across the service brake switch when brakes are applied, and no continuity when brakes are released. Does the switch close when service brakes are applied and open when brakes are released?		*Go to Step 6*	*Go to Step 7*
6	***NOTE: The vehicle OEM has responsibility for all external harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 9*	

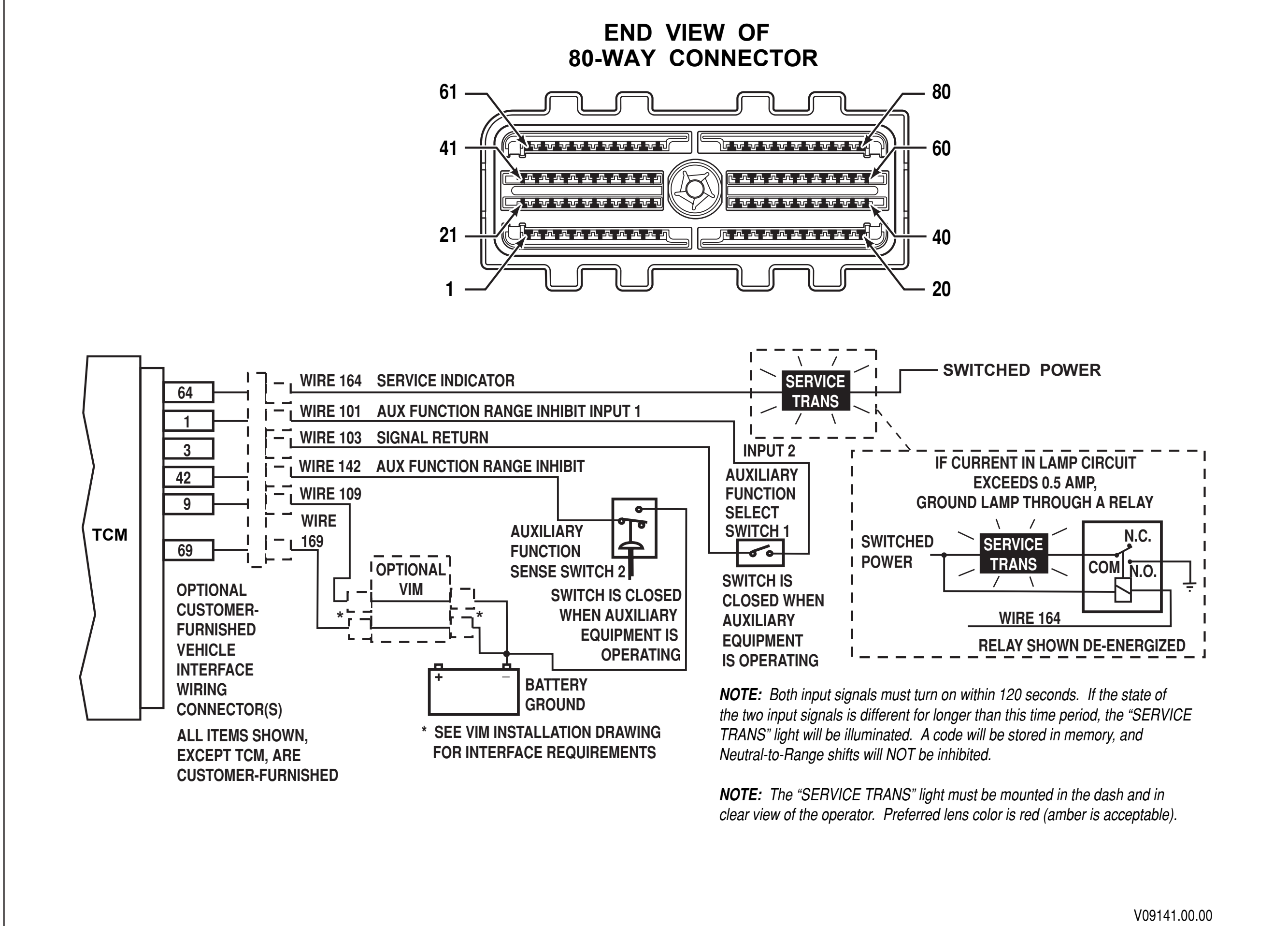
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071A RELS Input Failed On *(cont'd)*

Step	Action	Value(s)	Yes	No
7	***NOTE: The vehicle OEM has responsibility for vehicle input/output switch repairs. Switch repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the service brake switch. Is the repair complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor RELS status. 3. Drive the vehicle under conditions noted in failure records. 4. Confirm with the service tool in the test passed section that the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071D General Purpose Input Fault



Circuit Description

Some emergency vehicles are equipped with an input function known as Auxiliary Function Range Inhibit (Special), which prevents inadvertent range selection when auxiliary equipment is operating. This function is enabled under the following conditions:

- Input wire 101 is connected to signal return wire 103, and
- Input wire 142 is connected to battery ground.

In a typical installation, a dash-mounted auxiliary equipment selector switch completes the circuit between wires 101 and 103. A second switch closes during operation of the auxiliary equipment to complete the circuit between wire 142 and battery ground. Both switches must be closed for the function to be enabled. When the two input wires (101 and 142) are ON, the TCM inhibits all neutral-to-range shifts. The inhibit remains in effect until either of the two input wires change state to OFF, or transmission output speed exceeds a preset value. The TCM sets DTC P071D if it detects the two input wires in two different states (ON or OFF) for longer than 120 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071D General Purpose Input Fault

Conditions for Running the DTC

The test is enabled by calibration.

Conditions for Setting the DTC

DTC P071D sets if the TCM detects wire 101 and wire 142 in different states for more than 120 seconds.

Actions Taken When the DTC Sets

When DTC P071D is active, the following conditions will occur:

- The **CHECK TRANS** light is illuminated.
- The TCM may illuminate **SERVICE TRANS** light based on OEM wiring. Refer to Appendix P, Dual Input Auxiliary Function Range Inhibit.
- DTC is stored in TCM history.
- TCM allows Neutral-to-Range shifts.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P071D indicates the two input wires for Auxiliary Function Range Inhibit (Special) are in different ON/OFF states. The code can be caused by:
  - — Faulty wiring
  - — Faulty connections to the auxiliary equipment selector switch
  - — A faulty auxiliary equipment selector switch
  - — Faulty connection to the auxiliary equipment sense switch
  - — A faulty auxiliary equipment sense switch
  - — A faulty TCM.
- Inspect the wiring for poor electrical connections at the TCM and auxiliary equipment switches. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- The status of analog input wires 101 and 142 can be read on Allison DOC™ For PC–Service Tool.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for an active DTC.
3. This step tests for status of analog input wires 101 and 142.

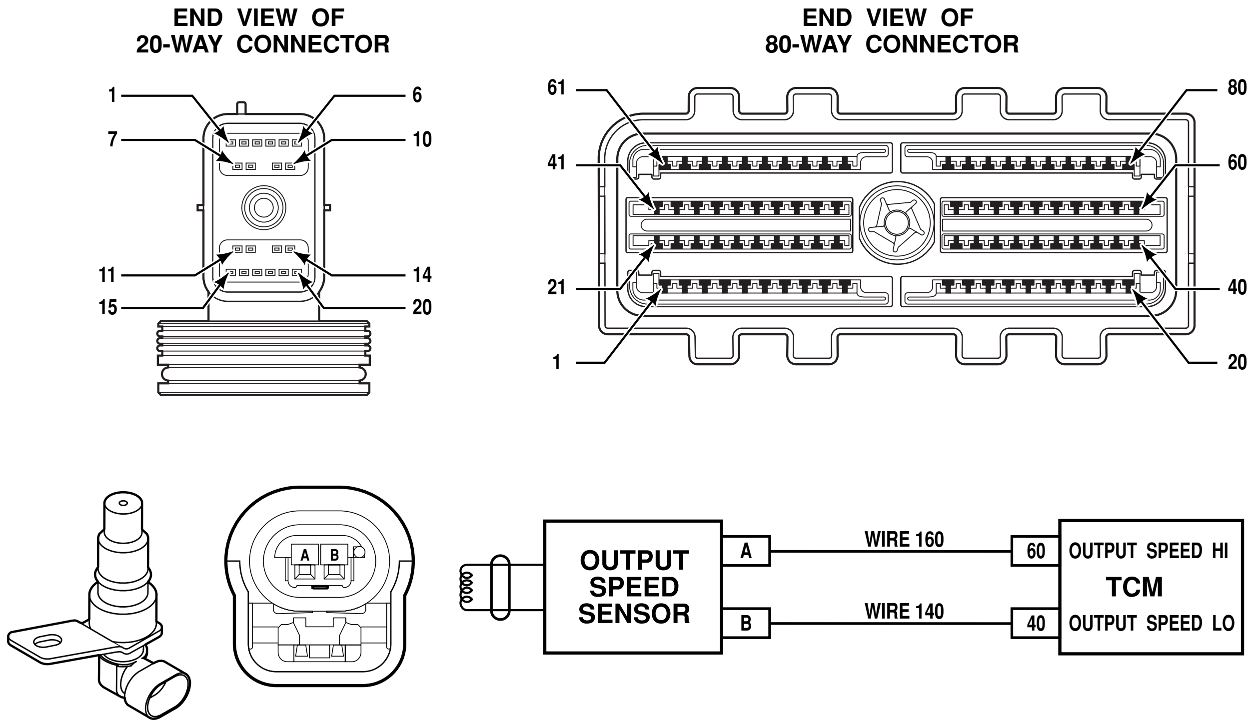
DIAGNOSTIC TROUBLE CODES (DTC)

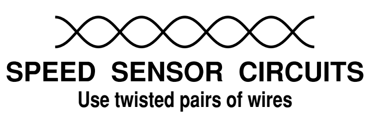
DTC P071D General Purpose Input Fault

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTCs. 5. Operate the auxiliary equipment in accordance with the vehicle manufacturer's operating instructions. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the two input wires for the auxiliary function range inhibit (special) I/O function are in different states for longer than 120 seconds.*** Did DTC P071D return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Using Allison DOC™ For PC–Service Tool, determine the states of input wires 101 and 142. 2. Inspect the input wiring, connectors, and switches to determine why the input states are different. Did you find and correct the problem?		*Go to Step 5*	*Go to Step 4*
4	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 5*	
5	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor Auxiliary Function Range Inhibit (special) input wires. 3. Operate the auxiliary equipment in accordance with the manufacturer's operating instructions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0721 Output Speed Sensor Circuit Performance





Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	TEMP (˚F)	TEMP (˚C)
250	200	–40	–40
340	300	68	20
450	400	230	110

V09135.00.01

Circuit Description

Speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member. Two signal wires extend from one end of the housing and an exposed end of the pole piece is at the opposite end of the housing. The permanent magnet produces lines of flux around the pole piece. As a ferrous object (a tooth on the tone wheel) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The Transmission Control Module (TCM) calculates the frequency of these AC pulses and converts it to a speed value. The AC voltage generated varies from 150mV at low speed to 15V at high speed. The signal wires from the sensor are formed as twisted pairs to cancel magnetically induced fields. The cable is also shielded to protect from voltage-related fields. Using two-wire differential input at the TCM eliminates noise from other sources.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0721 Output Speed Sensor Circuit Performance

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Output speed is above 200 rpm.
- Shift is complete and range attained is not neutral.
- For fire truck vocation, pump not pumping.

Conditions for Setting the DTC

DTC P0721 is set when one of the following two conditions occur:

- Unrealistic large changes in output speed. Failure is set if an unrealistic change in transmission output speed is detected at or above 500 rpm for 0.15 seconds.
- Noisy output speed. Noise is determined with two counters. A low counter is incremented when output speed change is below 500 rpm for 80 samples. A high counter is incremented when output speed change is above 800 rpm. When both counters accumulate 5 events, a failure is set.

Actions Taken When the DTC Sets

When DTC P0721 is active, the following conditions will occur:

- If failure occurs while in a forward range and a shift has been completed, the transmission will remain in the current range.
- If failure occurs while in a forward range and a shift is in progress, the transmission will return to the previous range, except in post-shift state, then the transmission will continue to the commanded range.
- DTC P0721 is stored in TCM history.
- The **CHECK TRANS** light illuminates.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and service brake switch. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- You may have to drive the vehicle in order to experience a fault.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect the Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - Intermittent wiring connection
  - Excessive vibration (driveline or engine torsionals)
  - Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).
- Install a known good speed sensor and see if normal function is restored to rule out an internal short or open in the sensor removed.
- Check that the speed sensor wiring consists of twisted pairs at the rate of 12 to 16 twists per 300 mm. These twists must extend the entire length of the wiring harness to within at least 50 mm of the speed sensor connector.
- Install a known good TCM, if available. If the DTC does not return, reinstall the old TCM to verify the repair.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper ignition voltage.
3. This step tests for proper output speed sensor resistance at the OEM-side of the harness.
4. This step tests for output speed sensor resistance.

DTC P0721 Output Speed Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTCs. 5. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is voltage within specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems (refer to DTC P0882 and P0883)*
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Using a DVOM, measure resistance between terminal 40 and terminal 60 at the OEM-side of the 80-way connector. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–12	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the output speed sensor. 2. Using a DVOM, check the resistance between the speed sensor terminals. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–12	*Go to Step 5*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0721 Output Speed Sensor Circuit Performance *(cont'd)*

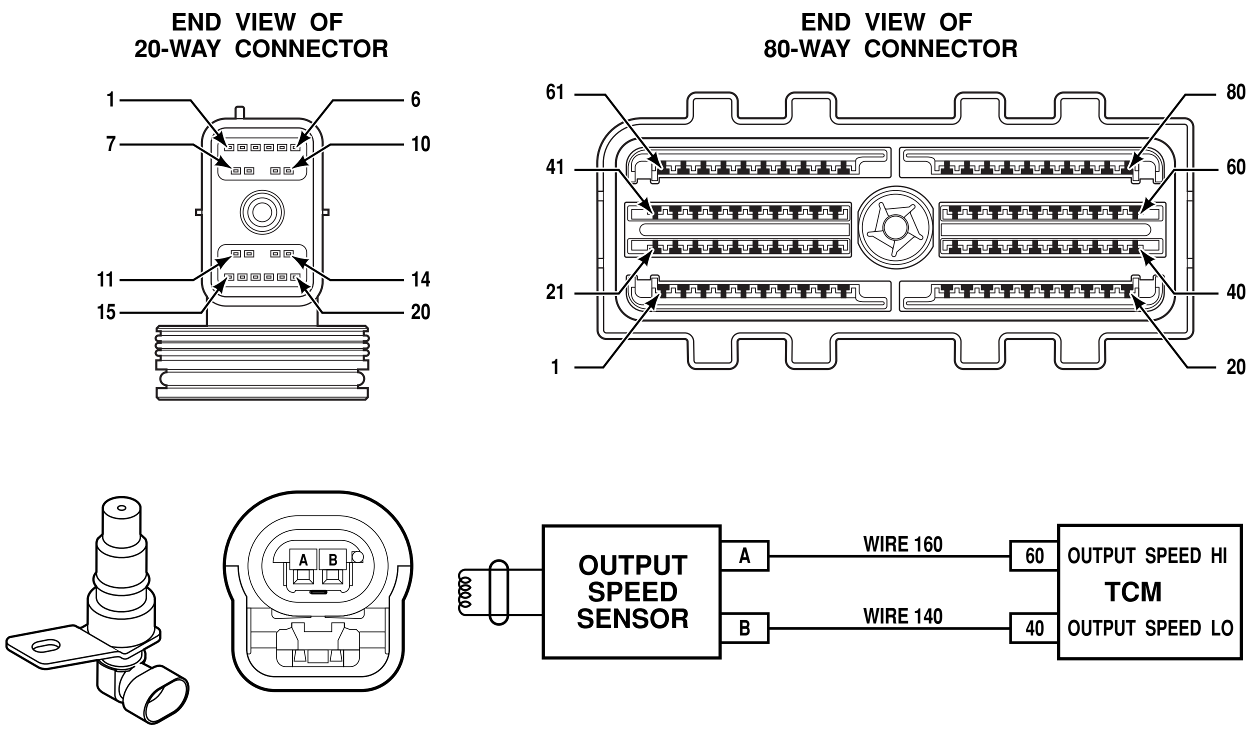
Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 7*	
6	Replace the output speed sensor (refer to appropriate service manual). Is replacement complete?		*Go to Step 7*	
7	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Use Allison DOC™ For PC–Service Tool to monitor output speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

Table 6–12. Speed Sensor Temperature Resistance

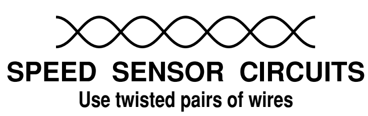
Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0722 Output Speed Sensor Circuit No Signal



Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	TEMP (˚F)	TEMP (˚C)
250	200	–40	–40
340	300	68	20
450	400	230	110



V09135.00.01

Circuit Description

Speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member. Two signal wires extend from one end of the housing and an exposed end of the pole piece is at the opposite end of the housing. The permanent magnet produces lines of flux around the pole piece. As a ferrous object (a tooth of the tone wheel) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The Transmission Control Module (TCM) calculates the frequency of these AC pulses and converts it to a speed value. The AC voltage generated varies from 150mV at low speed to 15V at high speed. The signal wires from the sensor are formed as twisted pairs to cancel magnetically induced fields. The cable is also shielded to protect from voltage-related fields. Using two-wire differential input at the TCM eliminates noise from other sources.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0722 Output Speed Sensor Circuit No Signal

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- For fire truck vocation, pump not pumping.
- For unrealistically large change in output speed test:
  - — Output speed is at or above 600 rpm for more than 1 second.
- For low output speed test:
  - — Shifting complete
  - — Reverse-to-Neutral shift not in progress
  - — Engine is running
  - — No hydraulic default condition due to loss of ignition voltage
  - — Transmission fluid temperature greater than –1.1ºC (30ºF)
  - — Transmission turbine speed greater than or equal to 600 rpm

Conditions for Setting the DTC

DTC P0722 is set when one of the following three conditions occur:

- Unrealistic large change in output speed. A failure pending is set if the TCM detects a change in output speed of more than 600 rpm. A failure is set if range attained is Neutral.
- Unrealistic low value in output speed. A failure pending is set if output speed is detected below 61 rpm.
  - — A failure is set when output speed is below 61 rpm in third, fourth, or fifth range for more than 1 second.
  - — A failure is also set when output speed is below 61 rpm in second range for more than one 1 second when net engine torque is +/- 1 N·m or turbine speed is greater than 800 rpm.

Actions Taken When the DTC Sets

When DTC P0722 is active, the following conditions will occur:

- If failure occurs while in a forward range and a shift has been completed, the transmission will remain in the current range.
- If failure occurs while in a forward range and a shift is in progress, the transmission will return to the previous range, except in post-shift state, then the transmission will continue to the commanded range.
- DTC P0722 is stored in TCM history.
- The **CHECK TRANS** light illuminates.
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and service brake switch. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect the Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - Intermittent wiring connection
  - Excessive vibration (driveline or engine torsionals)
  - Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).
- Install a known good speed sensor and see if normal function is restored to rule out an internal short or open in the sensor removed.
- Check that the speed sensor wiring consists of twisted pairs at the rate of 12 to 16 twists per 300 mm. These twists must extend the entire length of the wiring harness to within at least 50 mm of the speed sensor connector.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests ignition voltage.
3. This step tests for proper output speed sensor resistance at the OEM-side of the harness.
4. This step tests for output speed sensor resistance.

DTC P0722 Output Speed Sensor Circuit No Signal

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTCs. 5. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is voltage within specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems (refer to DTC P0882 and P0883)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0722 Output Speed Sensor Circuit No Signal *(cont'd)*

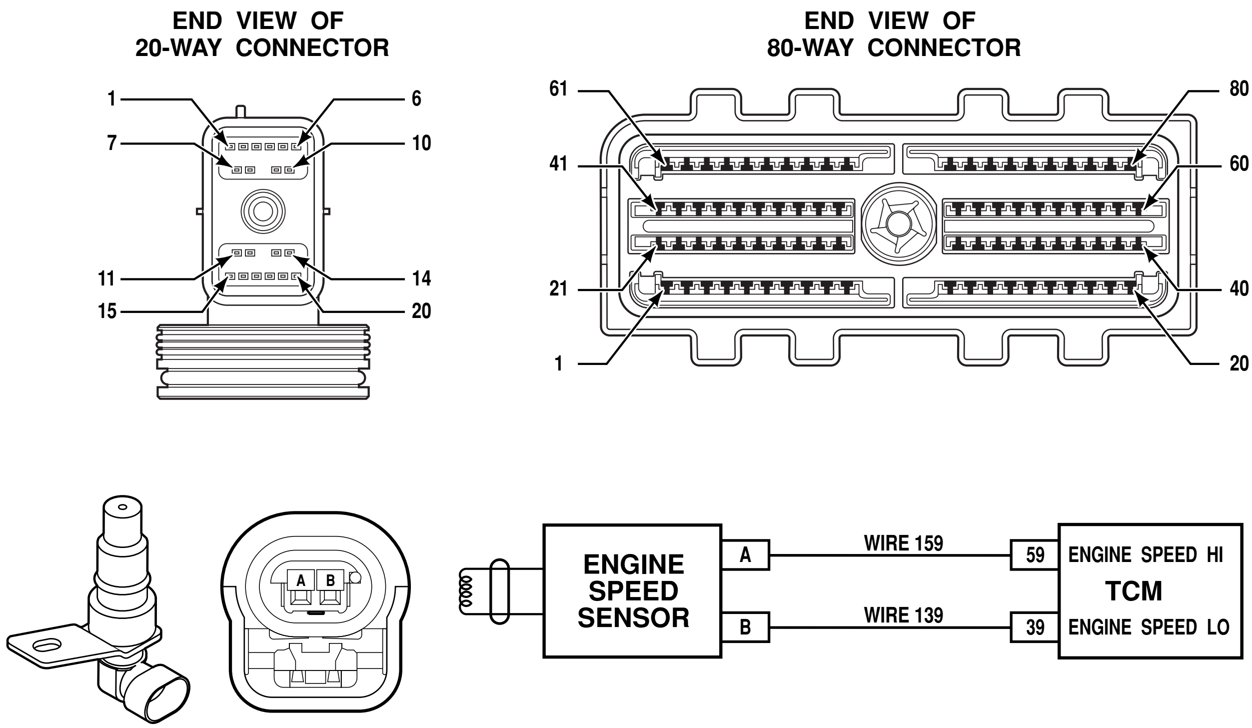
Step	Action	Value(s)	Yes	No
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Using a DVOM, measure resistance between terminal 40 and terminal 60 at the OEM-side of the 80-way connector. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–13	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the output speed sensor. 2. Using a DVOM, check the resistance between the speed sensor terminals. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–13	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 7*	
6	Replace the output speed sensor (refer to appropriate service manual). Is replacement complete?		*Go to Step 7*	
7	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Use Allison DOC™ For PC–Service Tool to monitor output speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

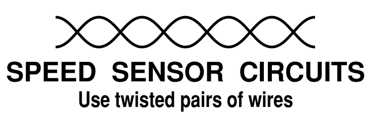
Table 6–13. Speed Sensor Temperature Resistance

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0726 Engine Speed Sensor Circuit Performance





Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	TEMP (˚F)	TEMP (˚C)
250	200	–40	–40
340	300	68	20
450	400	230	110

V09136.00.01

Circuit Description

Speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member. Two signal wires extend from one end of the housing and an exposed end of the pole piece is at the opposite end of the housing. The permanent magnet produces lines of flux around the pole piece. As a ferrous object (a rib on torque converter impeller) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The Transmission Control Module (TCM) calculates the frequency of these AC pulses and converts it to a speed value. The AC voltage generated varies from 150mV at low speed to 15V at high speed. The signal wires from the sensor are formed as twisted pairs to cancel magnetically induced fields. The cable is also shielded to protect from voltage-related fields. Using two-wire differential input at the TCM eliminates noise from other sources.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0726 Engine Speed Sensor Circuit Performance

Conditions for Running the DTC

- The test is enabled by calibration.
- Engine speed is above 600 rpm.
- Shift is complete and range attained is not neutral.

Conditions for Setting the DTC

DTC P0726 is set when one of the following conditions occur:

- Unrealistic large changes in engine speed. Failure is set if an unrealistic change in transmission engine speed is detected at or above 600 rpm for 0.15 seconds.
- Noisy engine speed. Noise is determined with two counters. A low counter is incremented when engine speed change is below 650 rpm for 80 samples. A high counter is incremented when engine speed change is above 1050 rpm. When both counters accumulate 5 events, a failure is set.

Actions Taken When the DTC Sets

When DTC P0726 is active, the following conditions will occur:

- DTC P0726 is stored in TCM history.
- The TCM does not illuminate the **CHECK TRANS** light.
- The TCM defaults engine speed to turbine speed. Turbine speed is used to determine the missing engine speed.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and engine speed sensor. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect the Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - Intermittent wiring connection
  - Excessive vibration (driveline or engine torsionals)
  - Irregular sensor gap (loose sensor, damaged torque converter ribs).
- Install a known good speed sensor and see if normal function is restored to rule out an internal short or open in the sensor removed.
- Check that the speed sensor wiring consists of twisted pairs at the rate of 12 to 16 twists per 300 mm. These twists must extend the entire length of the wiring harness to within at least 50 mm of the speed sensor connector.
- Install a known good TCM, if available. If the DTC does not return, reinstall the old TCM to verify the repair.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper ignition voltage.
3. This step tests for proper engine speed sensor resistance at the OEM-side of the harness.
4. This step tests for engine speed sensor resistance.

DTC P0726 Engine Speed Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTCs. 5. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is voltage within specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems (refer to DTC P0882 and P0883)*
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Using a DVOM, measure resistance between terminal 39 and terminal 59 at the OEM-side of the 80-way connector. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–14	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the output speed sensor. 2. Using a DVOM, measure the resistance between the speed sensor terminals. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–14	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 7*	
6	Replace the engine speed sensor (refer to service manual). Is replacement complete?		*Go to Step 7*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0726 Engine Speed Sensor Circuit Performance *(cont'd)*

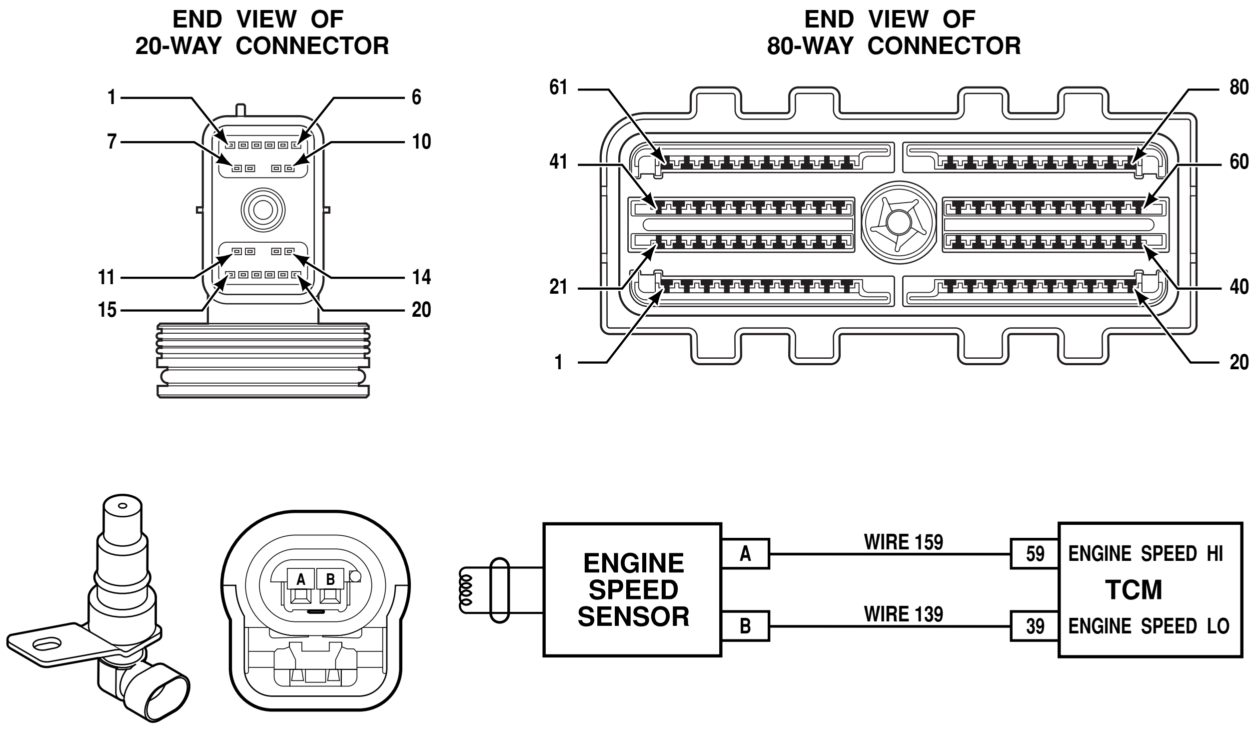
Step	Action	Value(s)	Yes	No
7	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor engine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

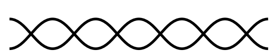
Table 6–14. Speed Sensor Temperature Resistance

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0727 Engine Speed Sensor Circuit No Signal





Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	TEMP (˚F)	TEMP (˚C)
250	200	–40	–40
340	300	68	20
450	400	230	110

V09136.00.01

Circuit Description

Speed sensors are variable reluctance devices that convert mechanical motion to an AC voltage. Each sensor consists of a wire coil wrapped around a pole piece that is adjacent to a permanent magnet. These elements are contained in a housing that is mounted adjacent to a rotating ferrous member. Two signal wires extend from one end of the housing and an exposed end of the pole piece is at the opposite end of the housing. The permanent magnet produces lines of flux around the pole piece. As a ferrous object (a rib on the torque converter impeller) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The Transmission Control Module (TCM) calculates the frequency of these AC pulses and converts it to a speed value. The AC voltage generated varies from 150mV at low speed to 15V at high speed. The signal wires from the sensor are formed as twisted pairs to cancel magnetically induced fields. The cable is also shielded to protect from voltage-related fields. Using two-wire differential input at the TCM eliminates noise from other sources.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0727 Engine Speed Sensor Circuit No Signal

Conditions for Running the DTC

- The test is enabled by calibration.
- For unrealistically low engine speed test:
  - — Turbine speed is at or above 400 rpm.
  - — The ignition key is in RUN.

Conditions for Setting the DTC

DTC P0727 is set when one of the following conditions occur:

- Unrealistic large change in engine speed. A failure pending is set if the TCM detects a change in engine speed of more than 1040 rpm.
- Unrealistic low value in engine speed. A failure is set if engine speed is detected below 61 rpm for 4 seconds.

Actions Taken When the DTC Sets

When DTC P0727 is active, the following conditions will occur:

- DTC P0727 is stored in TCM history.
- The TCM does not illuminate the **CHECK TRANS** light.
- The TCM defaults engine speed to turbine speed. Turbine speed is used to determine the missing engine speed.
- The TCM inhibits torque converter clutch (TCC) momentarily.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and engine speed sensor. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect the Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, damaged torque converter ribs).
- Install a known good speed sensor and see if normal function is restored to rule out an internal short or open in the sensor removed.
- Inspect that the speed sensor wiring consists of twisted pairs at the rate of 12 to 16 twists per 300 mm. These twists must extend the entire length of the wiring harness to within at least 50 mm of the speed sensor connector.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper ignition voltage.
3. This step tests for proper engine speed sensor resistance at the OEM-side of the harness.
4. This step tests for engine speed sensor resistance.

DTC P0727 Engine Speed Sensor Circuit No Signal

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTCs. 5. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is voltage within specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems (refer to DTC P0882 and P0883)*
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Using a DVOM, measure resistance between terminal 39 and terminal 59 at the OEM-side of the 80-way connector. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–15	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the engine speed sensor. 2. Using a DVOM, measure the resistance between the speed sensor terminals. Is the speed sensor resistance within the specified value?	Refer to Speed Sensor Resistance Table 6–15	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed at Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 7*	
6	Replace the engine speed sensor (refer to service manual). Is replacement complete?		*Go to Step 7*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0727 Engine Speed Sensor Circuit No Signal *(cont'd)*

Step	Action	Value(s)	Yes	No
7	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor engine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

Table 6–15. Speed Sensor Temperature Resistance

Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp ˚F	Temp ˚C
250	200	–40	–40
340	300	68	20
450	400	230	110

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0729 Incorrect 6th Gear Ratio

Refer to Sixth Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to determine the current commanded steady state gear ratio. The TCM then compares the known gear ratio to the calculated gear ratio for the current range.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- No shift in progress.
- Hydraulic default condition not present.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P0729 sets during steady state condition when the calculated sixth gear ratio differs from the known sixth gear ratio for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P0729 is active, the following conditions will occur:

- The TCM attempts to shift to fifth range. If unsuccessful, the TCM commands third range.
- While diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode where DTC was set.
- Incorrect ratio codes typically indicate mechanical problems with specific clutches for range indicated, i.e. C2 and C4 for sixth range.
- An incorrect ratio DTC may indicate a mechanically failed clutch control solenoid. Review the DTC information for the specific solenoid.
- Output speed or turbine speed tone wheel damage may cause erratic speed sensor input allowing this code to set.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for proper ignition voltage.

DIAGNOSTIC TROUBLE CODES (DTC)

4. This step tests speed sensor readings.
5. This step tests for clutch slippage in sixth range.
6. This step tests for clutch pressure to range clutches.
7. This step tests for evidence of clutch failure.

DTC P0729 Incorrect 6th Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
.2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Start the engine. 2. Record the DTC failure record data. 3. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using the Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 5*
5	**WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:** • **Put the transmission in N (Neutral).** • **Apply the parking brake and service brake.** • **Chock the wheels and take any other steps necessary to prevent the vehicle from moving.** • **Warn personnel to keep clear of the vehicle and its path.** 1. Start the engine. 2. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 3. With brakes applied, select **D** (Drive). 4. With the engine at idle, select and **attain the range indicated** by the DTC. Turbine speed should go to zero. 5. Slowly increase engine speed to 1200 to 1500 rpm. Watch for turbine speed (turbine speed should remain at zero). Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0729 Incorrect 6th Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main pressure tap and C2 and C4 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain range indicated by the DTC. 6. Read and record Main, C2, and C4 clutch pressures. Are the pressure readings within specified values in Appendix B?	See Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Using pressure readings obtained in Step 6, replace the affected solenoid. • Incorrect C2 pressure—PCS2 • Incorrect C4 pressure—PCS4 Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0731 Incorrect 1st Gear Ratio

Refer to First Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to determine the current commanded steady state gear ratio. The TCM then compares the known gear ratio to the calculated gear ratio for the current range.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- No shift in progress.
- Hydraulic default condition not present.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P0731 sets when the calculated first range ratio (steady state) differs from the known first range ratio.

Actions Taken When the DTC Sets

When DTC P0731 is active, the following conditions will occur:

- The TCM attempts to shift to second range. If unsuccessful, the TCM will shift to fifth range.
- While diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode where DTC was set.
- Incorrect ratio codes typically indicate mechanical problems with specific clutches for range indicated, i.e. C1 and C5 for first range.
- An incorrect ratio DTC may indicate a mechanically failed clutch control solenoid. Review the DTC information for the specific solenoid.
- Incorrect TCM calibration will cause this DTC to set. Verify that the Calibration Identification Number (CIN) is compatible with the model of transmission installed in the vehicle.
- Output speed or turbine speed tone wheel damage may cause erratic speed sensor input allowing this code to set.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step test for proper transmission fluid level.
3. This step tests for proper ignition voltage.
4. This step tests for proper match between calibration gear ratio and actual gear ratio.
5. This step tests speed sensor readings.
6. This step tests for clutch slippage in first range.
7. This step tests for clutch pressure to range clutches.
8. This step tests for evidence of clutch failure.

DTC P0731 Incorrect 1st Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Start the engine. 2. Record the DTC failure record data. 3. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Start the engine, use the shift selector to hold in first range, and drive the vehicle under normal operating conditions. 2. Using the Allison DOC™ For PC–Service Tool, read the Diagnostic Transmission Gear Ratio. 3. Compare the gear ratio shown on Allison DOC™ For PC–Service Tool with the actual gear ratio of the transmission. Is the TCM CIN correct for transmission model?	3000 Product Family Close ratio=3.49:1 Wide ratio= 4.59:1 4000 Product Family Close ratio=3.51:1 Wide ratio= 4.70:1	*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using the Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0731 Incorrect 1st Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
6	**WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:** • **Put the transmission in N (Neutral).** • **Apply the parking brake and service brake.** • **Chock the wheels and take any other steps necessary to prevent the vehicle from moving.** • **Warn personnel to keep clear of the vehicle and its path.** 1. Start the engine. 2. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 3. With brakes applied, select **D** (Drive). 4. With the engine at idle, select and **attain the range indicated** by the DTC. Turbine speed should go to zero. 5. Slowly increase engine speed to 1200 to 1500 rpm. Watch for turbine speed (turbine speed should remain at zero). Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main pressure tap and C1 and C5 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain range indicated by the DTC. 6. Read and record Main, C1, and C5 clutch pressures. Are the pressure readings within specified values in Appendix B?	See Main and Clutch Pressure specifications in Appendix B	*Go to Step 8*	*Go to Step 9*
8	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 11*	*Go to Diagnostic Aids*
9	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 12*	*Go to Step 10*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0731 Incorrect 1st Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
10	Using pressure readings obtained in Step 6, replace the affected solenoid. • Incorrect C1 pressure—PCS1 • Incorrect C5 pressure—PCS3 Is the replacement complete?		*Go to Step 12*	
11	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 12*	
12	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0732 Incorrect 2nd Gear Ratio

Refer to Second Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to determine the current commanded steady state gear ratio. The TCM then compares the known gear ratio to the calculated gear ratio for the current range.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- No shift in progress.
- Hydraulic default condition not present.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P0732 sets when the calculated second range ratio (steady state) differs from the known second range ratio.

Actions Taken When the DTC Sets

When DTC P0732 is active, the following conditions will occur:

- The TCM will attempt to shift to third range. If unsuccessful, the TCM commands fifth range.
- While diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing failures mode where DTC was set.
- Incorrect ratio codes typically indicate mechanical problems with specific clutches for range indicated, i.e. C1 and C4 for second range.
- An incorrect ratio DTC may indicate a mechanically failed clutch control solenoid. Review the DTC information for the specific solenoid.
- Incorrect TCM calibration will cause this DTC to set. Verify that the Calibration Identification Number (CIN) is compatible with the model of transmission installed in the vehicle.
- Output speed or turbine speed tone wheel damage may cause erratic speed sensor input allowing this code to set.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for proper ignition voltage.
4. This step tests for proper match between calibration gear ratio and actual gear ratio.
5. This step tests speed sensor readings.
6. This step tests for clutch slippage in second range.
7. This step tests for clutch pressure to range clutches.
8. This step tests for evidence of clutch failure.

DTC P0732 Incorrect 2nd Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Start the engine. 2. Record the DTC failure record data. 3. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Start the engine and drive the vehicle under normal operating conditions in the range that sets the code. 2. Use the shift selector to hold transmission in second range. 3. Using the Allison DOC™ For PC–Service Tool, read the Diagnostic Transmission Gear Ratio. 4. Compare the gear ratio shown on Allison DOC™ For PC–Service Tool with the actual gear ratio of the transmission. Is the TCM CIN correct for transmission model?	3000 Product Family Close ratio= 1.86:1 Wide ratio= 2.25:1 4000 Product Family Close ratio= 1.91:1 Wide ratio= 2.21:1	*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using the Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0732 Incorrect 2nd Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
6	**WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:** • **Put the transmission in N (Neutral).** • **Apply the parking brake and service brake.** • **Chock the wheels and take any other steps necessary to prevent the vehicle from moving.** • **Warn personnel to keep clear of the vehicle and its path.** 1. Start the engine. 2. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 3. With brakes applied, select **D** (Drive). 4. With the engine at idle, select and **attain the range indicated** by the DTC. Turbine speed should go to zero. 5. Slowly increase engine speed to 1200 to 1500 rpm. Watch for turbine speed (turbine speed should remain at zero). Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main pressure tap and C1 and C4 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain range indicated by the DTC. 6. Read and record Main, C1, and C4 clutch pressures. Are the pressure readings within specified values in Appendix B?	See Main and Clutch Pressure specifications in Appendix B	*Go to Step 8*	*Go to Step 9*
8	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 11*	*Go to Diagnostic Aids*
9	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 12*	*Go to Step 10*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0732 Incorrect 2nd Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
10	Using pressure readings obtained in Step 6, replace the affected solenoid. • Incorrect C1 pressure—PCS1 • Incorrect C4 pressure—PCS4 Is the replacement complete?		*Go to Step 12*	
11	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 12*	
12	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0733 Incorrect 3rd Gear Ratio

Refer to Third Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to determine the current commanded steady state gear ratio. The TCM then compares the known gear ratio to the calculated gear ratio for the current range.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- No shift in progress.
- Hydraulic default condition not present.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P0733 sets when the calculated third range ratio (steady state) differs from the known third range ratio.

Actions Taken When the DTC Sets

When DTC P0733 is active, the following conditions will occur:

- The TCM attempts to shift to fourth range. If unsuccessful, the TCM commands sixth range.
- While diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode where the DTC was set.
- Incorrect ratio codes typically indicate mechanical problems with specific clutches for range indicated, i.e. C1 and C3 for third range.
- An incorrect ratio DTC may indicate a mechanically failed clutch control solenoid. Review the DTC information for the specific solenoid.
- Incorrect TCM calibration will cause this DTC to set. Verify that the Calibration Identification Number (CIN) is compatible with the model of transmission installed in vehicle.
- Output speed or turbine speed tone wheel damage may cause erratic speed sensor input allowing this code to set.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for proper ignition voltage.
4. This step tests for proper match between calibration gear ratio and actual gear ratio.
5. This step tests speed sensor readings.
6. This step tests for clutch slippage in third range.
7. This step tests for clutch pressure to range clutches.
8. This step tests for evidence of clutch failure.

DTC P0733 Incorrect 3rd Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Start the engine. 2. Record the DTC failure record data. 3. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Start the engine and drive the vehicle under normal operating conditions. 2. Use the shift selector to hold transmission in third range. 3. Using the Allison DOC™ For PC–Service Tool, read the Diagnostic Transmission Gear Ratio. 4. Compare the gear ratio shown on Allison DOC™ For PC–Service Tool with the actual gear ratio of the transmission. Is the TCM CIN correct for transmission model?	3000 Product Family Close ratio= 1.41:1 Wide ratio= 1.54:1 4000 Product Family Close ratio= 1.43:1 Wide ratio= 1.53:1	*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using the Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0733 Incorrect 3rd Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
6	**WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:** **• Put the transmission in N (Neutral).** **• Apply the parking brake and service brake.** **• Chock the wheels and take any other steps necessary to prevent the vehicle from moving.** **• Warn personnel to keep clear of the vehicle and its path.** 1. Start the engine. 2. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 3. With brakes applied, select **D** (Drive). 4. With the engine at idle, select and **attain the range indicated** by the DTC. Turbine speed should go to zero. 5. Slowly increase engine speed to 1200 to 1500 rpm. Watch for turbine speed (turbine speed should remain at zero). Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main pressure tap and C1 and C3 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain range indicated by the DTC. 6. Read and record Main, C1, and C3 clutch pressures. Are the pressure readings within specified values in Appendix B?	See Main and Clutch Pressure specifications in Appendix B	*Go to Step 8*	*Go to Step 9*
8	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 11*	*Go to Diagnostic Aids*
9	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 12*	*Go to Step 10*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0733 Incorrect 3rd Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
10	Using pressure readings obtained in Step 6, replace the affected solenoid. • Incorrect C1 pressure—PCS1 • Incorrect C3 pressure—PCS3 Is the replacement complete?		*Go to Step 12*	
11	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 12*	
12	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0734 Incorrect 4th Gear Ratio

Refer to Fourth Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to determine the current commanded steady state gear ratio. The TCM then compares the known gear ratio to the calculated gear ratio for the current range.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- No shift in progress.
- Hydraulic default condition not present.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P0734 sets when the calculated fourth range ratio (steady state) differs from the known fourth range ratio.

Actions Taken When the DTC Sets

When DTC P0734 is active, the following conditions will occur:

- The TCM attempts to shift to fifth range. If unsuccessful, the TCM commands third range.
- While diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing failures mode where DTC was set.
- Incorrect ratio codes typically indicate mechanical problems with specific clutches for range indicated, i.e. C1 and C2 for fourth range.
- An incorrect ratio DTC may indicate a mechanically failed clutch control solenoid. Review the DTC information for the specific solenoid.
- Output speed or turbine speed tone wheel damage may cause erratic speed sensor input allowing this code to set.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for proper ignition voltage.
4. This step tests speed sensor readings.
5. This step tests for clutch slippage in fourth range.
6. This step tests for clutch pressure to range clutches.
7. This step tests for evidence of clutch failure.

DTC P0734 Incorrect 4th Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Start the engine. 2. Record the DTC failure record data. 3. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using the Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0734 Incorrect 4th Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
5	**WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:** • **Put the transmission in N (Neutral).** • **Apply the parking brake and service brake.** • **Chock the wheels and take any other steps necessary to prevent the vehicle from moving.** • **Warn personnel to keep clear of the vehicle and its path.** 1. Start the engine. 2. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 3. With brakes applied, select **D** (Drive). 4. With the engine at idle, select and **attain the range indicated** by the DTC. Turbine speed should go to zero. 5. Slowly increase engine speed to 1200 to 1500 rpm. Watch for turbine speed (turbine speed should remain at zero). Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main pressure tap and C1 and C2 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain range indicated by the DTC. 6. Read and record Main, C1, and C2 clutch pressures. Are the pressure readings within specified values in Appendix B?	See Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 10*	*Go to Step 9*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0734 Incorrect 4th Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Using pressure readings obtained in Step 6, replace the affected solenoid. • Incorrect C1 pressure—PCS1 • Incorrect C2 pressure—PCS2 Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0735 Incorrect 5th Gear Ratio

Refer to Fifth Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to determine the current commanded steady state gear ratio. The TCM then compares the known gear ratio to the calculated gear ratio for the current range.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- No shift in progress.
- Hydraulic default condition not present.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P0735 sets when the calculated fifth range ratio (steady state) differs from the known fifth range ratio.

Actions Taken When the DTC Sets

When DTC P0735 is active, the following conditions will occur:

- The TCM attempts to shift to sixth range. If unsuccessful, the TCM will attempt to shift to third range. If unsuccessful, the TCM commands second range.
- While diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode where the DTC was set.
- Incorrect ratio codes typically indicate mechanical problems with specific clutches for range indicated, i.e. C2 and C3 for fifth range.
- An incorrect ratio DTC may indicate a mechanically failed clutch control solenoid. Review the DTC information for the specific solenoid.
- Output speed or turbine speed tone wheel damage may cause erratic speed sensor input allowing this code to set.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for proper ignition voltage.
4. This step tests speed sensor readings.
5. This step tests for clutch slippage in fifth range.
6. This step tests for clutch pressure to range clutches.
7. This step tests for evidence of clutch failure.

DTC P0735 Incorrect 5th Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Start the engine. 2. Record the DTC failure record data. 3. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using the Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0735 Incorrect 5th Gear Ratio *(cont'd)*

<table>
<tr><th>Step</th><th>Action</th><th>Value(s)</th><th>Yes</th><th>No</th></tr>
<tr><td>5</td><td>WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:
• Put the transmission in N (Neutral).
• Apply the parking brake and service brake.
• Chock the wheels and take any other steps necessary to prevent the vehicle from moving.
• Warn personnel to keep clear of the vehicle and its path.
1. Start the engine.
2. Using Allison DOC™ For PC–Service Tool, select the clutch test mode.
3. With brakes applied, select D (Drive).
4. With the engine at idle, select and attain the range indicated by the DTC. Turbine speed should go to zero.
5. Slowly increase engine speed to 1200 to 1500 rpm. Watch for turbine speed (turbine speed should remain at zero).
Did turbine speed remain at zero?</td><td></td><td>Go to Diagnostic Aids</td><td>Go to Step 6</td></tr>
<tr><td>6</td><td>1. Turn OFF the ignition.
2. Install 2000 kPa (300 psi) pressure gauges in main pressure tap and C2 and C3 pressure taps.
3. Start the engine.
4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode.
5. With brakes applied, select and attain range indicated by the DTC.
6. Read and record Main, C2, and C3 clutch pressures.
Are the pressure readings within specified values in Appendix B?</td><td>See Main and Clutch Pressure specifications in Appendix B</td><td>Go to Step 7</td><td>Go to Step 8</td></tr>
<tr><td>7</td><td>Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection.
Are there signs of a clutch failure?</td><td></td><td>Go to Step 10</td><td>Go to Diagnostic Aids</td></tr>
<tr><td>8</td><td>1. Consult the service manual and remove the transmission hydraulic control module.
2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves.
3. Inspect the suction filter. Be sure screen is not plugged.
4. Inspect for damaged gaskets and face seals.
Was a valve body problem found and repaired?</td><td></td><td>Go to Step 11</td><td>Go to Step 9</td></tr>
</table>

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0735 Incorrect 5th Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Using pressure readings obtained in Step 6, replace the affected solenoid. • Incorrect C2 pressure—PCS2 • Incorrect C3 pressure—PCS3 Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0736 Incorrect Reverse Gear Ratio

Refer to Reverse Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to determine the current commanded steady state gear ratio. The TCM then compares the known gear ratio to the calculated gear ratio for the current range.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- No shift in progress.
- Hydraulic default condition not present.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P0736 sets when the calculated reverse range ratio (steady state) differs from the known reverse range ratio.

Actions Taken When the DTC Sets

When DTC P0736 is active, the following conditions will occur:

- The TCM will lock in N (Neutral).
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode where the DTC was set.
- Incorrect ratio codes typically indicate mechanical problems with specific clutches for range indicated, i.e. C3 and C5 for reverse range.
- An incorrect ratio DTC may indicate a mechanically failed clutch control solenoid. Review the DTC information for the specific solenoid.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for proper ignition voltage.
4. This step tests for proper match between calibration gear ratio and actual gear ratio.
5. This step tests speed sensor readings.
6. This step tests for clutch slippage in Reverse.
7. This step tests for clutch pressure to range clutches.
8. This step tests for evidence of clutch failure.

DTC P0736 Incorrect Reverse Ratio

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Start the engine. 2. Record the DTC failure record data. 3. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using the Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0736 Incorrect Reverse Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
5	**WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:** • **Put the transmission in N (Neutral).** • **Apply the parking brake and service brake.** • **Chock the wheels and take any other steps necessary to prevent the vehicle from moving.** • **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: DO NOT conduct a stall test in Reverse. The torque produced in Reverse can damage the vehicle.** 1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main pressure tap and C3 and C5 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select R (Reverse). 6. With the engine at idle speed, select and **attain the range indicated** by the DTC. Turbine speed should go to zero. Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 6*
6	Read and record Main, C3 and C5 clutch pressures. Are the pressure readings within specified values in Appendix B?	See Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0736 Incorrect Reverse Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Using pressure readings obtained in Step 6, replace the affected solenoid. • Incorrect C3 pressure—PCS2 • Incorrect C5 pressure—PCS3 Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0741 Torque Converter Clutch System Stuck Off

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses data from the engine speed sensor and the turbine speed sensor to calculate torque converter slip value. The TCM then compares this calculated slip value to a preset value in the TCM calibration.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm.
- Selected range is a forward range.
- Throttle position is above 75 percent.
- Transmission fluid temperature is between 25ºC (77ºF) and 130ºC (266ºF).
- 6 seconds or more have elapsed since torque converter clutch (TCC) was applied in a range.

Conditions for Setting the DTC

DTC P0741 sets when the TCM detects a TCC slip value greater than 150 rpm for more than 25.5 seconds, indicating TCC did not apply.

Actions Taken When the DTC Sets

When DTC P0741 is active, the following conditions will occur:

- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

Residue or contamination may cause solenoid regulator (spool) valves to stick intermittently.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests converter slip speed.
3. This step tests if TCC is being commanded ON.
4. This step tests for hydraulic pressure in lockup clutch circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0741 Torque Converter Clutch System Stuck Off

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition. leave the engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. 6. Using Allison DOC™ For PC–Service Tool, monitor TCC slip speed when a range is attained where the TCC should be applied. ***NOTE: This DTC sets when converter slip speed is detected above 150 rpm for 25.6 seconds or more. This indicates the TCC has not applied.*** Is the slip speed value at or above the specified value when the TCC should be applied.	>150 rpm	*Go to Step 3*	*Go to Diagnostic Aids*
3	Monitor TCC solenoid state when converter slip speed is greater than 150 rpm. Is the TCC solenoid ON?		*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauge in the lockup pressure tap. 3. Drive the vehicle under normal operating conditions. 4. Using Allison DOC™ For PC–Service Tool, monitor TCC slip speed. 5. Read and record lockup pressure when TCC slip speed is greater than 150 rpm. Is lockup pressure reading within specified values in Appendix B?	See Lockup Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 5*
5	1. Consult the appropriate service manual and remove the transmission hydraulic control module. 2. Inspect the solenoid control valve body for a stuck or sticking TCC solenoid regulator valve. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets. Was a valve body problem found and repaired?		*Go to Step 8*	*Go to Step 6*
6	Replace the TCC solenoid. Is replacement complete?		*Go to Step 8*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0741 Torque Converter Clutch System Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the transmission (refer to the appropriate service manual). 2. Disassemble and inspect the torque converter. 3. Inspect for worn lockup clutch damper friction material, damaged seals, etc. Is the repair complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor converter slip speed. 3. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0776 Pressure Control Solenoid 2 Stuck Off

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to detect if a clutch is slipping. Pressure Control Solenoid 2 (PCS2) supplies hydraulic pressure to the C3 clutch in reverse and to the C2 clutch in fourth through sixth range. The TCM sets a DTC P0776 when it detects a slip condition while PCS2 is supplying hydraulic pressure to the oncoming clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 125 rpm.
- Turbine speed greater than or equal to 60 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P0776 sets when the TCM detects an incorrect oncoming ratio (range-to-range) for an accumulated number of occurrences.

Actions Taken When the DTC Sets

- When DTC P0776 occurs, the TCM will command the previous range.
- While diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates the oncoming clutch being controlled by PCS2 is not applied or applied too slowly. Common causes include:
  - — Erratic turbine or output speed signals.
  - — A leak or obstruction in a specific clutch apply circuit.
  - — A defective PCS2 solenoid.
  - — A stuck PCS2 regulator valve.
  - — A stuck C2 logic latch valve.
- PCS2 supplies hydraulic pressure to the C3 clutch in reverse and to the C2 clutch in fourth range through sixth range. Review the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C2 and C3 clutch pressure from PCS2.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P0776 Pressure Control Solenoid 2 Stuck Off

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure record. ***NOTE: This DTC indicates that the TCM has detected a slip condition and could not verify the correct oncoming ratio following a shift.*** Did DTC P0776 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC failure record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting Section 8*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0776 Pressure Control Solenoid 2 Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main, C2, and C3 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the Failure Records. 6. Read and record Main and C2 and C3 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS2. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0777 Pressure Control Solenoid 2 Stuck On

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses information from the turbine and output speed sensors to detect if a clutch is in a tie-up condition or if three clutches are applied. Pressure Control Solenoid 2 (PCS2) supplies hydraulic pressure to the C3 clutch in reverse and to the C2 clutch in fourth range through sixth range. The TCM sets a DTC P0777 when it detects a tie-up condition while PCS2 is supplying hydraulic pressure to the off-going clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 200 rpm.
- Turbine speed greater than or equal to 200 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P0777 sets when the transmission is shifting from range to range and the off-going range (ratio) remains engaged even though the off-going clutch is commanded OFF.

Actions Taken When the DTC Sets

- When DTC P0777 occurs, the TCM will command previous range.
- While the diagnostic response is active, the TCM ignores shift selectors inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates the off-going clutch being controlled by PCS2 is not released or released too slowly. Common causes include:
  - — Erratic turbine and output speed sensor readings.
  - — An obstruction in the C2 clutch exhaust circuit.
  - — A defective PCS2 solenoid.
  - — A stuck PCS2 regulator valve.
- PCS2 supplies hydraulic pressure to C3 clutch in reverse and to C2 clutch in fourth range through sixth range. Review the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.
- PCS1 and PCS2 are "normally high" solenoids. PCS1 and PCS2 supply full hydraulic pressure when their coils are de-energized, and no output pressure when receiving maximum current from the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C2 or C3 clutch pressure from PCS2.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P0777 Pressure Control Solenoid 2 Stuck On

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected that the off-going clutch did not release (clutch tie-up) following a shift.*** Did DTC P0777 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC failure record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting Section 8*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the Appropriate Speed Sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0777 Pressure Control Solenoid 2 Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main and C2 and C3 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the failure records. 6. Read and record Main, C2, and C3 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS2. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0796 Pressure Control Solenoid 3 Stuck Off

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to detect if a clutch is slipping. Pressure Control Solenoid 3 (PCS3) supplies hydraulic pressure to the C5 clutch in reverse, neutral, and first; and to the C3 clutch in third and fifth. The TCM sets a DTC P0796 when it detects a slip condition while PCS3 is supplying hydraulic pressure to the oncoming clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 125 rpm.
- Turbine speed greater than or equal to 60 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P0796 sets when the TCM detects an incorrect oncoming ratio (range-to-range) for an accumulated number of occurrences.

Actions Taken When the DTC Sets

- When DTC P0796 occurs, the TCM will command previous range.
- While the Diagnostic Response is active, the TCM will ignore shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates the oncoming clutch being controlled by PCS3 is not applied or applied too slowly. Common causes include:
  - — Erratic turbine or output speed signals.
  - — A leak or obstruction in a specific clutch apply circuit.
  - — A defective solenoid.
  - — A stuck PCS3 regulator valve.
  - — A stuck C1 or C2 logic latch valve.
- PCS3 supplies hydraulic pressure to C5 clutch in reverse, neutral and first range; and to C3 clutch in third and fifth ranges. Review the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C3 and C5 clutch pressure from PCS3.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P0796 Pressure Control Solenoid 3 Stuck Off

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected a slip condition and could not verify the correct oncoming ratio following a shift.*** Did DTC P0796 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC failure record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting Section 8*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0796 Pressure Control Solenoid 3 Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main, C3, and C5 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the failure records. 6. Read and record Main, C3, and C5 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS3. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0797 Pressure Control Solenoid 3 Stuck On

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses information from the turbine and output speed sensors to detect if a clutch is in a tie-up condition or if three clutches are applied. Pressure Control Solenoid 3 (PCS3) supplies hydraulic pressure to the C5 clutch in reverse, neutral, and first; and to the C3 clutch in third and fifth ranges. The TCM sets a DTC P0797 when it detects a tie-up condition while PCS3 is supplying hydraulic pressure to the off-going clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 200 rpm.
- Turbine speed greater than or equal to 200 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P0797 sets when the transmission is shifting from range to range and the off-going range (ratio) remains engaged even though the off-going clutch is commanded OFF.

Actions Taken When the DTC Sets

- When DTC P0797 occurs, the TCM will command previous range.
- While Diagnostic Response is active, the TCM will ignore shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates the off-going clutch being controlled by PCS3 is not released or released too slowly. Common causes include:
  - — Erratic turbine and output speed sensor readings.
  - — An obstruction in the C3 or C5 clutch exhaust circuit.
  - — A defective PCS3 solenoid.
  - — A stuck PCS3 regulator valve.
- PCS3 supplies hydraulic pressure to C5 clutch in reverse, neutral and first range; and to C3 clutch in third and fifth ranges. Review the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C3 or C5 clutch pressure from PCS3.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P0797 Pressure Control Solenoid 3 Stuck On

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go at Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected that the off-going clutch did not release (clutch tie-up) following a shift.*** Did DTC P0797 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC failure record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting Section 8*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 6*

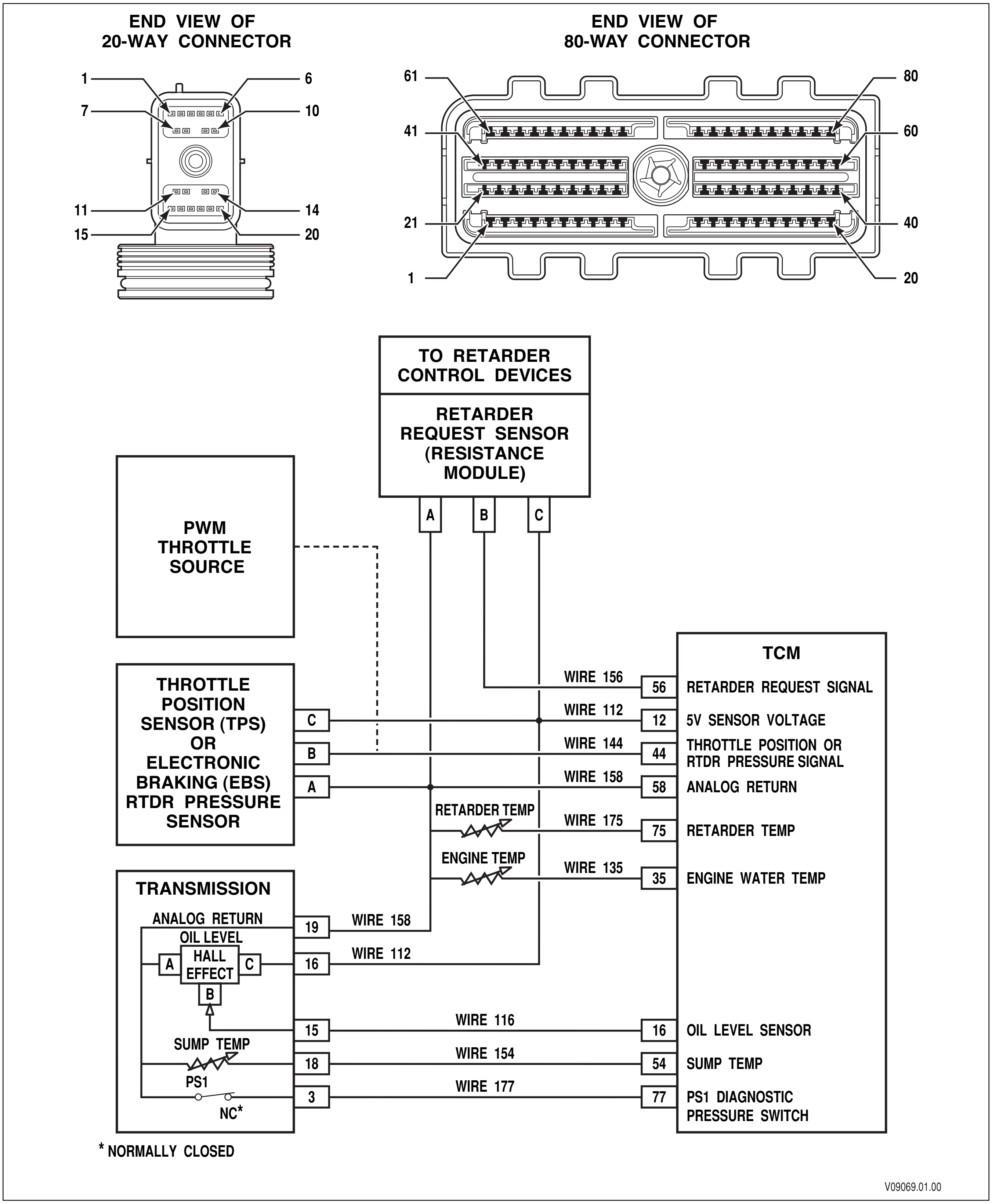
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0797 Pressure Control Solenoid 3 Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main, C3, and C5 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the Clutch Test Mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the failure records. 6. Read and record Main, C3 and C5 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS3. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 Circuit Low



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 Circuit Low

Circuit Description

Diagnostic pressure switch 1 (PS1) is a normally closed switch. When the switch is depressurized, PS1 closes to complete a circuit between wire 177 and analog return wire 158. The Transmission Control Module (TCM) detects PS1 closed when it senses a ground on wire 177. When the switch is pressurized, PS1 opens and voltage on wire 177 goes high.

The TCM uses the signal from PS1 to confirm the following control valve functions:

- When the C5 clutch is filled as in reverse, neutral, or first range—PS1 senses PCS2 solenoid regulator valve position to verify proper C3 clutch control in these three ranges.
- When the C5 clutch is exhausted as in second through sixth ranges—PS1 monitors C1 and C2 latch valve position.

Conditions for Running the DTC

- Hydraulic system pressurized
- Initialization complete
- Transmission sump temperature greater than –15°C (5°F)

Conditions for Setting the DTC

DTC P0842 sets if the TCM detects that PS1 is EXHAUSTED when it should be PRESSURIZED. Specifically, the TCM will set a P0842 code if it senses that PS1 is EXHAUSTED during the following conditions:

- Integrity Test
  - — The C5 clutch is filled and PCS2 solenoid is commanded ON, or
  - — The C5 clutch is exhausted and both latch valves are stroked.
- Time Out Test
  - — After a change in latch valve states that ends up with both latch valves stroked.

Actions Taken When the DTC Sets

When DTC P0842 occurs:

- The TCM will lock in range.
- While the diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the code from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Unlike the WTEC II/III C3 pressure switch, the Allison 4th Generation Pressure Switch 1 (PS1) closes when exhausted, and opens when pressurized.

DIAGNOSTIC TROUBLE CODES (DTC)

- DTC P0842 may be caused by:
  - Low transmission fluid level.
  - Defective PS1 pressure switch.
  - Stuck C1 or C2 latch valves.
  - Defective shift solenoid SS1.
  - Stuck diagnostic valve.
  - A short-to-ground in wire 177.
  - Worn or damaged charging pump.
- Compare transmission fluid level measurements when the engine is shutdown and when the engine is operating. Fluid level should drop after starting the engine. If level does not change, the transmission charging pump may have failed.
- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damage terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change It may be necessary to test for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Test Procedures).
- You may have to drive the vehicle in order to experience a fault. The data obtained from failure records can be useful in reproducing failure modes when the DTC was set.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step verifies failure conditions.
4. This step tests the entire PS1 circuit.
5. This step tests for internal short in TCM.
6. This step tests for wiring defects in OEM harness.
9. This step tests defective internal harness.
13. This step tests for active diagnostic code.
14. This step tests for low main pressure.
15. This step tests for proper function of SS1 solenoid.
16. This step test stuck valves in the hydraulic control module.
18. This step tests for the cause of low main pressure.

DTC P0842 Transmission Pressure Switch 1 Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). ***NOTE: If transmission fluid was recently drained and refilled, allow the engine to run for a few minutes to prime the main pump and clutch apply circuits.*** Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, with the engine OFF. 3. Record failure records. 4. Clear the DTC. 5. Start vehicle and test drive. Attempt to duplicate the same conditions observed in failure records (range attained, transmission temperature, etc.). Did DTC P0842 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Disconnect the transmission 20-way connector. 3. Turn ON the ignition, with the engine OFF. 4. Observe PS1 status on Allison DOC™ For PC–Service Tool. ***NOTE: Allison DOC™ For PC–Service Tool should show PS1 switch status as PRESSURIZED under these test conditions.*** Does Allison DOC™ For PC–Service Tool show PS1 EXHAUSTED?		*Go to Step 5*	*Go to Step 12*
5	1. Turn OFF the ignition. 2. Install a 2000 kPa (300 psi) pressure gauge in main pressure tap. 3. Start the engine. 4. Read and record main pressure. Is the pressure reading within specified value in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 6*	*Go to Step 10*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
6	**WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:** • **Put the transmission in N (Neutral).** • **Apply the parking brake and service brake.** • **Chock the wheels and take any other steps necessary to prevent the vehicle from moving.** • **Warn personnel to keep clear of the vehicle and its path.** 1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) gauges in C1 and C2 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select D (Drive). 6. With the engine at idle speed, select and attain fourth range. Are both C1 and C2 pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Got to Step 7*	*Go to Step 10*
7	1. Verify the ignition is in the OFF position. 2. Consult appropriate transmission service manual and remove the control module from the transmission. 3. Disconnect PS1. 4. Using a DVOM, test pin 3 in the internal wiring harness for pin-to-pin shorts, and shorts-to-ground. Were any pin-to-pin shorts or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 17*	
9	Replace pressure switch PS1. Is the replacement complete?		*Go to Step 17*	
10	1. Verify the ignition is in the OFF position. 2. Consult appropriate transmission service manual and remove the control module from the transmission. 3. Inspect the solenoid and main valve bodies for sticking or defective diagnostic valve, PCS1 and PCS2 solenoid regulator valves, or C1 and C2 latch valves. Was a defective valve found or repaired?		*Go to Step 17*	*Go to Step 11*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
11	Replace the solenoid that is controlling the malfunctioning clutch (as indicated by pressure readings obtained in step 6 above). • C1 clutch – PCS1 solenoid • C2 clutch – PCS2 solenoid • Both C1 and C2 clutch – SS1 solenoid Is the repair complete?		*Go to Step 17*	
12	1. Turn OFF the ignition. 2. Install the J 47275 TCM Breakout at the TCM 80-way connector. 3. Disconnect the 16-pin bypass connector on J 47275 TCM Breakout. 4. Turn ON the ignition. 5. Observe PS status on Allison DOC™ For PC–Service Tool. ***NOTE: Allison DOC™ For PC–Service Tool should show PS1 switch status as PRESSURIZED under these test conditions.*** Does Allison DOC™ For PC–Service Tool show PS1 PRESSURIZED?		*Go to Step 13*	
13	1. Turn OFF the ignition. 2. Inspect the routing of the PS1 sense wire 177 between the TCM and the transmission 20-way connector. 3. Disconnect the TCM from J 47275 TCM Breakout. Leave the OEM-side connected. 4. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 5. Disconnect the transmission 20-way connector. 6. Using a DVOM at J 47275-1 TCM Overlay, test for wire-to-wire shorts and shorts-to-ground at pin 177 (PS1 signal). Were short-to-ground or wire damage found?		*Go to Step 14*	*Go to Diagnostic Aids*
14	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 17*	
15	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 17*	

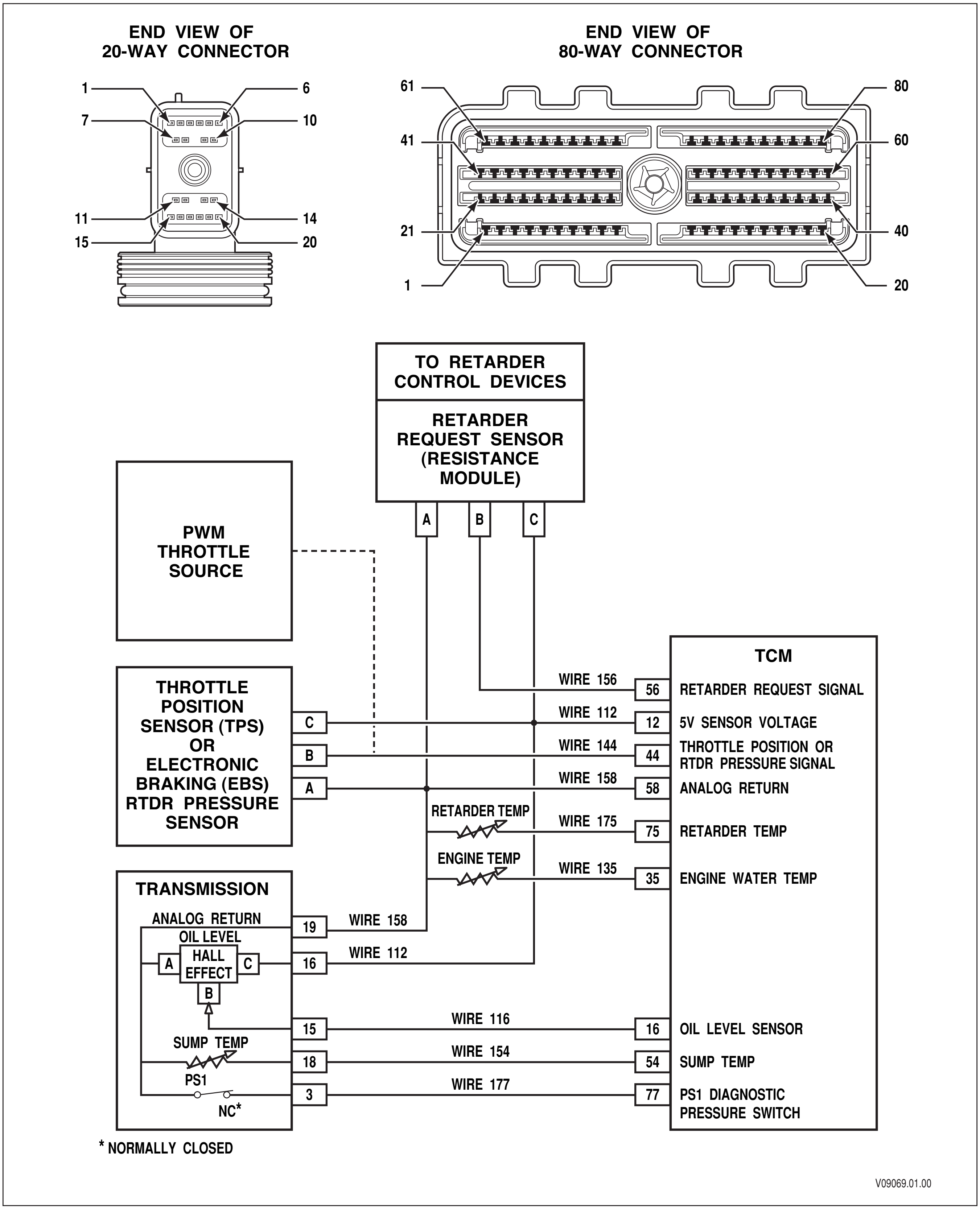
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
16	Investigate the cause of low main pressure. Possible causes include: • Collapsed main filter • Broken converter pump or PTO gear tangs • Worn main charging pump. Is the cause of low main pressure repaired?		Go to Step 17	
17	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor pressure switch PS1 status. 3. Drive the vehicle under conditions noted in failure records. Did the DTC P0842 return?		Begin the diagnosis again. Go to Step 1	System OK

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0843 Transmission Pressure Switch 1 Circuit High



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0843 Transmission Pressure Switch 1 Circuit High

Circuit Description

The TCM uses diagnostic pressure switch Pressure Switch 1 (PS1) to confirm the following control valve function. While C5 clutch is filled as in reverse, neutral, or first range, PS1 senses Pressure Control Switch 2 (PCS2) solenoid regulator valve position to verify C3 clutch control in these three ranges. While C5 is exhausted as in second through sixth ranges, PS1 monitors C1 and C2 latch valve positions.

PS1 is a normally closed switch. When the switch is depressurized, PS1 closes to complete a circuit between wire 177 and analog return wire 158. The TCM detects PS1 closed when it senses a ground on wire 177. When the switch is pressurized, PS1 opens and voltage on wire 177 goes high.

Conditions for Running the DTC

- Hydraulic system pressurized
- Initialization complete
- Transmission sump temperature greater than –15ºC (5ºF)

Conditions for Setting the DTC

DTC P0843 sets if the TCM detects that PS1 is pressurized in the following situations:

- Integrity Test
  — The C5 clutch is exhausted or PCS2 solenoid is commanded OFF, and at least one C1 and C2 latch valve is de-stroked.
- Time Out Test
  — After a change in latch valve states that starts with both latch valves stroked and ends up with at least one latch valve de-stroked.

Actions taken when the DTC Sets

When DTC P0843 occurs:

— The TCM will lock in range.
— While the diagnostic response is active, the TCM ignores shift selector inputs.
— The **CHECK TRANS** light illuminates.
— DTC is stored in TCM history.
— The TCM inhibits torque converter clutch (TCC) engagement.
— The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  — A bent terminal
  — A backed-out terminal
  — A damaged terminal
  — Poor terminal tension
  — A chafed wire
  — A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- When only a P0843 is set, look for an intermittent open in the pressure switch circuit.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change. It may be necessary to test for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Test Procedures).
- You may have to drive the vehicle in order to experience a fault. The data obtained from failure records can be useful in reproducing failure modes when the DTC was set.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step verifies failure conditions.
4. This step tests the TCM for PS1 switch status.
5. This step tests for internal open in TCM.
6. This step tests for wiring defects (opens) in OEM harness.
9. This step tests for opens in the internal harness.

DTC P0843 Transmission Pressure Switch 1 Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Check Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, with the engine OFF. 3. Record failure records. 4. Clear the DTC. 5. Start vehicle and test drive. Attempt to duplicate the same conditions observed in failure records (range attained, transmission temperature, etc.). ***NOTE: This DTC indicates that an open circuit condition may exist in the OEM harness, internal transmission harness, or PS1 diagnostic pressure switch.*** Did DTC P0843 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0843 Transmission Pressure Switch 1 Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn OFF the ignition. 2. Disconnect the transmission 20-way connector. 3. Connect the OEM-side of the 20-way connector to the J 47279 Transmission Breakout. Leave the transmission-side disconnected. 4. At J 47279-1 Transmission Overlay, install a jumper between pin 3 and a known good ground. 5. Turn ON the ignition, with the engine OFF. 6. Observe PS1 status on Allison DOC™ For PC–Service Tool. Does Allison DOC™ For PC–Service Tool show PS1 PRESSURIZED?		*Go to Step 5*	*Go to Step 9*
5	1. Turn OFF the ignition. 2. Install the J 47275 TCM Breakout at the TCM 80-way connector. 3. Disconnect the 16-pin bypass connector on J 47275 TCM Breakout. 4. At J 47275-1 TCM Overlay, install a jumper between pin 77 and ground (pin 9 or pin 69). 5. Turn ON the ignition. Leave the engine OFF. Does Allison DOC™ For PC–Service Tool show PS1 PRESSURIZED?		*Go to Step 8*	*Go to Step 6*
6	1. Turn OFF the ignition. 2. Inspect the routing of the PS1 sense wire 177 between the TCM and transmission 20-way connector. 3. Disconnect the TCM from J 47275 TCM Breakout. Leave the OEM-side connected. 4. Reconnect the 16-pin bypass connector on J 47275 TCM Breakout. 5. Disconnect the transmission 20-way connector. 6. Test for opens on wire 177. Were opens or wire damage found?		*Go to Step 7*	*Go to Diagnostic Aids*
7	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 12*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 12*	

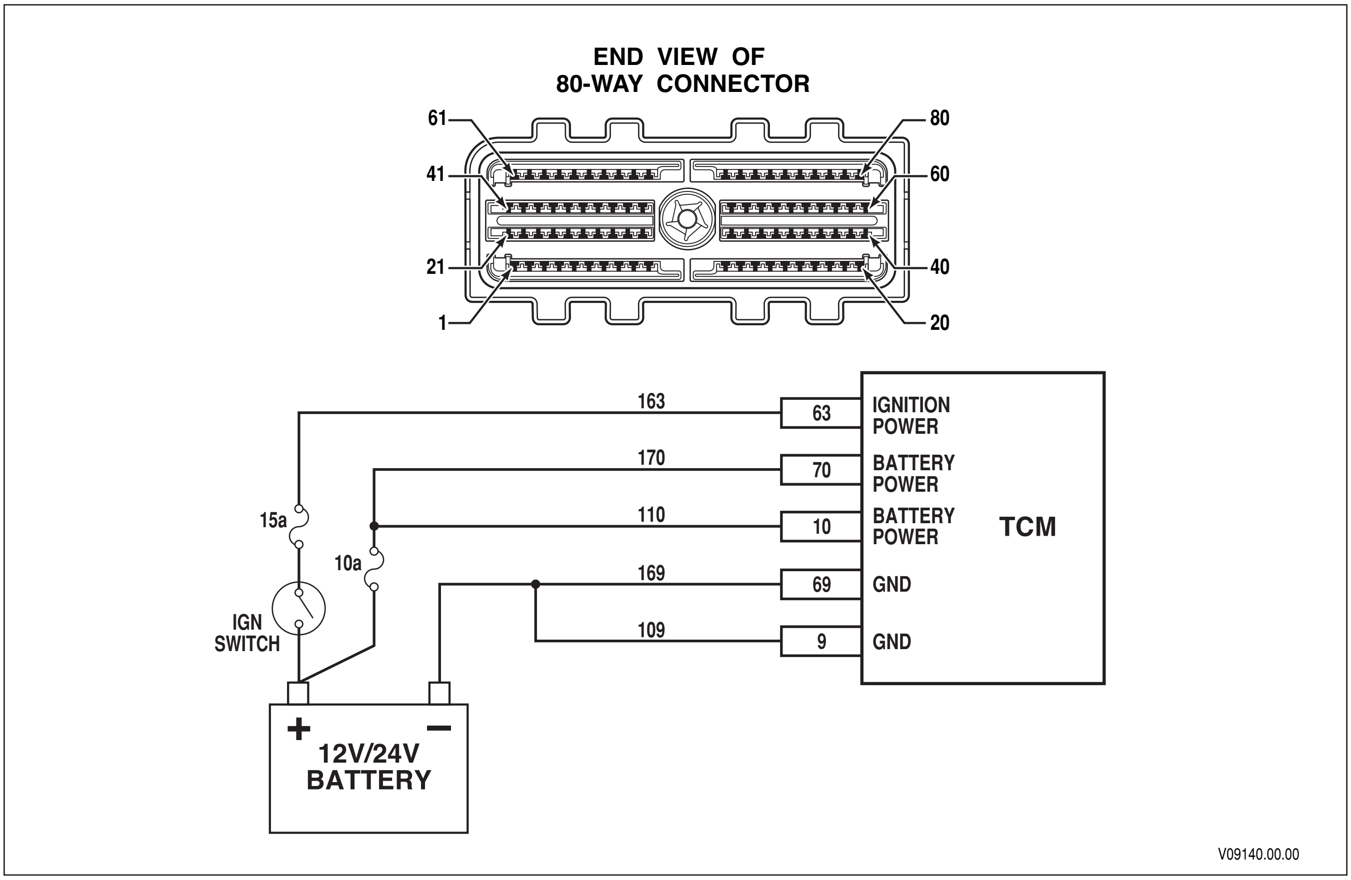
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0843 Transmission Pressure Switch 1 Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
9	1. Consult appropriate transmission service manual and remove the control module from the transmission. 2. Disconnect PS1. 3. Using a DVOM, test for continuity across pressure switch PS1. Is there continuity across pressure switch PS1?		*Go to Step 10*	*Go to Step 11*
10	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 12*	
11	Replace the pressure switch PS1. Is the replacement complete?		*Go to Step 12*	
12	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor pressure switch PS1 status. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0880 TCM Power Input Signal



Circuit Description

The Transmission Control Module (TCM) requires a switched ignition voltage input and a direct battery voltage input. This switched ignition voltage signal originates from the ignition switch or an ignition relay to supply voltage to pin 63 in the 80-way connector at the TCM. Battery direct voltage is supplied to pins 10 and 70 at the 80-way connector.

Conditions for Running the DTC

This test is continuously enabled.

Conditions for Setting the DTC

DTC P0880 sets during the next ignition cycle if battery power is lost before the power down process is complete and the engine is running.

Actions Taken When the DTC Sets

When DTC P0880 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- The TCM loses adaptive information for the drive cycle.
- The TCM reverts to previous adaptive settings.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0880 TCM Power Input Signal

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0880 may set if battery disconnects are opened before switching OFF ignition.
- You may have to drive the vehicle in order to experience a fault.
- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper battery voltage.
3. This step tests for proper charging system operation.
4. This step tests for proper system voltage.
5. This step tests for proper ignition voltage.

DTC P0880 TCM Power Input Signal

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn the ignition to the RUN position with the engine OFF. 3. Record the DTC failure records. 4. Using a digital multimeter (DVOM), measure and record voltage at the battery terminals. Is voltage greater than specified value?	10.5V (12V TCM) 22V (24V TCM)	*Go to Step 3*	*Resolve battery problem. Go to Step 7*
3	Start the engine and warm to normal operating temperature. Is the Alternator/Check Engine lamp ON?		*Repair charging system*	*Go to Step 4*

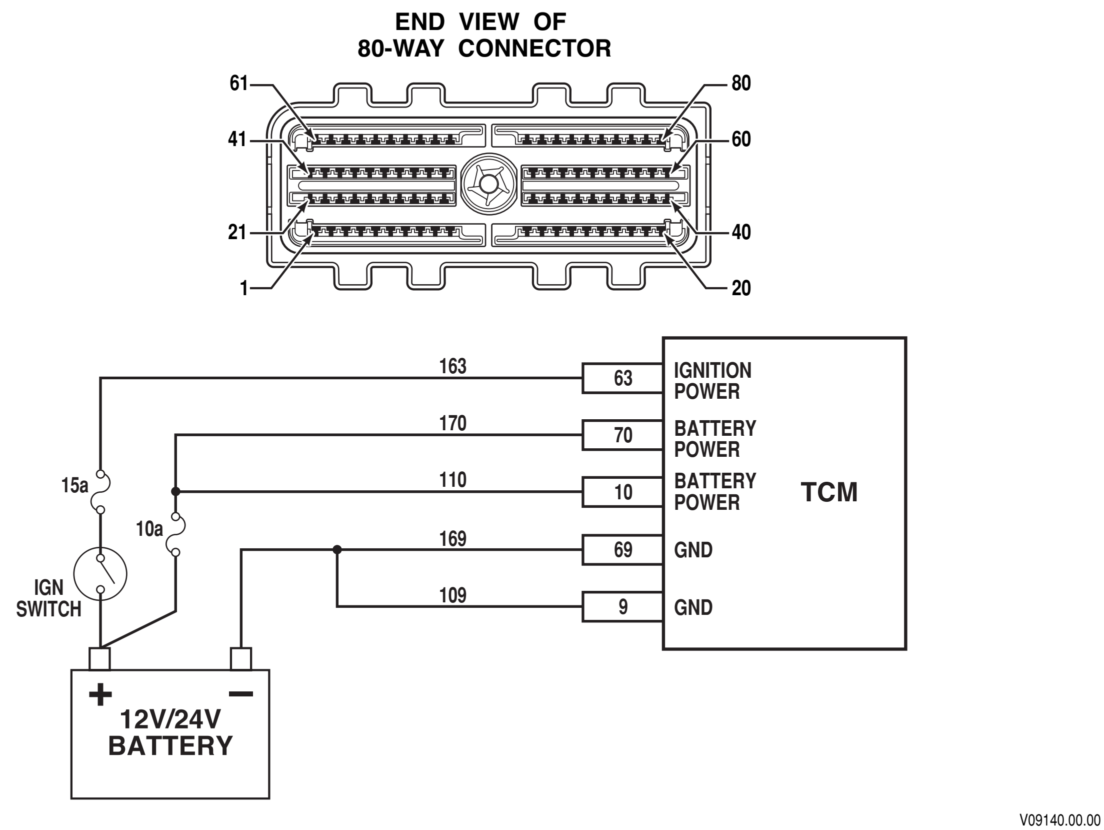
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0880 TCM Power Input Signal *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Increase engine speed to 1000–1500 rpm. 2. Using Allison DOC™ For PC–Service Tool, monitor system voltage. Is the voltage within the specified values?	13–15V (12V TCM) 25–30V (24V TCM)	*Go to Step 5*	*Repair charging system*
5	1. Turn OFF the ignition. 2. Disconnect the 80-way connector from the TCM and install J 47275 TCM Breakout between the OEM and TCM connectors. 3. Using a DVOM, measure voltage between 80-way connector pins 9 and 10 with ignition OFF. 4. Turn ON the ignition, leave engine OFF. 5. Using a DVOM, measure voltage between 80-way connector pins 9 and 63 with ignition ON. 6. Subtract the voltage reading obtained in Step 5 from the voltage reading obtained in Step 3. Is the difference between Step 3 voltage and Step 5 voltage greater than the specified value?	0.5V	*Go to Step 6*	*Go to Diagnostic Aids*
6	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Repair the vehicle wiring harness. Is the repair complete?		*Go to Step 7*	
7	In order to verify your repair: 1. Clear the DTC. 2. Start the engine and warm to normal operating temperature. 3. Using Allison DOC™ For PC–Service Tool, monitor system voltage. System voltage should be 9–18V. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0881 TCM Power Input Signal Performance



Circuit Description

The Transmission Control Module (TCM) requires a switched ignition voltage input and a direct battery voltage input. This switched ignition voltage signal originates from the ignition switch or an ignition relay to supply voltage to pin 63 in the 80-way connector at the TCM. Battery voltage is supplied to pins 10 and 70 at the 80-way connector.

Conditions for Running the DTC

Engine speed is greater than 500 rpm for at least 1.5 seconds.

Conditions for Setting the DTC

DTC P0881 sets under the following conditions:

- The TCM detects direct battery voltage below 5.5V. When battery voltage drops below 5.5V for 10 samples, a fault pending is reported. DTC P0881 is set if voltage remains below 5.5V for 20 samples.
- The TCM detects a large variation in direct battery voltage. When battery voltage varies by 4.0V or more for 10 samples, a fault pending is reported. DTC P0881 is set if ignition or battery voltage varies by 4.0V or more for 20 samples.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0881 TCM Power Input Signal Performance

Actions Taken When the DTC Sets

When DTC P0881 is active, the following conditions will occur:

- The **CHECK TRANS** light does not illuminate.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to drive the vehicle in order to experience a fault.
- This DTC indicates a variation in direct battery voltage.
  - — Battery voltage problems may be due to loose or corroded battery cables, a bad connection at the battery direct feed terminal (10 or 70), or an internal TCM failure due to a burnt trace.
  - — A vehicle charging system failure may cause this DTC under certain circumstances.
- This code may indicate that an internal voltage problem has occurred inside the TCM. The use of a substitute TCM would be a good way to diagnose this problem.
- A defective vehicle battery may induce this DTC.
- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for an active DTC.
3. This step tests for proper direct battery input voltage.
4. This step tests for shorts or open conditions at direct battery input circuit.

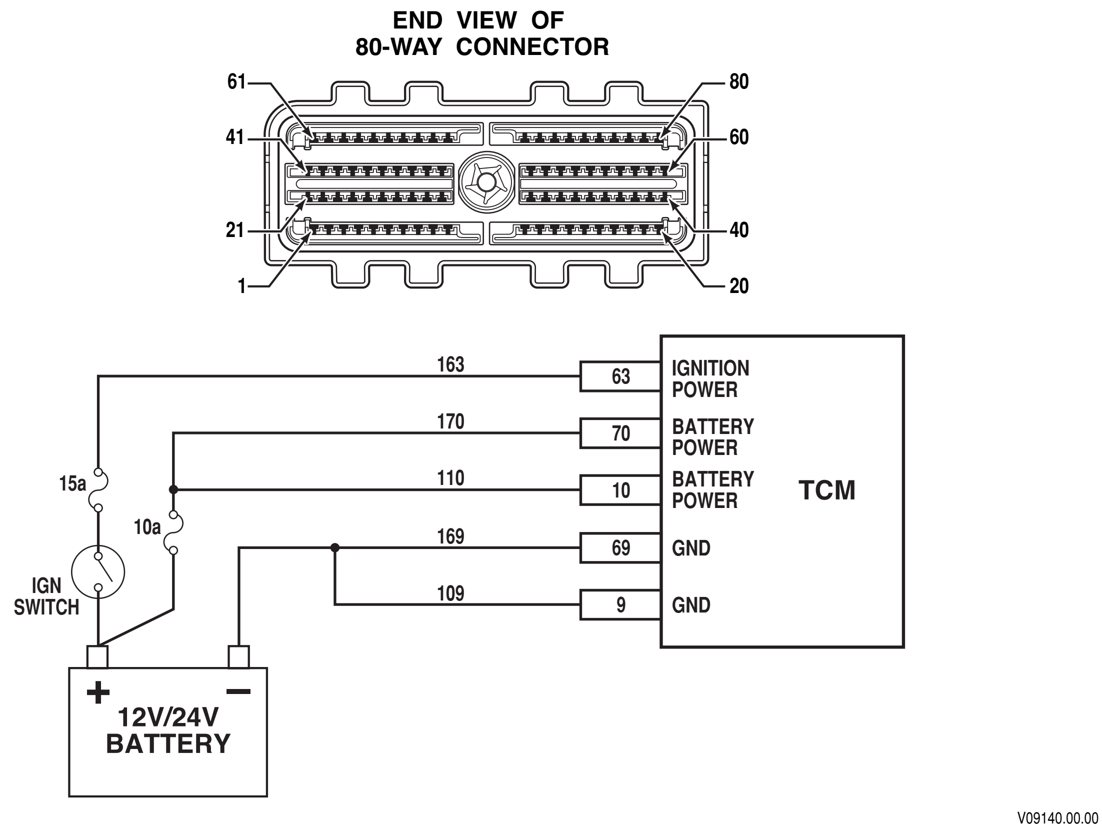
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0881 TCM Power Input Signal Performance

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that a voltage variation exists in the battery input circuit. This variation is measured for min. and max. voltage values. This DTC sets if the voltage variation is present for a pre-determined number of samples.*** Did DTC P0881 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 4. Using a digital multimeter (DVOM), sequentially measure voltage at 80-way connector pins 9 and 10, then between pins 69 and 70. Is the voltage within the specified values?	11.5–12.5V	*Repair charging system*	*Go to Step 4*
4	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Inspect battery direct circuits 110 and 170 for one of the following conditions: • Intermittent open or short at battery direct power and ground circuits 109, 110, 169, and 170. • Loose or corroded connections at battery or connection points. • Defective battery. Was one of these conditions discovered and repaired?		*Go to Step 5*	
5	In order to verify your repair: 1. Clear the DTC. 2. Start the engine and warm to normal operating temperature. 3. Using Allison DOC™ For PC–Service Tool, monitor system voltage. System voltage should be 9–18V. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0882 TCM Power Input Signal Low



Circuit Description

The Transmission Control Module (TCM) receives power directly from the battery. Wires 110 and 170 supply direct battery power to pins 10 and 70 respectively at the TCM.

Conditions for Running the DTC

Engine has been running for more than 10 seconds and engine speed is greater than 450 rpm.

Conditions for Setting the DTC

DTC P0882 sets under the following condition:

- The TCM detects battery voltage below 8V at 0°C (32°F) for six times. The voltage threshold is temperature dependent varying from 5V at –60°C (–75°F) to 9V at 20°C (68°F).

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0882 TCM Power Input Signal Low

Actions Taken When the DTC Sets

When DTC P0882 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determine the range attained.
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- A defective vehicle battery may allow this DTC to set. Test the vehicle battery to verify proper voltage and load capacity.
- A defective vehicle charging system may cause this DTC.
- Intermittent faults may exist in vehicle components such as a poor connection at the battery posts. Such faults would cause this DTC to set and not remain active.
- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper battery voltage.
3. This step tests for an active DTC.
4. This step tests vehicle battery per OEM guidelines.
5. This step tests vehicle charging system per OEM guidelines.

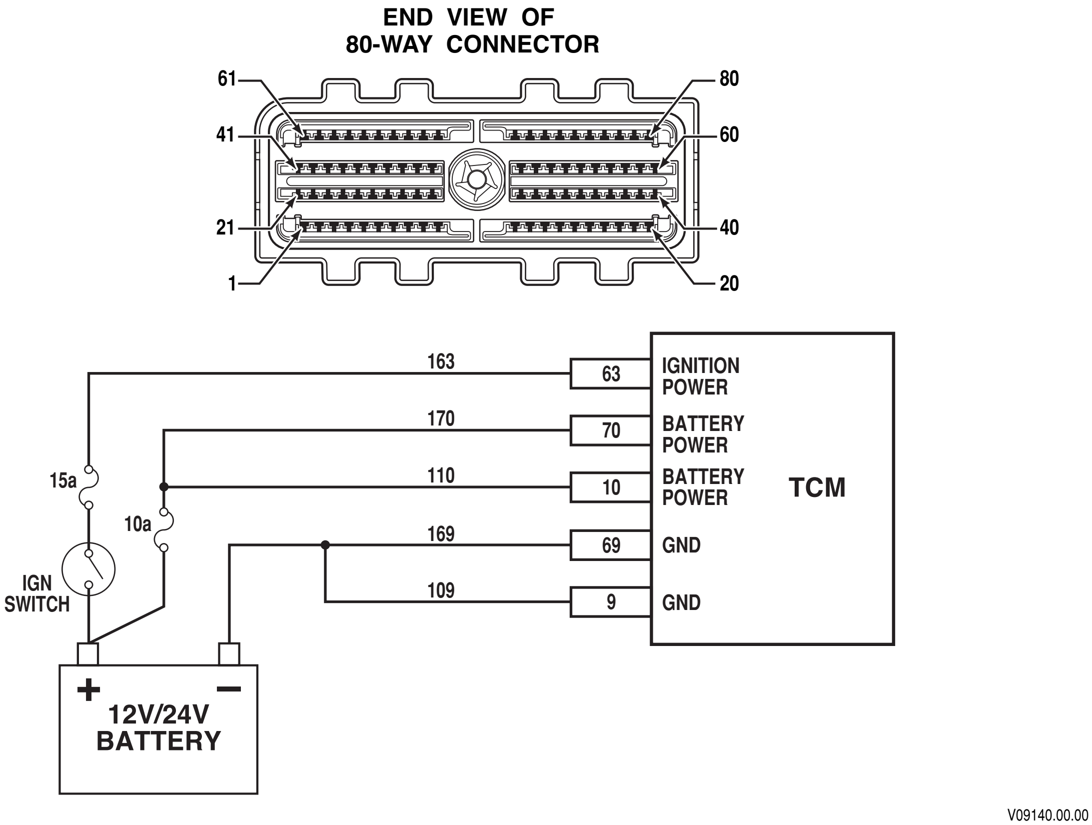
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0882 TCM Power Input Signal Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Observe the battery voltage value on Allison DOC™ For PC–Service Tool. ***NOTE: This DTC sets when battery voltage drops below a predetermined level that is temperature dependent for a pre-determined number of detections.*** Is the battery voltage below specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to Step 3*
3	1. Start the vehicle, if possible. 2. If the DTC is not active, drive the vehicle. Attempt to duplicate the same operating conditions observed in the failure records. Did the DTC return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	Test the vehicle battery per OEM instructions. This should include a voltage test and a load test. Does test indicate the battery is good?	Refer to OEM for correct battery specifications	*Go to Step 5*	*Replace vehicle battery. Go to Step 6*
5	Test the vehicle charging system per the OEM recommended testing procedure. Is the charging system operating properly?	Refer to OEM for correct charging system specifications	*Go to Diagnostic Aids*	*Repair the charging system. Go to Step 6*
6	In order to verify your repair: 1. Clear the DTC. 2. Start the engine and warm to normal operating temperature. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0883 TCM Power Input Signal High



Circuit Description

The Transmission Control Module (TCM) receives power directly from the battery. Wires 110 and 170 supply direct battery power to pins 10 and 70 respectively at the TCM.

Conditions for Running the DTC

Engine has been running for more than 10 seconds and engine speed is greater than 450 rpm.

Conditions for Setting the DTC

DTC P0883 sets under the following conditions:

- 12V TCM—The TCM detects an ignition voltage greater than or equal to 16V for 6 out of 10 samples.
- 24V TCM—The TCM detects an ignition voltage greater than or equal to 32V for 6 out of 10 samples.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0883 TCM Power Input Signal High

Actions Taken When the DTC Sets

When DTC P0883 is active, the following conditions will occur:

- The **CHECK TRANS** light does not illuminate.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- A defective vehicle charging system that is overcharging may cause this DTC.
- Intermittent faults may exist in vehicle components such as a poor connection at the battery posts. Such faults would cause this DTC to set and not remain active.
- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- DTC P0883 may set if an A41 or A42 TCM is installed in a 24V electrical system.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper battery voltage.
3. This step tests for an active DTC.
4. This step tests vehicle charging system per OEM guidelines.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0883 TCM Power Input Signal High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Observe the battery voltage value on Allison DOC™ For PC–Service Tool. ***NOTE: This DTC sets when battery voltage is detected at or above a predetermined level for a predetermined number of samples.*** Is the battery voltage at or above specified value?	Refer to Conditions for Setting DTC	*Go to Step 4*	*Go to Step 3*
3	1. Start the vehicle, if possible. 2. If the DTC is not active, drive the vehicle. Attempt to duplicate the same operating conditions observed in the failure records. Did the DTC return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	Test the vehicle charging system per the OEM recommended testing procedure. Is the charging system operating properly?	Refer to OEM for correct charging system specifications	*Go to Diagnostic Aids*	*Repair the charging system. Go to Step 5*
5	In order to verify your repair: 1. Clear the DTC. 2. Start the engine and warm to normal operating temperature. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0894 Transmission Component Slipping

Refer to First Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to verify the transmission has attained first range when the operator selects **D** (Drive). If the TCM does not detect turbine speed pull down following the shift into **D** (Drive), the TCM sets a Code P0894.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Hydraulic default condition not present.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P0894 sets when first range is selected and turbine speed remains above a calibrated value.

Actions Taken When the DTC Sets

When DTC P0894 is active, the following conditions will occur:

- The TCM commands first range.
- While diagnostic response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits torque converter clutch (TCC) engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the code from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing failures mode where DTC was set.
- DTC P0894 may be caused by the following:
  - — Improper transmission fluid level
  - — Stuck solenoid regulator valve
  - — Stuck C1 or C2 latch valve
  - — Defective pressure control or shift solenoid
  - — Mechanical problem with the C1 or C5 clutch
- If this code is accompanied by a P0701, troubleshoot and correct the cause of the P0701 first.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for presence of a code P0701.
3. This step tests for improper transmission fluid level.
4. This step tests for active diagnostic codes.
5. This step tests for low main pressure.
6. This step tests for proper clutch pressures in first range.
7. This step tests for signs of a clutch failure.

DTC P0894 Transmission Component Slipping

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	If DTC P0701 is present, troubleshoot and resolve before going to the next step. Is a DTC P0701 present?		*Go to DTC P0701 and resolve before proceeding to Step 3*	*Go to Step 3*
3	Perform the Fluid Check Procedure (refer to mechanic's tips). Is the transmission fluid level correct?		*Go to Step 4*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record DTC failure record data. 4. Clear the DTC. 5. Drive the vehicle under normal operating conditions. Did DTC P0894 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn OFF the ignition. 2. Install a 2000 kPa (300 psi) pressure gauge in the main pressure tap. 3. Start the engine. 4. Read and record main pressure. Is the pressure reading within the specified value in Appendix B?	See Main and Clutch Pressure specifications in Appendix B	*Go to Step 6*	*Go to Step 10*
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main, C1 and C5 pressure taps. 3. Start the engine. 4. Select Drive and shift the transmission into first range. 5. Read and record Main, C1, and C5 clutch pressures. Are the pressure readings within specified values in Appendix B?	See Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*

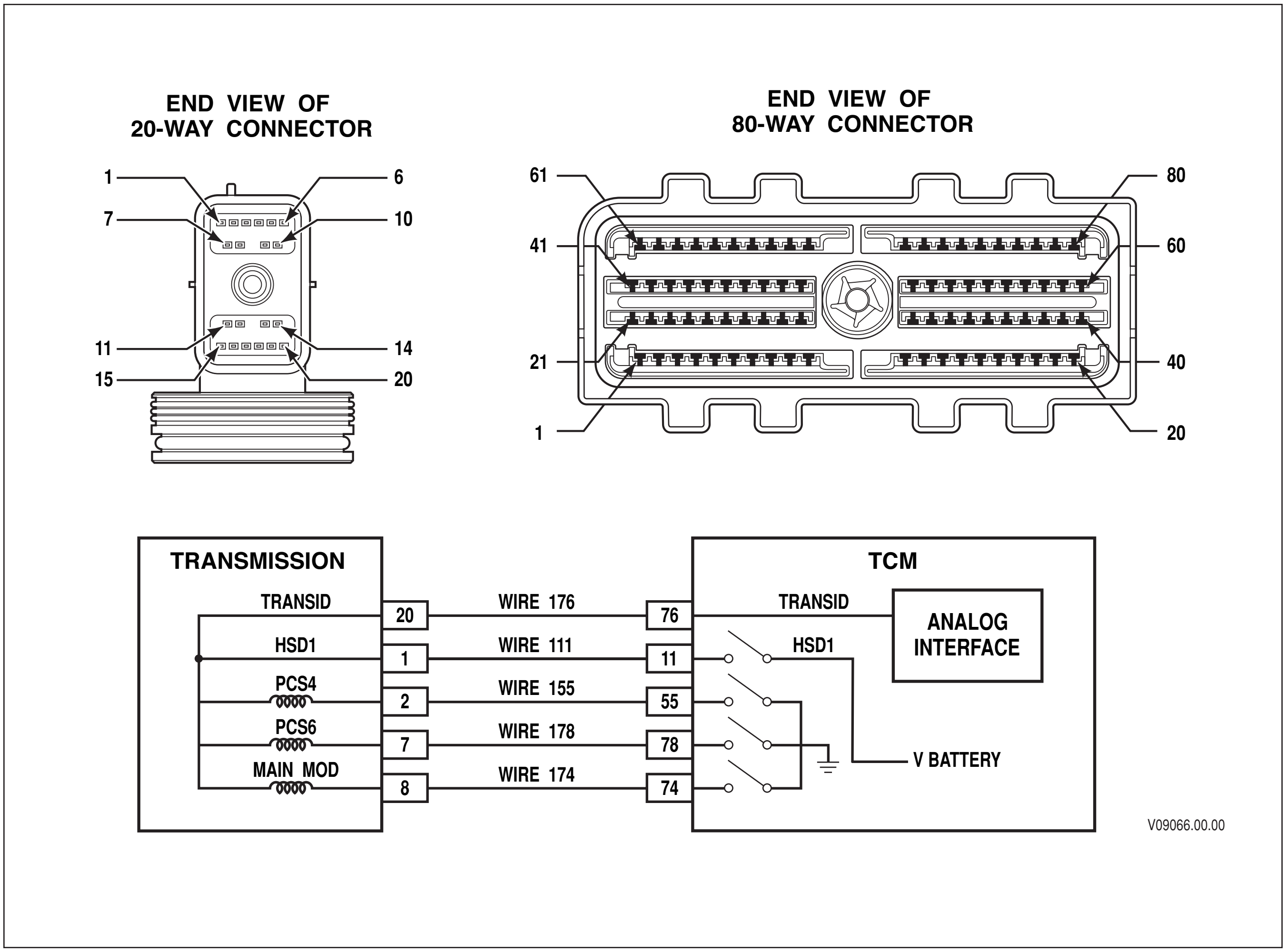
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0894 Transmission Component Slipping

Step	Action	Value(s)	Yes	No
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 11*	*Go to Diagnostic Aids*
8	1. Consult the appropriate service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 12*	*Go to Step 9*
9	Using pressure readings obtained in Step 6 above, replace the affected solenoid. • Incorrect C1 pressure—PCS1 • Incorrect C5 pressure—PCS3 Is the replacement complete?		*Go to Step 12*	
10	Investigate the cause of low main pressure. Possible causes include: • Collapsed main filter • Broken converter pump or PTO gear tangs • Worn main charging pump Is the cause of low main pressure repaired?		*Go to Step 12*	
11	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 12*	
	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0960 Pressure Control Solenoid Main Mod Control Circuit Open



Circuit Description

Pressure control solenoid Main Mod solenoid is a normally closed (N/C) solenoid used to modulate the transmission main pressure schedule. The TCM commands the solenoid ON when specific transmission and engine conditions are met. When the Main Mod solenoid is commanded ON, pressure is routed to the main regulator valve lowering the main pressure schedule.

The TCM sends control current to the Main Mod solenoid from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to the Main Mod solenoid by switching the Main Mod solenoid's Low Side Driver ON and OFF. Wire 174 completes the circuit between the Main Mod solenoid and its Low Side Driver (LSD). DTC P0960 indicates that the TCM has detected an open condition in the Main Mod solenoid electrical circuit. The open condition may exist in the high side (wire 111) or low side (wire 174).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0960 Pressure Control Solenoid Main Mod Control Circuit Open

Conditions for Setting the DTC

DTC P0960 is set when the TCM detects an open circuit on the Main Mod solenoid return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P0960 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0960 indicates an open in the electrical circuit for the Main Mod solenoid. In addition to the Main Mod solenoid, HSD1 also supplies power to Pressure Control Solenoids 4 (PCS4) and PCS6. If DTC P0960 is accompanied by DTC P2718 (PCS4 open circuit) and/or DTC P2812 (PCS6 open circuit), the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage drop caused by an open condition in either wire 111 or wire 174 of the OEM chassis harness.
6. This step tests for an open condition in the transmission internal harness.
7. This step tests for the proper the Main Mod solenoid resistance.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0960 Pressure Control Solenoid Main Mod Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem.* *Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in the Main Mod solenoid electrical circuit.*** Did DTC P0960 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0960 Pressure Control Solenoid Main Mod Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors. 4. Turn ON the ignition, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command the Main Mod solenoid ON. 6. Determine the voltage drop in the high side of the Main Mod solenoid circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 11 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 1 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the Main Mod solenoid circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 74 and an isolated ground. • At J 47279 Transmission Breakout, measure voltage between pin 8 and ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Disconnect the OEM 20-way connector from J 47279 Transmission Breakout. Leave the transmission 20-way connector connected to the breakout. 3. Using a digital multimeter (DVOM), measure the resistance between pin 1 and pin 8 of the transmission 20-way connector. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 10*	*Go to Step 7*

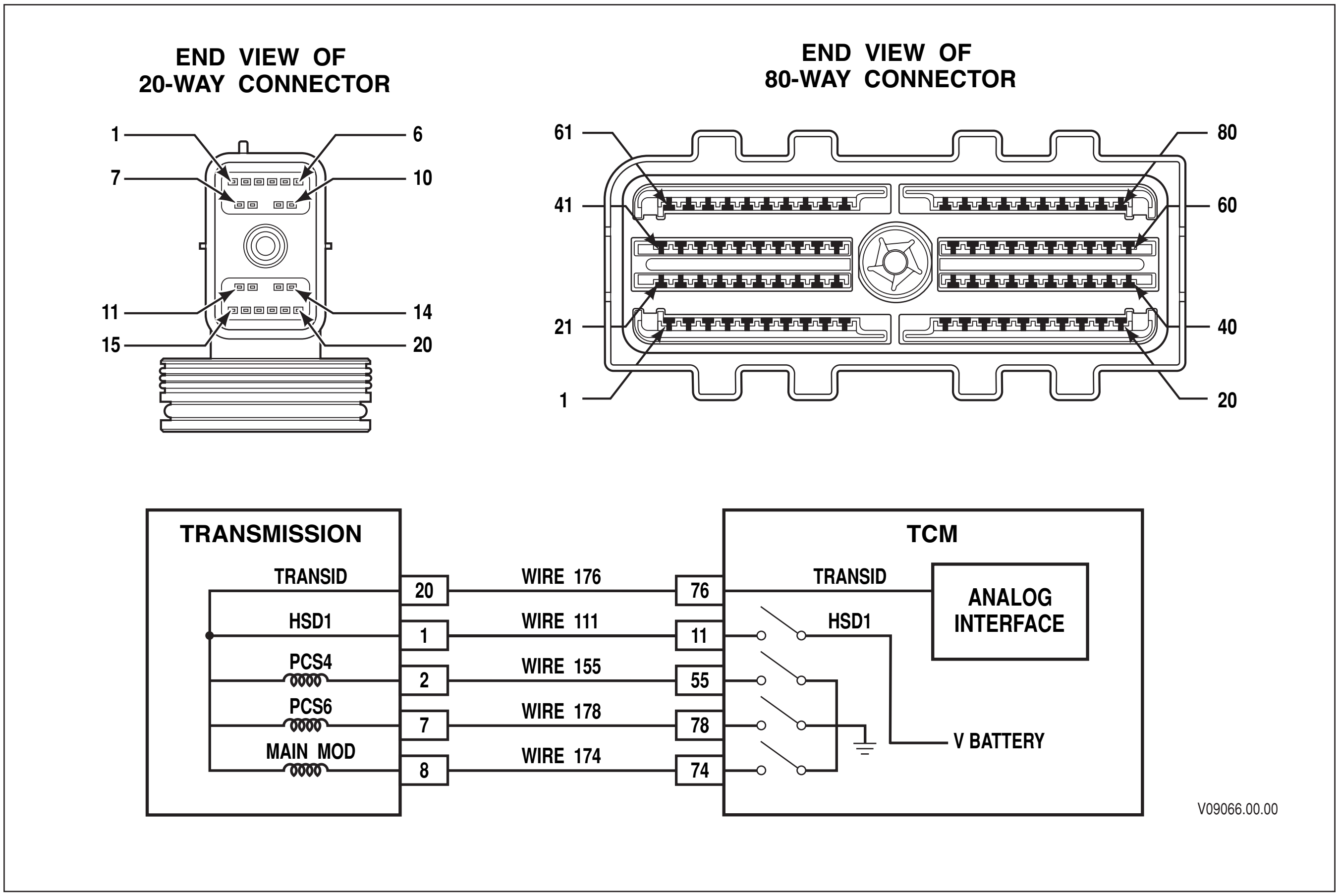
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0960 Pressure Control Solenoid Main Mod Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the hydraulic control module assembly. 2. Disconnect the Main Mod solenoid from the internal wiring harness. 3. Using a DVOM, measure the Main Mod solenoid resistance at pins A and B. Is resistance within the specified values?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace the Main Mod solenoid. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0962 Pressure Control Solenoid Main Mod Control Circuit Low



Circuit Description

Main Mod solenoid is a normally closed (N/C) solenoid used to modulate the transmission main pressure schedule. The TCM commands the solenoid ON when specific transmission and engine conditions are met. When the Main Mod solenoid is commanded ON, pressure is routed to the main regulator valve lowering the main pressure schedule.

The TCM sends control current to the Main Mod solenoid from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to the Main Mod solenoid by switching the Main Mod solenoid's Low Side Driver (LSD) ON and OFF. Wire 174 completes the circuit between the Main Mod solenoid and its LSD. DTC P0962 indicates that the TCM has detected a short-to-ground condition in the low side of the Main Mod solenoid electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0962 is set when the TCM detects a short-to-ground in the Main Mod solenoid return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0962 Pressure Control Solenoid Main Mod Control Circuit Low

Actions Taken When the DTC Sets

When DTC P0962 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determine the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0962 indicates a short-to-ground in the electrical circuit for the Main Mod solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 174.
6. This step tests for wire-to-wire shorts or a short-to-ground in the internal transmission harness.

DTC P0962 Pressure Control Solenoid Main Mod Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the Main Mod solenoid electrical circuit.*** Did DTC P0962 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connectors. 3. Install the OEM-side 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 174 in the chassis harness between the TCM and transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 74 and all other pins in the 80-way connector, and shorts-to-ground between pin 74 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground wiring defects found?		*Go to Step 5*	*Go to Step 6*

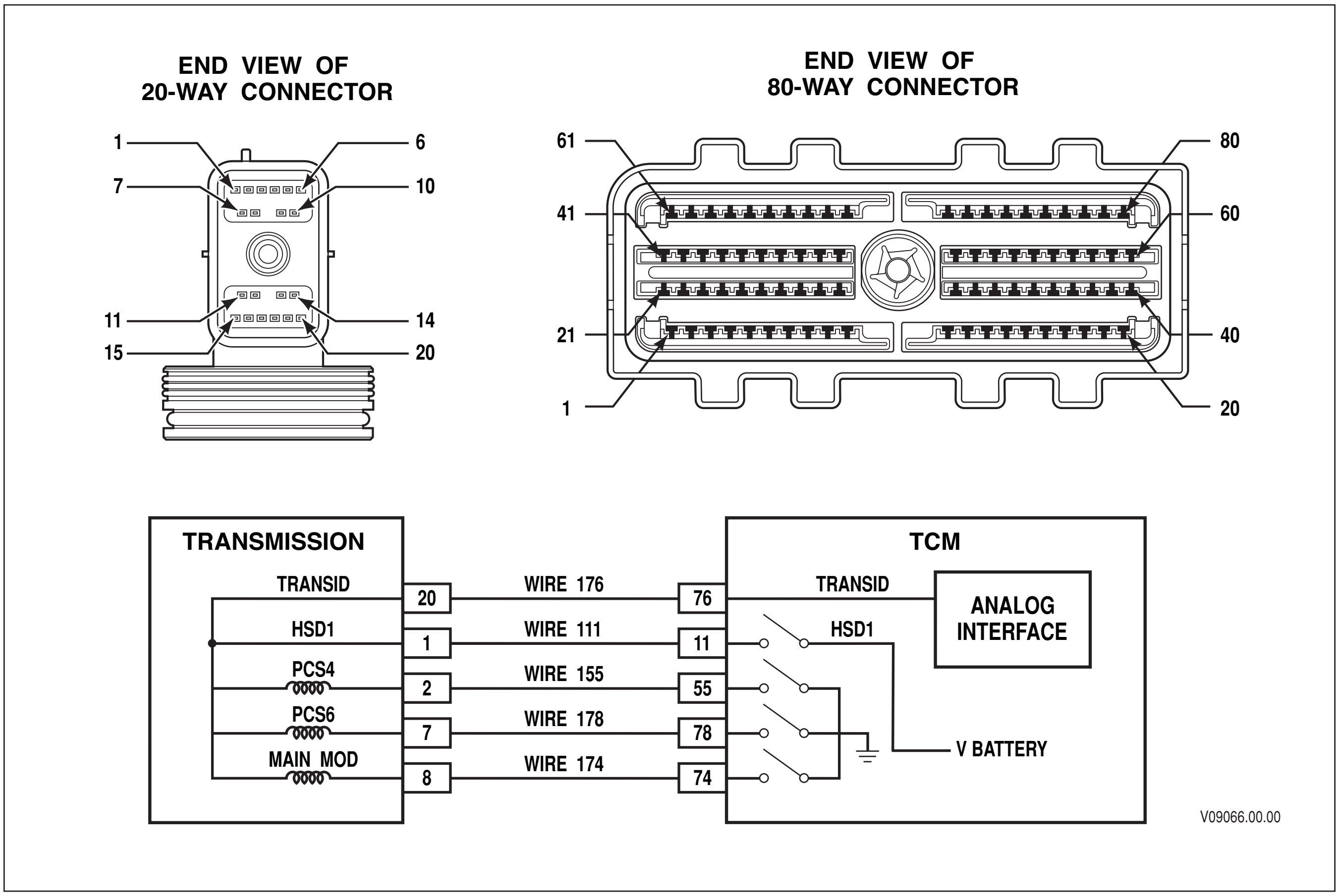
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0962 Pressure Control Solenoid Main Mod Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using DVOM, test for wire-to-wire shorts between pin 8 and all other pins in the 20-way connector, and shorts-to-ground between pin 8 and chassis ground. ***NOTE: The resistance value between pins 8 and 1, and between pins 8 and 20 will read normal solenoid resistance. The resistance value between pins 8 and 2, and between 8 and 7 (7-speed models) will be twice normal solenoid resistance.*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts or shorts-to-ground. Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace the Main Mod solenoid. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0963 Pressure Control Solenoid Main Mod Control Circuit High



Circuit Description

Main Modulation Solenoid (Main Mod) is a normally closed (N/C) solenoid used to modulate the transmission main pressure schedule. The TCM commands the solenoid ON when specific transmission and engine conditions are met. When the Main Mod solenoid is commanded ON, pressure is routed to the main regulator valve lowering the main pressure schedule.

The TCM sends control current to the Main Mod solenoid from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to the Main Mod solenoid by switching the Main Mod solenoid's Low Side Driver (LSD) ON and OFF. Wire 174 completes the circuit between the Main Mod solenoid and its LSD. DTC P0963 indicates that the TCM has detected a short-to-battery condition in the low side of the Main Mod solenoid's electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0963 is set when the TCM detects a short-to-battery in the Main Mod solenoid return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0963 Pressure Control Solenoid Main Mod Control Circuit High

Actions Taken When the DTC Sets

When DTC P0963 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0963 indicates a short-to-battery in the electrical circuit for the Main Mod solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  — A bent terminal
  — A backed-out terminal
  — A damaged terminal
  — Poor terminal tension
  — A chafed wire
  — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 174 and other wires in the OEM chassis harness.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.

DTC P0963 Pressure Control Solenoid Main Mod Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem.* *Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-battery condition in the Main Mod solenoid electrical circuit.*** Did DTC P0963 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wires 111 and 174 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 74 and all other pins in the 80-way connector, and shorts-to-ground between pin 74 and chassis ground. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*

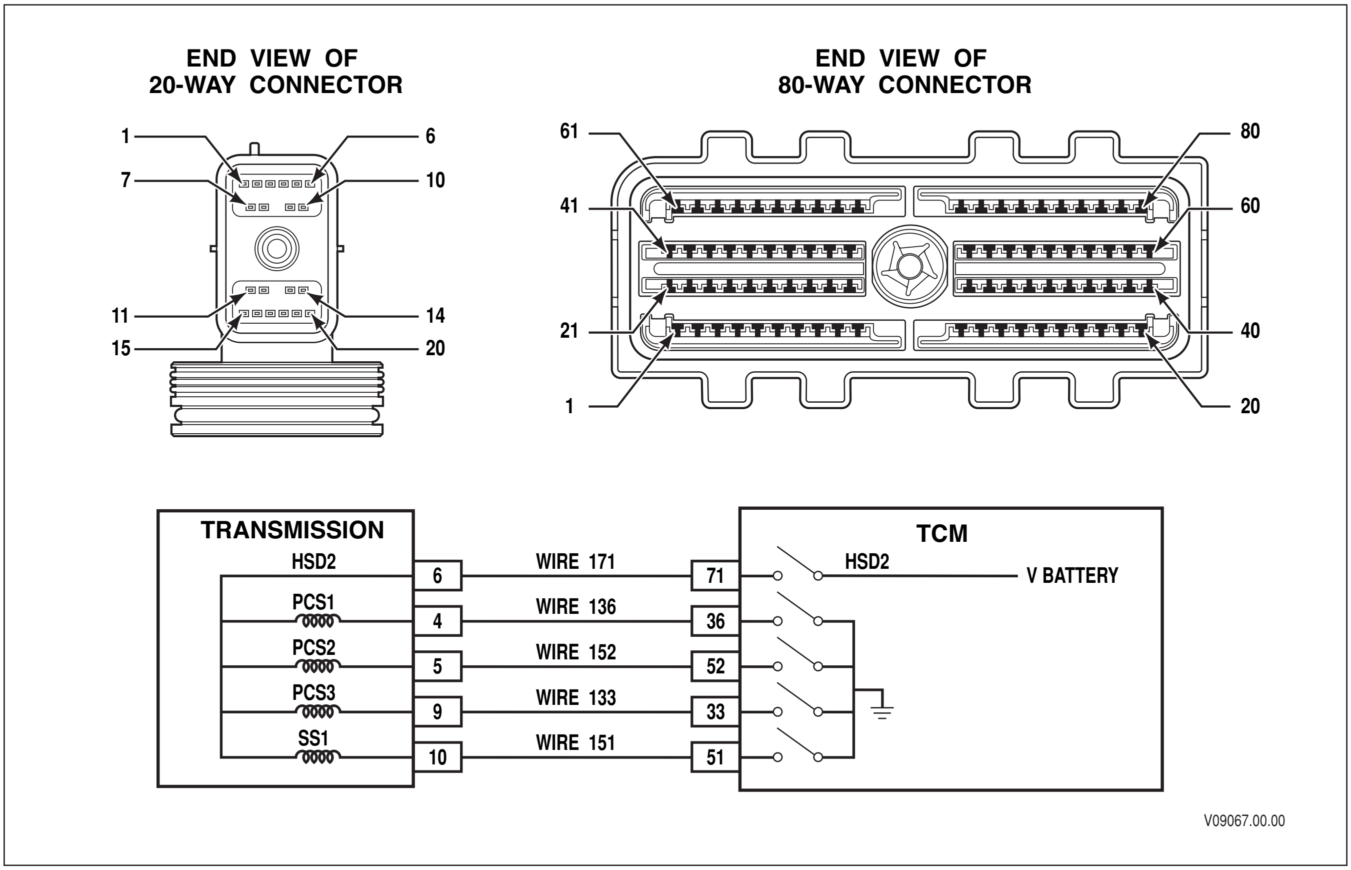
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0963 Pressure Control Solenoid Main Mod Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 8 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 8 and 1, and between pins 8 and 20 will read normal solenoid resistance. The resistance value between pins 8 and 2, and between 8 and 7 (7-speed models) will be twice normal solenoid resistance.*** Were any wire-to-wire shorts found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts. Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace the Main Mod solenoid. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0964 Pressure Control Solenoid 2 (PCS2) Control Circuit Open



Circuit Description

Pressure Control Solenoid 2 (PCS2) is a normally open (N/O) solenoid used to apply the C2 clutch in fourth through sixth range, and the C3 clutch in Reverse. The TCM commands the solenoid OFF to produce hydraulic pressure in the clutch apply circuit. When PCS2 is commanded ON, the C2 clutch is released.

The TCM sends control current to PCS2 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS2 by switching PCS2 Low Side Driver (LSD) ON and OFF. Wire 152 completes the circuit between PCS2 and its LSD. DTC P0964 indicates that the TCM has detected an open condition in PCS2 electrical circuit. The open condition may exist in the high side (wire 171) or low side (wire 152).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0964 is set when the TCM detects an open circuit on the PCS2 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0964 Pressure Control Solenoid 2 (PCS2) Control Circuit Open

Actions Taken When the DTC Sets

When DTC P0964 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0964 indicates an open in the electrical circuit for the PCS2 solenoid. In addition to PCS2, HSD2 also supplies power to solenoids PCS1, PCS3, and SS1. If DTC P0964 is accompanied by DTC P2727 (PCS1 open circuit) and/or DTC P0968 (PCS3 open circuit), the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage drop caused by open condition in either wire 171 or wire 152 of the OEM chassis harness.
6. This step tests for an open condition in the transmission internal harness.
7. This step tests for the proper PCS2 resistance.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0964 Pressure Control Solenoid 2 (PCS2) Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in the PCS2 electrical circuit.*** Did DTC P0964 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors. 4. Turn ON the ignition, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command PCS2 ON. 6. Determine the voltage drop in the high side of the PCS2 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 71 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 6 and an isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the PCS2 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 52 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 5 and an isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*

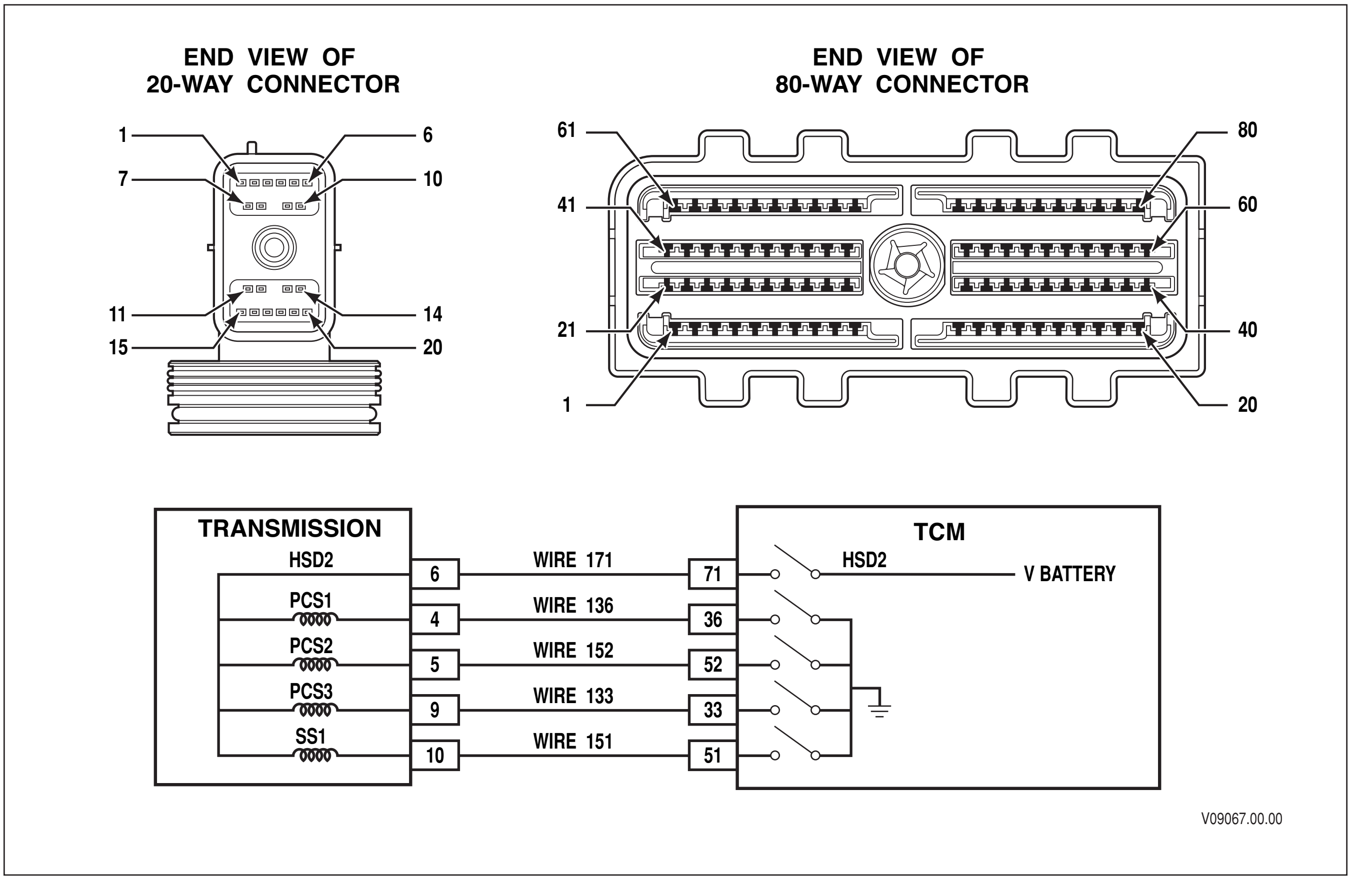
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0964 Pressure Control Solenoid 2 (PCS2) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Disconnect the OEM 20-way connector from J 47279 Transmission Breakout. Leave the transmission 20-way connector connected to the breakout. 3. Using a digital multimeter (DVOM), measure the resistance between pin 5 and pin 6 of the transmission 20-way connector. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 10*	*Go to Step 7*
7	1. Remove the hydraulic control module assembly. 2. Disconnect PCS2 from the internal wiring harness. 3. Using a DVOM, measure PCS2 resistance at pins A and B. Is resistance within the specified values?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS2. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0966 Pressure Control Solenoid 2 (PCS2) Control Circuit Low



Circuit Description

Pressure Control Solenoid 2 (PCS2) is a normally open (N/O) solenoid used to apply the C2 clutch in fourth through sixth range and the C3 clutch in reverse. The TCM commands the solenoid OFF to produce hydraulic pressure in the clutch apply circuit. When PCS2 is commanded ON, the C2 clutch is released.

The TCM sends control current to PCS2 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS2 by switching PCS2 Low Side Driver (LSD) ON and OFF. Wire 152 completes the circuit between PCS2 and its LSD. DTC P0966 indicates that the TCM has detected a short-to-ground condition in the low side of PCS2 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0966 is set when the TCM detects a short-to-ground in the PCS2 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0966 Pressure Control Solenoid 2 (PCS2) Control Circuit Low

Actions Taken When the DTC Sets

When DTC P0966 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0966 indicates a short-to-ground in the electrical circuit for the PCS2 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  — A bent terminal
  — A backed-out terminal
  — A damaged terminal
  — Poor terminal tension
  — A chafed wire
  — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 152.
6. This step tests for the wire-to-wire shorts or a short-to-ground in the internal transmission harness.

DTC P0966 Pressure Control Solenoid 2 (PCS2) Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the PCS2 electrical circuit.*** Did DTC P0966 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 152 in the chassis harness between the TCM and transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 52 and all other pins in the 80-way connector, and short-to-ground between pin 52 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground wiring defects found?		*Go to Step 5*	*Go to Step 6*

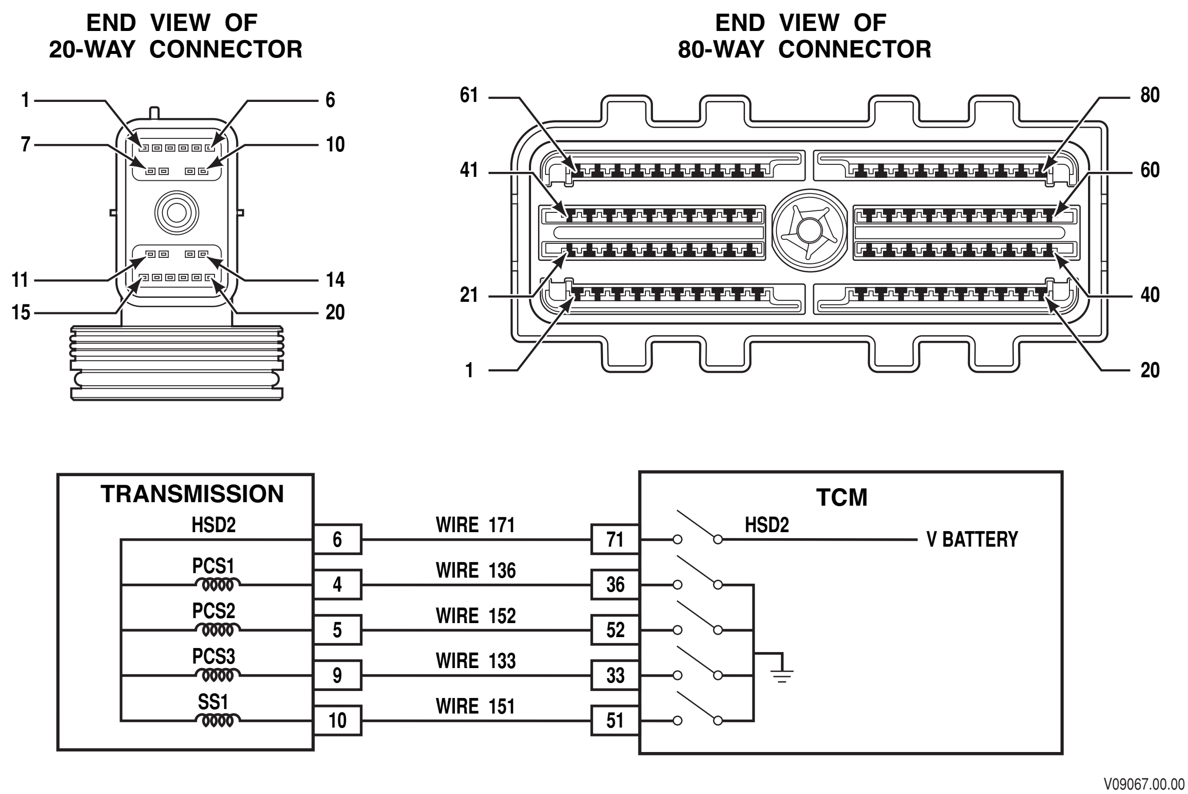
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0966 Pressure Control Solenoid 2 (PCS2) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 5 and pin 6 of the 20-way connector, or shorts-to-ground between pin 5 and chassis ground. ***NOTE: The resistance value between pins 5 and 6 will read normal solenoid resistance. The resistance between pins 5 and 4, between 5 and 9, and between pins 5 and 10 will be twice normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts or shorts-to-ground. Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace PCS2. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0967 Pressure Control Solenoid 2 (PCS2) Control Circuit High



Circuit Description

Pressure Control Solenoid 2 (PCS2) is a normally open (N/O) solenoid used to apply the C2 clutch in fourth through sixth range and the C3 clutch in reverse. The TCM commands the solenoid OFF to produce hydraulic pressure in the clutch apply circuit. When PCS2 is commanded ON, the C2 clutch is released.

The TCM sends control current to PCS2 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS2 by switching PCS2 Low Side Driver (LSD) ON and OFF. Wire 152 completes the circuit between PCS2 and its LSD. DTC P0967 indicates that the TCM has detected a short-to-battery condition in the low side of PCS2 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0967 is set when the TCM detects a short-to-battery in the PCS2 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0967 Pressure Control Solenoid 2 (PCS2) Control Circuit High

Actions Taken When the DTC Sets

When DTC P0967 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0967 indicates a short-to-battery in the electrical circuit for the PCS2 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 152 and other wires in the OEM chassis harness.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.

DTC P0967 Pressure Control Solenoid 2 (PCS2) Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-Battery condition in the PCS2 electrical circuit.*** Did DTC P0966 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wires 171 and 152 in the chassis harness between the TCM and transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 52 and all other pins in the 80-way connector, and short-to-ground between pin 52 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground wiring defects found?		*Go to Step 5*	*Go to Step 6*

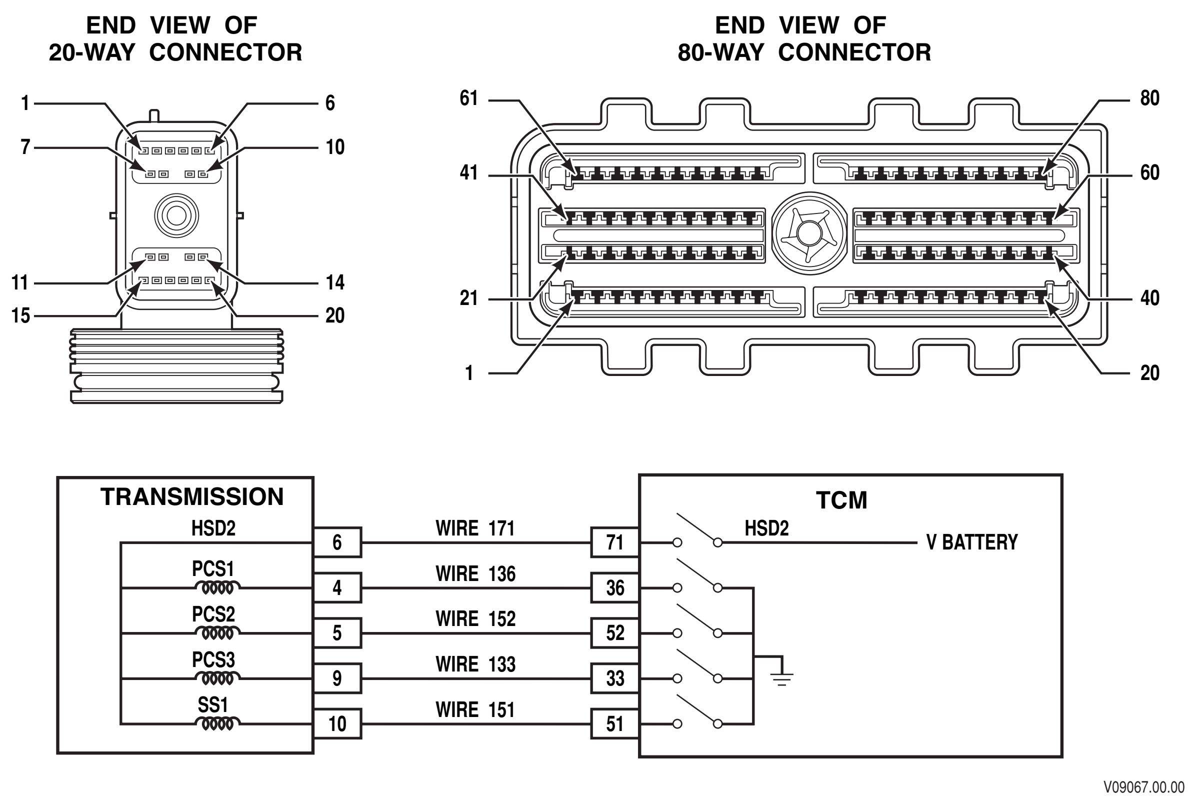
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0967 Pressure Control Solenoid 2 (PCS2) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 5 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 5 and 6 will read normal solenoid resistance. The resistance between pins 5 and 4, between 5 and 9, and between pins 5 and 10 will be twice normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts or shorts-to-ground. Were any wire-to-wire shorts found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Repair or Replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace PCS2. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0968 Pressure Control Solenoid 3 (PCS3) Control Circuit Open



Circuit Description

Pressure Control Solenoid 3 (PCS3) is a normally closed (N/C) solenoid used to apply the C5 clutch in reverse, neutral and first and to apply the C3 clutch in third and fifth ranges. The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS3 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS3 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS3 by switching PCS3 Low Side Driver (LSD) ON and OFF. Wire 133 completes the circuit between PCS3 and its LSD. DTC P0968 indicates that the TCM has detected an open condition in PCS3 electrical circuit. The open condition may exist in the high side (wire 171) or low side (wire 133).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0968 is set when the TCM detects an open circuit on the PCS3 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0968 Pressure Control Solenoid 3 (PCS3) Control Circuit Open

Actions Taken When the DTC Sets

When DTC P0968 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0968 indicates an open in the electrical circuit for the PCS3 solenoid. In addition to PCS3, HSD2 also supplies power to solenoids PCS1, PCS2, and SS1. If DTC P0968 is accompanied by DTC P2727 (PCS1 open circuit) and/or DTC P0964 (PCS2 open circuit), the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage drop caused by an open condition in either wire 171 or wire 133 of the OEM chassis harness.
6. This step tests for an open condition in the transmission internal harness.
7. This step tests for the proper PCS3 resistance.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0968 Pressure Control Solenoid 3 (PCS3) Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V(12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in the PCS3 electrical circuit.*** Did DTC P0968 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command PCS3 ON. 6. Determine the voltage drop in the high side of the PCS3 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 71 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 6 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the PCS3 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 33 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 9 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*

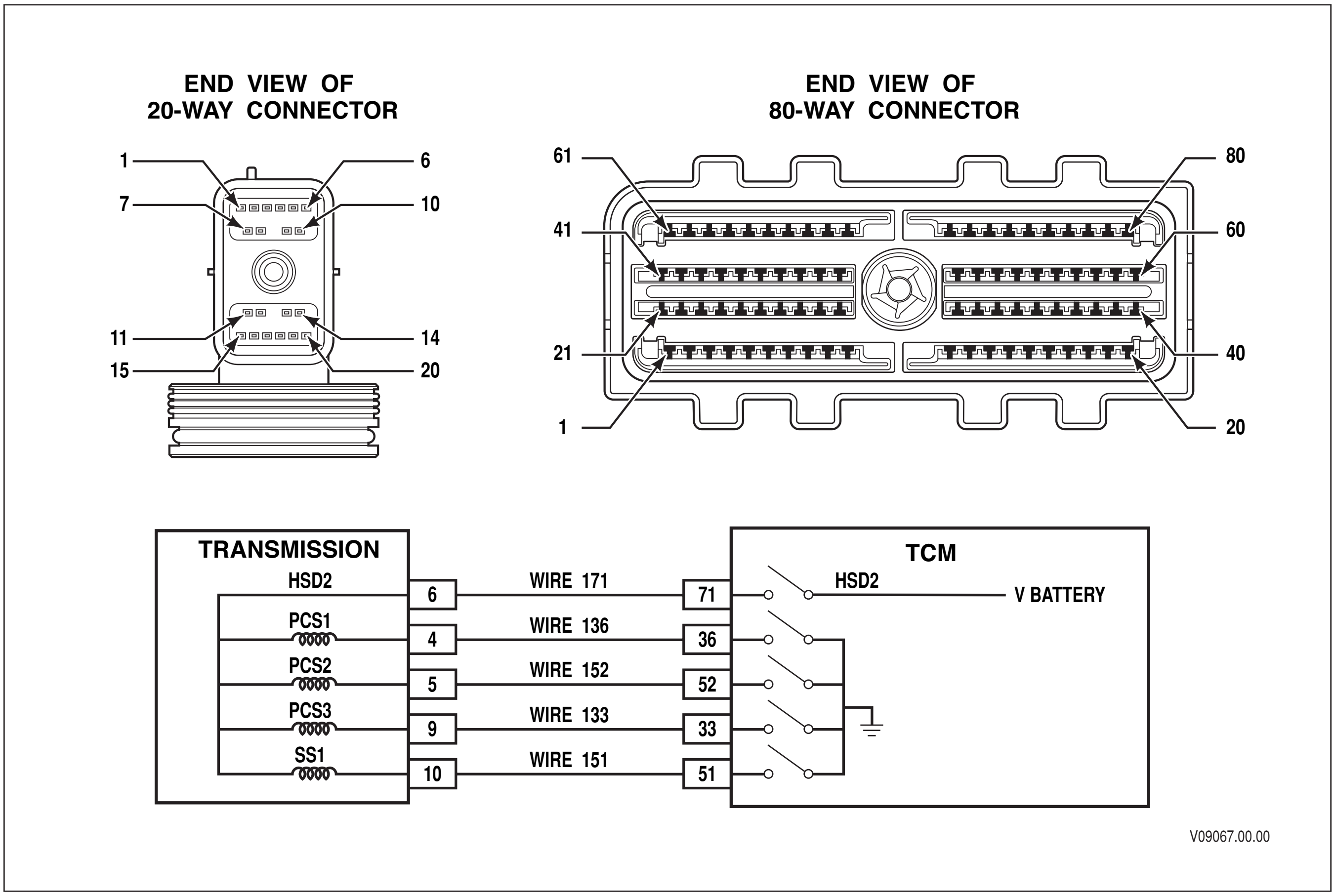
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0968 Pressure Control Solenoid 3 (PCS3) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Disconnect the OEM 20-way connector from J 47279 Transmission Breakout. Leave the transmission 20-way connector connected to the breakout. 3. Using a DVOM, measure the resistance between pin 6 and pin 9 of the transmission 20-way connector. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 10*	*Go to Step 7*
7	1. Remove the hydraulic control module assembly. 2. Disconnect PCS3 from the internal wiring harness. 3. Using a DVOM, measure PCS3 resistance at pins A and B. Is resistance within the specified values?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS3. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0970 Pressure Control Solenoid 3 (PCS3) Control Circuit Low



Circuit Description

Pressure Control Solenoid 3 (PCS3) is a normally closed (N/C) solenoid used to apply the C5 clutch in reverse, neutral and first; and to apply the C3 clutch in third and fifth ranges. The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS3 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS3 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS3 by switching PCS3 Low Side Driver (LSD) ON and OFF. Wire 133 completes the circuit between PCS3 and its LSD. DTC P0970 indicates that the TCM has detected a short-to-ground condition in the low side of PCS electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0970 is set when the TCM detects a short-to-ground in the PCS3 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0970 Pressure Control Solenoid 3 (PCS3) Control Circuit Low

Actions Taken When the DTC Sets

When DTC P0970 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0970 indicates a short-to-ground in the electrical circuit for the PCS3 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 133.
6. This step tests for the wire-to-wire shorts or a short-to-ground in the internal transmission harness.

DTC P0970 Pressure Control Solenoid 3 (PCS3) Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the PCS3 electrical circuit.*** Did DTC P0970 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM-side disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 133 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 33 and all other pins in the 80-way connector, and shorts-to-ground between pin 33 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 5*	*Go to Step 6*

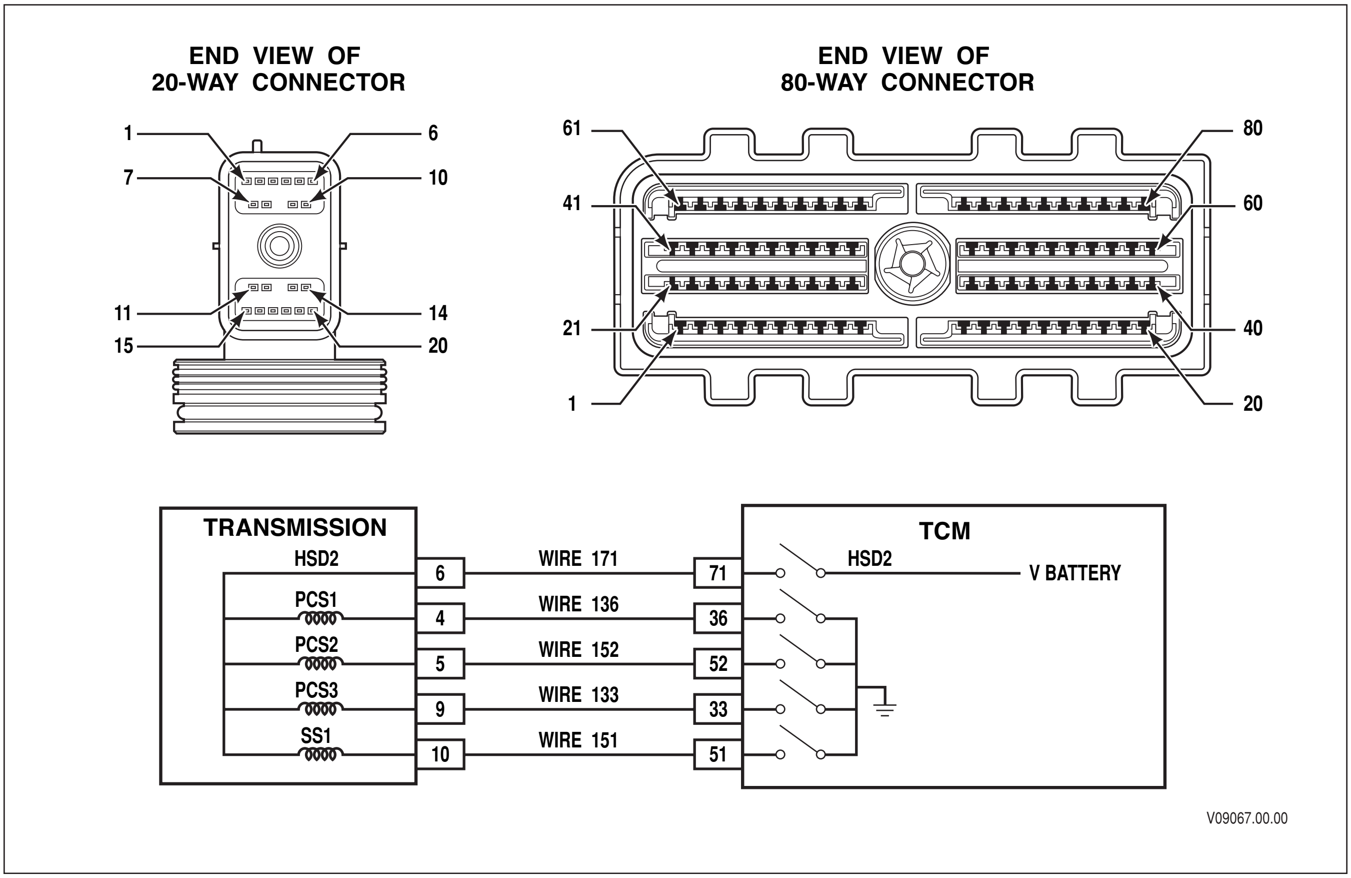
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0970 Pressure Control Solenoid 3 (PCS3) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 9 and all other pins in the 20-way connector, and shorts-to-ground between pin 9 and chassis ground. ***NOTE: The resistance value between pins 9 and 6 will read normal solenoid resistance. The resistance value between pins 9 and 4, between pins 9 and 5, and between pins 9 and 10 will be twice normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** Were wire-to-wire or shorts-to-ground found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts or shorts-to-ground. Were wire-to-wire or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS3. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0971 Pressure Control Solenoid 3 (PCS3) Control Circuit High



Circuit Description

Pressure Control Solenoid 3 (PCS3) is a normally closed (N/C) solenoid used to apply the C5 clutch in reverse, neutral and first and to apply the C3 clutch in third and fifth ranges. The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS3 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS3 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS3 by switching PCS3 Low Side Driver (LSD) ON and OFF. Wire 133 completes the circuit between PCS3 and its LSD. DTC P0971 indicates that the TCM has detected a short-to-battery condition in the low side of PCS electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0971 is set when the TCM detects a short-to-battery in the PCS3 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0971 Pressure Control Solenoid 3 (PCS3) Control Circuit High

Actions Taken When the DTC Sets

When DTC P0971 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0971 indicates a short-to-battery in the electrical circuit for the PCS3 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 133 and other wires in the OEM chassis harness.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.

DTC P0971 Pressure Control Solenoid 3 (PCS3) Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect short-to-battery condition in the PCS3 electrical circuit.*** Did DTC P0971 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wires 177 and 133 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 33 and all other pins in the 80-way connector, and shorts-to-ground between pin 33 and chassis ground. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*

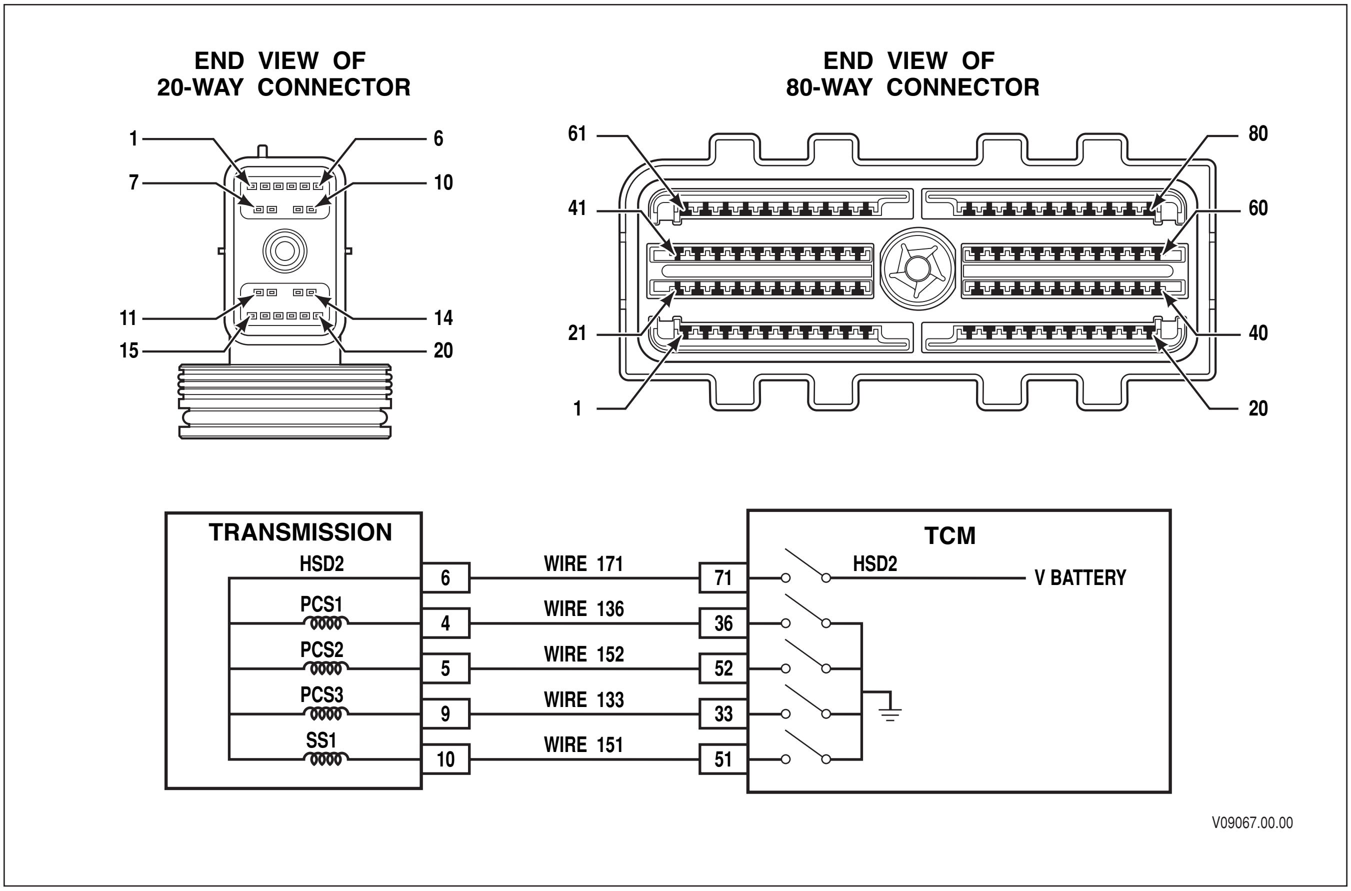
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0971 Pressure Control Solenoid 3 (PCS3) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 9 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 9 and 6 will read normal solenoid resistance. The resistance value between pins 9 and 4, between pins 9 and 5, and between pins 9 and 10 will be twice normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** Were wire-to-wire shorts found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts. Were wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace or repair PCS3. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0973 Shift Solenoid 1 (SS1) Control Circuit Low



Circuit Description

Shift Solenoid 1 (SS1) is a normally closed (N/C) solenoid used to properly position the C1 and C2 latch valves in forward ranges. The TCM commands the solenoid ON to supply control main pressure to the C1 and C2 latch valves. When solenoid SS1 is commanded OFF, control main pressure is relieved from the C1 and C2 latch valves.

The TCM sends control current to solenoid SS1 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM energizes SS1 by switching the solenoid's Low Side Driver (LSD) ON. Wire 151 completes the circuit between SS1 and its LSD. DTC P0973 indicates that the TCM has detected a short-to-ground or open circuit condition in the low side of SS1 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0973 is set when the TCM detects a short-to-ground or open condition in the SS1 return circuit for more than 125 milliseconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0973 Shift Solenoid 1 (SS1) Control Circuit Low

Actions Taken When the DTC Sets

When DTC P0973 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0973 indicates a short-to-ground or an open condition in the electrical circuit for the SS1 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF. **NOTE: A 1000 hertz test pulse may be present in the SS1 circuit.**

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for the OEM harness for an excessive voltage drop caused by an open condition in either wire 171 or wire 151 of the OEM chassis harness.
5. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 151.
7. This step tests for wire-to-wire shorts or a short-to-ground or an open in the internal transmission harness.

DTC P0973 Shift Solenoid 1 (SS1) Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground or open condition in the SS1 electrical circuit.*** Did DTC P0973 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0973 Shift Solenoid 1 (SS1) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4–Wire Test Procedures before performing steps.*** 1. Turn ignition OFF. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool enter Solenoid Test mode and command solenoid SS1 ON. 6. Determine the voltage drop in the high side of the SS1 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 71 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 6 and ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the SS1 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 51 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 10 and ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5 VDC?		*Go to Step 6*	*Go to Step 5*
5	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 151 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 51 and all other pins in the 80-way connector. Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 6*	*Go to Step 7*

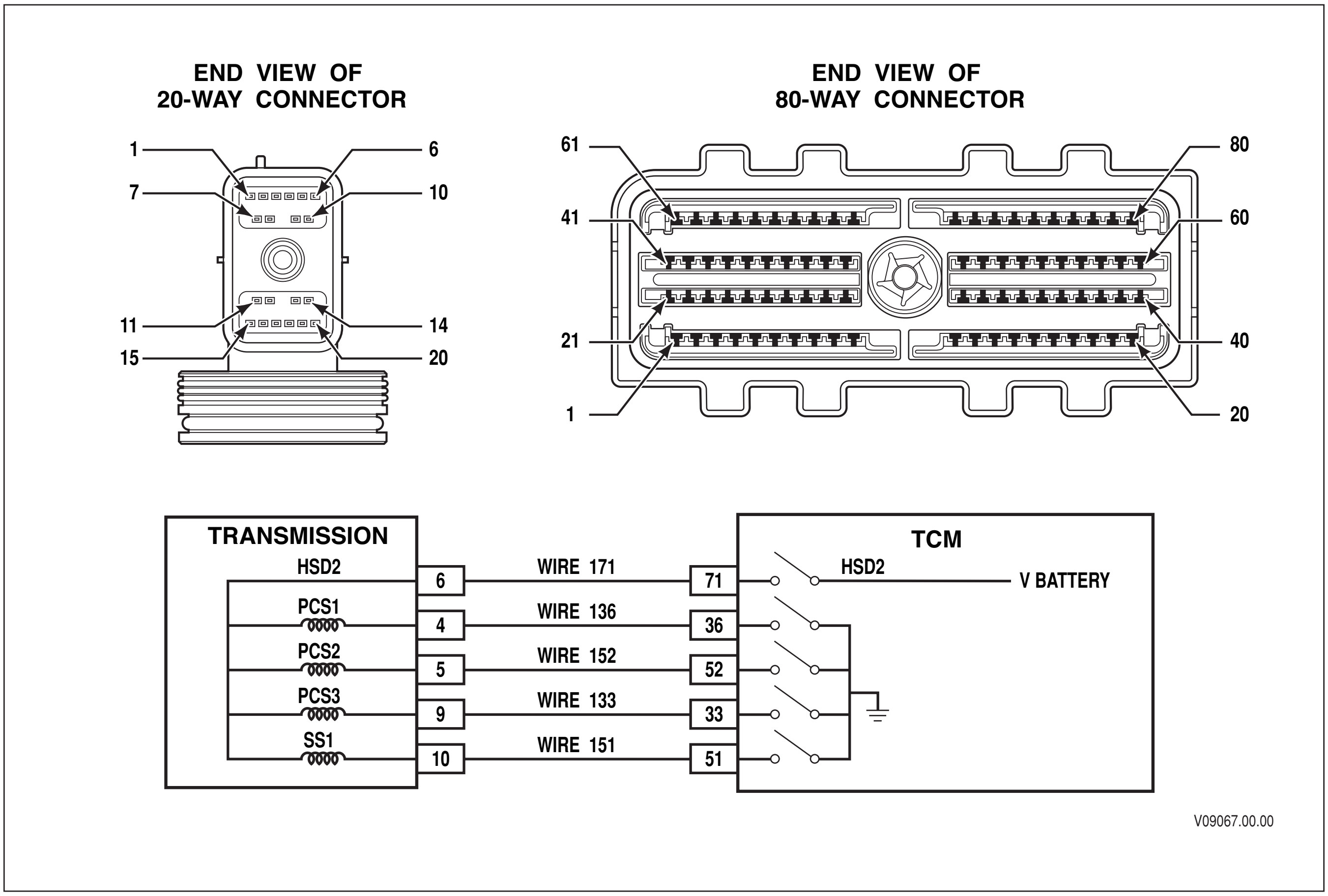
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0973 Shift Solenoid 1 (SS1) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
6	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 12*	
7	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 10 and all other pins in the 20-way connector. 4. Test for an open between pins 6 and 10. ***NOTE: The resistance value between pins 10 and 6 will read normal solenoid resistance. The resistance value between pins 10 and 4, between pins 10 and 5, and between pins 10 and 9 will be twice normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** Were any wiring defects found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 11*
8	1. Remove the hydraulic control module assembly. 2. Disconnect SS1 from the internal harness. 3. Inspect the internal harness for wire-to-wire shorts. Were any wiring defects found?		*Go to Step 8*	*Go to Step 10*
9	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 12*	
10	Replace SS1. Is the replacement complete?		*Go to Step 12*	
11	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 12*	
12	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0974 Shift Solenoid 1 (SS1) Control Circuit High



Circuit Description

Shift Solenoid 1 (SS1) is a normally closed (N/C) solenoid used to properly position the C1 and C2 logic latch valves in forward ranges. The TCM commands the solenoid ON to supply control main pressure to the C1 and C2 logic latch valves. When SS1 is commanded OFF, control main pressure is relieved from the C1 and C2 latch valves.

The TCM sends control current to SS1 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM energizes SS1 by switching the solenoid's Low Side Driver (LSD) ON. Wire 151 completes the circuit between SS1 and its LSD. DTC P0974 indicates that the TCM has detected a short-to-battery condition in the low side of SS1 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0974 is set when the TCM detects a short-to-battery in the SS1 return circuit for more than 125 milliseconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0974 Shift Solenoid 1 (SS1) Control Circuit High

Actions Taken When the DTC Sets

When DTC P0974 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0974 indicates a short-to-battery in the electrical circuit for the SS1 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF. **Note: A 1000 hertz test pulse may be present in the SS1 solenoid circuit.**

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 151 and other wires in the OEM chassis harness.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.

DTC P0974 Shift Solenoid 1 (SS1) Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem.* *Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.) ***NOTE: This DTC is intended to detect a short-to-battery condition in the SS1 electrical circuit.*** Did DTC P0974 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 171 and wire 151 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 51 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*

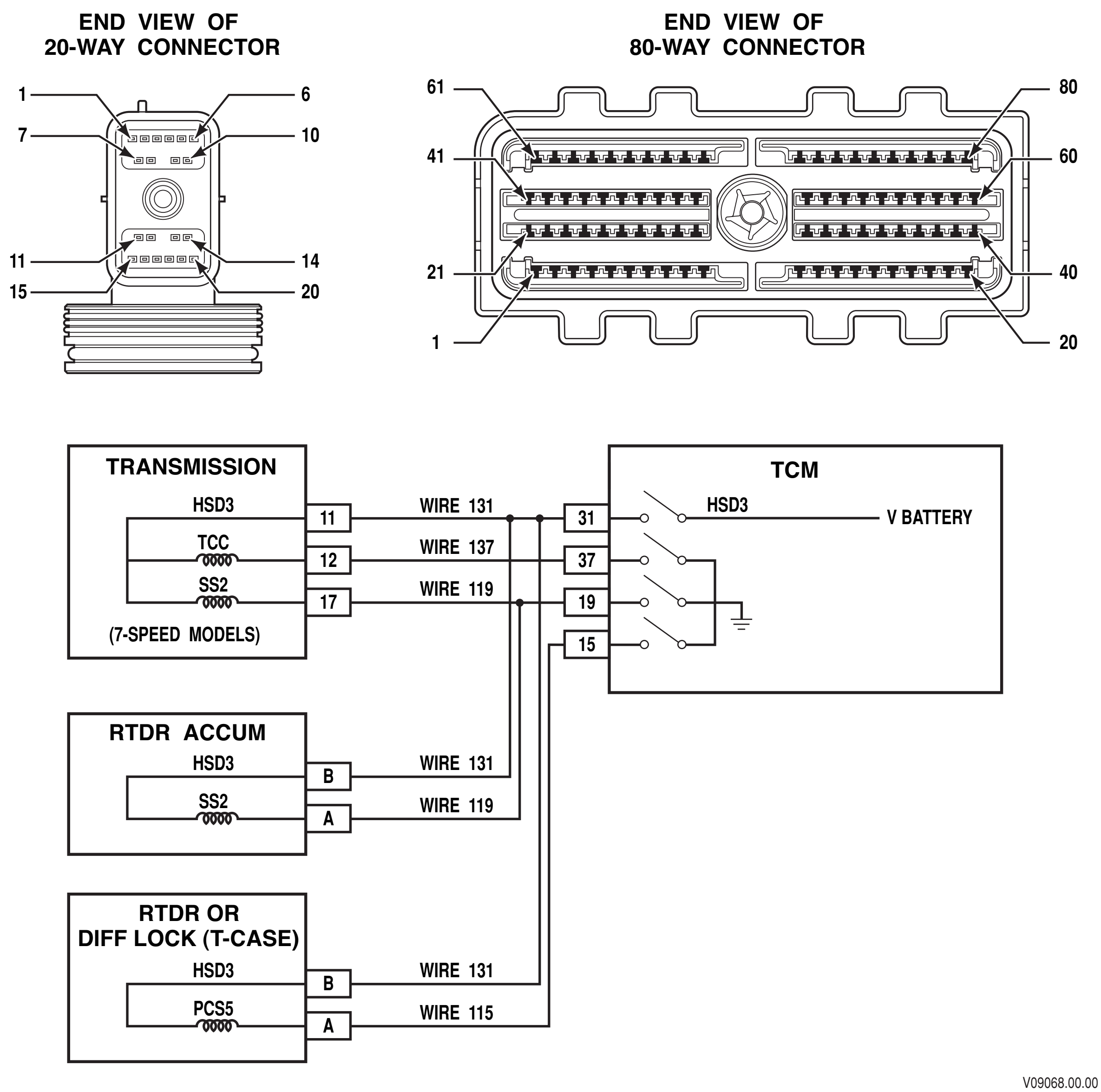
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0974 Shift Solenoid 1 (SS1) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using DVOM, test for wire-to-wire shorts between pin 10 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 10 and 6 will read normal solenoid resistance. The resistance value between pins 10 and 4, between pins 10 and 5, and between pins 10 and 9 will be twice normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts. Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace SS1. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0975 Shift Solenoid 2 (SS2) Control Circuit Open



DIAGNOSTIC TROUBLE CODES (DTC)

Circuit Description

- Shift Solenoid 2 (SS2) is a normally closed (N/C) solenoid used to either activate:
  - — The retarder accumulator air solenoid (retarder models)
  - — The C6 enable solenoid (7-speed models).
- The TCM commands the solenoid ON to supply control main pressure to SS2. When SS2 is commanded OFF, the retarder accumulator air solenoid closes in retarder units or the C6 enable valve closes in 7-speed transmissions.
- The TCM sends control current to SS2 from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM energizes SS2 by switching the solenoid's Low Side Driver (LSD) ON. Wire 119 completes the circuit between SS2 and its LSD. DTC P0975 indicates that the TCM has detected an open condition in SS2 electrical circuit. The open condition may exist in the high side (wire 131) or low side (wire 119).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0975 is set when the TCM detects an open circuit on the SS2 return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

- When DTC P0975 is active, the following will occur:
  - — The **CHECK TRANS** light illuminates.
  - — DTC is stored in TCM history.
  - — For 7-speed transmissions, the TCM allows operation in second range through sixth range, and neutral and reverse.
  - — For retarder equipped transmissions, the retarder accumulator is disabled.

Conditions for Clearing the DTC/CHECK TRANS light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0975 indicates an open in the electrical circuit for the SS2 solenoid. In addition to SS2, HSD3 also supplies power to solenoids TCC and PCS5. If DTC P0975 is accompanied by DTC P2736 and P2761, the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0975 Shift Solenoid 2 (SS2) Control Circuit Open

- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage drop caused by an open condition in either wire 131 or wire 115 of the OEM chassis harness.
6. This step tests for an open condition in the transmission internal harness or retarder accumulator solenoid harness.
7. This step tests for the proper SS2 resistance (7-speed models only).

DTC P0975 Shift Solenoid 2 (SS2) Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem. Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in the SS2 electrical circuit.*** Did DTC P0975 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0975 Shift Solenoid 2 (SS2) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install the J 47275 TCM Breakout between the OEM and TCM 80-way connector. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors, and OEM and retarder accumulator solenoid connector, if applicable. 4. Turn ON the ignition, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command SS2 ON. 6. Determine the voltage drop in the high side of the SS2 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 31 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 11 (7-speed) or pin RTDR ACCUM-B (retarder) and an isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the SS2 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 19 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 17 (7-speed) or pin RTDR ACCUM-A (retarder) and an isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	

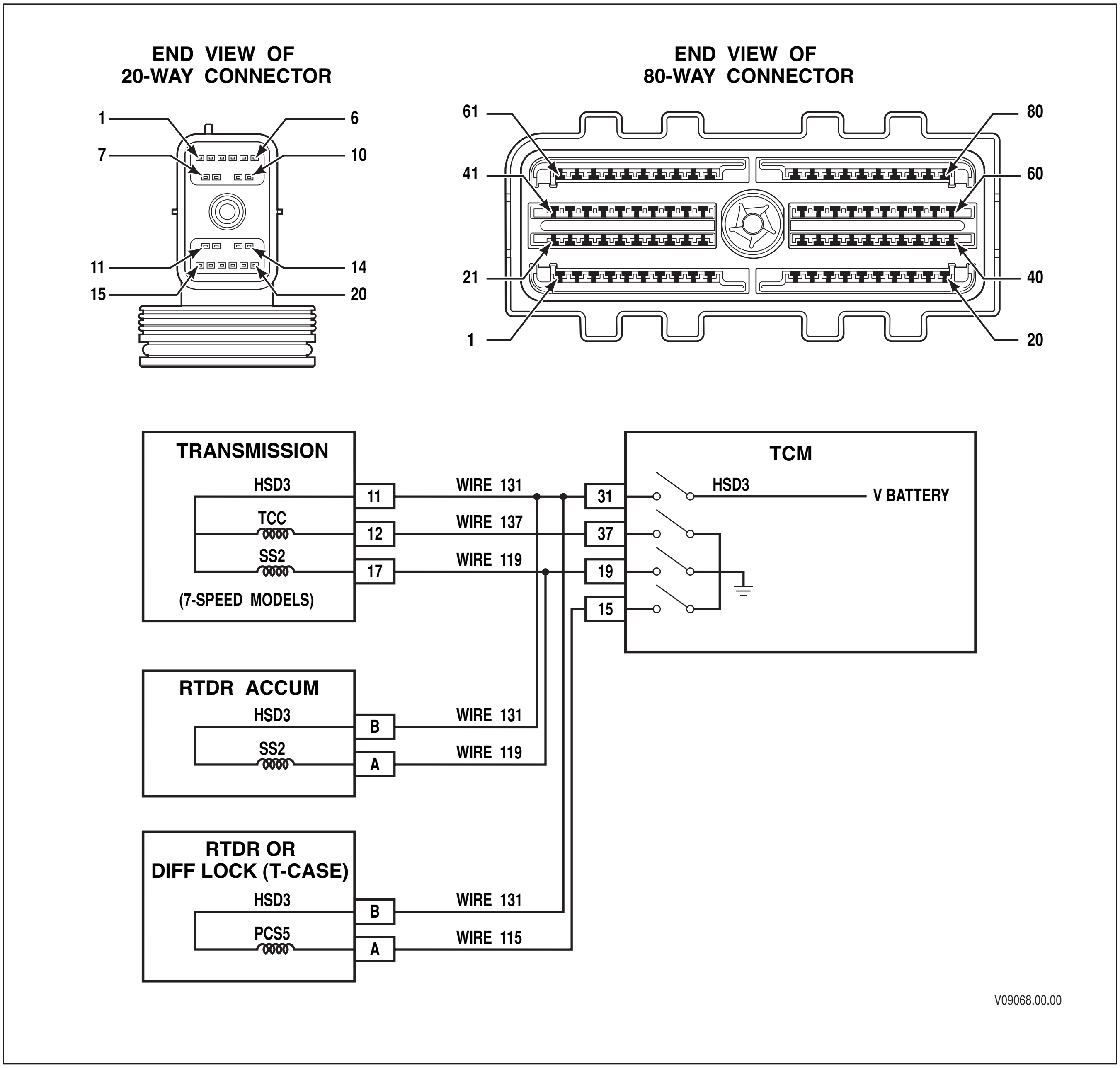
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0975 Shift Solenoid 2 (SS2) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	For 7-speed transmissions: 1. Turn OFF the ignition. 2. Disconnect the OEM 20-way connector from J 47279 Transmission Breakout. Leave the transmission-side connected. 3. Using a DVOM, measure the resistance between pin 11 and pin 17 of the transmission 20-way connector. For retarder units: 1. Disconnect the retarder accumulator SS2 connector. 2. Using a DVOM, measure the resistance between pins A and B of the retarder accumulator solenoid. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 10*	*7-speed transmissions, go to Step 7. Retarder equipped transmissions, go to Step 9.*
7	***NOTE: This step applies to 7-speed models only. For retarder models, go to Step 9.*** 1. Remove the hydraulic control module assembly. 2. Remove C6 Enable SS2. 3. Using a DVOM, measure resistance of SS2 between pins A and B. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace SS2. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0976 Shift Solenoid 2 (SS2) Control Circuit Low



Circuit Description

Shift Solenoid 2 (SS2) is a normally closed (N/C) solenoid used to either activate the retarder accumulator air solenoid (retarder models) or the C6 enable solenoid (7-speed models).

The TCM sends control current to SS2 from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM energizes SS2 by switching the solenoid's Low Side Driver (LSD) ON. Wire 119 completes the circuit between SS2 and its LSD. DTC P0976 indicates that the TCM has detected a short-to-ground condition in the low side of SS2 electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0976 Shift Solenoid 2 (SS2) Control Circuit Low

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0976 is set when the TCM detects a short-to-ground in the SS2 return circuit for more than 125 milliseconds.

Actions Taken When the DTC Sets

When DTC P0976 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM allows operation in second range through sixth range and in Neutral and Reverse.
- The TCM inhibits TCC operation.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0976 indicates a short-to-ground in the electrical circuit for the SS2 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

DIAGNOSTIC TROUBLE CODES (DTC)

- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 119.
6. This step tests for the wire-to-wire shorts or a short-to-ground in the internal transmission harness.

DTC P0976 Shift Solenoid 2 (SS2) Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem.* *Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the SS2 electrical circuit.*** Did DTC P0976 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0976 Shift Solenoid 2 (SS2) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 119 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 19 and all other pins in the 80-way connector, and shorts-to-ground between pin 19 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground wiring defects found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	

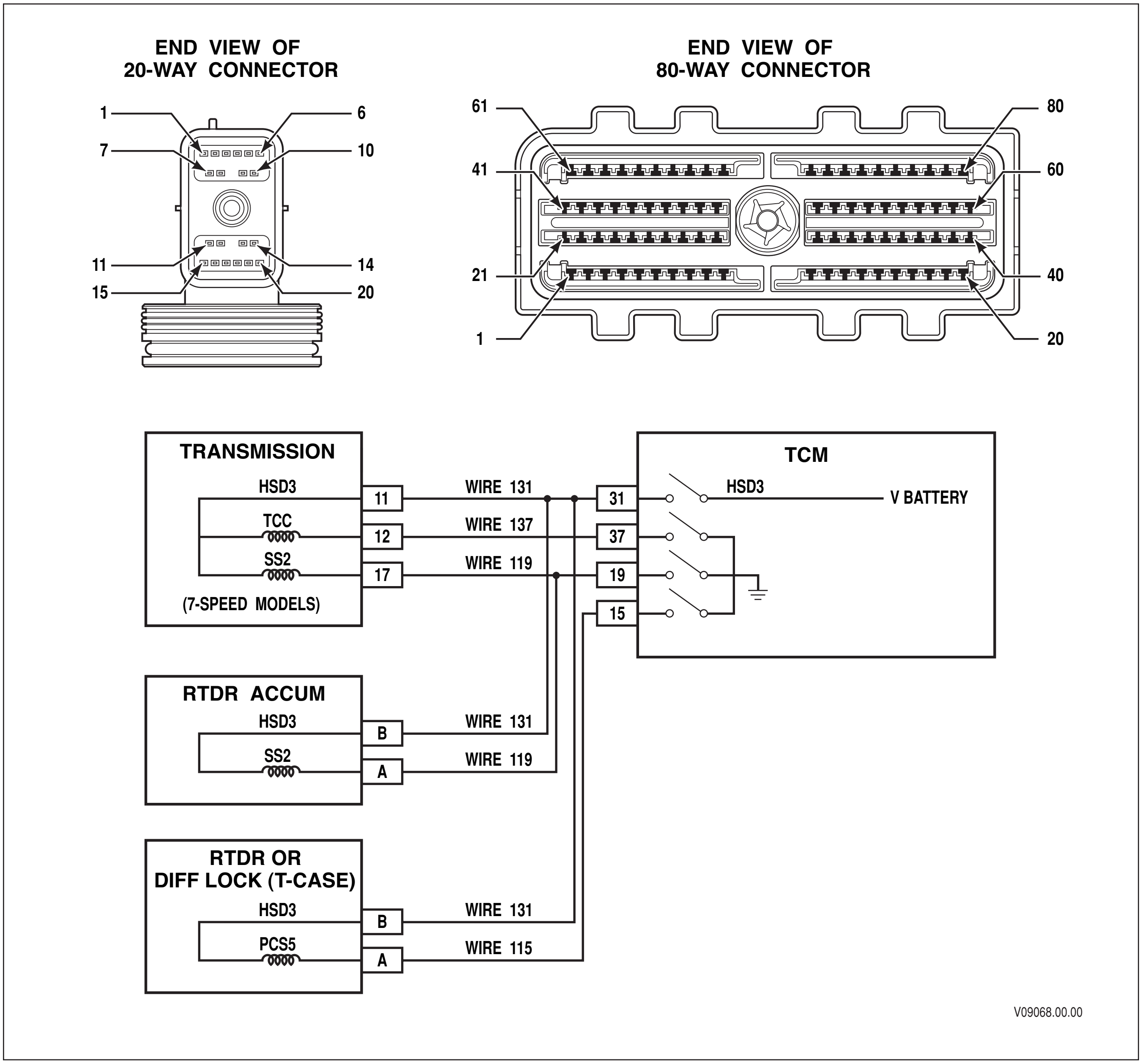
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0976 Shift Solenoid 2 (SS2) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
6	For 7-speed transmissions: 1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 17 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 17 and 11 will read normal solenoid resistance. The resistance value between 17 and 12 will be twice normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** 4. Test for shorts-to-ground between pin 17 and chassis ground. For retarder units: 1. Turn OFF the ignition. 2. Disconnect the retarder accumulator solenoid. 3. Using a DVOM, test for shorts-to-ground between pin A of SS2 and chassis ground. ***NOTE: The resistance value of SS2 (retarder accumulator) will be normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts or shorts-to-ground found?		*7-speed transmissions go to Step 7. Retarder equipped transmission go to Step 9.*	*Go to Step 10*
7	***NOTE: This step applies to 7-speed models only. For retarder models skip to Step 9.*** 1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts or shorts-to-ground. Were any wire-to-wire or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace SS2. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0977 Shift Solenoid 2 (SS2) Control Circuit High



Circuit Description

Shift Solenoid 2 (SS2) is a normally closed (N/C) solenoid used to either activate the retarder accumulator air solenoid (retarder models) or the C6 enable solenoid (7-speed models). The TCM commands the solenoid ON to supply control main pressure to SS2. When SS2 is commanded OFF, the retarder accumulator air solenoid closes in retarder units or the C6 enable valve closes in 7-speed transmissions.

The TCM sends control current to SS2 from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM energizes SS2 by switching the solenoid's Low Side Driver (LSD) ON. Wire 119 completes the circuit between SS2 and its LSD. DTC P0977 indicates that the TCM has detected a short-to-battery condition in the low side of SS2 electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0977 Shift Solenoid 2 (SS2) Control Circuit High

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P0977 is set when the TCM detects a short-to-battery in the SS2 return circuit for more than 125 milliseconds.

Actions Taken When the DTC Sets

When DTC P0977 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM allows operation in second range through sixth range and in Neutral and Reverse.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P0977 indicates a short-to-battery in the electrical circuit for the SS2 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.

DIAGNOSTIC TROUBLE CODES (DTC)

3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 119 and other wires in the OEM chassis harness.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.
10. This step tests for proper operation of the SS2 Low Side Driver.

DTC P0977 Shift Solenoid 2 (SS2) Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem.* *Go to Step 11*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-battery condition in the SS2 electrical circuit.*** Did DTC P0977 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0977 Shift Solenoid 2 (SS2) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wires 131 and 119 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 19 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	For 7-speed transmissions: 1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a digital multimeter (DVOM), test for wire-to-wire shorts between pin 17 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 17 and 11 will read normal solenoid resistance. The resistance value between pins 17 and 12 will be twice normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** For retarder equipped units: 1. Turn OFF the ignition. 2. Disconnect the retarder accumulator solenoid. 3. Using a digital multimeter (DVOM), test for wire-to-wire shorts between pin A and pin B of SS2. ***NOTE: The resistance value between pins A and B of SS2 (retarder accumulator) will be normal solenoid resistance. Refer to Solenoid Resistance chart for this value.*** Were any wire-to-wire shorts found?		*7-speed transmissions go to Step 7. Retarder equipped transmission go to Step 9.*	*Go to Step 10*

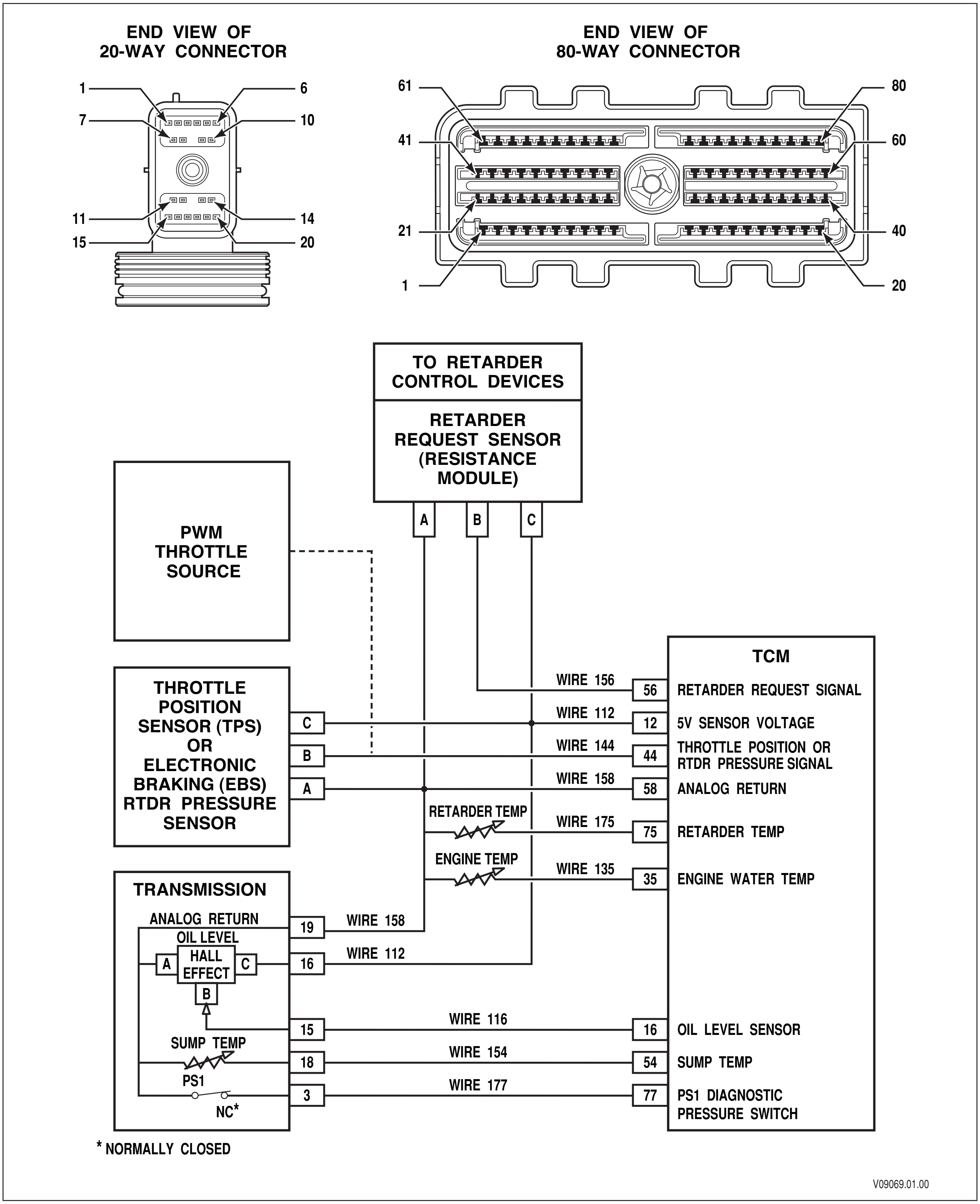
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0977 Shift Solenoid 2 (SS2) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
7	***NOTE: This step applies to 7-speed models only. Retarder models skip to Step 9.*** 1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts. Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace SS2. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0989 Retarder Pressure Sensor Failed Low



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0989 Retarder Pressure Sensor Failed Low

Circuit Description

The Transmission Control Module (TCM) can be calibrated to control retarder capacity in response to signals from an integral vehicle electronic braking system (EBS). However, the EBS controller requires accurate information about the state of the retarder. Because retarder capacity is proportional to retarder charge pressure, the TCM uses a pressure transducer located in the retarder cavity to measure the precise retarder capacity when the retarder is in operation. The TCM is connected to the pressure transducer by:

- a reference voltage wire,
- retarder request signal wire, and
- analog ground wire.

When the TCM commands more retardation, pressure in the retarder charge pressure circuit increases resulting in a larger voltage signal from the retarder pressure transducer.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- Electronic Braking is enabled in the TCM calibration.

Conditions for Setting the DTC

The TCM detects retarder pressure voltage signal equal to 0V for 10 seconds.

Actions Taken When the DTC Sets

When DTC P0989 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and retarder pressure sensor. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle and operate the retarder in order to experience a fault.

DIAGNOSTIC TROUBLE CODES (DTC)

- DTC P0989 can be caused by an open or short-to-ground in either the 5V reference wire 112 or retarder pressure sensor signal wire 144. The retarder pressure sensor shares a common 5V reference voltage wire 112 with the optional transmission oil level sensor (OLS) and retarder request sensor. An open or short-to-ground in the common 5V reference causes a “sensor failed low” code for the other devices as well. An open or short-to-ground on wire 144 will cause DTC P0989 only.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for active diagnostic codes.
3. This step tests for wire-to-wire shorts, opens, or shorts-to-ground on wires 112 and 144.
6. This step verifies the TCM is supplying proper 5V reference voltage.

DTC P0989 Retarder Pressure Sensor Failed Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTC. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the retarder pressure sensor signal is at 0V for 10 seconds. It may also indicate an open or short-to-ground in either the 5V reference wire 112 or retarder pressure sensor signal wire 144.*** Did DTC P0989 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Turn OFF the ignition. 2. Inspect the routing of the 5V reference wire 112, signal wire 144, and analog return wire 158 between the TCM and the retarder pressure sensor. 3. Disconnect the 80-way connector from the TCM. 4. Install the OEM-side of the 80-way connector to J 47275 TCM Breakout. Leave the TCM disconnected. 5. Disconnect the retarder pressure sensor from the OEM wiring harness. 6. Disconnect the transmission 20-way connector and RMR connector, if installed. 7. Test for wire-to-wire shorts, opens and shorts-to-ground on wires 112 and 144. Was chafing or wire damage found?		*Go to Step 4*	*Go to Step 5*

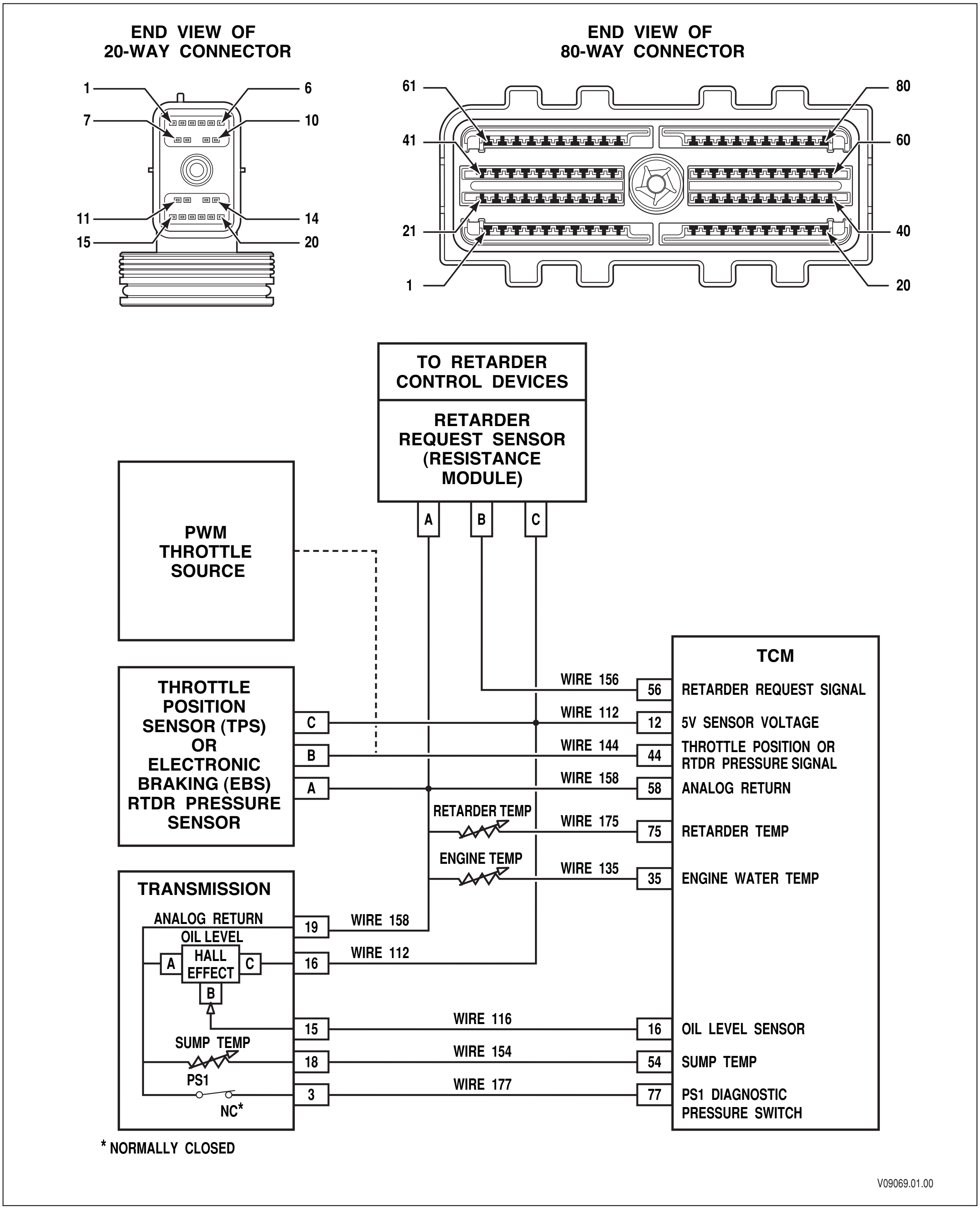
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0989 Retarder Pressure Sensor Failed Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 8*	
5	1. Remove J 47275 TCM Breakout and reconnect the TCM and OEM 80-way connector to each other. 2. Disconnect the retarder pressure sensor from the OEM harness, if not disconnected in Step 3 above. 3. Reconnect the transmission 20-way connector and RMR connector, if installed. 4. Turn ON the ignition. Leave the engine OFF. 5. Using a DVOM, measure the voltage between pin B (5V reference wire 112) and pin A (analog return wire 158) at the OEM harness retarder pressure sensor connector. Is the voltage within the specified values?	4.75–5.0V	*Go to Step 6*	*Go to Step 7*
6	Replace the retarder pressure sensor. Is the replacement complete		*Go to Step 8*	
7	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor retarder pressure. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0990 Retarder Pressure Sensor Failed High



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0990 Retarder Pressure Sensor Failed High

Circuit Description

The Transmission Control Module (TCM) can be calibrated to control retarder capacity in response to signals from an integral vehicle electronic braking system (EBS). However, the EBS controller requires accurate information about the state of the retarder. Because retarder capacity is proportional to retarder charge pressure, the TCM uses a pressure transducer located in the retarder cavity to measure the precise retarder capacity when the retarder is in operation. The TCM is connected to the pressure transducer by:

- a reference voltage wire,
- retarder pressure signal wire, and
- analog ground wire.

When the TCM commands more retardation, pressure in the retarder charge pressure circuit increases resulting in a larger voltage signal from the retarder pressure transducer.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- Electronic Braking is enabled in the TCM calibration.

Conditions for Setting the DTC

The TCM detects retarder pressure voltage signal greater than or equal to 5V for 10 seconds.

Actions Taken When the DTC Sets

When DTC P0990 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM and retarder pressure sensor. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle and operate the retarder in order to experience a fault.

DIAGNOSTIC TROUBLE CODES (DTC)

- DTC P0990 can be caused by a short-to-battery in the 5V reference wire 112 or retarder pressure sensor wire 144. DTC P0990 can also be caused by an open in analog return wire 158. The retarder pressure sensor shares a common 5V reference voltage wire 112 with the optional transmission oil level sensor (OLS) and retarder request sensor. A short-to-battery in the 5V reference wire 112 or open in analog return wire 158 causes a "sensor failed high" code for these other devices as well. A short-to-battery in retarder pressure sensor signal wire 144 will produce DTC P0990 only.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for active diagnostic codes.
3. This step tests for wire-to-wire shorts or shorts-to-battery on wires 112 and 144, and opens in wire 158.
6. This step verifies the TCM is supplying proper 5V reference voltage.

DTC P0990 Retarder Pressure Sensor Failed High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTC. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the retarder pressure sensor signal is greater than or equal to 5V for 10 seconds. It may also indicate a short-to-battery in either the 5V reference wire 112 or retarder pressure sensor signal wire 144, or an open in analog return wire 158.*** Did DTC P0990 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Turn OFF the ignition. 2. Inspect the routing of the 5V reference wire 112, signal wire 144, and analog return wire 158 between the TCM and the retarder pressure sensor. 3. Disconnect the 80-way connector from the TCM. 4. Install the OEM-side of the 80-way connector to J 47275 TCM Breakout. Leave the TCM-side disconnected. 5. Disconnect the retarder pressure sensor from the OEM wiring harness. 6. Disconnect the transmission 20-way connector and RMR connector, if installed. 7. Test for wire-to-wire shorts and shorts-to-battery in wires 112 and 144. 8. Test for an open condition in wire 158. Was chafing or wire damage found?		*Go to Step 4*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0990 Retarder Pressure Sensor Failed High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 8*	
5	1. Remove J 47275 TCM Breakout and reconnect the TCM and OEM 80-way connectors to each other. 2. Disconnect the retarder pressure sensor from the OEM harness, if not disconnected in Step 3. 3. Reconnect the transmission 20-way connector and RMR connector, if installed. 4. Turn ON the ignition. 5. Using a DVOM, measure the voltage between pin B (5V reference wire 112) and pin A (analog return wire 158) at the OEM harness retarder pressure sensor connector. Is the voltage within the specified values?	4.75–5.0V	*Go to Step 6*	*Go to Step 7*
6	Replace the retarder pressure sensor. Is the replacement complete?		*Go to Step 8*	
7	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor retarder pressure. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1739 Incorrect Low Gear Ratio

Refer to Low Range Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to determine the current commanded steady state gear ratio. The TCM then compares the known gear ratio to the calculated gear ratio for the current range.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- No shift in progress.
- Hydraulic default condition not present.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in progress.

Conditions for Setting the DTC

DTC P1739 sets when the calculated low range ratio (steady state) differs from the known Low range ratio.

Actions Taken When the DTC Sets

When DTC P1739 is active, the following conditions will occur:

- The TCM commands second range and allows operation in second range through sixth range, and in neutral and reverse.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to clear the DTC and drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time, etc. This data can be useful in reproducing failures mode where DTC was set.
- Incorrect ratio codes typically indicate mechanical problems with specific clutches for range indicated, i.e. C3 and C6 (3000 7-speed model) or C1 and C6 (4000 7-speed model) for Low range.
- An incorrect ratio DTC may indicate a mechanically failed clutch control solenoid. Check the DTC information for the specific solenoid.
- Output speed or turbine speed tone wheel damage may cause erratic speed sensor input allowing this code to set.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for proper ignition voltage.
4. This step tests for proper match between calibration gear ratio and actual gear ratio.
5. This step tests speed sensor readings.
6. This step tests for clutch slippage in Low range.
7. This step tests for clutch pressure to range clutches.
8. This step tests for evidence of clutch failure.

DTC P1739 Incorrect Low Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Start the engine. 2. Record the DTC Failure Record data. 3. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting Section 8*
4	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to appropriate speed sensor DTC*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1739 Incorrect Low Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
5	**WARNING: To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you do all of the following:** • **Put the transmission in N (Neutral).** • **Apply the parking brake and service brake.** • **Chock the wheels and take any other steps necessary to prevent the vehicle from moving.** • **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: DO NOT conduct a stall test in Low. The torque produced in Low can damage the vehicle driveline or axle.** 1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main pressure tap, and C3 and C6 (3000 7-speed only) or C1 and C6 (4000 7-speed only) pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select **D** (Drive). 6. With the engine at idle speed, select and attain the range indicated by the DTC. Turbine speed should go to zero. Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 6*
6	Read and record Main, C6, C1 (4000 7-speed only) or C3 (3000 7-speed only) clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the appropriate service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Ensure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*

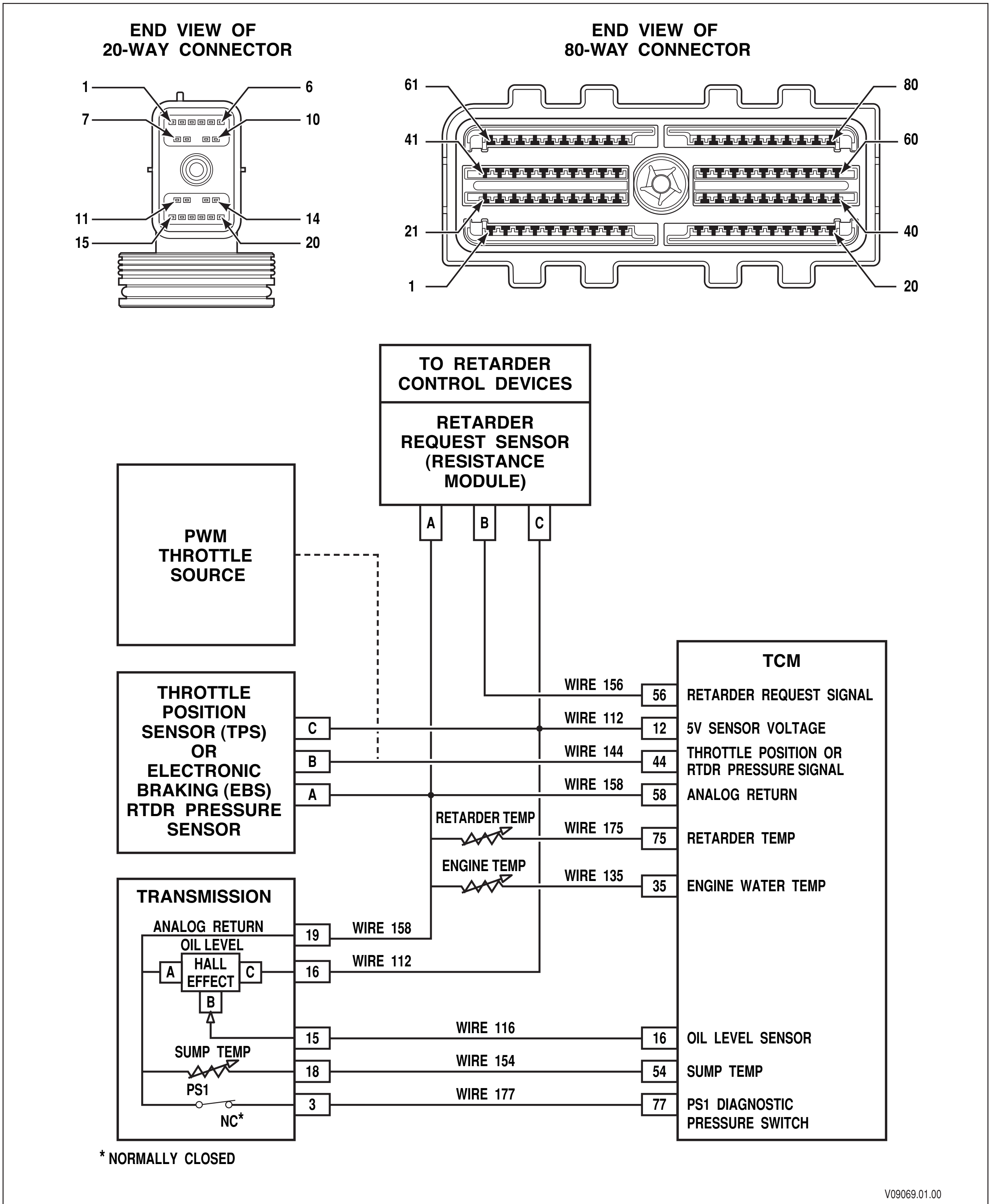
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1739 Incorrect Low Gear Ratio *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Using pressure readings obtained in Step 6 above, replace the affected solenoid. • Incorrect C1 (4000 7-speed only) pressure—PCS1 • Incorrect C3 (3000 7-speed only) pressure—PCS3 • Incorrect C6 (Both) pressure—PCS6 Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1891 Throttle Position Sensor PWM Signal Low Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1891 Throttle Position Sensor PWM Signal Low Input

Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive throttle information from a Pulse Width Modulation (PWM) signal.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- The TCM has autodetected a PWM throttle source.

Conditions for Setting the DTC

The TCM detects PWM throttle signal less than 4.9 percent for 5 seconds.

Actions Taken When the DTC Sets

When DTC P1891 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- TCM uses default throttle values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- The TCM detects the throttle source automatically during the initial series of engine starts. The TCM may have auto-detected the wrong throttle source type. Use the Allison DOC™ For PC–Service Tool to reset auto-detect or select the appropriate throttle source if PWM-type sensor is not being used.
- Inspect the wiring for poor electrical connections at the TCM and PWM throttle sensor. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.
- Advanced troubleshooting—monitor frequency on pin 44 as throttle is increased from closed throttle to wide open throttle. If frequency does not vary, the signal is bad. Have the vehicle manufacturer replace the PWM device.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper ignition voltage.
3. This step tests for operation of the PWM throttle sensor.
4. This step tests for wire-to-wire shorts, shorts-to-ground, or an open on wire 144.
6. This step inspects for damage or corrosion to the TCM and engine control module connectors.

DTC P1891 Throttle Position Sensor PWM Signal Low Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is ignition voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (refer to DTC P0882 and DTC P0883)*
3	1. Operate the throttle while monitoring Allison DOC™ For PC–Service Tool. 2. Verify the throttle source is functioning correctly? Is the PWM signal OK?		*Go to Diagnostic Aids.*	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Disconnect the 80-way connector from the TCM. 3. Install the OEM-side of the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the PWM throttle sensor connector. 5. Using a DVOM at J 47275-1 TCM Overlay, test for opens, pin-to-pin shorts, or shorts-to-ground on wire 144. Were any wiring defects found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 10*	
6	Inspect the TCM and Engine Control Module (ECM) connectors and terminals for damage and/or corrosion. Did you find a problem?		*Go to Step 7*	*Go to Step 8*
7	Repair and clean terminals if possible. Is the repair complete?		*Go to Step 10*	

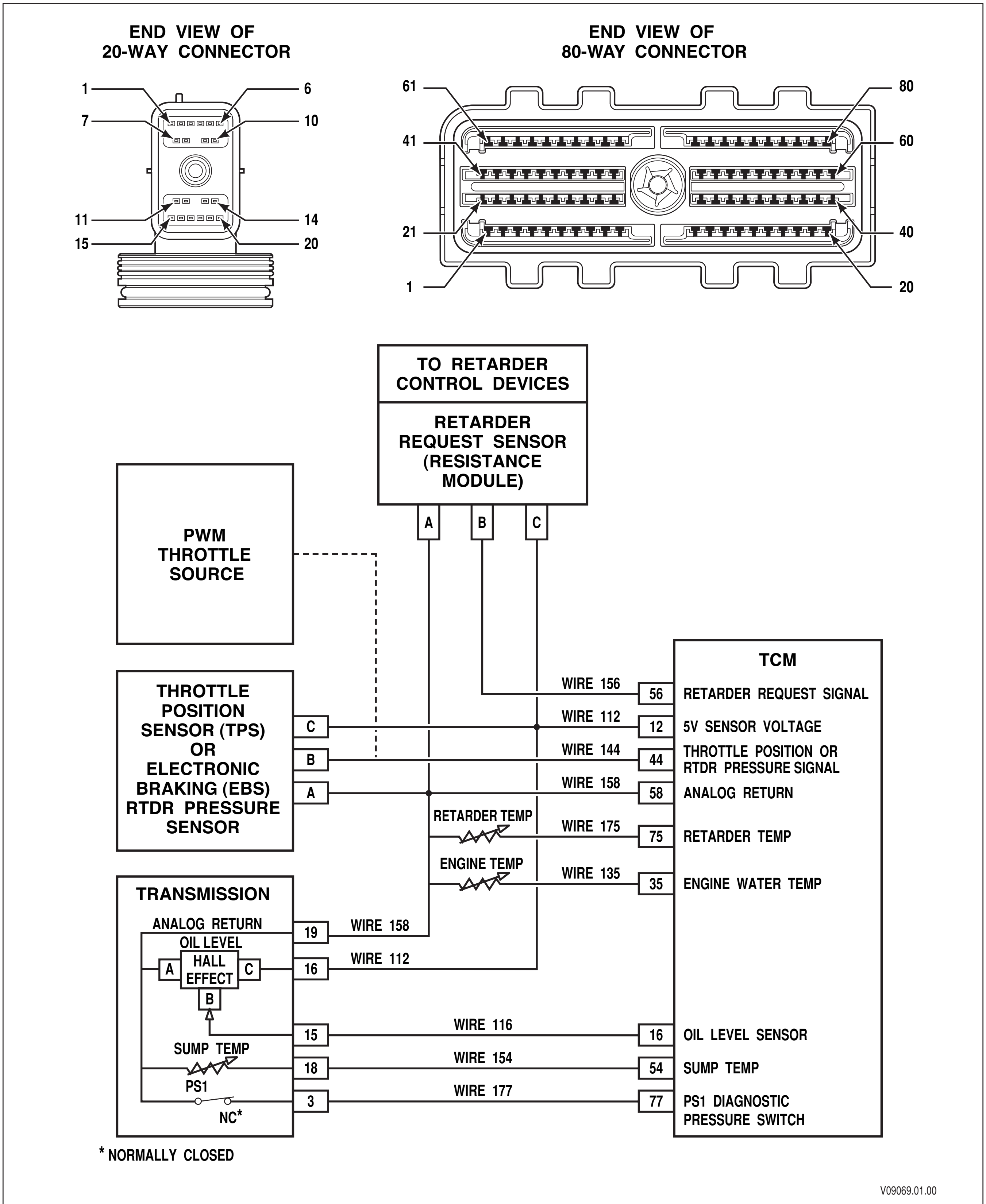
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1891 Throttle Position Sensor PWM Signal Low Input *(cont'd)*

Step	Action	Value(s)	Yes	No
8	***NOTE: The vehicle OEM has responsibility for the PWM throttle sensor. PWM throttle sensor repairs performed by Allison Transmission distributors and dealers are not covered by Allison warranty.*** Coordinate with the vehicle OEM to troubleshoot and replace the PWM throttle sensor. Did a new PWM throttle sensor correct the problem?		*Go to Step 10*	*Go to Step 9*
9	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor throttle percentage. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1892 Throttle Position Sensor PWM Signal High Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1892 Throttle Position Sensor PWM Signal High Input

Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive throttle information from a Pulse Width Modulation (PWM) signal.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- The TCM has autodetected a PWM throttle source.

Conditions for Setting the DTC

The TCM detects PWM throttle signal greater than or equal to 95.1 percent for 5 seconds.

Actions Taken When the DTC Sets

When DTC P1892 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- TCM uses default throttle values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- The TCM detects the throttle source automatically during the initial series of engine starts. The TCM may have auto-detected the wrong throttle source type. Use the Allison DOC™ For PC–Service Tool to reset auto-detect or select the appropriate throttle source if PWM-type sensor is not being used.
- Inspect the wiring for poor electrical connections at the TCM and PWM throttle sensor. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.
- Advanced troubleshooting—monitor frequency on pin 44 as throttle is increased from closed throttle to wide open throttle. if frequency does not vary, the signal is bad. Have the vehicle manufacturer replace the PWM device.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper ignition voltage.
3. This step tests for operation of the PWM throttle sensor.
4. This step tests for wire-to-wire shorts, shorts-to-ground, or an open on wire 144.
6. This step inspects for damage or corrosion to the TCM and engine control module connectors.

DTC P1892 Throttle Position Sensor PWM Signal High Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is ignition voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (refer to DTC P0882 and DTC P0883)*
3	1. Operate the throttle while monitoring Allison DOC™ For PC–Service Tool. 2. Verify the throttle source is functioning correctly? Is the PWM signal OK?		*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Turn OFF the ignition. 2. Disconnect the 80-way connector from the TCM. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the PWM throttle sensor connector. 5. Using a DVOM at J 47275-1 TCM Overlay, test for opens, pin-to-pin shorts, or shorts-to-ground on wire 144. Were any wiring defects found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 10*	
6	Inspect the TCM and Engine Control Module (ECM) connectors and terminals for damage and/or corrosion. Did you find a problem?		*Go to Step 7*	*Go to Step 8*
7	Repair and clean terminals if possible. Is the repair complete?		*Go to Step 10*	

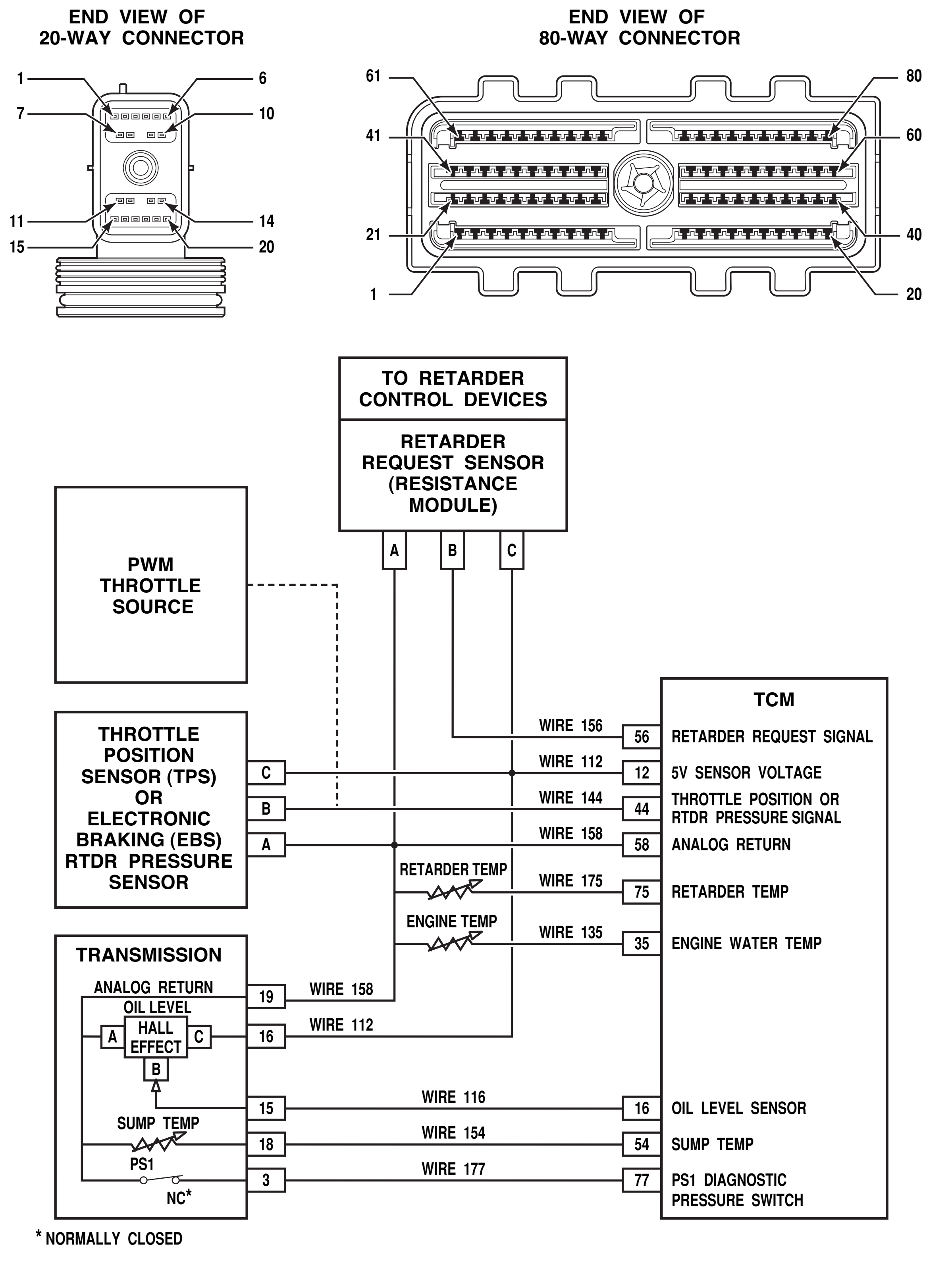
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1892 Throttle Position Sensor PWM Signal High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
8	***NOTE: The vehicle OEM has responsibility for the PWM throttle sensor. PWM throttle sensor repairs performed by Allison Transmission distributors and dealers are not covered by Allison warranty.*** Coordinate with the vehicle OEM to troubleshoot and replace the PWM throttle sensor. Did a new PWM throttle sensor correct the problem?		*Go to Step 10*	*Go to Step 9*
9	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor throttle percentage. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2184 Engine Coolant Temperature Sensor Circuit Low Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2184 Engine Coolant Temperature Sensor Circuit Low Input

Circuit Description

The Transmission Control Module (TCM) receives an input from an engine coolant temperature sensor. The TCM supplies a 5V reference voltage signal into a voltage-sensing network that is connected to one side of the engine coolant temp sensor via wire 135. The other side of the temp sensor is connected to the TCM analog ground wire 158.

The resistance value of the engine coolant temperature sensor determines the voltage drop in the engine coolant temp sensor circuit. As resistance changes, the voltage drop across the temp sensor circuit will also change varying the sensor input voltage on wire 135. The TCM uses engine coolant temperature information to restrict retarder operation when an engine coolant over-heat condition is detected.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- The TCM has autodetected the following:
  - — Retarder
  - — Analog engine coolant temperature sensor
  - — PWM retarder request source.
- The "Retarder reduction and preselect based on engine coolant temperature" feature is enabled in the calibration.

Conditions for Setting the DTC

The TCM detects engine coolant temperature greater than a calibrated value for more than 10 seconds.

Actions Taken When the DTC Sets

When DTC P2184 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- The TCM uses default engine coolant values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2184 may be caused by a short-to-ground on wire 135.
- Review Appendix A for diagnosing intermittent electrical conditions.
- Inspect the wiring for poor electrical connections at the TCM and engine coolant temp sensor. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper ignition voltage.
3. This step verifies which condition has set the DTC P2184.
4. This step tests for the proper 5V reference voltage at TCM.
5. This step tests for wire-to-wire shorts, shorts-to-ground, or an open in wires 135 (engine coolant temp) and wire 112 (5V reference).

DTC P2184 Engine Coolant Temperature Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record failure record. 4. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is ignition voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (refer to DTC P0882 and DTC P0883)*
3	1. Clear the DTCs. 2. Monitor the engine coolant temperature on Allison DOC™ For PC–Service Tool. 3. Drive the vehicle and observe Allison DOC™ For PC–service tool for an unrealistically high temperature condition. Is the Allison DOC™ For PC–Service Tool transmission fluid temperature greater than 174.11°C (345.4°F)?	>174.11°C (345.4°F)	*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout at the TCM. 3. Disconnect the engine coolant temp sensor connector. 4. Turn ON the ignition. 5. At J 47275-1 TCM Overlay connect a DVOM and measure voltage between pins 35 and 58. Is the voltage within the specified value?	4.75 to 5.0V	*Go to Step 7*	*Go to Step 5*

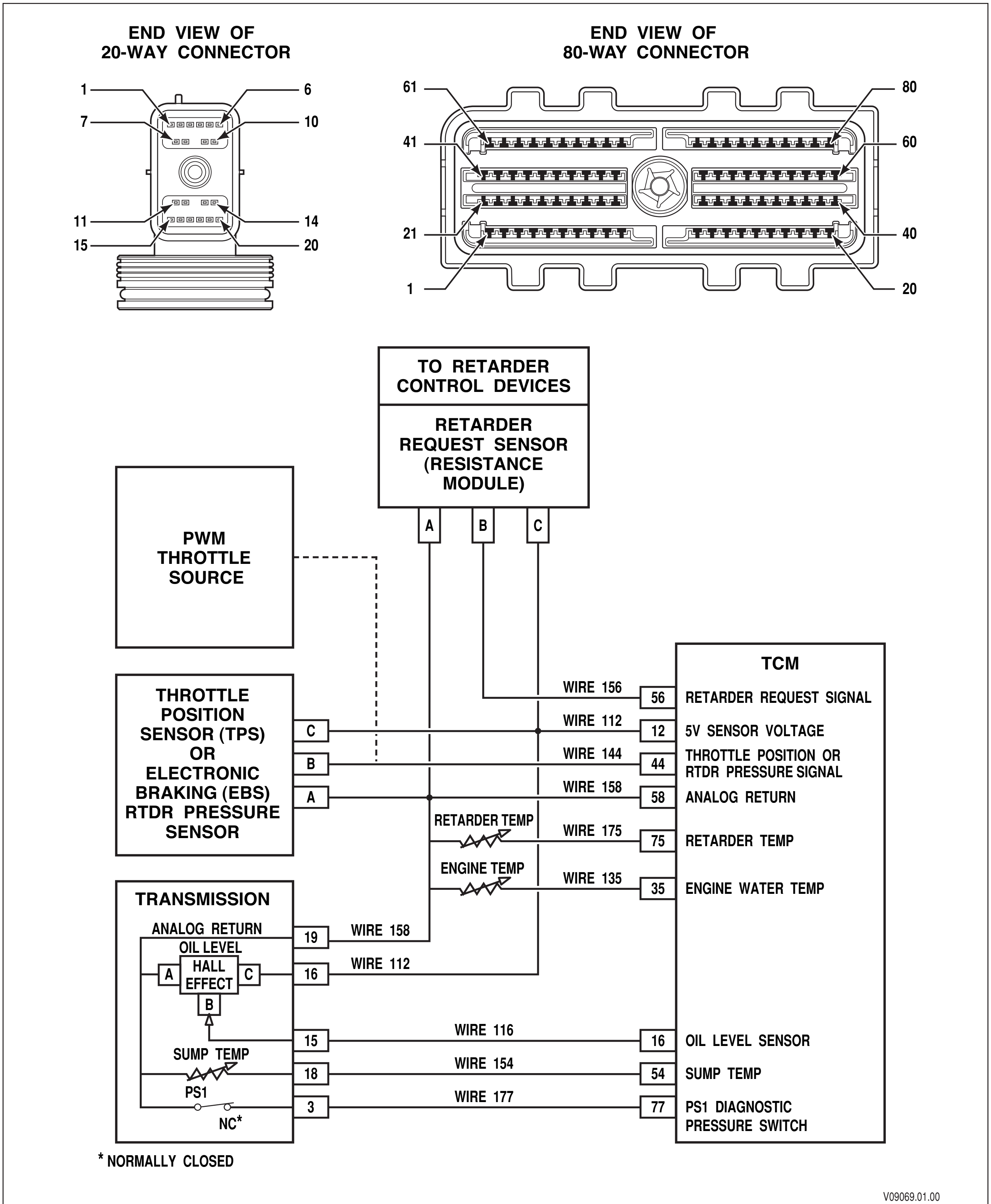
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2184 Engine Coolant Temperature Sensor Circuit Low Input *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect J 47275 TCM Breakout from the TCM. Leave the OEM-side connected. 3. Disconnect the engine coolant temp sensor connector, if not disconnected in Step 4. 4. Using a DVOM at J 47275-1 TCM Overlay, test for pin-to-pin shorts, or shorts-to-ground, at pin 35. Were any wiring defects found?		*Go to Step 6*	*Go to Step 8*
6	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 9*	
7	***NOTE: The vehicle OEM has responsibility for the engine coolant temp sensor. Engine coolant temperature sensor repairs performed by Allison Transmission distributors and dealers are not covered by Allison warranty.*** Coordinate with the vehicle OEM to troubleshoot and replace the engine coolant temp sensor. Is replacement complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor the engine coolant temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant change in engine coolant temperature. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2185 Engine Coolant Temperature Sensor Circuit High Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2185 Engine Coolant Temperature Sensor Circuit High Input

Circuit Description

The Transmission Control Module (TCM) receives an input from an engine coolant temperature sensor. The TCM supplies a 5V reference voltage signal into a voltage-sensing network that is connected to one side of the engine coolant temp sensor via wire 135. The other side of the temp sensor is connected to the TCM analog ground wire 158.

The resistance value of the engine coolant temp sensor determines the voltage drop in the engine coolant temp sensor circuit. As resistance changes, the voltage drop across the temp sensor circuit will also change varying the sensor input voltage on wire 135.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- The TCM has autodetected the following:
  - — Retarder
  - — Analog engine coolant temperature sensor
  - — PWM retarder request source.
- The "Retarder reduction and preselect based on engine coolant temperature" feature is enabled in the calibration.

Conditions for Setting the DTC

The TCM detects engine coolant temperature less than or equal to a calibrated value for more than 2.5 seconds.

Actions Taken When the DTC Sets

When DTC P2185 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- The TCM uses default engine coolant values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2185 may be caused by an open on wire 135 or 158.
- DTC P2185 may be caused by a short-to-battery on wire 135. If DTC P2185 is accompanied by a DTC P0713 and/or P2743, the problem is likely a short-to-battery on wire 154, wire 135, or wire 175.
- Review Appendix A for diagnosing intermittent electrical fault conditions.
- Inspect the wiring for poor electrical connections at the TCM and engine coolant temp sensor. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level and condition.
3. This step verifies which condition has set the DTC P2185.
4. This step tests for the proper 5V reference voltage at TCM.
5. This step tests for wiring defects in the OEM chassis harness.

DTC P2185 Engine Coolant Temperature Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record failure record. 4. Using Allison DOC™ For PC–Service Tool, measure ignition voltage. Is ignition voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (refer to DTC P0882 and DTC P0883)*
3	1. Clear the DTCs. 2. Monitor the engine coolant temperature on Allison DOC™ For PC–Service Tool. 3. Drive the vehicle and observe Allison DOC™ For PC–Service Tool for an unrealistically low temperature condition. Is the Allison DOC™ For PC–Service Tool engine coolant temperature less than or equal to –42°C (–43.75°F)?	≤–42°C (–43.75°F)	*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout at the TCM. 3. Disconnect the engine coolant temp sensor connector. 4. Turn ON the ignition. 5. At J 47275-1 TCM Overlay connect a DVOM and select the volts-DC scale. 6. Measure voltage between pin 35 and an isolated ground. Is the voltage within the specified value?	4.75 to 5.0V	*Go to Step 7*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2185 Engine Coolant Temperature Sensor Circuit High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Disconnect the engine coolant temperature sensor, if not disconnected in Step 4. 4. Disconnect the transmission 20-way connector and retarder temperature sensor. 5. Using a DVOM at J 47275-1 TCM Overlay, test for opens in wires 135 and 158. 6. Also test for wire-to-wire shorts, or shorts-to-battery on wire 135, wire 154, or wire 175. Were any wiring defects found?		*Go to Step 6*	*Go to Step 8*
6	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 9*	
7	***NOTE: The vehicle OEM has responsibility for the engine coolant temp sensor. Engine coolant temperature sensor repairs performed by Allison Transmission distributors and dealers are not covered by Allison warranty.*** Coordinate with the vehicle OEM to troubleshoot and replace the engine coolant temp sensor. Is replacement complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor the engine coolant temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant change in engine coolant temperature. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2637 Torque Management Feedback Signal (SEM)

No Schematic for this DTC

Circuit Description

Shift Energy Management (SEM) allows the Transmission Control Module (TCM) to request torque reduction from the engine controller. By reducing torque, shifts can be made quicker, at a more consistent output torque which reduces clutch temperatures and increases clutch life.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm but less than 7500 rpm for 5 seconds.
- SEM is enabled in the calibration.

Conditions for Setting the DTC

DTC P2637 sets when the TCM detects one of the following conditions for a minimum of four up shifts (consecutive or non-consecutive) during one drive cycle:

- Engine ECM is not responding to SEM torque reduction signal request from the TCM.
- A non-approved J1939 device is interfering with the SEM torque reduction signal request.

Actions Taken When the DTC Sets

When DTC P2637 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- SEM operation is not active.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the actual engine torque follows TCM commanded torque for 20 consecutive up-shifts in the same ignition cycle.

Diagnostic Aids

It will be necessary to drive the vehicle with heavy to moderate throttle settings for at least four up-shift cycles in order to set a DTC P2637.

When a DTC P2637 is set with a P0614, start troubleshooting with P0614 first. This combination of DTCs indicates that AUTOSELECT was active and engine software is not correct.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for presence of DTC P0614.
3. This step tests for proper ECM SEM torque request response.
4. This step tests to identify the device causing the torque request to be ignored.
5. This step tests for the offending device by removing it from the J1939 network.
6. This step tests for the presence of proper engine controller software.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2637 Torque Management Feedback Signal (SEM)

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	If DTC P0614 is present, troubleshoot and resolve before going to the next step.		*Go to DTC P0614 and resolve before proceeding to Step 3*	*Go to Step 3*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition. 3. Refer to the SEM torque reduction status in SEM/LRTP AUTODECT INFO display of Allison DOC™ For PC–Service Tool. Does Allison DOC™ For PC–Service Tool indicate the ECM response to SEM torque reduction as **INCORRECT**?	Allison DOC™ diagnostic tool indicates “correct response” or “incorrect response”	*Go to Step 6*	*Go to Step 4*
4	Use Allison DOC™ For PC–Service Tool to identify an unapproved SEM torque reduction device. Is the unapproved device one of the following? 1. Engine or transmission? 2. Null Address (N/A) or All/Any (info not valid)?	Allison DOC™ diagnostic tool shows the actual device at fault	*Go to Step 6*	*Go to Step 5*
5	1. If Allison DOC™ For PC–Service Tool is indicating another device such as brakes, cruise control, headway controller etc., inspect the controller for the device indicated. 2. If possible eliminate the device by disconnecting it from the J1939 CAN backbone. ***NOTE: It may be possible that the device causing the interruption is only triggered under certain circumstances. For example, a brake controller may only send commands under certain road conditions. Since these conditions may not be easily repeatable, replacement with a known good controller may be the only way to verify the failure.*** 3. If necessary to confirm the failure, test the system with a known good controller. Was the device causing the problem replaced or repaired?		*Go to Step 7*	
6	1. Verify that compatible engine controller software is being used. 2. If the software is correct, turn the vehicle over to the engine manufacturer to replace the engine controller. 3. If neither solves the problem, use an engine torque/power rating that does not require SEM. Was the software updated or engine controller replaced?		*Go to Step 7*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2637 Torque Management Feedback Signal (SEM) *(cont'd)*

Step	Action	Value(s)	Yes	No
7	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. Clear the DTC. 3. Drive the vehicle under moderate to heavy throttle setting for at least four up shift cycles. 4. Attempt to duplicate conditions when DTC was set (cruise control, headway controls, ABS, etc.). Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2641 Torque Management Feedback Signal (LRTP)

No Schematic for this DTC

Circuit Description

Lower Range Torque Protection (LRTP) protects the transmission during low vehicle speed conditions. When an engine torque rating exceeds a predetermined value, LRTP limits engine torque in lower ranges to protect the transmission from damage during a converter stall condition.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm but less than 7500 rpm for 5 seconds.
- LRTP is enabled in the calibration.

Conditions for Setting the DTC

DTC P2641 sets when the TCM detects one of the following conditions for a minimum of four up shifts (consecutive or non-consecutive) during one drive cycle:

- Engine ECM is not responding to LRTP torque reduction signal request from the TCM.
- A non-approved J1939 device is interfering with the LRTP torque reduction signal request.

Actions Taken When the DTC Sets

When DTC P2641 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- LRTP operation is not active.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

It may be necessary to drive the vehicle in order to set a DTC P2641.

When a DTC P2641 is set with a P0614, start troubleshooting with P0614 first. This combination of DTCs indicates that AUTOSELECT was still active and the engine software is not correct.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the presence of DTC P0614.
3. This step tests for proper ECM LRTP torque request response.
4. This step tests to identify the device causing the torque request to be ignored.
5. This step tests for the offending device by removing it from the J1939 network.
6. This step tests for the presence of proper engine controller software.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2641 Torque Management Feedback Signal—LRTP

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	If DTC P0614 is present, troubleshoot and resolve before going to the next step.		*Go to DTC P0614 and resolve before proceeding to Step 3*	*Go to Step 3*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition. 3. Refer to LRTP torque reduction status in SEM/ LRTP AUTODETECT INFO display of Allison DOC™ For PC–Service Tool. Does Allison DOC™ For PC–Service Tool indicate the ECM response to LRTP torque reduction as **INCORRECT**?	Allison DOC™ diagnostic tool indicates "correct response" or "incorrect response"	*Go to Step 6*	*Go to Step 4*
4	Use Allison DOC™ For PC–Service Tool to identify an unapproved LRTP torque reduction device. Is the unapproved device one of the following? 1. Engine? 2. Null Address (N/A) or All/Any (info not valid)?	Allison DOC™ For PC–Service Tool shows the actual device at fault	*Go to Step6*	*Go to Step 5*
5	1. If Allison DOC™ For PC–Service Tool is indicating another device such as brakes, cruise control, headway controller etc., inspect the controller for the device indicated. 2. If possible eliminate the device by disconnecting it from the J1939 CAN backbone. ***NOTE: It may be possible that the device causing the interruption is only triggered under certain circumstances. For example, a brake controller may only send commands under certain road conditions. Since these conditions may not be easily repeatable, replacement with a known good controller may be the only way to verify the failure.*** 3. If necessary to confirm the failure, test the system with a known, good controller. Was the device causing the problem replaced or repaired?		*Go to Step 7*	
6	1. Verify that compatible engine controller software is being used. 2. If the software is correct, turn the vehicle over to the engine manufacturer to replace the engine controller. 3. If neither solves the problem, use an engine torque/power rating that does not require LRTP. Was the software updated or engine controller replaced?		*Go to Step 7*	

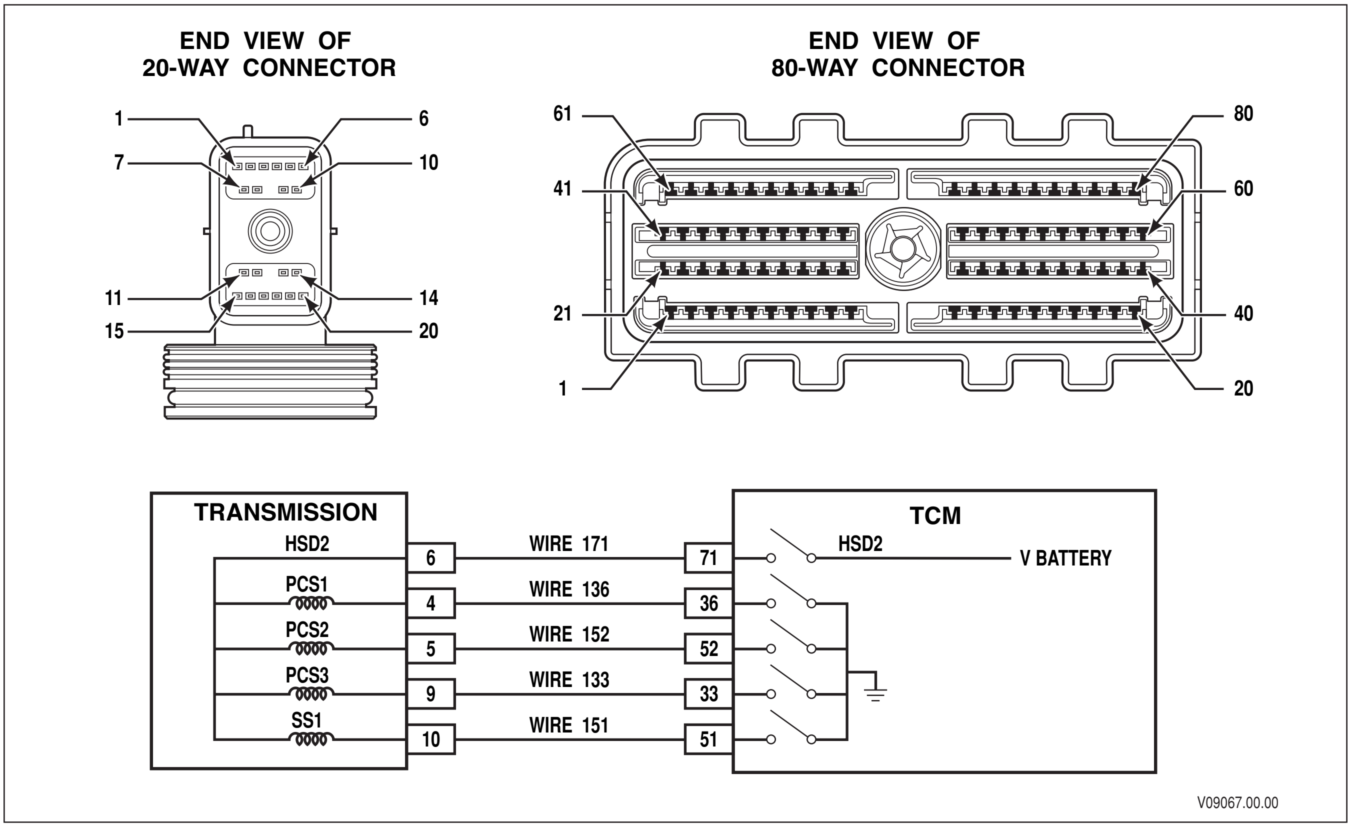
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2641 Torque Management Feedback Signal—LRTP *(cont'd)*

Step	Action	Value(s)	Yes	No
7	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. Clear the DTC. 3. Drive the vehicle. Refer to Allison DOC™ For PC–Service Tool "Test Passed" section and confirm the test was run. 4. Attempt to duplicate the conditions when the DTC was set (loads, grades, road conditions). Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2670 Actuator Supply Voltage 2 (HSD2) Low



Circuit Description

High Side Driver 2 (HSD2) supplies battery voltage to the PCS1, PCS2, PCS3, and SS1 solenoids via wire 171. HSD2 is continuously ON during normal operation except during brief circuit tests. The TCM regulates control current to the solenoids by switching the appropriate Low Side Driver (LSD) ON and OFF. DTC P2670 indicates the TCM has detected a supply voltage in the HSD2 circuit of 6V or less. DTC P2670 could be caused by a short-to-ground in the high side wiring attached to HSD2 (wire 171).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- HSD2 is commanded ON.
- Engine speed greater than 200 rpm.

Conditions for Setting the DTC

DTC P2670 is set when the TCM detects a low voltage condition (less than 6V) in three solenoids in the HSD2 circuit.

Actions Taken When the DTC Sets

When DTC P2670 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2670 Actuator Supply Voltage 2 (HSD2) Low

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  — A bent terminal
  — A backed-out terminal
  — A damaged terminal
  — Poor terminal tension
  — A chafed wire
  — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for a wire-to-wire short, or short-to-ground in the wire 171 of the OEM chassis harness.
6. This step tests for wiring defects in the transmission internal harness.

DTC P2670 Actuator Supply Voltage 2 (HSD2) Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2670 Actuator Supply Voltage 2 (HSD2) Low *(cont'd)*

Step	Action	Value(s)	Yes	No
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the HSD2 electrical circuit.*** Did DTC P2670 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the 80-way connectors at the TCM. 3. Install the OEM-side of the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the OEM-side 20-way connector from the transmission. 5. Inspect the routing of wire 171 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 71 and all other pins in the 80-way connector, and test for shorts-to-ground between pin 71 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the chassis harness. Is the repair complete?		*Go to Step 9*	
6	1. Turn OFF the ignition. 2. Install the transmission 20-way connector to the J 47279 Transmission Breakout. Leave the OEM-side disconnected. 3. Using a DVOM at J 47279-1 Transmission Overlay, test for wire-to-wire shorts between pin 6 and all other pins in the 20-way connector, and shorts-to-ground between pin 6 and chassis ground. ***NOTE: The resistance value between pins 6 and 4, between pins 6 and 5, between pins 6 and 9, and between pins 6 and 10 will read normal solenoid resistance.*** Were any opens, wire-to-wire shorts or shorts-to-ground found?		*Go to Step 7*	*Go to Step 8*

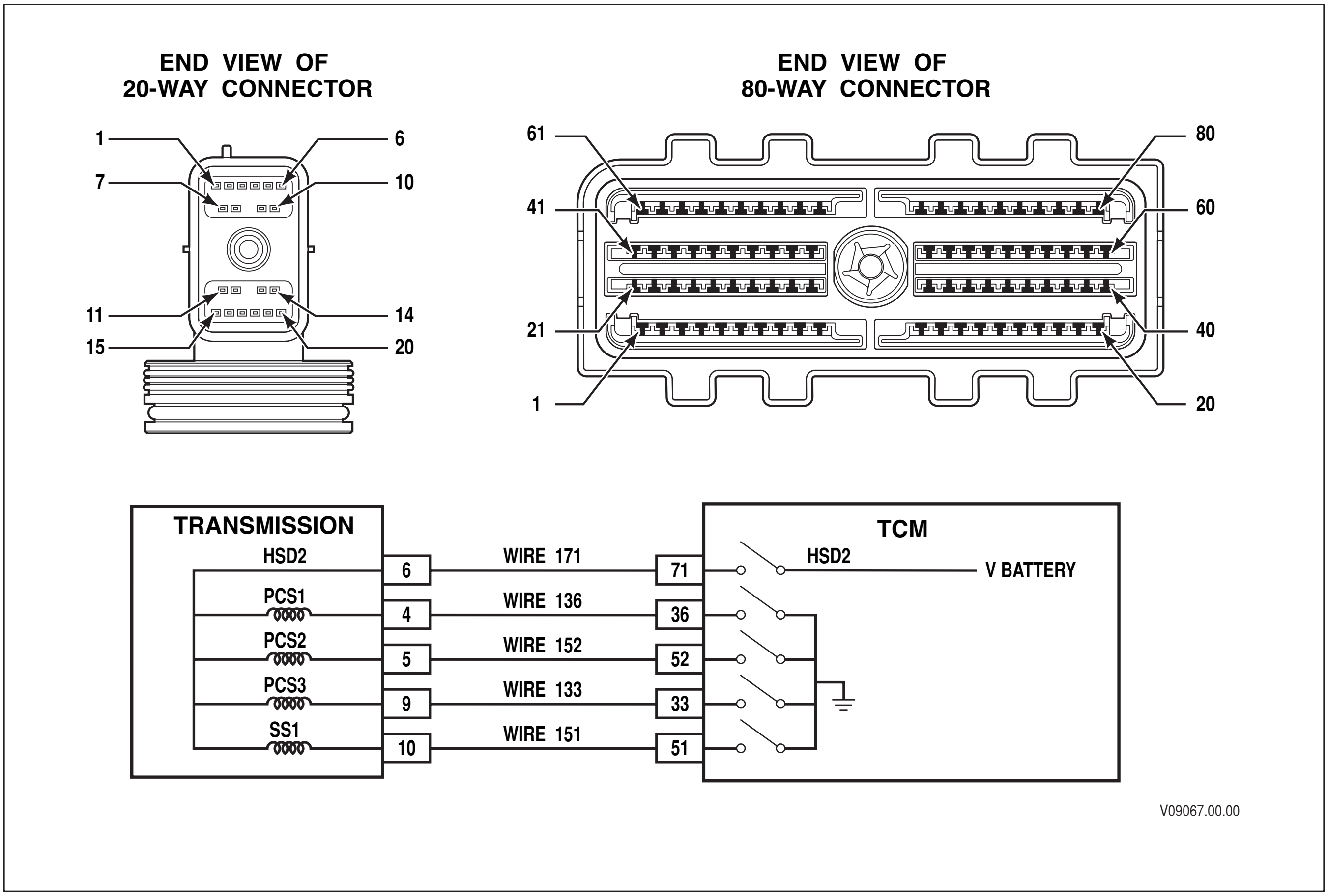
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2670 Actuator Supply Voltage 2 (HSD2) Low *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the hydraulic control module assembly. 2. Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM Diagnostic Procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2671 Actuator Supply Voltage 2 (HSD 2) High



Circuit Description

High Side Driver 2 (HSD2) supplies battery voltage to the PCS1, PCS2, PCS3, and SS1 solenoids via wire 171. HSD2 is continuously ON during normal operation except during brief circuit tests. The TCM regulates control current to the solenoids by switching the appropriate Low Side Driver (LSD) ON and OFF. DTC P2671 indicates the TCM has detected greater than or equal to 6V in the HSD2 circuit when HSD2 is OFF during TCM initialization. DTC P2671 could be caused by an open or short-to-battery in the high side wiring attached to HSD2 (wire 171).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- HSD2 is commanded ON.
- Engine speed greater than 200 rpm.

Conditions for Setting the DTC

DTC P2671 is set when the TCM detects a high voltage condition (> 6V) in the HSD2 circuit after two solenoids indicate a failure.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2671 Actuator Supply Voltage 2 (HSD 2) High

Actions Taken When the DTC Sets

When DTC P2671 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for an open in wire 171 of OEM chassis harness.
5. This step tests for a wire-to-wire short, or short-to-battery in the wire 171 of the OEM chassis harness.
7. This step tests for wiring defects in the transmission internal harness.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2671 Actuator Supply Voltage 2 (HSD2) High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open or short-to-battery condition in the HSD2 electrical circuit.*** Did DTC P2671 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Install the J 47275 TCM Breakout at the TCM 80-way connector. 3. Install J 47275 TCM Breakout at the transmission 20-way connector. 4. Turn ON the ignition, leave the engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command PCS3 ON. 6. Determine the voltage drop in the HSD2 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 71 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 6 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V indicates an excessive voltage loss in the OEM harness.*** Did the high-side voltage drop exceed 0.5VDC?		*Go to Step 6*	*Go to Step 5*

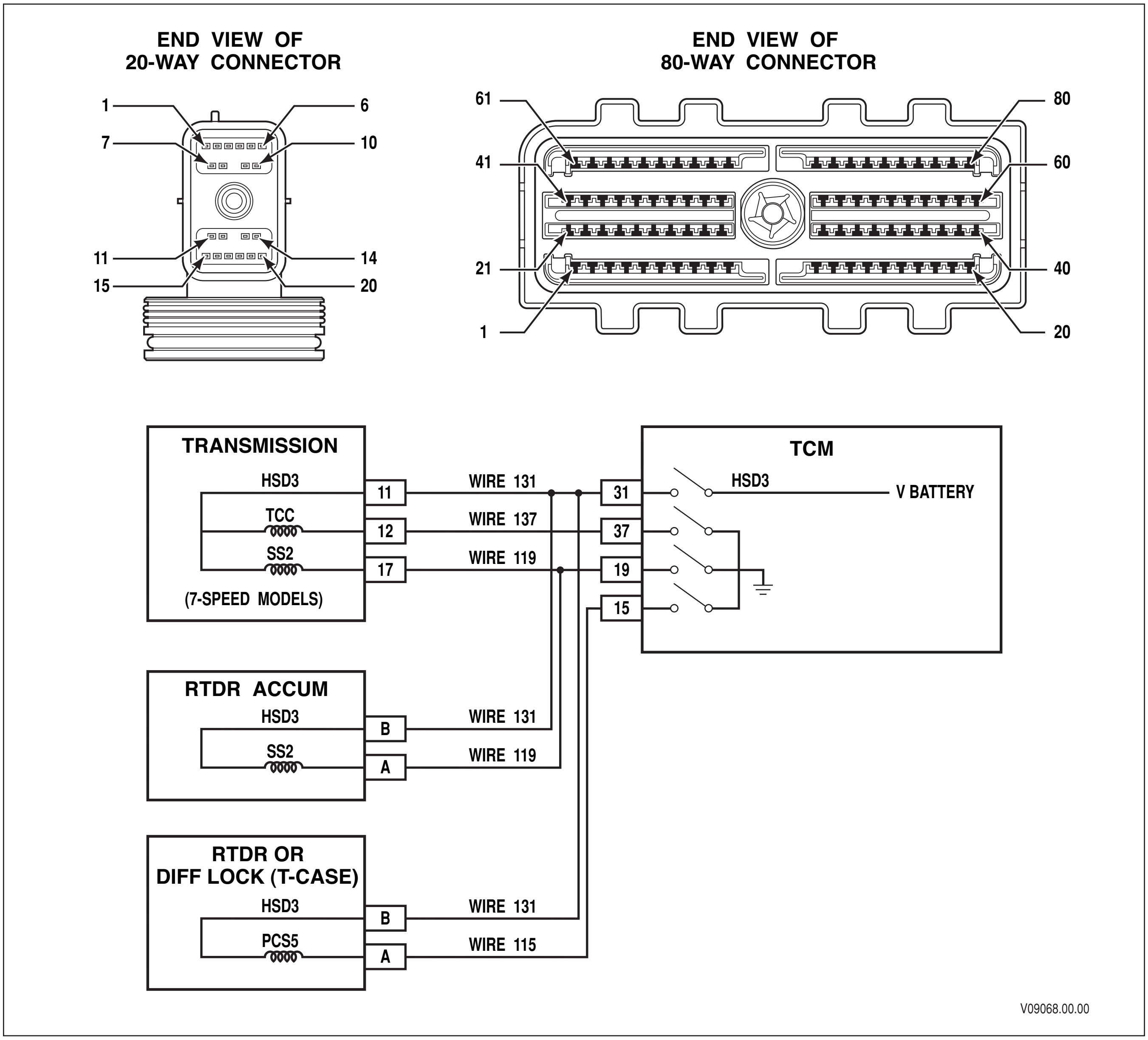
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2671 Actuator Supply Voltage 2 (HSD2) High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 harness. Leave the OEM-side connected. 3. Disconnect the OEM-side of the 20-way connector J 47279 Transmission Breakout. Leave the transmission-side connected. 4. Inspect the routing of wire 171 in the chassis harness between the TCM and the transmission connector. 5. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 71 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 6*	*Go to Step 7*
6	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repair performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Got to Step 10*	
7	1. Turn OFF the ignition. 2. Verify the J 47279 Transmission Breakout is installed at the transmission 20-way connector and the OEM-side is disconnected. 3. Using a DVOM at J 47279-1 Transmission Overlay, test for wire-to-wire shorts between pin 6 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 6 and 4, between pins 6 and 5, between pins 6 and 9, and between pins 6 and 10 will read normal solenoid resistance. Refer to Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	1. Remove the hydraulic control module assembly. 2. Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 10*	
9	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2685 Actuator Supply Voltage 3 (HSD3) Low



Circuit Description

High Side Driver 3 (HSD3) supplies battery voltage to the TCC, PCS5 (retarder and 7-speed models) and SS2 (also, retarder and 7-speed models) solenoids via wire 131. HSD3 is continuously ON during normal operation except during brief circuit tests. The TCM regulates control current to the solenoids by switching the appropriate Low Side Driver (LSD) ON and OFF. DTC P2685 indicates the TCM has detected a supply voltage in the HSD3 circuit of 6V or less. DTC P2685 could be caused by a short-to-ground in the high side wiring attached to HSD3 (wire 131).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- HSD3 is commanded ON.
- Engine speed greater than 200 rpm.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2685 Actuator Supply Voltage 3 (HSD 3) Low

Conditions for Setting the DTC

DTC P2685 is set when the TCM detects a low voltage condition (less than 6V) in two solenoids in the HSD3 circuit.

Actions Taken When the DTC Sets

When DTC P2685 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  — A bent terminal
  — A backed-out terminal
  — A damaged terminal
  — Poor terminal tension
  — A chafed wire
  — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for a wire-to-wire short, or short-to-ground in the wire 131 of the OEM chassis harness.
6. This step tests for wiring defects in the transmission internal harness.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2685 Actuator Supply Voltage 3 (HSD 3) Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the HSD3 electrical circuit.*** Did DTC P2685 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the OEM 20-way connector from the transmission. 5. For retarder transmissions, disconnect the SS2 (accumulator) and PCS5 (retarder control) connectors. 6. For 3000 7-speed only, disconnect the T-case electrical connector. 7. Inspect the routing of wire 131 in the chassis harness between the TCM and the transmission connectors. 8. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 31 and all other pins in the 80-way connector, and test for shorts-to-ground between pin 31 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the chassis harness. Is the repair complete?		*Go to Step 12*	

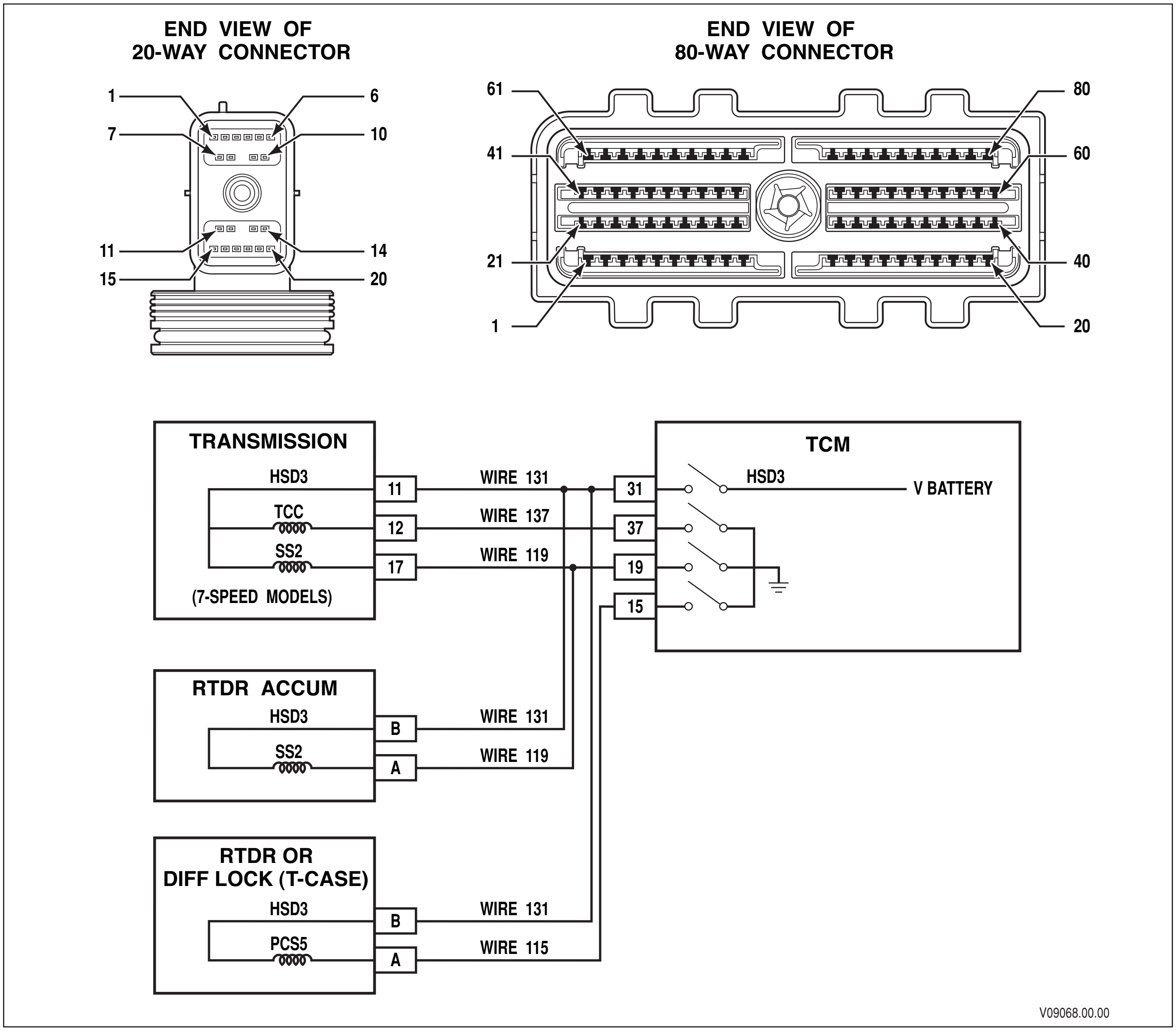
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2685 Actuator Supply Voltage 3 (HSD 3) Low *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install the transmission 20-way connector to the J 47279 Transmission Breakout. Leave the OEM-side connected. 3. Using a DVOM at J 47279-1 Transmission Overlay, test for wire-to-wire shorts between pin 11 and all other pins in the 20-way connector, and shorts-to-ground between pin 11 and chassis ground. ***NOTE: The resistance value between pins 11 and 12, and between pins 11 and 17 (7-speed models) will read normal solenoid resistance.*** Were any opens, wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 7*	*Go to Step 8*
7	1. Remove the hydraulic control module assembly. 2. Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2686 Actuator Supply Voltage 3 (HSD 3) High



Circuit Description

High Side Driver 3 (HSD3) supplies battery voltage to the TCC, PCS5 (retarder and 7-speed models) and SS2 (also, retarder and 7-speed models) solenoids via wire 131. HSD3 is continuously ON during normal operation except during brief circuit tests. The TCM regulates control current to the solenoids by switching the appropriate Low Side Driver (LSD) ON and OFF. DTC P2686 indicates the TCM has detected greater than or equal to 6V in the HSD3 circuit when HSD3 is OFF during TCM initialization. DTC P2686 could be caused by an open or short-to-battery in the high side wiring attached to HSD3 (wire 131).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- HSD3 is commanded ON.
- Engine speed greater than 200 rpm.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2686 Actuator Supply Voltage 3 (HSD 3) High

Conditions for Setting the DTC

DTC P2686 is set when the TCM detects a high voltage condition (> 6V) in the HSD3 circuit after two solenoids indicate a failure.

Actions Taken When the DTC Sets

When DTC P2686 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for an open in wire 131 of the OEM chassis harness.
5. This step tests for wire-to-wire short, or short-to-battery in wire 131 of the OEM chassis harness.
7. This step tests for wiring defects in the transmission internal harness.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2686 Actuator Supply Voltage 3 (HSD3) High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problems*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open or short-to-battery condition in the HSD3 electrical circuit.*** Did DTC P2686 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Install the J 47275 TCM Breakout at the 80-way connector. 3. Install J 47279 adapter at the 20-way connector. 4. Turn ON the ignition. Leave the engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command the TCC solenoid ON. 6. Determine the voltage drop in the HSD3 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 31 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage drop between pin 11 and an isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V indicates an excessive voltage loss in the OEM harness.*** Did the high-side voltage drop exceed 0.5VDC?		*Go to Step 6*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2686 Actuator Supply Voltage 3 (HSD3) High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Disconnect the OEM-side of the 20-way connector from the J 47279 adapter. Leave the transmission-side connected. 4. Inspect the routing of wire 131 in the chassis harness between the TCM and the transmission connectors. 5. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 31 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 6*	*Go to Step 7*
6	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the chassis harness. Is the repair complete?		*Go to Step 10*	
7	1. Turn OFF the ignition. 2. Verify the J 47279 Transmission Breakout is installed at the transmission 20-way connector and the OEM-side is disconnected. 3. Using a DVOM at J 47279-1 Transmission Overlay, test for wire-to-wire shorts between pin 11 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 11 and 12, and between pins 11 and 17 (7-speed models) will read normal solenoid resistance.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	1. Remove the hydraulic control module assembly. 2. Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 10*	
9	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2714 Pressure Control Solenoid 4 (PCS4) Stuck Off

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to detect if a clutch is slipping. Pressure Control Solenoid 4 (PCS4) supplies hydraulic pressure to the C4 clutch in second and sixth ranges. The TCM sets a DTC P2714 when it detects a slip condition while PCS4 is supplying hydraulic pressure to the oncoming clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 125 rpm.
- Turbine speed greater than or equal to 60 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P2714 sets when the TCM detects an incorrect oncoming ratio (range-to-range) for an accumulated number of occurrences.

Actions Taken When the DTC Sets

- When DTC P2714 occurs, the TCM will command previous range.
- While Diagnostic Response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates the oncoming clutch being controlled by PCS4 is not applied or applied too slowly. Common causes include:
  - — Erratic turbine or output speed signals.
  - — A leak or obstruction in the C4 clutch apply circuit.
  - — A defective solenoid.
  - — A stuck PCS4 regulator valve.
- PCS4 supplies hydraulic pressure to C4 clutch in second and sixth ranges. Check the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C4 clutch pressure from PCS4.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P2714 Pressure Control Solenoid 4 (PCS4) Stuck Off

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to the appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected a slip condition and could not verify the correct oncoming ratio following a shift.*** Did DTC P2714 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting Section 8*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2714 Pressure Control Solenoid 4 (PCS4) Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in Main and C4 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the failure records. 6. Read and record Main and C4 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specification in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS4. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2715 Pressure Control Solenoid 4 (PCS4) Stuck On

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses information from the turbine and output speed sensors to detect if a clutch is in a tie-up condition or if three clutches are applied. Pressure Control Solenoid 4 (PCS4) supplies hydraulic pressure to the C4 clutch in second and sixth ranges. The TCM sets a DTC P2715 when it detects a tie-up condition while PCS4 is supplying hydraulic pressure to the off-going clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 200 rpm.
- Turbine speed greater than or equal to 200 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P2715 sets when the transmission is shifting from range to range and the off-going range (ratio) remains engaged even though the off-going clutch is commanded OFF.

Actions Taken When the DTC Sets

- When DTC P2715 occurs, the TCM will command previous range.
- While Diagnostic Response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates the off-coming clutch being controlled by PCS4 is not released or released too slowly. Common causes include:
  - Erratic turbine and output speed sensor readings.
  - An obstruction in the C4 clutch exhaust circuit.
  - A defective PCS4 solenoid.
  - A stuck PCS4 regulator valve.
- PCS4 supplies hydraulic pressure to C4 clutch in second and sixth ranges. Check the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - Intermittent wiring connection
  - Excessive vibration (driveline or engine torsionals)
  - Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C4 clutch pressure from PCS4.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P2715 Pressure Control Solenoid 4 (PCS4) Stuck On

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	Install the Allison DOC™ For PC–Service Tool. 1. Turn ON the ignition, leave engine OFF. 2. Record the failure records. 3. Clear the DTC. 4. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected that the off-going clutch did not release (clutch tie-up), following a shift.*** Did DTC P2715 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting Section 8*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to appropriate speed sensor DTC*	*Go to Step 6*

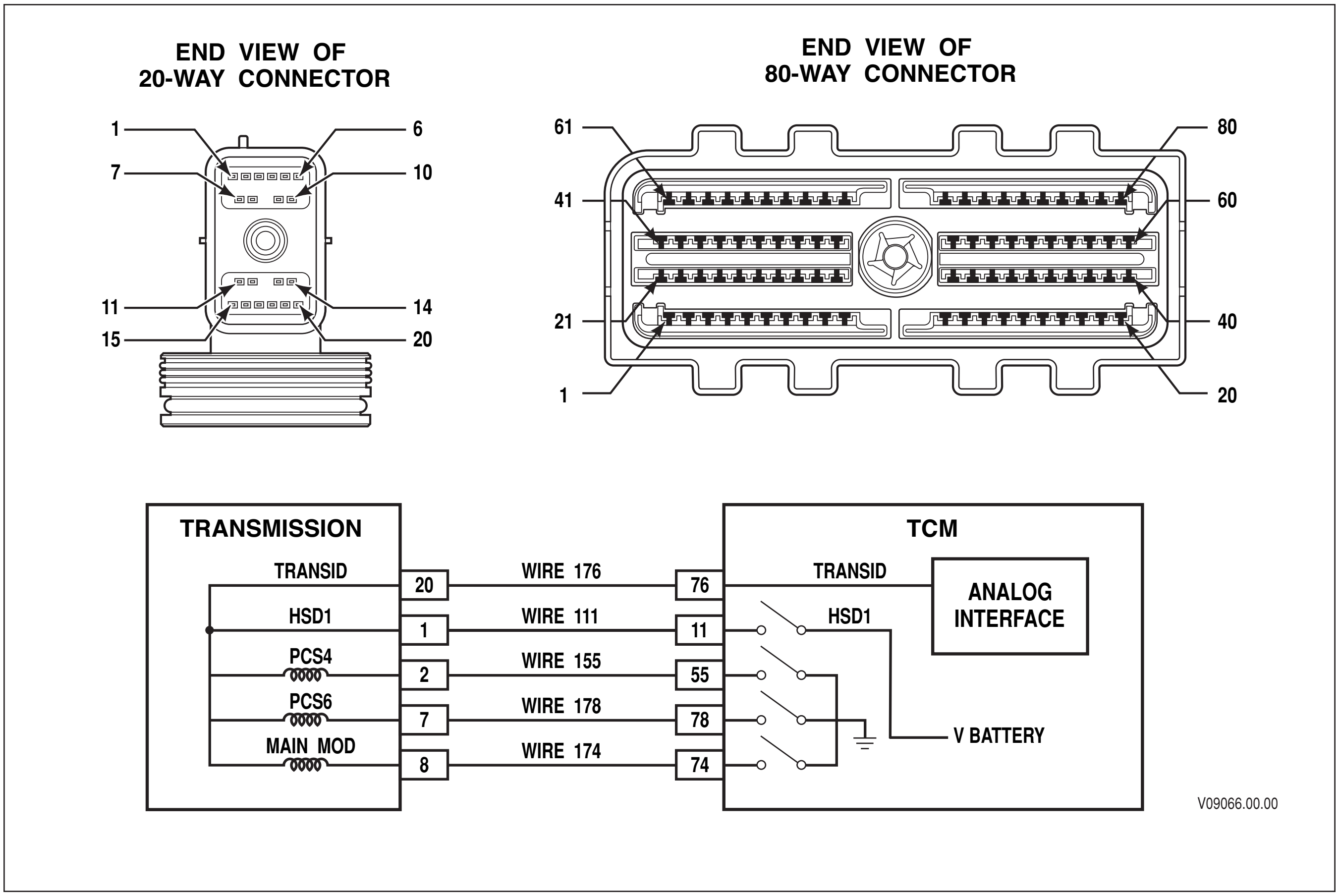
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2715 Pressure Control Solenoid 4 (PCS4) Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in Main and C4 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the failure records. 6. Read and record Main and C4 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specification in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS4. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2718 Pressure Control Solenoid 4 (PCS4) Control Circuit Open



Circuit Description

Pressure Control Solenoid 4 (PCS4) is a normally closed (N/C) solenoid used to apply the C4 clutch in second and sixth ranges. The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS4 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS4 from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS4 by switching PCS4 Low Side Driver (LSD) ON and OFF. Wire 155 completes the circuit between PCS4 and its LSD. DTC P2718 indicates that the TCM has detected an open condition in PCS4 electrical circuit. The open condition may exist in the high side (wire 111) or low side (wire 155).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2718 is set when the TCM detects an open circuit on the PCS4 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2718 Pressure Control Solenoid 4 (PCS4) Control Circuit Open

Actions Taken When the DTC Sets

When DTC P2718 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2718 indicates an open in the electrical circuit for the PCS4. In addition to PCS4, HSD1 also supplies power to Main Mod and PCS6. If DTC P2718 is accompanied by DTC P0960 (Main Mod open circuit) and/or P2812 (PCS6 open circuit), the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage drop caused by an open condition in either wire 111 or wire 155 of the OEM chassis harness.
6. This step tests for an open condition in the transmission internal harness.
7. This step tests for the proper PCS4 resistance.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2718 Pressure Control Solenoid 4 (PCS4) Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in the PCS4 electrical circuit.*** Did DTC P2718 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM external wiring harness and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM external wiring harness and transmission 20-way connectors. 4. Turn ON the ignition, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command PCS4 ON. 6. Determine the voltage drop in the high side of the PCS4 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 11 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 1 and an isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the PCS4 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 55 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 2 and an isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*

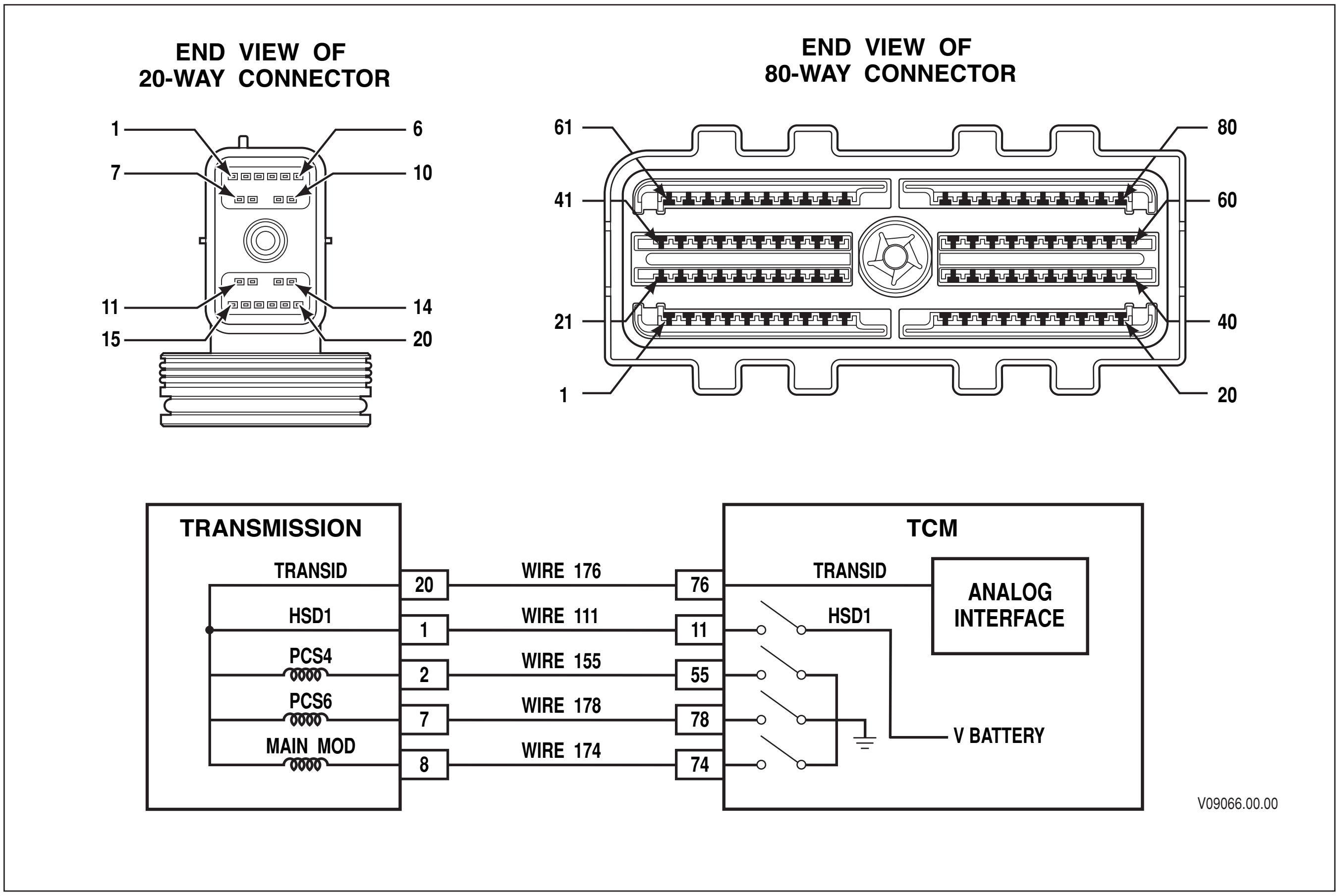
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2718 Pressure Control Solenoid 4 (PCS4) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Disconnect the OEM 20-way connector from J 47279 Transmission Breakout. Leave the transmission 20-way connector connected to the breakout. 3. Using a digital multimeter (DVOM), measure the resistance between pin 1 and pin 2 of the transmission 20-way connector. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 10*	*Go to Step 7*
7	1. Remove the hydraulic control module assembly. 2. Disconnect PCS4 from the internal wiring harness. 3. Using a DVOM, measure PCS4 resistance at pins A and B. Is resistance within the specified values?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS4. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2720 Pressure Control Solenoid 4 (PCS4) Control Circuit Low



Circuit Description

Pressure Control Solenoid 4 (PCS4) is a normally closed (N/C) solenoid used to apply the C4 clutch in second and sixth ranges. The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS4 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS4 from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS4 by switching PCS4 Low Side Driver (LSD) ON and OFF. Wire 155 completes the circuit between PCS4 and its LSD. DTC P2720 indicates that the TCM has detected a short-to-ground condition in the low side of PCS4 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2720 is set when the TCM detects a short-to-ground in the PCS4 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2720 Pressure Control Solenoid 4 (PCS4) Control Circuit Low

Actions Taken When the DTC Sets

When DTC P2720 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2720 indicates a short-to-ground in the electrical circuit for PCS4.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47279—3000 and 4000 Product Families Transmission Breakout Harness. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 155.
6. This step tests for the wire-to-wire shorts or a short-to-ground in the internal transmission harness.

DTC P2720 Pressure Control Solenoid 4 (PCS4) Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the PCS4 electrical circuit.*** Did DTC P2720 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 harness. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 155 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 55 and all other pins in the 80-way connector, and shorts-to-ground between pin 55 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground wiring defects found?		*Go to Step 5*	*Go to Step 6*

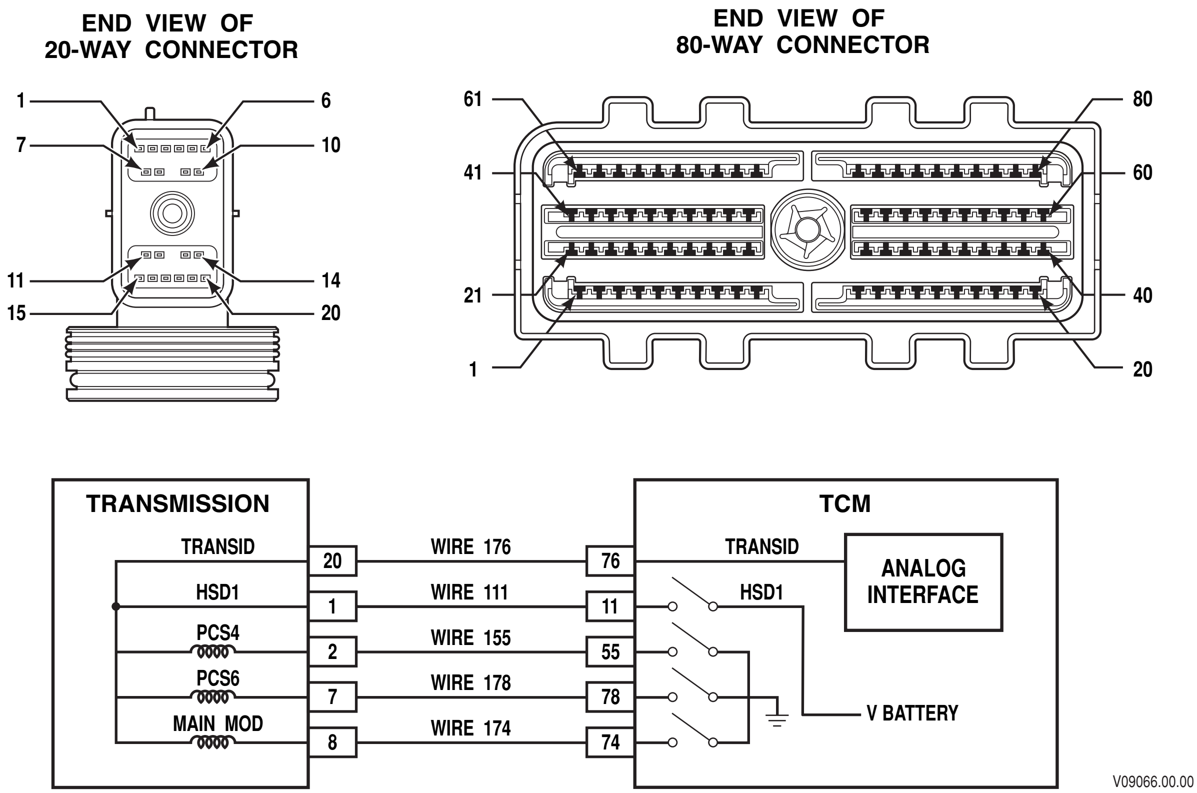
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2720 Pressure Control Solenoid 4 (PCS4) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 2 and all other pins in the 20-way connector, and shorts-to-ground between pin 2 and chassis ground. ***NOTE: The resistance value between pins 2 and 1, and between pins 2 and 20 will read normal solenoid resistance. The resistance value between pins 2 and 7 (7-speed models), and between pins 2 and 8 will be twice normal solenoid resistance. Refer to the Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts or shorts -to-ground found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts or shorts-to-ground. 3. Were wire-to-wire shorts or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS4. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2721 Pressure Control Solenoid 4 (PCS4) Control Circuit High



Circuit Description

Pressure Control Solenoid 4 (PCS4) is a normally closed (N/C) solenoid used to apply the C4 clutch in second and sixth ranges. The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS4 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS4 from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS4 by switching PCS4 Low Side Driver (LSD) ON and OFF. Wire 155 completes the circuit between PCS4 and its LSD. DTC P2721 indicates that the TCM has detected a short-to-battery condition in the low side of PCS4 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2721 is set when the TCM detects a short-to-battery in the PCS4 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2721 Pressure Control Solenoid 4 (PCS4) Control Circuit High

Actions Taken When the DTC Sets

When DTC P2721 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2721 indicates a short-to-battery in the electrical circuit for the PCS4 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 155 and other wires in the OEM chassis harness.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.

DTC P2721 Pressure Control Solenoid 4 (PCS4) Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is voltage within specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-battery condition in the PCS4 electrical circuit.*** Did DTC P2721 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM-side disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 111 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 55 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2721 Pressure Control Solenoid 4 (PCS4) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 2 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 2 and 1, and between pins 2 and 20 will read normal solenoid resistance. The resistance value between pins 2 and 7 (7-speed models), and between pins 2 and 8 will be twice normal solenoid resistance. Refer to the Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts. Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace PCS4. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2723 Pressure Control Solenoid 1 (PCS1) Stuck Off

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to detect if a clutch is slipping. Pressure Control Solenoid 1 (PCS1) supplies hydraulic pressure to the C1 clutch in first range through fourth range. The TCM sets a DTC P2723 when it detects a slip condition while PCS1 is supplying hydraulic pressure to the oncoming clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 125 rpm.
- Turbine speed greater than or equal to 60 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P2723 sets when the TCM detects an incorrect oncoming ratio (range-to-range) for an accumulated number of occurrences.

Actions Taken When the DTC Sets

- When DTC P2723 occurs, the TCM will command previous range.
- While Diagnostic Response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates the oncoming clutch being controlled by PCS1 is not applied or applied too slowly. Common causes include:
  - — Erratic turbine or output speed signals.
  - — A leak or obstruction in a specific clutch apply circuit.
  - — A defective solenoid. PCS1 and SS1 each receive commands from the TCM during a shift to Drive. A failure of either solenoid or related hydraulic circuit can cause a DTC P2723.
  - — A stuck PCS1 regulator valve.
  - — A stuck C1 logic latch valve.
- PCS1 supplies hydraulic pressure to C1 clutch in first range through fourth ranges. Check the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the DTC. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C1 clutch pressure from PCS1.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P2723 Pressure Control Solenoid 1 (PCS1) Stuck Off

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected a slip condition and could not verify the correct oncoming ratio following a shift.*** Did DTC P2723 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting (Section 7)*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2723 Pressure Control Solenoid 1 (PCS1) Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main and C1 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the Failure Records. 6. Read and record Main and C1 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. 5. Be sure the C1 latch valve is not sticking. The valve should drop freely into its bore. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Consult Allison DOC™ For PC–Service Tool failure record data. Replace PCS1 and/or SS1 based on the following: • DTC P2723 logged during neutral-to-drive and/or reverse-to-drive shifts only—replace both PCS1 and SS1. • DTC P2723 logged during fifth-to-fourth range shifts—replace PCS1 only. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2724 Pressure Control Solenoid 1 (PCS1) Stuck On

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses information from the turbine and output speed sensors to detect if a clutch is in a tie-up condition or if three clutches are applied. Pressure Control Solenoid 1 (PCS1) supplies hydraulic pressure to the C1 clutch in first through fourth ranges. The TCM sets a DTC P2724 when it detects a tie-up condition while PCS1 is supplying hydraulic pressure to the off-going clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 200 rpm.
- Turbine speed greater than or equal to 200 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P2724 sets when the transmission is shifting from range to range and the off-going range (ratio) remains engaged even though the off-going clutch is commanded OFF.

Actions Taken When the DTC Sets

- When DTC P2724 occurs, the TCM will command previous range.
- While Diagnostic Response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates the off-coming clutch being controlled by PCS1 is not released or released too slowly. Common causes include:
  - — An obstruction in the C1 clutch exhaust circuit.
  - — A defective PCS1 solenoid.
  - — A stuck PCS1 regulator valve.
- PCS1 supplies hydraulic pressure to C1 clutch in first range through fourth ranges. Check the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.
- PCS1 and PCS2 are “normally high” solenoids. PCS1 and PCS2 supply full hydraulic pressure when their coils are de-energized, and no output pressure when receiving maximum current from the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect Allison DOC™ diagnostic tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - Intermittent wiring connection
  - Excessive vibration (driveline or engine torsionals)
  - Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C1 clutch pressure from PCS1.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P2724 Pressure Control Solenoid 1 (PCS1) Stuck On

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected that the off-going clutch did not release (clutch tie-up) following a shift.*** Did DTC P2724 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting (Section 7)*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to appropriate speed sensor DTC*	*Go to Step 6*

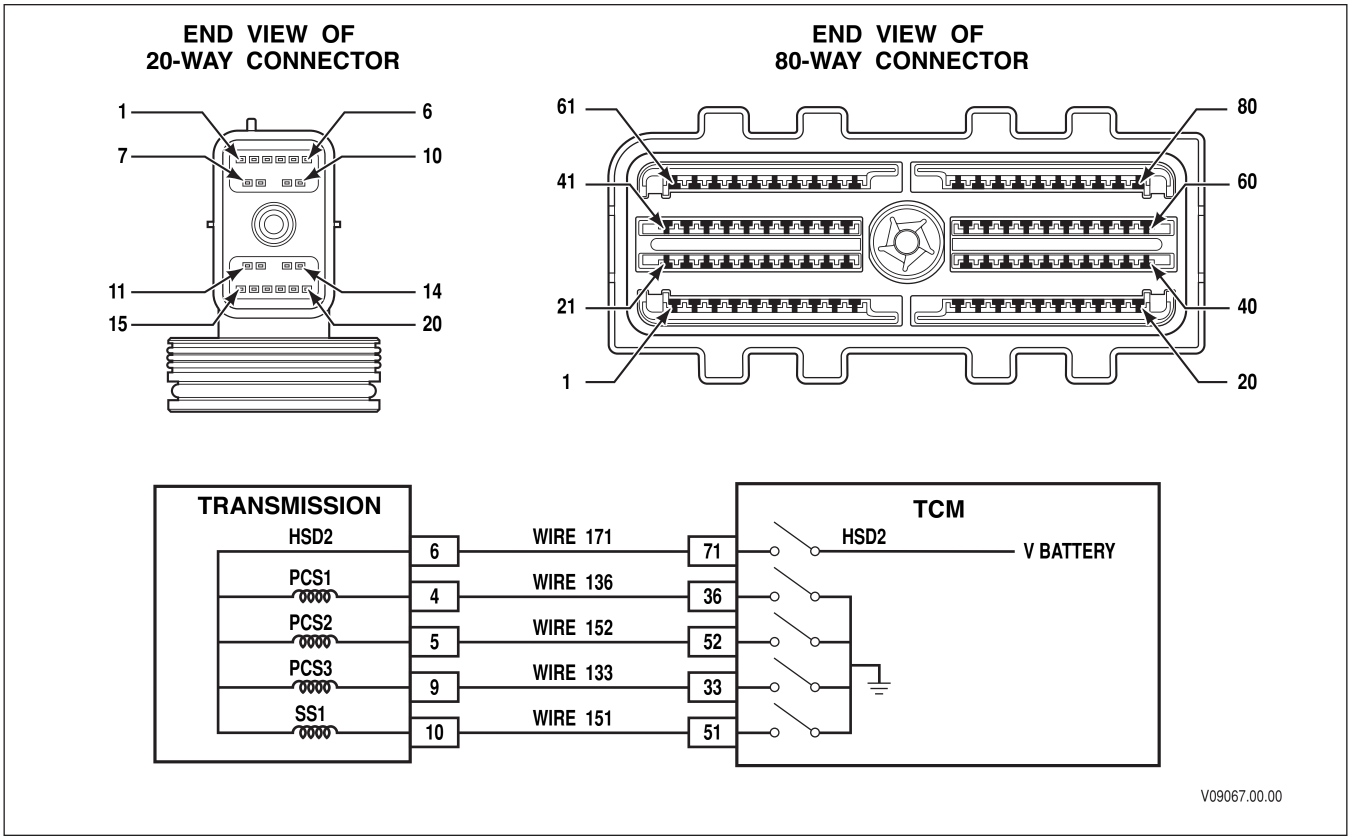
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2724 Pressure Control Solenoid 1 (PCS1) Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main and C1 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the failure records. 6. Read and record Main and C1 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve bodies for stuck or sticking solenoid regulator valves and logic latch valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS1. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine, and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2727 Pressure Control Solenoid 1 (PCS1) Control Circuit Open



Circuit Description

Pressure Control Solenoid 1 (PCS1) is a normally open (N/O) solenoid used to apply the C1 clutch in first through fourth range. The TCM commands the solenoid OFF to produce hydraulic pressure in the clutch apply circuit. When PCS1 is commanded ON, the C1 clutch is released.

The TCM sends control current to PCS1 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS1 by switching PCS1 Low Side Driver (LSD) ON and OFF. Wire 136 completes the circuit between PCS1 and its LSD. DTC P2727 indicates that the TCM has detected an open condition in PCS1 electrical circuit. The open condition may exist in the high side (wire 171) or low side (wire 136).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2727 is set when the TCM detects an open circuit on the PCS1 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2727 Pressure Control Solenoid 1 (PCS1) Control Circuit Open

Actions Taken When the DTC Sets

When DTC P2727 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2727 indicates an open in the electrical circuit for PCS1. In addition to PCS1, HSD2 also supplies power to PCS2, PCS3, and SS1. If DTC P2727 is accompanied by DTC P0964 (PCS2 open circuit) and/or DTC P0968 (PCS3 open circuit), the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  — A bent terminal
  — A backed-out terminal
  — A damaged terminal
  — Poor terminal tension
  — A chafed wire
  — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage drop caused by an open condition in either wire 171 or wire 136 of the OEM chassis harness.
6. This step tests for an open condition in the transmission internal harness.
7. This step tests for the proper PCS1 resistance.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2727 Pressure Control Solenoid 1 (PCS1) Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in the PCS1 electrical circuit.*** Did DTC P2727 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors. 4. Turn ON the ignition, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command PCS1 ON. 6. Determine the voltage drop in the high side of the PCS1 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 71 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 6 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the PCS1 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 36 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 4 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*

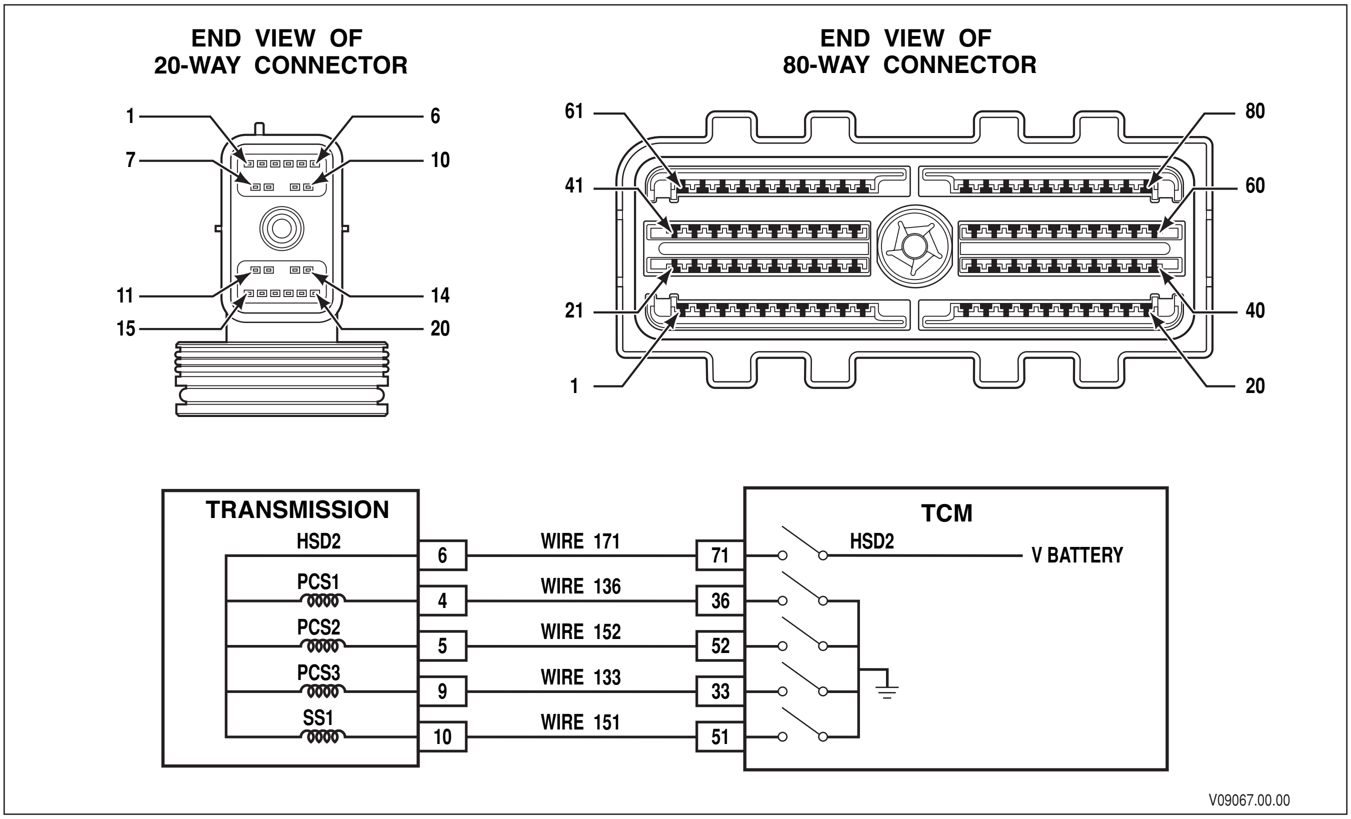
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2727 Pressure Control Solenoid 1 (PCS1) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Disconnect the OEM 20-way connector from J 47279 Transmission Breakout. Leave the transmission 20-way connector connected to breakout. 3. Using a digital multimeter (DVOM), measure the resistance between pin 4 and pin 6 of the transmission 20-way connector. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 10*	*Go to Step 7*
7	1. Remove the hydraulic control module assembly. 2. Disconnect PCS1 from the internal wiring harness. 3. Using a DVOM, measure PCS1 resistance at pins A and B. Is resistance within the specified values?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS1. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2729 Pressure Control Solenoid 1 (PCS1) Control Circuit Low



Circuit Description

Pressure Control Solenoid 1 (PCS1) is a normally open (N/O) solenoid used to apply the C1 clutch in first through fourth range. The TCM commands the solenoid OFF to produce hydraulic pressure in the clutch apply circuit. When PCS1 is commanded ON, the C1 clutch is released.

The TCM sends control current to PCS1 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS1 by switching PCS1 Low Side Driver (LSD) ON and OFF. Wire 136 completes the circuit between PCS1 and its LSD. DTC P2729 indicates that the TCM has detected a short-to-ground condition in the low side of PCS1 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2729 is set when the TCM detects a short-to-ground in the PCS1 return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P2729 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2729 Pressure Control Solenoid 1 (PCS1) Control Circuit Low

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2729 indicates a short-to-ground in the electrical circuit for PCS1.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 136.
6. This step tests for the wire-to-wire shorts or a short-to-ground in the internal transmission harness.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2729 Pressure Control Solenoid 1 (PCS1) Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem.*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect short-to-ground condition in the PCS1 electrical circuit.*** Did DTC P2729 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 136 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 36 and all other pins in the 80-way connector, and shorts-to-ground between pin 36 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground wiring defects found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	

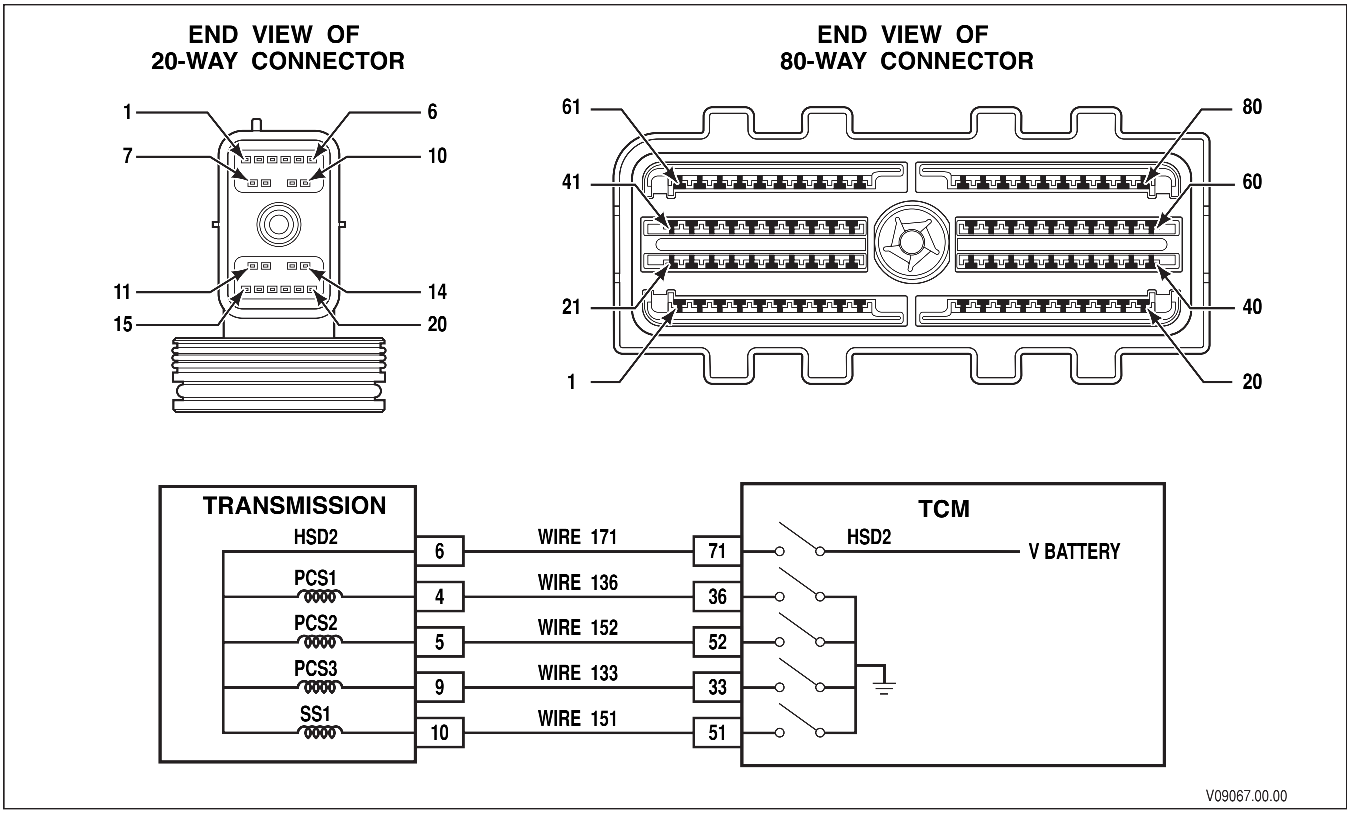
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2729 Pressure Control Solenoid 1 (PCS1) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 4 and all other pins in the 20-way connector, and shorts-to-ground between pin 4 and chassis ground. ***NOTE: The resistance value between pins 8 and 6 will read normal solenoid resistance. The resistance value between pins 4 and 5, and between 4 and 9 will be twice normal solenoid resistance.*** Were any wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts, or shorts-to-ground. Were any wire-to-wire shorts, or shorts-to-ground found?	.	*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace PCS1. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 12*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2730 Pressure Control Solenoid 1 (PCS1) Control Circuit High



Circuit Description

Pressure Control Solenoid 1 (PCS1) is a normally open (N/O) solenoid used to apply the C1 clutch in first through fourth range. The TCM commands the solenoid OFF to produce hydraulic pressure in the clutch apply circuit. When PCS1 is commanded ON, the C1 clutch is released.

The TCM sends control current to PCS1 from High Side Driver 2 (HSD2) via wire 171. HSD2 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS1 by switching PCS1 Low Side Driver (LSD) ON and OFF. Wire 136 completes the circuit between PCS1 and its LSD. DTC P2730 indicates that the TCM has detected a short-to-battery condition in the low side of PCS1 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2730 is set when the TCM detects a short-to-battery in the PCS1 return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P2730 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2730 Pressure Control Solenoid 1 (PCS1) Control Circuit High

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2730 indicates a short-to-battery in the electrical circuit for PCS1.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 136 and other wires in the OEM chassis harness.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2730 Pressure Control Solenoid 1 (PCS1) Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem.*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect short-to-battery condition in the PCS1 electrical circuit.*** Did DTC P2730 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 171 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 36 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	

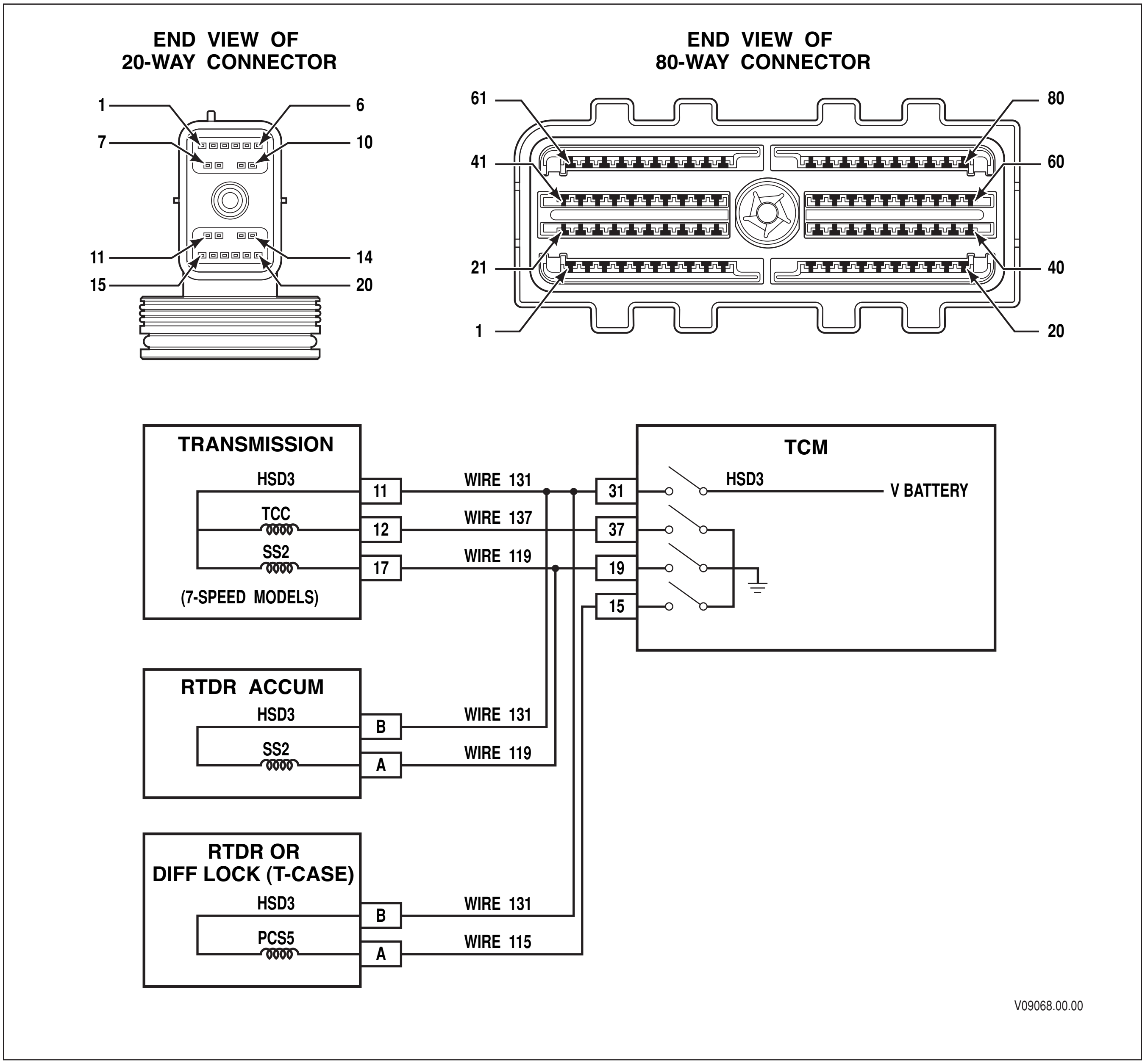
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2730 Pressure Control Solenoid 1 (PCS1) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 4 and all other pins in the 20-way connector, and shorts-to-ground between pin 4 and chassis ground. ***NOTE: The resistance value between pins 4 and 6 will read normal solenoid resistance. The resistance value between pins 4 and 5, between 4 and 9, and between 4 and 10 will be twice normal solenoid resistance.*** Were any wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts. Were any wire-to-wire shorts, or shorts-to-ground found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace PCS1. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2736 Pressure Control Solenoid 5 (PCS5) Control Circuit Open



Circuit Description

Pressure Control Solenoid 5 (PCS5) is a normally closed (N/C) solenoid used to apply the retarder solenoid (retarder units) or differential lock solenoid (3000 7-speed only). The TCM commands the solenoid ON to produce hydraulic pressure in the control circuit. When PCS5 is commanded OFF, the control circuit is deactivated.

The TCM sends control current to PCS5 from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS5 by switching PCS5 Low Side Driver (LSD) ON and OFF. Wire 115 completes the circuit between PCS5 and its LSD. DTC P2736 indicates that the TCM has detected an open condition in PCS5 electrical circuit. The open condition may exist in the high side (wire 131) or low side (wire 115).

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2736 Pressure Control Solenoid 5 (PCS5) Control Circuit Open

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2736 is set when the TCM detects an open circuit on the PCS5 return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P2736 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits retarder operation.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2736 indicates an open in the electrical circuit for PCS5. In addition to PCS5, HSD3 also supplies power to solenoids torque converter clutch (TCC) and SS2. If DTC P2736 is accompanied by DTC P0975 and P2761, the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage caused by an open condition in either wire 131 or wire 115 of the OEM chassis harness.
6. This step tests for the proper PCS5 resistance.

DTC P2736 Pressure Control Solenoid 5 (PCS5) Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in PCS5 electrical circuit.*** Did DTC P2736 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2736 Pressure Control Solenoid 5 (PCS5) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors. 4. Turn ON the ignition. Leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command PCS5 ON. 6. Determine the voltage drop in the high side of the PCS5 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 31 and an isolated ground. • To measure PCS5 high-side voltage: — At J 47279-1 Transmission Overlay, measure voltage between RTDR FEED THRU-B and isolated ground (retarder units), **OR** — Back probe pin B of the T-case 6-way Cannon connector using jumper wire kit J39197 or equivalent. — Measure voltage between T-case-B and isolated ground (3000 7-speed only). • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the PCS5 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 15 and an isolated ground. • To measure PCS5 low-side voltage: — At J 47279-1 Transmission Overlay, measure voltage between RTDR FEED THRU-A and isolated ground (retarder units), **OR** — Back probe pin B of the T-case 6-way Cannon connector using jumper wire kit J39197 or equivalent. — Measure voltage between T-case-B and isolated ground (3000 7-speed only). • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*

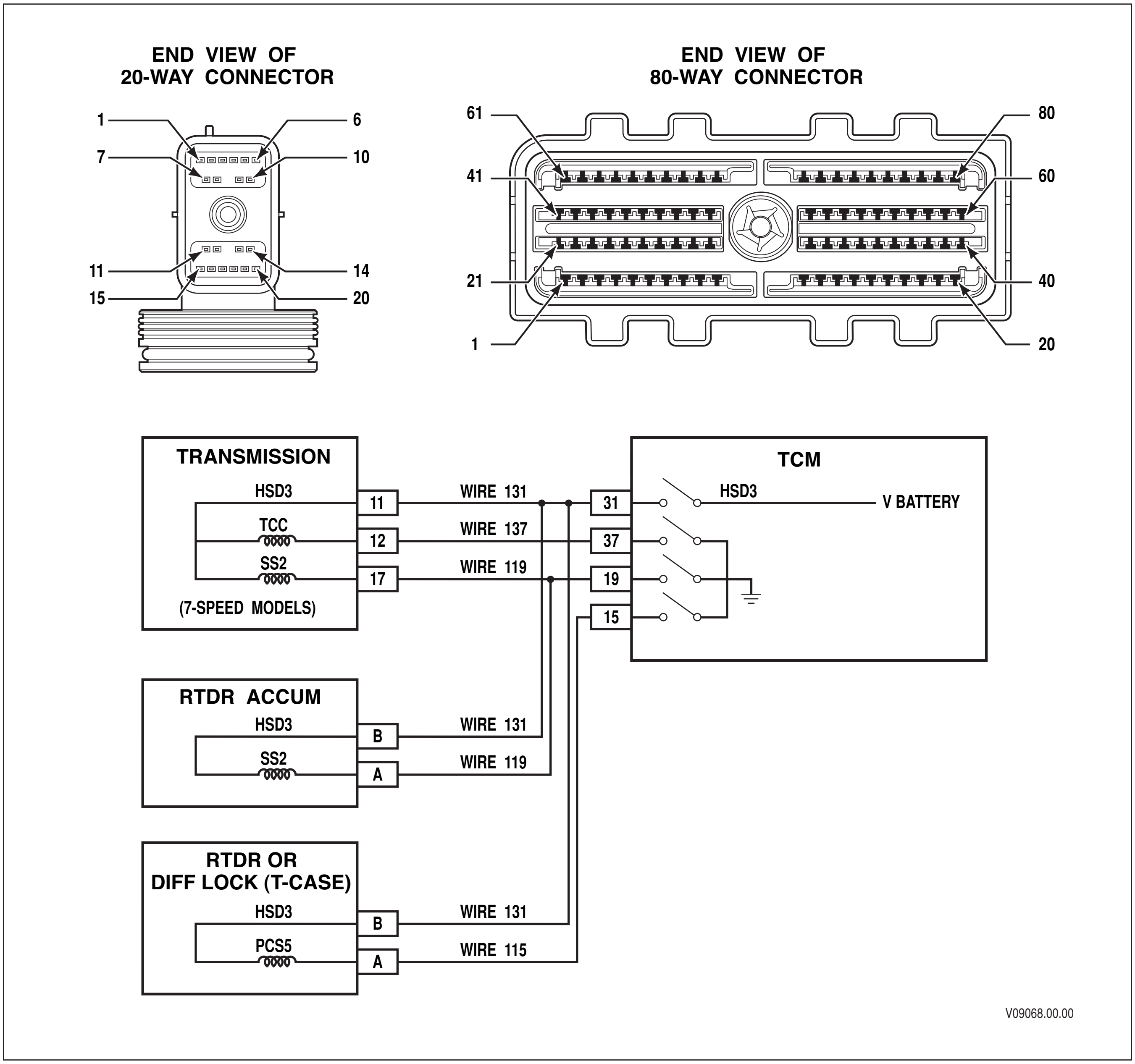
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2736 Pressure Control Solenoid 5 (PCS5) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 9*	
6	1. Turn OFF the ignition. 2. Disconnect the OEM PCS5 connector from J 47279 Transmission Breakout. 3. Using a DVOM, measure the resistance between pins A and B of the RTDR FEED THRU connector (retarder units) or T-case connector (3000 7-speed only). Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 7*
7	1. Remove the retarder valve body (retarder units) or T-case (3000 7-speed only). 2. Replace PCS5. Is the replacement complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2738 Pressure Control Solenoid 5 (PCS5) Control Circuit Low



Circuit Description

Pressure Control Solenoid 5 (PCS5) is a normally closed (N/C) solenoid used to apply the retarder solenoid (retarder units) or differential lock solenoid (3000 7-speed only). The TCM commands the solenoid ON to produce hydraulic pressure in the control circuit. When PCS5 is commanded OFF, the control circuit is deactivated.

The TCM sends control current to PCS5 from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS5 by switching PCS5 Low Side Driver (LSD) ON and OFF. Wire 115 completes the circuit between PCS5 and its LSD. DTC P2738 indicates that the TCM has detected a short-to-ground condition in the low side of PCS5 electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2738 Pressure Control Solenoid 5 (PCS5) Control Circuit Low

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2738 is set when the TCM detects a short-to-ground in the PCS5 return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P2738 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM allows operation in second through sixth range, and in Neutral and Reverse.
- The TCM inhibits retarder and TCC operation.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2738 indicates a short-to-ground in the electrical circuit for PCS5.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.

DIAGNOSTIC TROUBLE CODES (DTC)

3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
4. Use Allison DOC™ For PC–Service Tool.
5. solenoid test function to command the solenoid ON and OFF.
6. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 115.
6. This step tests for short-to-ground in the internal solenoid circuit.

DTC P2738 Pressure Control Solenoid 5 (PCS5) Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the PCS5 electrical circuit.*** Did DTC P2738 return?		*Go to Step 4*	*Go to Diagnostic Aids*

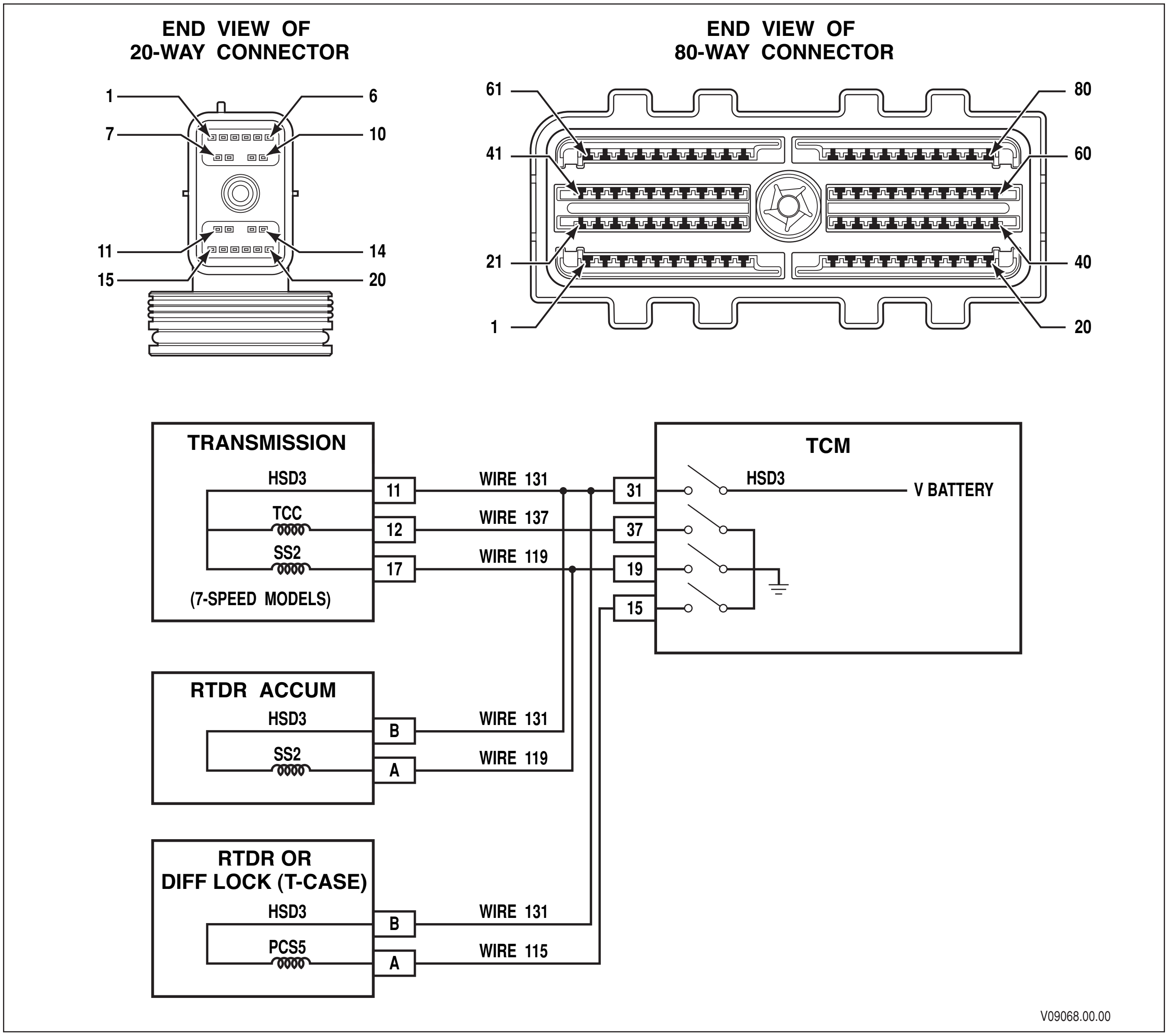
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2738 Pressure Control Solenoid 5 (PCS5) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the retarder feedthrough or T-case connector. 5. Inspect the routing of wire 115 in the chassis harness between the TCM and the PCS5 connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 15 and all other pins in the 80-way connector, and shorts-to-ground between pin 15 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground wiring defects found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 9*	
6	1. Turn OFF the ignition. 2. Using a DVOM, test for shorts-to-ground between pin A of retarder feed through or T-case connector and chassis ground. Were any shorts-to-ground found?		*Go to Step 7*	*Go to Step 8*
7	1. Remove the retarder valve body (retarder units) or T-case (3000 7-speed only). 2. Replace PCS5. Is the replacement complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2739 Pressure Control Solenoid 5 (PCS5) Control Circuit High



Circuit Description

Pressure Control Solenoid 5 (PCS5) is a normally closed (N/C) solenoid used to apply the retarder solenoid (retarder units) or differential lock solenoid (3000 7-speed only). The TCM commands the solenoid ON to produce hydraulic pressure in the control circuit. When PCS5 is commanded OFF, the control circuit is deactivated.

The TCM sends control current to PCS5 from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS5 by switching PCS5 Low Side Driver (LSD) ON and OFF. Wire 115 completes the circuit between PCS5 and its LSD. DTC P2739 indicates that the TCM has detected a short-to-battery condition in the low side of PCS5 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2739 Pressure Control Solenoid 5 (PCS5) Control Circuit High

Conditions for Setting the DTC

DTC P2739 is set when the TCM detects a short-to-battery in the PCS5 return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P2739 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits retarder operation.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ diagnostic tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2739 indicates a short-to-battery in the electrical circuit for PCS5.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 115 and other wires in the OEM chassis harness.
6. This step tests for proper PCS5 resistance.

DTC P2739 Pressure Control Solenoid 5 (PCS5) Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-battery condition in the PCS5 electrical circuit.*** Did DTC P2739 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the retarder feedthrough or T-case connector. 5. Inspect the routing of wires 115 and 131 in the chassis harness between the TCM and the PCS5 connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 15 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2739 Pressure Control Solenoid 5 (PCS5) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 9*	
6	1. Turn OFF the ignition. 2. Using a DVOM, measure resistance across pins A and B of PCS5. Is resistance within the correct values?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 7*
7	1. Remove the retarder valve body (retarder units) or T-case (3000 7-speed only). 2. Replace PCS5. Is replacement complete?		*Go to Step 9*	
8	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2740 Retarder Oil Temperature Hot

Refer to Retarder Hydraulic Schematic

Circuit Description

During retarder operation, the retarder housing is filled and pressurized with transmission fluid. This fluid acts on the vaned rotor assembly and impedes rotation of the transmission output shaft, converting a significant amount of rotational energy into heat in the process. Additionally, when the retarder is activated the retarder control valve supplies main pressure to the large autoflow valve in the retarder housing. The autoflow valve is repositioned during retarder operation to direct hot fluid in the retarder cavity to the transmission oil cooler. The retarder temperature sensor monitors fluid temperature in the retarder-housing cavity.

Conditions for Running the DTC

The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

The TCM detects retarder oil temperature greater than 165°C (330°C) for more than 10 seconds.

Actions Taken When the DTC Sets

When DTC P2740 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.

Conditions for Clearing the DTC/CHECK TRANS Light

- The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.
- The TCM cancels the DTC default actions when the fault no longer exists and the DTC passes test.

Diagnostic Aids

- The Allison DOC™ For PC–Service Tool retarder oil temperature should rise steadily during retarder operation and drop to near sump temp when the retarder is deactivated.
- A stuck autoflow valve can cause overheating in retarder-equipped transmissions. Refer to Section 8 for general troubleshooting of performance complaints.
- Other possible causes include:
  - Prolonged retarder use
  - Low fluid level
  - High fluid level
  - A retarder apply system that allows the throttle and retarder to be applied simultaneously
  - A cooler that is inadequately sized for the retarder.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level and condition.
3. This step monitors the status of DTC P2740.
4. This step verifies which condition has set the DTC P2740.
5. This step tests for proper resistance value in entire circuit.
6. This step tests the resistance value of the retarder temperature sensor.
10. This step tests the condition of the vehicle cooling system.
11. This step tests for proper cooler pressure drop.
12. This step tests for deficiencies with the transmission oil cooler and cooling lines.

DTC P2740 Retarder Oil Temperature Hot

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Install a temperature gauge at the retarder outlet port. 3. Turn ON the ignition. 4. Record the failure records. 5. Clear the DTCs. 6. Drive the vehicle and monitor retarder temperature on Allison DOC™ For PC–Service Tool. Did DTC P2740 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	Compare the manual temperature reading to the Allison DOC™ For PC–Service Tool retarder temperature when the DTC is set. Does the manual temperature reading confirm the retarder oil temperature is actually hot when DTC P2740 is logged?		*Go to Step 10*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2740 Retarder Oil Temperature Hot *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the 80-way connector from the TCM. 3. Connect J 47425 TCM Breakout to the OEM connector. Leave the TCM disconnected from J 47275 TCM Breakout. 4. Using a DVOM at J 47275-1 TCM Overlay, measure the resistance between pin 75 and 58. 5. Refer to Appendix Q and find the retarder oil temperature that corresponds to the resistance value determined in the preceding step. Does the value listed in Appendix Q match the manual retarder temperature reading?	Refer to Appendix Q	*Go to Step 9*	*Go to Step 6*
6	1. Disconnect the retarder temperature sensor connector. 2. Using a DVOM, measure resistance at retarder temp sensor pins A and B. 3. Refer to Appendix Q and find the retarder oil temperature that corresponds to the resistance value determined in the preceding step. Does the value listed in Appendix Q match the manual retarder temperature reading?	Refer to Appendix Q	*Go to Step 7*	*Go to Step 8*
7	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 14*	
8	Replace the retarder temperature sensor. Is the replacement complete?		*Go to Step 14*	
9	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 14*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2740 Retarder Oil Temperature Hot *(cont'd)*

Step	Action	Value(s)	Yes	No
10	1. Inspect the engine cooling system for the following conditions: • Air flow restrictions • Air flow blockage • System fluid level and condition • Debris 2. Inspect the transmission cooling system for the following conditions: • Air flow restrictions • Air flow blockage • System fluid level and condition • Damaged cooler lines and hoses Did you find and correct the condition?		*Go to Step 14*	*Go to Step 11*
11	1. Install pressure gauges in the "to" and "from" cooler lines. 2. Start the engine. 3. Subtract the "from cooler" pressure from the "to cooler" pressure to obtain pressure drop across the transmission oil cooler. 4. Verify cooler pressure drop satisfies limits of Table 6–16 (4000 Product Family) or Table 6–17 (3000 Product Family). Is cooler pressure drop within specified values?	Refer to Table 6–18 or 6–19	*Go to Diagnostic Aids*	*Go to Step 12*
12	Inspect the transmission cooling system for the following conditions: • Transmission cooler lines reversed. • Cooler lines restricted. • Improperly sized cooler fittings. • Inadequately sized cooler. Did you find any problems with the vehicle's cooling system?		*Go to Step 13*	*Go to Diagnostic Aids*
13	***NOTE: The vehicle OEM has responsibility for all vehicle cooling system repairs. Cooling system repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair the vehicle cooling system. Is the repair complete?		*Go to Step 13*	*Go to Diagnostic Aids*
14	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor retarder temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant change in temperature. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2740 Retarder Oil Temperature Hot

External Hydraulic Circuit Characteristics

Basic, PTO, 93°C (200°F) Sump Temperature

Table 6–16. 4000 Product Family

CONVERTER OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
	Flow		Pressure Drop	
Input rpm	L/s	GPM	kPa	psi
600	0.22	3.4	0	0
900	0.38	6.1	0	0
1200	0.55	8.7	0	0
1500	0.80	12.7	0	0
1800	1.03	16.4	0	0
2100	1.13	18.0	0	0
2300	1.20	19.0	0	0
CONVERTER OPERATION COOLER FLOW AT MAXIMUM ALLOWABLE PRESSURE DROP				
600	0.20	3.2	31.0	4.5
900	0.37	5.8	63.0	9.1
1200	0.55	8.7	108.0	15.7
1500	0.77	12.2	167.0	24.2
1800	0.92	14.5	231.0	30.9
2100	0.97	15.3	238.0	34.5
2300	1.00	15.9	250.0	36.3

Table 6–17. 3000 Product Family

CONVERTER OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
	Flow		Pressure Drop	
Input rpm	L/s	GPM	kPa	psi
600	0.10	1.6	0	0
800	0.23	3.7	0	0
1200	0.47	7.4	0	0
1400	0.61	9.7	0	0
1600	0.74	11.7	0	0
2000	0.94	14.9	0	0
2400	1.19	18.9	0	0
3200	1.28	20.3	0	0

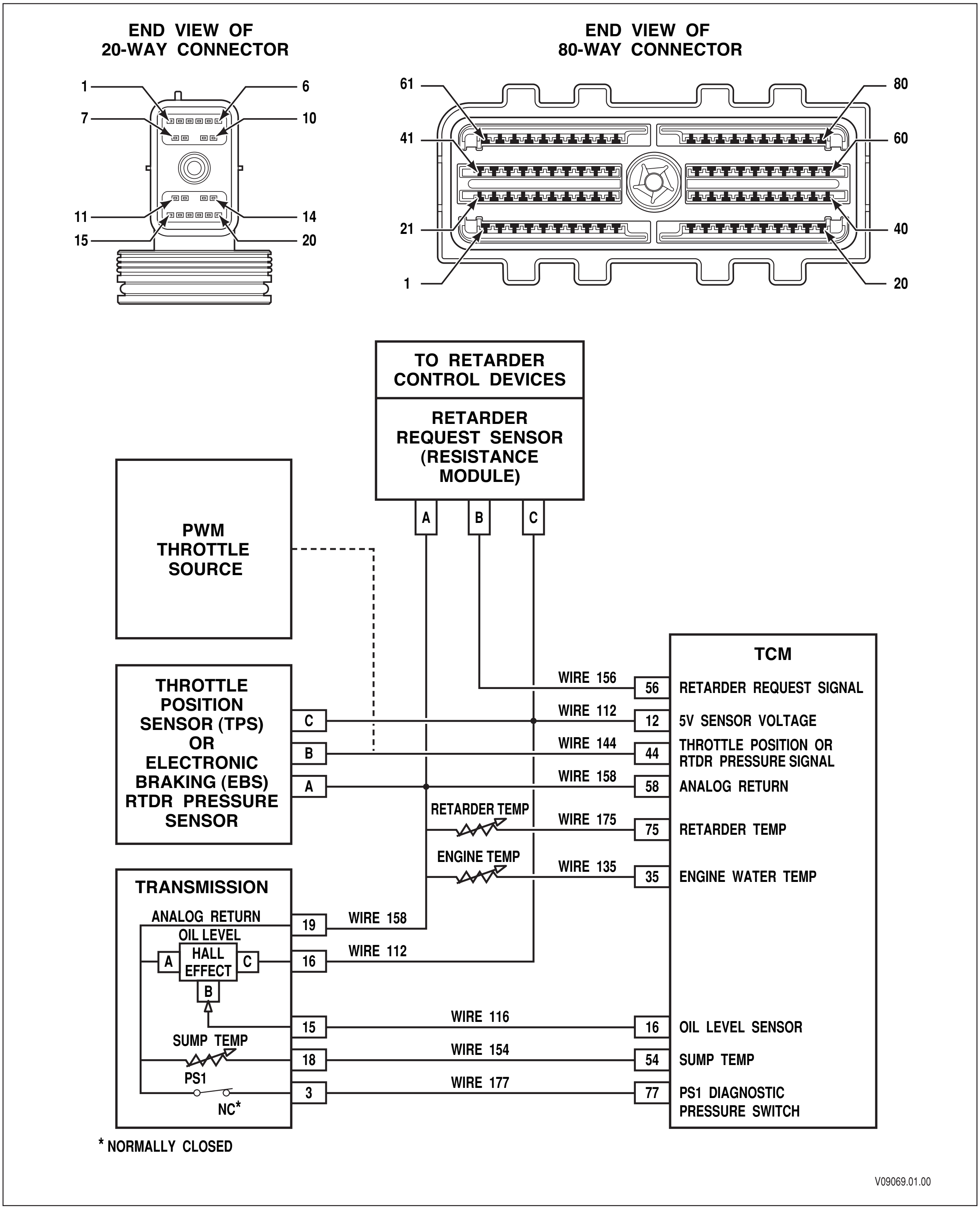
DIAGNOSTIC TROUBLE CODES (DTC)

Table 6–17. 3000 Product Family *(cont'd)*

Input rpm	Flow L/s	Flow GPM	Pressure Drop kPa	Pressure Drop psi
CONVERTER OPERATION MAXIMUM ALLOWABLE PRESSURE DROP				
600	0.10	1.6	10.0	1.5
800	0.23	3.5	40.0	5.8
1200	0.45	7.1	159.0	23.1
1400	0.57	9.0	252.0	36.6
1600	0.67	10.6	338.0	49.0
2000	0.80	12.7	481.0	69.8
2400	0.85	13.5	549.0	79.6
3200	0.85	13.5	549.0	79.6
LOCKUP OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
600	0.10	1.6	0	0
800	0.23	3.7	0	0
1200	0.50	7.9	0	0
1400	0.63	10.0	0	0
1600	0.77	12.2	0	0
2000	0.95	15.1	0	0
2400	1.12	17.8	0	0
2800	1.22	19.3	0	0
3200	1.28	20.3	0	0
LOCKUP OPERATION MAXIMUM ALLOWABLE PRESSURE DROP				
600	0.10	1.6	5.0	0.7
800	0.23	3.7	46.0	6.7
1200	0.48	7.6	148.0	21.5
1400	0.62	9.8	247.0	35.8
1600	0.73	11.6	346.0	50.2
2000	0.90	14.3	561.0	81.4
2400	1.07	17.0	737.0	106.9
2800	1.10	17.4	770.0	111.7
3200	1.10	17.4	791.0	114.7

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2742 Retarder Oil Temperature Sensor Circuit — Low Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2742 Retarder Oil Temperature Sensor Circuit — Low Input

Circuit Description

A retarder oil temperature sensor monitors retarder cavity fluid temperature. The sensor consists of a thermistor that varies its resistance value based on the temperature of the fluid in the retarder housing. The Transmission Control Module (TCM) supplies a 5V reference voltage signal into a voltage-sensing network that is connected to one side of the retarder temperature sensor via wire 175. The other side of the temp sensor is connected to the TCM analog ground wire 158.

The resistance value of the retarder temperature sensor determines the voltage drop in the retarder temperature sensor circuit. As resistance changes, the voltage drop across the thermistor will also change varying the sensor input voltage on wire 175. When retarder fluid is cold the sensor resistance is high, which produces a large voltage drop across the temp sensor circuit. The TCM, therefore, detects a high sensor input voltage during cold conditions. As the retarder fluid temperature warms to normal operating temperature, the resistance decreases producing a smaller voltage drop across the temp sensor. As a result, the TCM detects a lower sensor input voltage on wire 175 during hot oil conditions. The TCM uses retarder temperature information to restrict retarder operation and reduce fluid temperature when a retarder over-heat condition is detected.

Conditions for Running the DTC

The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

The TCM detects retarder oil temperature greater than a calibrated value for more than 2.5 seconds.

NOTE: ***The TCM is detecting voltage. An unusually low input voltage implies low thermistor resistance, which corresponds to an illogically high retarder oil temperature measurement.***

Actions Taken When the DTC Sets

When DTC P2742 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- TCM uses default retarder temperature values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2742 may be caused by a short-to-ground on wire 175.
- Review Appendix A for diagnosing intermittent electrical conditions.
- Inspect the wiring for poor electrical connections at the TCM and retarder temperature sensor. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle and operate the retarder in order to experience a fault.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level and condition.
3. This step verifies which condition has set the DTC P2742.
4. This step tests for the proper 5V reference voltage at TCM.
5. This step tests for wire-to-wire shorts or shorts-to-ground on wire 175 (Retarder Oil Temp).
6. This step tests for proper system circuit resistance value.
7. This step tests the resistance value of the retarder temp sensor.

DTC P2742 Retarder Oil Temperature Sensor Circuit—Low Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. With the engine OFF, turn the ignition to the ON position. 3. Record the failure records. 4. Clear the DTCs. 5. Monitor the retarder temperature on Allison DOC™ For PC–Service Tool. 6. Drive the vehicle and observe Allison DOC™ For PC–Service Tool for an unrealistically high temperature condition. Is the Allison DOC™ For PC–Service Tool retarder oil temperature greater than 178°C (352°F)?	>178ºC (352ºF)	*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout at the TCM. 3. Disconnect the retarder temp sensor connector. 4. Turn ON the ignition. 5. At J 47275-1 TCM Overlay, connect a DVOM and measure voltage between pins 75 and 58. Is the voltage within the specified value?	4.75 to 5.0V	*Go to Step 6*	*Go to Step 5*

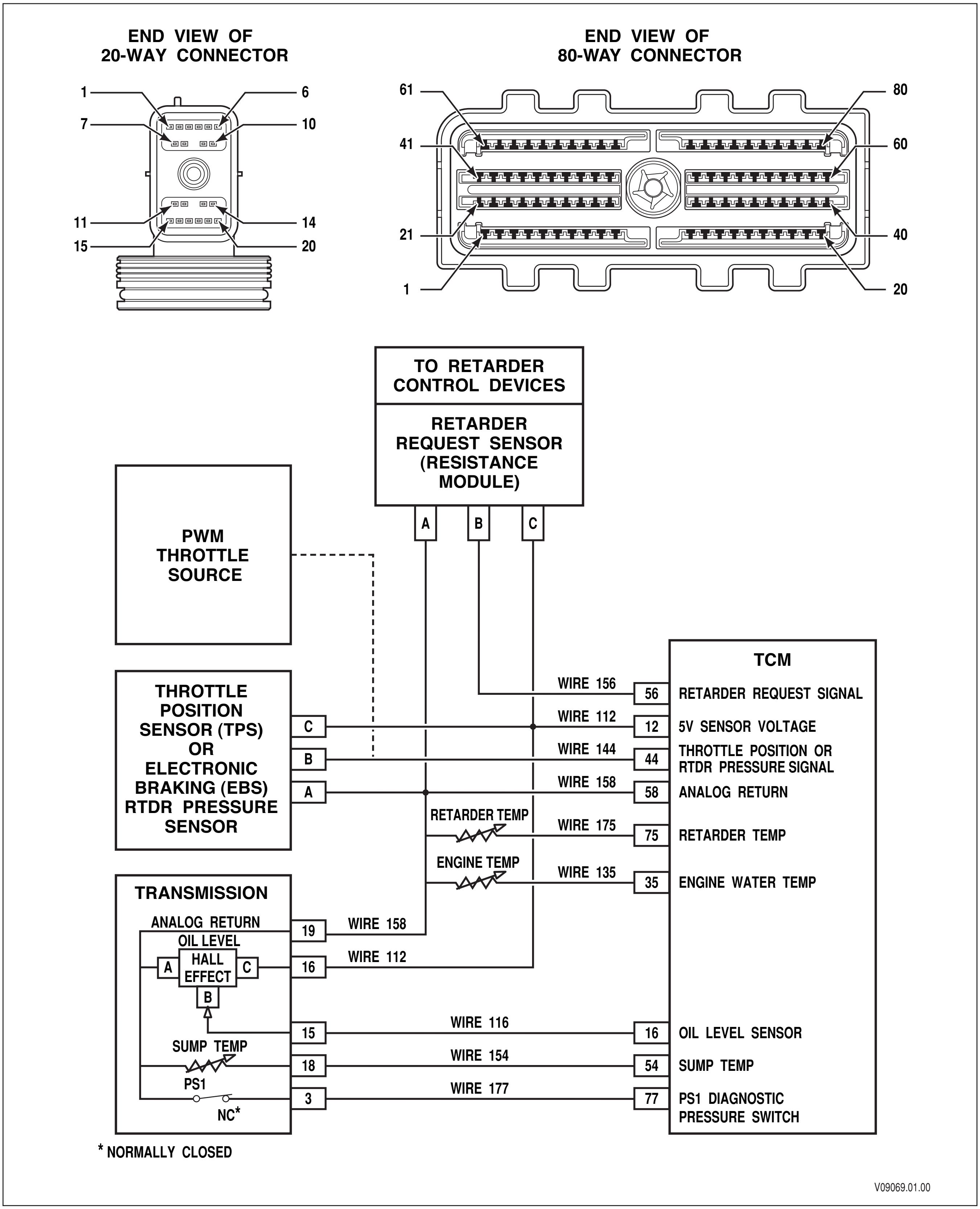
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2742 Retarder Oil Temperature Sensor Circuit—Low Input *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Disconnect the retarder temp sensor connector, if not disconnected in Step 4. 4. Using a DVOM at J 47275-1 TCM Overlay, test for pin-to-pin shorts, or shorts-to-ground on wire 175. Were any wiring defects found?		*Go to Step 8*	*Go to Step 10*
6	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Reconnect the retarder temp sensor connector. 4. At J 47275-1 TCM Overlay connect a DVOM, measure the resistance between pin 75 and 58. Is the resistance within the specified value?	Refer to Appendix Q	*Go to Diagnostic Aids*	*Go to Step 7*
7	1. Disconnect the retarder temp sensor connector. 2. Using a DVOM, measure resistance between pins A and B of the retarder temp sensor. Is the resistance within the specified value?	Refer to Appendix Q	*Go to Step 8*	*Go to Step 9*
8	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by distributors and dealers are not covered by warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
9	Replace the retarder temperature sensor. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor retarder temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant change in temperature. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2743 Retarder Oil Temperature Sensor Circuit—High Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2743 Retarder Oil Temperature Sensor Circuit—High Input

Circuit Description

A retarder oil temperature sensor monitors retarder cavity fluid temperature. The sensor consists of a thermistor that varies its resistance value based on the temperature of the fluid in the retarder housing. The Transmission Control Module (TCM) supplies a 5V reference voltage signal into a voltage-sensing network that is connected to one side of the retarder temperature sensor via wire 175. The other side of the temperature sensor is connected to the TCM analog ground wire 158.

The resistance value of the retarder temperature sensor determines the voltage drop in the retarder temperature sensor circuit. As resistance changes, the voltage drop across the thermistor will also change varying the sensor input voltage on wire 175. When retarder fluid is cold the sensor resistance is high, which produces a large voltage drop across the temp sensor circuit. The TCM, therefore, detects a high sensor input voltage during cold conditions. As the retarder fluid temperature warms to normal operating temperature, the resistance decreases producing a smaller voltage drop across the temp sensor. As a result, the TCM detects a lower sensor input voltage on wire 175 during hot oil conditions.

Conditions for Running the DTC

The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

The TCM detects retarder oil temperature less than or equal to a calibrated value for more than 2.5 seconds.

NOTE: ***The TCM is detecting voltage. A high input voltage implies high thermistor resistance, which corresponds to an extremely cold retarder oil temperature measurement.***

Actions Taken When the DTC Sets

When DTC P2743 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- TCM uses default retarder temperature values.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2743 may be caused by an open in wire 175 or 158.
- DTC P2743 may be caused by a short-to-battery on wire 175. If DTC P2743 is accompanied by a DTC P0713 and/or P2185, the problem is likely a short-to-battery on wire 154, wire 135, or wire 175.
- Review Appendix A for diagnosing intermittent electrical fault conditions.
- Inspect the wiring for poor electrical connections at the TCM and retarder temp sensor. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level and condition.
3. This step verifies which condition has set the DTC P2743.
4. This step tests for the proper 5V reference voltage at TCM.
5. This step tests for wire-to-wire shorts, shorts-to-ground, or an open on wire 175.
6. This step tests for proper system circuit resistance value.
7. This step tests the resistance value of the internal TFT sensor.

DTC P2743 Retarder Oil Temperature Sensor Circuit—High Input

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. With the engine OFF, turn the ignition to the ON position. 3. Record the failure records. 4. Clear the DTCs. 5. Monitor the retarder temperature on Allison DOC™ For PC–Service Tool. 6. Drive the vehicle and observe Allison DOC™ For PC–Service Tool for an unrealistically low temperature condition. Is the Allison DOC™ For PC–Service Tool transmission fluid temperature less than –45°C (–49°F)?	<–45° C (–49° F)	*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout at the TCM. 3. Disconnect the retarder temp sensor connector. 4. Turn ON the ignition. 5. At J 47275-1 TCM Overlay connect a DVOM and select the volts-DC scale. 6. Measure voltage between pin 75 and an isolated ground. Is the voltage within the specified value?	4.75 to 5.0V	*Go to Step 6*	*Go to Step 5*

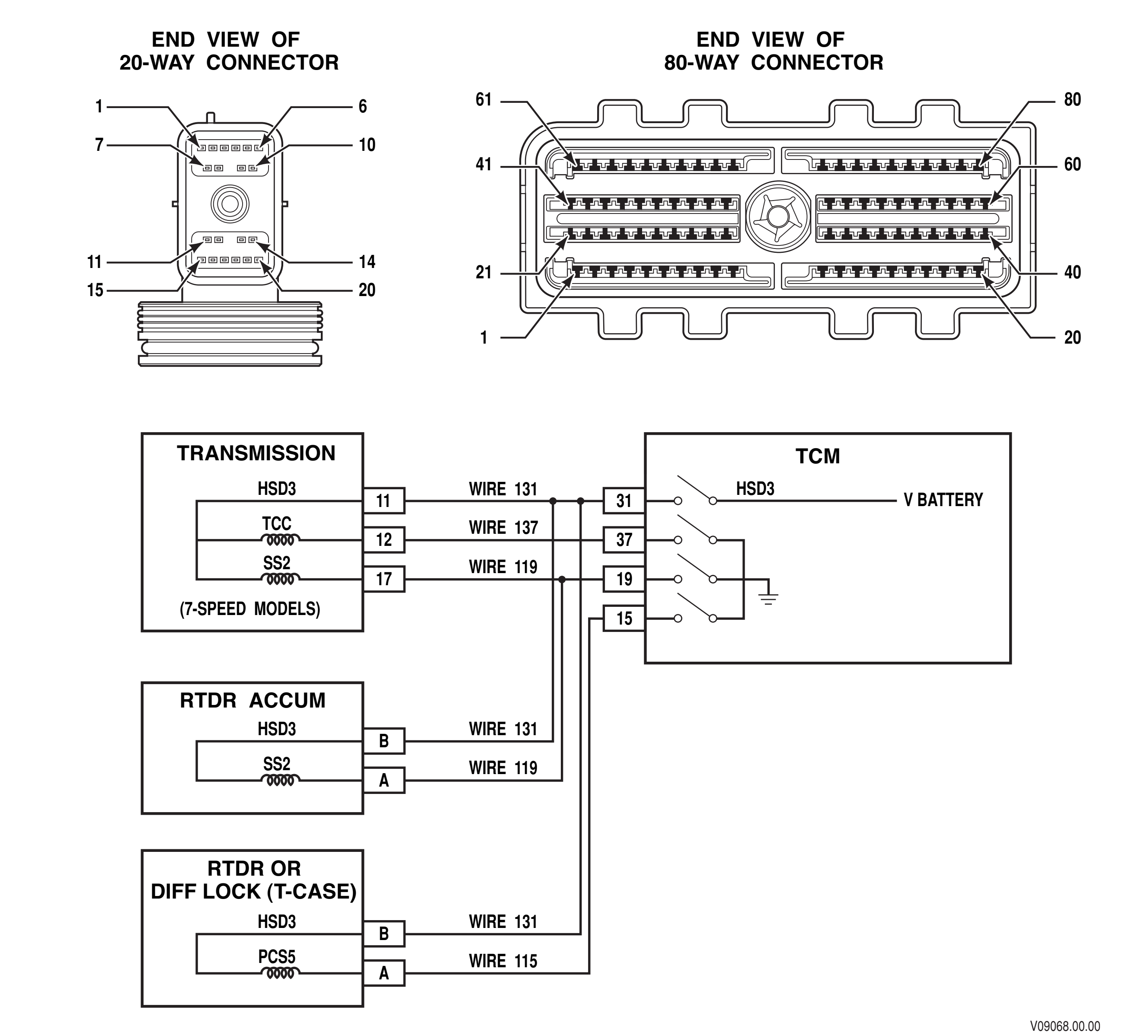
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2743 Retarder Oil Temperature Sensor Circuit—High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Disconnect the retarder temperature sensor, if not disconnected in Step 4. 4. Disconnect the transmission 20-way connector and engine coolant temperature sensor. 5. Using a DVOM at J 47275-1 TCM Overlay, test for opens in wire 175 and wire 112. 6. Also test for wire-to-wire shorts, or shorts-to-battery on wire 135, wire 154, or wire 175. Were any wiring defects found?		*Go to Step 8*	*Go to Step 10*
6	1. Turn OFF the ignition. 2. Disconnect the TCM from the J 47275 TCM Breakout. Leave the OEM-side connected. 3. Reconnect the transmission 20-way connector. 4. At J 47275-1 TCM Overlay connect a DVOM, measure the resistance at pin 75 and 58. Is the resistance within the specified value?	Refer to Appendix Q	*Go to Diagnostic Aids*	*Go to Step 7*
7	1. Disconnect the retarder temp sensor connector. 2. Using a DVOM, measure resistance between pins A and B of the retarder temp sensor. Is the resistance within the specified value?	Refer to Appendix Q	*Go to Step 8*	*Go to Step 9*
8	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
9	Replace the retarder temperature sensor. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor retarder temperature. 3. Drive the vehicle under normal operating conditions. Watch for significant change in temperature. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2761 TCC PCS Control Circuit Open



Circuit Description

Torque Converter Clutch Pressure Control Solenoid (TCC) is a normally closed (N/C) solenoid used to apply the torque converter clutch when specific engine and turbine speed conditions are met. The TCM commands the solenoid ON to produce hydraulic pressure in the torque converter clutch apply circuit. When solenoid TCC is commanded OFF, torque converter clutch pressure is released.

The TCM sends control current to solenoid TCC from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to TCC by switching TCC's Low Side Driver (LSD) ON and OFF. Wire 137 completes the circuit between TCC and its LSD. DTC P2761 indicates that the TCM has detected an open condition in solenoid TCC's electrical circuit. The open condition may exist in the high side (wire 131) or low side (wire 137).

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2761 TCC PCS Control Circuit Open

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2761 is set when the TCM detects an open circuit on the TCC solenoid return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P2761 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC operation.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2761 indicates an open in the electrical circuit for the TCC solenoid. In addition to TCC, HSD3 also supplies power to PCS5 and SS2. If DTC P2761 is accompanied by DTCs P0975 and P2736, the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage drop caused by an open condition in either wire 131 or wire 137 of the OEM chassis harness.
6. This step tests for an open condition in the transmission internal harness.
7. This step tests for the proper TCC solenoid resistance.

DTC P2761 TCC PCS Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in the TCC solenoid electrical circuit.*** Did DTC P2761 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2761 TCC PCS Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors. 4. Turn ON the ignition, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command solenoid TCC ON. 6. Determine the voltage drop in the high side of the TCC circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 31 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 11 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the TCC circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 37 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 12 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	

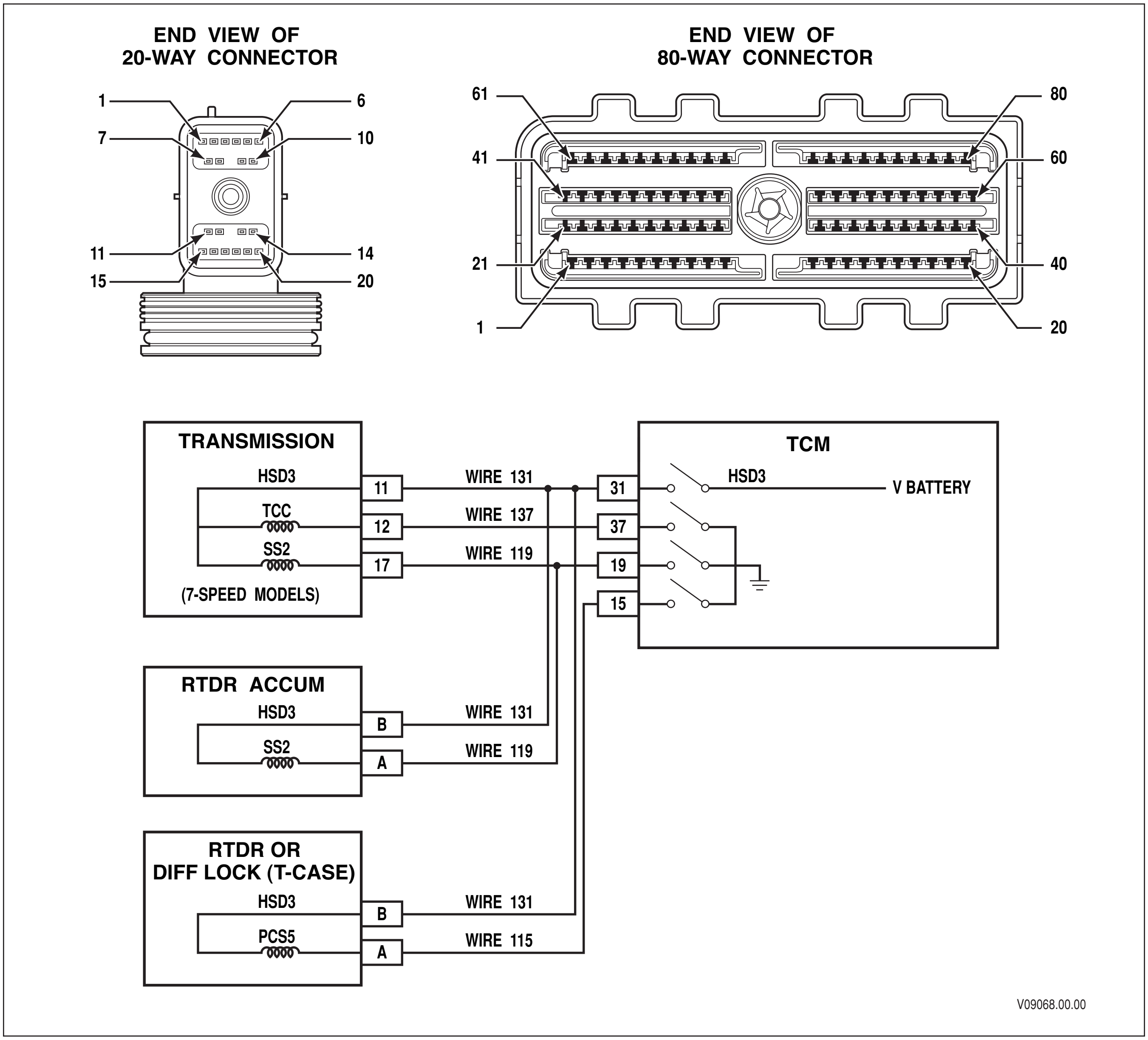
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2761 TCC PCS Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Disconnect the OEM 20-way connector from J 47279 Transmission Breakout. Leave the transmission 20-way connector connected to the breakout. 3. Using a digital multimeter (DVOM), measure the resistance between pin 11 and pin 12 in the transmission 20-way connector. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 10*	*Go to Step 7*
7	1. Remove the hydraulic control module assembly. 2. Disconnect solenoid TCC from the internal wiring harness. 3. Using a DVOM, measure solenoid TCC resistance at pins A and B. Is resistance within the specified values?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace solenoid TCC. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Watch for significant change in temperature. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2763 TCC PCS Control Circuit High



Circuit Description

Torque Converter Clutch Pressure Control Solenoid (TCC) is a normally closed (N/C) solenoid used to apply the torque converter clutch when specific engine and turbine speed conditions are met. The TCM commands the solenoid ON to produce hydraulic pressure in the torque converter clutch apply circuit. When solenoid TCC is commanded OFF, torque converter clutch pressure is released.

The TCM sends control current to solenoid TCC from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to TCC by switching TCC's Low Side Driver (LSD) ON and OFF. Wire 137 completes the circuit between TCC and its LSD. DTC P2763 indicates that the TCM has detected a short-to-battery condition in the low side of solenoid TCC's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2763 TCC PCS Control Circuit High

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2763 is set when the TCM detects a short-to-battery in the TCC solenoid return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P2763 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC operation.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2763 indicates a short-to-battery in the electrical circuit for the TCC solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter, if available)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.

DIAGNOSTIC TROUBLE CODES (DTC)

3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
4. Using Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts in wire 137.
6. This step tests for the wire-to-wire shorts in the internal transmission harness.

DTC P2763 TCC PCS Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-battery condition in the TCC solenoid electrical circuit.*** Did DTC P2763 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2763 TCC PCS Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 137 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 37 and all other pins in the 80-way connector, and shorts-to-ground between pin 37 and chassis ground. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 12 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 12 and 11 will read normal solenoid resistance. The resistance value between pins 12 and 17 (7-speed models) will be twice normal solenoid resistance. Refer to the Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts. Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace solenoid TCC. Is the replacement complete?		*Go to Step 11*	

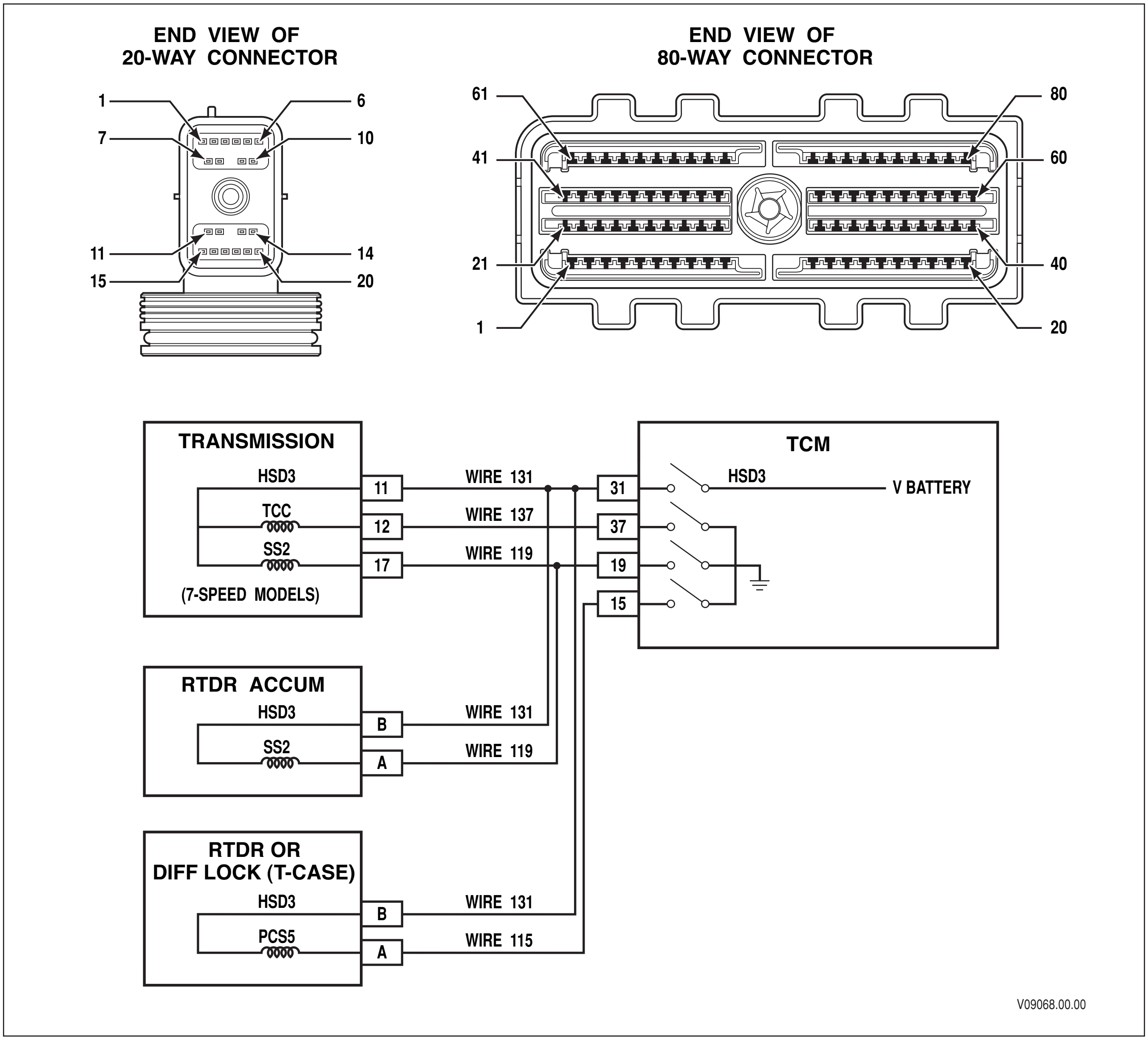
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2763 TCC PCS Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2764 TCC PCS Control Circuit Low



Circuit Description

Torque Converter Clutch Pressure Control Solenoid (TCC) is a normally closed (N/C) solenoid used to apply the torque converter clutch when specific engine and turbine speed conditions are met. The TCM commands the solenoid ON to produce hydraulic pressure in the torque converter clutch apply circuit. When solenoid TCC is commanded OFF, torque converter clutch pressure is released.

The TCM sends control current to solenoid TCC from High Side Driver 3 (HSD3) via wire 131. HSD3 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to TCC by switching TCC's Low Side Driver (LSD) ON and OFF. Wire 137 completes the circuit between TCC and its LSD. DTC P2764 indicates that the TCM has detected a short-to-ground condition in the low side of solenoid TCC's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2764 TCC PCS Control Circuit Low

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2764 is set when the TCM detects a short-to-ground in the TCC solenoid return circuit for more than 2 seconds.

Actions Taken When the DTC Sets

When DTC P2764 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM allows operation in second through sixth range, and Neutral and Reverse.
- The TCM inhibits TCC operation.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2764 indicates a short-to-ground in the electrical circuit for the TCC solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter)—measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.Connect the RED test lead to the solenoid

DIAGNOSTIC TROUBLE CODES (DTC)

low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.

3. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
4. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 137.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.

DTC P2764 TCC PCS Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect a short-to-ground condition in the TCC solenoid electrical circuit.*** Did DTC P2764 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2764 TCC PCS Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 8-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 131 and wire 137 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 37 and all other pins in the 80-way connector, and shorts-to-ground between pin 37 and chassis ground. 7. Test wire 131 for an intermittent short. Refer to Diagnostic Aids, Bullet 5 for the correct procedure. Were any wire-to-wire shorts or short-to-ground found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 12 and all other pins in the 20-way connector, and shorts-to-ground between pin 12 and chassis ground. ***NOTE: The resistance value between pins 12 and 11 will read normal solenoid resistance. The resistance value between pins 12 and 17 will be twice normal solenoid resistance.*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts, or shorts-to-ground. Were any wire-to-wire shorts or shorts-to-ground found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*

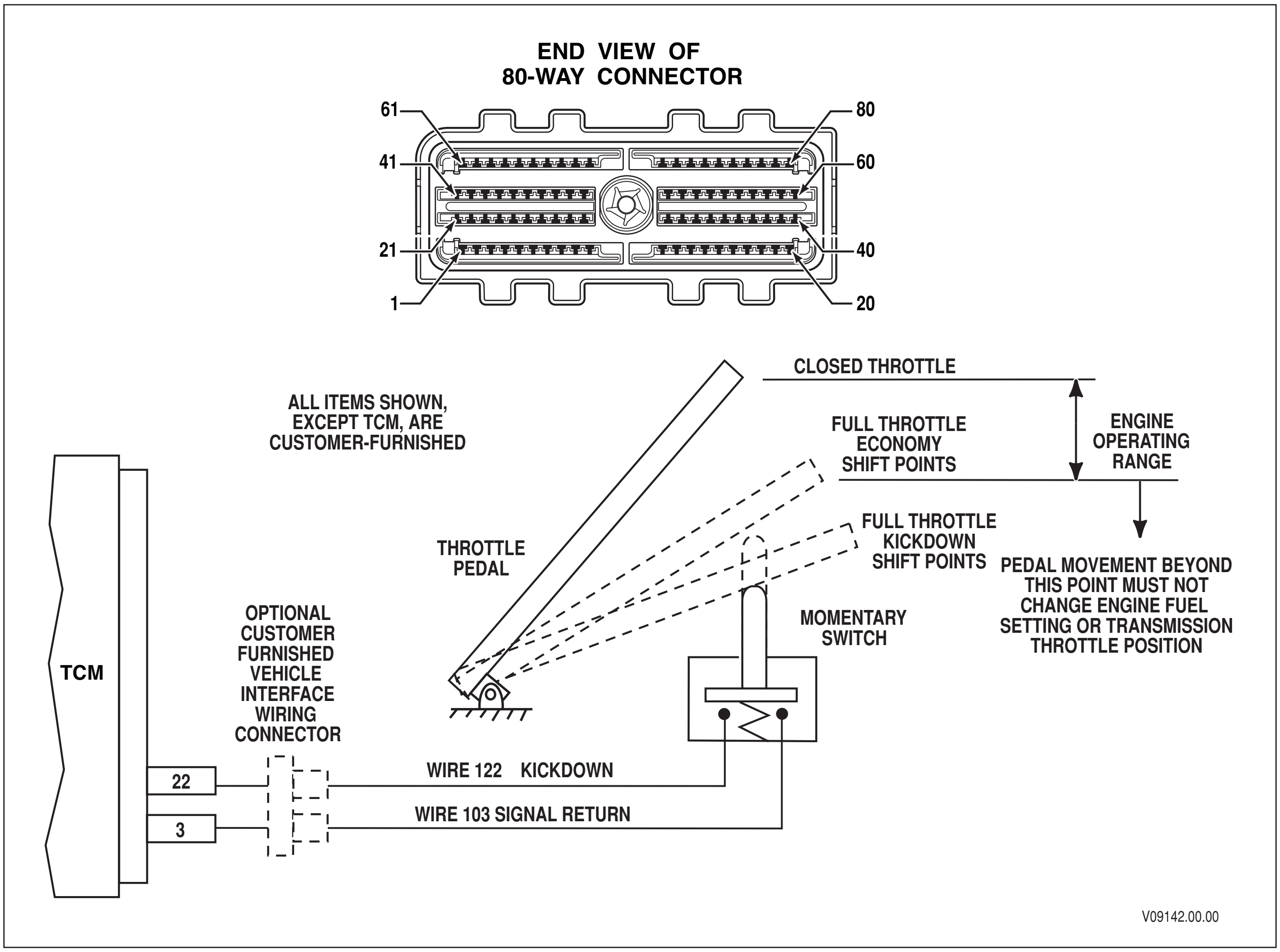
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2764 TCC PCS Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
8	Repair or replace the internal wiring harness. Is the repair complete?		*Go to Step 11*	
9	Replace solenoid TCC. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P278A Kickdown Input Failed ON



Circuit Description

The Transmission Control Module (TCM) can be calibrated to receive an acceleration pedal kickdown input from either an analog input wire or the digital data link. When the operator activates the kickdown feature in the Economy Mode, the TCM uses Performance shift points. A momentary, normally open switch attached to the throttle pedal typically generates the kickdown input signal. The switch provides a detente feel when full-throttle is achieved. When the operator “steps through” the detente, the kickdown function is activated.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- The components are powered and engine speed is greater than 200 rpm and less than 750 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P278A sets if the TCM is calibrated to receive the kickdown input signal and both of the following conditions are met:

- Throttle percentage is less than 20 percent.
- The kickdown input signal is ON for more than 5 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P278A Kickdown Input Failed ON

Actions Taken When the DTC Sets

When DTC P278A is active, the following conditions will occur:

- The **CHECK TRANS** light does not illuminate.
- DTC is stored in TCM history.
- TCM inhibits Kickdown operation.

Conditions for Clearing the DTC/CHECK TRANS light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- When analog input wires are used, the kickdown function is active when a switch is closed to complete the circuit between wire 122 and signal return wire 103. If a data link is used, the TCM receives “accelerator pedal kickdown input” as part of J1939 message parameters PGN 61443, Electronic Engine Controller 2 (EEC2).
- DTC P278A indicates the TCM has detected a kickdown input signal for more than 5 seconds with less than full throttle conditions. The code can be caused by:
  - — Faulty wiring
  - — Faulty connections to the accelerator pedal kickdown switch
  - — A faulty accelerator pedal kickdown switch
  - — Another controller improperly broadcasting kickdown signal on the data link when throttle conditions are not met
  - — A faulty TCM.
- Inspect the wiring for poor electrical connections at the TCM and kickdown input switch. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- J1939 Kickdown status can be read on Allison DOC™ For PC–Service Tool. Monitor data link communications using Data Bus Viewer.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for an active DTC.
4. This step tests for status of analog input wire 122.
5. This step determines if kickdown function activated by a data link message.
6. This step tests for shorts-to-ground in wire 122.
7. This step tests for proper kickdown switch function.
9. This step monitors received messages on the digital data link.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P278A Kickdown Input Failed ON

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Clear the DTC and drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the kickdown input signal is present for more than 5 seconds when throttle is below 20 percent.*** Did DTC P278A return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	Inspect vehicle for analog kickdown input wire 122. Is analog input wire 122 present?		*Go to Step 4*	*Go to Step 9*
4	1. Turn ON the ignition. 2. Using Allison DOC™ For PC–Service Tool, observe status of Kickdown input wire 122. Does wire 122 go ON when throttle pedal is depressed and go OFF when throttle pedal is released?		*Go to Step 5*	*Go to Step 6*
5	Using Allison DOC™ For PC–Service Tool, observe status of Kickdown function? ***NOTE: If Kickdown function is ON while the Kickdown input wire 122 is OFF, the TCM is receiving a "Kickdown Input-Active" message via the data link.*** Is the Kickdown function ON when wire 122 is OFF?		*Go to Step 9*	*Go to Diagnostic Aids*
6	1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to J 47275 TCM Breakout. Leave the TCM-side disconnected. 4. Check for shorts-to-ground on wire 122. Were any shorts or wiring defects found?		*Go to Step 8*	*Go to Step 7*
7	1. Turn OFF the ignition. 2. Using a DVOM, check for continuity when switch is depressed and no continuity when switch is released. Does the switch close when depressed and open when released?		*Go to Step 9*	*Go to Step 8*

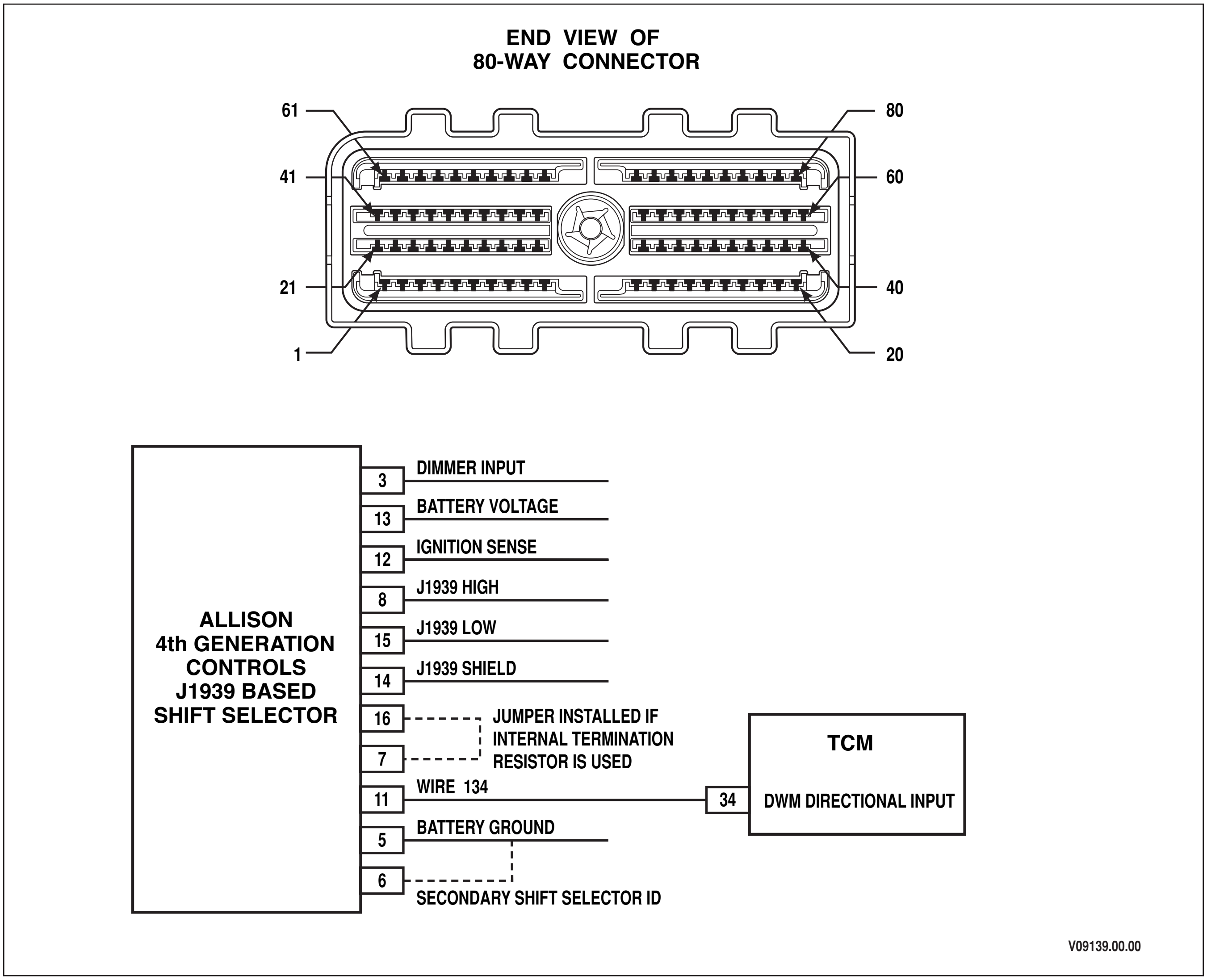
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P278A Kickdown Input Failed ON *(cont'd)*

Step	Action	Value(s)	Yes	No
8	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
9	1. Turn ON the ignition. 2. Reconnect the 80-way connector, if removed in Step 5. 3. Install Allison DOC™ For PC–Service Tool. 4. Turn ON the ignition. 5. Using Allison DOC™ For PC–Service Tool Data Bus Viewer, observe status of AP Kickdown Switch. Consult Allison DOC™ For PC–Service Tool User's Guide for instructions on using Data Bus Viewer. On Data Bus Viewer, does AP Kickdown Switch show ON when throttle pedal is depressed and OFF when throttle pedal is released?		*Go to Diagnostic Aids*	*Go to Step 10*
10	***NOTE: Allison Transmission is not responsible for data link messages that originate in other controllers. Repairs not associated with the transmission controller are not covered by Allison Transmission warranty.*** Coordinate with the vehicle or engine OEM to correct the cause of the inconsistent kickdown switch status message. Is the repair complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ For PC–Service Tool to monitor retarder request percentage. 3. Drive the vehicle under conditions noted in the failure records. 4. Confirm with the service tool in the test passed section that the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2793 Gear Shift Direction Circuit



Circuit Description

Allison 4th Generation Controls shift selectors communicate with the transmission control module (TCM) by exchanging standardized digital messages over the SAE J1939 controller area network (CAN). The shift selectors are also equipped with a single wire backup to the J1939 CAN data link. Allison 4th Generation shift selectors transmit directional information (Forward, Neutral, and Reverse) in the form of an analog pulse-width modulated (PWM) signal via wire 134 to the TCM. The shift selector switches an internal driver ON and OFF to vary the duty cycle of the voltage on wire 134. When the driver in the shift selector is ON, the voltage on wire 134 is pulled to ground. When the driver is OFF, the driver's output is open and the voltage on wire 134 is high. Since duty cycle is measured when voltage is high, the driver's OFF-time determines the duty cycle. For example, if wire 134 duty cycle is 15 percent, the shift selector driver is ON (pulled low) 85 percent of the time and OFF (open) 15 percent of the time.

Conditions for Running the DTC

The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2793 Gear Shift Direction Circuit

Conditions for Setting the DTC

DTC P2793 sets when the TCM has received invalid data from the shift selector.

Actions Taken When the DTC Sets

When DTC P2793 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM ignores PWM signal from shift selector.
- If CAN is also lost, the TCM will lock in last valid direction.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2793 is usually caused by an intermittent electrical defect in wire 134. Common causes include:
  - — An intermittent open in wire 134 between the shift selector and the TCM.
  - — An intermittent short-to-battery or short-to-ground in wire 134.
  - — A poor connection at the shift selector or the TCM.
  - — A defective shift selector.
- Inspect PWM signal wire 134 for poor electrical connections at the shift selector(s). Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- The PWM signal characteristics are shown in Table 6–18. When the vehicle is equipped with a primary and secondary shift selector, the TCM receives a PWM signal from the active shift selector only.

Table 6–18. PWM Signal Characteristics

	Primary Shift Selector 977 Hz 10 Hz (when active)	**Secondary Shift Selector 871 Hz 10 Hz (when active)**
Description	Duty Cycle (Percent)	
Unknown	15% ± 2%	15% ± 2%
Park	30% ± 2%	30% ± 2%
Reverse	45% ± 2%	45% ± 2%
Neutral	60% ± 2%	60% ± 2%
Forward	75% ± 2%	75% ± 2%
Error	90% ± 2%	90% ± 2%

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The number below refers to step numbers on the diagnostic table.

2. This step tests for wiring defects between the TCM and the active shift selector.

DTC P2793 Gear Shift Direction Circuit

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Connect the OEM 80-way connector to J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the shift selector(s). 5. Inspect wire 134 between the TCM and shift selector(s) for defects. 6. At J 47275-1 TCM Overlay, test pin 34 for wire-to-wire shorts, and shorts-to-ground, and opens between the TCM and shift selector. Massage the harness while making the wiring checks. Were any wiring defects found?		*Go to Step 4*	*Go to Step 3*
3	1. Verify ignition is OFF. 2. Reconnect the TCM and OEM 80-way connectors. 3. Disconnect the shift selector (s), if not disconnected in Step 2 above. 4. Using a digital multimeter (DVOM), test for continuity between pin 5 in the OEM shift selector connector and battery ground. Is there a clean ground to the shift selector?		*Go to Step 5*	*Go to Step 4*
4	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 8*	
5	***NOTE: If the vehicle has a primary and secondary shift selector, both must be disconnected to properly perform this step.*** 1. Disconnect the shift selector(s). 2. Turn ON the ignition. Leave the engine OFF. 3. Using a DVOM set on VDC, measure the voltage on pin 11 in the OEM shift selector connector. Is voltage within specified values?	4.5–5.0V	*Go to Step 7*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2793 Gear Shift Direction Circuit *(cont'd)*

Step	Action	Value(s)	Yes	No
6	Replace the affected shift selector. Is the replacement complete?		*Go to Step 8*	
7	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Clear the DTC. 2. Refer to Allison DOC™ For PC–Service Tool “Test Passed” section and confirm the test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2808 Pressure Control Solenoid 6 (PCS6) Stuck Off

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed and the output speed sensors to detect if a clutch is slipping. Pressure Control Solenoid 6 (PCS6) supplies hydraulic pressure to the C6 clutch in Low range for 7-speed models. The TCM sets a DTC P2808 when it detects a slip condition while PCS6 is supplying hydraulic pressure to the oncoming clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 125 rpm.
- Turbine speed greater than or equal to 60 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P2808 sets when the TCM detects an incorrect oncoming ratio (range-to-range) for an accumulated number of occurrences.

Actions Taken When the DTC Sets

- When DTC P2808 occurs, the TCM commands previous range.
- While Diagnostic Response is active, the TCM ignores shift selector input.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates that the oncoming clutch controlled by PCS6 is not applied or applied too slowly. Common causes include:
  - — Erratic turbine or output speed signals.
  - — A leak or obstruction in the C6 clutch apply circuit.
  - — A defective solenoid.
  - — A stuck PCS6 regulator valve.
- PCS6 supplies hydraulic pressure to C6 clutch in Low range for 7-speed models. Check the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - — Intermittent wiring connection
  - — Excessive vibration (driveline or engine torsionals)
  - — Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C6 clutch pressure from PCS6.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P2808 Pressure Control Solenoid 6 (PCS6) Stuck Off

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected a slip condition and could not verify the correct oncoming ratio following a shift.*** Did DTC P2808 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting Section 8*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2808 Pressure Control Solenoid 6 (PCS6) Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main and C6 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the Failure Records. 6. Read and record Main and C6 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the appropriate service manual and remove the transmission hydraulic control module. 2. Inspect the control valve body for stuck or sticking solenoid regulator valves. 3. Inspect the suction filter. Ensure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS6. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2809 Pressure Control Solenoid 6 (PCS6) Stuck On

Refer to Hydraulic Schematic

Circuit Description

The Transmission Control Module (TCM) uses information from the turbine and output speed sensors to detect if a clutch is in a tie-up condition or if three clutches are applied. Pressure Control Solenoid 6 (PCS6) supplies hydraulic pressure to the C6 clutch in Low range for 7-speed models. The TCM sets a DTC P2809 when it detects a tie-up condition while PCS6 is supplying hydraulic pressure to the off-going clutch.

Conditions for Running the DTC

- Hydraulic system is pressurized.
- Output speed greater than or equal to 200 rpm.
- Turbine speed greater than or equal to 200 rpm.
- Cold Mode operation not required.

Conditions for Setting the DTC

DTC P2809 sets when the transmission is shifting from range to range and the off-going range (ratio) remains engaged even though the off-going clutch is commanded OFF.

Actions Taken When the DTC Sets

- When DTC P2809 occurs, the TCM will command previous range.
- While Diagnostic Response is active, the TCM ignores shift selector inputs.
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- This DTC indicates that the off-coming clutch controlled by PCS6 is not released or released too slowly. Common causes include:
  - — Erratic turbine and output speed sensor readings.
  - — An obstruction in the C6 clutch exhaust circuit.
  - — A defective PCS6 solenoid.
  - — A stuck PCS6 regulator valve.
- PCS6 supplies hydraulic pressure to C6 clutch in Low range for 7-speed models. Check the Allison DOC™ For PC–Service Tool failure record data for previous or current range information when the DTC was set to determine which clutch circuit is suspect.

DIAGNOSTIC TROUBLE CODES (DTC)

- If the condition is intermittent, connect Allison DOC™ diagnostic tool and observe the speed sensor indicated by the code. If the signal is erratic, investigate and eliminate the following:
  - Intermittent wiring connection
  - Excessive vibration (driveline or engine torsionals)
  - Irregular sensor gap (loose sensor, loose tone wheel, or damaged tone wheel).

Test Description

The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper transmission fluid level.
3. This step tests for active diagnostic codes.
4. This step tests ignition voltage.
5. This step tests speed sensor readings.
6. This step tests for C6 clutch pressure from PCS6.
7. This step tests for evidence of clutch failure.
8. This step tests for stuck or sticking valves and damaged valve body gaskets.

DTC P2809 Pressure Control Solenoid 6 (PCS6) Stuck On

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Perform the Fluid Checking Procedure (refer to appropriate mechanic's tips). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Fluid Check Procedure (refer to mechanic's tips)*
3	1. Install the Allison DOC™ For PC–Service Tool. 2. Turn ON the ignition, leave engine OFF. 3. Record the failure records. 4. Clear the DTC. 5. Drive the vehicle. Attempt to duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that the TCM has detected that the off-going clutch did not release (clutch tie-up) following a shift.*** Did DTC P2809 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the DTC failure record data. 4. Using the Allison DOC™ For PC–Service Tool, measure ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 5*	*Go to General Troubleshooting Section 8*
5	1. Start the engine and drive the vehicle under normal operating conditions. 2. Using Allison DOC™ For PC–Service Tool, monitor turbine, engine, and output speed sensor readings using the strip chart display. Is speed sensor data erratic or are dropouts in signal indicated?	Watch for erratic speed sensor signals	*Go to the appropriate speed sensor DTC*	*Go to Step 6*

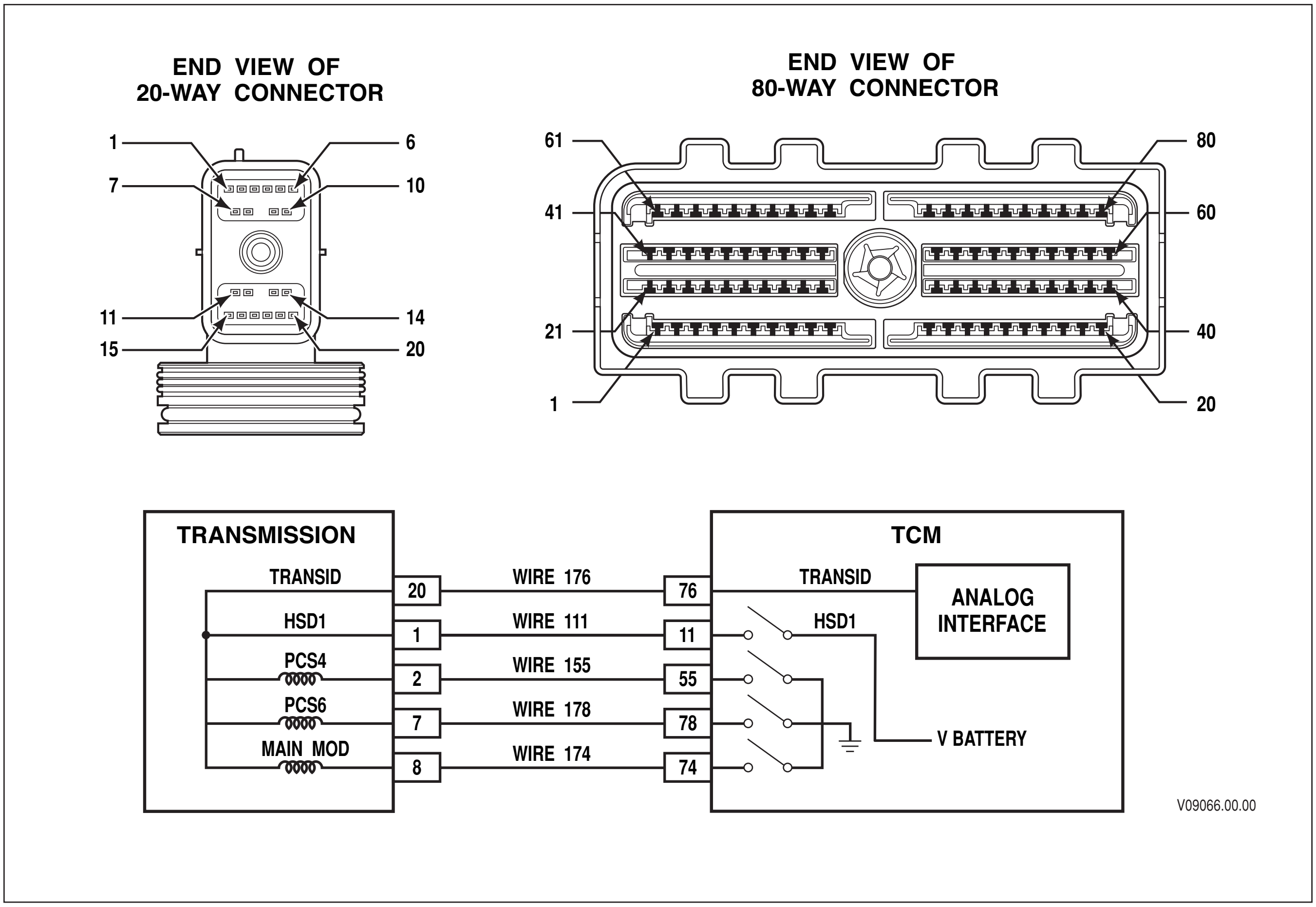
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2809 Pressure Control Solenoid 6 (PCS6) Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn OFF the ignition. 2. Install 2000 kPa (300 psi) pressure gauges in main and C6 pressure taps. 3. Start the engine. 4. Using Allison DOC™ For PC–Service Tool, select the clutch test mode. 5. With brakes applied, select and attain the range where the DTC occurred as indicated in the failure records. 6. Read and record Main and C6 clutch pressures. Are the pressure readings within specified values in Appendix B?	Refer to Main and Clutch Pressure specifications in Appendix B	*Go to Step 7*	*Go to Step 8*
7	Remove the dipstick and inspect the transmission fluid for clutch debris or burnt odor. If necessary, drain a small amount of fluid for this inspection. Are there signs of a clutch failure?		*Go to Step 10*	*Go to Diagnostic Aids*
8	1. Consult the service manual and remove the transmission hydraulic control module. 2. Inspect the control valve body for stuck or sticking solenoid regulator valves. 3. Inspect the suction filter. Be sure screen is not plugged. 4. Inspect for damaged gaskets and face seals. Was a valve body problem found and repaired?		*Go to Step 11*	*Go to Step 9*
9	Replace PCS6. Is the replacement complete?		*Go to Step 11*	
10	Remove the main and lube filters and inspect for clutch debris. It may also be necessary to remove the control module and inspect the suction screen for clutch debris. If debris is found, remove the transmission for overhaul or replacement (refer to the appropriate service manual). Is the replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™ For PC–Service Tool, monitor engine, turbine and output speed sensor readings. 3. Drive the vehicle under normal operating conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2812 Pressure Control Solenoid 6 (PCS6) Control Circuit Open



Circuit Description

Pressure Control Solenoid 6 (PCS6) is a normally closed (N/C) solenoid used to apply the C6 clutch in low range (7-speed models only). The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS6 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS6 from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS6 by switching PCS6 Low Side Driver (LSD) ON and OFF. Wire 178 completes the circuit between PCS6 and its LSD. DTC P2812 indicates that the TCM has detected an open condition in PCS6 electrical circuit. The open condition may exist in the high side (wire 111) or low side (wire 178).

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2812 is set when the TCM detects an open circuit on the PCS6 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2812 Pressure Control Solenoid 6 (PCS6) Control Circuit Open

Actions Taken When the DTC Sets

When DTC P2812 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2812 indicates an open in the electrical circuit for the PCS6 solenoid. In addition to PCS6, High Side Driver HSD1 also supplies power to the Main Mod and PCS4 solenoids. If DTC P2812 is accompanied by DTC P0960 (Main Mod solenoid open circuit) and/or DTC P2718 (PCS4 open circuit), the open is most likely in the high side of the circuit.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests the OEM harness for an excessive voltage drop caused by an open condition in either wire 111 or wire 178 of the OEM chassis harness.
6. This step tests for an open condition in the transmission internal harness.
7. This step tests for the proper PCS6 resistance.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2812 Pressure Control Solenoid 6 (PCS6) Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect an open condition in the PCS6 electrical circuit.*** Did DTC P2812 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Install J 47275 TCM Breakout between the OEM and TCM 80-way connectors. 3. Install J 47279 Transmission Breakout between the OEM and transmission 20-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™ For PC–Service Tool, enter Solenoid Test mode and command PCS6 ON. 6. Determine the voltage drop in the high side of the PCS6 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 11 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 1 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. 7. Determine the voltage drop in the low side of the PCS6 circuit as follows: • At J 47275-1 TCM Overlay, measure voltage between pin 78 and an isolated ground. • At J 47279-1 Transmission Overlay, measure voltage between pin 7 and isolated ground. • Subtract the two voltage measurements to obtain the voltage drop in the circuit. ***NOTE: A voltage drop of more than 0.5V across either circuit indicates an excessive voltage loss in the OEM harness.*** Did either high-side or low-side voltage drop exceed 0.5VDC?		*Go to Step 5*	*Go to Step 6*

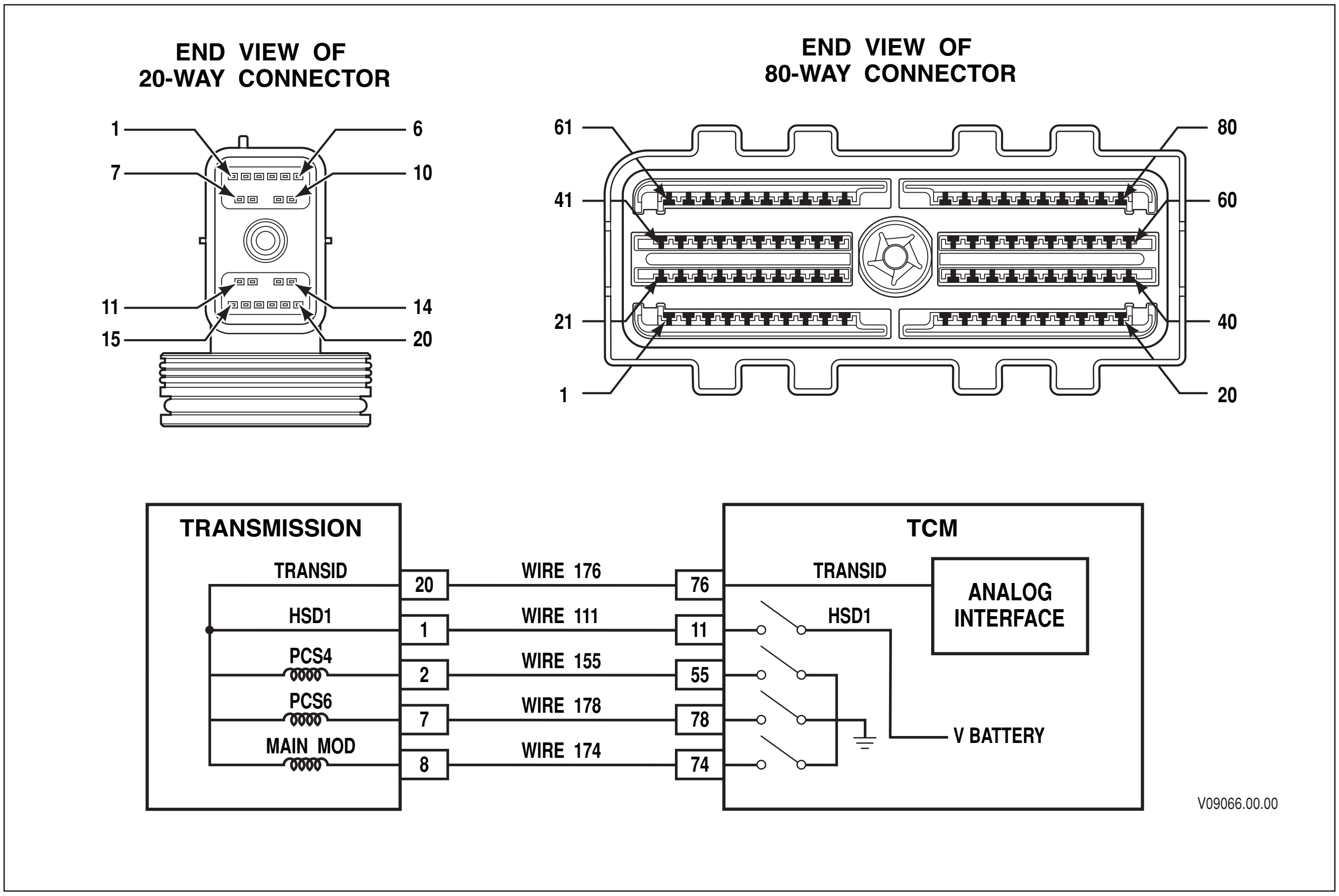
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2812 Pressure Control Solenoid 6 (PCS6) Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Disconnect the OEM 20-way connector from J 47279 Transmission Breakout. Leave the transmission 20-way connector connected to the breakout. 3. Using a digital multimeter (DVOM), measure the resistance between pin 1 and pin 7 of the transmission 20-way connector. Is the resistance within the specified value?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 10*	*Go to Step 7*
7	1. Remove the hydraulic control module assembly. 2. Disconnect PCS6 from the internal wiring harness. 3. Using a DVOM, measure PCS6 resistance. Is resistance within the specified values?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS6. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2814 Pressure Control Solenoid 6 (PCS6) Control Circuit Low



Circuit Description

Pressure Control Solenoid 6 (PCS6) is a normally closed (N/C) solenoid used to apply the C6 clutch in low range (7-speed models only). The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS6 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS6 from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS6 by switching PCS6 Low Side Driver (LSD) ON and OFF. Wire 178 completes the circuit between PCS6 and its LSD. DTC P2814 indicates that the TCM has detected a short-to-ground condition in the low side of PCS6 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2814 is set when the TCM detects a short-to-ground in the PCS6 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2814 Pressure Control Solenoid 6 (PCS6) Control Circuit Low

Actions Taken When the DTC Sets

When DTC P2814 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2814 indicates a short-to-ground in the electrical circuit for the PCS6 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter)—Measure solenoid LSD functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts or a short-to-ground condition in wire 178.
6. This step tests for the wire-to-wire shorts or a short-to-ground in the internal transmission harness.

DTC P2814 Pressure Control Solenoid 6 (PCS6) Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect short-to-ground condition in the PCS6 electrical circuit.*** Did DTC P2814 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wire 178 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 78 and all other pins in the 80-way connector, and shorts-to-ground between pin 78 and chassis ground. Were any wire-to-wire shorts or shorts-to-ground wiring defects found?		*Go to Step 5*	*Go to Step 6*

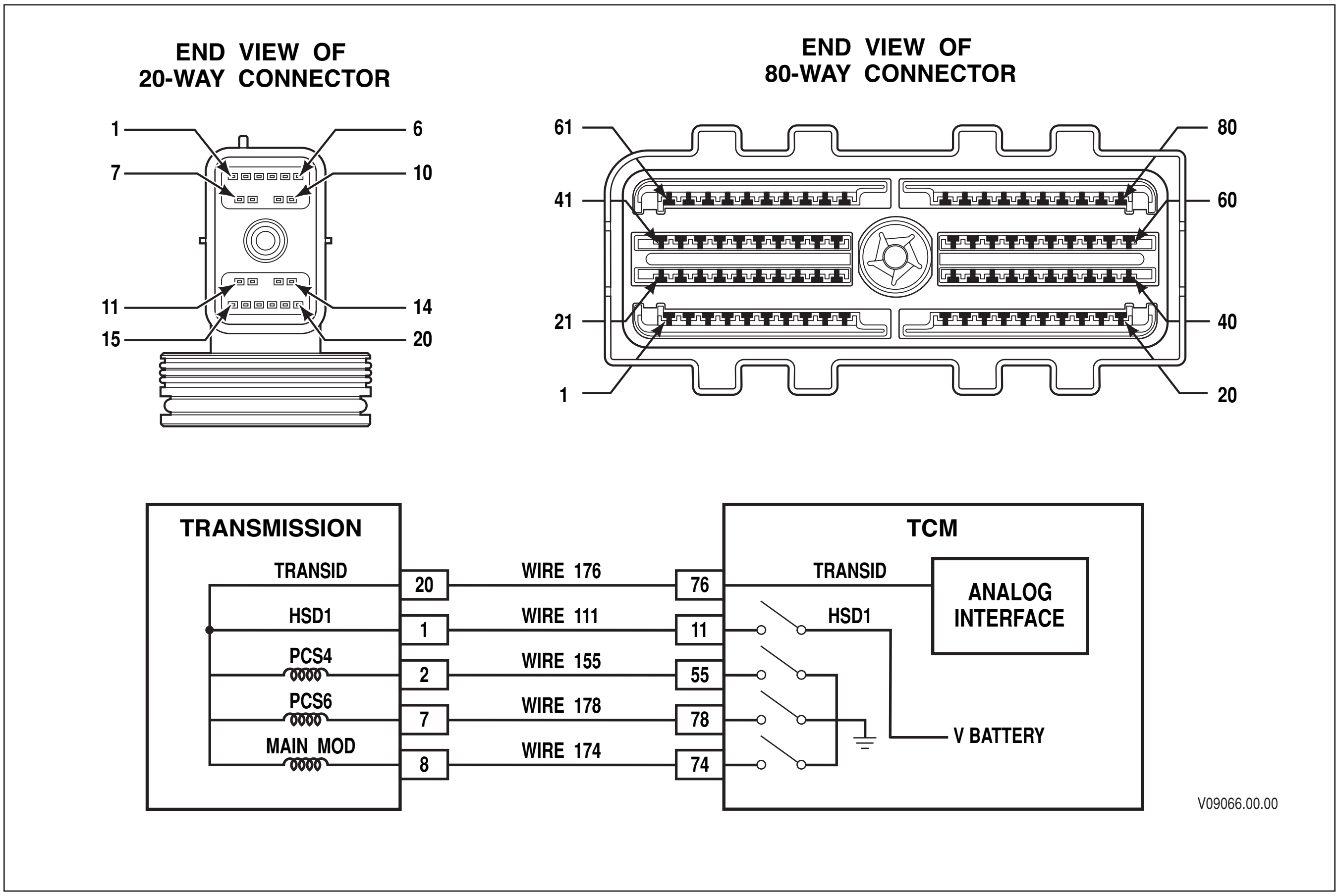
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2814 Pressure Control Solenoid 6 (PCS6) Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 7 and all other pins in the 20-way connector, and shorts-to-ground between pin 2 and chassis ground. ***NOTE: The resistance value between pins 7 and 1, and between pins 7 and 20 will read normal solenoid resistance. The resistance value between pins 7 and 2, and between 7 and 8 will be twice normal solenoid resistance. Refer to the Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts, or shorts-to-ground. Were any wire-to-wire shorts, or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS6. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2815 Pressure Control Solenoid 6 (PCS6) Control Circuit High



Circuit Description

Pressure Control Solenoid 6 (PCS6) is a normally closed (N/C) solenoid used to apply the C6 clutch in low range (7-speed models only). The TCM commands the solenoid ON to produce hydraulic pressure in the clutch apply circuit. When PCS6 is commanded OFF, the clutch pressure is released.

The TCM sends control current to PCS6 from High Side Driver 1 (HSD1) via wire 111. HSD1 is continuously ON unless the TCM detects a fault condition. The TCM regulates the amount of current to PCS6 by switching PCS6 Low Side Driver (LSD) ON and OFF. Wire 178 completes the circuit between PCS6 and its LSD. DTC P2815 indicates that the TCM has detected a short-to-battery condition in the low side of PCS6 electrical circuit.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- TCM initialization is in process or engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC P2815 is set when the TCM detects a short-to-battery in the PCS6 return circuit for more than 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2815 Pressure Control Solenoid 6 (PCS6) Control Circuit High

Actions Taken When the DTC Sets

When DTC P2815 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of latch valves determines the range attained.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC P2815 indicates a short-to-battery in the electrical circuit for the PCS6 solenoid.
- You may have to drive the vehicle in order to experience a fault. Use the data obtained from failure records to determine transmission range and/or certain vehicle operating variables such as temperature, run time etc. This data can be useful in reproducing the failure mode when DTC was set.
- Inspect the wiring for poor electrical connections at the TCM and transmission connector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open or short circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- Advanced Troubleshooting (requires a frequency-capable digital multimeter)—Measure solenoid Low Side Driver functionality as follows:
  1. Install TCM breakout harness adapter J 47275 between the 80-way connectors of the TCM and OEM harness.
  2. Set up a frequency-capable digital multimeter, e.g. Fluke 87, to monitor frequency by selecting the VOLTS-DC scale and depressing the HERTZ button once.
  3. Connect the RED test lead to the solenoid low side pin at TCM breakout harness adapter J 47275. Connect the BLACK test lead to the isolated ground pin.
  4. Use Allison DOC™ For PC–Service Tool solenoid test function to command the solenoid ON and OFF.
  5. Frequency should read in the KILOHERTZ range when the driver is commanded ON. Frequency should read 0 hertz when the driver is commanded OFF.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47275 TCM Breakout and J 47279 Transmission Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for the proper ignition voltage.
3. This step tests for an active DTC.
4. This step tests for wire-to-wire shorts between wire 178 and other wires in the OEM chassis harness.
6. This step tests for the wire-to-wire shorts in the transmission internal harness.

DTC P2815 Pressure Control Solenoid 6 (PCS6) Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Install the Allison DOC™ For PC–Service Tool. 2. Start the engine. 3. Record the failure records. 4. Monitor ignition voltage. Is the voltage within the specified values?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start the engine and test drive the vehicle. 3. Attempt to duplicate the same conditions observed in the failure records (range attained, temperature, etc.). ***NOTE: This DTC is intended to detect short-to-battery condition in the PCS6 electrical circuit.*** Did DTC P2815 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the OEM-side of the 80-way connector to the J 47275 TCM Breakout. Leave the TCM disconnected. 4. Disconnect the transmission 20-way connector. 5. Inspect the routing of wires 111 and 178 in the chassis harness between the TCM and the transmission connector. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts between pin 78 and all other pins in the 80-way connector. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*

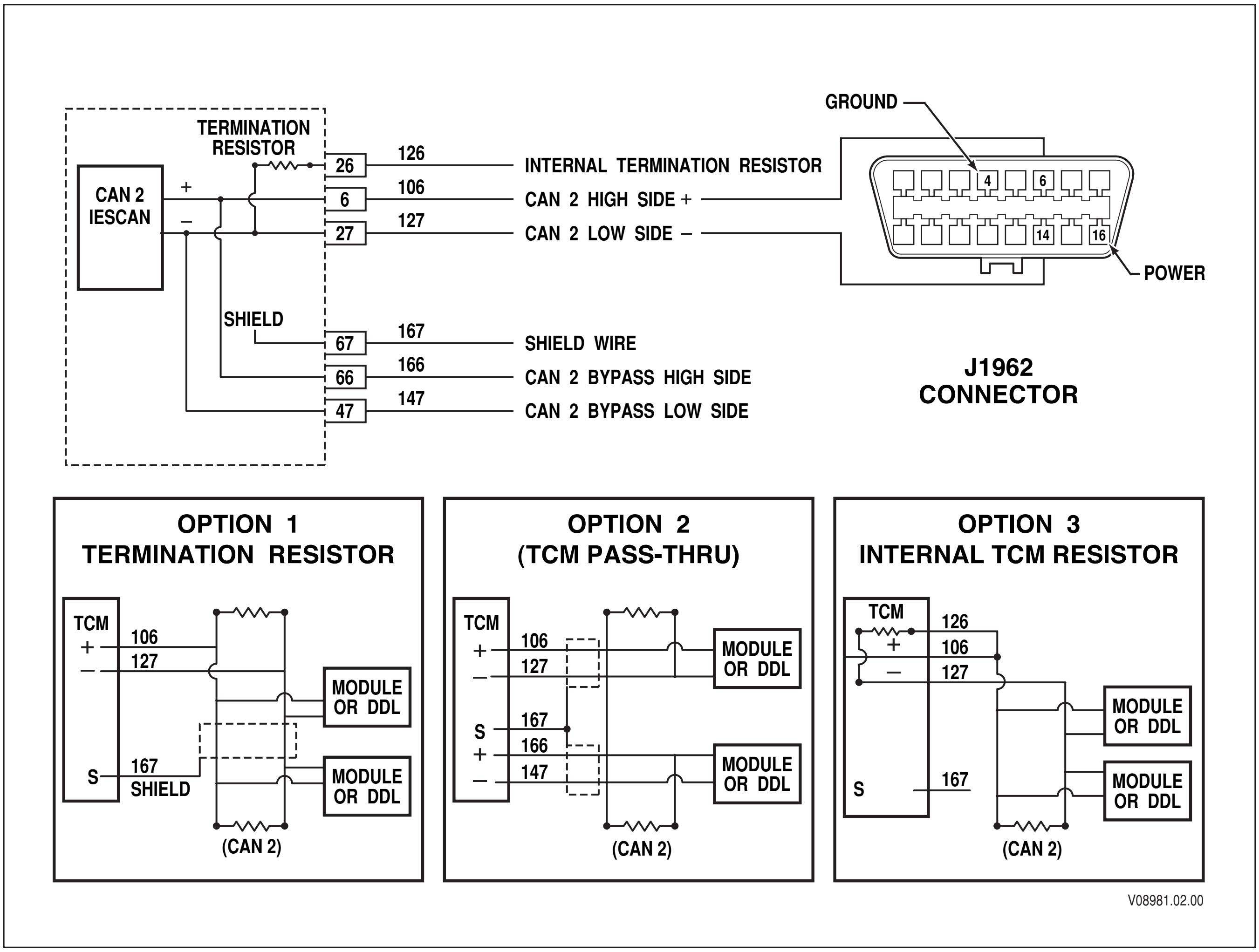
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2815 Pressure Control Solenoid 6 (PCS6) Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 11*	
6	1. Turn OFF the ignition. 2. Install J 47279 Transmission Breakout to the transmission 20-way connector. Leave the OEM harness disconnected. 3. Using a DVOM, test for wire-to-wire shorts between pin 7 and all other pins in the 20-way connector. ***NOTE: The resistance value between pins 7 and 1, and between pins 7 and 20 will read normal solenoid resistance. The resistance value between pins 7 and 2, and between 7 and 8 will be twice normal solenoid resistance. Refer to the Solenoid Resistance chart for these values.*** Were any wire-to-wire shorts found?		*Go to Step 7*	*Go to Step 10*
7	1. Remove the hydraulic control module assembly. 2. Inspect the internal harness for wire-to-wire shorts. Were any wire-to-wire shorts found?	Refer to Solenoid Resistance Chart (Appendix K)	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness. Is the replacement complete?		*Go to Step 11*	
9	Replace PCS6. Is the replacement complete?		*Go to Step 11*	
10	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0001 Hi Speed CAN Bus Reset Counter Overrun (IESCAN)



Circuit Description

Beginnings in MY07, the Allison 4th Generation Controls transmission control module (TCM) is capable of communicating with some Mercedes engines via the IESCAN. The TCM uses the high-speed Controller Area Network 2 (CAN2) chip to exchange standardized messages with the engine controller and other vehicle systems. The IESCAN physical network consists of a two-wire twisted pair, two 120 Ohm resistors and, in most cases, a third shield wire. A 120 Ohm termination resistor is located at each end of the network. Vehicle OEMs may choose to install external termination resistors or use internal termination resistors built into many IESCAN electronic modules.

Conditions for Running the DTC

- Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC U0001 sets when the TCM detects no communication on the CAN2 backbone for 3 seconds or more.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0001 Hi Speed CAN Bus Reset Counter Overrun (IESCAN)

Actions Taken When the DTC Sets

When DTC U0001 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- SEM operation is not active, if applicable.
- The TCM defaults to the most recent adaptive shift values and uses default throttle percentage.
- TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC U0001 indicates that a CAN bus hardware error has occurred. This may indicate a short-to-power or short-to-ground exists in the CAN bus wiring harness.
- Vehicle manufactures may use the following pin pairs for the J2284 CAN2 high and low wires:
  - Pins 6 and 7
  - Pins 66 and 47
  - Both pins 6 and 27, and pins 66 and 47 in a “pass-through” setup.

  As a result, vehicle manufactures can wire the TCM into the CAN2 backbone in three different ways:
  - The TCM may be on its own stub as in traditional CAN backbones.
  - The TCM may be wired in a “pass-through” configuration such that the CAN high and low wires are connected to two separate pin pairs in the TCM 80-way connector. Data link messages pass-through but can still be viewed by the TCM.
  - The TCM may represent one end of the backbone. Typically, the internal resistor in the TCM will be used in this setup.
- Often an active U0001 will prevent the Allison DOC™ For PC–Service Tool from communicating with the TCM. The J 47276 “T” Breakout and TCM Reflashing Harness may be used to confirm the TCM is operational. Connect the T-harness to the TCM and leave the OEM harness disconnected. Provide input power from the PCCS load box.
- Inspect the J2284 CAN wires for poor electrical connections at the TCM. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.
- For proper J2284 data link communications, it is necessary to have two 120 Ohm resistors installed in parallel at the J2284 CAN backbone.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47276 “T” Breakout and TCM Reflashing Harness. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for communication with the TCM via the vehicle diagnostic connector.
3. This step tests for communication with the TCM via the T-harness.
4. This step inspects for wiring defects in the CAN backbone.

DTC U0001 Hi Speed CAN Bus Reset Counter Overrun (IESCAN)

	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Connect Allison DOC™ For PC–Service Tool to the vehicle’s diagnostic tool connector. 2. Turn ON the ignition. Leave the engine OFF. Is the Allison DOC™ For PC–Service Tool communicating with the TCM?		*Go to Diagnostic Aids*	*Go to Step 3*
3	***NOTE: Review Section 4—Wire Test Procedures before performing steps.*** 1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install J 47276 “T” Breakout to the TCM. Leave the OEM-side disconnected. 4. Provide power to the TCM from the J 47455-A PCCS load box. 5. Connect Allison DOC™ For PC–Service Tool to the 16-pin J1962 connector in the T-harness. Is Allison DOC™ For PC–Service Tool communicating with the TCM?		*Go to Step 4*	*Go to Step 6*
4	1. Turn OFF the ignition. 2. Inspect the CAN2 high, CAN2 low, and CAN2 shield wires at the engine and transmission controllers for possible wire-to-wire shorts, shorts-to-ground, or shorts-to-battery. ***NOTE: Vehicle manufactures may used the following pin pairs for CAN high and CAN low.*** • ***Pins 6 and 27*** • ***Pins 66 and 47, or both pairs 6 and 27 and 66 and 47 in a “pass-through” setup.*** Were any wiring defects found?		*Go to Step 5*	*Go to Diagnostic Aids*

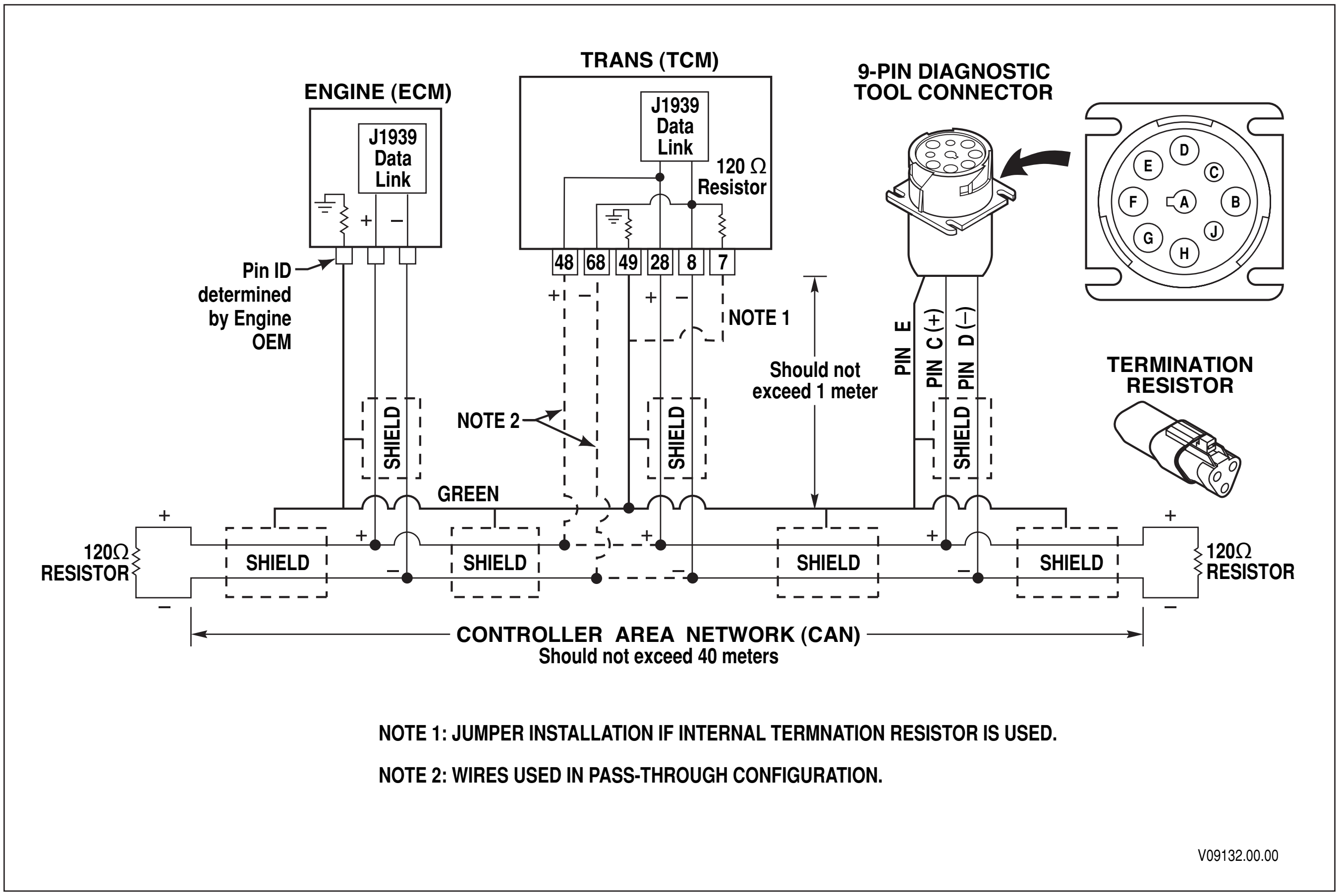
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0001 Hi Speed CAN Bus Reset Counter Overrun (IESCAN) *(cont'd)*

	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 7*	
6	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 7*	
7	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. If communication is established with the TCM, use Allison DOC™ For PC–Service Tool to clear the DTC. 3. Confirm the TCM can communicate with the engine. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0010 CAN Bus Reset Counter Overrun



Circuit Description

In Allison 4th Generation Controls, the preferred digital data link is the SAE J1939 Controller Area Network (CAN). The TCM communicates with the engine control module and other controllers by exchanging standardized digital messages over the SAE J1939 CAN. The physical network consists of a two-wire twisted pair, two 120 Ohm termination resistors and, in most cases, a third shield wire. A 120 Ohm termination resistor is located at each end of the network. Vehicle OEMs may chose to install external termination resistors or use internal termination resistors built into many J1939 electronic modules.

Conditions for Running the DTC

- Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

Conditions for Setting the DTC

DTC U0010 sets when the TCM detects no communication on the CAN backbone for 3 seconds or more.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0010 CAN Bus Reset Counter Overrun

Actions Taken When the DTC Sets

When DTC U0010 active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light.
- DTC is stored in TCM history.
- SEM operation is not active, if applicable.
- The TCM defaults to the most recent adaptive shifts values and uses default throttle percentage.
- TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- DTC U0010 indicates that a CAN bus hardware error has occurred. This may indicate a short-to-power or short-to-ground exists in the CAN bus wiring harness.
- Vehicle manufacturers may use the following pin pairs for the J1939 CAN high and CAN low wires:
  - — Pins 8 and 28
  - — Pins 48 and 68
  - — Both Pins 8 and 28, and Pins 48 and 68 in a “pass-through” setup
- As a result, vehicle manufacturers can wire the TCM into the CAN backbone in three different ways.
  - — The TCM may be on its own stub as in traditional CAN backbones.
  - — The TCM may be wired in a “pass-through” configuration such that the CAN high and low wires are connected to two separate pin pairs in the TCM 80-way connector. Data link messages pass-through but can still be viewed by the TCM.
  - — The TCM may represent one end of the backbone. Typically, the internal resistor in the TCM will be used in this setup.
- Often an active U0010 will prevent the Allison DOC™ For PC–Service Tool from communicating with the TCM. The J 47276 “T” Breakout and TCM Reflashing Harness may be used to confirm that the TCM is operational. Connect the T-harness to the TCM and leave the OEM harness disconnected. Provide input power from the PCCS load box.
- Inspect the J1939 CAN wires for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.
- For proper J1939 data link communications, it is necessary to have two 120 Ohm resistors installed in parallel at the J1939 CAN backbone.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47276 "T" Breakout and TCM Reflashing Harness. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for communication with the TCM via the vehicle diagnostic tool connector.
3. This step tests for communication with the TCM via the T-harness.
4. This step inspects for wiring defects in the CAN backbone.

DTC U0010 CAN Bus Reset Counter Overrun

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Connect Allison DOC™ For PC–Service Tool to the vehicle's diagnostic tool connector. 2. Turn ON the ignition. Leave the engine OFF. Is Allison DOC™ For PC–Service Tool communicating with the TCM?		*Go to Diagnostic Aids*	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Install J 47276 "T" Breakout to the TCM. Leave the OEM-side 80-way connector disconnected. 4. Provide power to the TCM from the J 42455-A PCCS load box. 5. Connect Allison DOC™ For PC–Service Tool to the 9-pin connector in the T-harness. Is Allison DOC™ For PC–Service Tool communicating with the TCM?		*Go to Step 4*	*Go to Step 6*
4	1. Turn OFF the ignition. 2. Inspect the CAN1 high, CAN1 low, and CAN1 Shield wires at the engine and transmission controllers for possible wire-to-wire shorts, shorts-to-ground, or shorts-to-battery. ***NOTE: Vehicle manufacturers may use the following pin pairs for CAN high and CAN low:*** • ***Pins 8 and 28*** • ***Pins 48 and 68, or*** • ***Both pairs (8 and 28), and (48 and 68) in a "pass-through" setup.*** Were any wiring defects found?		*Go to Step 5*	*Go to Diagnostic Aids*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the CAN wiring. Is the repair complete?		*Go to Step 7*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0010 CAN Bus Reset Counter Overrun *(cont'd)*

Step	Action	Value(s)	Yes	No
6	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 7*	
7	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. If communication is established with the TCM, use Allison DOC™ For PC–Service Tool to clear the DTC. 3. Confirm the TCM can communicate with the engine. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0100 Lost Communication with ECM/PCM (J1587)

REFER TO ELECTRICAL SCHEMATIC IN APPENDIX J

Circuit Description

In Allison 4th Generation Controls, the TCM is capable of communicating with the engine control module and other controllers by exchanging standardized digital messages over the following data links:

- SAE J1939 Controller Area Network (CAN)
- SAE J1708/J1587 Serial Communications Interface
- SAE J2284 High Speed CAN for use in IESCAN applications

The TCM sets a DTC U0100 when it stops receiving certain information (throttle position, coolant temperature, or torque) from the engine controller via the J1587 serial communications interface.

Conditions for Running the DTC

- Ignition voltage is stable for a calibration time.
- Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

DTC U0100 sets when the TCM detects that no engine torque or throttle messages have being received from the engine controller over the J1708/J1587 data link for 2 seconds or more.

Actions Taken when the DTC Sets

When DTC U0100 active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM defaults to the most recent adaptive shifts values and uses default throttle percentage.
- TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the code from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- The following condition points to an open in one of the serial communication interface wires at the Engine Control Module:
  - U0100 is active, and
  - Allison DOC™ can view raw J1708/J1587 data from the TCM on data bus viewer when plugged into the 9-pin connector.
- Inspect the J1939 CAN wires for poor electrical connections at the TCM. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.

Test Description

2. This step tests for communications between the TCM and engine controller on the J1708/J1587 data link.
3. This step tests for communications between the TCM and engine controller using the J 47276 T-harness.
4. This step tests the J1708/J1587 serial communication interface wiring for open conditions or terminal damage.

DTC U0100 Lost Communication with ECM/PCM (J1587)

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Connect Allison DOC™ For PC–Service Tool to the vehicle's diagnostic tool connector. 2. Turn ON the ignition. Leave the engine OFF. 3. Monitor Allison DOC™ For PC–Service Tool Data Bus Viewer. Can Allison DOC™ For PC–Service Tool read J1708/J1587 information from the TCM on Data Bus Viewer?		*Go to Step 4*	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the TCM-side of the 80-way connector to the J 47276 "T" Breakout. Leave the OEM-side disconnected. 4. Provide power to the TCM from the J 42455-A PCCS load box. 5. Connect Allison DOC™ For PC–Service Tool to the 9-pin connector in the T-harness. Can Allison DOC™ For PC–Service Tool read J1708/J1587 information from the TCM on Data Bus Viewer?		*Go to Step 4*	*Go to Step 7*
4	1. Turn OFF the ignition. 2. Inspect the J1708/J1587 SCI wires at the TCM and engine controller for possible open conditions or terminal damage. Look for: • Connector not locked at module. • Terminal not locked in back shell. • Chafing of insulation. • Terminal damage or signs of corrosion. Were any wiring defects found?		*Go to Step 5*	*Go to Step 6*

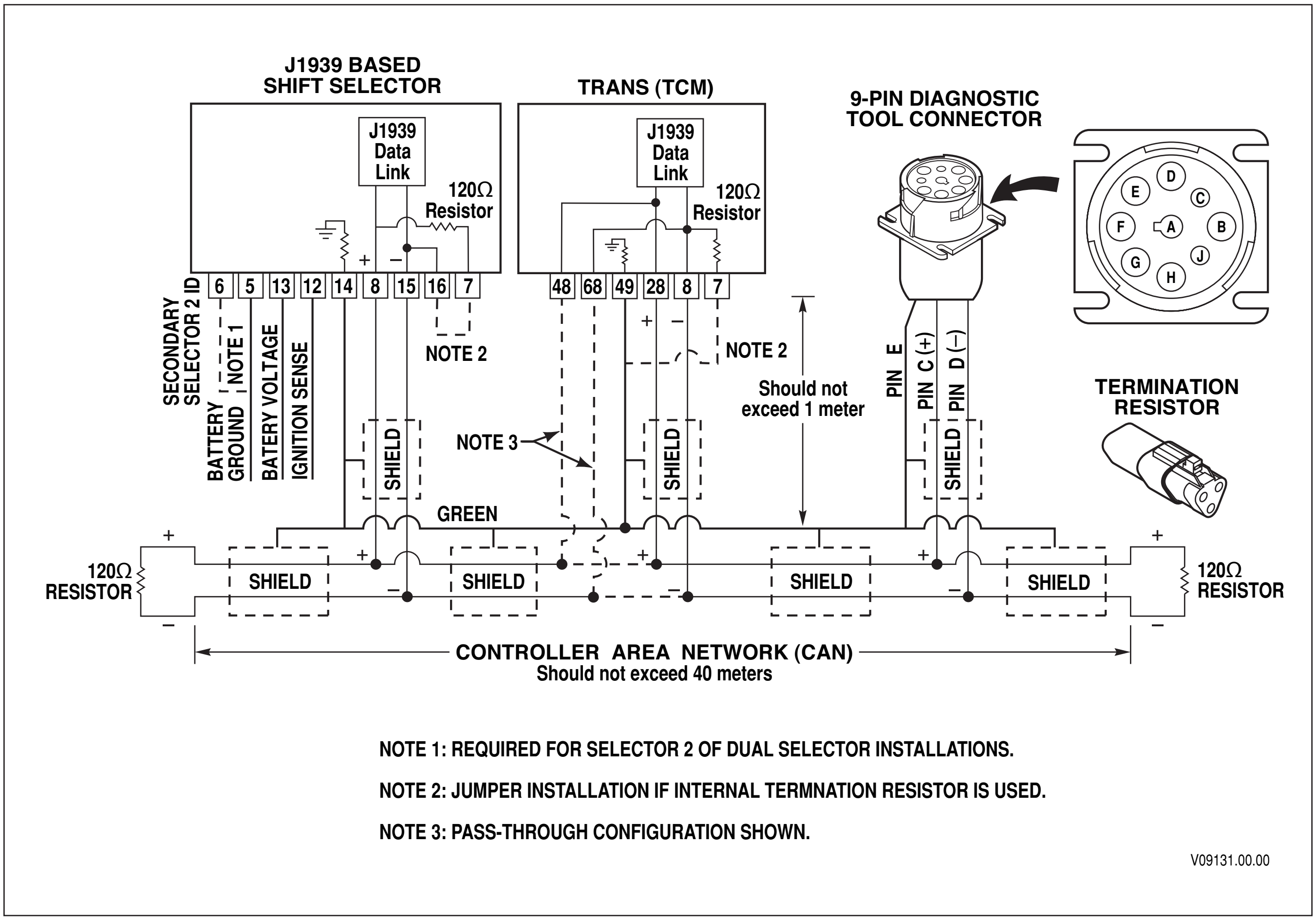
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0100 Lost Communication with ECM/PCM (J1587) *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 8*	
6	Return the vehicle to the OEM for inspection of the following: 1. The engine ECM is properly set to communicate with an Allison TCM. 2. Proper pin location at the engine ECM. 3. Proper operation of the ECM. Is the repair complete?		*Go to Step 8*	
7	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 8*	
8	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. If communication is established with the TCM, use Allison DOC™ For PC–Service Tool to clear the DTC. 3. Confirm the TCM can communicate with the engine. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0103 Lost Communication With Gear Shift Module (Shift Selector) 1



Circuit Description

Allison 4th Generation Controls shift selectors communicate with the transmission control module (TCM) by exchanging standardized digital messages over the SAE J1939 Controller Area Network (CAN). The physical network consists of a two-wire twisted pair, two 120 Ohm termination resistors and, in most cases, a third shield wire. A 120 Ohm termination resistor is located at each end of the network to maintain good J1939 signal quality. Vehicle OEMs may chose to configure the network to take advantage of 120 Ohm resistors built in to Allison 4th Generation Controls TCMs and shift selectors.

Conditions for Running the DTC

Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

DTC U0103 sets when the TCM has not received a state of health (SOH) message from the primary shift selector for 2 or more seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0103 Lost Communication With Gear Shift Module (Shift Selector) 1

Actions Taken When the DTC Sets

When DTC U0103 active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The active shift selector will freeze the displays for 1.5 seconds, go blank for 10.5 seconds, then display cat-eyes, i.e. -\-, -\-.
- Direction change shifts, i.e., forward to Reverse, etc., are allowed based on PWM signal from Allison shift selectors.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Vehicle manufacturers can configure the controller area network to use a built-in termination resistor in Allison shift selectors by installing a jumper between pins 7 and 18 at the primary shift selector connector. OEMs are required to clearly indicate where internal termination resistors have been used.
- DTC U0103 can be caused by the following conditions:
  - — An intermittent open between the shift selector and the connector node.
  - — A poor connection at the shift selector or the connector node.
  - — An intermittent open in the connector node.
  - — An open power or ground circuit to the shift selector.
  - — A defective shift selector.
- Inspect the J1939 CAN wires for poor electrical connections at the primary shift selector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper power inputs to the primary shift selector.
3. This step tests for wiring defects between the primary shift selector and the connection to the J1939 backbone.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0103 Lost Communication With Gear Shift Module (Shift Selector) 1

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Test the following primary shift selector circuits for an open or short-to-ground: 1. The battery power supply including fuses, if applicable. 2. The ignition sense circuit. 3. The ground return circuit. ***NOTE: DTC U0103 indicates the TCM did not detect a state of health message from the primary shift selector for 2 or more seconds. This may indicate an open in shift selector wiring or a defective shift selector.*** Did you find and correct the condition?		*Go to Step 6*	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM and install J 47275 TCM Breakout. 3. Disconnect the shift selector(s). 4. Inspect the CAN backbone between the TCM and shift selector(s) for defects. 5. At J 47275-1 TCM Overlay, test for wire-to-wire shorts, and shorts-to-ground, and opens between shift selector at pins 8 (CAN Lo1), 28 (CAN Hi1), 48 (CAN Hi2), and 68 (CAN Lo2), if used. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts and opens between shift selector at pin 49 (CAN shield). ***NOTE: If the TCM internal resistor is used, the vehicle OEM will connect the wire 107 and wire 128 together in the external harness.*** 7. If TCM internal termination resistor is used, test for opens, wire-to-wire shorts, and shorts-to-ground at pin 7 (internal resistor). Were any wiring defects found?		*Go to Step 4*	*Go to Step 5*
4	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 6*	

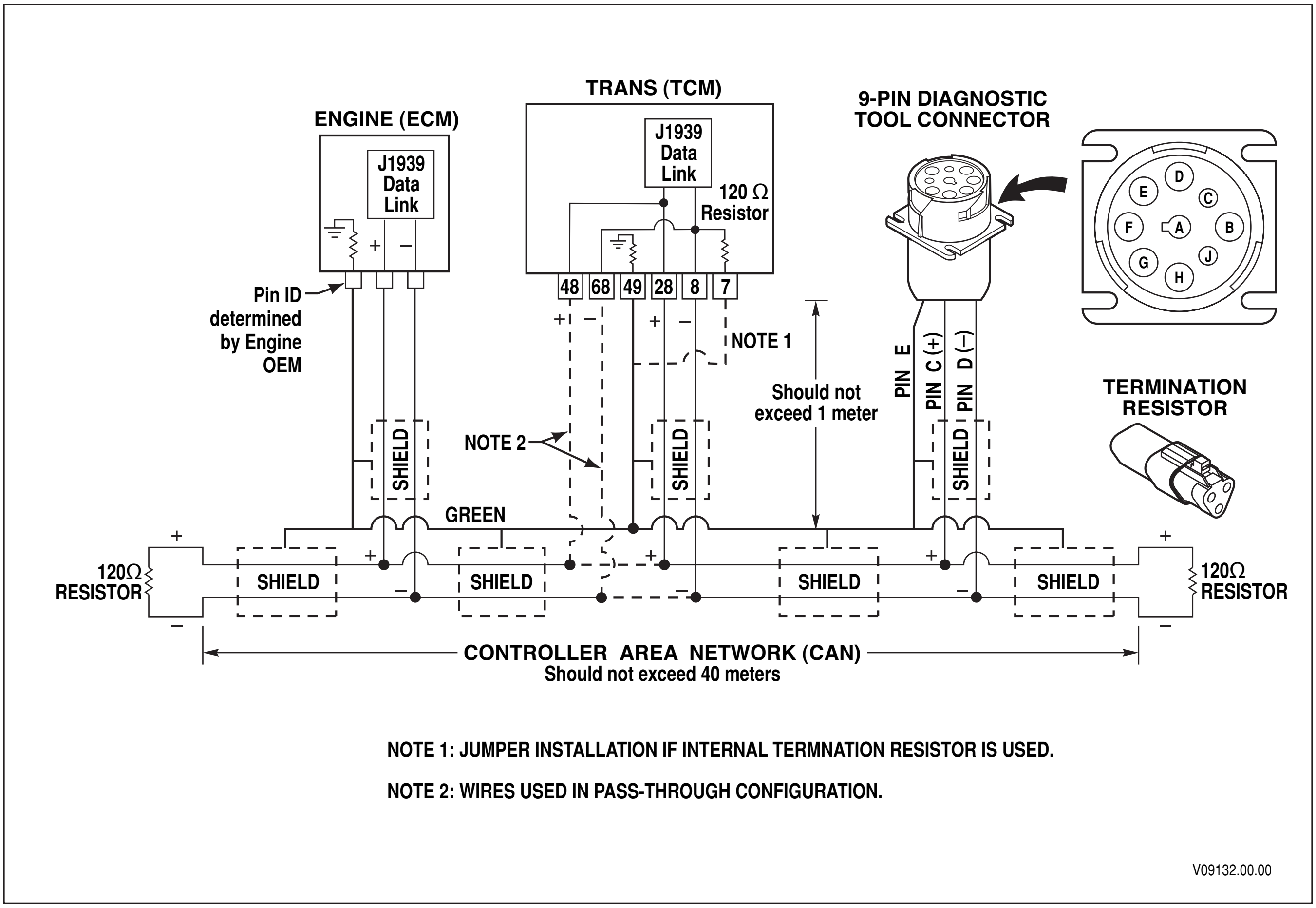
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0103 Lost Communication With Gear Shift Module (Shift Selector) 1 *(cont'd)*

Step	Action	Value(s)	Yes	No
5	Replace the primary shift selector. Is the replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. Clear the DTC. 3. Verify the TCM responds to shift selector commands. 4. Refer to Allison DOC™ For PC–Service Tool “Test Passed” section and confirm the test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0115 Lost Communication With ECM



Circuit Description

- In Allison 4th Generation Controls, the TCM is capable of communicating with the engine control module and other controllers by exchanging standardized digital messages over the following data links:
  - — SAE J1939 Controller Area Network (CAN)
  - — SAE J1708/J1587 Serial Communication Interface
  - — SAE J2284 High Speed CAN for use in IESCAN applications.
- The TCM sets a DTC U0115 when it stops receiving certain information (throttle position, coolant temperature, or torque) from the engine controller via the J1939 CAN.

Conditions for Running the DTC

- Ignition voltage is stable for a calibration time.
- Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

DTC U0115 sets when the TCM detects that no engine torque or throttle messages have been received from the engine controller over the J1939 for 2 seconds or more.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0115 Lost Communication With ECM

Actions Taken When the DTC Sets

When DTC U0115 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM defaults to the most recent adaptive shifts values and uses default throttle percentage.
- TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Often an active U0115 will prevent the Allison DOC™ For PC–Service Tool from communicating with the TCM. The J 47276 “T” Breakout and TCM Reflashing Harness may be used to confirm that the TCM is operational. The T-harness is only useful to confirm that the TCM is able to communicate with Allison DOC™ diagnostic tool.
- Vehicles that use SEM/LRTP may set a DTC U0115 when engine performance complaints are present. This may include injector concerns that could cause an engine to default to a “fail safe” mode. Some engine manufacturers may interrupt engine torque messaging, which will result in a DTC U0115. Inspect the engine side for possible engine diagnostic codes that may indicate that this condition is present and correct before performing further troubleshooting on DTC U0115.
- The following condition points to an open in one of the CAN wires at the Engine Control Module:
  - — U0115 is active, and
  - — Allison DOC™ For PC–Service Tool can communicate with the TCM when plugged into the 9-pin connector.
- This DTC can be caused if engine ECM parameters are improperly set.
- Inspect the J1939 CAN wires for poor electrical connections at the TCM. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- You may have to drive the vehicle in order to experience a fault.
- For proper J1939 data link communications, it is necessary to have two 120 Ohm resistors installed in parallel at the J1939 CAN backbone.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

This DTC requires the use of the J 47276 "T" Breakout and TCM Reflashing Harness. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for communications between the TCM and engine controller on the vehicle data link.
3. This step tests for communications between the TCM and the engine controller using the J 47276 "T" Breakout.
4. This step tests the J1939 CAN1 wiring for open conditions or terminal damage.
5. This step tests the J1939 CAN1 wiring for proper termination resistance value.

DTC U0115 Lost Communication With ECM/PCM (CAN)

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	1. Connect Allison DOC™ For PC–Service Tool to the vehicle's diagnostic tool connector. 2. Turn ON the ignition. Leave the engine OFF. Is Allison DOC™ For PC–Service Tool communicating with the TCM?		*Go to Step 4*	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the TCM 80-way connector. 3. Install the TCM-side of the 80-way connector to the J 47276 "T" Breakout and TCM Reflashing Harness. Leave the OEM-side disconnected. 4. Provide power to the TCM from the J 42455 at PCCS load box. 5. Connect Allison DOC™ For PC–Service Tool to the 9-pin connector on the J 47276 "T" Breakout and TCM Reflashing Harness. Is Allison DOC™ For PC–Service Tool communicating with the TCM?		*Go to Step 4*	*Go to Step 9*
4	1. Turn OFF the ignition. 2. Inspect the CAN1 high, CAN1 low, and CAN1 Shield wires at the engine and transmission controllers for possible open conditions or terminal damage. Look for the following: • Connector stub not locked at module • Terminal not locked in back shell • Chafing of insulation • Terminal damage or signs of corrosion. Were any wiring defects found?		*Go to Step 7*	*Go to Step 5*
5	Using a DVOM, measure resistance between pins C and D at the vehicle 9-pin diagnostic connector. Did the resistance match the specified value?	60 Ohms	*Go to Step 8*	*Go to Step 6*

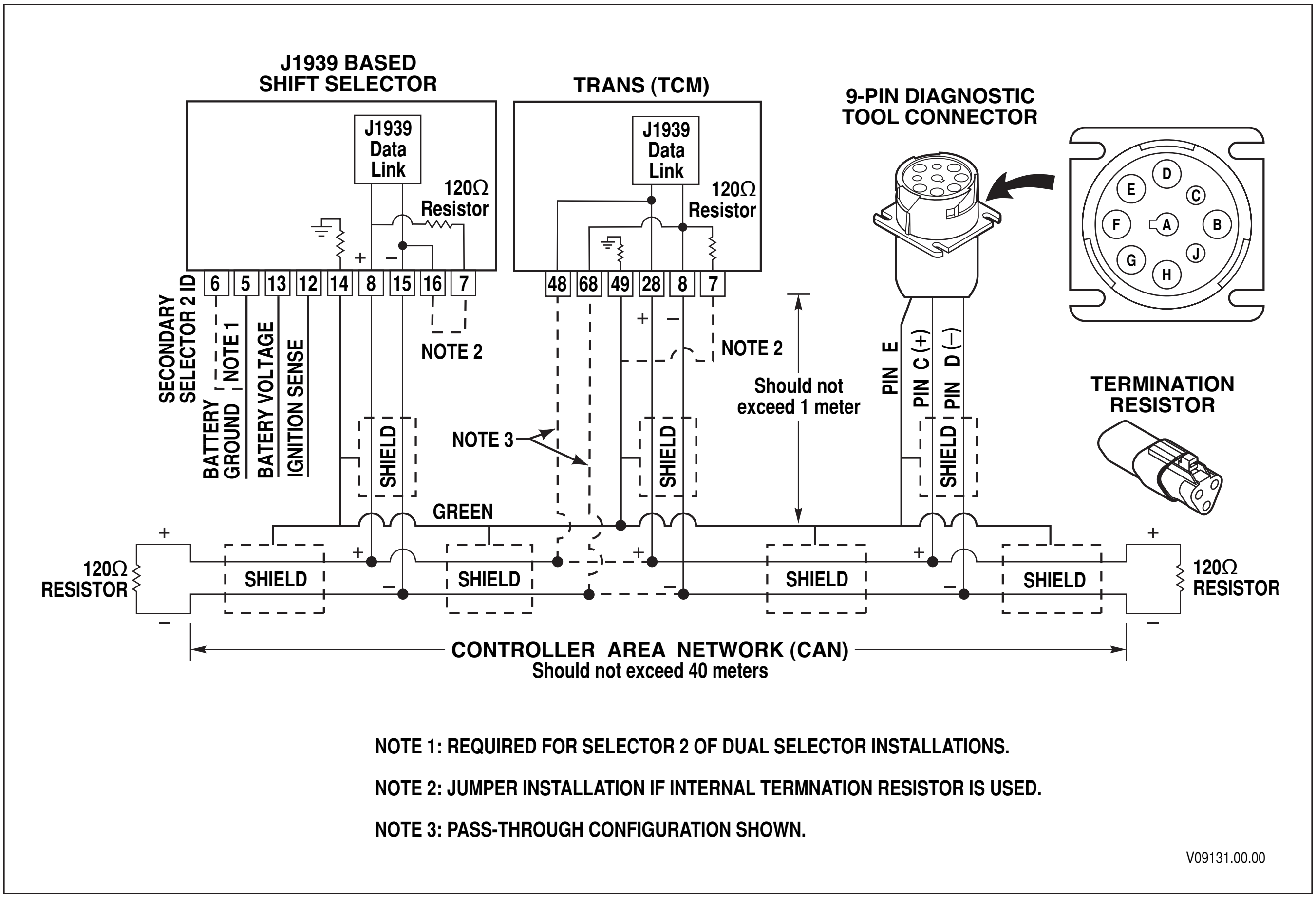
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0115 Lost Communication With ECM/PCM (CAN) *(cont'd)*

Step	Action	Value(s)	Yes	No
6	***NOTE: A resistance reading other than 60 Ohms indicates that a termination resistor is missing or a resistor with an improper value is installed. There should be two 120 Ohms resistors wired in parallel in the Controller Area Network.*** Return the vehicle to the OEM for repair. Is the repair complete?		*Go to Step 10*	
7	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 10*	
8	Return the vehicle to the OEM for inspection of the following: 1. The engine ECM is properly set to communicate with the Allison TCM. 2. Proper pin location at the engine ECM. 3. Proper operation of the ECM. Is the repair complete?		*Go to Step 10*	
9	***NOTE: In most cases, the TCM is not at fault. Investigate thoroughly before replacing the TCM.*** Refer to TCM diagnostic procedure, Section 3–6. Is Section 3–6 complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. If communication is established with the TCM, use Allison DOC™ For PC–Service Tool to clear the DTC. 3. Confirm the TCM can communicate with the engine. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0291 Lost Communication With Gear Shift Module (Shift Selector) 2



Circuit Description

Allison 4th Generation Controls shift selectors communicate with the transmission control module (TCM) by exchanging standardized digital messages over the SAE J1939 Controller Area Network (CAN). The physical network consists of a two-wire twisted pair, two 120 Ohm termination resistors and, in most cases, a third shield wire. A 120 Ohm termination resistor is located at each end of the network to maintain good J1939 signal quality. Vehicle OEMs may chose to configure the network to take advantage of 120 Ohm resistors built in to Allison 4th Generation Controls TCMs and shift selectors.

Conditions for Running the DTC

Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

DTC U0115 sets when the TCM has not received a state of health (SOH) message from the secondary shift selector for 2 or more seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0291 Lost Communication With Gear Shift Module (Shift Selector) 2

Actions Taken When the DTC Sets

When DTC U0291 active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The active shift selector will freeze the displays for 1.5 seconds, go blank for 10.5 seconds, then display cat-eyes, i.e. -\-, -\-.
- Direction change shifts i.e. forward to Reverse, etc are allowed based on PWM signal from Allison shift selectors.

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

- Vehicle manufacturers can configure the controller area network to use a built-in termination resistor in the Allison shift selectors by installing a jumper between pins 7 and 18 at the secondary shift selector connector. OEMs are required to clearly indicate where internal termination resistors have been used.
- DTC U0291 can be caused by the following conditions:
  - — An intermittent open between the shift selector and the connector node.
  - — A poor connection at the shift selector or the connector node.
  - — An intermittent open in the connector node.
  - — An open power or ground circuit to the shift selector.
  - — A defective shift selector.
- Inspect the J1939 CAN wires for poor electrical connections at the secondary shift selector. Look for the following conditions:
  - — A bent terminal
  - — A backed-out terminal
  - — A damaged terminal
  - — Poor terminal tension
  - — A chafed wire
  - — A broken wire inside the insulation.

Test Description

This DTC requires the use of the J 47275 TCM Breakout. The numbers below refer to step numbers on the diagnostic table.

2. This step tests for proper power inputs to the secondary shift selector.
3. This step tests for wiring defects between the secondary shift selector and the connection to the J1939 backbone.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0291 Lost Communication With Gear Shift Module (Shift Selector) 2

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Test the following secondary shift selector circuits for an open or short-to-ground: 1. The battery power supply including fuses, if applicable. 2. The ignition sense circuit. 3. The ground return circuit. ***NOTE: DTC U0291 indicates the TCM did not detect a state of health message from the secondary shift selector for 2 or more seconds. This may indicate an open in shift selector wiring or a defective shift selector.*** Did you find and correct the condition?		*Go to Step 6*	*Go to Step 3*
3	1. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM and install J 47275 TCM Breakout. 3. Disconnect the shift selector(s). 4. Inspect the CAN backbone between the TCM and shift selector(s) for defects. 5. At J 47275-1 TCM Overlay, test for wire-to-wire shorts, and shorts-to-ground, and opens between shift selector at pins 8 (CAN Lo1), 28 (CAN Hi1), 48 (CAN Hi2), and 68 (CAN Lo2), if used. 6. At J 47275-1 TCM Overlay, test for wire-to-wire shorts and opens between shift selector at pin 49 (CAN shield). ***NOTE: If the TCM internal resistor is used, the vehicle OEM will connect wire 107 and wire 128 together in the external harness.*** 7. If TCM internal termination resistor is used, test for opens, wire-to-wire shorts, and shorts-to-ground at pin 7 (internal resistor). Were any wiring defects found?		*Go to Step 4*	*Go to Step 5*
4	***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Coordinate with the vehicle OEM to repair or replace the vehicle wiring. Is the repair complete?		*Go to Step 6*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0291 Lost Communication With Gear Shift Module (Shift Selector) 2 *(cont'd)*

Step	Action	Value(s)	Yes	No
5	Replace the secondary shift selector. Is the replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. Clear the DTC. 3. Verify the TCM responds to shift selector commands. 4. Refer to Allison DOC™ For PC–Service Tool "Test Passed" section and confirm the test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0304 Incompatible Gear Shift Module 1 (Shift Selector) ID

No Schematic for this DTC

Circuit Description

In Allison 4th Generation Controls, the TCM communicates with the shift selector over the J1939 controller area network. Allison J1939 shift selectors broadcast proprietary messages to the TCM related to range selection and other operating modes. The TCM sets a DTC U0304 when the primary shift selector is not an Allison shift selector or on the approved list of shift selectors.

NOTE: ***The presence of DTC U0304 indicates the primary shift selector is not on the approved list of shift selectors. Contact the Allison Transmission Applications Engineering (1-800-252-5283) to obtain approval to use the shift selector.***

Conditions for Running the DTC

- Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- This test is run during the entire ignition cycle.

Conditions for Setting the DTC

DTC U0304 sets when the primary shift selector is not an Allison J1939-based shift selector, or on the approved list of OEM-provided shift selectors.

Actions Taken when the DTC Sets

When DTC U0304 active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM ignores shift selector inputs.
- TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the code from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0333 Incompatible Gear Shift Module 2 (Shift Selector) ID

No Schematic for this DTC

Circuit Description

In Allison 4th Generation Controls, the TCM communicates with the shift selector over the J1939 controller area network. Allison J1939 shift selectors broadcast proprietary messages to the TCM related to range selection and other operating modes. The TCM sets a DTC U0304 when the primary shift selector is not an Allison shift selector or on the approved list of shift selectors.

NOTE: The presence of DTC U0304 indicates the primary shift selector is not on the approved list of shift selectors. Contact the Allison Transmission Applications Engineering (1-800-252-5283) to obtain approval to use the shift selector.

Conditions for Running the DTC

- Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).
- This test is run during the entire ignition cycle.

Conditions for Setting the DTC

DTC U0304 sets when the primary shift selector is not an Allison J1939-based shift selector, or on the approved list of OEM-provided shift selectors.

Actions Taken when the DTC Sets

When DTC U0304 active, the following conditions will occur:

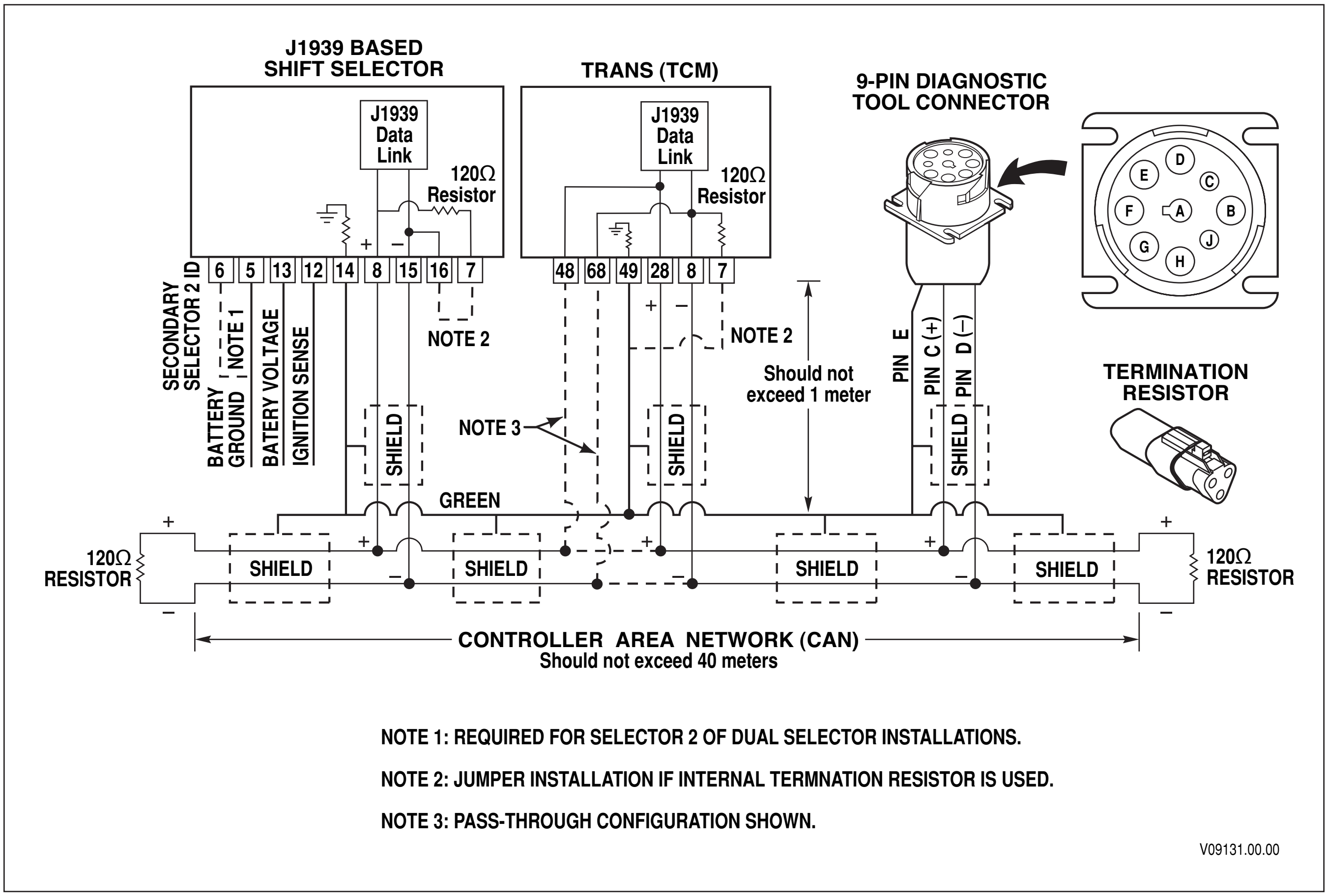
- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The TCM ignores shift selector inputs.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the code from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0404 Invalid Data Received From Gear Shift Module (Shift Selector) 1



Circuit Description

Allison 4th Generation Controls shift selectors communicate with the transmission control module (TCM) by exchanging standardized digital messages over the SAE J1939 Controller Area Network (CAN). The TCM sets a DTC U0404 when it receives invalid data from the primary shift selector.

Conditions for Running the DTC

Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

DTC U0404 sets when the TCM detects invalid data from the shift selector.

Actions Taken When the DTC Sets

When DTC U0404 active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The active shift selector will freeze the displays for 1.5 seconds, go blank for 10.5 seconds, then display cat-eyes, i.e. -\-, -\-.
- Direction change shifts, i.e., forward to Reverse etc., are allowed based on PWM signal from Allison shift selectors.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0404 Invalid Data Received From Gear Shift Module (Shift Selector) 1

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

DTC U0404 is typically caused by a defective primary shift selector.

Test Description

The number below refers to step numbers on the diagnostic table.

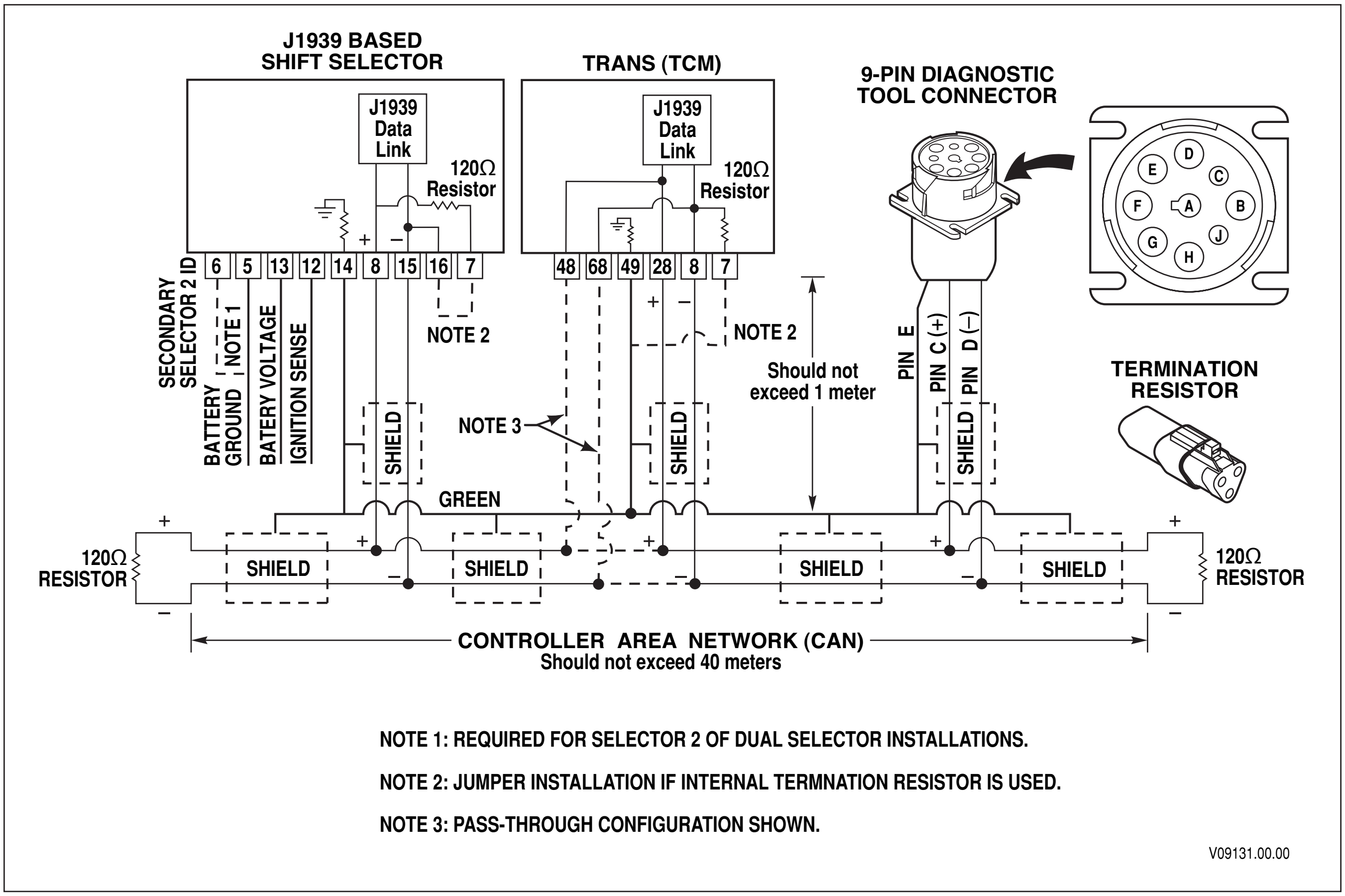
2. This step tests for proper power inputs to the primary shift selector.

DTC U0404 Invalid Data Received From Gear Shift Module (Shift Selector) 1

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Test the following primary shift selector circuits for an open or short-to-ground: 1. The battery power supply including fuses, if applicable. 2. The ignition sense circuit. 3. The ground return circuit. ***NOTE: DTC U0404 indicates the TCM did not detect valid data from the primary shift selector. This may indicate an open in shift selector wiring or a defective shift selector.*** Did you find and correct the condition?		*Go to Step 4*	*Go to Step 3*
3	Replace the primary shift selector. Is the replacement complete?		*Go to Step 4*	
4	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. Clear the DTC. 3. Verify the TCM responds to shift selector commands. 4. Refer to Allison DOC™ For PC–Service Tool “Test Passed” section and confirm the test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0592 Invalid Data Received From Gear Shift Module (Shift Selector) 2



Circuit Description

Allison 4th Generation Controls shift selectors communicate with the transmission control module (TCM) by exchanging standardized digital messages over the SAE J1939 Controller Area Network (CAN). The TCM sets a DTC U0592 when it receives invalid data from the secondary shift selector.

Conditions for Running the DTC

Ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 9V and less than 32V (24V TCM).

Conditions for Setting the DTC

DTC U0592 sets when the TCM has detects invalid data from the shift selector.

Actions Taken When the DTC Sets

When DTC U0592 active, the following conditions will occur:

- The **CHECK TRANS** light illuminates.
- DTC is stored in TCM history.
- The active shift selector will freeze the displays for 1.5 seconds, go blank for 10.5 seconds, then display cat-eyes, i.e. -\-, -\-.
- Direction change shifts, i.e., forward to Reverse etc., are allowed based on PWM signal from Allison shift selectors.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0592 Invalid Data Received From Gear Shift Module (Shift Selector) 2

Conditions for Clearing the DTC/CHECK TRANS Light

The Allison DOC™ For PC–Service Tool can be used to clear the DTC from the TCM history. The TCM automatically clears the DTC from the TCM history if the vehicle completes 40 warm-up cycles without failure.

Diagnostic Aids

DTC U0592 is typically caused by a defective secondary shift selector.

Test Description

The number below refers to step numbers on the diagnostic table.

2. This step tests for proper power inputs to the secondary shift selector.

DTC U0592 Invalid Data Received From Gear Shift Module (Shift Selector) 2

Step	Action	Value(s)	Yes	No
1	Was Section 3–5, Beginning The Troubleshooting Process, performed?		*Go to Step 2*	*Go to Section 3–5, Beginning the Troubleshooting Process*
2	Test the following secondary shift selector circuits for an open or short-to-ground: 1. The battery power supply including fuses, if applicable. 2. The ignition sense circuit. 3. The ground return circuit. ***NOTE: DTC U0592 indicates the TCM did not detect valid data from the secondary shift selector. This may indicate an open in shift selector wiring or a defective shift selector.*** Did you find and correct the condition?		*Go to Step 4*	*Go to Step 3*
3	Replace the secondary shift selector. Is the replacement complete?		*Go to Step 4*	
4	In order to verify your repair: 1. Install Allison DOC™ For PC–Service Tool. 2. Clear the DTC. 3. Verify the TCM responds to shift selector commands. 4. Refer to Allison DOC™ For PC–Service Tool “Test Passed” section and confirm the test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

SECTION 7—INPUT AND OUTPUT FUNCTIONS

7–1. INPUT FUNCTIONS

Input functions are signals sent into the TCM that prompt the TCM to take action. Input functions are activated and deactivated by switched ignition power or ground (wire 103) to the TCM (wired through the VIW), or through the **MODE** button on the shift selector. The following input functions can be activated using the **MODE** button:

- Secondary Shift Schedule
- D1 Selection (available with pushbutton selector only)
- PTO Enable
- Auto 2–1 Preselect for 7-Speeds

The wiring schematic in Appendix J illustrates installation requirements for input functions and designates specific wire numbers in the transmission control system to be used for the activation of these input functions. Appendix J should be used for reference only. The vehicle manufacturer determines which input functions are programmed, which wires are used, and whether voltage input was positive or ground. Wiring schematics for input and output functions are shown in Appendix P. Use Allison DOC™ For PC–Service Tool to determine which wire was programmed for a particular input function and the wiring schematic can be consulted to find out if input to the TCM is + or – voltage. Refer to Allison publication GN3433EN, User Guide for Allison DOC™ For PC–Service Tool, for further information regarding special input functions and other inhibits.

NOTE: ***The wiring schematic in Appendix J shows the intended use of the control features specified. These features have only been validated in the configuration shown. ANY USE OF THESE FEATURES WHICH DIFFERS FROM WHAT IS SHOWN IS NOT THE RESPONSIBILITY OF ALLISON TRANSMISSION.***

CAUTION:	**NEVER use chassis ground as an INPUT FUNCTION ground. Chassis ground can carry voltage potential of 1 or 2 volts above battery ground. This non-approved input will "confuse" the TCM and cause erroneous input results. Be sure to use wire 103 which is signal ground.**

Activating an input function can inhibit transmission operation in the same manner as a diagnostic code. Use the Allison DOC™ For PC–Service Tool to verify an active input function or a diagnostic code inhibit. Refer to Allison publication GN3433EN, User Guide for Allison DOC™ For PC–Service Tool, for further information regarding special input functions and other inhibits. For more detailed information on input functions, refer to the Allison Tech Data Book 4th Generation Controls and General Information.

The maximum number of input and output functions which may be used in any installation depends upon the transmission model and its features. Refer to Table 7–1.

Table 7–1. Input/Output Function Availability

Transmission Model	Auxiliary Transmission Controls Functions	Number Of Input Functions	Number Of Output Functions
6-Speed and 4000 7-Speed Transmissions	Retarder	12 + Mode Button	8
3000 7-Speed Transmissions	Transfer Case	12 + Mode Button	8

INPUT AND OUTPUT FUNCTIONS

The following input functions inhibit direction change shifts (forward to reverse or reverse to forward):

- Auxiliary Function Range Inhibit (standard)
- Auxiliary Function Range Inhibit (special)
- Quick to Neutral, Pump Option
- Automatic Neutral for PTO
- Automatic Neutral at Stop
- Reverse Enable
- Automatic Neutral for Refuse Packers
- Automatic Neutral for Refuse Packers with Service Brake Input
- Direction Change Enable

The following input functions lock the transmission in fourth range:

- Fire Truck Pump Mode
- Fourth Lockup Pump Mode

The following input functions preselect a lower range:

- Engine Brake and Preselect Request (standard)
- Engine Brake and Preselect Request (special)

The following input functions inhibit upshifts:

- D1 Selection
- Auxiliary Hold

The following input functions inhibit lockup shifts:

- Manual Lockup
- Anti-lock Brake Response

The following input function inhibits range and lockup shifts at high horsepower:

- Shift Enable/Shift in Process (Oil Field Application)

The following functions are general restrictions to normal operation:

- High Input Speed causes neutral to range inhibit
- Medium Cold Oil causes operation confined to **R** (Reverse), **N** (Neutral), and **2**nd-range start
- Hot Oil restricts operation to **4**th-range maximum (except emergency applications)
- Two Speed Axle Enable permits change only at low output speed and throttle
- Special Pattern Logic monitors **N** or **D** or **N** to **R** shifts; if engine throttle or output speed is too high, the transmission remains in **N**.
- Wheel Lock disengages the lockup clutch and inhibits forward range downshifts and shifts to reverse
- Anti-lock Brake Response deactivates the retarder and disengages the lockup clutch
- High Throttle during **N** (Neutral) to any range shift causes a revised clutch pressure apply rate and turns off shift adaptive
- Power loss to the TCM restricts operation to certain ranges. Hydraulic default (SOL OFF) is commanded. The shift selector position and hydraulic state of logic values determine the range attained.

The following input function limits operation to **1**st-range and **N** (Neutral):

- Refuse Vehicle Step Switch

INPUT AND OUTPUT FUNCTIONS

7–2. OUTPUT FUNCTIONS

Output functions are signals sent out by the TCM that activate or control devices or mechanisms. These control devices or mechanisms are controlled by relays or direct connection signals from the TCM.

Many input and output functions are closely related. For example, the PTO Enable option (input function) also includes PTO Output wiring information. When searching for output function information, be sure to review any related input function information references.

The wiring schematics in Appendix J and Appendix P illustrate installation requirements for output functions as well as input functions and designate specific wire numbers in the transmission control system to be used for the activation of these output functions. The wiring schematics in Appendix J should be used for reference only. Ask the vehicle manufacturer which specific output functions are programmed and which wires are used. Output function polarity is not significant when an Allison-supplied VIM is used. The Allison DOC™ For PC–Service Tool can also be utilized to determine which wire was programmed for a particular output function. For more detailed information on output functions, refer to Allison Tech Data, Allison 4th Generation Controls 3000 and 4000 Product Families on the Allison Transmission Extranet. The schematics in Appendix P are from Allison Tech Data.

SECTION 8—GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

IMPORTANT:

Determine the following before beginning specific troubleshooting, removing the transmission, or removing attached components.

- Are there active diagnostic codes?
- Is the lever shift selector lever in **N** (Neutral) to allow starting the engine?
- Is the battery properly connected and charged?
- Is isolated battery properly connected (if used)?
- Is the fluid level correct?
- Is voltage to the TCM correct?
- Is the engine properly tuned?
- Is fuel flow to the engine correct?
- Are wheel chocks in place?
- Is air flow to the cooler and radiator unrestricted?
- Is the driveline properly connected?
- Are there signs of fluid leakage under the vehicle? What is the origination point?
- Are hydraulic connections correctly made and not leaking?
- Is vehicle acceleration from a stop changed?
- Are electrical connections correctly made?
- Are there any other obvious vehicle or transmission problems?
- Are clutch pressures within specified limits?

Use the various sections of this manual to isolate the listed problems. The following charts address specific vehicle complaints. Some complaints involve diagnostic codes, so all troubleshooting should involve determining if the system has set any diagnostic codes.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints

Problem	Probable Cause	Suggested Remedy
SHIFT SELECTOR DISPLAYS "CATEYE" AND VEHICLE IS NOT OPERABLE	No communication between the TCM and a remote shift selector	Refer to code U0103 or U0291 in Troubleshooting Procedure
SHIFT SELECTOR DISPLAY IS BLANK	VIM fuse is blown	Replace VIM fuse
	Fuse blown in OEM substitute	Replace VIM fuse
	Failed CAN (J1939) Data Link	Should change to "cateye" (-\-) within 12 seconds (see Code U0103 or U0291)
SHIFT SELECTOR NOT LIGHTED AT NIGHT (WHEN HEADLIGHTS ARE ON)	OEM input wire at pin 3 of shift selector connector not connected or improperly connected	Find wire at pin 3 and connect it or install it, if necessary
VEHICLE WILL NOT START (ENGINE WILL NOT CRANK)	Lever shift selector not in **N** (Neutral)	Select **N** (Neutral) and restart
	Dead battery	Recharge battery
	Disconnected battery	Reconnect battery
	Faulty starter circuit	Repair vehicle starter circuit
	Faulty neutral start relay	Replace neutral start relay
	Faulty wiring in neutral start circuit	Repair wiring
	Calibration programmed to J 1939 neutral start message (neutral start relay not used)	Troubleshoot J1939 wiring (CAN link)
	Voltage to TCM too low	Measure battery and charging system voltage
	Faulty ignition wire (163)	Repair wire 163
	Faulty lever shift selector	Replace lever shift selector
	Lack of battery voltage on Circuit 141 from TCM when in neutral	Repair Circuit 141 or replace TCM
All display segments of display lighted	Shift selector in initialization (approximately 2 seconds)	None, normal
	Faulty TCM	Replace the TCM

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
CHECK TRANS LIGHT WILL NOT GO OUT AT START-UP		
A. Vehicle Drives Normally	Faulty **CHECK TRANS** light, relay, or circuit	Replace relay or repair circuit
	An LED rather than a lamp is installed for the **CHECK TRANS** light and the LED is partially lighted from leakage current	Install a lamp rather than an LED for the **CHECK TRANS** light
B. Vehicle Does Not Drive	Engine does not start	Repair engine starting system
	Faulty harness	Repair harness (Section 4 and Appendix E)
	Faulty interface wiring to vehicle electrical system	Repair wiring (Appendix E)
	Faulty TCM	Replace the TCM
CHECK TRANS LIGHT FLASHES INTERMITTENTLY	Intermittent power to TCM	Test input power to the TCM and correct if necessary
	Loose wiring to **CHECK TRANS** light	Repair wiring
	Faulty or incorrect ground wire attachment	Repair ground circuit
	Intermittent opening in Circuit 129	Repair Circuit 129
NO **CHECK TRANS** LIGHT AT IGNITION	Faulty light bulb or socket	Replace light bulb or socket
	Incorrect wiring to and from **CHECK TRANS** light bulb	Repair wiring (Appendix E)
	Faulty wiring harness	Inspect wiring between TCM and **CHECK TRANS** light, and repair where necessary (Appendix E)
	Circuit 129 open	Repair Circuit 129
	Vehicle wired for J1939 **CHECK TRANS** light but calibration doesn't support that message	Reprogram with correct calibration
	Faulty TCM	Replace TCM

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TCM WILL NOT TURN OFF WHEN IGNITION SWITCH OFF	Faulty ignition switch	Replace ignition switch
	Externally-generated speed sensor signal(s)—refer to Appendix L for detailed inspection	Find source of false speed sensor signal(s) and correct problem
TRANSMISSION WILL NOT SHIFT TO FORWARD OR REVERSE (STAYS IN NEUTRAL)	Engine rpm too high*****	Reduce engine rpm. Also, it may be necessary to reselect **N (**Neutral) and then **D** (Drive) or **R (**Reverse**)**.
	Low fluid level	Add fluid to proper level. Refer to appropriate transmission mechanic's tips for proper dipstick calibration.
	Throttle position sensor or linkage is not functioning properly*****	Refer to throttle position sensor for correct set-up (Appendix F)
	Voltage to TCM too low*	Test vehicle battery and charging system
	Shift selector is not functioning properly	Replace shift selector
	Disconnected or dirty connectors	Perform connector checkout (Appendix E)
	Faulty wiring harnesses	Repair harness (Appendix E)
	Speed sensor(s) not functioning properly*	Repair or replace speed sensor(s) or circuitry. Refer to appropriate transmission service manual and Appendix E.
	Faulty TCM	Replace the TCM
	Input function wire open and "auxiliary function range inhibit", or "direction change enable" in the calibration*	Test input function programming with Allison DOC™ For PC–Service Tool. Correct wiring or switch problem which does not allow input function wire to be grounded.
	"Auxiliary Function Range Inhibit-Standard" or "direction change enable"—hooked up to brake pressure*	Apply brakes with high force

* Flashing digital display on shifter.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TRANSMISSION WILL NOT STAY IN FORWARD OR REVERSE	Auto-neutral or quick-to-neutral circuit (input function) faulty	Repair quick-to-neutral circuit
	Leaking at solenoid assembly	Rebuild solenoid assembly. Refer to appropriate transmission service manual.
	Faulty solenoid—leaking	Replace solenoid. Refer to appropriate transmission service manual.
TRANSMISSION WILL NOT MAKE A SPECIFIC SHIFT	Low engine power	Correct engine problem. Refer to engine service manual.
	Incorrect fluid level	Correct fluid level. Refer to appropriate transmission mechanic's tips for proper dipstick calibration.
	Extreme fluid temperature	Inspect cooling system and fluid level
	Faulty speed sensor/circuit	Repair circuit or replace speed sensor(s) (refer to codes P0716, P0721, or P0726)
	Faulty temperature sensor/circuit	Test for temperature reading which inhibits shifts
	Incorrect calibration	Install proper calibration
	Faulty shift selector	Replace shift selector
	Hydraulic problem	Refer to Range Clutch Troubleshooting section
	Faulty TCM	Replace TCM
TRANSMISSION LOCKUP CLUTCH WILL NOT ENGAGE	ABS fault active	Correct ABS fault

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TRANSMISSION DOES NOT SHIFT PROPERLY (ROUGH SHIFTS, SHIFTS OCCURRING AT TOO LOW OR TOO HIGH SPEED)	Engine idle speed too fast (neutral to range shift)	Adjust engine idle speed. Refer to vehicle service manual.
	Faulty throttle sensor/circuit	Refer to throttle sensor section for installation and operation information (refer to Appendix F)
	TCM input voltage low	Test power, ground, charging system, and battery function
	Incorrect shift calibration for vehicle	Install correct calibration
	Instrument panel tachometer incorrect	Repair or replace tachometer
	Incorrectly calibrated electronic speedometer	Calibrate electronic speedometer
	Faulty speed sensor/circuit	Repair circuit or replace speed sensor (refer to codes P0716, P0721, or P0726)
	Loose speed sensor	Tighten speed sensor retaining bracket bolt
	Incorrect fluid level	Correct fluid level. Refer to appropriate mechanic's tips for proper dipstick calibration.
	Crossed wires in harness	Inspect for crossed wires and correct
	Intermittent problems	Inspect wiring harnesses and connectors (Appendix E)
	Loose or damaged speed gear	Replace output bearing nut sensor retainer
	Logic latch valve sticking	Overhaul valve body assembly. Refer to appropriate transmission service manual.
	Sticking solenoid regulator valve	Overhaul valve body assembly Refer to appropriate transmission service manual.
	Incorrect calibration	Install correct calibration

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
CRUISE CONTROL COMPLAINTS		
A. Cruise Control Shift Cycles	Performance shift schedule is being used	Switch to economy shift schedule
	Incorrect droop settings	Modify engine droop settings to provide a larger speed variation before reaction occurs (CAT engines should be set on “soft cruise”. Cummins engines droop settings should be +2 mph and –3 mph.)
RETARDER PERFORMANCE COMPLAINTS		
A. Retarder Does Not Apply	Retarder enable input not activated	Turn on retarder enable switch (if present)
	Retarder enable switch not working	Replace retarder enable switch (if present)
	ABS input is active (if vehicle is equipped with ABS)	None—this is normal. If ABS is active, retarder will not apply.
	Retarder Request below 10.2 percent	Use Allison DOC™ For PC–Service Tool to determine retarder request voltage signaled by each RMR device present. Replace RMR device, based on test results.
	Closed throttle not sensed	Use Allison DOC™ For PC–Service Tool to check throttle signal. Throttle must be below 9.8 percent before retarder will apply. Adjust or replace TPS. **Exception**: If TPS has failed and Service Brake Status input is sensed by TCM, the retarder will still be applied.
	Active code inhibiting retarder	Correct cause for setting these codes: P2685, P2686, P2736, P2738, P2739, C1312, or C1313
	Transmission output speed below 350 rpm (3000 Product Family) 450 rpm (4000 Product Family)	Raise output speed to above 350 rpm (3000 Product Family) 450 rpm (4000 Product Family)
	Transmission not in a forward range	Shift to a forward range

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
B. Reduced Retarder Effect	Retarder accumulator solenoid not being energized	Correct cause for setting these codes: P2685, P2686, P2736, P2738, P2739, C1312, or C1313
	TCM sensing false overheat condition	Use Allison DOC™ For PC–Service Tool or VOM to check retarder temperature sensor. Replace sensor as required.
	Normal response to overheating: • higher retarder fluid temperature • higher engine coolant temperature • higher sump temperature	See Table 6–7 in Section 6 (DTC P0218, P2740)
C. Less Retarder Effect Than Expected	Transmission fluid aerated due to incorrect level	Determine transmission fluid level and correct as required
	Wrong retarder control calibration	Measure retarder charging pressure. Change retarder control calibration, if necessary.
ABNORMAL ACTIVITIES OR RESPONSES		
A. Excessive Creep in First and Reverse Gears	Engine idle speed too high	Adjust to correct idle speed—between 500–800 rpm. Refer to vehicle service manual.
B. No Response to Shift Selector	Shift selector not properly connected	Test shift selector response with Allison DOC™ For PC–Service Tool. If no response, inspect remote connection and replace if necessary
	Using wrong shift selector on dual station equipment	Use other selector
	Faulty shift selector	Replace shift selector
	Incorrect fluid level	Correct fluid level. Refer to appropriate transmission mechanic's tips for proper dipstick calibration.
	Main pressure low	Refer to Low Pressure section
	Logic latch valves sticking (C1, C3, or C5 clutch pressure low)	Overhaul valve body assembly. Refer to appropriate transmission service manual.
C. Vehicle Moves Forward in Neutral*	C1 clutch failed or not released	Rebuild C1 clutch assembly. Refer to appropriate transmission service manual.
D. Vehicle Moves Backward in Neutral*	C3 clutch failed or not released	Rebuild C3 clutch assembly. Refer to appropriate transmission service manual.

* See explanation of NVL in Section 2–3.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
D. Vehicle Moves Backward in Neutral*	C3 clutch failed or not released	Rebuild C3 clutch assembly. Refer to appropriate transmission service manual.
EXCESSIVE FLARE — ENGINE OVERSPEED ON FULL-THROTTLE UPSHIFTS	TPS Adjustment:	
	— Overstroke	— Adjust TPS linkage for proper stroke (Appendix F)
	— Loose	— Tighten loose bolts or connections
	Incorrect calibration	Correct calibration
	TCM input voltage low	Test electrical system and all connections from battery and TCM
	Incorrect fluid level	Correct fluid level. Refer to appropriate mechanic's tips for proper dipstick calibration measurements.
	Low main pressure	See Low Pressure section
	Erratic speed sensor signal	Refer to DTC P0716, P0721, or P0726
	Sticking solenoid regulator valve (see Solenoid and Clutch sections)	Clean and repair solenoid regulator valve. Refer to appropriate transmission service manual.
	Piston seals leaking or clutch plates slipping in range involved (see Range Clutch Troubleshooting section)	Overhaul transmission. Refer to appropriate transmission service manual.
RANGE CLUTCH TROUBLESHOOTING SECTION		
EXCESSIVE SLIPPAGE AND CLUTCH CHATTER	Incorrect calibration	Verify calibration
	TCM input voltage low	Test power, ground, charging system, and battery functions
	Throttle position sensor out of adjustment or failed	Adjust or replace throttle position sensor (Appendix F)
	Incorrect speed sensor readings	Refer to DTC P0716, P0721, or P0726
	Incorrect fluid level	Correct fluid level. Refer to appropriate mechanic's tips for proper dipstick calibration measurements.
	Main pressure low	Refer to the Low Pressure section

* See Appendix B—Measure main pressure, clutch pressure, and pressure specifications.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
EXCESSIVE SLIPPAGE AND CLUTCH CHATTER *(cont'd)*	Lockup clutch not applied	Inspect lockup clutch system wiring, pressure, and controls; repair as necessary. Refer to appropriate transmission service manual.*
A. Ranges 1, 2, 3, 4 Only (6-speed and 3000 7-speed) Ranges Lo, 1, 2, 3, 4 only (4000 7-Speed)	C1 clutch slipping, leaks at splitline gasket, leaks at rotating clutch seals, leaks at piston seals, C1 clutch plates worn	Inspect control module gasket, C1 clutch plates, and piston and rotating seals; replace/rebuild as necessary. Refer to appropriate transmission service manual.*
B. Ranges 4, 5, 6 Only (6-speed, 7-speed)	C2 clutch slipping, leaks at splitline gasket, leaks at rotating clutch seals, leaks at piston seals, C2 clutch plates worn	Inspect control module gasket, C2 clutch plates, and piston and rotating seals; replace/rebuild as necessary. Refer to appropriate transmission service manual.*
C. Ranges 3, 5, R Only (6-speed and 4000 7-speed) Ranges Lo, 3, 5, R only (3000 7-speed)	C3 clutch slipping, leaks at face seals, leaks at piston seals, C3 clutch plates worn	Inspect control module face seals, C3 clutch plates, and piston seals; replace/rebuild as necessary. Refer to appropriate transmission service manual.*
D. Ranges 2, 6 Only (6-speed and 7-speed)	C4 clutch slipping, leaks at face seals, leaks at piston seals, C4 clutch plates worn	Inspect control module face seals, C4 clutch plates, and piston seals; replace/rebuild as necessary. Refer to appropriate transmission service manual.*
E. Ranges 1, R Only (6-speed and 7-speed)	C5 clutch slipping, leaks at face seals, leaks at piston seals, C5 clutch plates worn	Inspect control module face seals, C5 clutch plates, and piston seals; replace/rebuild as necessary. Refer to appropriate transmission service manual.*
F. Range Lo Only (7-Speed)	C6 clutch slipping, leaks at splitline gasket(s), leaks at piston seals, C6 clutch plates worn	Inspect control module gasket, adapter gasket, T-Case gasket(s) C6 clutch plates, and piston seals; replace/rebuild as necessary. Refer to appropriate transmission service manual.*
	LOW PRESSURE SECTION	
A. Low Main Pressure in All Ranges (Including C6, T-Case)	Incorrect fluid level	Correct fluid level. Refer to the appropriate mechanic's tips for correct dipstick calibration.*
	Oil filter element clogged or faulty	Replace oil filter. Refer to the appropriate mechanic's tips.

* See Appendix B—Measure main pressure, clutch pressure, and pressure specifications.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
A. Low Main Pressure in All Ranges (Including C6, T-Case) (cont'd)	Plugged or faulty suction filter	Clean or replace oil suction filter element and refill the transmission. Refer to the appropriate mechanic's tips.
	Main pressure regulator valve sticking	Overhaul control module assembly. Refer to appropriate transmission service manual.
	Main pressure regulator valve spring weak, broken, or missing	Test spring and replace if necessary. Refer to appropriate transmission service manual.
	Control module body leakage (separator plate not flat, separator plate gasket leakage, loose control valve body bolts)	Replace or rebuild control module assembly. Care should be taken when removing and labeling shift springs. Refer to appropriate transmission service manual.
	Faulty or incorrect fluid pressure gauge	Repair or replace gauge
	Oil pump worn or damaged	Replace or rebuild oil pump. Refer to appropriate transmission service manual.
B. Clutch Pressure Low in Specific Ranges, Normal Pressure in Other Ranges		See Range Clutch Troubleshooting section and Appendix B
C. Low Lubrication Pressure	Incorrect fluid level	Correct fluid level. Refer to the appropriate mechanic's tips for proper dipstick calibration.
	Plugged lube filter	Change filter. Refer to the appropriate mechanic's tips.
	Excessive internal fluid leakage	Measure other pressures (above items); also inspect control module mounting bolts; lubrication valve and spring. Refer to appropriate transmission service manual.
	Broken or damaged converter regulator retaining pin	Replace damaged or broken parts. Refer to appropriate transmission service manual.
	Cooler lines restricted or leaking	Inspect for kinks, leakage; reroute or replace lines as necessary

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
C. Low Lubrication Pressure (cont'd)	Lubrication valve sticking	Replace lubrication valve
	Cooler plugged	Clean or replace cooler
	Faulty gauge	Repair or replace gauge
STALLS IN FIRST RANGE		
A. High Stall Speeds	Not in gear	Select **D** (Drive)
	Low fluid level, aerated fluid	Add fluid to proper level. Refer to the appropriate mechanic's tips for proper dipstick calibration.
	Incorrect torque converter	Replace torque converter. Refer to appropriate transmission service manual.
	Clutch pressure low	Refer to Low Pressure section and Appendix B
	C1 or C5 clutch slipping. ***NOTE: Use the Allison DOC™ For PC–Service Tool to check turbine speed.***	Rebuild C1 or C5 clutch. Refer to appropriate transmission service manual.
	Higher power engine	Confirm proper engine match
B. Low Stall Speeds	Engine not performing efficiently (may be due to plugged or restricted injectors, high altitude conditions, dirty air filters, out of time, throttle linkage, electronic engine controls problem)	Refer to vehicle engine manufacturer's manual or vehicle service manual
	Stall speeds of 66 percent of normal implies freewheeling stator	Replace or rebuild converter assembly. Refer to appropriate transmission service manual.
	Incorrect torque converter	Install correct torque converter. Refer to appropriate transmission service manual.
OVERHEATING IN ALL RANGES	Aerated fluid—incorrect fluid level	Adjust fluid to proper level, check for defective pump. Refer to the appropriate mechanic's tips and transmission service manual.
	Air flow to cooler obstructed	Remove air flow obstruction
	Engine overheat	Correct overheat situation. Refer to vehicle service manual.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
OVERHEATING IN ALL RANGES *(cont'd)*	Inaccurate temperature gauge or sending unit	Replace gauge and/or sending unit
	Inaccurate sump temperature sensor	Replace temperature sensor or internal harness. Refer to appropriate transmission service manual.
	Transmission cooler lines reversed	Connect cooler lines properly (oil and water should flow in opposite directions)
	Fluid cooler lines restricted	Remove restrictions, clean or replace lines. Refer to vehicle service manual.
	Torque converter (wrong converter, no lockup, stuck stator, or slipping stator)	Replace or repair converter assembly. Refer to appropriate transmission service manual. ***NOTE: Stuck stator will not allow cool down in neutral.***
	Cooler flow loss due to internal leakage	Overhaul transmission. Refer to appropriate transmission service manual.
	Inadequate cooler sizing	See vehicle OEM for specifications
	Excessive cooler circuit pressure drop	Test for plugged cooler, lines too small, collapsed hose, too many elbows in circuit
FLUID COMES OUT OF THE FLUID FILL TUBE AND/OR BREATHER	Dipstick loose	Tighten cap, replace if necessary
	Fluid level too high	Drain to proper level. Refer to the appropriate mechanic's tips.
	Fluid level too low	Add fluid to proper level
	Breather stopped up—clogged	Clean or replace breather. Refer to appropriate transmission service manual.
	Fluid contaminated with foreign liquid	Drain and replace fluid. Locate and fix source of additional fluid. Refer to appropriate transmission service manual if repair is needed.
	Dipstick or fill tube seal worn	Replace seal or dipstick
	Incorrect dipstick marking	Calibrate dipstick. Refer to the appropriate mechanic's tips.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
NOISE OCCURRING INTERMITTENTLY (BUZZING)	Low fluid level	Add fluid to proper level. Refer to the appropriate mechanic's tips for proper dipstick calibration.
	Air leak in oil suction screen canister	Replace oil suction screen canister. Refer to appropriate transmission service manual.
	Clogged filters	Replace filters. Refer to the appropriate mechanic's tips.
	Aerated fluid causes noisy pump	Correct fluid level. Refer to the appropriate mechanic's tips for proper dipstick calibration.
	Low main pressure causes main regulator valve to oscillate	See Low Pressure section
LEAKING FLUID (OUTPUT SHAFT)	Faulty or missing seal at output flange	Install new lip-type seal in rear of transmission housing. Refer to appropriate transmission service manual.
	Machine lead on output flange seal surface	Replace flange
	Flange worn at seal surface	Replace flange
	Insufficient seal around seal OD	When replacing seal, apply sealant. Refer to appropriate transmission service manual.
	Damaged, missing, or loose output flange bolts	Replace and/or torque output flange bolts
	Damaged or missing flange button O-ring	Replace flange button O-ring
	Damaged or missing bolt O-rings	Replace O-rings
TRANSMISSION INPUT	Front seal leaks	Replace front seal. Refer to appropriate transmission service manual.
	Converter leaks	Inspect converter seals, cracked converter pump tangs, converter cover, or converter housing porosity; replace parts as required. Refer to appropriate transmission service manual.
	PTO driveline out of specification	Bring driveline into specification

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
DIRTY FLUID	Failure to change fluid and filters	Change fluid and install new filters. Refer to the appropriate mechanic's tips.
	Excessive heat	Refer to Overheating section
	Damaged fluid filter/seals	Replace oil filter/seals. Refer to the appropriate mechanic's tips.
	Substandard fluid	Use recommended fluid. Refer to the appropriate mechanic's tips.
	Clutch/transmission failure	Overhaul transmission. Refer to appropriate transmission service manual.
	POWER TAKEOFF (PTO)*	
A. Leaks	Damaged or cocked seal	Replace seal
	PTO flange grooved at seal	Replace PTO flange
	Loose flange	Inspect flange and bolts; replace if necessary and properly torque bolts
	Loose bolts or damaged gaskets	Replace gasket and/or properly torque bolts
	Loose or damaged hydraulic lines (clutched drive)	Tighten fittings. Replace if necessary.
B. Noisy PTO	Faulty driven component	Replace faulty driven component
	Gears or bearings worn, damaged, or contaminated	Rebuild PTO with new gears or bearings
C. No or Intermittent Operation (Clutched Drive)	Electrical problem (switch, connectors, solenoid, or wires)	Inspect for electrical problem and repair (Appendix E)
	Damaged or worn clutch	Rebuild clutch assembly
	Clutch piston seals damaged or missing	Rebuild clutch assembly
	Inadequate fluid pressure to PTO	Inspect and repair fluid pressure supply; line kinked, loose, or plugged; orifice too small
	Engine speed outside operating band	Increase or reduce engine speed to move within operating band
	Drive or driven gear teeth damaged	Replace damaged gears. Refer to appropriate transmission service manual.

* Contact your nearest Allison dealer/distributor with specific questions relating to PTO repair.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
	TRANSFER CASE (T-CASE)	
A. Will Not Go Into Lo Range	TPS adjustment	Properly adjust TPS (Appendix F)
	Engine speed too high	Reduce Engine Speed
	Wrong calibration	Calibrate properly
	Wrong control module (6 speed instead of 7 speed)	Install correct control module
	Faulty wiring, solenoid connectors	Inspect wiring and connectors in control module. Refer to appropriate transmission service manual.
	Faulty C6 seals	Replace C6 assembly piston seals. Refer to appropriate transmission service manual.
	Worn C6 clutch plates	Rebuild C6. Refer to appropriate transmission service manual.
B. Makes Excessive Noise	Improperly shimmed bearings	Inspect all T-case bearings as directed in transmission repair manual. Reshim as necessary.
C. No Front Output Drive	Differential clutch bad (C7 piston seals, C7 rotating seals, C7 clutch plates, C7 check ball)	Rebuild differential clutch. Refer to appropriate transmission service manual.
	C7 electrical (wires, solenoids, terminals, connectors)	Inspect and repair C7 electrical system (Appendix E)
D. Transmission Fluid Leaks	Damaged output seal, output flange seal journal, gasketed mating surfaces, bearing endcaps, electrical connector, oil scavenge line	Determine source of leak and repair. Refer to appropriate transmission service manual.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–2. Resistance Module Troubleshooting Data

	Resistance Test in Resistance Module*		Voltage Signal**		Wiring to Control Device
Description	**Terminals**	**Resistance KΩ ± 5%**	**% Retarder Application**	**Voltage ± 0.2V**	**Device Terminal**
Auto Full On	A to C	12	100	3.6	No connections
Pressure Switch Full On High	A to C	32	0 100	1.1 3.6	A B
3-Step E-10R Bendix Pedal	A to C	32	0 32 58 100	1.1 1.9 2.8 3.6	A B C D
6-Step Hand Lever — Off Position 1 Position 2 Position 3 Position 4 Position 5 Position 6	A to C	32	 0 16 28 48 65 84 100	 1.1 1.5 1.9 2.3 2.8 3.2 3.6	 + 1 2 3 4 5 6
Auto $^{1}/_{2}$ On	A to C	12	50	2.4	No connections
3 Pressure Switches — Low Medium High	A to C	32	0 32 68 100	1.1 1.9 2.3 3.6	A B A B A B
Auto $^{1}/_{3}$ On 2 Pressure Switches Auto Medium High	A to C	21.4	 32 68 100	 1.9 2.8 3.6	A B A B
Dedicated Pedal	No Tests	Interface not a resistance module	0 100	0.7–1.2 3.4–3.5	A B C

* Resistance module must be disconnected from the wiring harness and retarder control devices.
** These voltages must be measured between terminals A and B.

APPENDICES

APPENDIX A—IDENTIFICATION OF POTENTIAL CIRCUIT PROBLEMS

Intermittent codes are a result of faults that are detected, logged, and then disappear, only to recur later. If, when troubleshooting, a code is cleared in anticipation of it recurring and it does not, check the items in the following list for the fault's source.

A. Circuit Inspection

Intermittent power/ground problems—can cause voltage problems during TCM diagnostic checks which can set various codes depending upon where the TCM was in the diagnostic process.

- Damaged terminals.
- Dirty or corroded terminals.
- Terminals not fully seated in the connector. Inspect indicated wires by uncoupling connector and gently pulling on the wire at the rear of the connector and checking for excessive terminal movement.
- Connectors not fully mated. Inspect for missing or damaged locktabs.
- Screws or other sharp pointed objects pushed into or through one of the harnesses.
- Harnesses which have rubbed through and may be allowing intermittent electrical contact between two wires or between wires and vehicle frame members.
- Broken wires within the braiding and insulation.

B. Finding an Intermittent Fault Condition

To find a fault, like one of those listed, examine all connectors and the external wiring harnesses. Harness routing may make it difficult to see or feel the complete harness. However, it is important to thoroughly check each harness for chafed or damaged areas. Road vibrations and bumps can damage a poorly installed harness by moving it against sharp edges and cause some of the faults. If a visual inspection does not identify a cause, move and wiggle the harness by hand until the fault is duplicated.

The next most probable cause of an intermittent code is an electronic part exposed to excessive vibration, heat, or moisture. Examples of this are:

(1) Exposed harness wires subjected to moisture.

(2) A defective connector seal allows moisture to enter the connector or part.

(3) An electronic part (TCM, shift selector, solenoid, or throttle sensor) affected by vibration, heat, or moisture may cause abnormal electrical conditions within the part.

When troubleshooting Item 3, eliminate all other possible causes before replacing any parts.

Another cause of intermittent codes is good parts in an abnormal environment. The abnormal environment will usually include excessive heat, moisture, or voltage. For example, an TCM that receives excessive voltage will generate a diagnostic code as it senses high voltage in a circuit. The code may not be repeated consistently because different circuits may have this condition on each check. The last step in finding an intermittent code is to observe if the code is set during sudden changes in the operating environment.

Troubleshooting an intermittent code requires looking for common conditions that are present whenever the code is diagnosed.

APPENDIX A—IDENTIFICATION OF POTENTIAL CIRCUIT PROBLEMS

C. Recurring Conditions

A recurring condition might be:

- Rain
- Outside temperature above or below a certain temperature
- Only on right-hand or left-hand turns
- When the vehicle hits a bump, etc.

If such a condition can be related to the code, it is easier to find the cause. If the time between code occurrences is very short, troubleshooting is easier than if it is several weeks or more between code occurrences.

APPENDIX B— MEASURING CLUTCH AND RETARDER PRESSURES

Testing individual clutch pressures helps to determine if a transmission malfunction is due to a mechanical or an electrical problem. Properly making these pressure checks requires transmission and vehicle (or test stand) preparation, recording of data, and comparing recorded data against specifications provided. These instructions are for all 3000 and 4000 Product Families transmissions.

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

A. Transmission and Vehicle Preparation

1. Remove the plugs from the pressure tap locations where measurement is desired (Figure B–1).

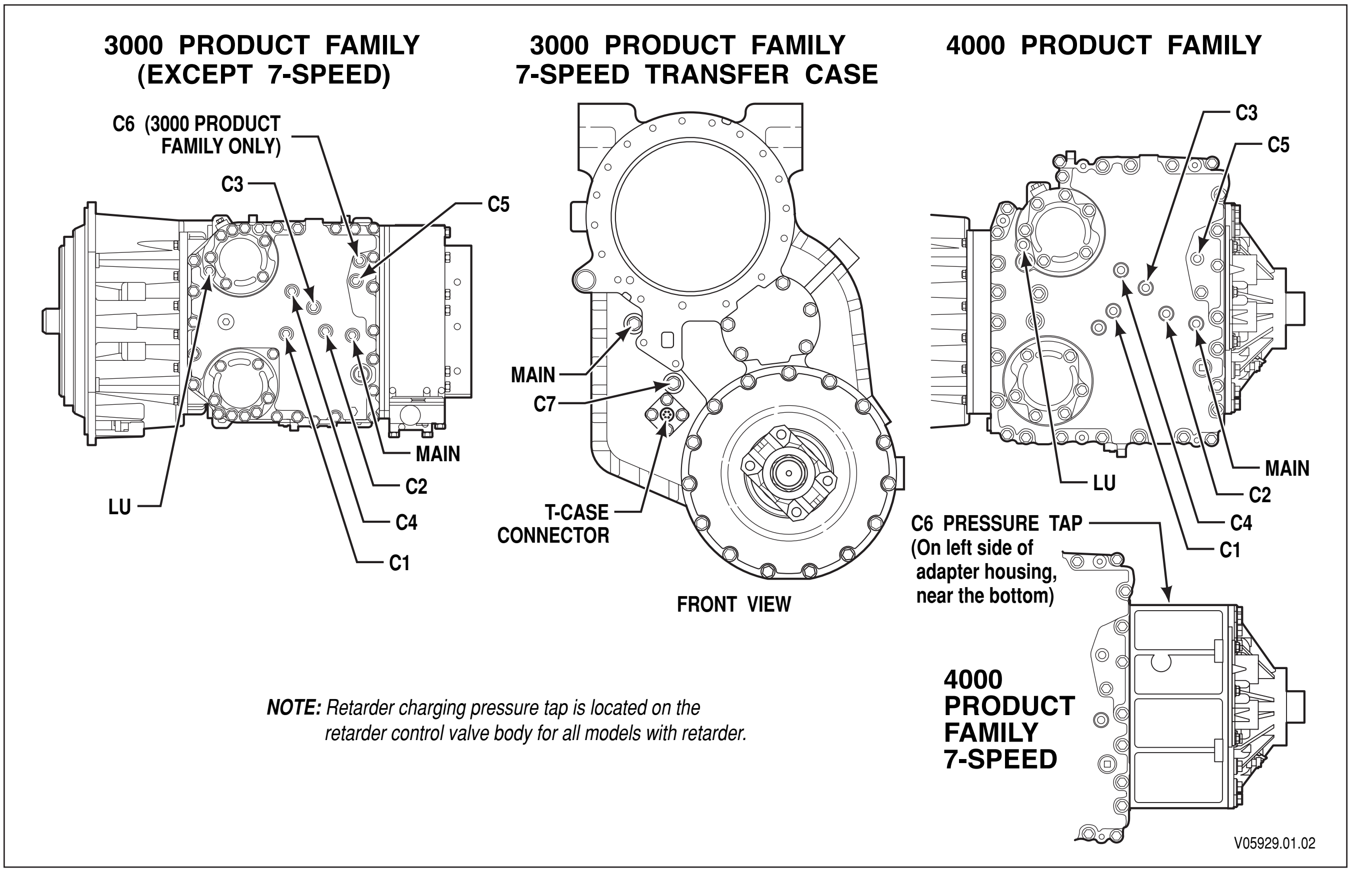


Figure B–1. Clutch Pressure Check Points

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

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

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

APPENDIX B— MEASURING CLUTCH AND RETARDER PRESSURES

4. Be sure that engine speed can be monitored (Allison DOC™ For PC–Service Tool may be used for this purpose).

5. Be sure that transmission sump fluid temperature can be measured (Allison DOC™ For PC–Service Tool may be used for this purpose).

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

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

B. Recording Data

1. Use the Allison DOC™ For PC–Service Tool, which allows checking of individual range clutch pressures, with the vehicle stationary. Consult Appendix N or Allison publication GN3433EN, User Guide for Allison DOC™ PC–Service Tool, for Action Request and select Clutch Test Mode. Follow instructions to test clutch pressures in individual ranges.

NOTE: ***Check lockup clutch pressure by driving the vehicle in a range where lockup can be obtained. Record the pressure values at the engine speed and sump fluid temperature values shown in Table B–1. The lockup clutch is functioning correctly when engine speed and turbine speed values are equal as recorded from Allison DOC™ For PC–Service Tool.***

2. Consult Table B–1 and locate the transmission model that you are testing.

3. Operate the transmission at the conditions shown in Table B–1 and record engine speed, transmission sump fluid temperature, main hydraulic pressure, and clutch pressures in the ranges where a problem is suspected.

Table B–1. Clutch Pressure Test Conditions

Transmission Model/ Test Type	Engine rpm	Sump Fluid Temperature	Range	Clutches Pressurized
All Models (except 3000 Product Family)—Idle Test	580–620	71–93ºC (160–200ºF)	Neutral Reverse 1C 2C (2nd range start)	C5 C3 C5 C1 C5 C1 C4
3000 Product Family—Idle Test	580–620	71–93ºC (160–200ºF)	Neutral Reverse LowC 1C	C5 C3 C5 C3 C6 C1 C5
3000 Product Family (except 7-Speed Models)—High Speed	2080–2120	71–93ºC (160–200ºF)	Reverse Neutral 1C 2C 2L 3L 4L 5L 6L	C3 C5 C5 C1 C5 C1 C4 C1 C4 LU C1 C3 LU C1 C2 LU C2 C3 LU C2 C4 LU

APPENDIX B— MEASURING CLUTCH AND RETARDER PRESSURES

Table B–1. Clutch Pressure Test Conditions *(cont'd)*

Transmission Model/ Test Type	Engine rpm	Sump Fluid Temperature	Range	Clutches Pressurized
3000 Product Family 7-Speed Models—High Speed	2080–2120	71–93ºC (160–200ºF)	Reverse Neutral LowC 1C 2C 2L 3L 4L 5L 6L	C3 C5 C5 C3 C6 C1 C5 C1 C4 C1 C4 LU C1 C3 LU C1 C2 LU C2 C3 LU C2 C4 LU
4000 Product Family—High Speed	1780–1820	71–93ºC (160–200ºF)	Reverse Neutral LowC** 1C 2C 2L 3L 4L 5L 6L	C3 C5 C5 C1 C6 C1 C5 C1 C4 C1 C4 LU C1 C3 LU C1 C2 LU C2 C3 LU C2 C4 LU
			** Only applies to HD 4070.	

C. Comparing Recorded Data to Specifications

1. Be sure that engine speed and transmission sump fluid temperatures were within the values specified in Table B–1.
2. Compare the main pressure and clutch pressure data, recorded in Step B, with the specifications in Table B–2.
3. If clutch pressures are within specifications, return the transmission and vehicle to their original configuration and proceed with electrical troubleshooting.
4. If clutch pressures are not within specification, take corrective action to replace the internal parts of the transmission necessary to correct the problem. (Refer to the appropriate transmission service manual for the model being tested.)
5. Review pressure values after the transmission has been repaired.
6. Return the transmission to its original configuration. (Remove instrumentation and reinstall any components removed for the pressure testing.)

APPENDIX B—CHECKING CLUTCH AND RETARDER PRESSURES

Table B–2. Main Pressure and Clutch Pressure Specifications (Sump Fluid Temperature Same as in Table B–1)

Transmission Model/Test Type	Engine rpm	Range	Main Press. Spec kPa [psi]	Clutches Applied	Range Clutch Press. Spec* kPa [psi]	Lube Pressure Spec* kPa [psi]	Dropbox Main Press. Spec* kPa [psi]
3000 Product Family—Idle	580–620	Neutral Main Mod OFF	1515–2035 (220–295)	C5	1440–2035 (210–295)	10–35 (1–5)	1440–2035 (210–295)
		Neutral Main Mod ON	1310–1725 (190–250)	C5	1235–1725 (180–250	10–35 (1–5)	1235–1725 (180–250)
		Reverse Main Mod OFF	1450–2035 (210–295)	C3, C5	1375–2035 (200–295)	10–35 (1–5)	1375–2035 (200–295)
		Reverse Main Mod ON	1170–1585 (170–230)	C3, C5	1095–1585 (160–230)	10–35 (1–5)	1095–1585 (160–230)
		Low C (3000 7-Speed) Main Mod OFF	1240–1725 (180–250)	C3, C6	1165–1725 (170–250)	10–35 (1–5)	1165–1725 (170–250)
		Low C (3000 7-Speed) Main Mod ON	870–1340 (125–195)	C3, C6	795–1340 (115–195)	10–35 (1–5)	795–1340 (115–195)
		1C Main Mod OFF	1240–1725 (180–250)	C1, C5	1165–1725 (170–250)	10–35 (1–5)	1165–1725 (170–250)
		1C Main Mod ON	870–1340 (125–195)	C1, C5	795–1340 (115–195)	10–35 (1–5)	795–1340 (115–195)
		2C Main Mod OFF	1240–1725 (180–250)	C1, C4	1165–1725 (170–250)	10–35 (1–5)	1165–1725 (170–250)
		2C Main Mod ON	870–1340 (125–195)	C1, C4	795–1340 (115–195)	10–35 (1–5)	795–1340 (115–195)

APPENDIX B—CHECKING CLUTCH AND RETARDER PRESSURES

Table B–2. Main Pressure and Clutch Pressure Specifications (Sump Fluid Temperature Same as in Table B–1) *(cont'd)*

Transmission Model/Test Type	Engine rpm	Range	Main Press. Spec kPa [psi]	Clutches Applied	Range Clutch Press. Spec* kPa [psi]	Lube Pressure Spec* kPa [psi]	Dropbox Main Press. Spec* kPa [psi]
3000 Product Family—High Speed	2080–2120	Neutral Main Mod OFF	1805–2205 (260–320)	C5	1730–2205 (250–320)	160–240 (23–35)	1730–2205 (250–320)
		Neutral Main Mod ON	1415–1725 (205–250)	C5	1335–1725 (195–250)	160–240 (23–35)	1335–1725 (195–250)
		Reverse	1805–2205 (260–320)	C3, C5	1730–2205 (250–320)	160–240 (23–35)	1730–2205 (250–320)
		Low C (3000 7-Speed)	1550–1965 (225–285)	C3, C6	1475–1965 (215–285)	160–240 (23–35)	1475–1965 (215–285)
		1C	1550–1965 (225–285)	C1, C5	1475–1965 (215–285)	160–240 (23–35)	1475–1965 (215–285)
		2C	1550–1965 (225–285)	C1, C4	1475–1965 (215–285)	160–240 (23–35)	1475–1965 (215–285)
		2L	1080–1365 (155–200)	C1, C4, LU	1005–1365 (145–200)	160–240 (23–35)	1005–1365 (145–200)
		3C	1550–1965 (225–285)	C1, C3	1475–1965 (215–285)	160–240 (23–35)	1475–1965 (215–285)
		3L	1080–1365 (155–200)	C1, C3, LU	1005–1365 (145–200)	160–240 (23–35)	1005–1365 (145–200)
		4C	1550–1965 (225–285)	C1, C2	1475–1965 (215–285)	125–200 (18–30)	1475–1965 (215–285)
		4L	1080–1365 (155–200)	C1, C4, LU	1005–1365 (145–200)	125–200 (18–30)	1005–1365 (145–200)
		5C	1550–1965 (225–285)	C2, C3	1475–1965 (215–285)	125–200 (18–30)	1475–1965 (215–285)
		5L	1080–1365 (155–200)	C2, C3, LU	1005–1365 (145–200)	125–200 (18–30)	1005–1365 (145–200)
		6C	1345-1590 (220–290)	C2, C4	1270-1590 (185-230)	125–200 (18–30)	1270-1590 (185-230)
		6L	1035–1415 (150–205)	C2, C4, LU	960–1415 (140–205)	125–200 (18–30)	960–1415 (140–205)

APPENDIX B—CHECKING CLUTCH AND RETARDER PRESSURES

Table B–2. Main Pressure and Clutch Pressure Specifications (Sump Fluid Temperature Same as in Table B–1) *(cont'd)*

Transmission Model/Test Type	Engine rpm	Range	Main Press. Spec kPa [psi]	Clutches Applied	Range Clutch Press. Spec* kPa [psi]	Lube Pressure Spec* kPa [psi]	Dropbox Main Press. Spec* kPa [psi]
4000 Product Family—Idle	580–620	Neutral Main Mod OFF	1515–2055 (220–300)	C5	1440–2055 (210–300)	3.5 min (0.5 min)	
		Neutral Main Mod ON	1310–1725 (190–250)	C5	1235–1725 (180–250)	3.5 min (0.5 min)	
		Reverse Main Mod OFF	1450–2055 (210–300)	C3, C5	1375–2055 (200–300)	3.5 min (0.5 min)	
		Reverse Main Mod ON	1170–1585 (170–230)	C3, C5	1095–1585 (160–230)	3.5 min (0.5 min)	
		Low C (4000 7-Speed) Main Mod OFF	1240–1725 (180–250)	C1, C6	1165–1725 (170–250)	3.5 min (0.5 min)	
		Low C (4000 7-Speed) Main Mod ON	870–1340 (125–195)	C1, C6	795–1340 (115–195)	3.5 min (0.5 min)	
		1C Main Mod OFF	1240–1725 (180–250)	C1, C5	1165–1725 (170–250)	3.5 min (0.5 min)	
		1C Main Mod ON	870–1340 (125–195)	C1, C5	795–1340 (115–195)	3.5 min (0.5 min)	
		2C Main Mod OFF	1240–1725 (180–250)	C1, C4	1165–1725 (170–250)	3.5 min (0.5 min)	
		2C Main Mod ON	870–1340 (125–195)	C1,C4	795–1340 (115–195)	3.5 min (0.5 min)	

APPENDIX B—CHECKING CLUTCH AND RETARDER PRESSURES

Table B–2. Main Pressure and Clutch Pressure Specifications (Sump Fluid Temperature Same as in Table B–1) *(cont'd)*

Transmission Model/Test Type	Engine rpm	Range	Main Press. Spec kPa [psi]	Clutches Applied	Range Clutch Press. Spec* kPa [psi]	Lube Pressure Spec* kPa [psi]	Dropbox Main Press. Spec* kPa [psi]
4000 Product Family—High Speed	1780–1820	Neutral Main Mod OFF	1805–2055 (260–300)	C5	1730–2055 (250–300)	160–240 (23–35)	
		Neutral Main Mod ON	1415–1725 (205–240)	C5	1340–1725 (195–240)	160–240 (23–35)	
		Reverse	1805–2055 (260–300)	C3, C5	1730–2055 (250–300)	160–240 (23–35)	
		Low C (4000 7-Speed)	1550–1795 (225–260)	C1, C6	1475–1795 (215–260)	160–240 (23–35)	
		1C	1550–1795 (225–260)	C1, C5	1475–1795 (215–260)	160–240 (23–35)	
		2C	1550–1795 (225–260)	C1, C4	1475–1795 (215–260)	160–240 (23–35)	
		2L	1080–1365 (155–200)	C1, C4, LU	1005–1365 (145–200)	160–240 (23–35)	
		3C	1550–1795 (225–260)	C1, C3	1475–1795 (215–260)	160–240 (23–35)	
		3L	1080–1365 (155–200)	C1, C3, LU	1005–1365 (145–200)	160–240 (23–35)	
		4C	1550–1795 (225–260)	C1, C2	1475–1795 (215–260)	125–200 (18–30)	
		4L	1080–1365 (155–200)	C1, C4, LU	1005–1365 (145–200)	125–200 (18–30)	
		5C	1550–1795 (225–260)	C2, C3	1475–1795 (215–260)	125–200 (18–30)	
		5L	1080–1365 (155–200)	C2, C3, LU	1005–1365 (145–200)	125–200 (18–30)	
		6C	1345–1590 (195–230)	C2, C4	1270–1590 (185–230)	125–200 (18–30)	
		6L	1035–1235 (150–180)	C2, C4, LU	960–1235 (140–180)	125–200 (18–30)	

* To pass this specification, measured clutch pressures **must be** within 75kPa (10 psi) of actual measured main pressure and still be within the minimum and maximum value of this specification.

APPENDIX B— MEASURING CLUTCH AND RETARDER PRESSURES

D. Retarder Pressure Checks—3000 and 4000 Product Families

1. 3000 Product Family Low Speed/Low Torque Transmission Dyno Test

   a. 3000 Product Family (except 3500 RDS/EVS/SPS, and MD 3560) Test Conditions:
   - Second Range Lockup, 100 Percent Retarder Apply, Input Speed = 1075–1125 rpm

   b. 3500 RDS/EVS/SPS and MD 3560 Test Conditions:
   - Second Range Lockup, 100 Percent Retarder Apply, Input Speed = 1350–1400 rpm

Table B–3. Retarder Specifications At Above Test Conditions

Parameter To Check	High Capacity	Medium Capacity	Low Capacity
Main Pressure–kPa [psi]	1080–1365 (155–200)	1080–1365 (155–200)	1080–1365 (155–200)
Retarder Charge Pressure – kPa [psi]	215–310 (31–45)	215–310 (31–45)	215–310 (31–45)
Cooler In Temperature – °C (°F)	150 (300) Max (Ref)	150 (300) Max (Ref)	150 (300) Max (Ref)

2. 3000 Product Family High Speed Vehicle Road Test Conditions:
   - Fourth Range Lockup, 100 Percent Retarder Apply, Input Speed =1900–2000 rpm

Table B–4. Retarder Specifications At Above Test Conditions

Parameter To Check	High Capacity	Medium Capacity	Low Capacity
Main Pressure–kPa [psi]	1080–1365 (155–200)	1080–1365 (155–200)	1080–1365 (155–200)
Retarder Charge Pressure–kPa [psi]	539–608 (78–88)	446–521 (65–76)	384–444 (56–64)
Cooler In Temperature–°C [°F]	150 [300] Max (Ref)	150 [300] Max (Ref)	150 [300] Max (Ref)

3. 4000 Product Family Low Speed/Low Torque Transmission Dyno Test

   a. 4000 Product Family (except 4500 models) Test Conditions:
   - Second Range Lockup, 100 Percent Retarder Apply, Input Speed = 1025–1075 rpm

   b. 4500 Model Test Conditions:
   - Second Range Lockup, 100 Percent Retarder Apply, Input Speed = 1190–1240 rpm

Table B–5. Retarder Specifications At Above Test Conditions

Parameter To Check	High Capacity	Medium Capacity	Low Capacity
Main Pressure–kPa [psi]	1080–1365 (155–200)	1080–1365 (155–200)	1080–1365 (155–200)
Retarder Charge Pressure–kPa [psi]	148–232 (21–34)	148–232 (21–34)	148–232 (21–34)
Cooler In Temperature–°C [°F]	150 [300] Max (Ref)	150 [300] Max (Ref)	150 [300] Max (Ref)

APPENDIX B— MEASURING CLUTCH AND RETARDER PRESSURES

4. 4000 Product Family High Speed Vehicle Road Test Conditions:
   - Fourth Range Lockup, 100 Percent Retarder Apply, Input Speed = 1550-1650 rpm

Table B–6. Retarder Specifications At Above Test Conditions

Parameter To Check	High Capacity	Medium Capacity	Low Capacity
Main Pressure–kPa [psi]	1080–1365 (155–200)	1080–1365 (155–200)	1080–1365 (155–200)
Retarder Charge Pressure–kPa [psi]	373–434 (54–63)	320–381 (46–55)	267–330 (39–48)
Cooler In Temperature–°C [°F]	150 [300] Max (Ref)	150 [300] Max (Ref)	150 [300] Max (Ref)

APPENDIX C—SOLENOID AND CLUTCH CHART

BASIC CONFIGURATION

Range	Solenoid Variable Bleed						Clutches					
	PCS1 N/O	PCS2 N/O	PCS3 N/C	PCS4 N/C	TCC N/C	SS1 On/Off	C1	C2	C3	C4	C5	LU
6	X			X	O			Y		Y		O
5	X		X		O	X		Y	Y			O
4					O	X	Y	Y				O
3		X	X		O	X	Y		Y			O
2		X		X	O	X	Y			Y		O
1		X	X		O		Y				Y	O
N–C5	X	X	X	*						*	Y	
NVL	X	X	X	X						Y	Y	
N–C4	X	X		X						Y		
N–C3	X								Y			
R	X		X						Y		Y	

NOTE: *See Page C–2 for legend.*

7-SPEED CONFIGURATION
(3000 and 4000 Product Families)

Range	Solenoid Variable Bleed									Clutches							
	PCS1 N/O	PCS2 N/O	PCS3 N/C	PCS4 N/C	TCC N/C	SS1 On/Off	SS2 On/Off	PCS5 N/L	PCS6 N/L	C1	C2	C3	C4	C5	LU	C6	DIF
6	X			X	O						Y		Y		O		O
5	X		X		O	X					Y	Y			O		O
4					O	X				Y	Y				O		O
3		X	X		O	X				Y		Y			O		O
2		X		X	O	X				Y			Y		O		O
1		X	X		O					Y				Y	O		O
LO-3700	X						X	X	X			Y				Y	O
LO-4700		X					X		X	Y						Y	O
N–C5	X	X	X	*									*	Y			O
NVL	X	X		X									Y	Y			O
N–C4	X	X		X									Y				O
N–C3	X											Y					O
R	X		X									Y		Y			

NOTE: *See Page C–2 for legend.*

APPENDIX C—SOLENOID AND CLUTCH CHART

LEGEND

X	Indicates solenoid is electrically ON.
Y	Indicates clutch is hydraulically applied.
Blank	Indicates solenoid is electrically OFF or clutch is not hydraulically applied.
O	Optional ON or OFF.
*	See NVL explanation below.
NVL	**As a diagnostic response:** If Turbine Speed is below 150 rpm when Output Speed is below 100 rpm and Engine Speed is above 400 rpm, Neutral Very Low (NVL) is commanded when N–C5 (Neutral) is the selected range. NVL is achieved by turning PCS4 solenoid "on" in addition to PCS3 being "on", which locks the output. Otherwise, PCS4 solenoid is turned off N1 (Neutral). **As a commanded range when shifting to Fire Truck Pump Mode:** While wire 123 is energized before wire 122 is energized when going into Fire Truck Pump Mode, Neutral Very Low (NVL) will be commanded to lock the output to assist the shifting of the split-shaft PTO transfer case from road mode to pump mode. While wire 123 is de-energized before wire 122 is de-energized when shifting out of Fire Truck Pump Mode, Neutral Very Low (NVL) will be commanded to lock the output to assist the shifting of the split-shaft PTO transfer case from pump mode to road mode.

APPENDIX D—WIRE/CONNECTOR CHART

The connector information in this appendix is provided for the convenience of the servicing technician. The connector illustration and pin identifications for connection to Allison Transmission components will be accurate. Allison Transmission components are the TCM, speed sensors, retarder connectors, transmission connectors, and shift selectors. Other kinds of connectors for optional or customer-furnished components are provided based on typical past practice for an Allison-designed system.

Contact St. Clair Technologies, Inc. or your vehicle manufacturer for information on connectors not found in this appendix.

NOTE: ***The following abbreviation guide should be used to locate connector termination points for wires in the Allison 4th Generation wiring harness(es).***

Table D–1. Appendix D Abbreviation Guide

Termination Point Abbreviation	Connector Name
ABS	Anti-lock Brake System
ARTN	Analog Return
CAN	Controller Area Network
DDRD	Diagnostic Connector—Deutsch
DDRP	Diagnostic Connector—Packard
GPI	General Purpose Input
GPO	General Purpose Output
J1939	J1939 Datalink From ECU Selector (S) Harness
NE	Engine Speed Sensor
NO	Output Speed Sensor
NT	Turbine Speed Sensor
OBDII	Diagnostic Connector—GMC On Board Diagnostics
OLS	Oil Level Sensor
PCS	Pressure Control Solenoid
PS	Pressure Switch—Control Module
PWM	Pulse Width Modulation
RMR	Retarder Modulation Request Device
RNGTRM	Chassis Ground Ring Terminal
RTEMP	Retarder Temperature—Retarder Housing
SCI	Serial Communication Interface
SS	Shift Solenoid
TCASE	3000 Product Family 7-Speed Transfer Case
TPS	Throttle Position Sensor
TRANS	Transmission Feedthrough Harness
VIM	Vehicle Interface Module

APPENDIX D—WIRE/CONNECTOR CHART

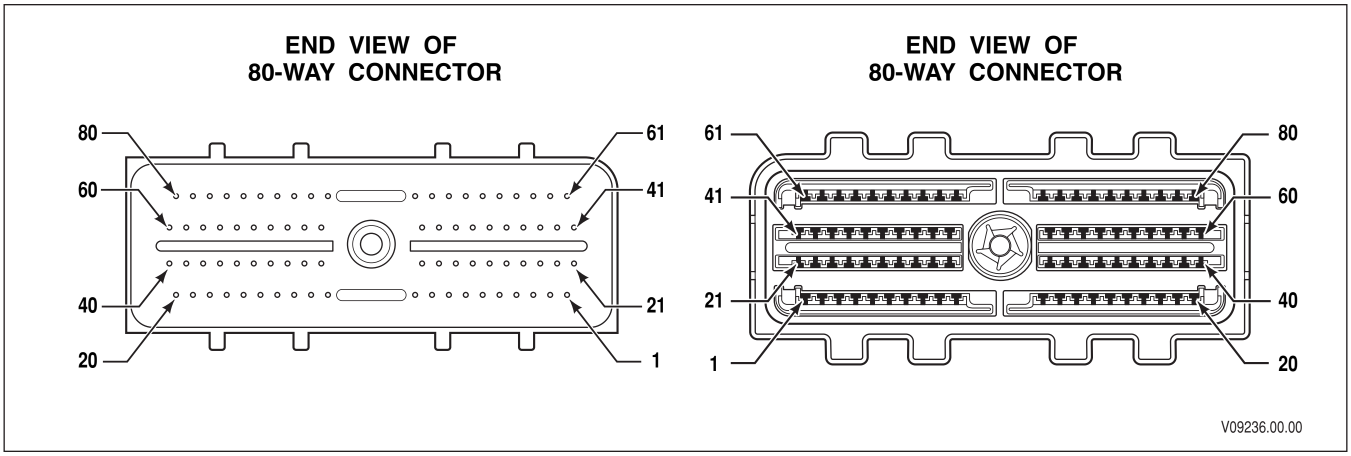


Figure D–1. 80-Way TCM Connector

80-Way TCM Connector

Terminal No.	Color	Wire No.	Description	Termination Point(s)
1	Blue	101	GPI 6 (–)	Vehicle System
2	Yellow	102	GPI 2 (+)	Vehicle System
3	Yellow	103	TCM Digital Return	Vehicle System
4	Yellow	104	GPO 2 (–)	Vehicle System or VIM-B1
5	Orange	105	GPO 4 (–)	Vehicle System or VIM-C2
6	Yellow	106	CAN 2 High (+)	IES CAN A or H
7	Yellow	107	Internal Terminating Resister CAN 1 (TCM)	Vehicle System
8	Green	108	CAN 1 Low (–)	J1939 B or L
9	Gray	109	Battery (–)	Vehicle System or VIM-A2
10	Pink	110	Battery (+)	Vehicle System or VIM-E2
11	Orange	111	High Side Driver Feed (HSD1)	Trans Connector (Pin 1)
12	Pink	112	Signal Reference 5V	Trans Connector (Pin 16) TPS (Pin C) RMR (Pin C)
13	White	113	GPO 8 (–)	Vehicle System
14	Blue	114	Strip Shift Selector Bit-4	Strip Shift Selector (Pin C)
15	White	115	Pressure Control Solenoid (PCS5)	Retarder Solenoid (Pin A) or T-Case (Pin A)
16	Blue	116	OLS	Trans Connector (Pin 15)
17	Blue	117	GPI 10 (–)	Vehicle System
18			Not used in 3000 and 4000 Product Families	
19	Blue	119	Shift Solenoid (SS2)	Trans Connector (Pin 17) or Retarder Accumulator Solenoid (Pin A)
20	Blue	120	Turbine Speed Sensor—Low	NT-B (4000) or Trans Connector (Pin 14) (3000)
21	Green	121	ABS/GPI 8 (–)	Vehicle System
22	Yellow	122	GPI 4 (–)	Vehicle System
23	Green	123	GPI 1 (+)	Vehicle System
24	White	124	GPO 5	Vehicle System
25	Tan	125	Vehicle Speed Signal	Input for Vehicle Speedometer or VIM-B2
26	Yellow	126	Internal Terminating Resistor CAN 2 (TCM)	Vehicle System
27	Green	127	CAN 2 Low (–)	IES CAN B or L
28	Yellow	128	CAN 1 High (+)	J1939 A or H
29	Green	129	CHECK TRANS (–)	Vehicle System

APPENDIX D—WIRE/CONNECTOR CHART

80-Way TCM Connector *(cont'd)*

Terminal No.	Color	Wire No.	Description	Termination Point(s)
30	White	130	GPO 1 (+)	Vehicle System or VIM-D2
31	Yellow	131	HSD3	Trans Connector (Pin 11), Retarder Accumulator Solenoid (Pin B), and Retarder Solenoid (Pin B) or T-Case (Pin-B)
32	White	132	SAE J1708 High	J1708 High
33	Yellow	133	PCS3	Trans Connector (Pin 9)
34	No Color	134	Allison-supplied J1939 Shift Selector	Allison J1939 Shift Selector (Pin 11)
35	Blue	135	Engine Water Temperature	Engine Water Temp (Pin A)
36	Orange	136	PCS1	Trans Connector (Pin 4)
37	White	137	TCC Solenoid	Trans Connector (Pin 12)
38	Tan	138	Strip Shift Selector Bit-Parity	Strip Shift Selector (Pin E)
39	Orange	139	Engine Speed Sensor—Low	NE-B
40	Green	140	Output Speed Sensor—Low	NO-B or T-Case (Pin D)
41	Tan	141	Neutral Start Output (+)	To OEM supplied starter relay or VIM-D1
42	White	142	GPI 5 (–)	Vehicle System
43	Blue	143	GPI 3 (+)	Vehicle System
44	Blue	144	PWM/TPS Input	Vehicle System or TPS (Pin B)
45	Orange	145	GPO 3 (–)	Vehicle System or VIM-F3
46	N/A	146	ISO 9141	Vehicle System
47	Green	147	CAN 2 Low	IES CAN B or L
48	Yellow	148	CAN 1 High	J1939 A ot H
49	N/A	149	CAN 1 Shield	J1939 C or S
50	Pink	150	GPO 7 (–)	Vehicle System
51	White	151	SS1	Trans Connector (Pin 10)
52	Green	152	PCS2	Trans Connector (Pin 5)
53	Green	153	Strip Shift Selector Bit-2	Strip Shift Selector (Pin B)
54	Tan	154	Sump Temp Sensor	Trans Connector (Pin 18)
55	White	155	PCS4	Trans Connector (Pin 2)
56	Yellow	156	Retarder Request Sensor	RMR (Pin B)
57	White	157	GPI 12 (–)	Vehicle System
58	Green	158	TCM Analog Return	Trans Connector (Pin 19), RMR (Pin A), TPS (Pin A), Engine Water Temp (Pin B), Retarder Temp (Pin B)
59	Tan	159	Engine Speed Sensor—High	NE-A
60	Yellow	160	Output Speed Sensor—High	NO-A or T-Case (Pin C)
61	Orange	161	GPI 7 (–)	Vehicle System
62	Yellow	162	GPI 9 (–)	Vehicle System or VIM-F1
63	Yellow	163	Ignition Power	Vehicle System or VIM-F1
64	Blue	164	GPO 6 (–)	Vehicle System
65	Tan	165	Reverse Warning	Vehicle System or VIM-F2
66	Yellow	166	CAN 2 High	IES CAN A or H
67	N/A	167	CAN 2 Shield	IES CAN C or S
68	Green	168	CAN 1 Low	J1939 B or L
69	Gray	169	Battery (–)	Vehicle System or VIM-A1
70	Pink	170	Battery (+)	Vehicle System or VIM-E1
71	Yellow	171	HSD2	Trans Connector (Pin 6)
72	Blue	172	SAE J1708 Low	J1708 Low
73	Orange	173	Strip Shift Selector Bit-1	Strip Shift Selector (Pin A)

APPENDIX D—WIRE/CONNECTOR CHART

80-Way TCM Connector *(cont'd)*

Terminal No.	Color	Wire No.	Description	Termination Point(s)
74	Blue	174	MAIN MOD Solenoid	Trans Connector (Pin 8)
75	Orange	175	Retarder Temperature	Retarder Temp (Pin A)
76	Yellow	176	TransID	Trans Connector (Pin 20)
77	Green	177	PS1	Trans Connector (Pin 3)
78	White	178	PCS6	Trans Connector (Pin 7)
79	Pink	179	GPI 11 (–)	Vehicle System
80	Orange	181	Turbine Speed Sensor—High	NT-A (4000) or Trans Connector (Pin 13) (3000)

APPENDIX D—WIRE/CONNECTOR CHART

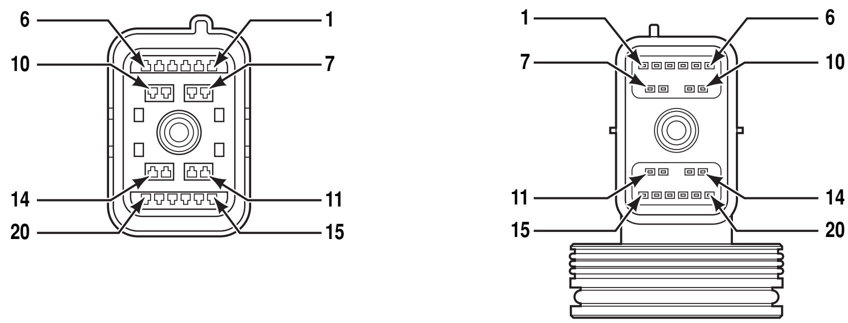


Figure D–2. 20-Way AFL Transmission Connector

20-Way AFL Transmission Connector

Terminal No.	Recommended Wire Color	Wire No.	Description	Termination Point(s)
1	Orange	111	HSD1	TCM-11, TID Wire 176, MAIN MOD-A, PCS4-A, PCS6-A
2	White	155	PCS4, Low	TCM-55, PCS4-B
3	Green	177	Pressure Switch PS1 Input	TCM-77, PS1-A
4	Orange	136	PCS1, Low	TCM-36, PCS1-B
5	Green	152	PCS2, Low	TCM-52, PCS2-B
6	Yellow	171	HSD2	TCM-71, PCS1-A, PCS2-A, PCS3-A, SS1-A
7	White	178	PCS6, Low (7-speed only)	TCM-78, PCS6-B
8	Blue	174	MAIN MOD Solenoid, Low	TCM-74, MAIN MOD-B
9	Yellow	133	PCS3, Low	TCM-33, PCS3-B
10	White	151	SS1, Low	TCM-51, SS1-B
11	Yellow	131	HSD3	TCM-31, TCC-A, SS2-A (7-speed only)
12	White	137	TCC Solenoid, Low	TCM-37, TCC-B
13	Orange	180	Turbine Speed Sensor, High (3000 only)	TCM-80, NT-A
14	Blue	120	Turbine Speed Sensor, Low (3000 only)	TCM-20. NT-B
15	Blue	116	OLS Input	TCM-16, OLS-B
16	Pink	112	5V Reference Voltage	TCM-12, OLS-C, TPS-C, RMR-C
17	Blue	119	SS2, Low (7-speed only)	TCM-19, SS2-B
18	Tan	154	Sump Temperature Sensor Input	TCM-58, Sump Temp-B
19	Green	158	Analog Return	TCM-58, OLS-A, Sump Temp-A, PS1-B, RMR-A, TPS-A, RTR Temp-B, Engine Water Temp-B
20	Yellow	176	TransID	TCM-76, Wire 111

APPENDIX D—WIRE/CONNECTOR CHART

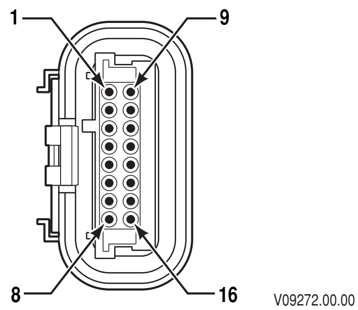


Figure D–3. Pushbutton or Lever Shift Selector Connector

Pushbutton Or Lever Shift Selector Connector

Terminal No.	Recommended Wire Color	Wire No.	Description	Termination Point(s)
1				
2				
3			Dimmer Input	Vehicle System
4				
5			Battery Ground	
6			Shift Selector 2 ID	Battery Ground
7			J1939 Internal Termination Resistor Jumper, if used	Shift Selector Pin 16
8			CAN High J1939	J1939 A or H
9				
10				
11			PWM Directional Signal	TCM-34
12			Ignition Sense	Vehicle System
13			Battery Voltage	Vehicle System
14			CAN 1 Shield J1339	
15			CAN 1 Low	J1939 B or L
16			J1939 Internal Terminal Resistor Jumper, if used	Shift Selector Pin 7

APPENDIX D—WIRE/CONNECTOR CHART

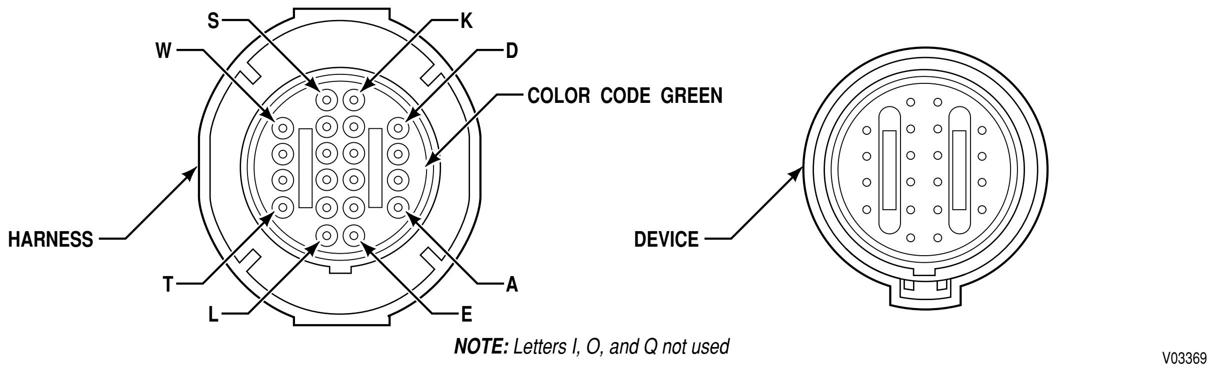


Figure D–4. Strip Shift Selector Connector

Strip Shift Selector

Terminal No.	Recommended Wire Color	Wire No.	Description	Termination Point(s)
A	Orange	173	Strip Selector, Data Bit 1	TCM-73
B	Green	153	Strip Selector, Data Bit 2	TCM-53
C	Blue	114	Strip Selector, Data Bit 4	TCM-14
D				
E	Tan	138	Strip Selector, Parity	TCM-38
F				
G				
H				
J				
K				
L	Tan	150	Lamp Ground	TCM-50
M				
N				
P	Yellow	103	Digital Ground	TCM-3
R			Switch Power	Vehicle System
S				
T				
U				
V				
W				

APPENDIX D—WIRE/CONNECTOR CHART

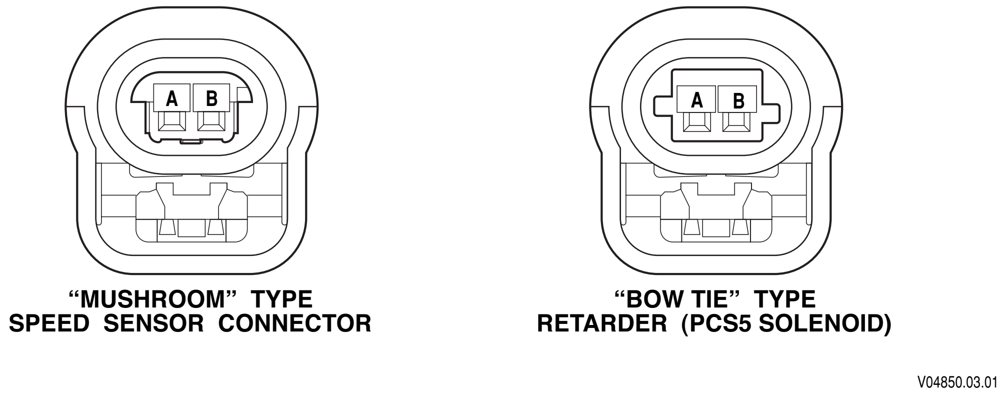


Figure D–5. Delphi-Packard GT150 Speed Sensor and Retarder Connectors

Engine Speed Sensor Connector

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Tan	159	Engine Speed Sensor High	TCM-59
B	Orange	139	Engine Speed Sensor Low	TCM-39

Turbine Speed Sensor Connector (4000 Product Family Only)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Orange	180	Turbine Speed Sensor High	TCM-80
B	Blue	120	Turbine Speed Sensor Low	TCM-20

Output Speed Sensor Connector

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Yellow	160	Output Speed Sensor High	TCM-60
B	Green	140	Output Speed Sensor Low	TCM-40

Retarder (PCS5 Solenoid)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	115	PCS5 Low	TCM-15
B	Yellow	131	PCS5 High	TCM-31, TRANS-11

APPENDIX D—WIRE/CONNECTOR CHART

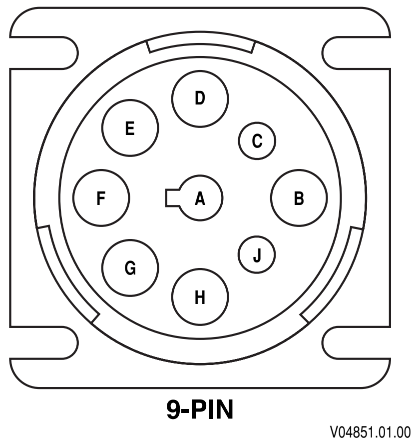


Figure D–6. Deutsch Diagnostic Tool Connector

9-Pin Diagnostic Tool Connector For CAN 1

Terminal No.	Wire No.	Description	Termination Point(s)
A	109 or 169	Battery Return (–)	TCM-9 or TCM-69
B	110 or 170	Battery Power (+)	TCM-10 or TCM-70
C	128 or 148	J1939 High	TCM-28 or TCM-48, J1939-A/H
D	108 or 168	J1939 Low	TCM-8 or TCM-68, J1939-B/L
E	149	J1939 Shield/Ground	TCM-49, J1939-C/S
F	132	Serial Communication (+)	TCM-23, SCI-A
G	172	Serial Communication (–)	TCM-72, SCI-B

APPENDIX D—WIRE/CONNECTOR CHART

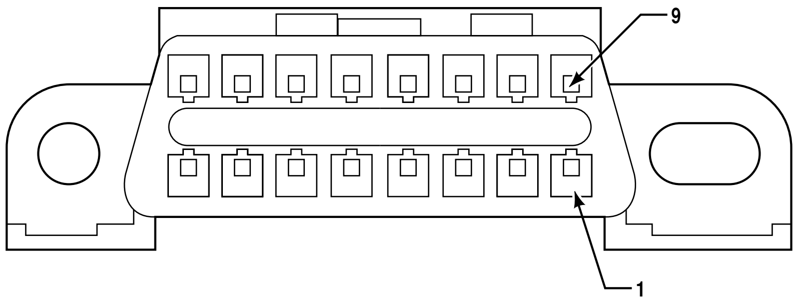


Figure D–7. GMC Connector for OBD-II Diagnostic Adapter

Optional OBD-II Diagnostic Connector

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
1				
2				
3				
4				
5	Gray	109 or 169	Battery Return (–)	TCM-9 or TCM-69, VIWS-P, PSS-P, SSS-P
6				
7	White	132	Serial Communication Interface, High	TCM-32, SCI-A
8				
9				
10				
11				
12				
13				
14				
15	Blue	172	Serial Communication Interface, Low	TCM-72, SCI-B
16	Yellow	163	Ignition Sense (+)	TCM-63, VIWS-E

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulkhead connector are used.

APPENDIX D—WIRE/CONNECTOR CHART

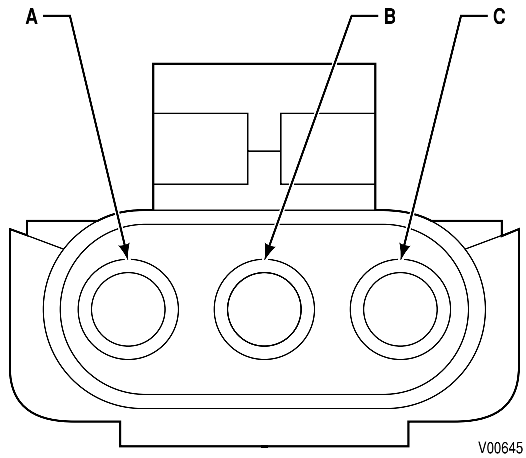


Figure D–8. TPS Connector

Throttle Position Sensor Connector

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Green	158	Analog Return	TCM-58; TRANS-19, RMR-A
B	Blue	144	TPS Signal	TCM-44
C	Pink	112	TPS High	TCM-12, RMR-C, TRANS-16

APPENDIX D—WIRE/CONNECTOR CHART

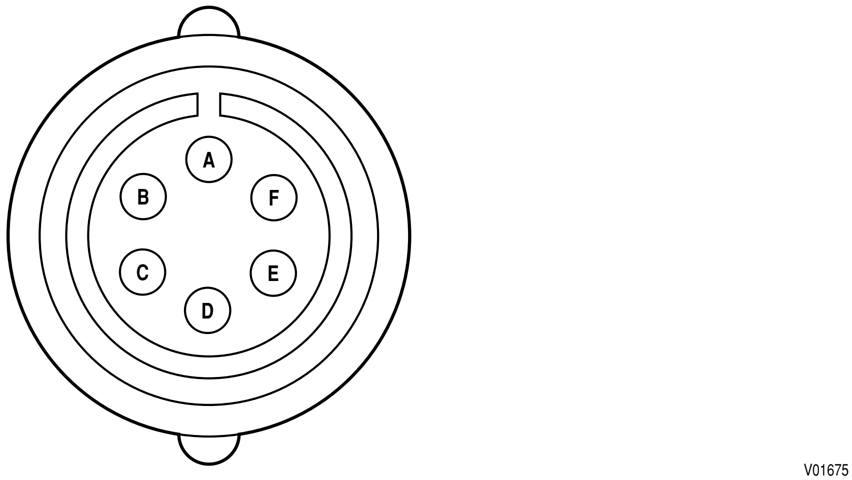


Figure D–9. Transfer Case Connector (3000 Product Family 7-Speed)

Transfer Case Connector (3000 Product Family 7-Speed Only)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	115	PCS5 (Diff Lock) Low	TCM-15
B	Yellow	131	PCS5 (Diff Lock) High	TCM-31, TRANS-11
C	Yellow	160	Output Speed Sensor High	TCM-60
D	Green	140	Output Speed Sensor Low	TCM-40

APPENDIX D—WIRE/CONNECTOR CHART

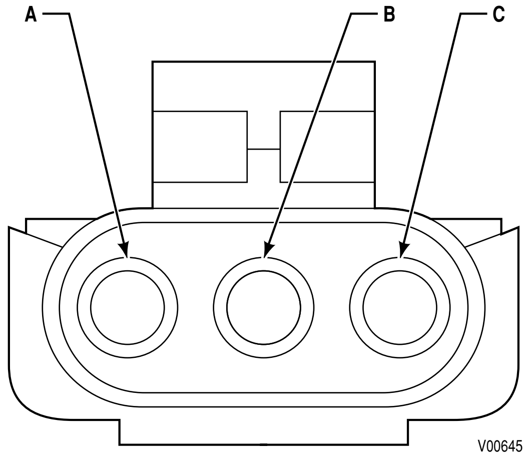


Figure D–10. Retarder Resistance Module/Interface Connector

Retarder Resistance Module/interface Connector

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Green	158	Analog Return	TCM-58, TRANS-19, TPS-A, Engine Water Temp-B, RMR-A, Retarder Temp-B
B	Yellow	156	Retarder Mod.	TCM-56
C	Pink	112	Retarder Mod. High	TCM-12, TRANS-16, TPS-C

APPENDIX D—WIRE/CONNECTOR CHART

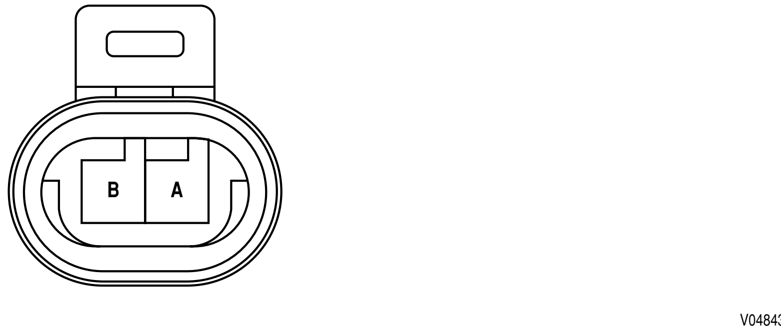


Figure D–11. Retarder Temperature Sensor Connector (3000 and 4000 Product Families)

Retarder Temperature Sensor Connector
3000 and 4000 Product Families

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Orange	175	Retarder Temperature Input	TCM-75
B	Green	158	Analog Return	TCM-58, TRANS-19, RMR-A, TPS-A, Engine Water Temp-B

APPENDIX D—WIRE/CONNECTOR CHART

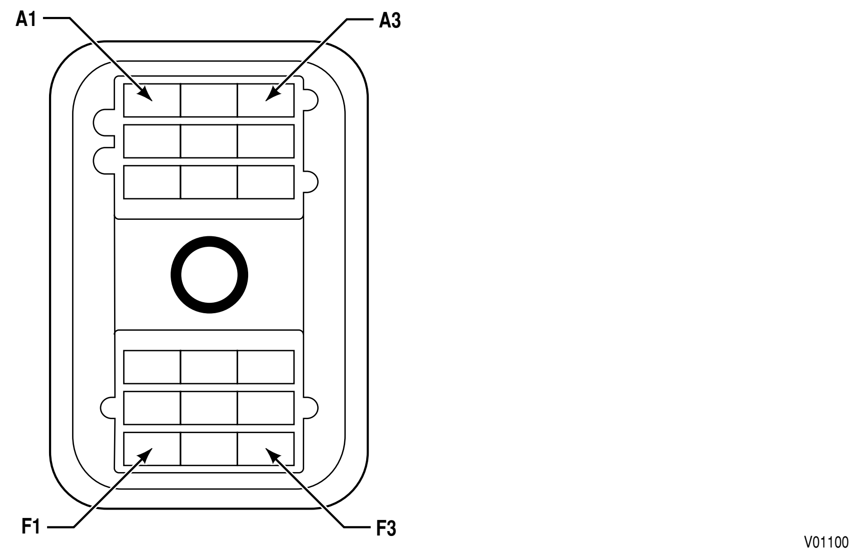


Figure D–12. VIM Connector (Harness)

VIM Connector (Harness)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A1	Gray	169	Battery Return (–)	TCM-69
A2	Gray	109	Battery Return (–)	TCM-9
A3			Reserved	
B1	Yellow	104	GPO 2	TCM-4
B2	Tan	125	Speedometer Signal	TCM-25
B3			Reserved	
C1			Reserved	
C2	White	124	GPO 4	TCM-24
C3			Reserved	
D1	Tan	141	Neutral Start	TCM-41
D2	Orange	145	GPO 3	TCM-45
D3			Reserved	
E1	Pink	170	Battery Power (+)	TCM-70
E2	Pink	110	Battery Power (+)	TCM-10
E3			Reserved	
F1	Yellow	163	Ignition Sense (+)	TCM-63
F2	Tan	165	Reverse Warning	TCM-65
F3	White	130	GPO 1	TCM-30

APPENDIX D—WIRE/CONNECTOR CHART

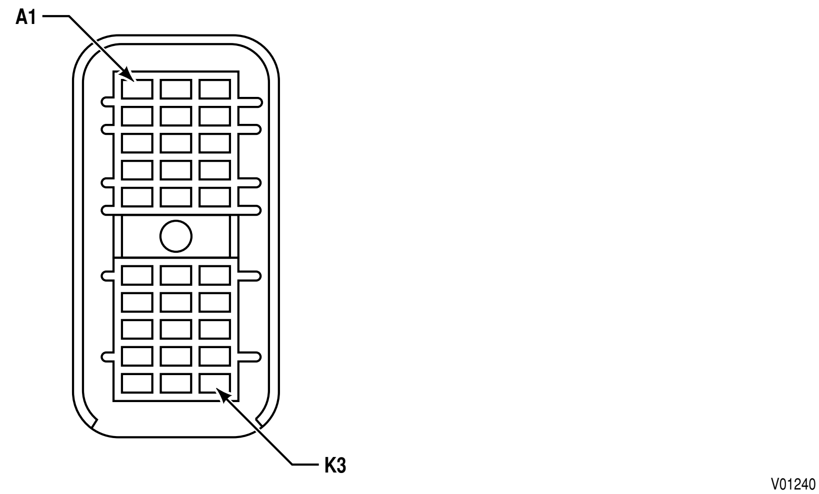


Figure D–13. VIM Connector (Harness)

VIM Connector (Harness 30-Way)

Terminal No.	Color*	Wire No.*	Description	Termination Point(s)*
A1			Reverse Warning Relay—Normally Open	
A2			Output Wire 145 Relay—Common	
A3			Output Wire 145 Relay—Normally Open	
B1			Reverse Warning Relay—Common	
B2			Output Wire 145 Relay—Normally Closed	
B3			Reserved	
C1			Ignition Power	
C2			Output Wire 130 Relay—Normally Closed	
C3			Reserved	
D1			Output Wire 124 Relay—Normally Closed	
D2			Output Wire 104 Relay—Normally Closed	
D3			Reserved	
E1			Output Wire 124 Relay—Common	
E2			Output Wire 104 Relay—Common	
E3			Output Wire 104 Relay—Normally Open	
F1			Neutral Start Relay—Normally Open	
F2			Output Wire 130 Relay—Common	
F3			Output Wire 130 Relay—Normally Open	
G1			Neutral Start Relay—Common	
G2			Reserved	
G3			Reserved	
H1			Reserved	
H2			Speedometer—Unfiltered	
H3			Reserved	
J1			Battery Power	
J2			Battery Power	
J3			Reserved	
K1			Battery Return	
K2			Battery Return	
K3			Reserved	

* Colors, wire numbers, and termination points are determined by OEM electrical system design.

APPENDIX D—WIRE/CONNECTOR CHART

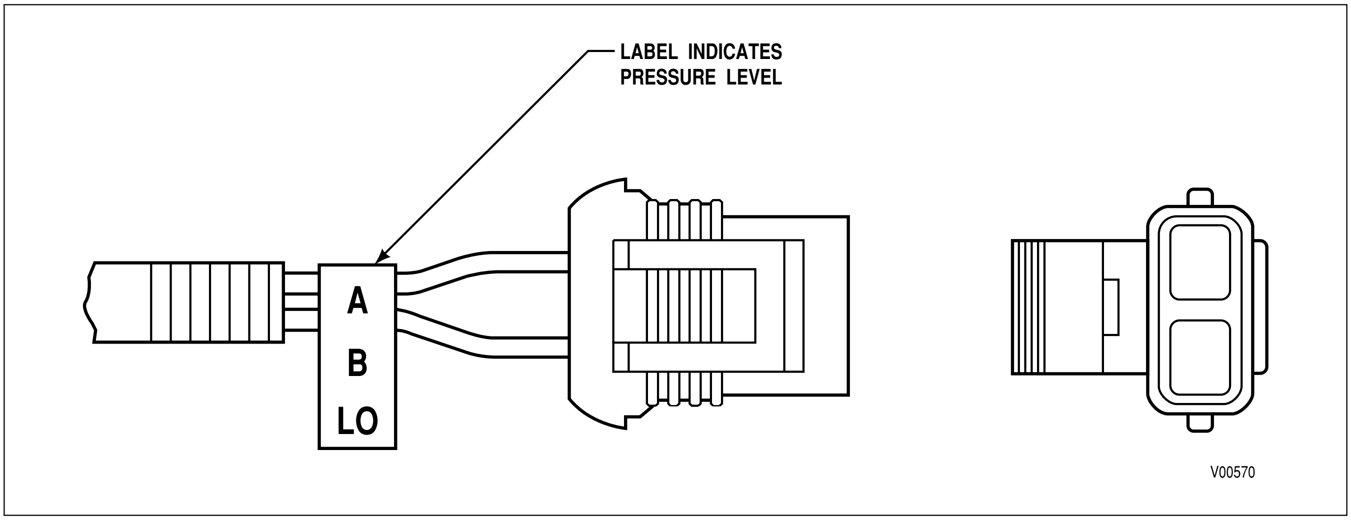


Figure D–14. Resistance Module Type 2—Single Pressure Switch and SCI Interface

Resistance Module Type 2

Terminal No.
A
B

SCI Interface Connector

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	132	Serial Communication Interface, High	TCM-32, 9-pin Diagnostic Tool Connector-F
B	Blue	172	Serial Communication Interface, Low	TCM-72, 9-pin Diagnostic Tool Connector-G

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulkhead connector are used.

APPENDIX D—WIRE/CONNECTOR CHART

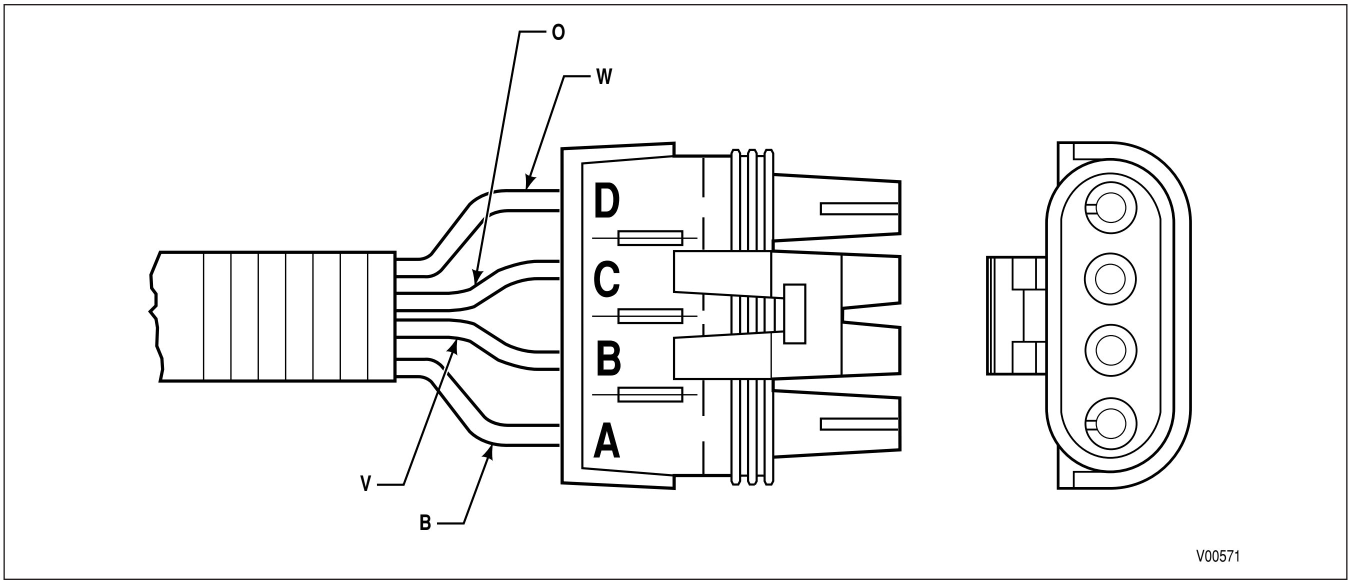


Figure D–15. Resistance Module Type 3—Bendix E-10R Pedal

Resistance Module Type 3

Terminal No.	Wire Color
A	Blue
B	Violet
C	Orange
D	White

APPENDIX D—WIRE/CONNECTOR CHART

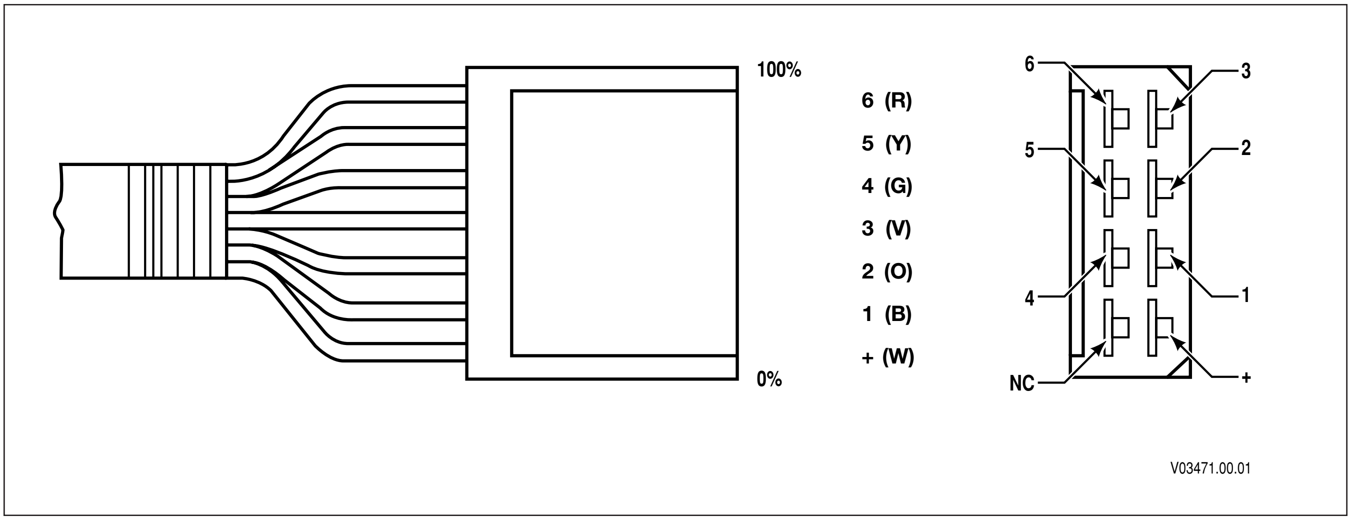


Figure D–16. Resistance Module Type 5—Hand Lever

Resistance Module Type 5

Terminal No.	Wire Color
+	White
1	Blue
2	Orange
3	Violet
4	Green
5	Yellow
6	Red

APPENDIX D—WIRE/CONNECTOR CHART

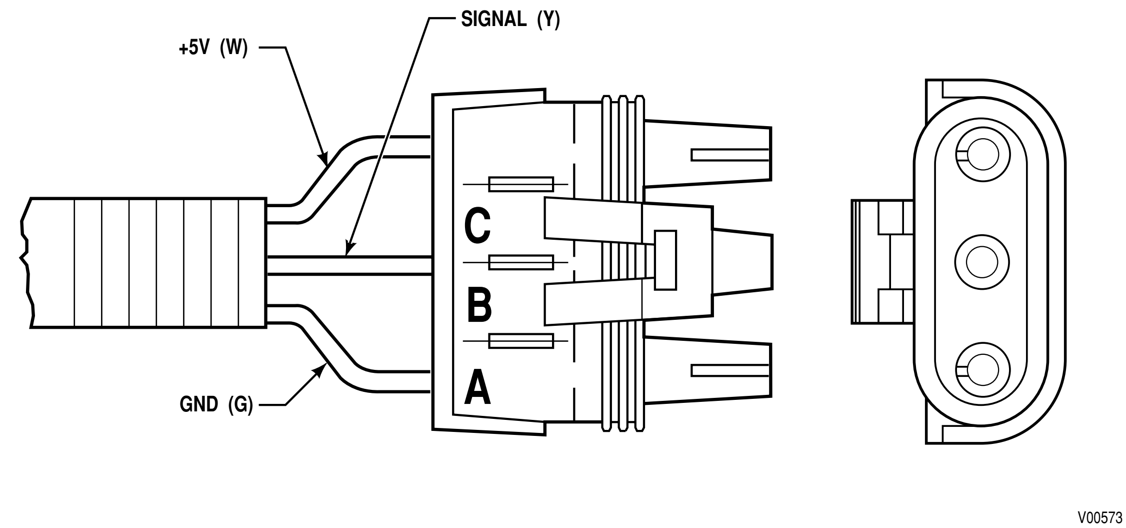


Figure D–17. Resistance Module Type 7—Dedicated Pedal

Resistance Module Type 7

Terminal No.	Wire Color
A	Green
B	Yellow
C	White

APPENDIX D—WIRE/CONNECTOR CHART

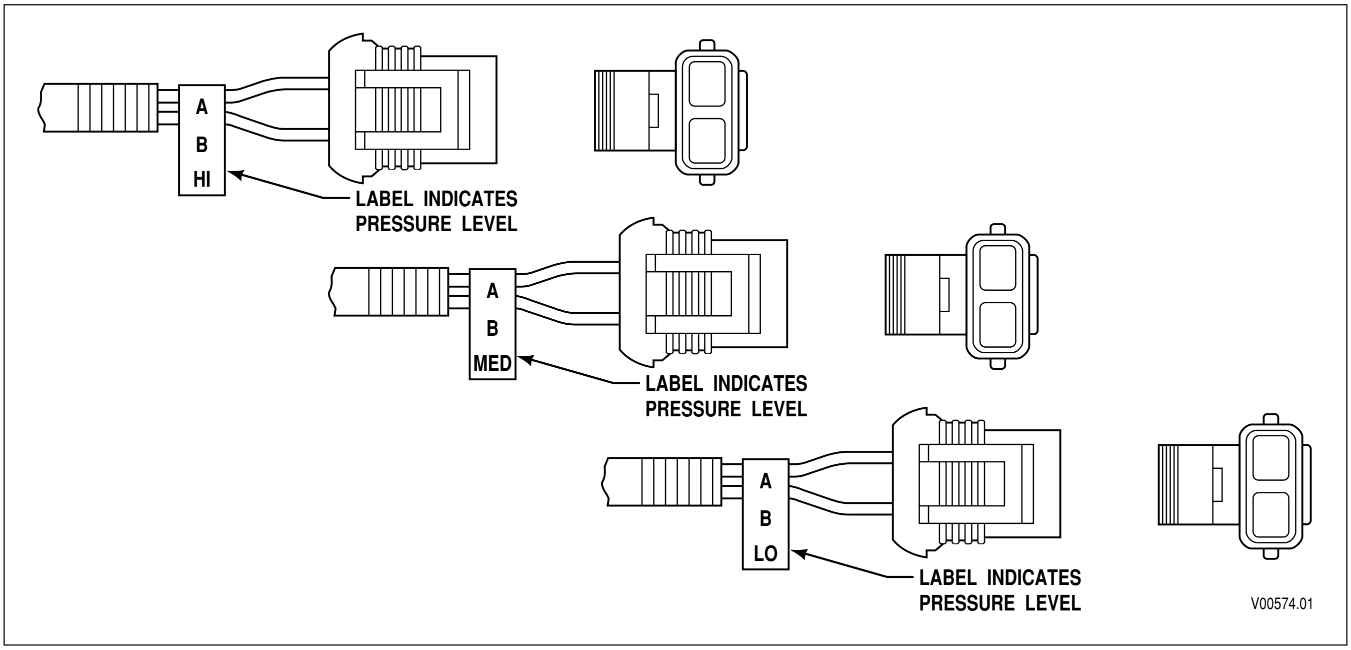


Figure D–18. Resistance Module Type 8—Three Pressure Switch

Resistance Module Type 8

Low Pressure

Terminal No.	Wire Color
A	White
B	Blue

Medium Pressure

Terminal No.	Wire Color
A	White
B	Orange

High Pressure

Terminal No.	Wire Color
A	White
B	Violet

APPENDIX D—WIRE/CONNECTOR CHART

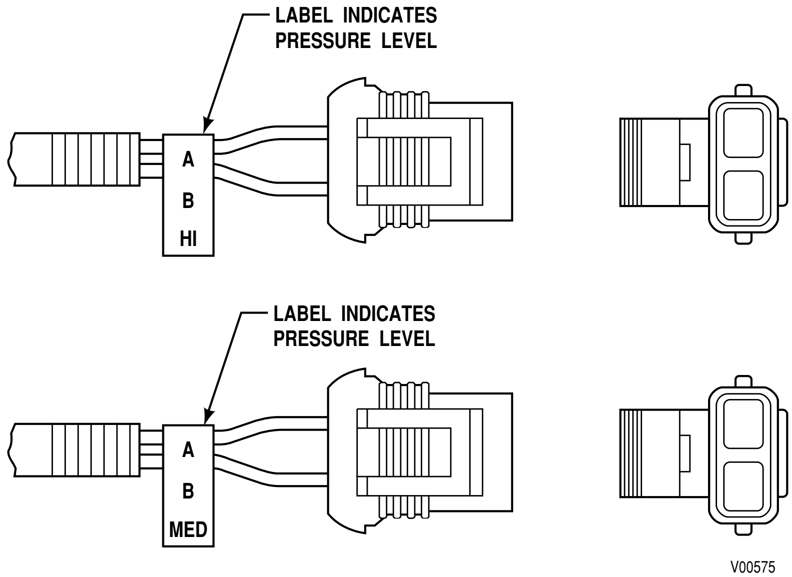


Figure D–19. Resistance Module Type 9—Two Pressure Switch

Resistance Module Type 9

Medium Pressure

Terminal No.	Wire Color
A	White
B	Orange

High Pressure

Terminal No.	Wire Color
A	White
B	Violet

APPENDIX D—WIRE/CONNECTOR CHART

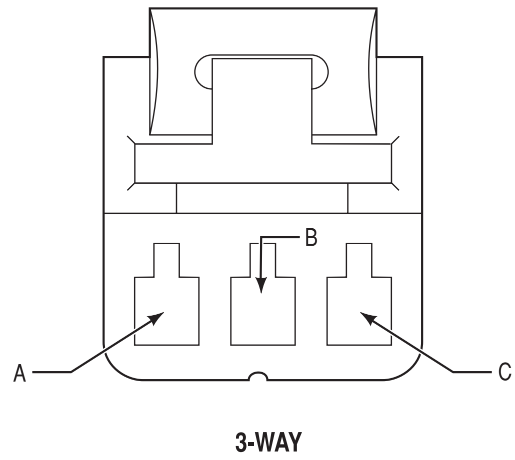


Figure D–20. Oil Level Sensor Plug

3-Way Connector (Redesigned OLS)

Terminal No.	Color	Wire No.	Description	Termination Point(s) 20-Way Feedthrough Harness Connector
A	Black	158	Analog Return	TRANS-19
B	White	116	OLS Input	TRANS-15
C	Red	112	Sensor Power	TRANS-16

APPENDIX D—WIRE/CONNECTOR CHART

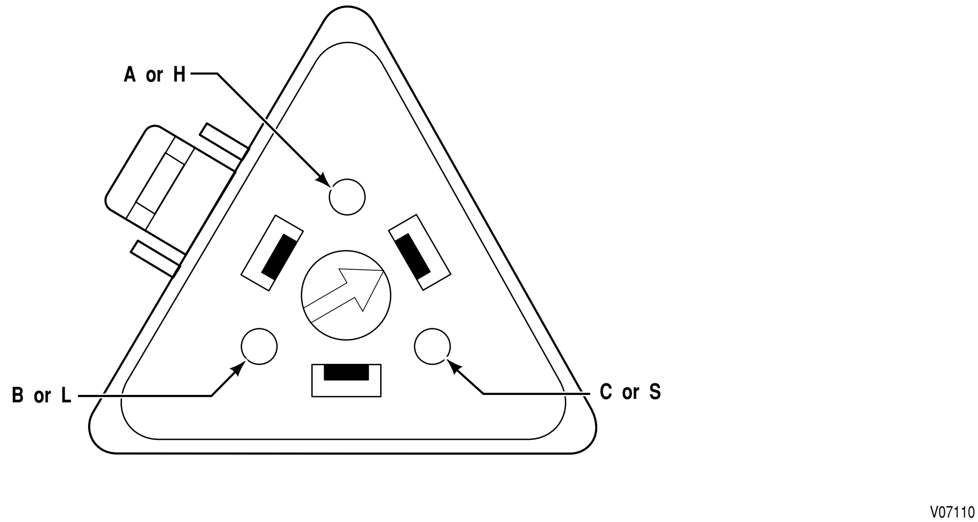


Figure D–21. J1939 Interface Connector

J1939 Interface Connector

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A or H	Yellow	128	J1939 Controller #1, High	TCM-28 and/or TCM-48
B or L	Green	108	J1939 Controller #1, Low	TCM-8 and/or TCM-68
C or S	N/A	149	J1939 Shield #1	TCM-49

IES CAN Interface Connector

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A or H	Yellow	106	CAN Controller #2, High	TCM-6 and/or TCM-66
B or L	Green	127	CAN Controller #2, Low	TCM-27 and/or TCM-47
C or S	N/A	167	CAN Shield #2	TCM-67

APPENDIX D—WIRE/CONNECTOR CHART

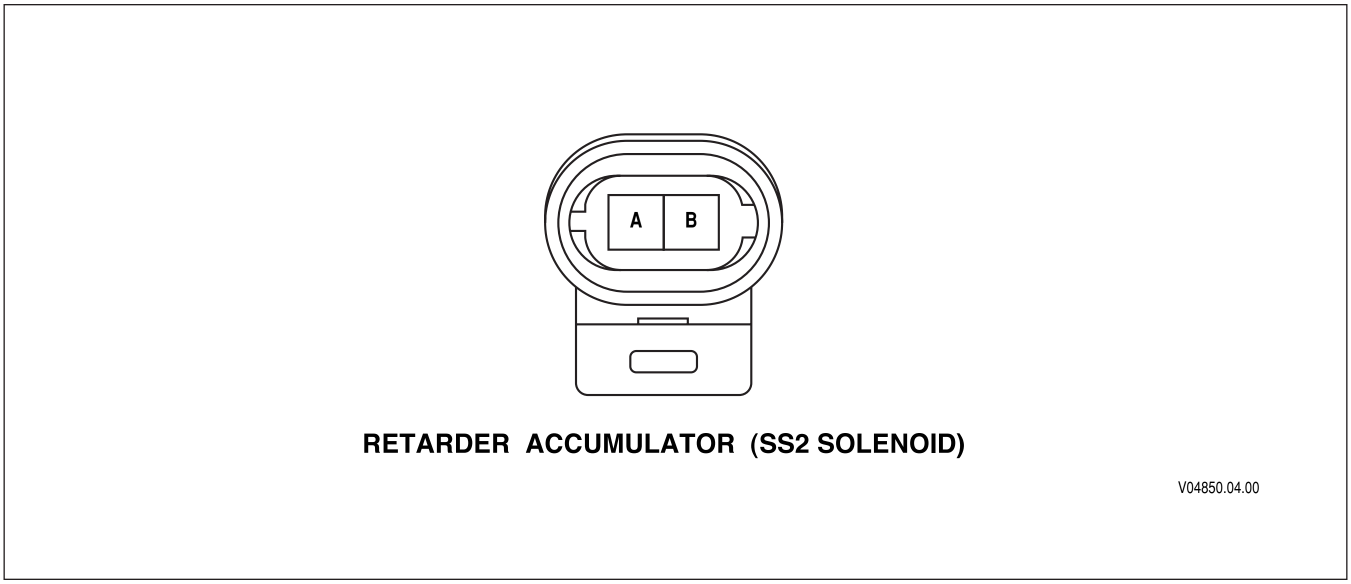


Figure D–22. Retarder Accumulator Solenoid Connector

Accumulator (SS2) Solenoid

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Blue	119	SS2 Low	TCM-19
B	Yellow	131	SS2 High	TCM-31, TRANS-11

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

Contents **Page**

NOTE: ***Allison Transmission is providing for service of wiring harnesses and wiring harness components as follows:***

- ***Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.***
- ***Repair parts for the external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes Allison Transmission, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI will have parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:***

St. Clair Technologies, Inc.
920 Old Glass Road
Wallaceburg, Ontario, Canada N8A 4L8
Phone: 519-627-1673
Fax: 519-627-4227

St. Clair Technologies, Inc.
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APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

List Of Special Tools Required To Service Allison 4th Generation Controls Wiring Harnesses

Tool Number	Tool Type	Paragraph Reference
23046604	Splice, Sealed (14–16 AWG)	E–15
23046605	Splice, Sealed (18–22 AWG)	E–15
J 25070	Heat Gun	E–15
J 34182	Crimping Tool	E–12, E–13, E–14
J 34513	Remover Tool	E–12
J 35123	Crimping Tool (Alternate)	E–5, E–6, E–7
J 35606	Crimping Tool (Alternate)	E–10
J 35615	Wire Stripper	E–6, E–7, E–9, E–15
J 35689-A	Remover Tool	E–5, E–6, E–7, E–8
J 38125-6	Crimping Tool	E–10
J 38125-7	Crimping Tool	E–5, E–6, E–7, E–9, E–11
J 38125-8	Crimping Tool	E–16
J 38125-10	Remover Tool	E–10
J 38125-12A	Crimping Tool	E–1, E–2, E–3, E–16
J 38125-13	Remover Tool	E–11, E–16
J 38528-3	Remover Tool	E–12
J 38852	Crimping Tool (Alternate)	E–10
J 39227	Remover Tool	E–4
J 39842	Terminal Remover/Installer (3000 7-Speed T-Case)	E–13
J 41193	Connector Repair Kit (FMTV)	E–13
J 41193-1	Guide Pin	E–13
J 41193-2	Insertion Tool	E–13
J 41194	Extractor/Inserter	E–12
J 42215	Crimping Tool	E–8
J 47139	Crimping Tool	E–1, E–2, E–3

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

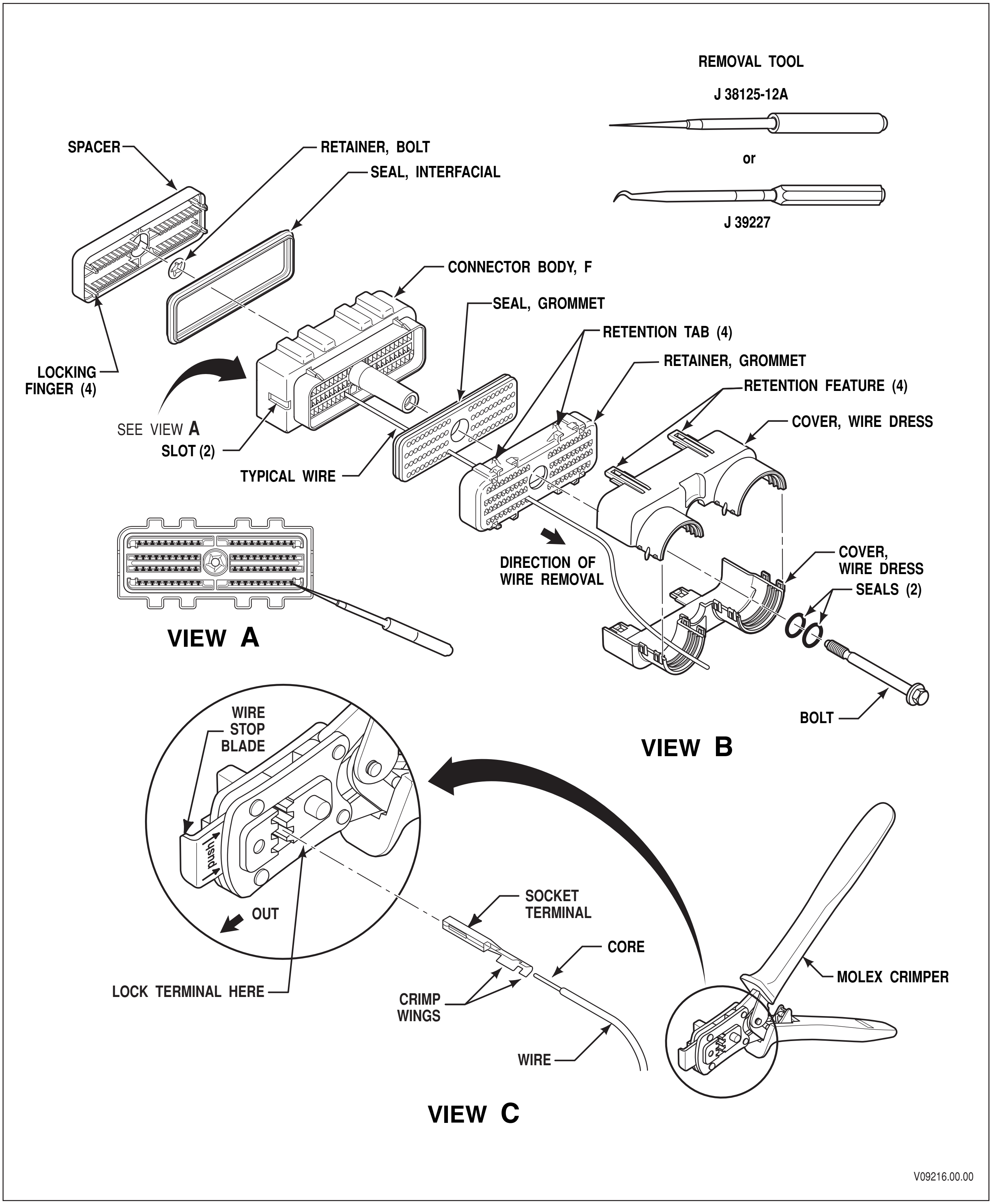


Figure E–1A. AFL 80F Bolt-Assist TCM Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

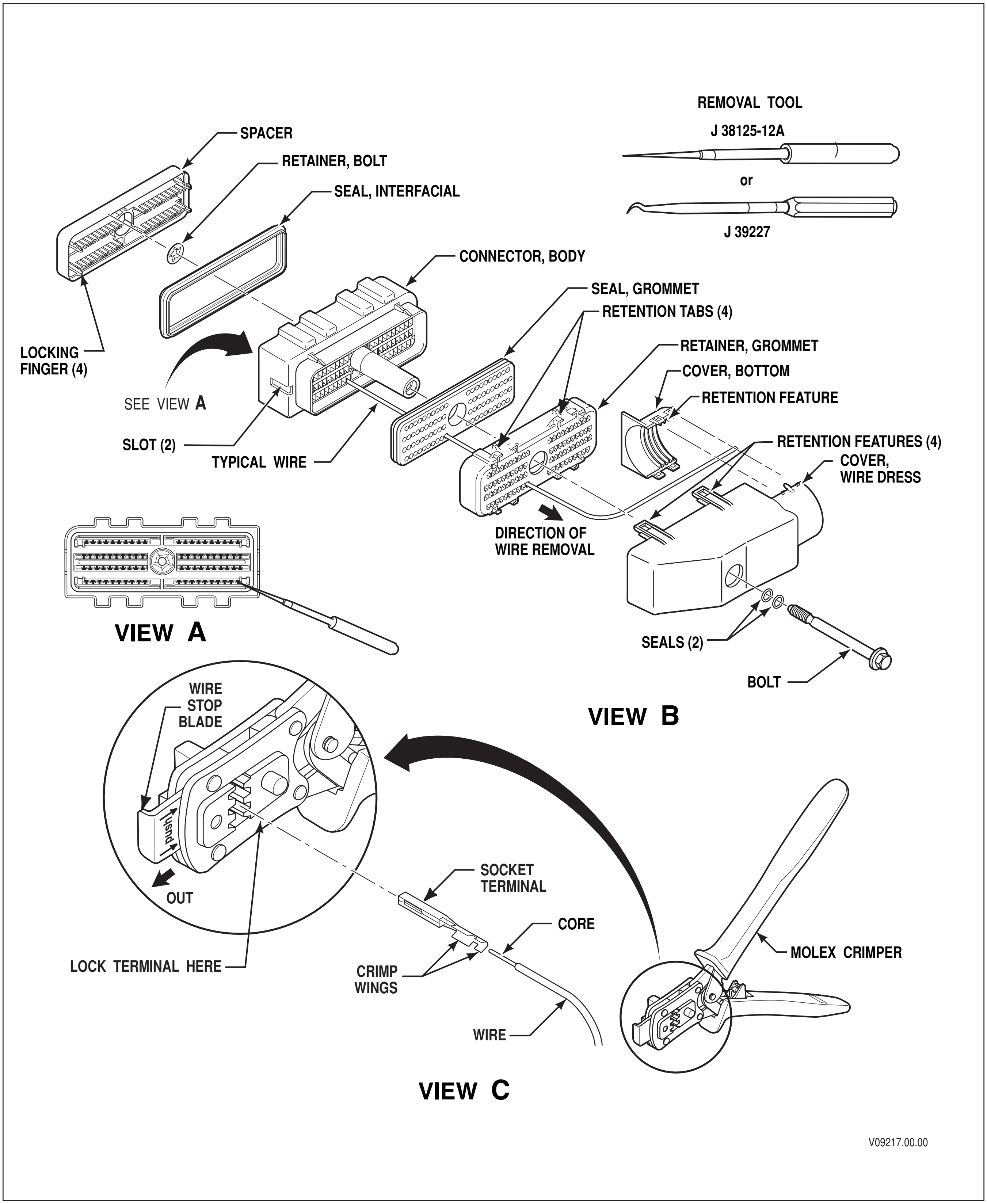


Figure E–1B. AFL 80F Bolt-Assist, Direction ‘A’ 90 Degree TCM Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

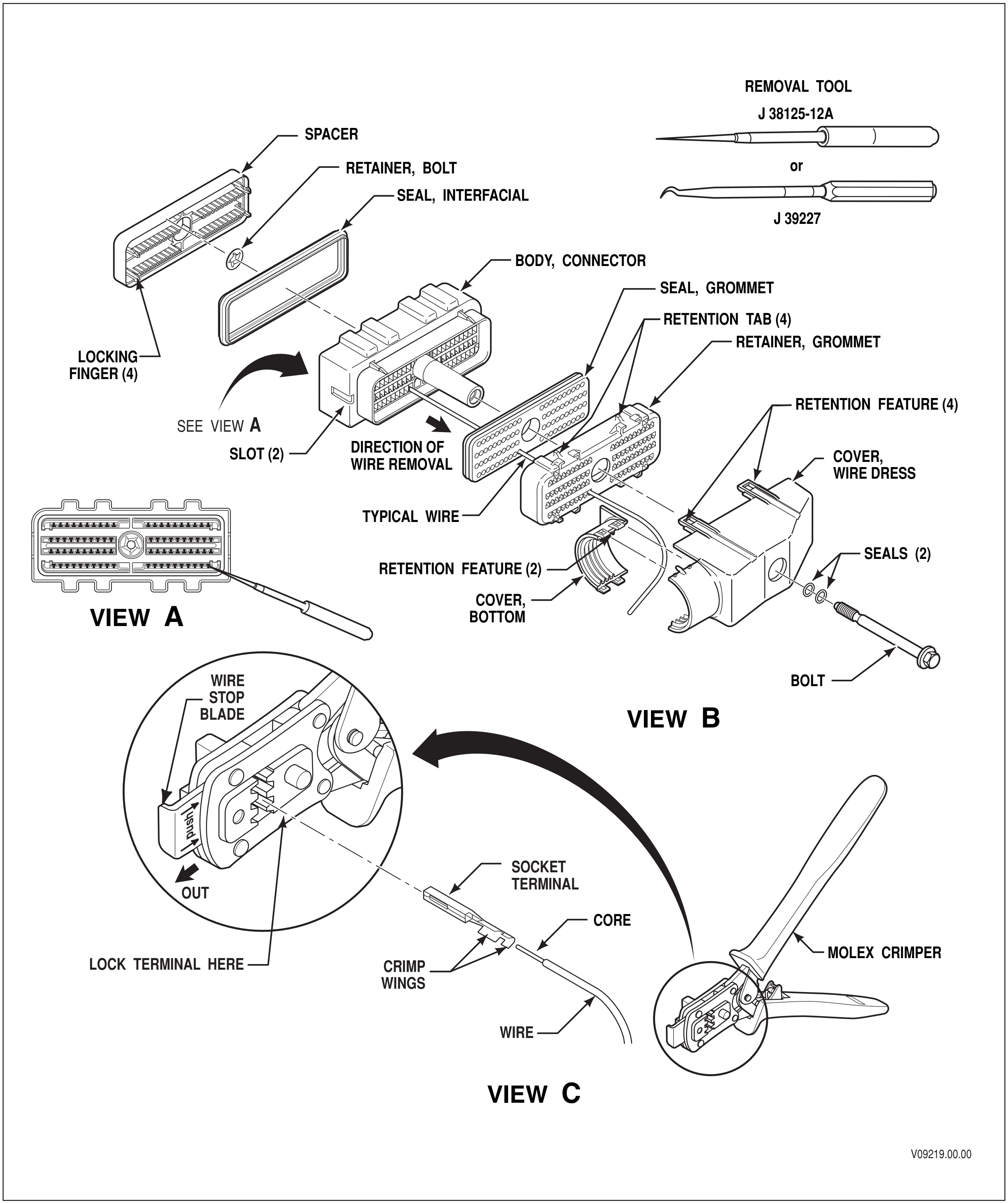


Figure E–1C. AFL 80F Bolt-Assist, Direction 'B' 90 Degree TCM Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–1. AFL AUTOMOTIVE 80F BOLT ASSIST CONNECTORS (TCM CONNECTOR)

A. TCM Connector, Assembly 80F Bolt Assist (refer to Figure E–1A)

Required Tools

Crimping Tool	J 47139
Remover Tool	J 38125-12A

Use	Description	St. Clair P/N	Manufacturers P/N
TCM Connector 80F, Bolt	Kit, Connector Assembly, 80F, Bolt Assist	300278	
	Connector Assembly, 80F, Bolt	300243	R-61991-001
	Spacer 80F		E-4540
	Seal, Interfacial		E-4539
	Connector Body, 80F Bolt		E-4538
	Bolt		E-4543-001
	Seal, Bolt		E-4544
	Retainer Bolt		E-4545
	Grommet, Wire Seal		E-4541
	Grommet, Retainer	300244	E-4542
	Cover A, Wire Dress	300245	E-4550
	Cover B, Wire Dress	300246	E-4551
	Terminal, Receptacle	300247	33001-0004
	Plug, Cavity Seal	300008	12034413
	Wire Cover Kit 80W Bolt	300235	
	Cover A, Wire Dress	300245	E-4550
	Cover B, Wire Dress	300246	E-4551
	Bolt Kit	300234	
	Bolt		E-4543-001
	Seal, Bolt		E-4544
	Retainer, Bolt		E-4545

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

B. TCM Connector, Assembly 80F Bolt Assist, Direction 'A' 90 Degree Wire Dress (refer to Figure E–1B)

Required Tools

Crimping Tool	J 47139
Remover Tool	J 38125-12A

Use	Description	St. Clair P/N	Manufacturers P/N
TCM Connector	Kit, Connector Assembly, 80F, Bolt Assist, 90 Degree, Dir A		
	Connector Assembly, 80F Bolt, 90 Degree, Dir A	300243	R-61991-001
	Spacer, 80F		E-4540
	Seal, Interfacial		E-4539
	Connector Body, 80F Bolt		E-4538
	Bolt		E-4543-001
	Seal, Bolt		E-4544
	Retainer, Bolt		E-4545
	Grommet, Wire Seal		E-4541
	Grommet, Retainer	300244	E-4542
	Cover, Wire Dress, 80F, Dir A		E-6206-002
	Cover, Bottom		E-4555
	Terminal, Receptacle	300247	33001-0004
	Plug, Cavity Seal	300008	12034413
	Wire Cover Kit 80W Bolt	300236	
	Cover, Wire Dress, 80F, Dir A		E-6206-001
	Cover, Bottom		E-4555

Read disassembly process/procedure thoroughly before beginning disassembly.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. TCM Connector, Assembly 80F Bolt Assist, Direction ‘B’ 90 Degree Wire Dress (refer to Figure E–1C)

Required Tools

Crimping Tool	J 47139
Remover Tool	J 38125-12A

Use	Description	St. Clair P/N	Manufacturers P/N
TCM Connector 80F, Bolt	Kit, Connector Assembly, 80F, Bolt Assist, 90 Degree, Dir B	300278	
	Connector Assembly, 80F Bolt, 90 Degree, Dir B	300243	R-61991-001
	Spacer 80F		E-4540
	Seal, Interfacial		E-4539
	Connector Body, 80F Bolt		E-4538
	Bolt		E-4543-001
	Seal, Bolt		E-4544
	Retainer, Bolt		E-4545
	Grommet, Wire Seal		E-4541
	Grommet, Retainer	300244	E-4542
	Cover, Wire Dress, 80F, Dir B		E-6206-001
	Cover, Bottom		E-4555
	Terminal, Receptacle	300247	33001-0004
	Plug, Cavity Seal	300008	12034413
	Wire Cover Kit 80W Bolt	300237	
	Cover, Wire Dress, 80F, Dir B		E-6206-002
	Cover, Bottom		E-4555

D. Terminal Removal

1. Loosen the bolt (Figure E–1A, B, or C, View B) that retains 80-way connector to the transmission control module (TCM).
2. Separate the 80-way connector from the TCM.
3. Refer to the proper Figure for the connector being used:
   a. Refer to Figure E–1A, View B. Use a small-bladed screwdriver to gently unlatch the retention features (4) of the wire dress cover and separate the two halves.
   b. Refer to Figures E–1B or E–1C, View B. Use a small-bladed screwdriver to gently unlatch the retention features (2) of the wire dress cover and remove it from the backshell wire dress. Gently release the retention features (4) of the backshell wire dress and remove it from the connector body.
4. Insert a small-bladed screwdriver in between the connector body and the grommet retainer (Figure E–1A, B, or C, View B) and carefully pry the grommet retainer away from the connector body. Slide the grommet retainer along the wires away from the connector body. If the grommet seal stayed with the connector body, also slide it away from the connector body and seat it into the grommet retainer, allowing better access to the wires.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Terminal Removal *(cont'd)*

5. Insert a small-bladed screwdriver through the slot in the connector body (being careful not to damage the green interfacial seal) and apply upward pressure on the red spacer until it lifts to the pre-stage location on one side (approximately ⅛ inch). Repeat this process on the other side so it is removed evenly. Carefully continue to evenly lift the red spacer out of the connector body until the four lock tabs release. Remove the red spacer completely. The red spacer **must be replaced** if any of the four lock tabs are broken during removal.
6. Make a note for reassembly purposes of which wire (number) goes into which terminal cavity in the connector body.
7. Insert the metal blade of J 38125-12A or J 39227 removal tool into the small hole in the front of the connector body above or below the desired terminal/wire lead cavity location (See Figures E–1A, B, or C, View A).
8. Remove the selected terminal by gently lifting the locking finger with the removal tool and pulling the wire and terminal rearward out of the connector.

NOTE: Care should be taken not to damage or break the terminal locking fingers during removal. If a locking finger is damaged or broken, proper terminal retention will be lost after reassembly.

E. Terminal Crimping

1. Carefully strip the insulation from the wire to leave 4.70–5.60 mm (0.185–0.220 inch) of bare wire (core) exposed.
2. Refer to Figures E–1A, B, or C, View C. Pull out the wire stop blade of the crimping tool so it is clear of the terminal crimp area. Place the terminal all the way into the appropriate wire size opening of the J 47139 crimping tool until it contacts the stop and is properly oriented. Squeeze the handle enough to keep the terminal in place in the tool but not enough to compress the crimp wings.
3. Push in the wire stop blade until it touches the terminal. Insert the wire core into the terminal, with the core held against the wire stop blade.
4. Hold the wire and terminal against the stops until the terminal is fully crimped. Squeeze the crimper handle until the ratchet releases.
5. Pull out the wire stop blade and remove the crimped terminal and wire.

NOTE: If cavities do not have a terminal/wire lead or grommet cover pin (or if grommet cover pin is damaged) install cavity plug #12034413 into corresponding cavity in grommet seal in connector body.

6. Repeat as necessary.
7. Slide the grommet retainer containing the grommet seal along the wires and snap it into place on the connector body.
8. When all terminals have been inserted, be sure the green interfacial seal is properly located on the connector body and not damaged. Install the red spacer into the connector body. Push it into the connector body until it is fully seated against the connector body.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E. Terminal Crimping *(cont'd)*

NOTE: If the red spacer will not seat properly on the connector body, be sure all terminals are fully seated.

9. Refer to the proper Figure for the connector being used:
   a. Refer to Figure E–1A. Align and press together the two halves of the wire dress cover until they lock. Align the four retention features on the wire dress cover with the four lock tabs on the grommet retainer and press the wire dress cover onto the grommet retainer until all four retention features lock.
   b. Refer to Figures E–1B or E–1C. Align the four retention features of the backshell wire dress with the four lock tabs on the grommet retainer and press the backshell wire dress onto the grommet retainer until all four retention features lock. Align the wire dress cover with the backshell wire dress and press into place until it locks on both sides.
10. Reconnect the 80-way connector to the TCM and tighten connector bolt to specified torque value (N·m) shown on the wire dress cover (DO NOT OVER-TORQUE).

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

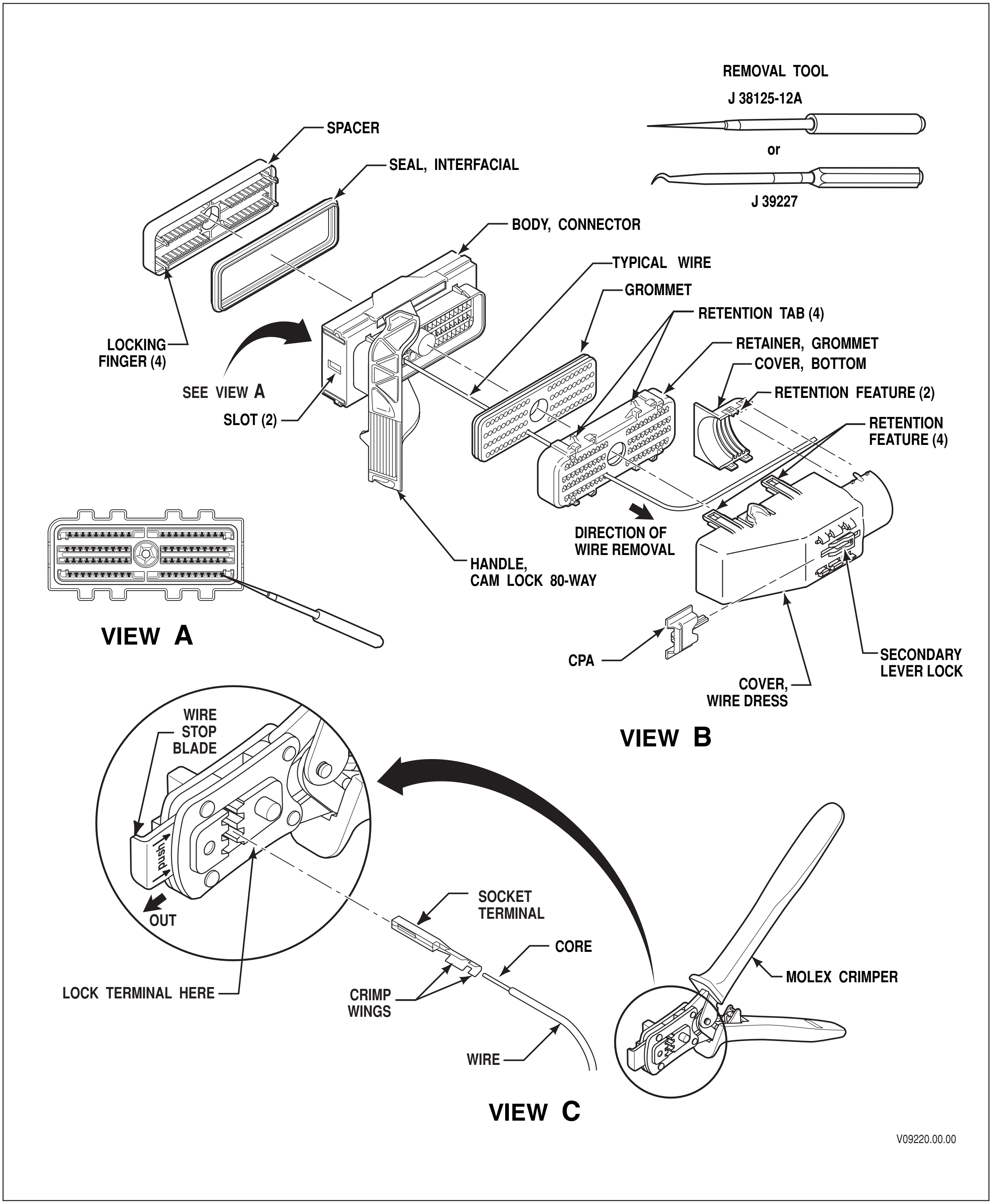


Figure E–2A. AFL 80F Cam-Assist, Direction 'A' TCM Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

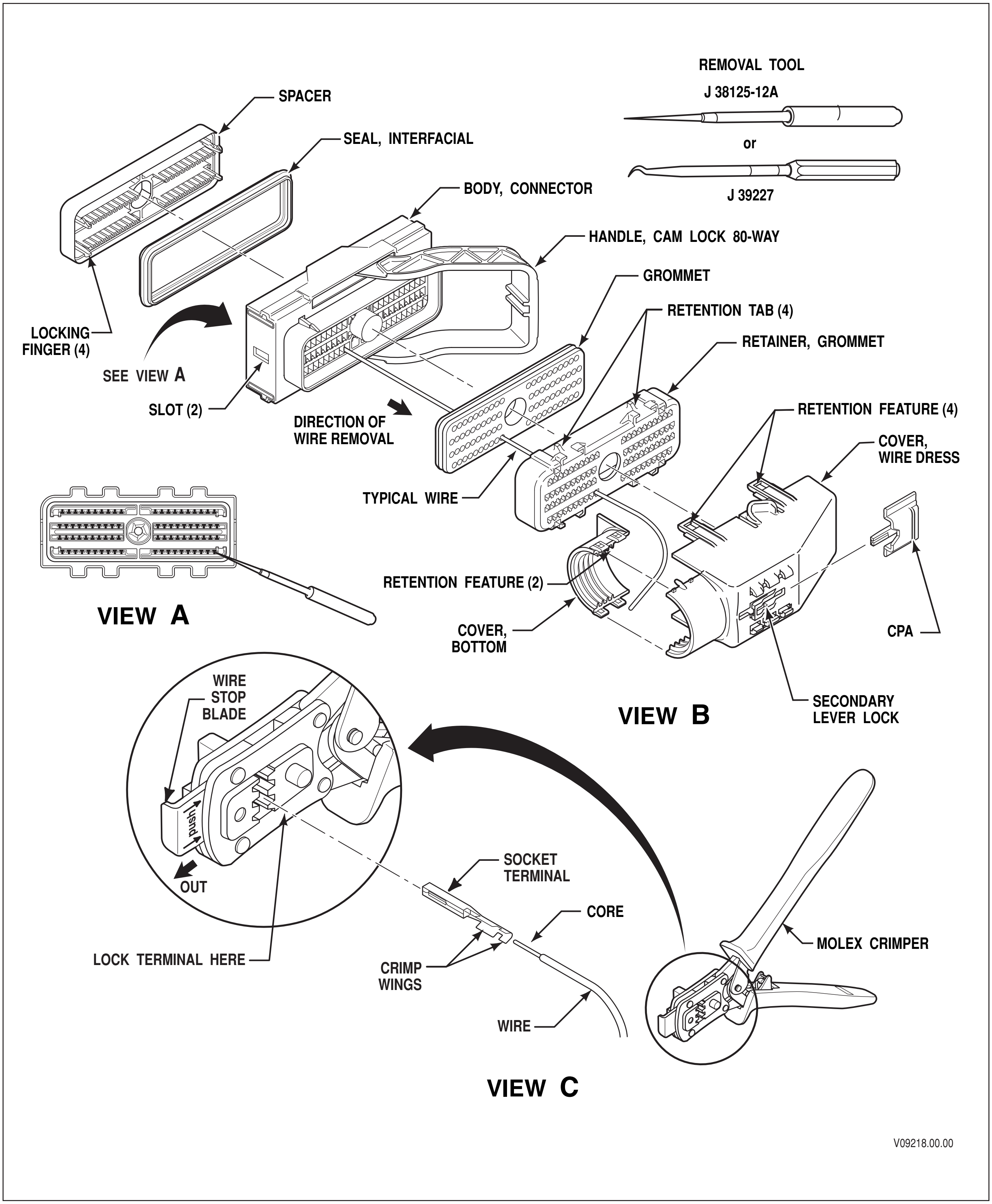


Figure E–2B. AFL 80F Cam-Assist, Direction 'B' TCM Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–2. AFL AUTOMOTIVE 80F CAM-ASSIST CONNECTORS (TCM CONNECTOR)

A. Connector, Assembly 80F Cam-Assist, 'A' Direction (refer to Figure E–2A)

Required Tools

Crimping Tool	J 47139
Remover Tool	J 38125-12A

Use	Description	St. Clair P/N	Manufacturers P/N
TCM Connector	Kit, Connector Assembly, 80F, Cam-Assist, Dir A		
	Connector Assembly, 80F, Cam-Assist, Dir A		R-62004-001
	Spacer, 80F		E-4540
	Seal, Interfacial		E-4539
	Connector Body, 80F, Cam		E-4547
	Cam, Left		E-4554
	Cam, Right		E-4553
	Handle, Cam		E-4548
	Retainer, Bolt		E-4545
	Grommet, Wire Seal		E-4541
	Grommet, Retainer	300244	E-4542
	Cover, Wire Dress and CPA		E-4589
	Cover, Bottom		E-4555
	Terminal, Receptacle	300247	33001-0004
	Plug, Cavity Seal	300008	12034413
	Wire Cover Kit 80W Cam, Dir A	300238	
	Cover, Wire Dress and CPA		E-4555
	Cover, Bottom		E-4589

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

B. Connector, Assembly 80F Cam-Assist, 'B' Direction (refer to Figure E–2B)

Required Tools

Crimping Tool	J 47139
Remover Tool	J 38125-12A

Use	Description	St. Clair P/N	Manufacturers P/N
TCM Connector	Kit, Connector Assembly, 80F, Cam-Assist, Dir B		
	Connector Assembly, 80F, Cam-Assist, Dir B		R-62004-002
	Spacer, 80F		E-4540
	Seal, Interfacial		E-4539
	Connector Body, 80F, Cam		E-4547
	Cam, Left		E-4554
	Cam, Right		E-4553
	Handle, Cam		E-4548
	Retainer, Bolt		E-4545
	Grommet, Wire Seal		E-4541
	Grommet, Retainer	300244	E-4542
	Cover, Wire Dress and CPA		E-4588
	Cover, Bottom		E-4555
	Terminal, Receptacle	300247	33001-0004
	Plug, Cavity Seal	300008	12034413
	Wire Cover Kit 80W Cam, Dir B	300239	
	Cover, Wire Dress and CPA		E-4555
	Cover, Bottom		E-4588

Read disassembly process/procedure thoroughly before beginning disassembly.

C. Connector Removal (Figures E–2A or B, View B)

1. Remove the CPA from the secondary lever lock and press in on the secondary lever lock while moving the cam lock handle to the unlatched position.
2. Separate connector from Transmission Control Module (TCM).

NOTE: ***Do not attempt to move CAM lever after it is disengaged from the TCM, doing so can break the internal latching mechanism***

3. Refer to Figures E–2A or B, View B. Use a small-bladed screwdriver to gently unlatch the retention features (2) of the wire dress cover and remove it from the backshell wire dress. Gently release the retention features (4) of the backshell wire dress and remove it from the connector body.
4. Insert a small-bladed screwdriver in between the connector body and the grommet retainer (Figure E–2A or B, View B) and carefully pry the grommet retainer away from the connector body. Slide the grommet retainer along the wires away from the connector body. If the grommet seal stayed with the connector body, also slide it away from the connector body and seat it into the grommet retainer, allowing better access to the wires.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Connector Removal (Figures E–2A or B, View B) *(cont'd)*

5. Insert a small-bladed screwdriver through the slot in the connector body (being careful not to damage the blue interfacial seal) and apply upward pressure on the red spacer until it lifts to the pre-stage location on one side (approximately 1⁄8 inch). Repeat this process on the other side so it is removed evenly. Carefully continue to evenly lift the red spacer out of the connector body until the four lock tabs release. Remove the red spacer completely. The red spacer **must be replaced** if any of the four lock tabs are broken during removal.
6. Make a note for reassembly purposes of which wire (number) goes into which terminal cavity in the connector body.
7. Insert the metal blade of J 38125-12A or J 39227 remover tool into the small hole in the front of the connector body above or below the desired terminal/wire lead cavity location (See Figures E–2A or B, View A).
8. Remove the selected terminal by gently lifting the locking finger with the remover tool and pulling the wire and terminal rearward out of the connector.

NOTE: Care should be taken not to damage or break the terminal locking finger during removal. If the locking finger is damaged or broken, proper terminal retention will be lost after reassembly.

D. Terminal Crimping

1. Carefully strip the insulation from the wire to leave 4.70–5.60 mm (0.185–0.220 inch) of bare wire (core) exposed.
2. Refer to Figures E–2A or B, View C. Pull out the wire stop blade of the crimping tool so it is clear of the terminal crimp area. Place the terminal all the way into the appropriate wire size opening of the J 47139 crimping tool until it contacts the stop and is properly oriented. Squeeze the handle enough to keep the terminal in place in the tool but not enough to compress the crimp wings.
3. Push in the wire stop blade until it touches the terminal. Insert the wire core into the terminal, with the core held against the wire stop blade.
4. Hold the wire and terminal against the stops until the terminal is fully crimped. Squeeze the crimper handle until the ratchet releases.

NOTE: If cavities do not have a terminal/wire lead or grommet cover pin (or if grommet cover pin is damaged) install cavity plug #12034413 into corresponding cavity in grommet seal in connector body.

5. Repeat as necessary.
6. Slide the grommet retainer containing the grommet seal along the wires and snap it into place on the connector body.
7. When all terminals have been inserted, be sure the green interfacial seal is properly located on the connector body and is not damaged. Install the red spacer into the connector body. Push it into the connector body until it is fully seated against the connector body.

NOTE: If the red spacer will not seat properly on the connector body, be sure all terminals are fully seated.

8. Refer to Figures E–2A or B, View B. Align the four retention features of the backshell wire dress with the four lock tabs on the grommet retainer and press the backshell wire dress onto the grommet retainer until all four retention features lock. Align the wire dress cover with the backshell wire dress and press into place until it locks on both sides.
9. To reconnect the 80-way connector to the TCM:
   a. Bring the connector to TCM "squared up", not at an angle.
   b. Keeping hands away from the handle, squarely press the connector onto the TCM until the cam lever handle moves of its own accord approximately 3⁄4 inch.
   c. Gently complete mating the connector to the TCM by moving the cam lever handle to the locked position.
   d. Slide the CPA back toward the secondary lock.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

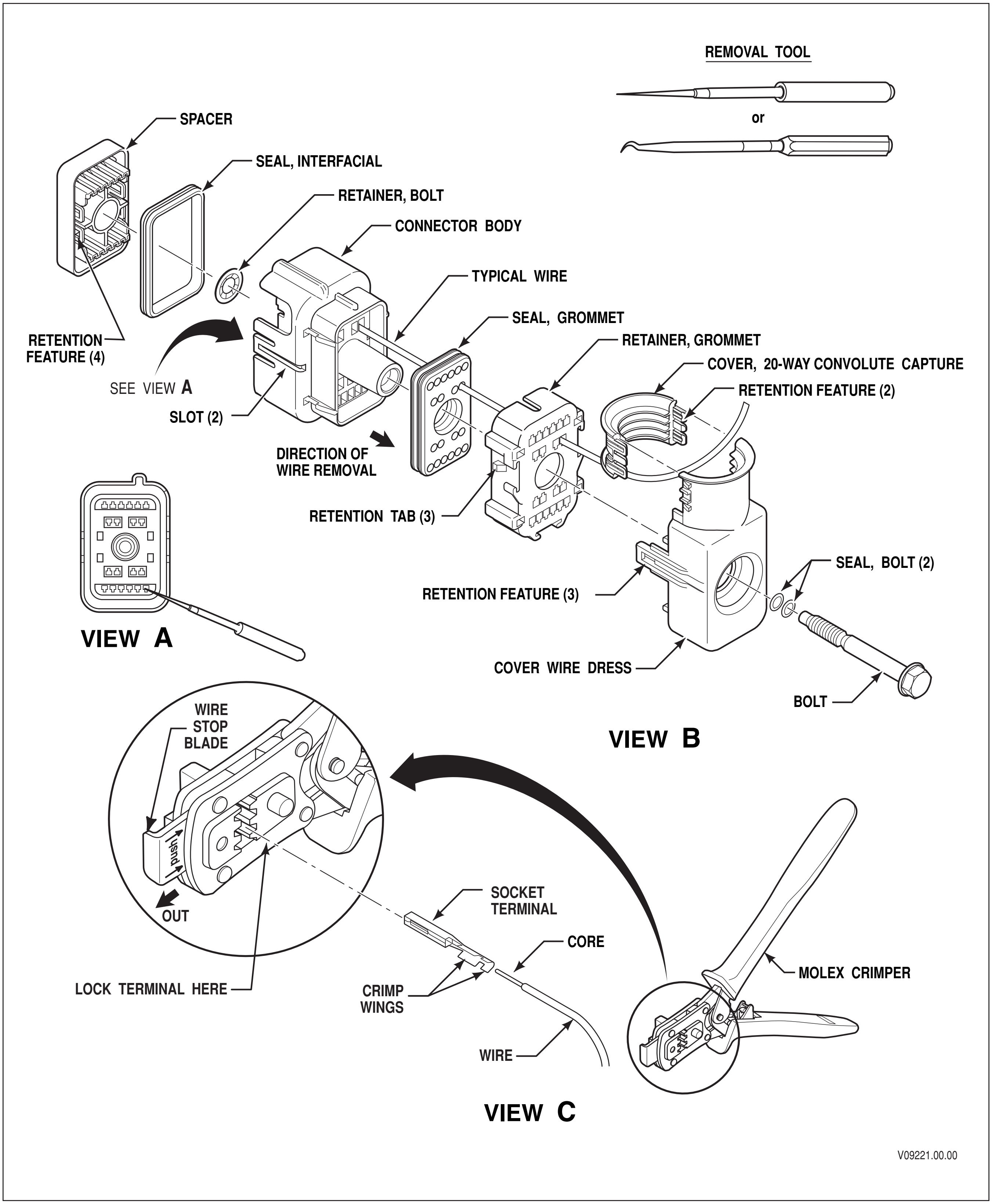


Figure E–3. AFL Automotive 20-Way, Bolt-Assist TCM Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–3. AFL AUTOMOTIVE 20-WAY BOLT-ASSIST CONNECTORS (TCM CONNECTOR)

A. Connector/Terminal Tools

Required Tools

Crimping Tool	J 47139
Remover Tool	J 38125-12A

Use	Description	St. Clair P/N	Manufacturers P/N
TCM Connector (20-way Bolt assist)	Kit, Connector Assembly, 20F, Bolt Assist	300278	
	Connector Assembly, 20F, Bolt Assist	300252	R-62183-001
	Spacer, 80F		E-4564
	Seal, Interfacial		E-4542
	Connector Body, 20F, Bolt		E-4561
	Bolt		E-6187-001
	Seal, Bolt		E-4590
	Retainer, Bolt		E-4545
	Grommet, Wire Seal		E-4565
	Grommet Cover, 20-Way	300253	E-4566
	Cover, Wire Dress	300254	E-4569
	Clip, Convolute	300251	E-4570
	Terminal, Receptacle	300247	33001-0004
	Plug, Cavity Seal	300008	12034413
	Bolt Kit	300241	
	Bolt		E-6187-001
	Seal, Bolt		E-4590
	Retainer, Bolt		E-4545
	Wire Cover Kit	300242	
	Cover, Wire Dress		E-4569
	Clip, Convolute		E-4570

Read disassembly process/procedure thoroughly before beginning disassembly.

1. Loosen the bolt (Figure E–3, View B) that retains 20-way connector to the transmission pass-through connector.
2. Separate the 20-way connector from the transmission pass-through connector.
3. Use a small-bladed screwdriver to gently unlatch the retention features (2) of the wire dress cover and remove it from the backshell wire dress. Gently release the retention features (3) of the backshell wire dress and remove it from the connector body.
4. Insert a small-bladed screwdriver in between the connector body and the grommet retainer (Figure E–1A, B, or C) and carefully pry the grommet retainer away from the connector body. Slide the grommet retainer along the wires away from the connector body. If the grommet seal stayed with the connector body, also slide it away from the connector body and seat it into the grommet retainer, allowing better access to the wires (only required when adding or deleting circuits).

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

A. Connector/Terminal Tools *(cont'd)*

5. Make a note for reassembly purposes of which wire (number) goes into which terminal cavity in the connector body.
6. Insert a small-bladed screwdriver through the slot in the connector body (being careful not to damage the interfacial seal) and apply upward pressure on the spacer until it lifts to the pre-stage location on one side (approximately 1⁄8 inch). Repeat this process on the other side so it is removed evenly. Carefully continue to evenly lift the spacer out of the connector body until the two lock tabs release. Remove the spacer completely. The spacer **must be replaced** if any one of the four retention features is broken during removal.
7. Insert the metal blade of J 38125-12A or J 39227 remover tool into the small hole in the front of the connector body above or below the desired terminal/wire lead cavity location (See Figures E–3, View A).
8. Remove the selected terminal by gently lifting the locking finger with the remover tool and pulling the wire and terminal rearward out of the connector.

NOTE: Care should be taken not to damage or break a terminal locking finger during removal. If a locking finger is damaged or broken, proper terminal retention will be lost after reassembly.

B. Terminal Crimping

1. Carefully strip the insulation from the wire to leave 4.70–5.60 mm (0.185–0.220 inch) of bare wire (core) exposed.
2. Refer to Figures E–3, View C. Pull out the wire stop blade of the crimping tool so it is clear of the terminal crimp area. Place the terminal all the way into the appropriate wire size opening of the J 47139 crimping tool until it contacts the stop and is properly oriented. Squeeze the handle enough to keep the terminal in place in the tool but not enough to compress the crimp wings.
3. Push in the wire stop blade until it touches the terminal. Insert the wire core into the terminal, with the core held against the wire stop blade.
4. Hold the wire and terminal against the stops until the terminal is fully crimped. Squeeze the crimper handle until the ratchet releases.
5. Pull out the wire stop blade and remove the crimped terminal.

NOTE: If cavities do not have a terminal/wire lead or grommet cover pin (or if grommet cover pin is damaged) install cavity plug #12034413 into corresponding cavity in grommet seal in connector body.

6. Repeat as necessary.
7. Slide the grommet retainer containing the grommet seal along the wires and snap it into place on the connector body (only if removed).
8. Be sure the interfacial seal is properly located on the connector body and not damaged. Install the spacer into the connector body. Push it into the connector body until it is fully seated against the connector body.

NOTE: If the spacer will not seat properly on the connector body, be sure all terminals are fully seated.

9. Refer to Figures E–3, View A. Align the three retention features of the backshell wire dress with the three lock tabs on the grommet retainer and press the backshell wire dress onto the grommet retainer until all three retention features lock. Align the wire dress cover with the backshell wire dress and press into place until it locks on both sides.
10. Reconnect the 20-way connector to the transmission pass-through connector and tighten connector bolt to specified torque value (N·m or lb ft) shown on the wire dress cover (DO NOT OVER-TORQUE).

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

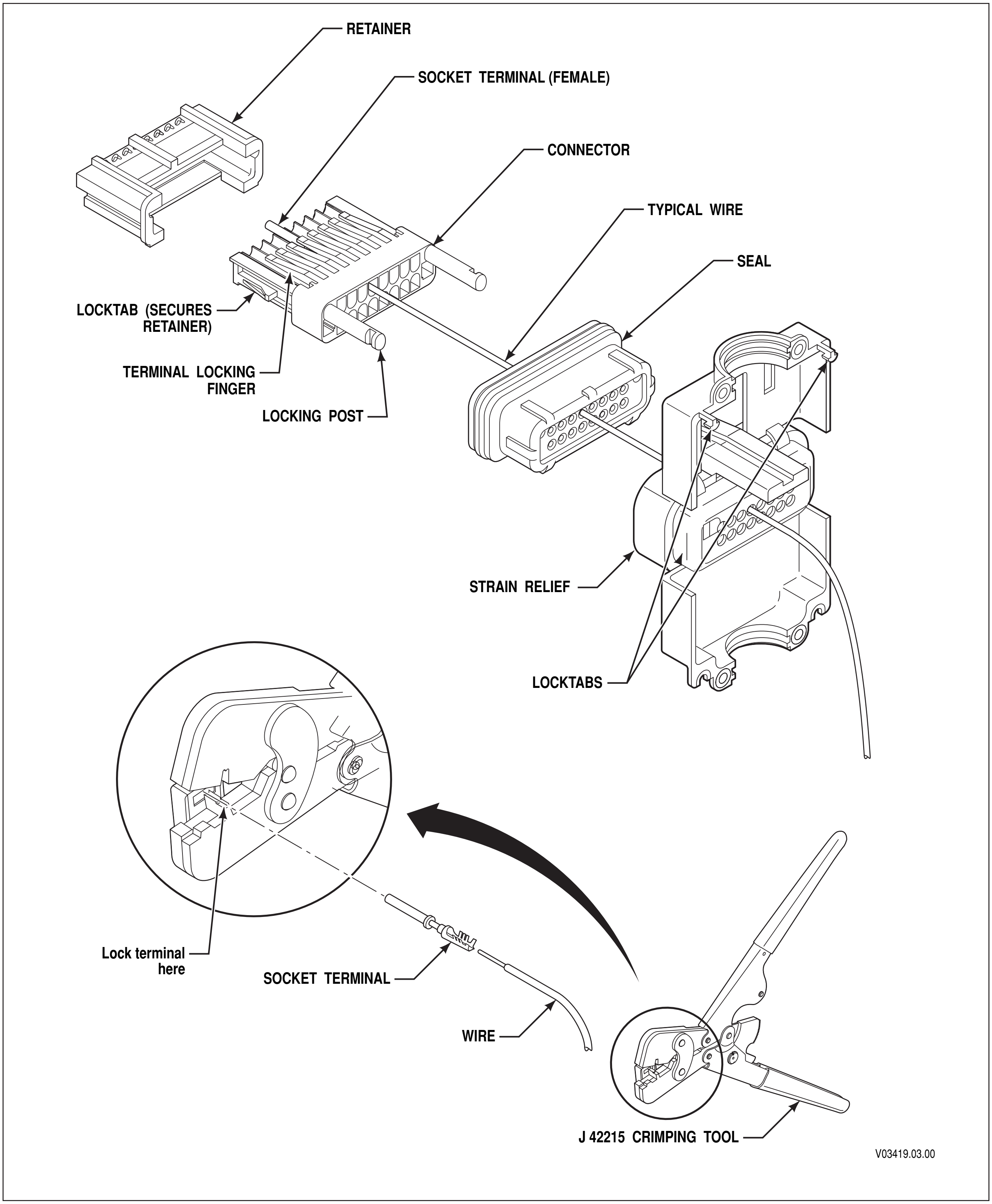


Figure E–4A. Delphi-Packard Micro Pack 16-Way 180 Degree Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

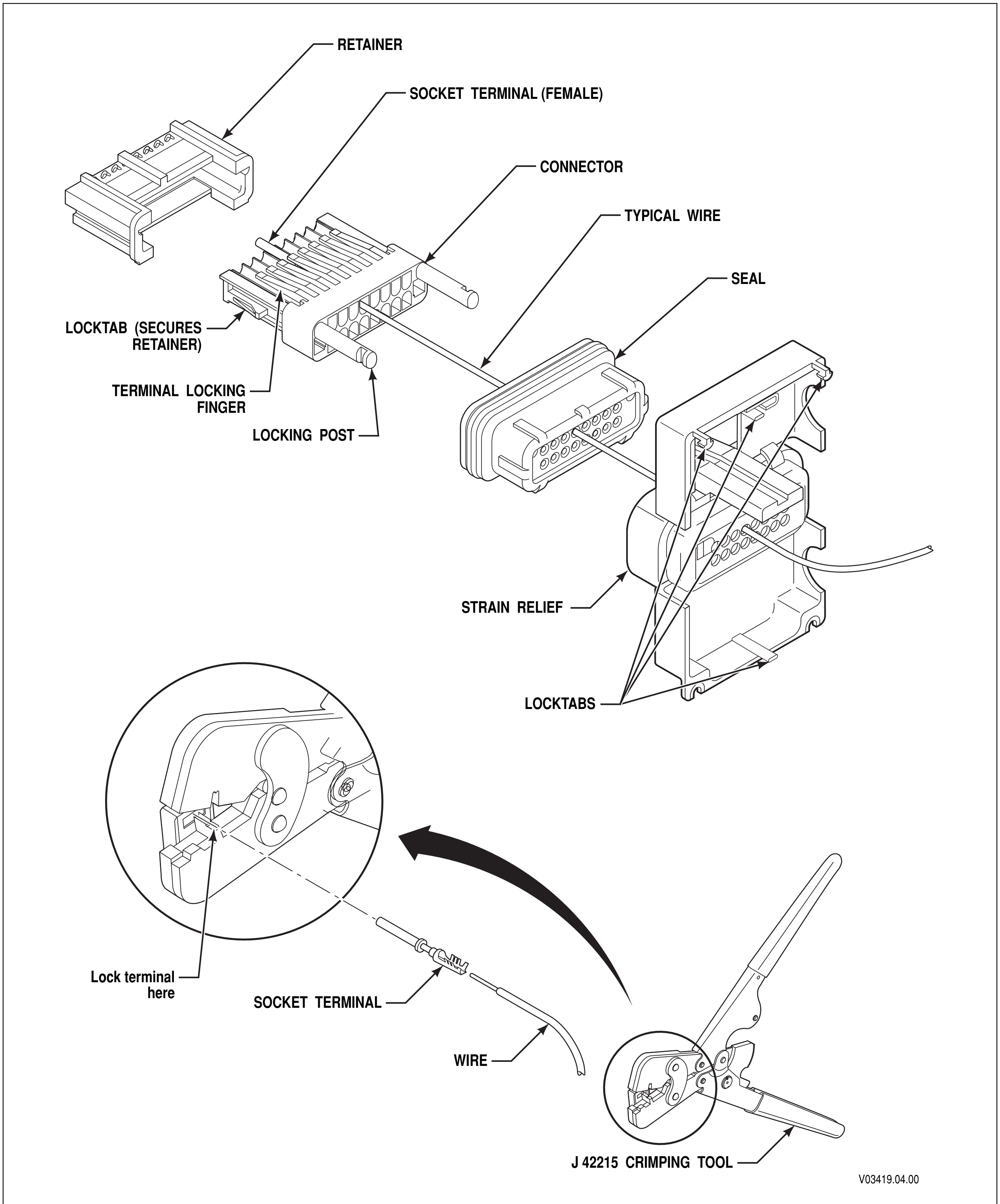


Figure E–4B. Delphi-Packard Micro Pack 16-Way 90 Degree Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

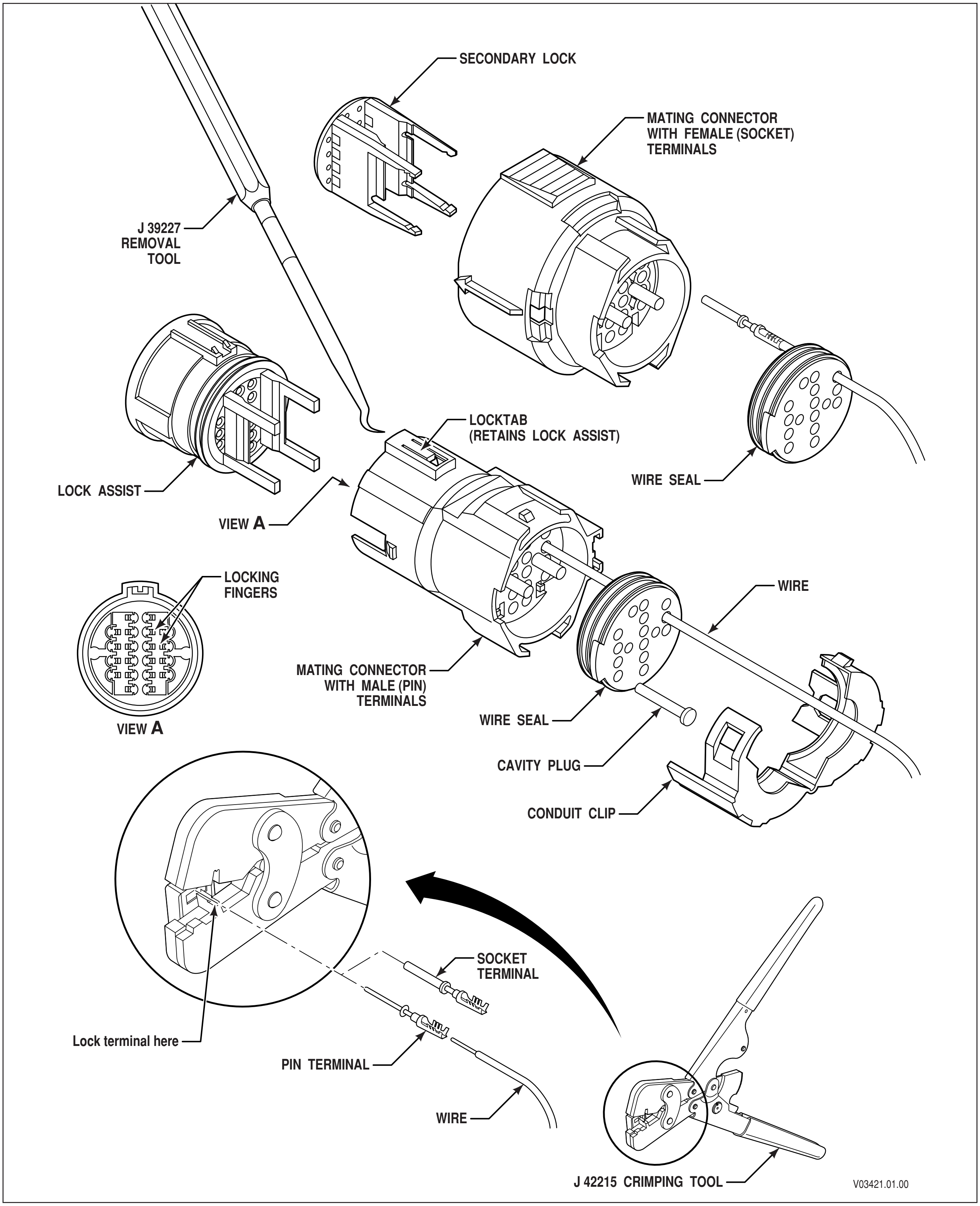


Figure E–4C. Delphi-Packard Micro Pack Connector (Strip Shift Selector)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–4. DELPHI-PACKARD MICRO PACK 100W CONNECTORS (CAN AND STRIP SHIFT SELECTORS)

A. Connector/Terminal Repairs

Crimping Tool	J 42215
Remover Tool	J 39227

Use	Description	St. Clair P/N	Manufacturers P/N
CAN Shift Selector, 90 Degree	Kit, CAN Shift Selector, 90 Degree	300279	
	Connector, 16F	300255	12191065
	Seal, 16-way	300256	12191066
	TPA Retainer, 16F	300257	12191067
	Strain Relief, 16F, 90 Degree	300258	12191068
	Terminal, 0.8 mm Wire	300087	12084912
	Cavity Plug	300105	12129557
	CPA Lock M/P	300114	12177289
CAN Shift Selector, 180 Degree	Kit, CAN Shift Selector, 180 Degree	300280	
	Connector, 16F	300255	12191065
	Seal, 16-way	300256	12191066
	TPA Retainer, 16F	300257	12191067
	Strain Relief, 16F, 180 Degree	300259	15460298
	Terminal, 0.8 mm Wire	300087	12084912
	Cavity Plug	300105	12129557
	CPA Lock M/P	300114	12177289
Strip Shift Selector, Harness	Connector		12160280
	Wire Seal		15304882
	Secondary Lock		12160494
	Terminal, Socket		12084912
	Cavity Plug		12129557
	Conduit Clip		12176394
Strip Shift Selector, Device	Connector, Gray		12160542
	Wire Seal		12110693
	Lock Assist/Seal		12191176
	Terminal, Pin		12060551
	Cavity Plug		12129557
	Conduit Clip, Black		12176394

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

B. Terminal Removal

1. CAN Shift Selector Harness Connectors (Figure E–4A, 4B, and 4C)

CAUTION:	**The color-code of the strain relief should match the color-code of the retainer. However, cases have been reported where this has not occurred. The retainer color-code and key configuration ensures that the proper wiring harness connector is in the right socket of the ECU. The color-code of the strain relief is of secondary importance and may not agree with the retainer. Change the strain relief to match the color-code of the retainer (Figure E–1A) when color-code mismatch is found.**

a. Use a small-bladed screwdriver to gently release the locktabs at the splitline of the strain relief.

b. Spread the strain relief open.

c. Remove the retainer from the connector by using a small-bladed screwdriver to depress the locktabs on the side of the connector.

d. Remove a selected terminal by pushing forward on the wire or by lifting the locking finger and pulling the wire and terminal rearward out of the connector.

2. Strip Shift Selector (Device) Connectors (Figure E–4C)

a. Lift locktab on the side of the connector and remove the lock assist.

b. Open the conduit clip on the back of the connector after lifting locktabs on each side and sliding clip back to release it from connector.

c. Use the J 39227 tool to release the locking finger inside the connector and pull the terminal/wire out the rear of the connector.

3. Strip Shift Selector Harness Connectors (Figure E–4C)

a. Carefully insert a small screwdriver blade between the connector body and the secondary lock. Twist/pry to remove the secondary lock from the connector body.

b. Open the conduit clip on the back of the connector after lifting locktabs on each side and sliding clip back to release it from connector.

c. Use the J 39227 tool to release the locking finger inside the connector and pull the terminal/wire out the rear of the connector.

C. Terminal Crimping

1. Carefully strip insulation to leave 5.0 mm ± 0.5 mm (0.20 ± 0.02 inch) of bare wire showing.
2. Insert the new terminal to be crimped in the J 42215 crimping tool. There is a spring-loaded terminal positioner at the front of the tool to hold the terminal in place. Squeeze the crimper handles for a few clicks to start the crimping process but leave room to insert the wire end.
3. Insert the bare wire end into the terminal. Squeeze the crimper handles to complete the crimping process and until the crimper handles open when released to remove the terminal/wire from the tool.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping *(cont'd)*

4. Complete terminal installation for Strip Shift Selector Connectors as follows: (Figure E–4C)
   a. Insert the wire seal in the back of the connector.
   b. Push the terminal/wire assembly through the proper hole in the back of the wire seal. Push the wire in until the terminal clicks into position. Gently pull rearward on the wire to be sure that the terminal is fully seated. Install cavity plugs as needed.
   c. Install the lock assist or secondary lock into the connector body.
   d. Close the conduit clip around the conduit and lock the clip into the rear of the connector body.

5. Complete terminal installation of the CAN Shift Selector Connectors as follows: (Figure E–4A and E–4B)
   a. Align the locking posts on the connector with the seal and push the locking posts through the seal into the mating holes in the strain relief (if the connector was removed from the strain relief).
   b. Push the terminal/wire assembly through the proper hole in the back of the seal. Push the wire in until the terminal clicks into position.

NOTE: ***All terminals must be properly positioned to install the retainer in Step (5c).***

   c. Install the retainer on the connector body to lock the terminals in position. Pull rearward on the wire to be sure that the terminal is fully seated. Install cavity plugs as needed.
   d. Position the conduit inside the strain relief and snap the strain relief halves together.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

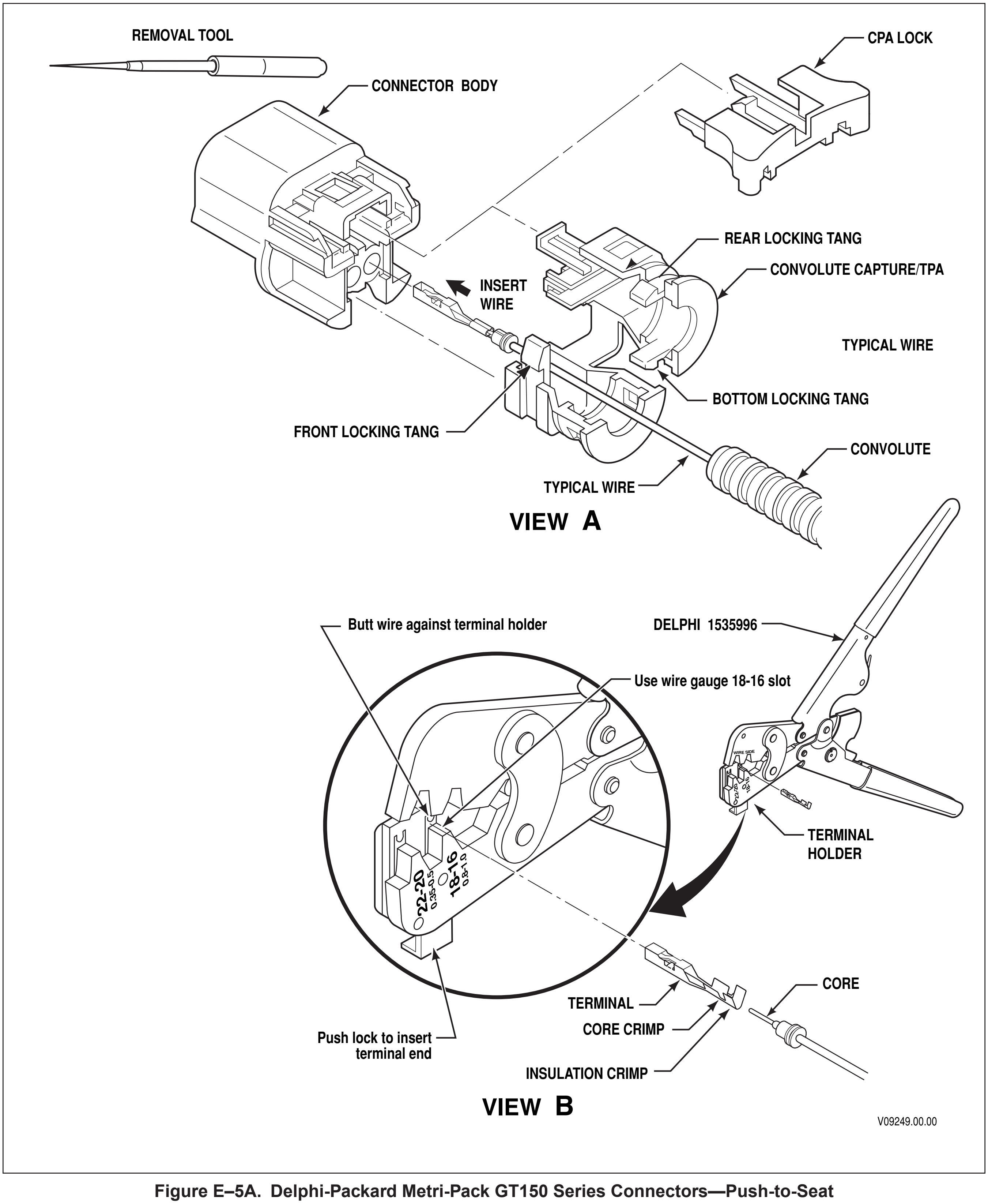


Figure E–5A. Delphi-Packard Metri-Pack GT150 Series Connectors—Push-to-Seat (Speed Sensor; Accumulator Solenoid; Retarder Solenoid)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

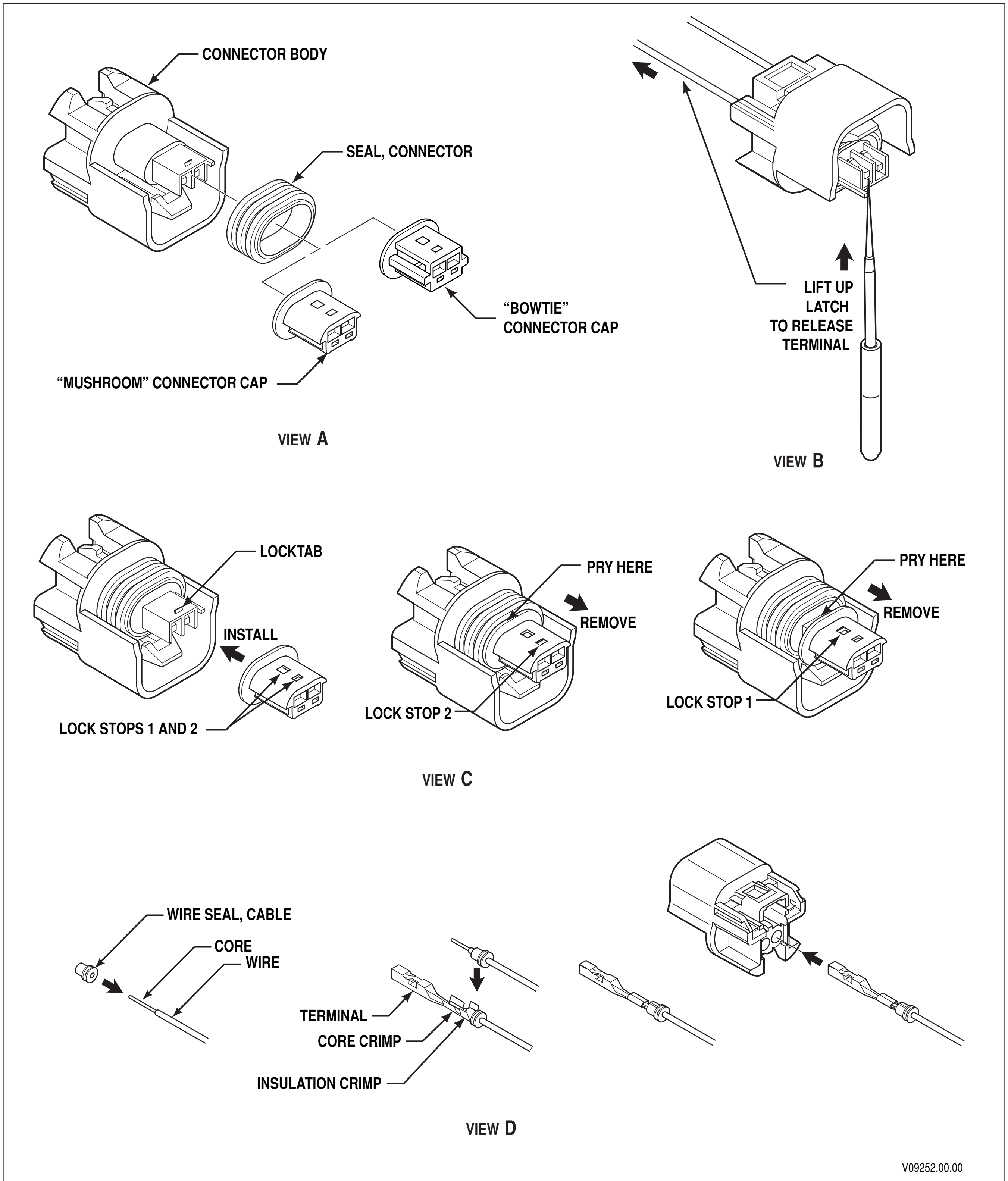


Figure E–5B. Delphi-Packard GT150 Series Connectors—Push-to-Seat (Speed Sensor; Accumulator Solenoid; Retarder Solenoid)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–5. DELPHI-PACKARD GT150 SERIES CONNECTORS—PUSH-TO-SEAT (SPEED SENSOR; RETARDER SOLENOID)

A. Connector/Terminal Repairs

Tool Description	Part Number
Wire Stripper	J 35615
Crimp Tool	Delphi 15359996
Alternate Crimp Tool	
	J 38125-6 Anvil “1”
	J 38125-7 Anvil “E”
Remover Tool	J 38125-12A
Alternate Removal Tool	J 35689-A

Use	Description	St. Clair P/N	Manufacturers P/N (Current)	Manufacturers P/N (Former)
GT Turbine Speed (Nt)	Kit, GT150, Speed Sensor	300227		
Sensor (4000 Product	Connector Assembly	300260	13520101	15490464
Family)	CPA	300261	15496486	
GT Engine/Output	Terminal	300262	15326267	
(All Models) (Ne/No)	Cable Seal	300263	15305351	
Speed Sensor	Convolute Capture, TPA	300064	15358890	
Retarder Solenoid (PCS5)	Connector Assembly		13523048	13513314
	CPA		15496486	
	Terminal		15326267	
	Cable Seal		15305351	
	Convolute Capture, TPA		15358890	
Retarder Accumulator	Connector Assembly		13520104	
Solenoid	Cable Seal		15305351	
	Terminal		15326267	
	CPA		15496486	
	Convolute Capture, TPA		15358890	

B. Terminal Removal

NOTE: Do not solder crimps.

1. The CPA lock has two positions. The fully locked position retains the connector to the mating connector. The second position allows the connector to be released from the mating connector. To facilitate terminal removal, completely remove the CPA lock by depressing the lock tang and pulling the lock up and away from the connector (Figure E–5A, View A).
2. Remove the convolute capture from the rear of the GT150 connector by raising the retainer clip and pulling on the harness.
3. Remove the convolute capture from the convolute by applying pressure with a small-bladed screwdriver inserted into the front locking tang. Repeat the process on the rear locking tang and open the capture. The wires are now loose in the convolute and can be pulled out a short distance to make terminal installation easier.
4. Two different connector caps, “bowtie” or “mushroom”, are used (Figure E–5B, View A). Each connector cap has two stops (Figure E–5B, View C). The cap **must be** completely removed from

the connector in order to remove and install a wire and terminal. Remove the appropriate connector cap from the connector by carefully prying up on the cap and push it away from the connector past the lock tab, so that it completely clears the connector. **Be sure seal is not damaged.**

5. Insert the J 38125-12A removal tool between the terminal lock finger and the terminal (Figure E–5B, View B) and carefully lift the finger while pulling the wire and terminal rearward from the connector body (Figure E–5A, View A).
6. If the terminal is to be replaced, cut the terminal between the core and insulation crimp to minimize wire loss.

C. Terminal Crimping—(Delphi 15359996 Crimping Tool)

1. Carefully strip the wire of enough insulation to expose 4.5 mm ± 0.5 mm (0.18 ± 0.02 inch) of bare wire (core).
2. Install a seal onto the wire (Figure E–5D, View D).
3. Pull out the wire stop blade of the crimping tool so it is clear of the terminal crimp area (Figure E–5A, View C). Place the terminal all the way into the appropriate wire size opening of the J 47139 crimping tool until it contacts the stop and is properly oriented. Squeeze the handle just enough to maintain pressure on the terminal so it does not drop out of the tool, but not enough to compress the crimp wings.
4. Push in the wire stop blade until it touches the terminal. Insert the wire core into the terminal, with the core held against the wire stop blade. Position the seal on the wire so the small diameter is in the insulation crimp wing (Figure E–5B, View D).
5. Hold the wire and terminal against the stops and be sure the seal is in the insulation crimp wing. Squeeze the crimping tool handle until it releases. Pull out the wire stop blade and remove the wire and terminal from the tool.
6. Lightly pull on the wire while holding the terminal to be sure the crimp is tight.
7. Repeat as needed to crimp another wire.
8. Insert the terminal and sealed wire into the connector (Figure E–5B, View D) until it stops. Lightly pull on the wire to be sure it is held in the connector by the terminal lock finger.
9. Install connector cap (Figure E–5B, View A) onto front of connector body.
10. Close the convolute capture over the convolute until both locks are engaged.
11. Push the convolute capture into the connector body until both locks are engaged. Install the CPA lock onto the connector body.

D. Terminal Crimping Using Alternate Tool J 38125-6 and J 38125-7

1. Use J 38125-7 to crimp the wire core. Place core crimp portion of terminal onto bed of anvil “E” and squeeze crimper enough to keep terminal from dropping.
2. Position wire core in terminal and squeeze crimper tool to complete the core crimp. **Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.** The terminal should be positioned so that the notch on top of the terminal is aligned with the locking finger in the connector cavity.
3. Position the wire seal between the two insulation crimping tabs (Figure E–5B, View D).
4. Use J 38125-6 to crimp the insulation over the wire seal. Position insulation crimp of terminal on anvil “1” so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

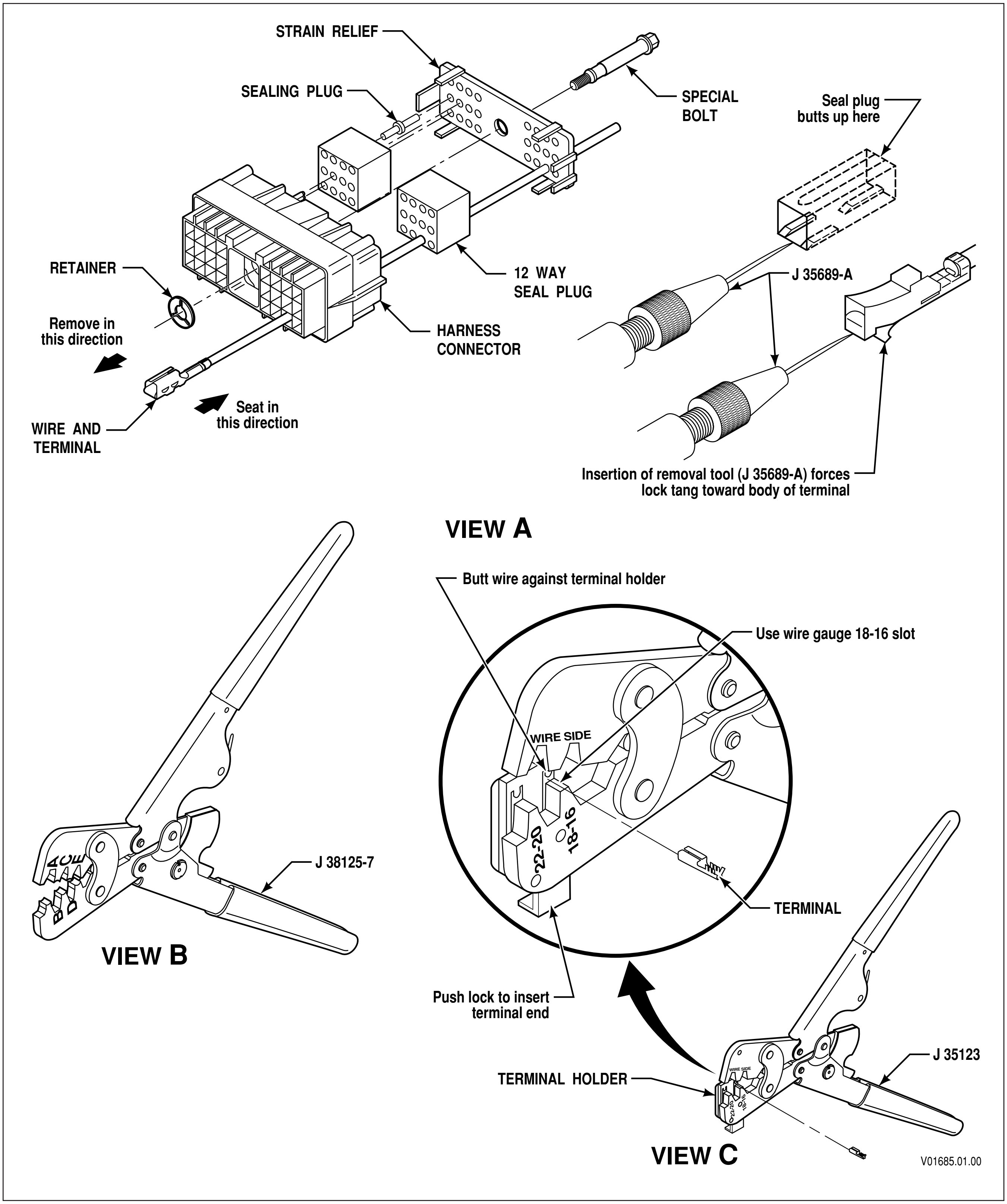


Figure E–6. Delphi-Packard Metri-Pack 150 Series connectors Pull-To-Seat (Turbine Speed Sensor: 30-Way and 18-Way VIM; Retarder Temperature Sensor; Retarder Accumulator Solenoid)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–6. DELPHI-PACKARD METRI-PACK 150 SERIES CONNECTORS—PULL-TO-SEAT (TURBINE SPEED SENSOR; 30-WAY AND 18-WAY VIM; RETARDER TEMPERATURE SENSOR; RETARDER ACCUMULATOR SOLENOID)

A. Connector/Terminal Repairs

Wire Stripper	J 35615
Crimping Tool	J 38125-7
Wire Crimp	Anvil “E”
Insulation Crimp	Anvil “C”
Alternate Crimping Tool	J 35123
Remover Tool	J 35689-A

Use	Description	Manufacturers P/N
Turbine Speed (Nt) Sensor	Connector	15490953
(3000 Product Family)	Terminal	12110236
Vehicle Interface Module (VIM)	Connector (VIM)	
	Connector Body	12040920
	9-Way Seal (x2)	12040936
	30-Way Strain Relief	12110545
	Special Bolt	12129426
	Bolt Retainer	12034236
	Sealing Ring	12034413
	Terminal	12103881
Vehicle Interface Module (Vehicle)	Connector (VIM)	
	Connector Body	12034397
	15-Way Seal (x2)	12040879
	18-Way Strain Relief	12110546
	Special Bolt	12129426
	Bolt Retainer	12034236
	Sealing Ring	12034413
	Terminal	12103881
Vehicle Interface Module (Vehicle)	Connector (OEM)	
	Connector Body	12034397
	15-Way Seal (x2)	12040879
	30-Way Strain Relief	12110546
	Special Bolt	12129426
	Bolt Retainer	12034236
	Sealing Plug	12034413
	Terminal	12103881
Retarder Temperature Sensor	Connector Assembly, 2F M/P 150	12162852
	Connector Body, Black	12162734
	Connector Seal	12110513
	Cable Seal	12110514
	Terminal	12124075
Retarder Accumulator Solenoid	Connector Assembly, 2F M/P 150	15326143
	Connector Body, Black	15326141
	Connector Seal	12040751
	Cable Seal	12110514
	Terminal	12124075

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

B. Terminal Removal

NOTE: Do not solder crimps.

1. Insert needle end of terminal remover J 35689-A into the small notch between the connector and the terminal to be removed (Figure E–6, View A). Push the lock tang toward the terminal.
2. Push the wire and terminal out of the connector—this is a “pull-to-seat” terminal.
3. Pull terminal as far as necessary from the connector. This will be limited by the number of other wires inserted into the connector and by the distance between the back side of the connector and the beginning of the harness covering.
4. If terminal is to be replaced, cut the terminal between the core and insulation crimp to minimize wire loss.

C. Terminal Crimping—VIM, Speed Sensor, Retarder Temperature Sensor, and Retarder Accumulator Solenoid Terminals (Standard Crimping Tool)

1. If a spare wire is used, the wire should be pushed through the proper hole in the strain relief (if used), through the wire seal, and out the other side of the connector before stripping.
2. Carefully strip insulation 4.5 mm ± 0.5 mm (0.18 ± 0.02 inch). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
3. Place core crimp portion of terminal on bed of anvil “E” and squeeze crimper enough to keep terminal from dropping (Figure E–6, View B).
4. Position wire core in terminal and squeeze crimper tool to complete the core crimp. **Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.** The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
5. Position insulation crimp of terminal on anvil “C” so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.
6. Be sure lock tang is lifted to allow proper reseating of the terminal.
7. Pull on the wire to pull the terminal completely into the cavity. A click will be heard and the terminal should stay in place if the wire is pushed.

D. Terminal Crimping Using Alternate Tool J 35123

1. If a spare wire is used, the wire should be pushed through the proper hole in the strain relief (if used) and the wire seal, and out the other side of the connector prior to stripping.
2. Insert remover tool in front side of connector to release locktab and push terminal out front of connector. Pull the terminal and wire out the front of the connector to complete Steps (3) through (7).
3. Push open the terminal holder on the crimper tool J 35123 and insert a terminal into the opening marked 18–16 (Figure E–6, View C) so that the crimp ends point up. Release the terminal holder.
4. Slightly close the crimping tool (close until one click is heard) but do not start to crimp the terminal. Place the terminal on the wire so it is in the same position as it will be when pulled back into the connector. The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Terminal Crimping Using Alternate Tool J 35123 *(cont'd)*

5. Insert the wire into the terminal until the wire contacts the holder. By doing this, the core and insulation should be properly positioned for the core and insulation crimp wings.
6. Squeeze the crimper fully until it opens when released.
7. Open the terminal holder and remove the wire and terminal from the crimping tool.
8. Pull on the terminal to assure a tight crimp.
9. Be sure lock tang is lifted to allow proper reseating of the terminal.
10. Pull on the wire to pull the terminal completely into the cavity. A click will be heard and the terminal should stay in place if the wire is pushed.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

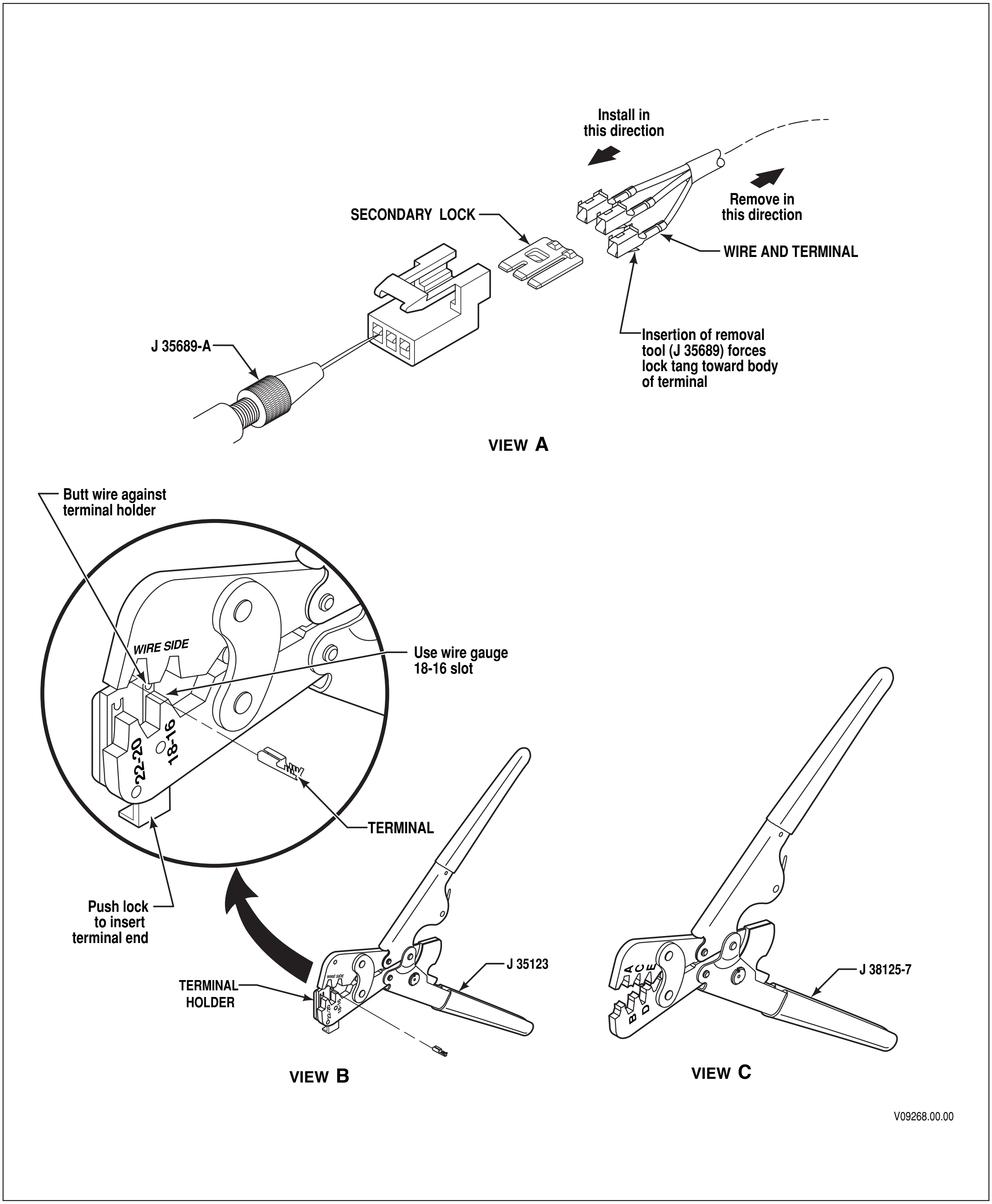


Figure E–7. Delphi-Packard Metri-Pack 150 Series Connectors Push-To-Seat (Oil Level Sensor)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–7. DELPHI-PACKARD METRI-PACK 150 SERIES CONNECTORS—PUSH-TO-SEAT (OIL LEVEL SENSOR)

A. Connector/Terminal Repairs

Wire Stripper	J 35615
Crimping Tool	J 38125–7
Wire Crimp	Anvil "E"
Insulation Crimp	Anvil "C"
Alternate Crimping Tool	J 35123
Remover Tool	J 35689–A

Use	Description	Manufacturers P/N
Oil Level Sensor	3-Pin Plug	12064758
	Terminal (Socket)	12047767
	Secondary Lock, TPA	12047783

B. Terminal Removal

NOTE: Do not solder crimps.

1. Remove the secondary lock.
2. Insert needle end of terminal remover J 35689-A into the small notch between the connector and the terminal to be removed (Figure E–7, View A). Push the lock tang toward the terminal.
3. Pull the wire and terminal out the rear of the connector—this is a "push-to-seat" terminal.
4. Pull terminal as far as necessary from the connector. This will be limited by the number of other wires inserted into the connector and by the distance between the back side of the connector and the beginning of the harness covering.
5. If terminal is to be replaced, cut the terminal between the core and insulation crimp to minimize wire loss.

C. Terminal Crimping

1. Carefully strip insulation 4.5 mm ± 0.5 mm (0.18 ± 0.02 inch). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
2. Place core crimp portion of terminal on bed of anvil "E" and squeeze crimper enough to keep terminal from dropping (Figure E–7, View C).
3. Position wire core in terminal and squeeze crimper tool to complete the core crimp. **Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.** The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
4. Position insulation crimp of terminal on anvil "C" so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.
5. Be sure lock tang is lifted to allow proper reseating of the terminal.
6. Push on the wire until the terminal is completely into the cavity. A click will be heard and the terminal should stay in place when the wire is lightly pulled.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Terminal Crimping Using Alternate Tool J 35123

1. Insert remover tool in front side of connector to release locktab and pull terminal out rear of connector. Pull the terminal and wire out the rear of the connector to complete Steps (3) through (7).
2. Push open the terminal holder on the crimper tool J 35123 and insert a terminal into the opening marked 18–16 (Figure E–7, View B) so that the crimp ends point up. Release the terminal holder.
3. Slightly close the crimping tool (close until one click is heard) but do not start to crimp the terminal. Place the terminal on the wire so it is in the same position as it will be when pulled back into the connector. The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
4. Insert the wire into the terminal until the wire contacts the holder. By doing this, the core and insulation should be properly positioned for the core and insulation crimp wings.
5. Squeeze the crimper fully until it opens when released.
6. Open the terminal holder and remove the wire and terminal from the crimping tool.
7. Pull on the terminal to assure a tight crimp.
8. Be sure lock tang is lifted to allow proper reseating of the terminal.
9. Push on the wire until the terminal is completely into the cavity. A click will be heard and the terminal should stay in place if the wire is lightly pulled.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

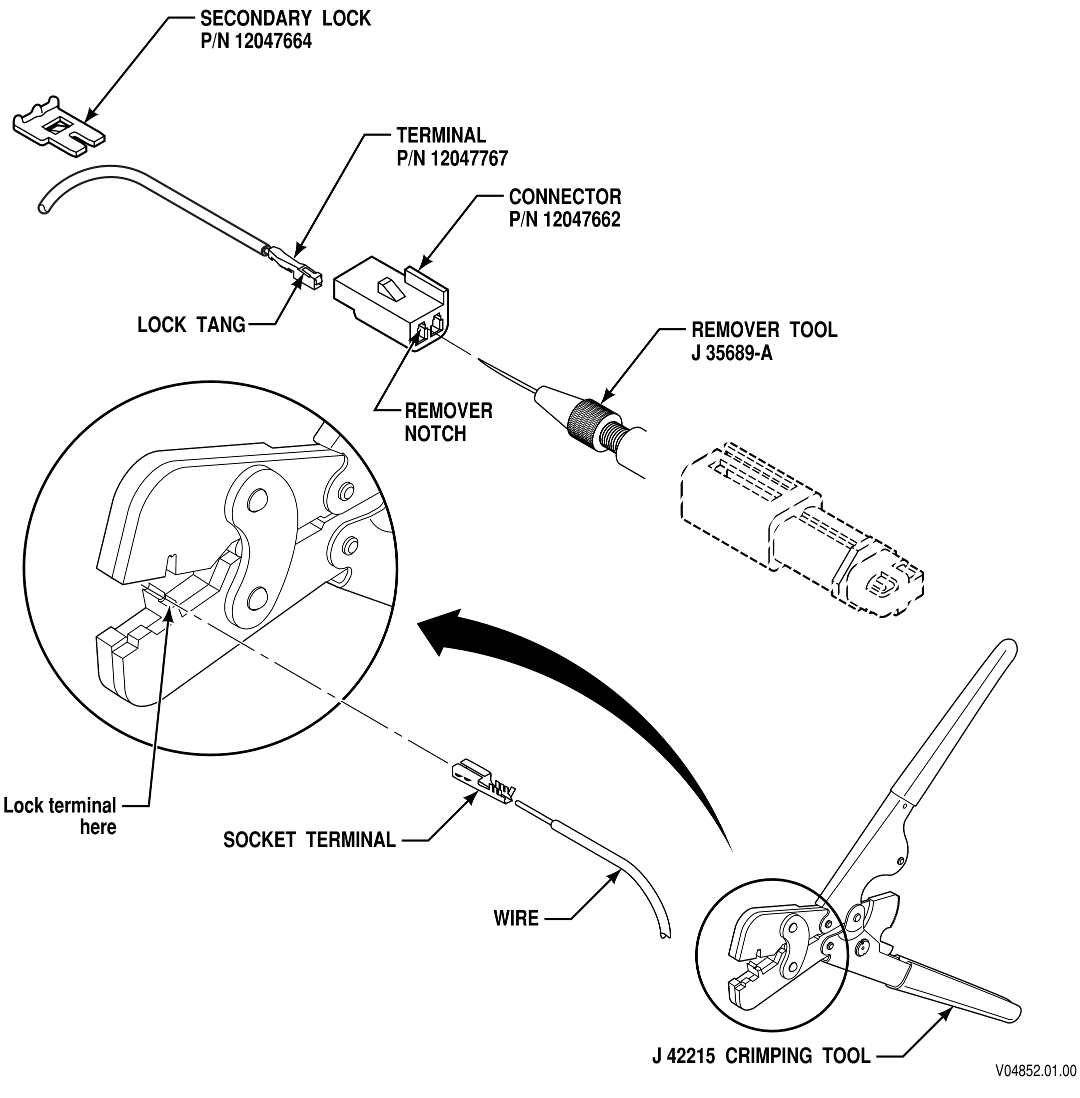


Figure E–8. Delphi-Packard Metri-Pack 150 Series Connector—Push-To-Seat (All Models, Sump Temperature Thermistor)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–8. DELPHI-PACKARD METRI-PACK 150 SERIES CONNECTORS—PUSH-TO-SEAT (ALL MODELS, SUMP TEMPERATURE THERMISTOR)

A. Connector/Terminal Repairs

Crimping Tool	J 42215 (with terminal positioner removed)
Remover Tool	J 35689-A

Use	Description	Manufacturers P/N
All Models, TransID 2 and Later	Sump Temperature Sensor	12129691
Sump Temperature Thermistor	Connector, Black	12047662
	Terminal	12047767
	Secondary Lock	12047664

B. Terminal Removal

1. Remove the secondary lock from the connector.
2. Insert needle end of terminal remover J 35689-A into the small notch in the front of the connector cavity of the terminal to be removed (Figure E–8).
3. Push the lock tang toward the terminal.
4. Pull the wire and terminal out of the connector.
5. Cut the terminal between the core and insulation crimp to minimize wire loss.

C. Terminal Crimping

1. Strip insulation approximately 4.5 mm (0.18 inch).
2. Remove the spring-loaded terminal positioner from the J 42215 crimping tool.
3. Insert the new terminal to be crimped in the J 42215 crimping tool. Squeeze the crimper handles a couple clicks to start the crimping process but leave room to insert the wire end.
4. Insert the bare wire end into the terminal. Squeeze the crimper handles to complete the crimping process and until the crimper handles open when released to remove the terminal/wire from the tool.
5. Be sure the lock tang is positioned to allow proper retention of the terminal in the connector.
6. Push the terminal completely into the cavity. A click will be heard and the terminal should stay in place if the wire is pulled.
7. Install the secondary lock in the connector.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

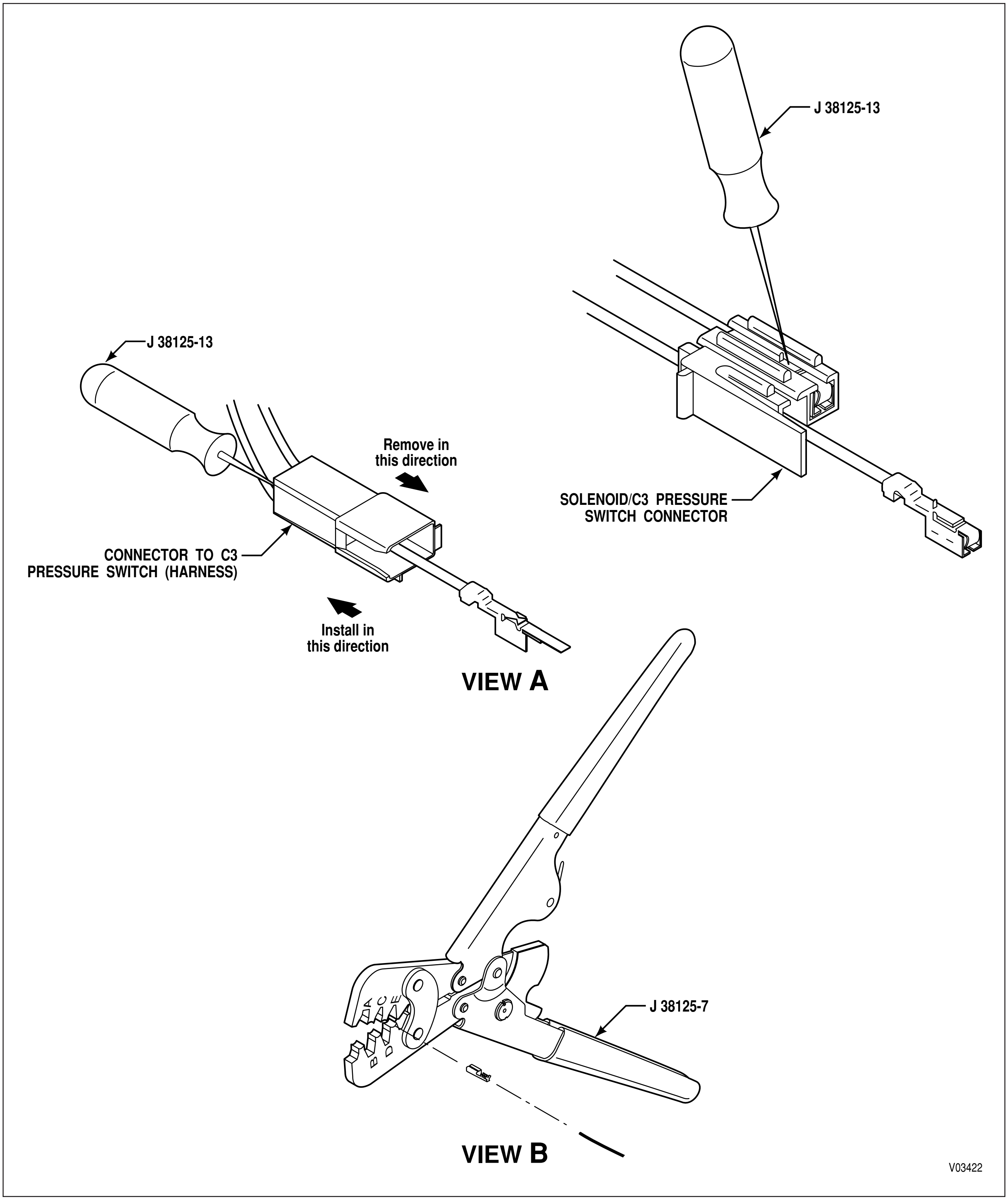


Figure E–9. Delphi-Packard Metri-Pack 280 Series Connectors—Pull-to-Seat (Internal Harness On/Off Solenoid and PS1 Pressure Switch)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–9. DELPHI-PACKARD METRI-PACK 280 SERIES CONNECTORS—PULL-TO-SEAT (INTERNAL HARNESS ON/OFF SOLENOID AND PS1 PRESSURE SWITCH)

A. Connector/Terminal Repairs

Wire Stripper	J 35615
Crimping Tool	J 38125-7

NOTE: ***Crimping anvils will be listed following the terminal part numbers for the various connectors in this section. The anvil for the core crimp is always listed first.***

Remover Tool	J 38125-13

Use	Description	Manufacturers P/N
Shift Solenoid/PS1 Pressure Switch (Switch)	Connector	29541590
PS1 Pressure Switch (Harness)	Connector	12110139
Shift Solenoid/PS1 Pressure Switch (Switch)	Terminal (Use crimping anvils “C” and “D”)	12124639
PS1 Pressure Switch (Harness)	Terminal (Use crimping anvils “C” and “D”)	12066337

B. Terminal Removal

1. Depress locktab on terminal (accessible in slot of connector) and push terminal out front of connector (Figure E–9, View A).
2. If replacing terminal, cut terminal between core and insulation crimp (to minimize wire loss).

C. Terminal Crimping

1. Carefully strip insulation 6.5 mm ± 0.5 (0.26 ± 0.02 inch). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
2. Place core crimp portion of terminal on bed of anvil indicated and squeeze crimper enough to hold terminal from dropping (Figure E–9, View B).
3. Position wire core in terminal and squeeze crimper tool to complete the core crimp. Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.
4. Position insulation crimp of terminal on anvil indicated so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.
5. Slip the wire through the slot in the connector and pull to fully seat the terminal(s).

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

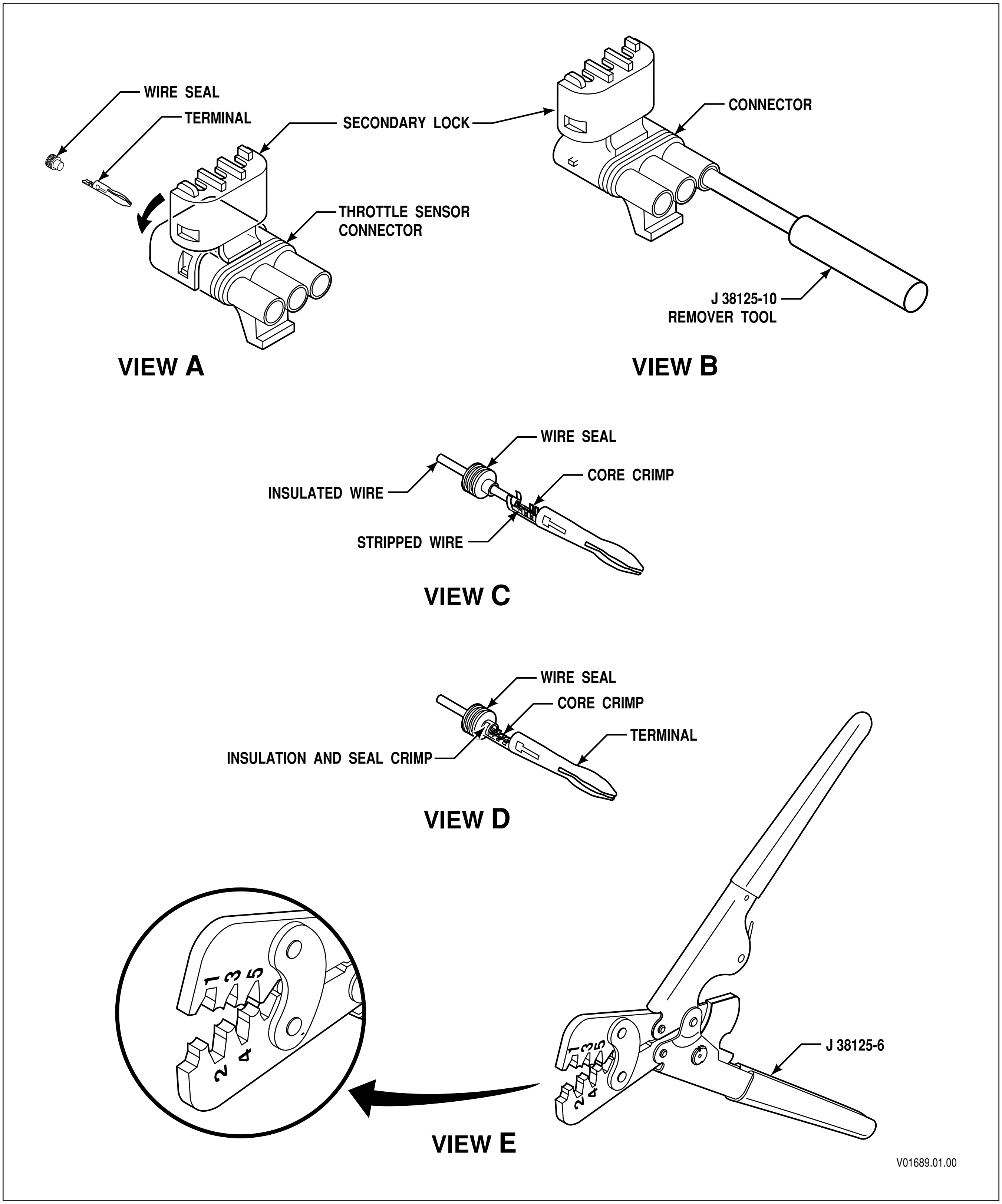


Figure E–10. Delphi-Packard WeatherPack Connectors (TPS; 3-Way RMR Sensor; Type 3; 3-Way RMR Device (Dedicated Pedal))

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

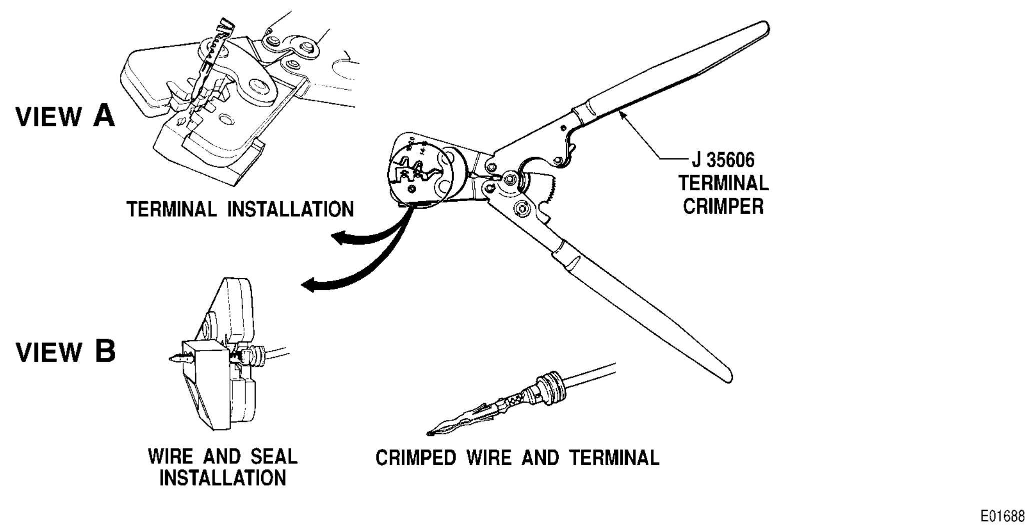


Figure E–11. Terminal Crimping With Tool J 35606

E–10. DELPHI-PACKARD WEATHERPACK CONNECTORS (TPS; 3-WAY RMR SENSOR; 3-WAY RMR DEVICE (DEDICATED PEDAL))

A. Connector/Terminal Repairs

Crimping Tool	J 38125-6
Wire Crimp	Anvil “2”
Insulation Crimp	Anvil “5”
Alternate Crimping Tool	J 35606 or J 38852
Remover Tool	J 38125-10

Use	Description	Manufacturers P/N
Throttle Position (TPS)	Connector	12015793
	Terminal	12089040
	Wire Seal	12089444
RMR Device	Connector	12015795
	Terminal	12089040
	Wire Seal	12089444
Retarder Temperature Sensor	Connector	12010973
	Terminal (Socket)	12089188
	Wire Seal	12089444

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

B. Terminal Removal

1. Unlatch and open the secondary lock on the connector (Figure E–10, View A).
2. On the front of the connector, insert remover tool J 38125-10 over the terminal. Push the tool over the terminal and pull the terminal out of the back end of the connector (Figure E–10, View B).
3. If terminal is to be replaced, cut terminal between core and insulation crimp (this minimizes wire loss).

NOTE:* *Two special tools are available for this operation: tool J 38125-6 (Paragraph C); tool J 35606 (Figure E–11) or J 38852 (Paragraph D).

C. Terminal Crimping Using Crimping Tool J 38125-6

1. Place the wire seal onto the wire before stripping the wire (Figure E–10, View C).
2. Strip wire to 6.0 ± 0.25 mm (0.24 ± 0.01 inch).
3. Place terminal onto crimping tool J 38125-6 (Figure E–10, View E), anvil “2.”
4. Slightly close crimping tool to hold terminal steady.
5. Insert wire so that the stripped portion of wire is in the core crimp area and the insulated portion of the wire is in the insulation crimping area (Figure E–10, View C).
6. Crimp the stripped section of the wire.
7. Remove the terminal from the crimping tool.
8. Push the wire seal into the terminal (Figure E–10, View D). The second crimp will wrap around the wire seal. This will seal the insulated area of wire.
9. Use a pair of needle nose pliers, if necessary, to squeeze the terminal wings together to fit in anvil “5.”
10. Crimp wire seal in anvil “5.”
11. Tug on terminal and be sure the crimp is tight.
12. Insert the terminal into the connector. The terminal will “click” into place and should not pull out.
13. Secure the secondary lock. Both sides of the connector must be latched.

D. Terminal Crimping Using Alternate Crimper Pliers J 35606 or J 38852

1. Place the wire seal onto the wire before stripping the wire (Figure E–10, View C).
2. Strip wire to 6.0 ± 0.25 mm (0.24 ± 0.01 inch).
3. Insert terminal into crimping tool J 35606 (Figure E–11, View A), opening marked 18–20.
4. Position the terminal so the crimp wings are pointing up from the bottom jaw of the crimper and are properly positioned.
5. Slightly close the crimping tool to hold the terminal steady.
6. Slide the wire seal to the edge of the insulation and insert the wire and seal into the terminal (Figure E–11, View B).

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Terminal Crimping Using Alternate Crimper Pliers J 35606 or J 38852 *(cont'd)*

7. Position the wire and seal and squeeze the crimping tool until it opens when released.
8. Tug on terminal to be sure the crimp is tight.
9. Insert terminal into connector. The terminal will "click" into place and should not pull out.
10. Relatch the secondary lock. Both sides of the connector must be latched.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

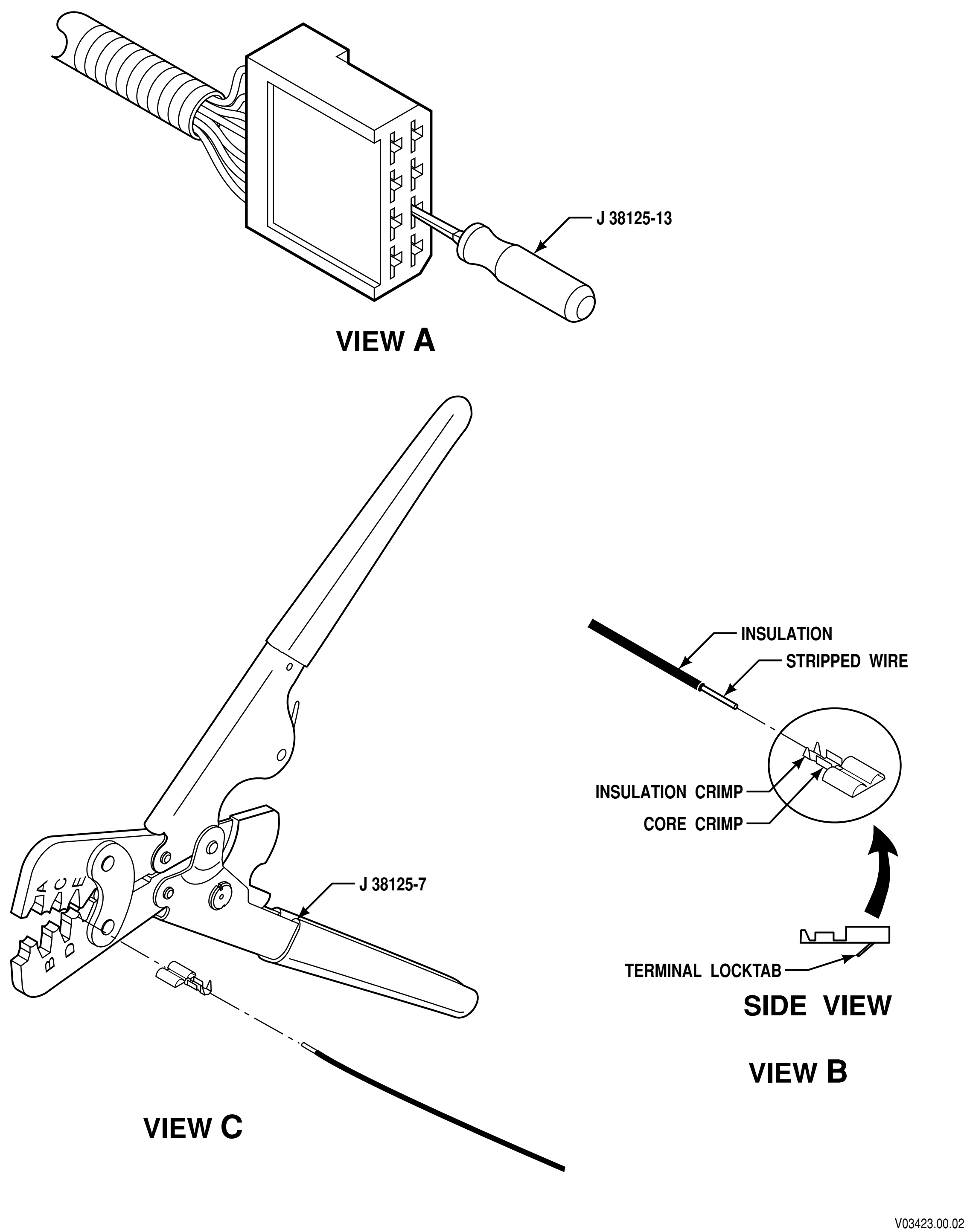


Figure E–12. Amp Products Connectors (8-Way RMR Device (Hand Lever))

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–11. AMP PRODUCTS CONNECTORS (8-WAY RMR DEVICE (HAND LEVER))

A. Connector/Terminal Repairs

Crimping Tool	J 38125-7
Wire Crimp	Anvil "E"
Insulation Crimp	Anvil "A"
Remover Tool	J 38125-13

Use	Description	Manufacturers P/N
8-Way RMR Device (Hand Lever)	8-Way Receptacle	163007-0
	Terminal (Socket)	42100-2

B. Terminal Removal

1. Insert removal tool J 38125-13 into the small notch at the front of the connector to release the terminal locktab (Figure E–12, View A).
2. Pull the terminal and wire out the back of the connector.
3. If replacing terminal, cut terminal between core and insulation crimp (this minimizes wire loss).

C. Terminal Crimping

1. Strip wire to approximately 4.0 ± 0.25 mm (0.16 ± 0.01 inch) (Figure E–12, View B).
2. Place new terminal onto crimping tool J 38125-7, anvil "E" (Figure E–12, View C).
3. Slightly close the crimping tool to hold the terminal steady.
4. Insert the wire so that the stripped portion of the wire is in the core crimp area and the insulated portion of the wire is in the insulation crimping area.
5. Crimp the stripped section of the wire (Figure E–12, View B).
6. Remove the terminal from the crimping tool.
7. Use a pair of needle nose pliers, if necessary, to start the bend on the insulation crimp wings.
8. Crimp the insulated section of the wire using anvil "A" of the crimpers (Figure E–9, View C).
9. Remove the terminal from the crimping tool.
10. Tug on the terminal to make sure the crimp is tight.
11. Insert the terminal into the connector. The terminal will "click" into place and should not pull out.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

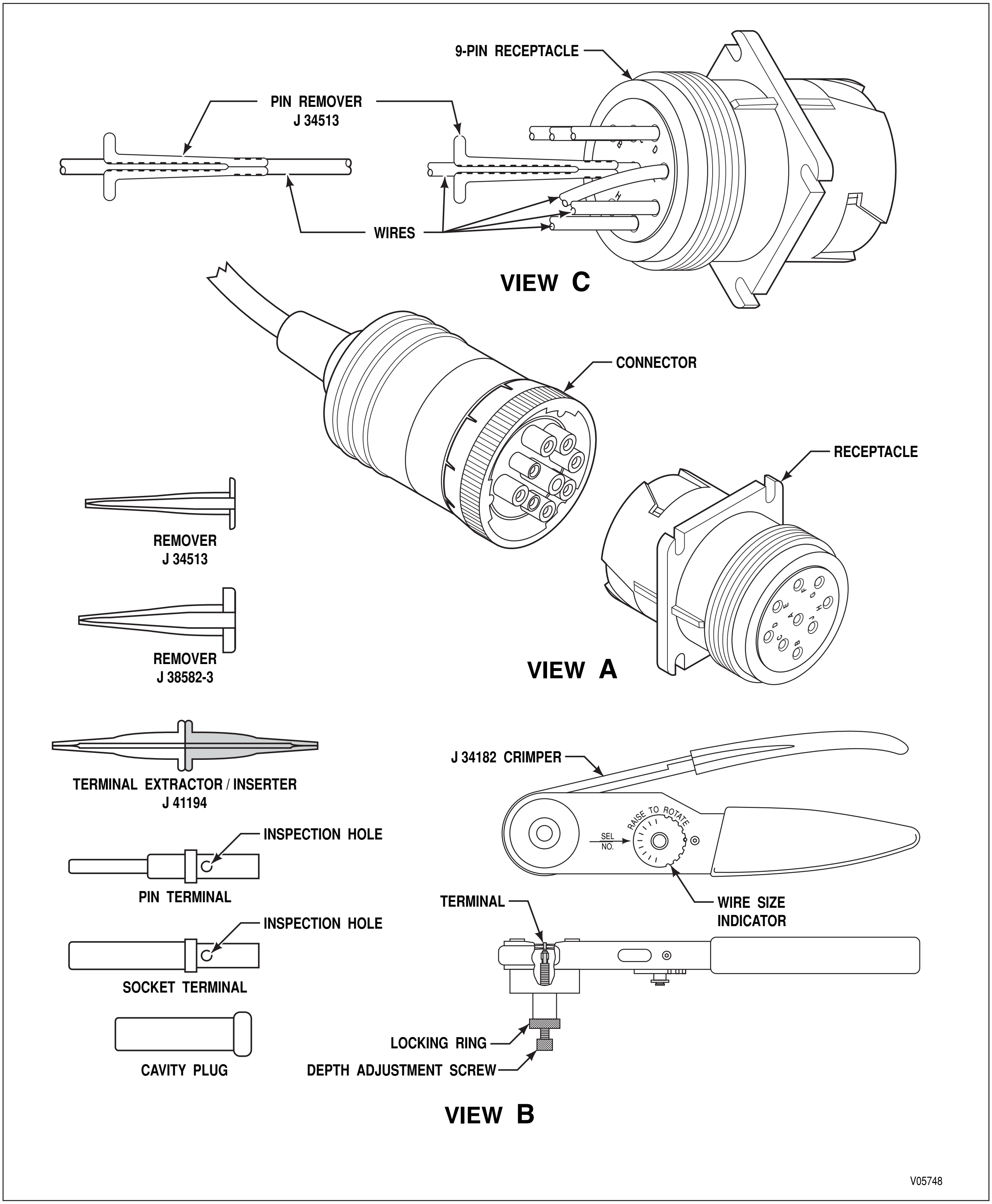


Figure E–13. Deutsch IPD/ECD Connectors (9-Way Optional Diagnostic Tool Connector)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–12. DEUTSCH IPD/ECD CONNECTORS (J1939 DIAGNOSTIC DATA LINK 9-WAY DIAGNOSTIC TOOL CONNECTOR)

A. Connector/Terminal Repairs

Required Tools

Crimper Tool	J 34182
Extractor/Inserter Tool	J 41194 (18 GA ECD Bulkhead)
Remover Tool Set	J 34513
Remover Tool (Diagnostic Tool Connector)	J 38528-3 (12–14 GA)

Use	Description	St. Clair P/N	Manufacturers P/N
J1939 Diagnostic Link (9-way Diagnostic Tool Connector)	Kit, J1939 9-Way Diagnostic Link Receptacle	300217	
	Connector, 9-Way	300267	HD10-9-1939P
	Contact, Pin	300007	0460-202-1631
	Contact, Pin Extract	300273	0460-247-1631
	Seal Plug	300000	114017
	Strain Relief	300269	HD18
	Cap, Connector	300268	HDC16-6

***NOTE:** If difficulty is encountered in removing or installing the plug backshell, insert the plug into the receptacle, but do not lock it into place, and loosen the backshell.*

B. Terminal Removal (Figure E–13, View A)

***NOTE:** When using remover/inserter tool J 41194, take care not to break the tip of the tool. Lay the wire in the widest part of the wire slot and work toward the tool tip.*

1. Loosen and slide the backshell along the convolute conduit.
2. Remove the convolute conduit from the base of the backshell follower. Peel enough conduit from the harness to allow working access.
3. Slide the backshell follower clear of the connector housing.
4. Remove as much tape wrap as necessary to allow working access.
5. Fully insert the proper remover/extractor tool into the back of the connector until it releases the terminal.
6. Pull the terminal, wire, and tool out the back of the connector.
7. If replacing the terminal, cut the wire through the middle of the terminal crimp (this minimizes wire loss).

C. Terminal Crimping (Figure E–13, View B)

1. Strip approximately 6–8 mm (0.236–0.315 inch) of insulation from the wire.
2. Set the crimping tool wire size to number 18. Tot set the wire size, remove the retainer pin. Lift and rotate the indicator until the number 12 is aligned with the SEL NO arrow. Reinstall the retainer pin.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping (Figure E–9, View B) *(cont'd)*

3. Insert the contact end of the terminal into crimping tool J 34182. To adjust the crimping tool depth, loosen the locking ring until the depth adjusting screw is free. Turn the adjusting screw until the top of the terminal is just above flush with the top of the crimping hole (the crimp jaws will contact the middle of the terminal barrel). Tighten the locking ring to retain the adjustment.
4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.5-1.0 mm or 0.02-0.04 inch) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool handle until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to ensure the crimp is tight.
8. Install a 25 mm (one inch) long piece of heat shrink tubing over the wire insulation just behind the terminal. Apply heat to shrink and lock tubing to the insulation.

D. Terminal Insertion (ECD Bulkhead)

1. Insert the terminal and attached wire through the proper hole in the grommet.
2. Push on the terminal and wire until the terminal clicks into position. Pull gently on the wire to be sure that the terminal is fully seated.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

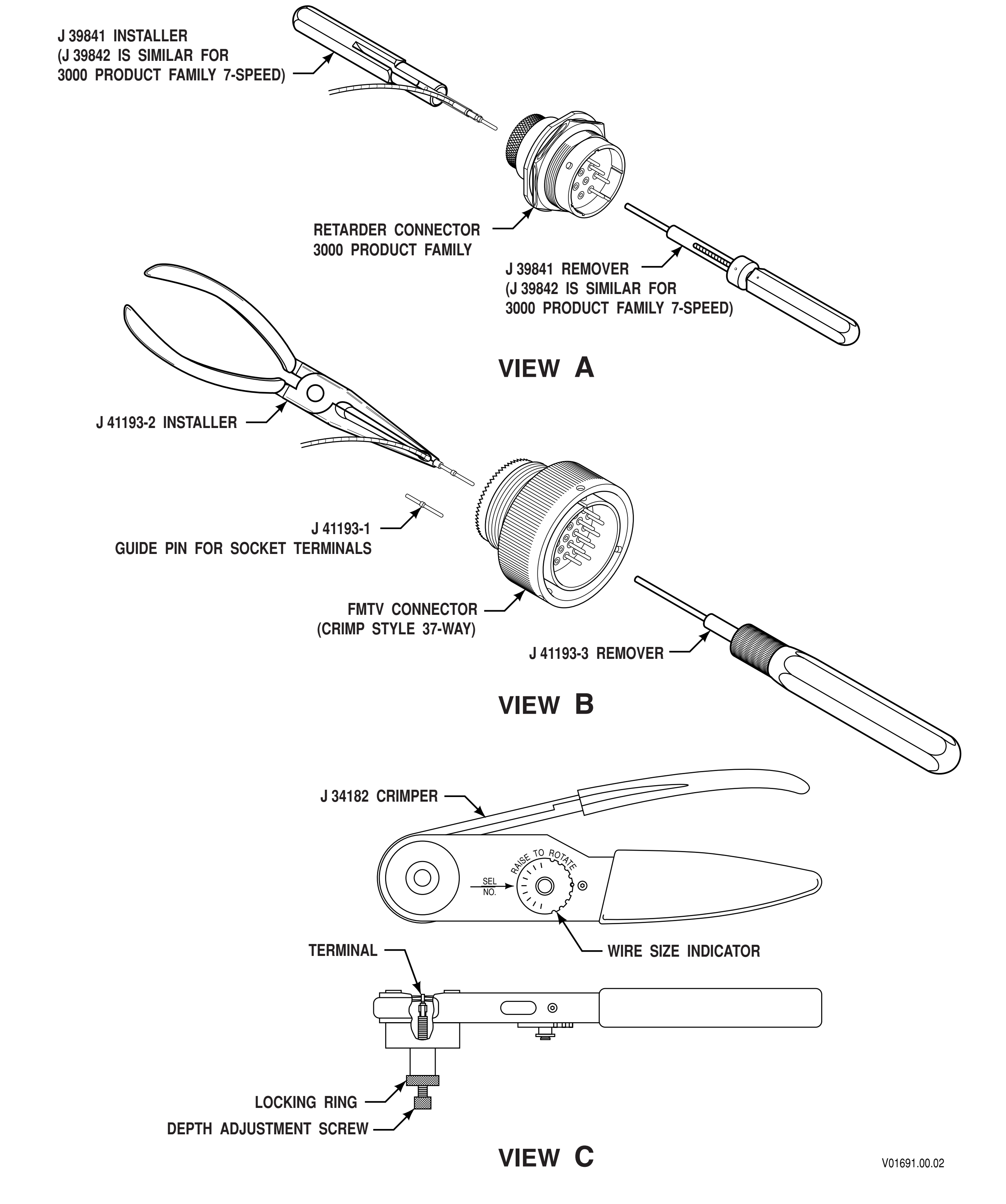


Figure E–14. ITT Cannon Connectors—Crimped (Bulkhead; 6-Way Transfer Case)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–13. ITT CANNON CONNECTORS — CRIMPED (BULKHEAD 6-WAY TRANSFER CASE)

A. Connector/Terminal Repair

Crimping Tool	
Connector Repair Kit (FMTV)	J 34182
Guide Pin	J 41193-1
Insertion Tool	J 41193-2
Terminal Remover	J 41193-3
Terminal Remover/Installer (3000 7-Speed T-Case Connector)	J 39842

Use	Description	Manufacturers P/N
3000 Product Family FMTV	37-Way Plug Assembly	CA3106E28-21P-B
	37-Way Receptacle Assembly	CA3100E28-21S-B
3000 Product Family Transfer Case	6-Way Plug Assembly	KPSE06E10-6S
	Terminal (Socket)	031-9174-004
	Cavity Plug	225-0070-000
	6-Way Receptacle Assembly	KPSE07E10-6P
	Terminal (Pin)	030-9173-006
	Cavity Plug	225-0070-000

B. Terminal Removal (Figure E–14, View A and B)

1. Select the remover tool for the plug or receptacle that is being repaired.
2. For the FMTV connector, choose either the pin or socket terminal remover tip and lock it into the handle.
3. Place the tip of the remover tool over the pin or into the socket and push the contact/terminal out the rear of the connector using slow, even pressure.
4. Pull the wire and terminal out the back of the connector.
5. If replacing the terminal, cut the wire through the middle of the terminal crimp to minimize wire loss.

C. Terminal Crimping (Figure E–14, View C)

1. Strip approximately 6–8 mm (0.24–0.31 inch) of insulation from the wire.
2. Set the crimping tool wire size to number 18. To set the wire size, remove the retainer pin. Lift and rotate the indicator until 18 is aligned with the SEL NO. arrow. Reinstall the retainer pin.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping (Figure E–14, View C) *(cont'd)*

3. Insert the contact end of the terminal down into crimping tool J 34182. Adjust the crimping tool depth by loosening the locking ring until the depth adjusting screw is free and turning the adjusting screw until the wire end of the terminal is just above flush with the top of the crimping hole. The crimp jaws will now contact the middle of the terminal barrel. Tighten the lock ring to retain the adjustment.
4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.5–1.0 mm (0.020–0.040 inch)) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool handle until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to ensure the crimp is tight.

D. Terminal Insertion

1. Select the proper insertion tool for the connector or receptacle that is being reassembled.
2. Place the terminal and wire in the insertion tool (Figure E–14, View A and B).

NOTE: When installing a socket terminal for the FMTV plug, use the J 41193-1 guide pin.

3. Insert the terminal through the correct hole in the back of the connector and push until the terminal is seated. Remove the insertion tool. Check to see that the terminal is at the same height as other terminals. Tug on the wire at the rear of the connector to ensure that the terminal is locked in place.
4. Insert cavity plugs into all unused cavities.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

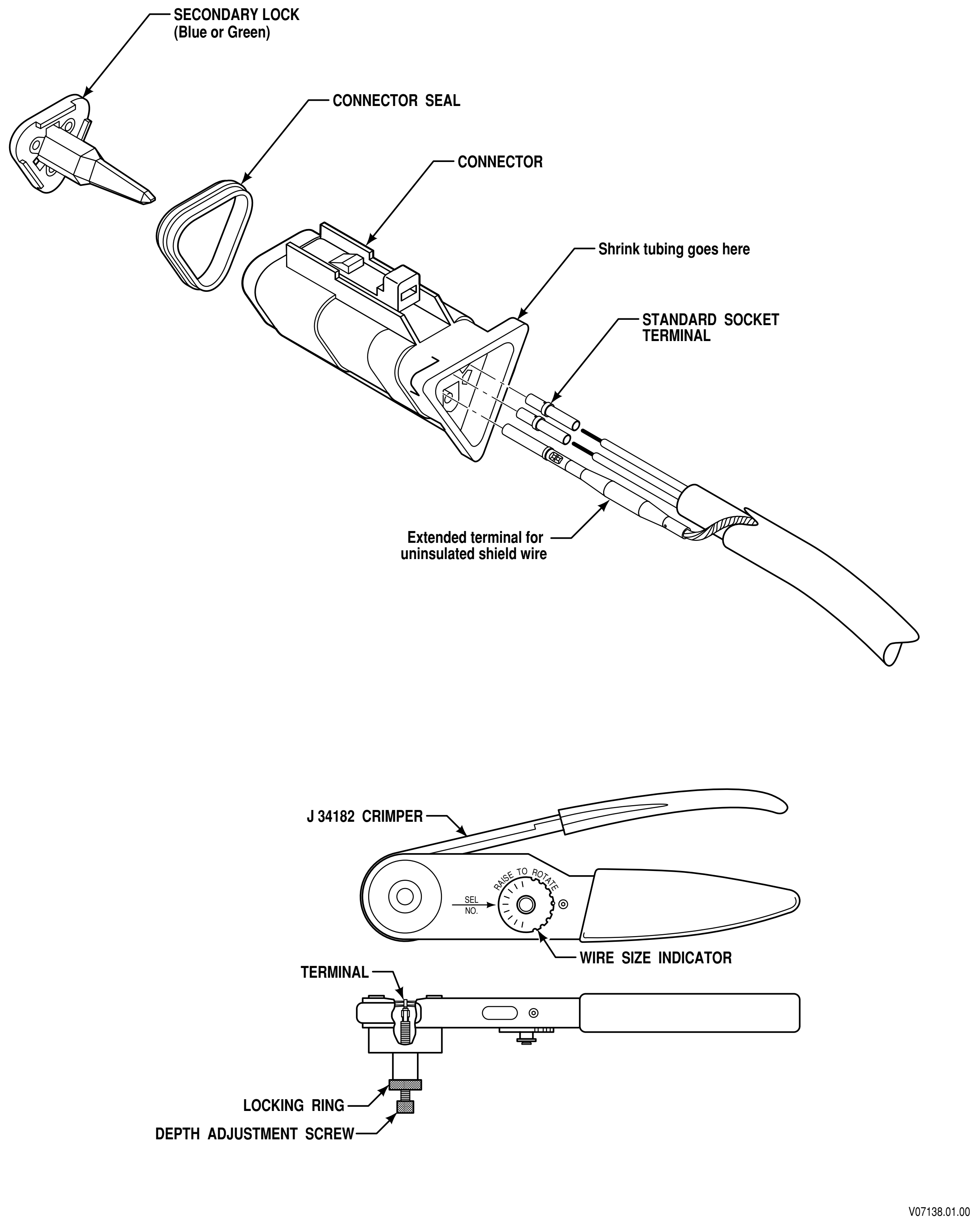


Figure E–15. Deutsch DT Series Connector (3-Way J1939 Interface)

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–14. DEUTSCH DT SERIES CONNECTORS (3-WAY J 1939 INTERFACE)

A. Connector/Terminal Repairs

Crimping Tool J 34182

Use	Description	St. Clair P/N	Manufacturers P/N
J1939 Interface, Plug	Kit, J1939, 3-way Plug	300283	
(Typically on backbone side)	Connector, Plug, 3-way	300206	DT06-3S-EP11
	Wedgelock, Plug	300275	W3S-P012
	Contact, Socket #16	300005	0462-201-1631
	Contact, Extended Socket	300035	0462-221-1631
	Heat Shrink	300274	ATUM-3⁄4-0
J1939 Interface, Receptacle	Kit, J1939, 3-way Receptacle	300282	
(Typically on module side)	Connector, Recpt, 3-way	300270	DT06-3P-EE01
	Wedgelock, Receptacle	300271	W3P
	Contact, Pin #16	300007	0462-202-1631
	Contact, Extended Pin	300273	0462-247-1631
	Heat Shrink	300274	ATUM-3⁄4-0
	Resistor (optional)	300272	DT06-3S-P006

B. Terminal Removal (Figure E–15)

1. Use a small-bladed screwdriver to remove the secondary lock that holds the terminals in place.
2. Use a sharp knife to carefully remove the shrink tubing from the rear of the connector plug.
3. Use a small screwdriver to release the locking lever from all of the terminals. Pull the wire and terminal out of the rear of the connector.
4. Slide a new piece of shrink tubing over the removed terminals an onto the cable.
5. If replacing the terminal, cut the wire through the middle of the terminal. Pull the wire and terminal out the rear of the connector.

C. Terminal Crimping (Figure E–15)

1. Stripe 6–8 mm (0.24–0.31 inch) of insulation from the wire. There is no insulation on the shield wire.
2. Set the crimping tool wire size to number 18. To set the wire size, remove the retainer pin. Lift and rotate the indicator until 18 is aligned with the SEL NO. arrow. Reinstall the retainer pin.
3. Insert the contact end of the terminal into crimping tool J 34182. Adjust the crimping tool depth by loosening the locking ring until the depth adjusting screw is free. Turn the adjusting screw until the wire end of the terminal is just above flush with the top of the crimping hole. The depth adjustment screw will have to be backed out enough to accept the extended shield terminal. The crimp jaws will now contact the middle of the terminal barrel. Tighten the locking ring to maintain the adjustment.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping (Figure E–15) *(cont'd)*

4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.5–1.0 mm or 0.02–0.04 inch) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to be sure the crimp is tight.

D. Terminal Insertion

1. Slide the wire with the crimped terminal attached into the rear of the connector.
2. Push the terminal and wire into the connector until it locks into position. (Figure E–15). Check the front of the connector to see that the terminal is at the same height as the other terminals. Tug on the wire at the rear of the connector to be sure that the terminal is locked in place.
3. Insert the wedge lock to hold the terminal in place. Slide the sealing plug back into place at the rear of the connector.
4. Slide the shrink tubing over the raised area at the rear of the connector. Use a heat gun to shrink the tubing into position over the connector and cable.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–15. REPAIR OF A BROKEN WIRE WITH IN-LINE BUTT SPLICE

A. Connector Check Before Repair

NOTE: Before repairing or replacing wiring harness, sensor, solenoid, switch, or TCM as indicated for a diagnosed problem, follow the procedure below:

1. Disconnect the connector or connectors associated with the problem and inspect for:
   - Bent terminals
   - Broken terminals
   - Dirty terminals
   - Pushed back terminals
   - Missing terminals
   - Condition of mating tabs
   - Condition of mating terminals

   Ensure that terminals are secure in the connector. Clean, straighten, or replace parts as required.

2. Reconnect all previous unmated connectors. Ensure connectors are fully inserted or twisted until they lock in place. Connectors with locking tabs make an audible "click" when the lock is engaged.

3. If trouble recurs after starting the vehicle, follow proper repair procedures for trouble code or complaint.

4. If trouble does not recur, or if the correct repairs and/or replacements have been made, the problem should be corrected.

B. Special Tools

- Heat Gun, J 25070 or equivalent
- Crimping Tool for Pre-insulated Crimp J 38125-8 (Figure E–16)

NOTE: Use crimping anvils "F" and "G."

- Wire Stripper, J 35615
- Splices P/N 23046604 14–16 AWG
- Splices P/N 23046605 18–22 AWG

NOTE: Each splice must be properly crimped and then heated to shrink the covering to protect and insulate the splice. Insulation piercing splice clips should not be used.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

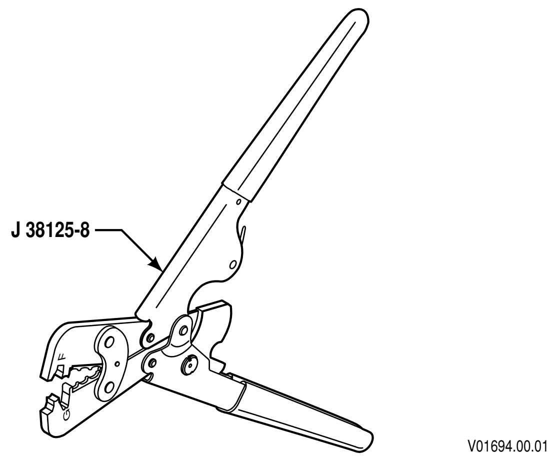


Figure E–16. Crimper J 38125-8

C. Straight Lead Repair Procedure

1. Locate damaged wire.
2. Remove insulation 8.0 mm (0.3 inch).
3. Insert one wire into crimp barrel and crimp.
4. Insert other wire into crimp barrel and crimp.
5. Pull on connection to ensure crimping integrity.
6. Heat splice with heat gun until covering shrinks and adhesive flows from under the covering.
7. The splice is now sealed and insulated. Electrical tape should not be used and is not necessary.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

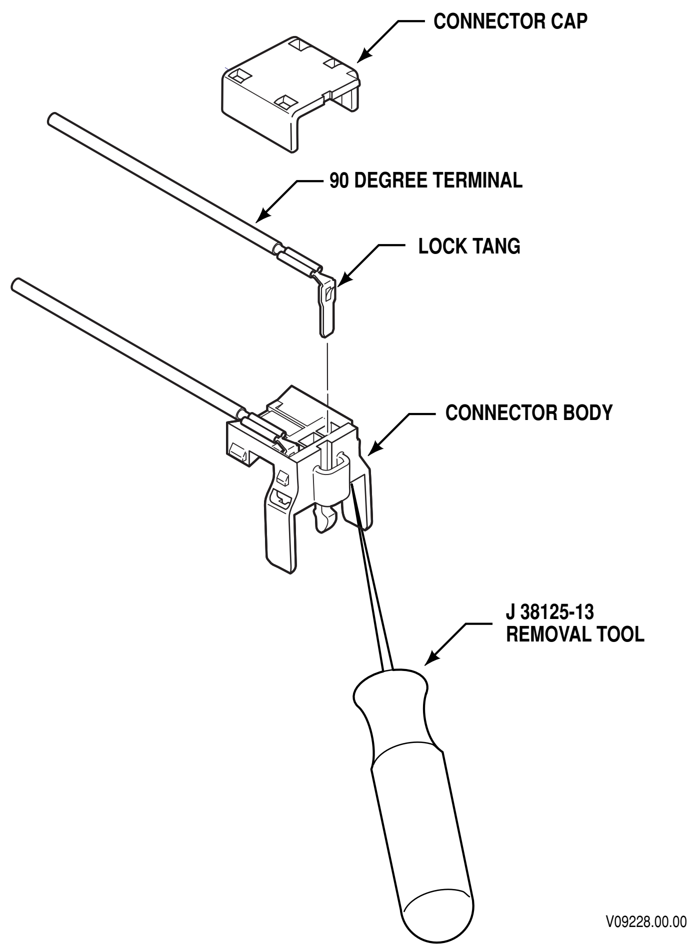


Figure E–17. AFL Automotive 2-Way, 90 Degrees Solenoid Connector

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

E–16. AFL AUTOMOTIVE 2-WAY, 90 DEGREE SOLENOID CONNECTOR

A. Connector/Terminal Repairs

Crimping Tool	J 38125-8
Remover Tool	J 38125-13
Alternate Remover Tool	J 38125-12A

Use	Description	Manufacturers P/N
PCS Solenoid Connector	Connector, 2-Way	R-61992-001
	Cap, Connector	R-62189-001
	Terminal with 0.5 m (20 inches) wire	R-61970-001
	In-Line Splice Connector	23046605

Read disassembly process/procedure thoroughly before beginning disassembly.

B. Terminal Removal

1. Separate the 2-way connector from the solenoid (Figure E–17).
2. Remove the connector cap from the connector body.
3. Make a note for reassembly purposes of which wire (number) goes into which terminal cavity in the connector body.
4. Insert the metal blade of J 38125-13 or J 38125-12A remover into the bottom of the connector where terminal blade protrudes from the connector body.
5. Apply pressure to the terminal blade. Lift selected terminal from connector body when lock tang releases.
6. Repeat Steps 4 and 5 for the remaining terminal leads.

C. Terminal Crimping

Crimping of AFL 2-way, 90 degree terminals is not permitted. Perform repairs using a pre-crimped, 90 degree terminal and wire assembly. New terminal/wire leads are serviced as follows:

1. Locate damaged wire in terminal wiring harness.
2. Identify a location to cut the damaged wire where the butt splice connector(s) will not interfere with re-assembly and re-installation of the hydraulic control module.
3. Cut wire and strip 8.0 mm (0.3 inch) of insulation from the end. Be careful not to nick or cut wire strands.
4. Insert the stripped end of the wire into the crimp barrel and crimp.
5. Cut the 90 degree terminal and wire assembly to an appropriate length that will allow the crimped wire to securely fit into the plastic channel of the internal wiring harness. Strip 8.0 mm (0.3 inch) of installation from the end of wire, being careful no to nick or cut wire strands.
6. Insert the stripped end of the wire into the other end of the crimp barrel and crimp.
7. Pull on connector to be sure crimp is tight.
8. Heat splice with heat gun until covering shrinks and adhesive flows from under the covering.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping *(cont'd)*

9. The splice is now sealed and insulated. Electrical tape **should not be used** and is not necessary.
10. Complete terminal installation of the 2-way connector as follows:
    a. Position proper terminal into the correct location in connector body. Push terminal and wire into connector until it locks in place. Push lightly on the terminal blade to be sure the terminal is seated.
    b. After both terminals have been inserted, install connector cap onto connector body and push lightly on cap until it locks in place.
    c. Reconnect the solenoid connector to the appropriate solenoid.

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

CONNECTOR	MFG. P/N	PART NAME	SCT Part #	SCT Kit #	MANUFACTURER	CONFIG	MATING P/N	MFG. P/N	MATING PART NAME
TCM, 80-Way, Bolt Assist	R-61991-001	Spacer, 80F	300243	300276	AFL Automotive	1-PC/TCM			TCM Header
		Seal, Industrial							
		Connector Body, 80F Bolt							
		Bolt							
		Seal, Bolt							
		Retainer, Bolt							
		Grommet, Wire Seal							
	E-4542	Grommet, Retainer	300244						
	E-4550	Cover A, Wire Dress	300245						
	E-4551	Cover B, Wire Dress	300246						
	33001-0004	Terminal	300247		Molex				
	12034413	Plug, Cavity Seal	300008		Delphi				
TCM, 80-Way, Bolt-Assist, Dir “A” 90 Degree Wire Dress	R-61991-001	Spacer, 80F	300243	300276	AFL Automotive	1-PC/TCM			TCM Header
		Seal, Industrial							
		Connector Body, 80F Bolt							
		Bolt							
		Seal, Bolt							
		Retainer, Bolt							
		Grommet, Wire Seal							
	E-4542	Grommet, Retainer	300244						
	E-6206-002	Cover, Wire Dress, Dir A							
	E-4555	Cover, Bottom							
	33001-0004	Terminal	300247		Molex				
	12034413	Plug, Cavity Seal	300008		Delphi				
TCM, 80-Way, Bolt-Assist, Dir “B” 90 Degree Wire Dress	R-61991-001	Spacer, 80F	300243	300276	AFL Automotive	1-PC/TCM			TCM Header
		Seal, Industrial							
		Connector Body, 80F Bolt							
		Bolt							
		Seal, Bolt							
		Retainer, Bolt							
		Grommet, Wire Seal							
	E-4542	Grommet, Retainer	300244						
	E-6206-001	Cover, Wire Dress, Dir B							
	E-4555	Cover, Bottom							
	33001-0004	Terminal	300247		Molex				
	12034413	Plug, Cavity Seal	300008		Delphi				

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

CONNECTOR	MFG. P/N	PART NAME	SCT Part #	SCT Kit #	MANUFACTURER	CONFIG	MATING P/N	MFG. P/N	MATING PART NAME
TCM, 80-Way, Cam-Assist “A” Dir	R-62004-001	Spacer, 80F			AFL Automotive	1-PC/TCM			TCM Header
		Seal, Industrial							
		Connector Body, 80F Bolt							
		Cam-Left							
		Cam, Right							
		Handle, Cam							
		Grommet, Wire Seal							
	E-4542	Grommet, Retainer	300244						
	E-4555	Cover, Bottom							
	E-4589	Cover, Wire Dress							
		CPA							
TCM, 80-Way, Cam-Assist “B” Dir	R-62004-002	Spacer, 80F			AFL Automotive	1-PC/TCM			TCM Header
		Seal, Industrial							
		Connector Body, 80F Bolt							
		Cam-Left							
		Cam, Right							
		Handle, Cam							
		Grommet, Wire Seal							
	E-4542	Grommet, Retainer	300244						
	E-4555	Cover, Bottom							
	E-4588	Cover, Wire Dress							
		CPA							
TCM, 80-Way, 80W, All	E-4540	Spacer, 80F			St. Clair	1-PC/TCM			TCM Header
	E-4539	Seal, Interfacial							
Bolt Kit, TCM, 80W, All		Bolt	300234	300234	St. Clair	1-PC/TCM			TCM Header
		Seal, Bolt							
		Retainer, Bolt							
Wire Cover Kit, 80W Bolt		Cover A, Wire Dress	300235	300235	St. Clair	1-PC/TCM			TCM Header
		Cover B, Wire Dress							
Wire Cover Kit, 80W Bolt, Dir “A” 90 Degree		Cover, Wire Dress, Dir A	300236	300236	St. Clair	1-PC/TCM			TCM Header
		Cover, Bottom							
Wire Cover Kit, 80W Bolt, Dir “A” Dir		Cover, Wire Dress, Dir A	300237	300237	St. Clair	1-PC/TCM			TCM Header
		Cover, Bottom							
Wire Cover Kit, 80W CAM “A” Dir		Cover, Bottom	300238	300238	St. Clair	1-PC/TCM			TCM Header
		Cover, Wire Dress							
		CPA							

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

CONNECTOR	MFG. P/N	PART NAME	SCT Part #	SCT Kit #	MANUFACTURER	CONFIG	MATING P/N	MFG. P/N	MATING PART NAME
Wire Cover Kit, 80W Cam "B" Dir		Cover, Bottom	300239	300239	St. Clair	1-PC/TCM			
		Cover, Wire Dress							
		CPA							
TRANS, 20F, Bolt-Assist	R-62183-001	Spacer, 20F	300252	300278	AFL Automotive	1-PC/TCM	R-62000-001-D	R-62000-001-D	Connector Assy, 20M, Pass-Thru
		Seal, Industrial							
		Connector Body, 20F							
		Bolt							
		Seal, Bolt							
		Retainer, Bolt							
		Grommet, Wire Seal							
	E-4566	Grommet, Retainer	300253						
	E-4569	Cover, Wire Dress	300254						
	E-4570	Clip, Convolute	300251						
TRANS, 20F, Bolt-Assist	E-4564	Spacer, 20F			St. Clair	1-PC/TCM			Connector Assy, 20M, Pass-Thru
	E-4562	Seal, INterfacial							
Bolt Kit, TRANS, 20W		Bolt		300241	St. Clair	1-PC/TCM			Connector Assy, 20M, Pass-Thru
		Seal, Bolt							
		Retainer, Bolt							
Wire Cover Kit, 20W		Cover, Wire Dress		300242	St. Clair	1-PC/TCM			Connector Assy, 20M, Pass-Thru
		Clip, Convolute							
NE, NO, NT	15490464	Connector Assy, GT150, Half Shroud	300260	300227	Delphi	1-PC/COMP			Speed Sensors Engine, Turbine, Output
	15496486	CPA Lock, Beige/Natural	300261						
	15326267	Terminal, F GT150	300262						
	15305351	Seal Assy, Cable 1-Way, Yellow	300263						
	15358890	Convolute Capture/TPA Lock, Black	300264						
TPS	12015793	Connector, 3-Way			Delphi	1-PC/COMP			TPS Header
	12089040	Terminal, Pin							
	12089444	Seal- Wire Type, Silicone							
CAN Shift Sel, 90-Degree	12191065	Connector, 16F	300255	300278	Delphi	1-PC/COMP			CAN Shift Selector
	12191066	Seal, 16-Way Connector, Orange	300256						
	12191067	TPA Retainer, 16F	300257						
	12191068	Strain Relief, 16F 90-Degree	300258						
	12084912	Terminal, 0.8mm Wire	300087						
	12129557	Cavity Plug	300105						
	12177289	CPA Lock M/P, Red	300114						

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

CONNECTOR	MFG. P/N	PART NAME	SCT Part #	SCT Kit #	MANUFACTURER	CONFIG	MATING P/N	MFG. P/N	MATING PART NAME
CAN Shift Sel, 180-Degree	12191065	Connector, 16F	300255	300280	Delphi	1-PC/COMP			CAN Shift Selector
	12191066	Seal, 16-Way Connector, Orange	300256						
	12191067	TPA Retainer, 16F	300257						
	15460298	Strain Relief, 16F 180-Degree	300259						
	12084912	Terminal, 0.8mm Wire	300087						
	12129557	Cavity Plug	300105						
	12177289	CPA Lock M/P, Red	300114						
Strip SS	12160280	Conn 20F Mic/P 100W Gray			Delphi	1-PC/COMP	12160542	12160542	Conn 20M Mic/P 100W Gray
	15304882	Cable Seal, 14F Gray					12110693	12110693	Cable Assist/Seal, 20M Green
	12160494	Lock, Secondary 20F Green					12191176	12191176	Lock Assist/Seal, 20M Green
	12084912	Terminal, Socket 100W					12060551	12060551	Terminal, Pin 100W
	12129557	Cavity Plug, 100W					12129557	12129557	Cavity Plug, 100W
	12176394	Conduit Clip, 13mm Black					12176394	12176394	Conduit Clip, 13mm Black
DTC, 9-Pin	HD10-9-1939P	Connector, Rec., 9-Way	300267	300217	Delphi	1-PC/COMP			Diagnostic Tool
	0460-202-1631	Contact, Pin	300007						
	0460-247-1631	Contact, Pin Extended	300273						
	114017	Sealing Plug	300000						
	HD18	Strain Relief	300269						
	HDC16-6	Cap, Connector	300268						
J1939	0462-201-1631	Contact, Socket #16	300005	300283	Deutsch IPD	1-PC/COMP	29511369	0460-202-1631	Contact, Pin #18
	0462-221-1631	Contact, Extended Socket	300035					0460-247-1631	Contact, Pin Extended
	23-000-13	Cable, J1939 Data Bus							
	DT06-3S-EP11	Connector, Plug, 3-Way	300206		Deutsch IPD			DT04-3P-EE01	Connector, Rec., 3-Way
	W3S-P012	Wedgelock, Plug (Green)	300275					W3P	Wedgelock, Receptacle
RFT	13513314	Connector Assy, 2F GT150 Half Shroud			Delphi	1-PC/COMP	29542490	R-62184-001-A	Retarder Solenoid
	15326267	Terminal, F GT150	300262						
	15496486	CPA Lock, Beige/Natural	300261						
	15305351	Seal Assy, Cable 1-Way Yellow	300263						
	15358890	Convolute Capture/TPA Lock, Black	300264						
RMR	12015795	Connector, 3-Way			Delphi	1-PC/COMP	12015092	12015092	Connector, Shroud 3-Way
	12089040	Terminal, Pin					12089188	12089188	Terminal, Socket
	12089444	Seal, Wire Type, Silicone					12089444	12089444	Seal, Wire Type, Silicone

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

CONNECTOR	MFG. P/N	PART NAME	SCT Part #	SCT Kit #	MANUFACTURER	CONFIG	MATING P/N	MFG. P/N	MATING PART NAME
RMRX	12015092	Connector, Shroud 3-Way			Delphi	Resist Mod	12015795	12015795	Connector, 3-Way
	12089188	Terminal, Socket					12089040	12089040	Terminal, Pin
	12089444	Seal, Wire Type, Silicone					12089444	12089444	Seal, Wire Type, Silicone
RTEMP	12162852	Connector, 2F M/P 150.2, Black			Delphi	1-PC/COMP	12015792	12015792	Retarder Temp Sensor
	12124075	Terminal, F M/P 150.2							
RTDR Air Sol	15326143	Connector Assy, 2F M/P 150.2, Black			Delphi	1-PC/COMP	12084669		Accumulator Solenoid
	12124075	Terminal, F GT160							
STANDOFF					AFL Automotive	Internal			Control Module
	19134000	Seal, Interfacial			Minnesota				
	12092125	O-ring Seal			Parker Seal				
PCS Sol	R-61992-001	Connector, 2F			AFL Automotive	Internal			PCS Solenoid
	R-62189-001	Cap, Connector							
Connector Assembly, 2M, 90 Sol Kit	29544184	Connector, 2F			Allison Transmission PDC	Internal			PCS Solenoid
		Cap, Connector							
		Terminal with 0.5 meter wire							
		In-line Splice connection							
SS1 Sol	29541590	Connector, 2W Solenoid			Delphi	Internal			Solenoid SS1
	12124639	Terminal, 280 Series Socket							
SS2 Sol, 7-Speed	29541590	Connector, 2W Solenoid			Delphi	Internal			Solenoid SS2, 7-Speed
	12124639	Terminal, 280 Series Socket							
PS1	12110139	Connector, 2-Way, PS1			Delphi	Internal			Pressure Switch PS1
	12066337	Terminal, 280 Series Pin							
OLS	12064758	3-Pin Plug			Delphi	Internal			OiL Level Sensor
	12047767	Terminal, Socket							
	12047783	Secondary Lock, TPA							
NT1	15490953	Connector, 2-Way			Delphi	Internal			Turbine Speed Sensor (3000)
	12110236	Terminal, 150F							
OILT	12129691	Sump Temp Sensor			Phillips	Internal			Sump Temp Connector
TEMP	12047662	Connector, 2-Way			Delphi	Internal			Sensor, Temperature, Sump
	12047664	Lock, Secondary 20F Green							
	12047767	Terminal, Socket							
VIM, 18-Way	12040920	Connector Body, 18-Way			Delphi	1-PC/COMP			VIM Header Assy
	12040936	Seal, 15-Way							
	12110545	Strain Relief,308-Way							
	12129426	Bolt, 7mm Head Ext.							
	12034236	Retainer Clip, Bolt							
	12103881	Terminal, 150F							
	12034413	Cavity Plug, Metri-pack							

APPENDIX E—CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

CONNECTOR	MFG. P/N	PART NAME	SCT Part #	SCT Kit #	MANUFACTURER	CONFIG	MATING P/N	MFG. P/N	MATING PART NAME
VIM, 30-Way	12034397	Connector Body, 30-Way			Delphi	1-PC/COMP			VIM Header Assy
	12040879	Seal, 9-Way							
	12110546	Strain Relief, 18-Way							
	12129426	Bolt, 7mm Head Ext.							
	12034236	Retainer Clip, Bolt							
	12103881	Terminal, 150F							
	12034413	Cavity Plug, Metri-Pack							
XFER	KPSE06E10-6S	Connector Assy, Metri-Pack			ITT Cannon	1-PC/COMP		KPSE07E10-6P	Transfer Case

APPENDIX F—THROTTLE POSITION SENSOR ADJUSTMENT

A. Description of Operation *(Figure F–1)*

1. To properly communicate throttle position to the Transmission Control Module (TCM), the throttle position sensor must convert its mechanical movement to an electrical form the TCM can understand. To accomplish this, contacts move across a resistive strip inside the sensor which translates position into voltage (Figure F–1).

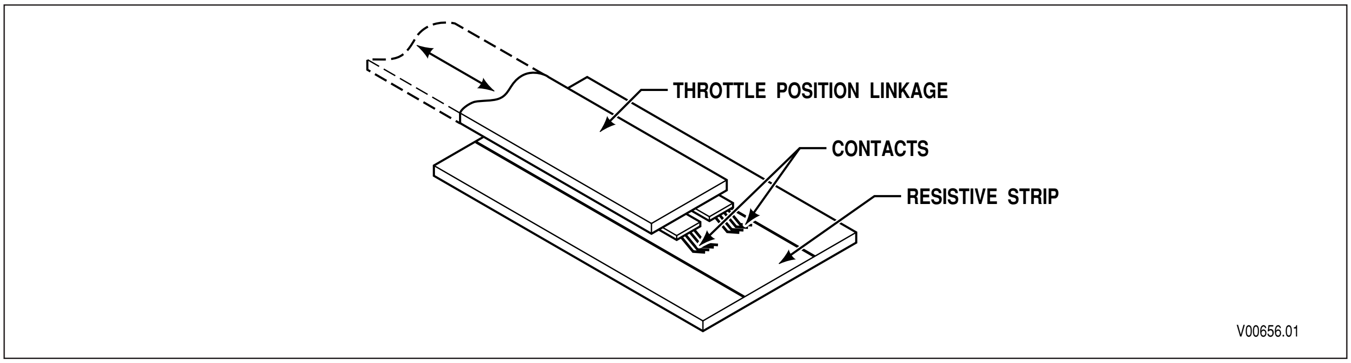


Figure F–1. Throttle Position to Voltage Conversion

2. Each position gives a different voltage. The TCM then converts this voltage into percent. Each millimeter of travel converts to approximately 0.110 volts. Figure F–2 diagrams the voltage and throttle movement relationship.

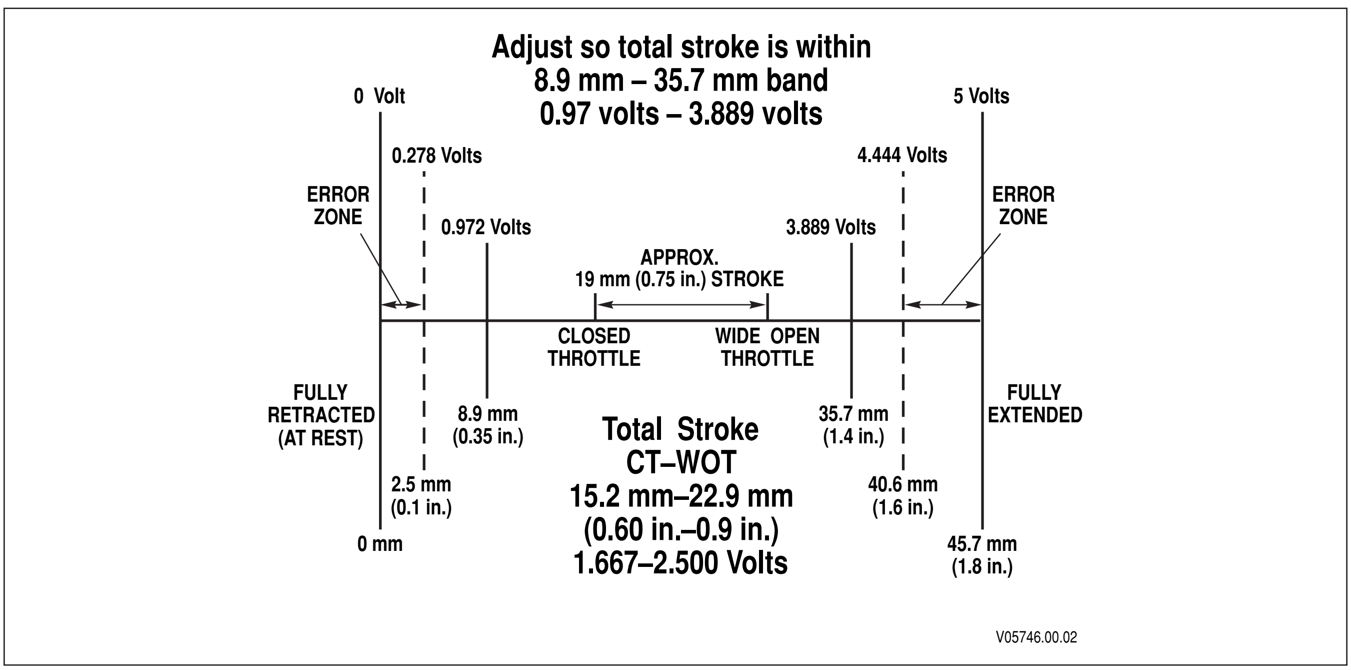


Figure F–2. Throttle Position Determination Diagram

3. Throttle percent is proportional to the amount of travel of the throttle position sensor (Table F–1). Therefore a small amount of travel corresponds to a low throttle percentage and a large amount of travel corresponds to a high throttle percentage (Table F–1).
4. The throttle position sensor (TPS) is self-calibrating within its normal range of operation. Each time the vehicle is started and the TCM is initialized, the idle position that is stored for closed throttle is increased from its previous lowest reading. Also, the wide open throttle position is reduced from its previous highest reading. Once the new position is read from the TPS, the idle and wide open

APPENDIX F—THROTTLE POSITION SENSOR ADJUSTMENT

throttle set points are continuously readjusted to the lowest and highest points, respectively. This compensates for fuel control system wear or previous mechanical adjustment. One area of particular concern is when the throttle sensor extends into the error zone. This indicates a TPS misadjustment to the TCM. and 100 percent throttle is assumed until readjustment is performed. Simply clearing the DTC will not resolve the situation; use the Allison DOC™ For PC–Service Tool to reset the TPS calibrations after a TPS adjustment.

B. Throttle Position Sensor (TPS) Adjustment

When properly installed by the equipment manufacturer (Figure F-3), the TPS should not require adjustment. Confirm that the throttle sensor is installed to manufacturer specifications before adjusting the throttle position sensor. The idle position should be approximately 8.9 mm or 0.97 volts or higher, and full throttle position should be approximately 35.7 mm or 3.889 volts or lower. The TPS is self-calibrating, meaning there is no optimum closed position or wide open position. As long as the travel is within the 8.5–35.7 mm range the TPS is set properly. A total stroke of 15.2–22.9 mm **must be maintained**. Watch the movement of the throttle sensor as the controls move it through its full stroke. Be sure there is no misalignment or obstruction to smooth movement through the full stroke. Make certain the idle and full throttle positions are not in the error zones (Figure F–2). The error zones occur when the idle position is less than 2.5 mm, or when the full throttle position is more than 40.6 mm. When idle or wide open throttle positions are in the error zones, the TCM will log a code. When a TPS code is logged, the TCM assumes a default throttle setting which will negatively affect shift quality.

NOTE: Use Test Harness J 41339 for measuring voltages.

Table F–1.

mm	Volts	mm	Volts
0	0	24	2.634
1	0.110	25	2.744
2	0.220	26	2.854
3	0.329	27	2.964
4	0.439	28	3.073
5	0.549	29	3.183
6	0.659	30	3.293
7	0.768	31	3.403
8	0.878	32	3.512
9	0.988	33	3.622
10	1.098	34	3.732
11	1.207	35	3.842
12	1.317	36	3.951
13	1.427	37	4.061
14	1.537	38	4.171
15	1.646	39	4.281
16	1.756	40	4.390
17	1.866	41	4.500
18	1.976	42	4.610
19	2.085	43	4.720
20	2.195	44	4.829
21	2.305	45	4.939
22	2.415	46	5.049
23	2.524		

APPENDIX F—THROTTLE POSITION SENSOR ADJUSTMENT

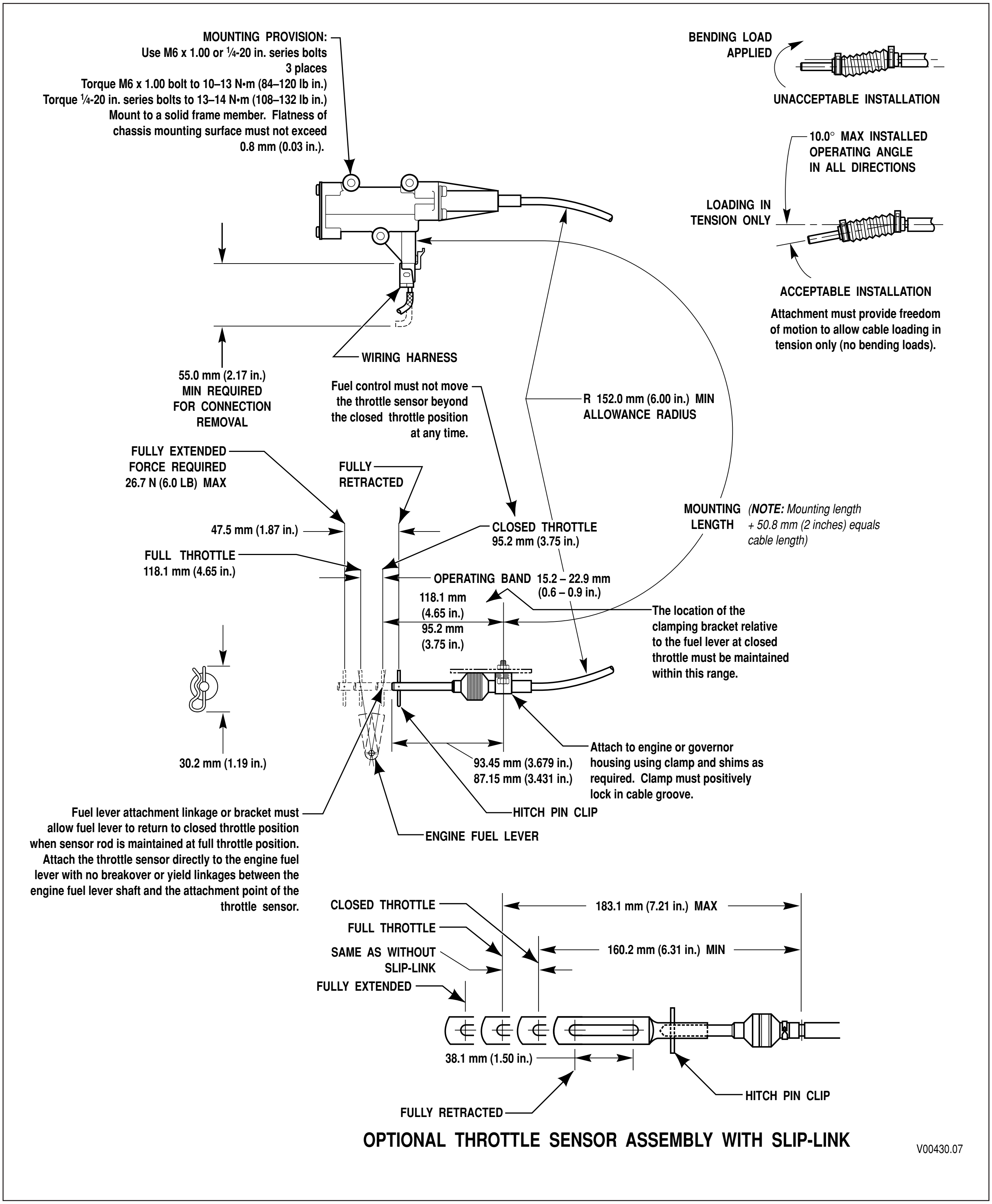


Figure F–3. Throttle Position Sensor Adjustment

APPENDIX F—THROTTLE POSITION SENSOR ADJUSTMENT

Allison Transmission only supplies the detail parts of these assemblies for both service requirements and support equipment requirements to OEMs and DOEMs. Here is the list of detail parts that are attached to the detail throttle position sensor to achieve the different configurations.

Configuration	Description	Part Number	Quality
Chassis-mounted with Slip-Link	Throttle Position Sensor x length	Various	1
	Slip-Link	29503631	1
Engine-mounted with Slip-Link	Throttle Position Sensor x length	Various	1
	Slip-Link	29503631	1
	Engine Bracket	29500824	1
	Grommet	29509441	3
	Ferrule	29509442	3
	0.250-20 x 2.250 long; bolt with nylon patch	25944294	3
Transmission-mounted (right or left) with Slip-Link	Throttle Position Sensor x length	Various	1
	Slip-Link	29503631	1
	Engine Bracket	29508371	1
	Grommet	29509441	3
	Ferrule	29509442	3
	0.250-20 x 2.250 long; bolt with nylon patch	2954494	3

The bolt for attaching the throttle sensor to the ferrules in engine and transmission brackets is torqued to 8–11 N·m (72–98 inch lbs).

APPENDIX G—WELDING ON VEHICLE/VEHICLE INTERFACE MODULE

G–1. WELDING ON VEHICLE

When frame or other welding is required on the vehicle, take the following precautions to protect the electronic control components:

1. Disconnect the wiring harness connectors at the transmission electronic control unit.
2. Disconnect the positive and negative battery connections, and any electronic control ground wires connected to the frame or chassis.
3. Cover electronic control components and wiring to protect them from hot sparks, etc.
4. Do not connect welding cables to electronic control components.

WARNING!	**Do not jump start a vehicle with arc welding equipment. Arc welding equipment's dangerously high currents and voltages cannot be reduced to safe levels.**

G–2. VEHICLE INTERFACE MODULE

The Allison Vehicle Interface Module (VIM) containing all Allison system relays and fuses must be used as the interface to all vehicle wiring. Refer to Figure G–2 for VIM component location and pin-out. To close an open VIM, tighten the bolts in the numerical order shown in Figure G–1 to provide a sealed, water-tight box. Torque the bolts to 5–8 N·m (4–6 lb ft).

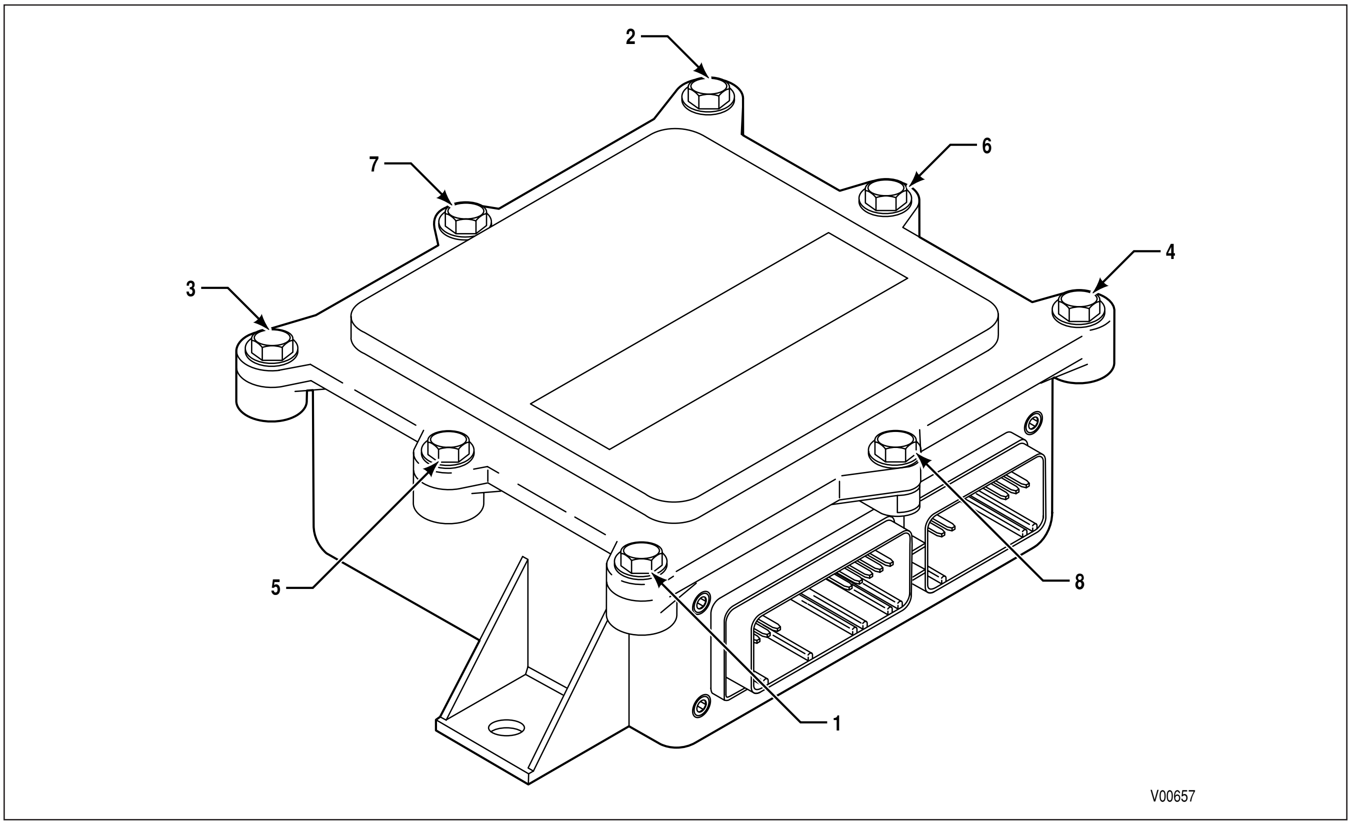


Figure G–1. Vehicle Interface Module (VIM)

APPENDIX G—WELDING ON VEHICLE/VEHICLE INTERFACE MODULE

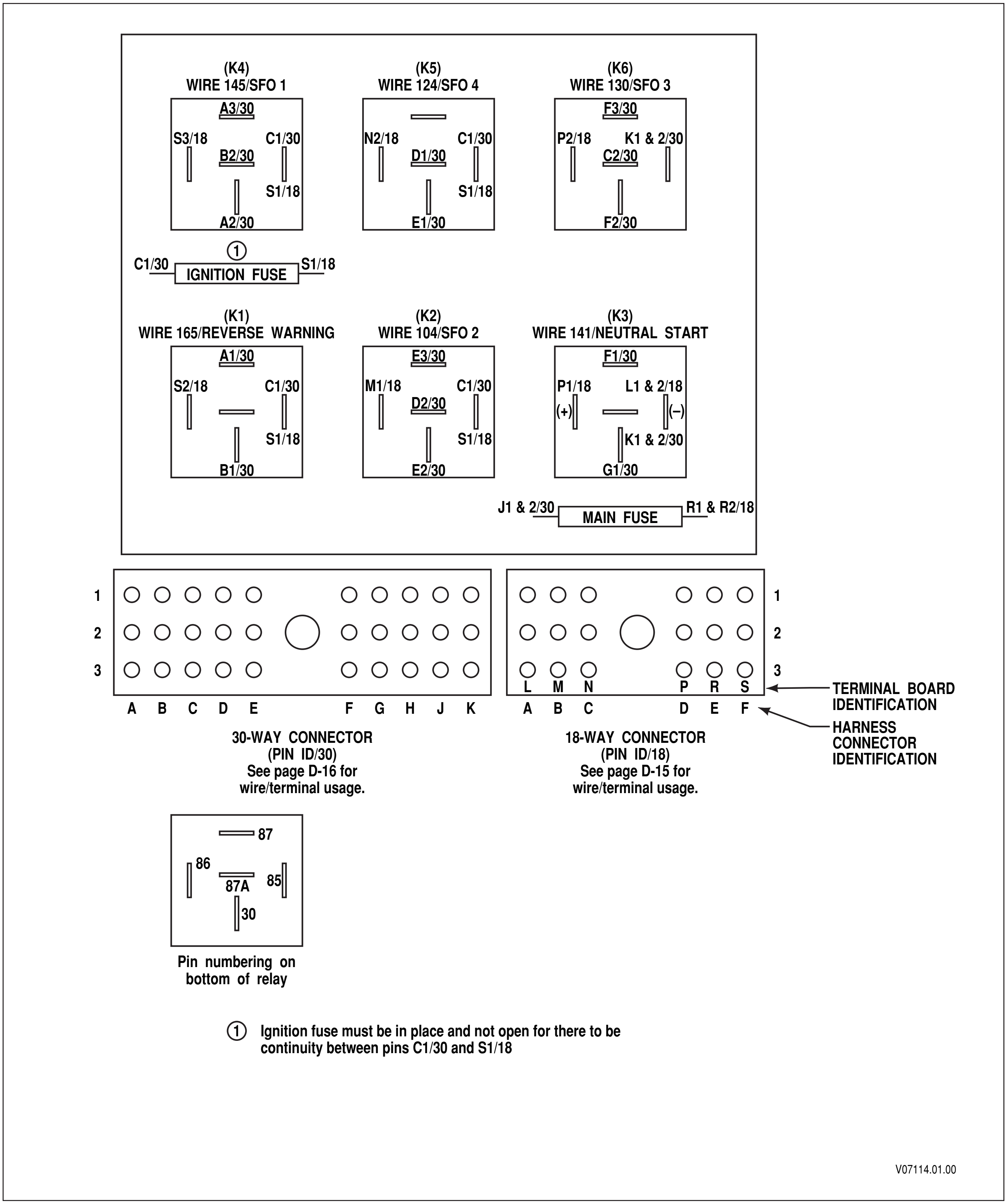


Figure G–2. VIM Components Location and Pin-Out Diagram

APPENDIX H—HYDRAULIC SCHEMATICS

APPENDIX H—HYDRAULIC SCHEMATICS

NOTES

APPENDIX H—HYDRAULIC SCHEMATICS

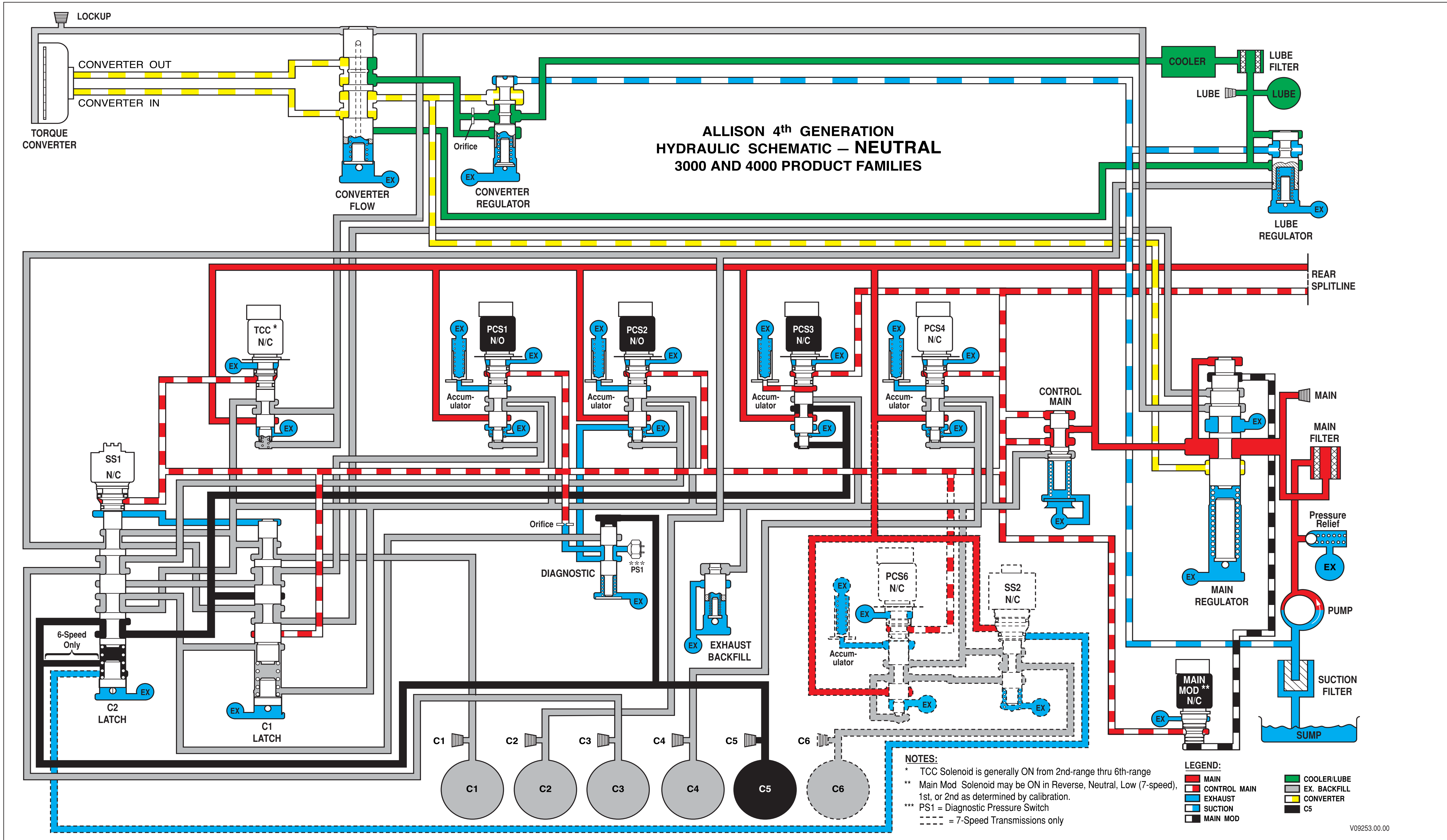


Figure H–1. 3000 and 4000 Product Families Hydraulic Schematic—Neutral

APPENDIX H—HYDRAULIC SCHEMATICS

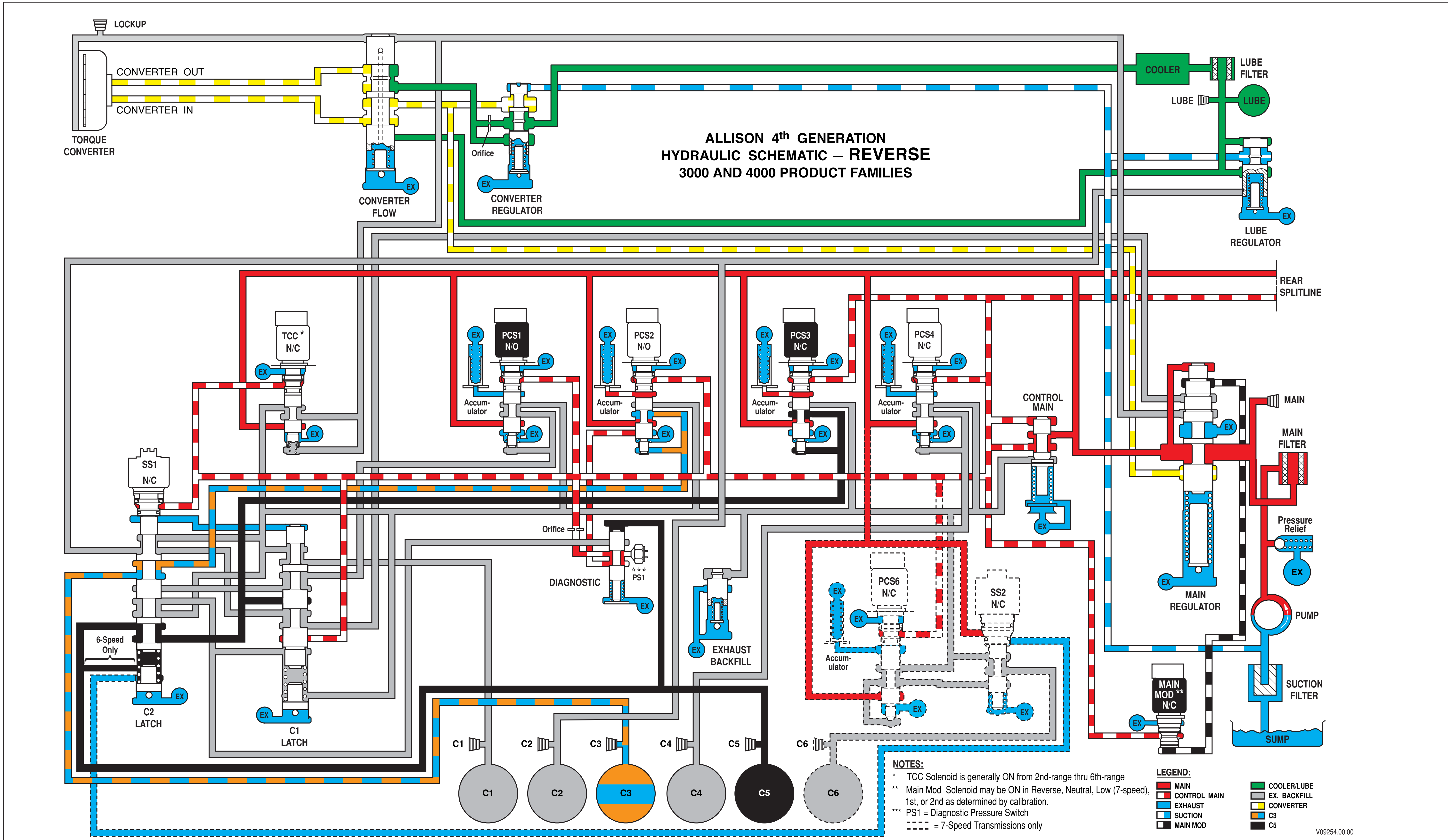


Figure H–2. 3000 and 4000 Product Families Hydraulic Schematic—Reverse

APPENDIX H—HYDRAULIC SCHEMATICS

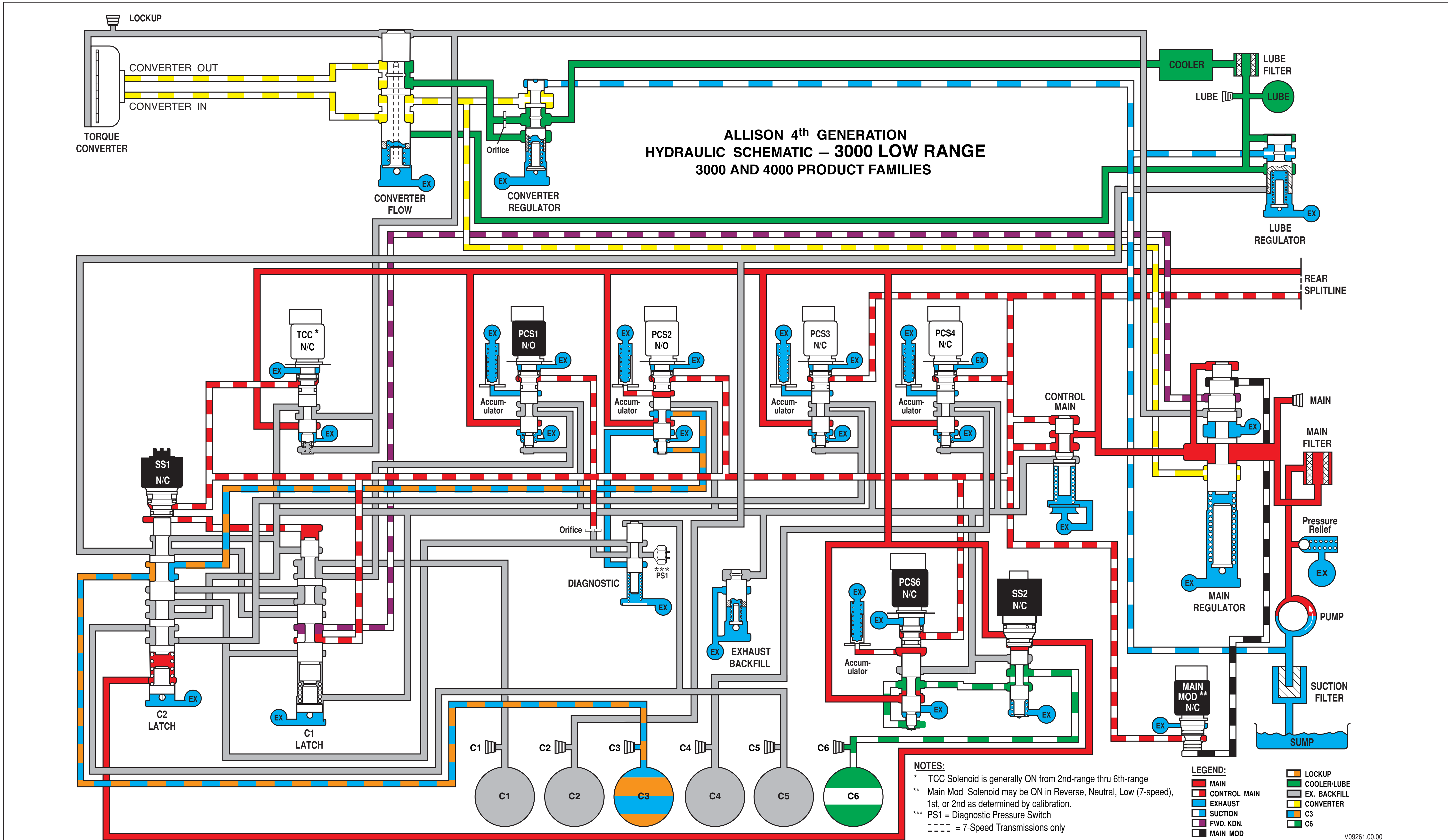


Figure H–3. 3000 Product Family Hydraulic Schematic—7-Speed, Low Range

APPENDIX H—HYDRAULIC SCHEMATICS

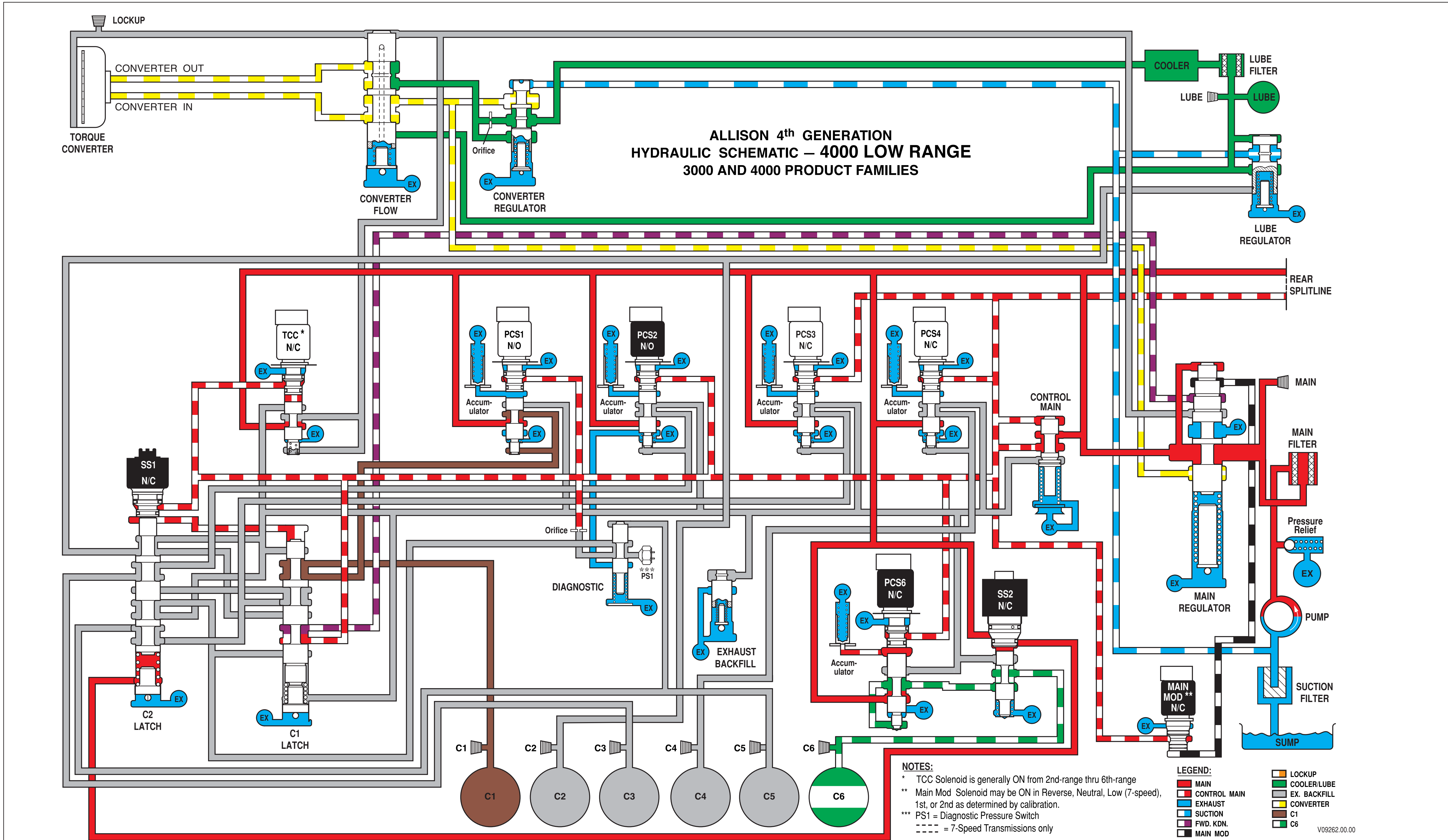
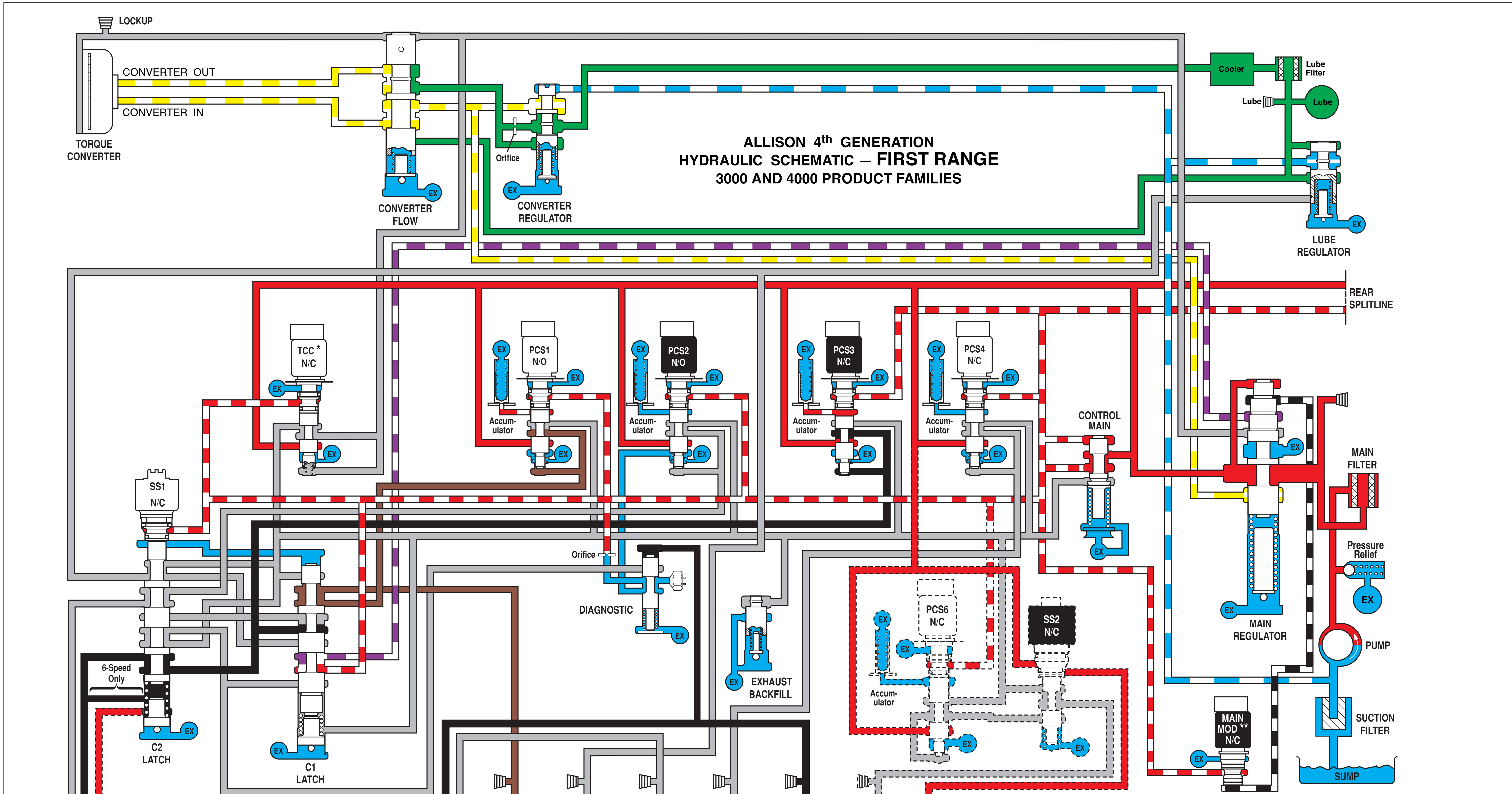


Figure H–4. 4000 Product Family Hydraulic Schematic—7-Speed, Low Range

APPENDIX H—HYDRAULIC SCHEMATICS



NOTES:

* TCC Solenoid is generally ON from 2nd-range thru 6th-range

** Main Mod Solenoid may be ON in Reverse, Neutral, Low (7-speed), 1st, or 2nd as determined by calibration.

*** PS1 = Diagnostic Pressure Switch

- - - - = 7-Speed Transmissions only

LEGEND:

MAIN
CONTROL MAIN
EXHAUST
SUCTION
FWD. KDN.
MAIN MOD
COOLER/LUBE
EX. BACKFILL
CONVERTER
C1
C5

V09255.00.00

Figure H–5. 3000 and 4000 Product Families Hydraulic Schematic—First Range

APPENDIX H—HYDRAULIC SCHEMATICS

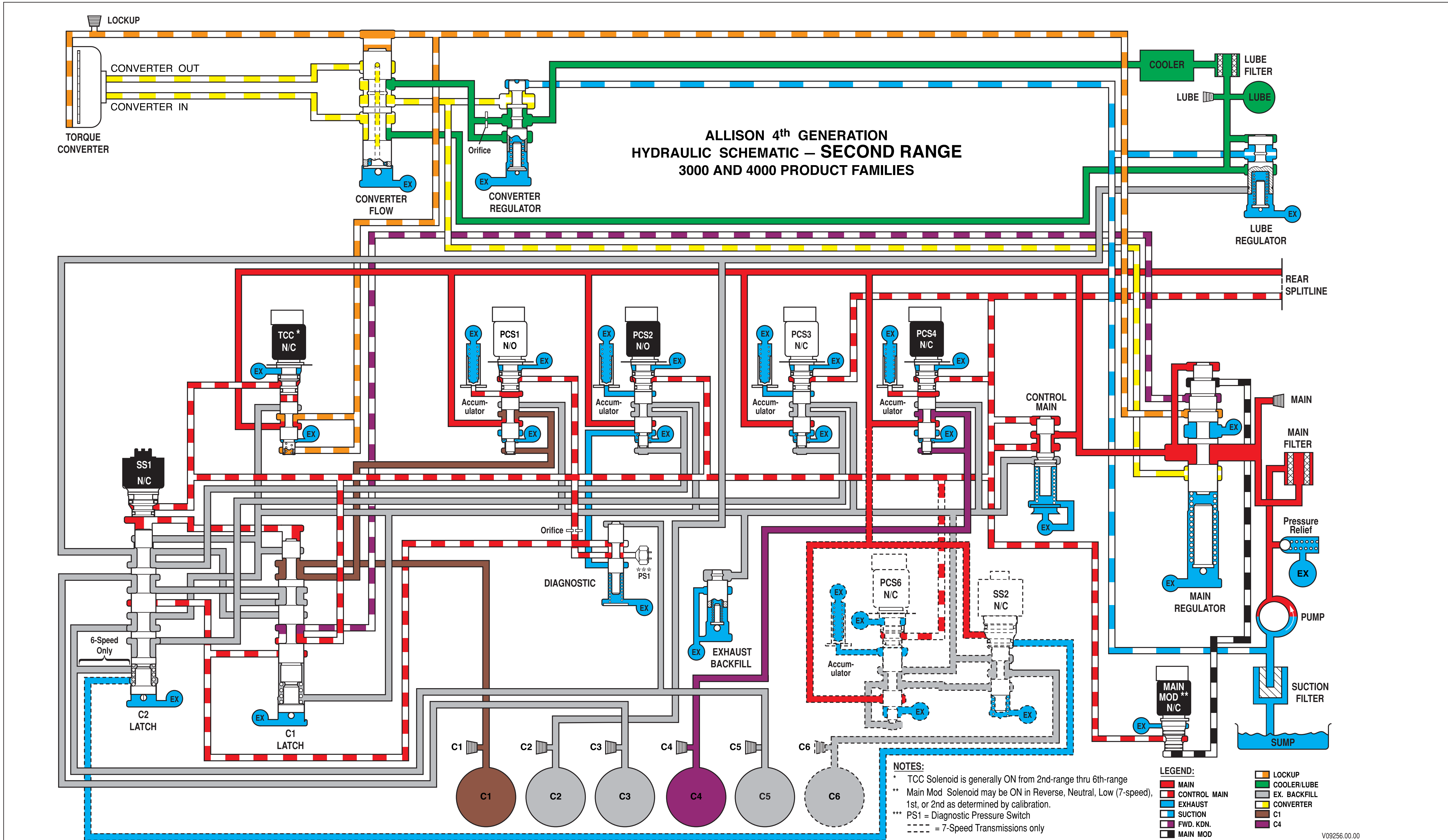


Figure H–6. 3000 and 4000 Product Families Hydraulic Schematic—Second Range

APPENDIX H—HYDRAULIC SCHEMATICS

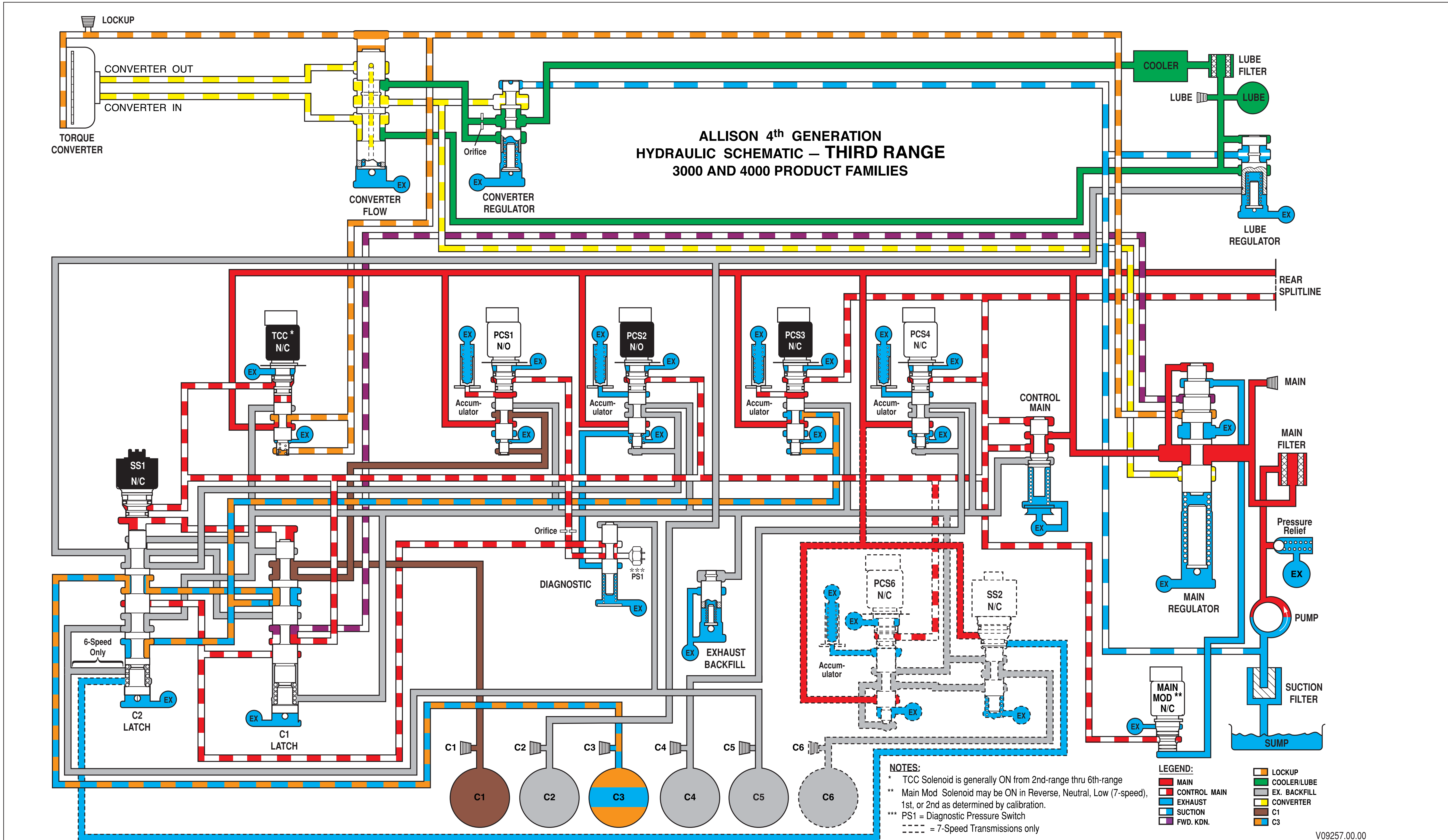


Figure H–7. 3000 and 4000 Product Families Hydraulic Schematic—Third Range

APPENDIX H—HYDRAULIC SCHEMATICS

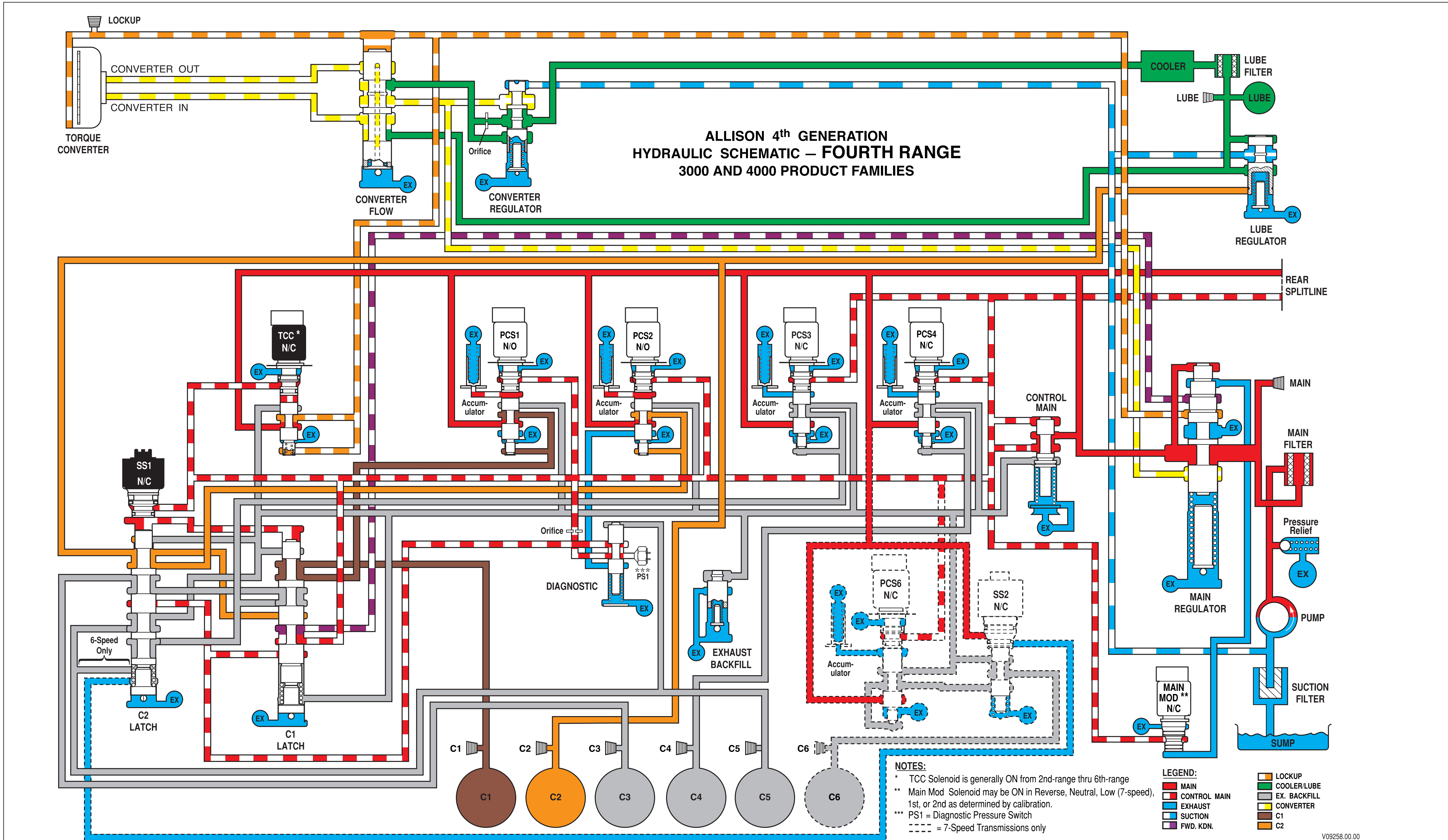


Figure H–8. 3000 and 4000 Product Families Hydraulic Schematic—Fourth Range

APPENDIX H—HYDRAULIC SCHEMATICS

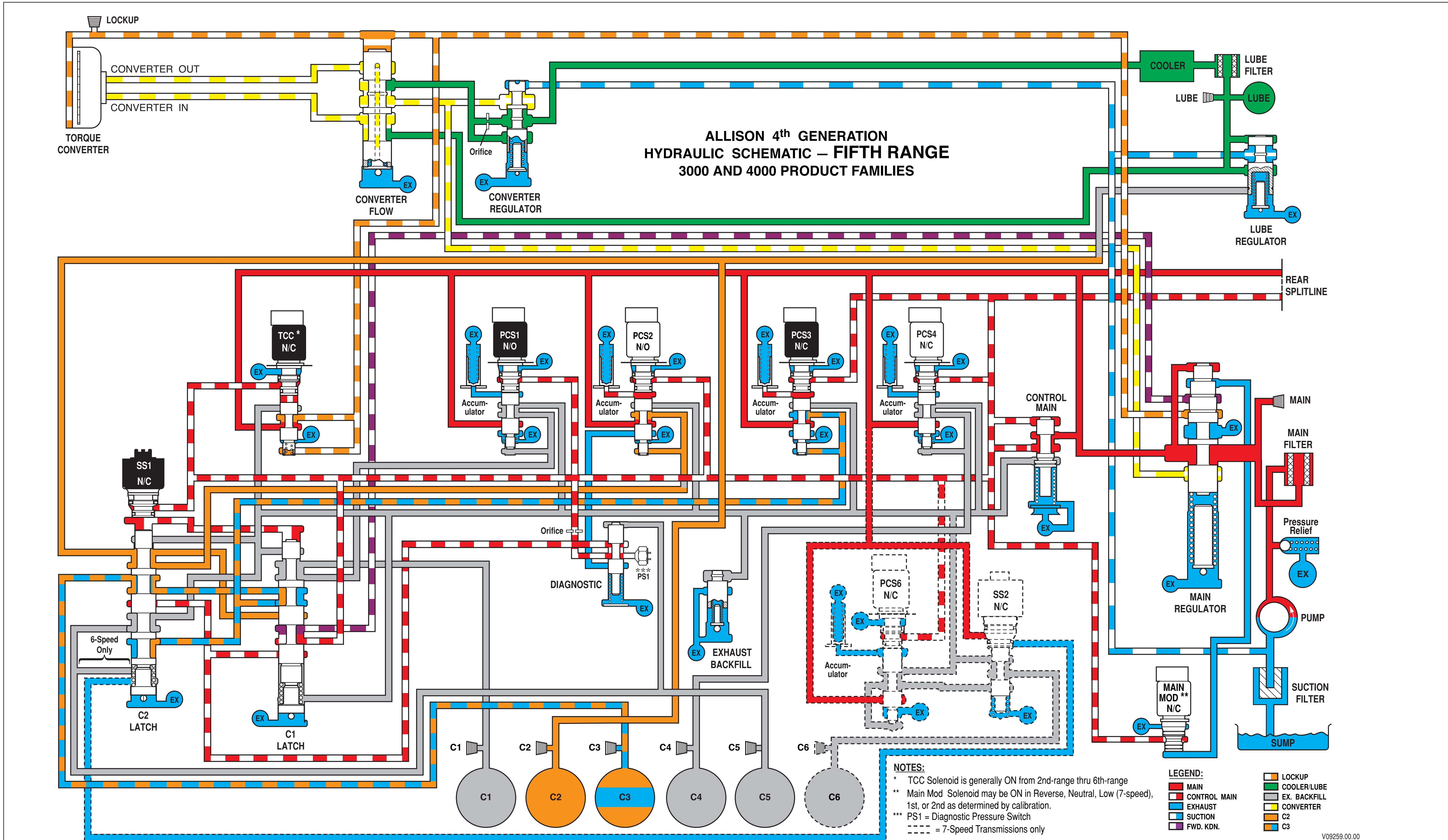


Figure H–9. 3000 and 4000 Product Families Hydraulic Schematic—Fifth Range

APPENDIX H—HYDRAULIC SCHEMATICS

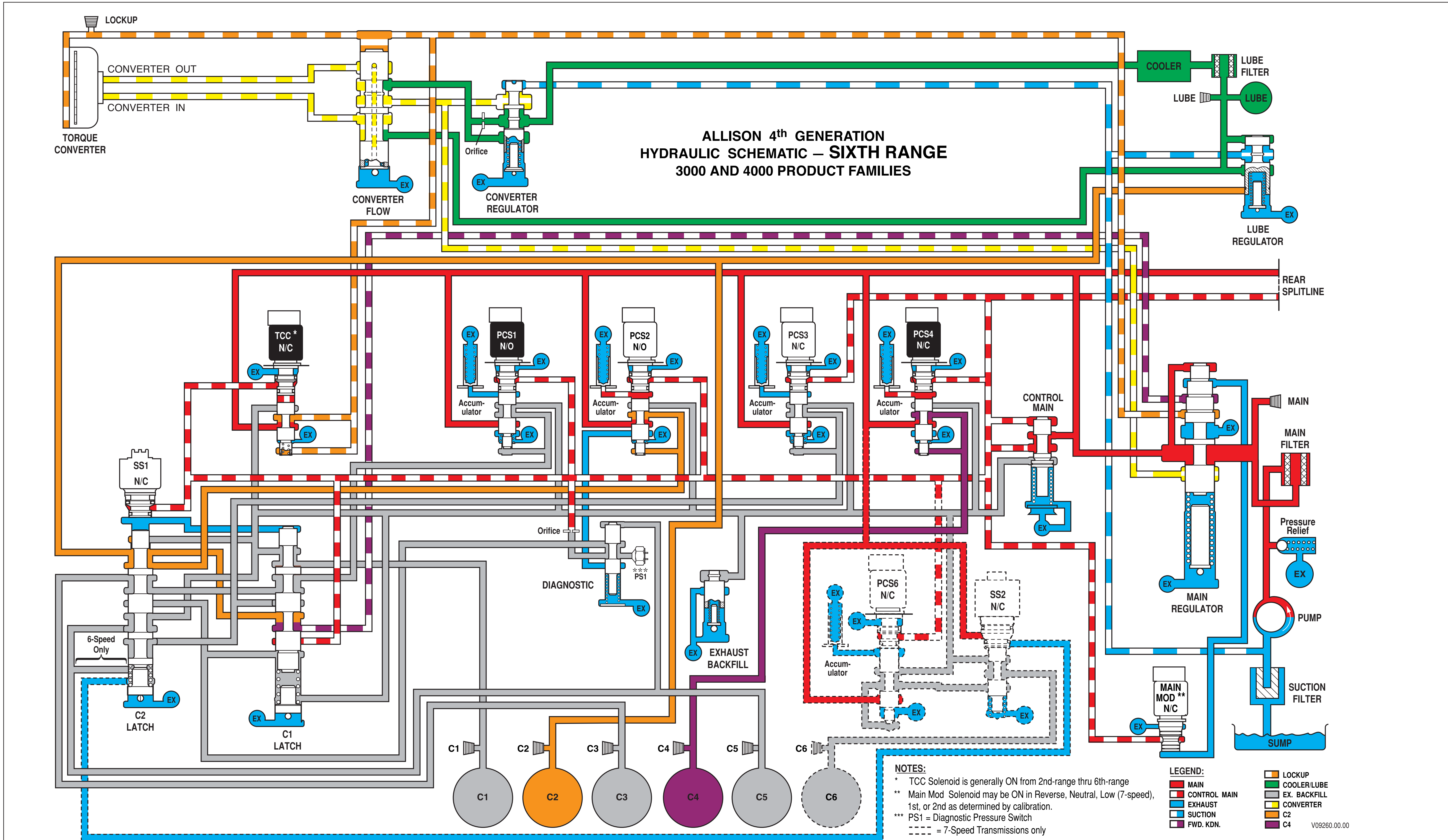


Figure H–10. 3000 and 4000 Product Families Hydraulic Schematic—Sixth Range

APPENDIX H—HYDRAULIC SCHEMATICS

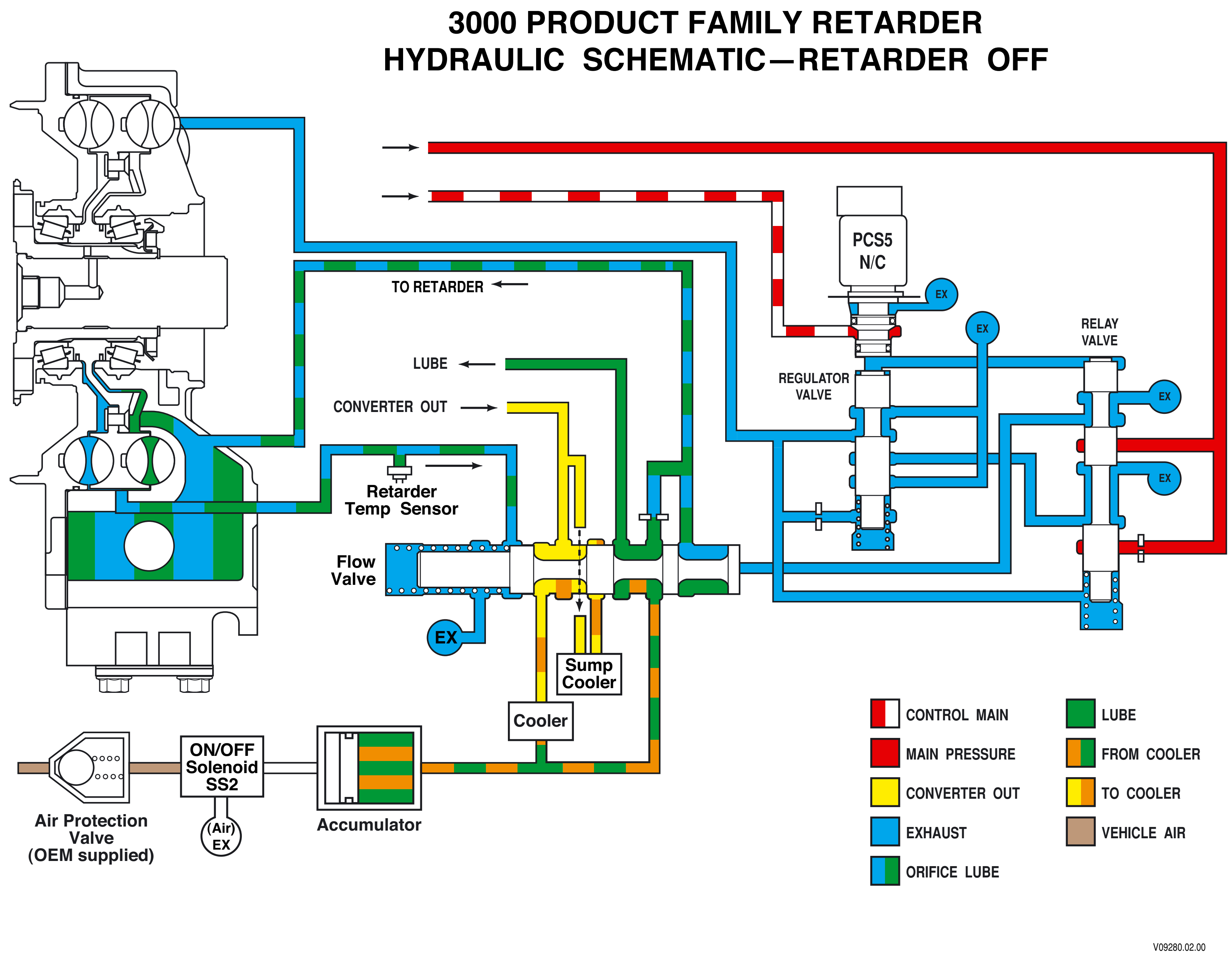


Figure H–11. 3000 Product Family Hydraulic Schematic—Retarder OFF

APPENDIX H—HYDRAULIC SCHEMATICS

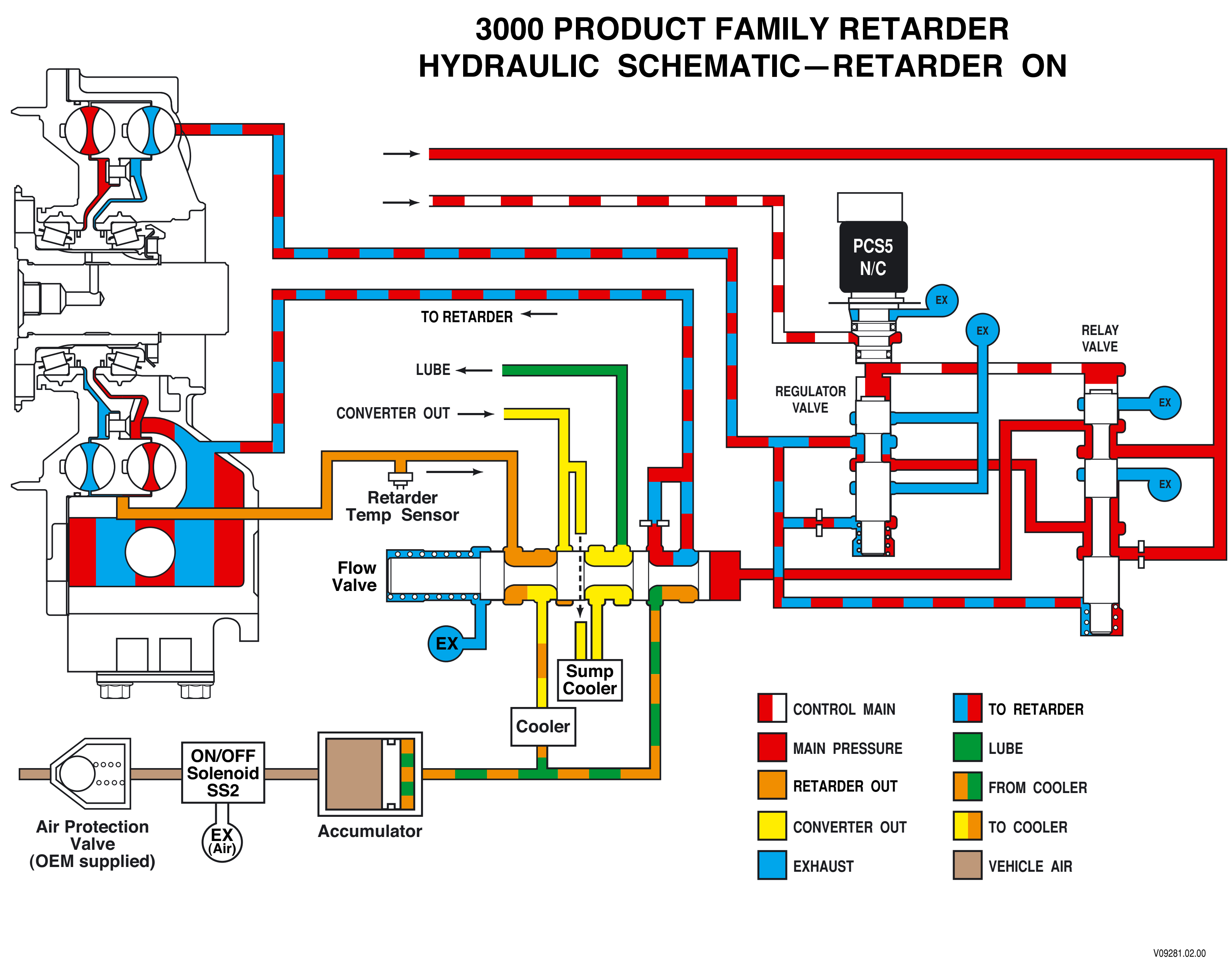


Figure H–12. 3000 Product Family Hydraulic Schematic—Retarder ON

APPENDIX H—HYDRAULIC SCHEMATICS

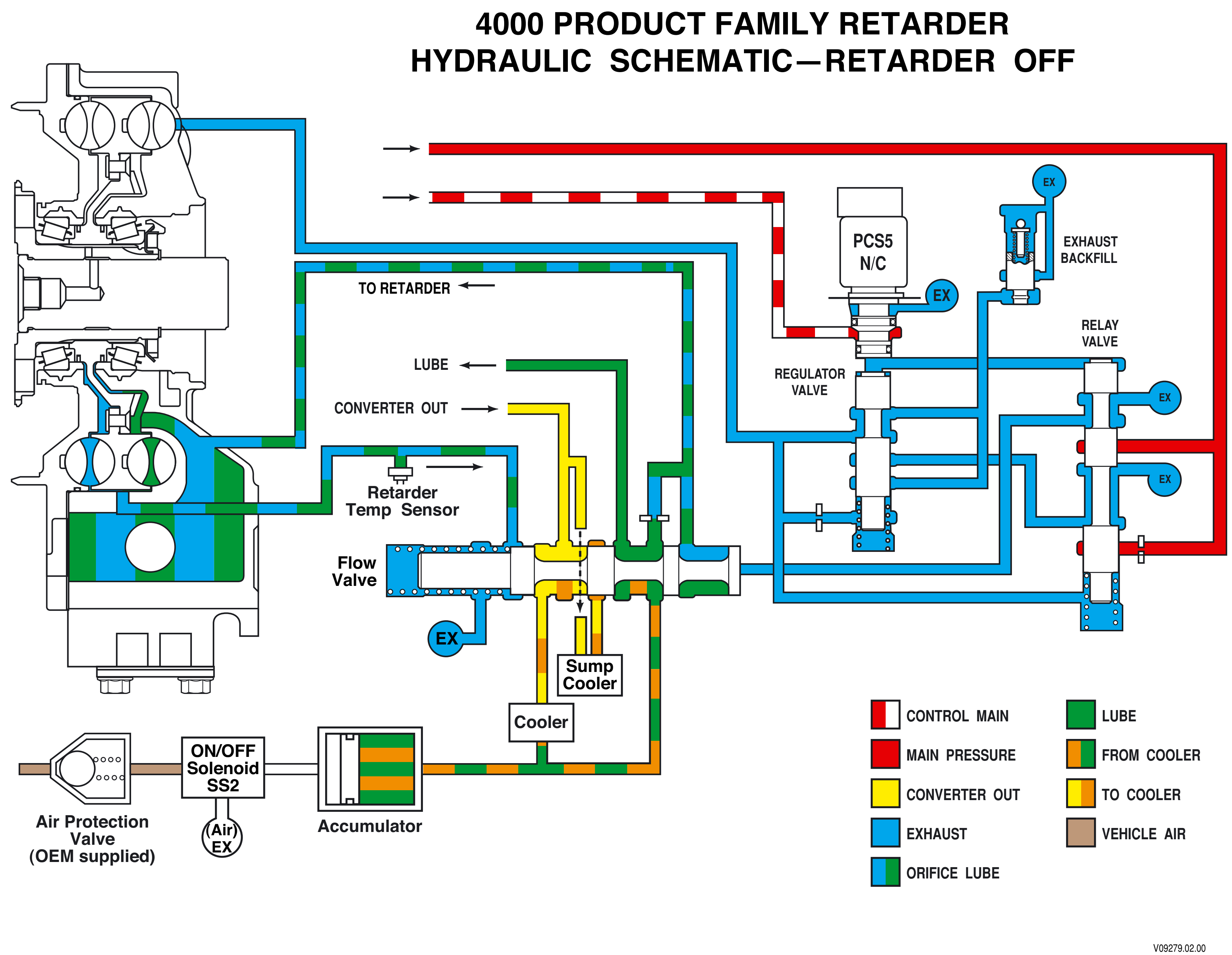


Figure H–13. 4000 Product Family Hydraulic Schematic—Retarder OFF

APPENDIX H—HYDRAULIC SCHEMATICS

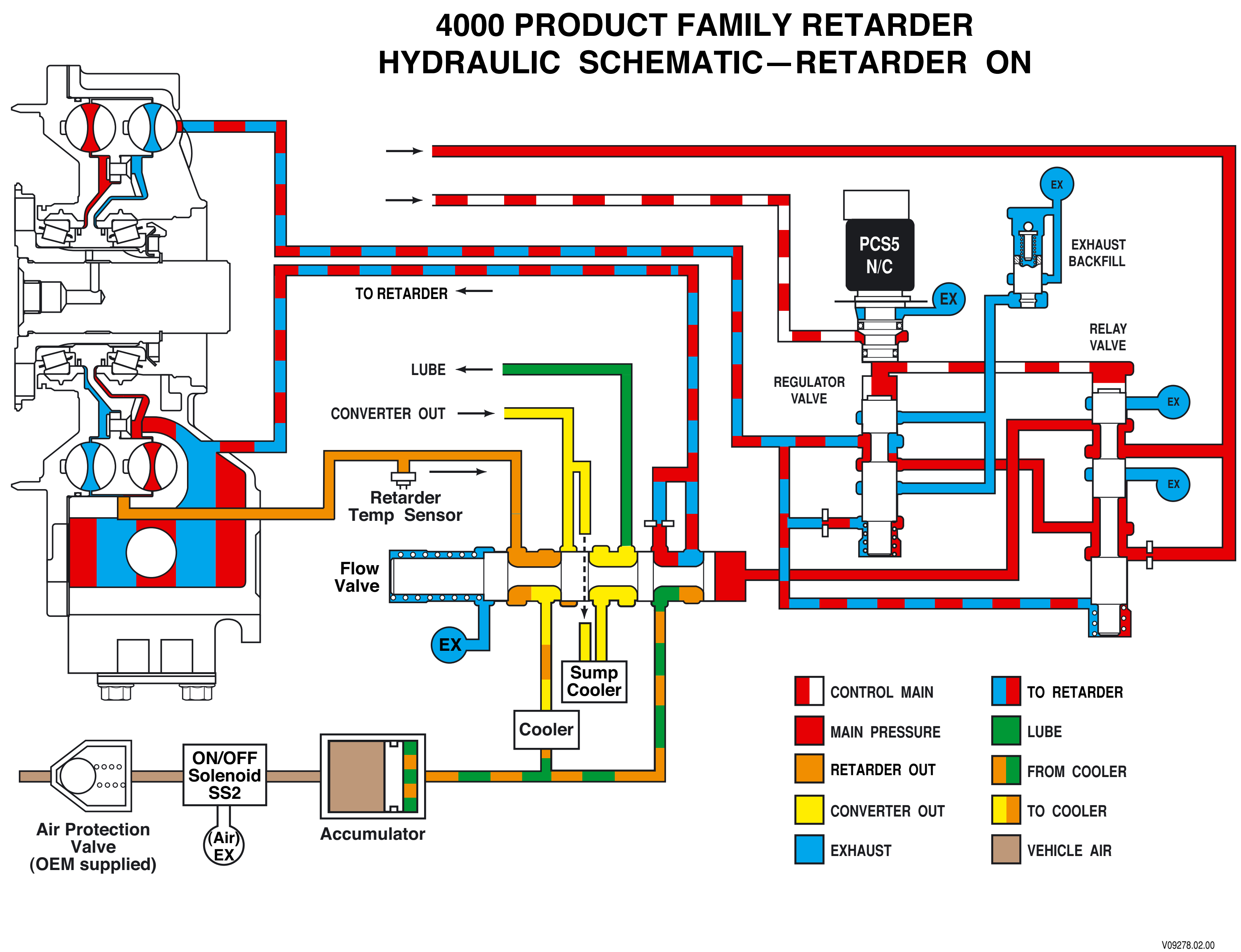
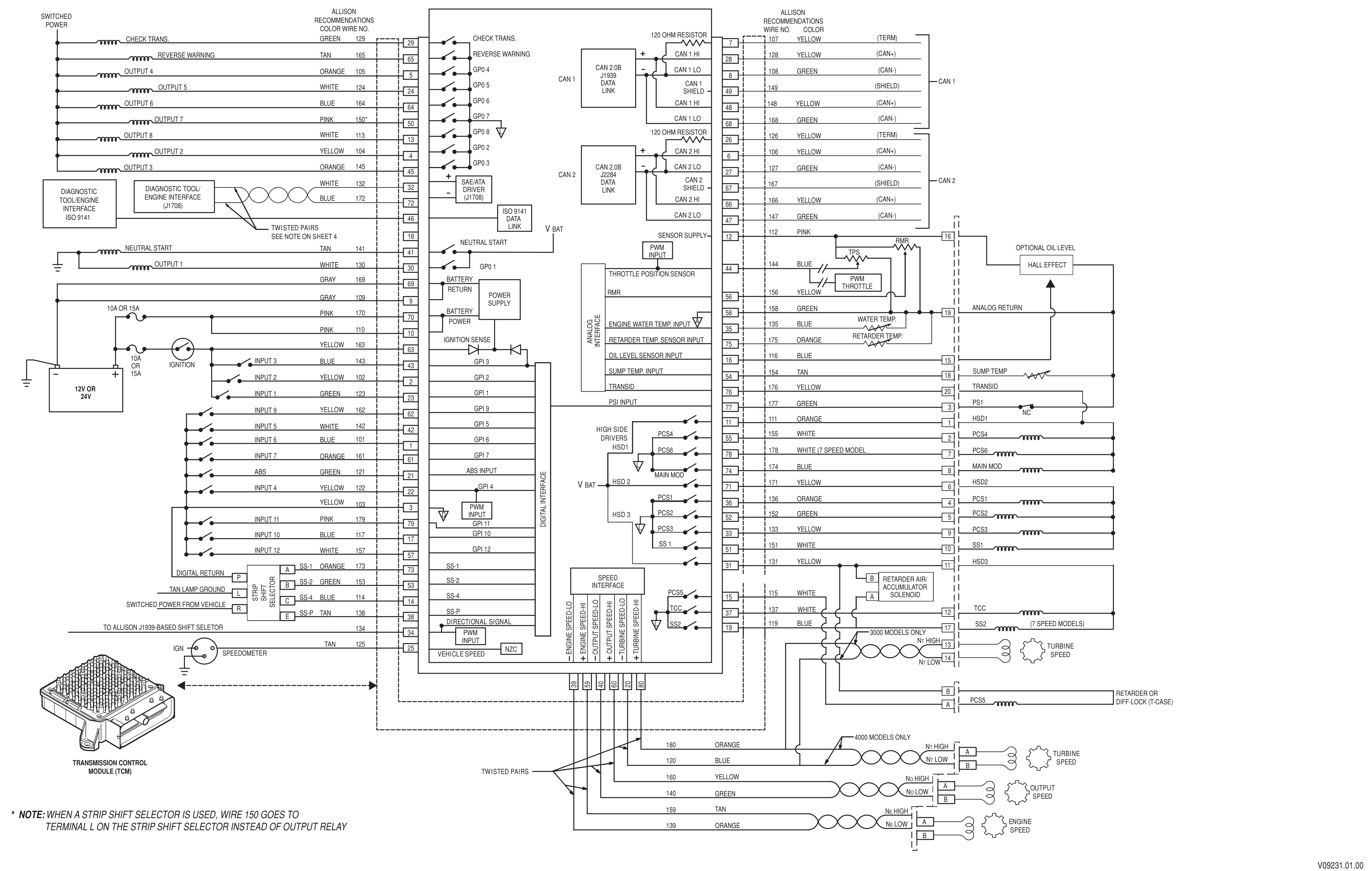


Figure H–14. 4000 Product Family Hydraulic Schematic—Retarder ON

APPENDIX J—3000 AND 4000 PRODUCT FAMILIES WIRING SCHEMATICS



* **NOTE:** *WHEN A STRIP SHIFT SELECTOR IS USED, WIRE 150 GOES TO TERMINAL L ON THE STRIP SHIFT SELECTOR INSTEAD OF OUTPUT RELAY*

Figure J–1. 3000 and 4000 Product Families Connector Diagram—TCM

APPENDIX K—SOLENOID RESISTANCE CHARTS

The following graphs show the coil resistance characteristics of Allison 4th Generation Controls solenoids.

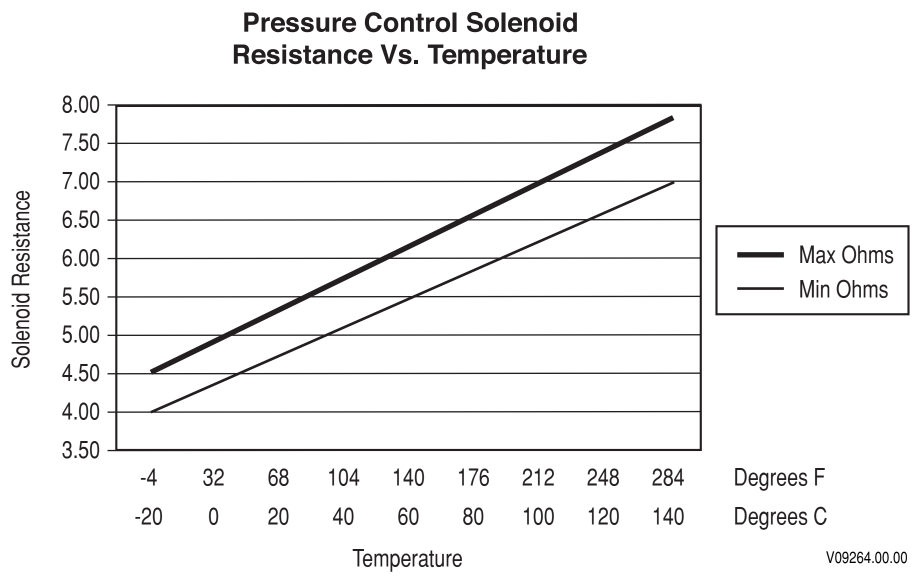


Figure K–1. 3000 and 4000 Product Families Variable Bleed Solenoids—Main Mod, TCC, And PCS1 through PCS6

APPENDIX K—SOLENOID RESISTANCE CHARTS

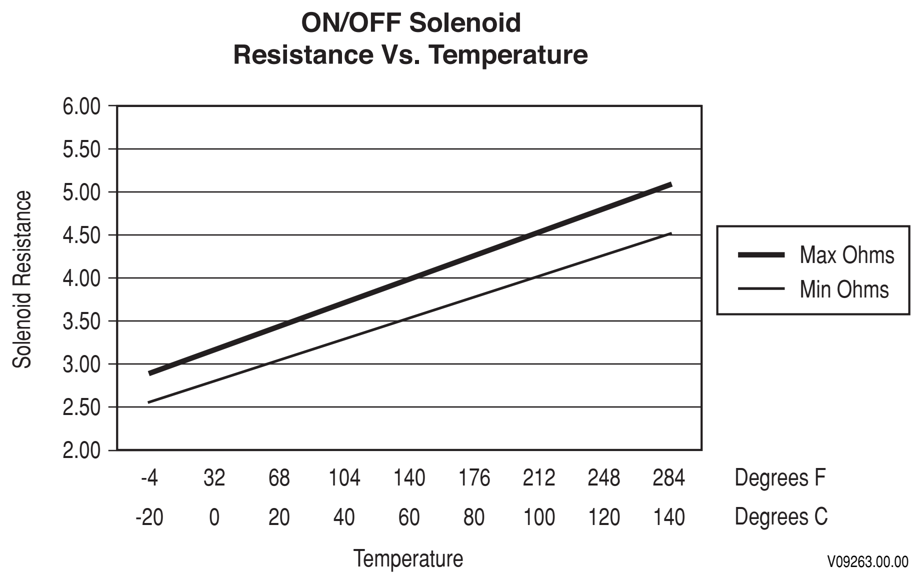


Figure K–2. 3000 and 4000 Product Families ON/OFF Solenoids—SS1 And SS2 (C6 Enable) in 7-Speed Models

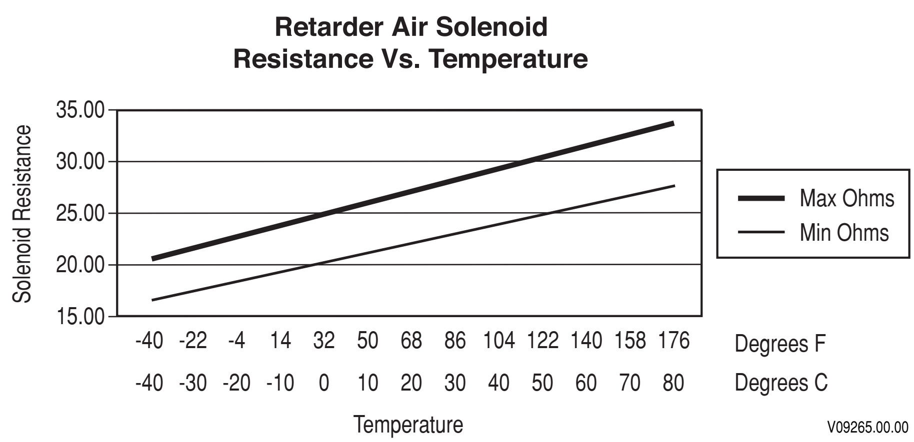


Figure K–3. 3000 and 4000 Product Families Retarder Accumulator Air Solenoid—SS2 in Retarder-Equipped Transmissions

APPENDIX L—EXTERNALLY-GENERATED ELECTRONIC INTERFERENCE

L–1. ELECTROMAGNETIC/RADIO FREQUENCY INTERFERENCE

Be sure that the TCM for the Allison Transmission Electronic Controls is properly grounded to prevent EMI interference problems. The chassis frame must be connected to the negative post of the vehicle battery. A proper connection to the chassis frame is required. The connection must be free from rust and paint. The electrical integrity of this connection must not deteriorate with the age of the vehicle. If the TCM is cab-mounted, there must be two 1½ to 2 inch braided grounding straps connecting the cab structure to the chassis frame.

All electrical and electronic systems generate electromagnetic fields that can interfere with other electronic systems. Allison Transmission electronic transmission controls comply with Federal Communications Commission (FCC) regulations and other guidelines concerning emitted radio frequency interference for transportation electronics. The position of Allison Transmission is that manufacturers and installers of EMI/RFI emitting equipment are responsible for adhering to FCC regulations and other guidelines concerning emitted radio frequency interference for transportation electronics.

Some radio-telephone or two-way communication radios (land-mobile radio), or the manner in which they are installed, can adversely affect vehicle operation or be affected by other vehicle components. Expenses incurred to protect vehicle-related systems from EMI/RFI emissions by radio-telephone or two-way communications radios (land-mobile radio) or to integrate such devices into vehicles are not the responsibility of Allison Transmission.

L–2. GENERAL GUIDELINES FOR RADIO EQUIPMENT INSTALLATION

The following general guidelines for installing radio-telephone or two-way communications radios (land-mobile radio) in a vehicle supplement, but DO NOT replace, detailed instructions provided by the radio equipment manufacturer. Detailed installation instructions are the sole responsibility of the radio equipment manufacturer.

Experience has shown that most EMI/RFI problems can be prevented or eliminated by following the guidelines. If EMI/RFI problems persist after following the guidelines and after ensuring the installation conforms to the guidelines, contact the vehicle and radio equipment manufacturers for additional installation or equipment operation instructions.

A. Transmitter Installation

1. Locate remote radio transmitters as far away from other electronic devices and as near to the side of the vehicle body as possible.
2. Mount transceivers (transmitter and receiver in one box) under the dash so as not to interfere with vehicle controls or passenger movement.

B. Antenna Installation

Each vehicle and body style react differently to radio frequency energy. When dealing with an unfamiliar vehicle, test various antenna locations by using a magnetic mount antenna and checking for adverse effects. Antenna location is a major factor in EMI/RFI problems.

C. Antenna Cable Routing

1. Use high quality, 95 percent shield coverage, coaxial (coax) cable. Route the coax well away from any electronic components.
2. Route antenna cables as far away from vehicle wiring as possible to reduce the likelihood of the vehicle wiring acting as an antenna for interference.

APPENDIX L—EXTERNALLY-GENERATED ELECTRONIC INTERFERENCE

D. Radio Wiring and Connector Location

1. Connect transmitter power leads directly to the battery.
2. For transceivers (transmitter and receiver in one box) with ignition control, place a 12V power contactor at the vehicle battery. Drive the contactor coil, through an appropriate in-line fuse, from an ignition circuit not powered during engine cranking.
3. Any negative lead from a handset or control unit must return to battery negative.
4. Connect the positive lead from a handset or control unit directly to battery.
5. Fuse handset or control unit positive and negative leads separately from the transceiver negative and positive leads. Use correctly rated fuses.

E. Power and Ground Wire Routing

Route radio power and ground wires as far away as possible from electronic control modules.

F. Troubleshooting

The following are common causes of EMI/RFI problems:

- Power leads connected to points other than the battery
- Improper antenna location
- Poor shielding or connections to antenna cable
- Transmitter or transceiver wiring too close to vehicle electronics

L–3. EXTERNALLY-GENERATED SPEED SENSOR SIGNALS

A. Testing for Externally-Generated Speed Sensor Signals

Use the following procedures to determine if speed sensor signals generated by a source external to the transmission or wiring harness are present:

1. Turn ignition ON.
2. Keep engine OFF.
3. If the TCM is ON (shift selector display remains illuminated), connect the Allison DOC™ For PC–Service Tool.

NOTE: ***If false speed signals were present at the previous shutdown, the TCM might still be "on" even though the ignition is "off." The Allison DOC™ For PC–Service Tool is powered by ignition power so the ignition must be "on" to use the Allison DOC™ For PC–Service Tool to read the speed signals.***

4. Read speed sensor signals.
5. If a speed sensor signal is other than one (1), then there is a short to another circuit that is carrying an AC or PWM signal.
6. Measure the resistance of the sensor.
7. Test for shorts to other circuits within the harness or transmission connector.
8. Inspect to be sure there is no conductive material inside the connector.

APPENDIX L—EXTERNALLY-GENERATED ELECTRONIC INTERFERENCE

9. Inspect to be sure speed sensor circuit wires are a twisted pair.
10. Test to be sure a properly grounded drain wire.
11. Test for the presence of a strong external AC signal.
12. Repair or replace parts as required.

NOTES

APPENDIX M—DIAGNOSTIC TREE—3000 AND 4000 HYDRAULIC SYSTEM

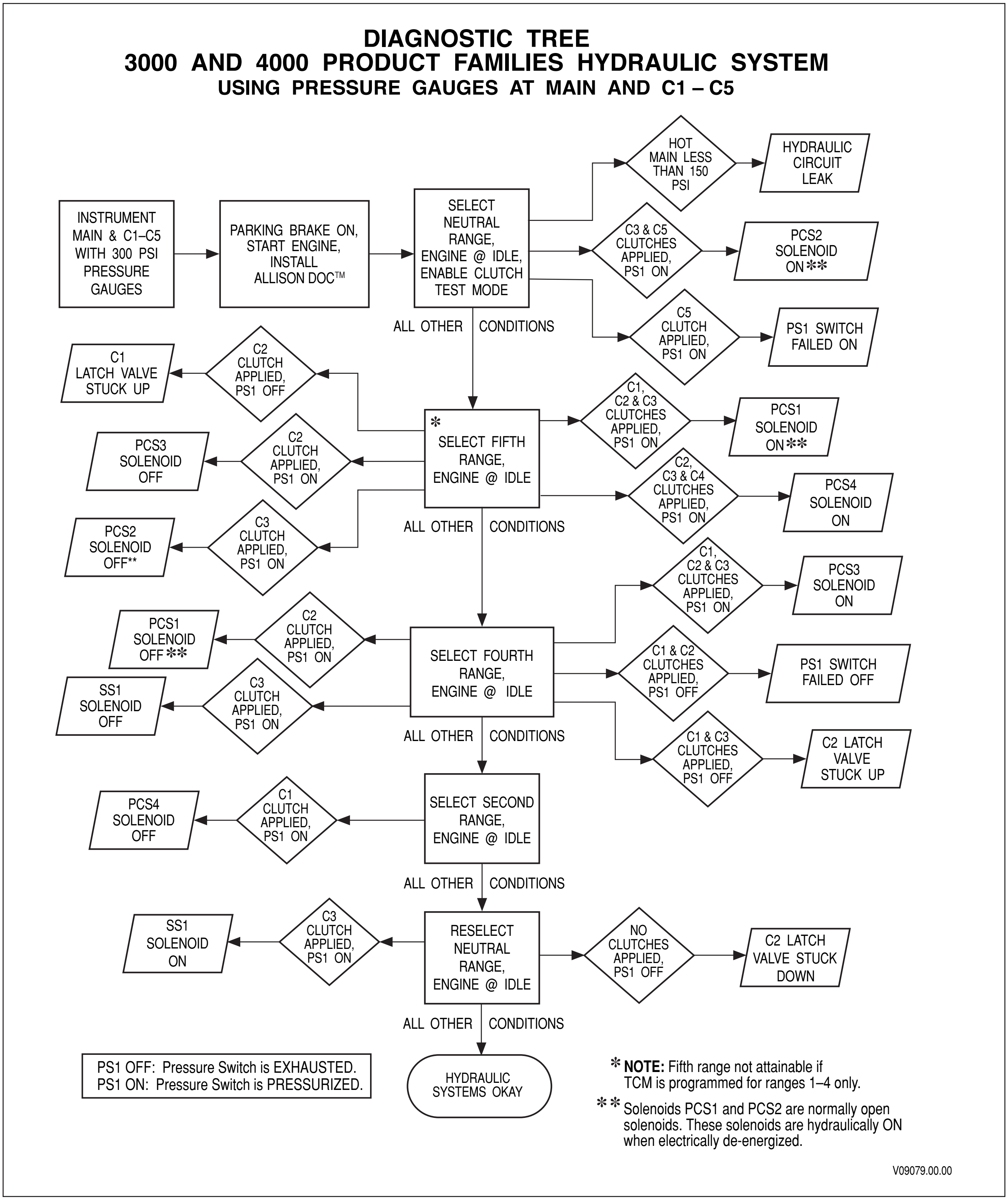


Figure M–1. Diagnostic Tree—3000 and 4000 Product Families Hydraulic System Using Pressure Gauges At Main and C1–C5

APPENDIX M—DIAGNOSTIC TREE—3000 AND 4000 HYDRAULIC SYSTEM

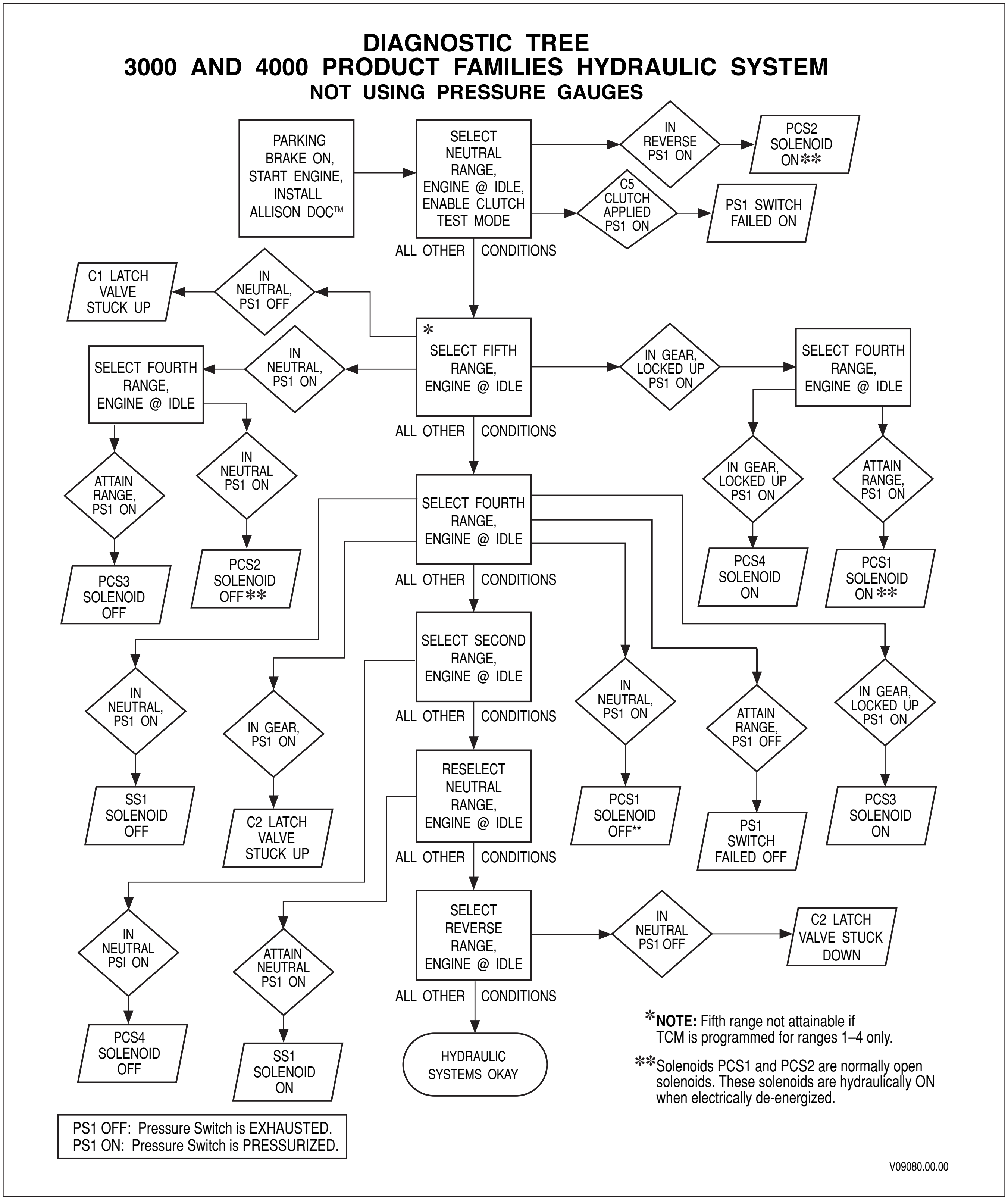


Figure M–2. Diagnostic Tree—3000 and 4000 Product Families Hydraulic System Without Pressure Gauges

APPENDIX N—ALLISON DOC™ FOR PC–SERVICE TOOL

NOTE: ***Refer to the Allison DOC™ For PC–Service Tool User Guide, GN3433EN, for complete information.***

APPENDIX N—ALLISON DOC™ FOR PC–SERVICE TOOL

NOTES

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

The schematics which follow were taken from the Sales Tech Data Book entitled Allison 4th Generation Controls. These schematics provide detail information needed to correctly perform input and output function connections. For an overview of Input/Output Functions, refer to Section 7 of this manual.

INPUT FUNCTION A. SECONDARY SHIFT SCHEDULE

USES: Provides operator selection of dual shift schedules. Can be used for performance/economy, loaded/empty, or other shift schedule combinations.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

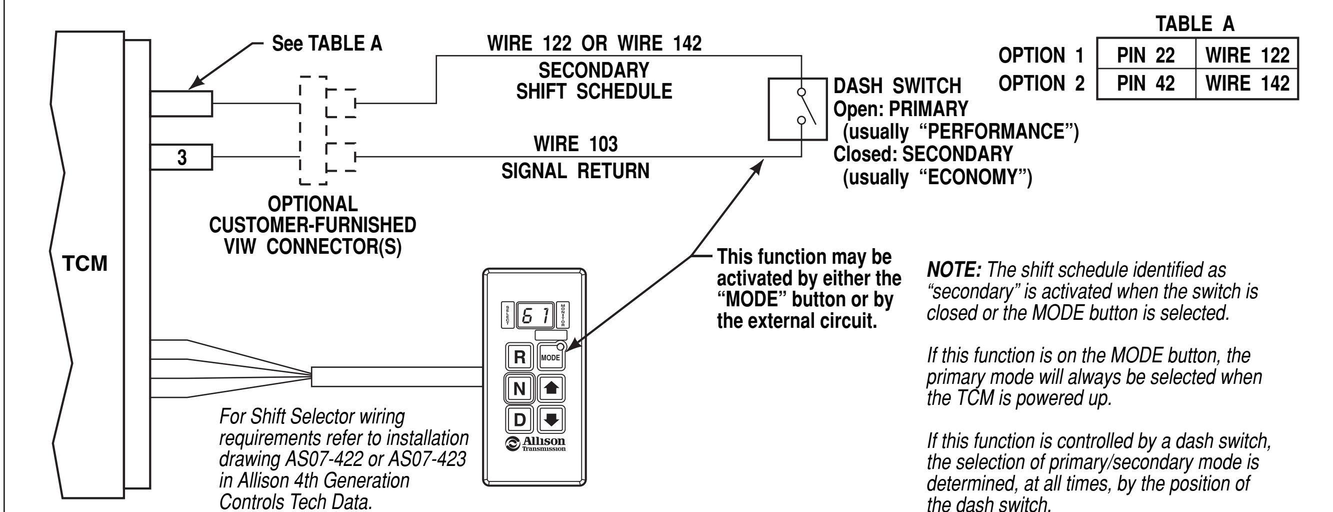


Figure P–1. Secondary Shift Schedule

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION B. D1 SELECTION

USES: Provides a convenient means of attaining 1st range hold for pushbutton shift selectors. Range to select is programmable for Primary and Secondary modes.

VARIABLES TO SPECIFY: Primary Mode selected range, Secondary Mode selected range (usually 1st range). Can be used only on the MODE button.

VOCATIONS: Various

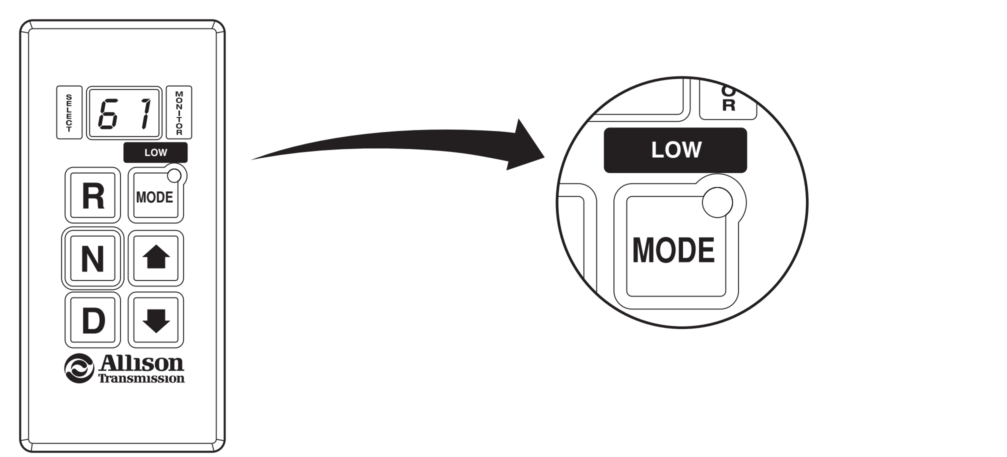


Figure P–2. D1 Selection

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION C. PTO ENABLE—SWITCHED TO POWER (WIRE 143)

USES: Permits PTO to be engaged only when engine speed and output speed are in allowable range and throttle is low. Also disengages PTO if speeds are exceeded.

VARIABLES TO SPECIFY: Minimum and maximum engine speed for engagement, maximum engine speed for allowable operation, minimum and maximum output speed for engagement, maximum output speed for allowable operation.

VOCATIONS: Various (with usage of PTO)

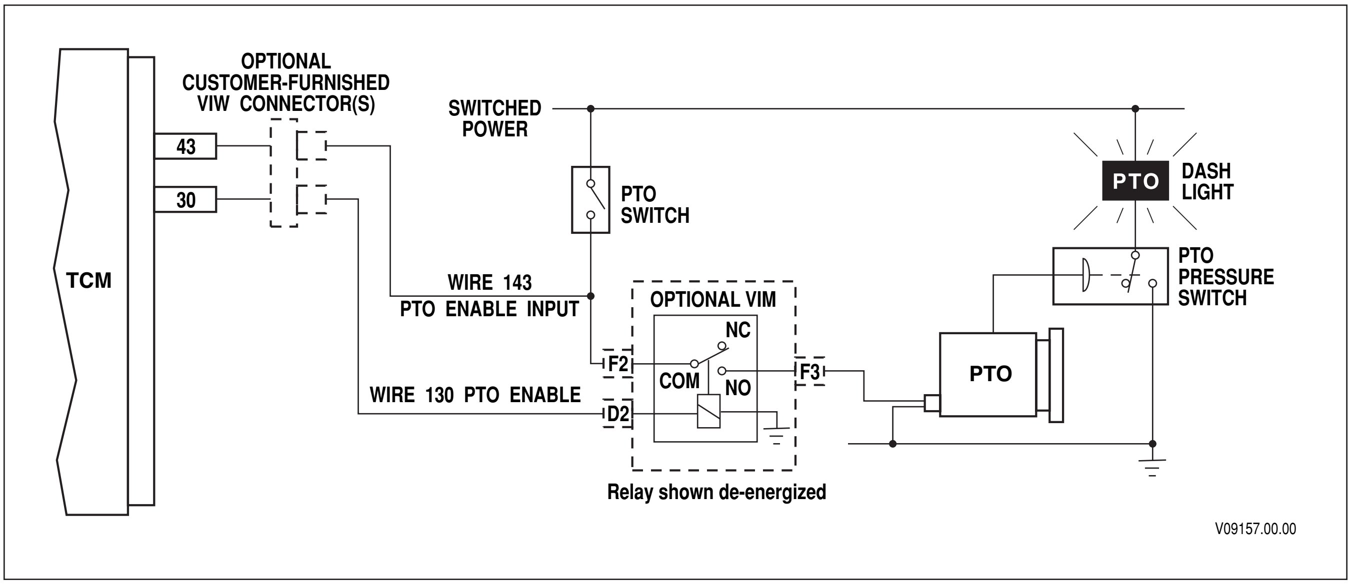


Figure P–3. PTO Enable—Switched to Power (Wire 143)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION C. PTO ENABLE—SWITCHED TO GROUND (WIRE 142)

USES: Permits PTO to be engaged only when engine speed and output speed are in allowable range and throttle is low. Also disengages PTO if speeds are exceeded.

VARIABLES TO SPECIFY: Minimum and maximum engine speed for engagement, maximum engine speed for allowable operation, minimum and maximum output speed for engagement, maximum output speed for allowable operation.

VOCATIONS: Various (with usage of PTO)

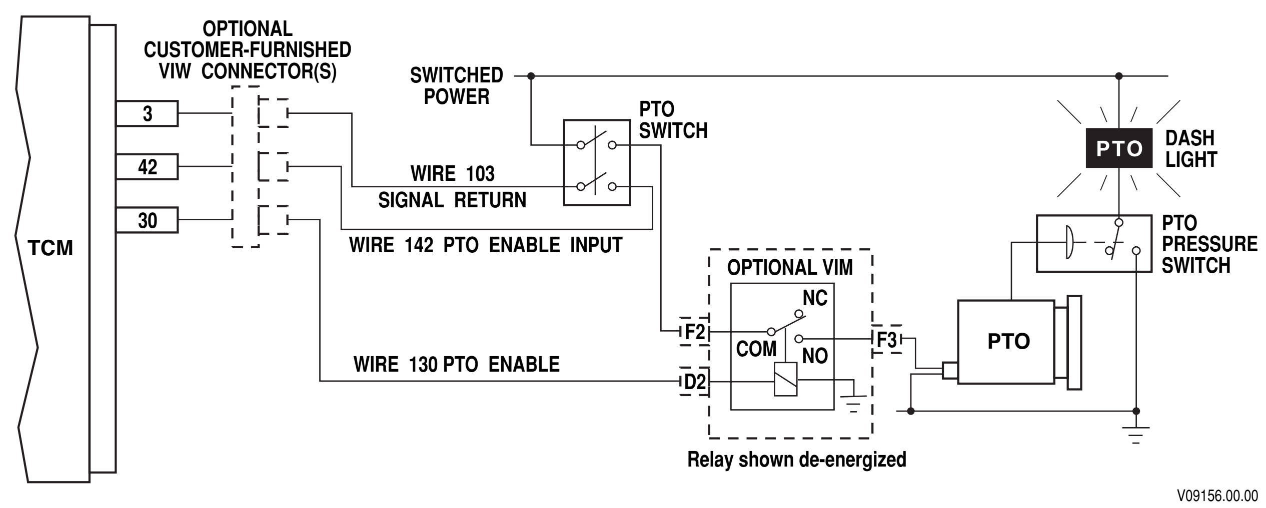


Figure P–4. PTO Enable—Switched to Ground (Wire 142)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION C. PTO ENABLE—USING MODE BUTTON

USES: Permits PTO to be engaged only when engine speed and output speed are in allowable range and throttle is low. Also disengages PTO if speeds are exceeded.

VARIABLES TO SPECIFY: Minimum and maximum engine speed for engagement, maximum engine speed for allowable operation, minimum and maximum output speed for engagement, maximum output speed for allowable operation.

VOCATIONS: Various (with usage of PTO)

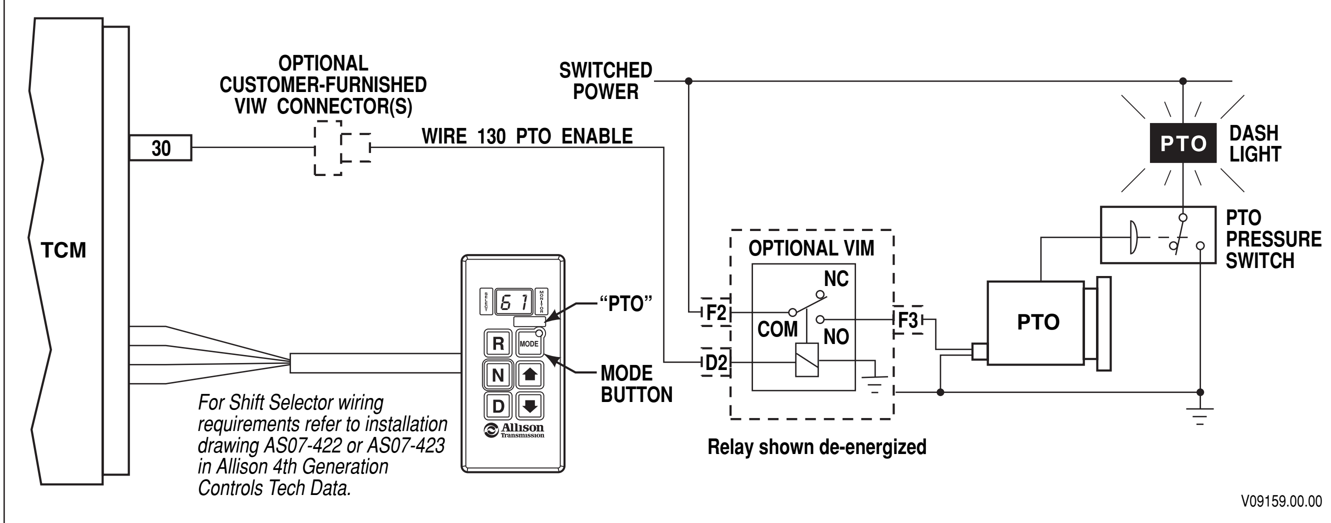


Figure P–5. PTO Enable—Using MODE Button

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION D. SHIFT SELECTOR TRANSITION

USES: When two shift selectors are used, to select which one is active.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

WARNING! **If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

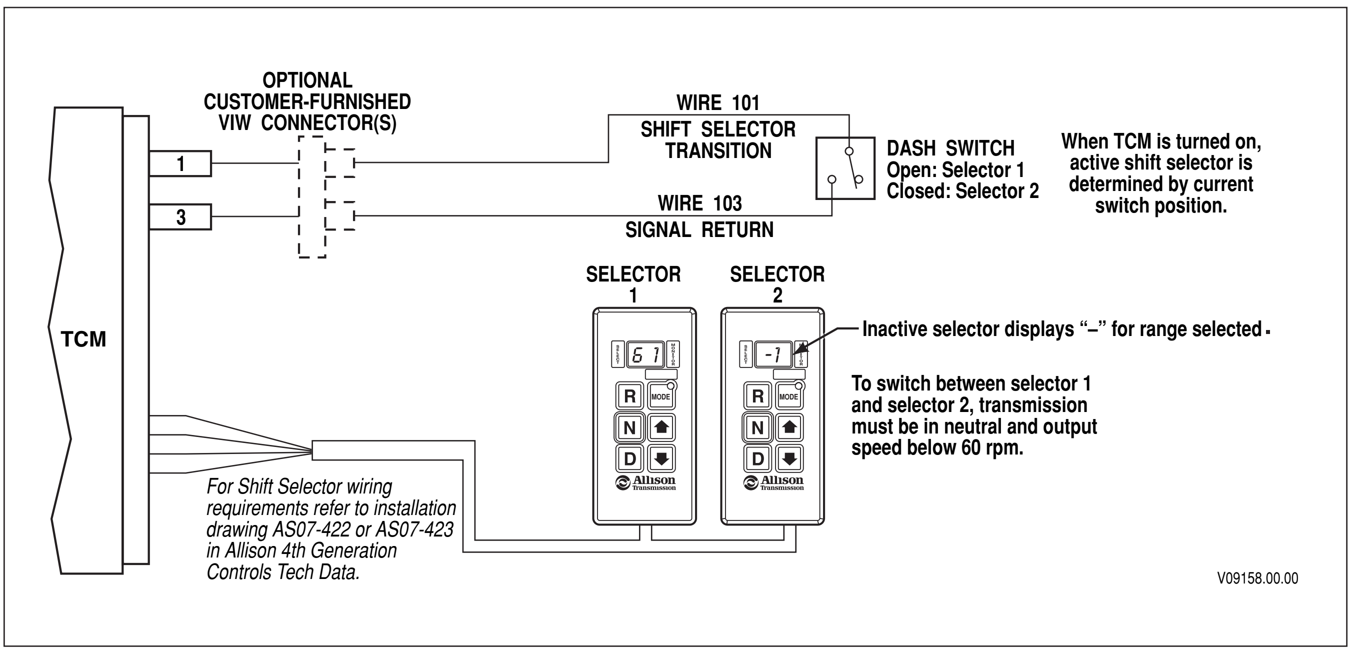


Figure P–6. Shift Selector Transition

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION E. SINGLE INPUT AUXILIARY FUNCTION RANGE INHIBIT

USES: Prevents inadvertent range selection when auxiliary equipment is operating or prevents engagement of the transmission unless brake pedal is depressed.

VARIABLES TO SPECIFY: None

VOCATIONS: Transit bus, school bus—auxiliary equipment input; various (brake pedal input)

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

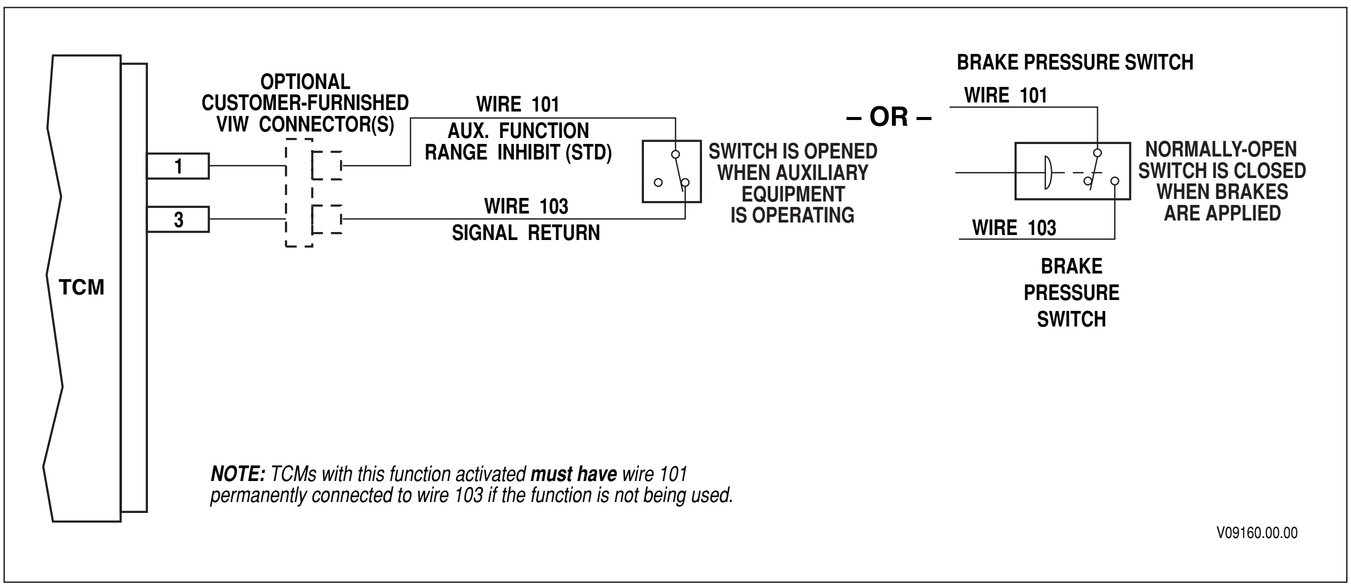


Figure P–7. Single Input Auxiliary Function Range Inhibit

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION F. DUAL INPUT AUXILIARY FUNCTION RANGE INHIBIT

USES: Prevents inadvertent range selection when auxiliary equipment is operating. Used in emergency equipment to prevent inadvertent range selection from NEUTRAL.

VARIABLES TO SPECIFY: None

VOCATIONS: Emergency equipment

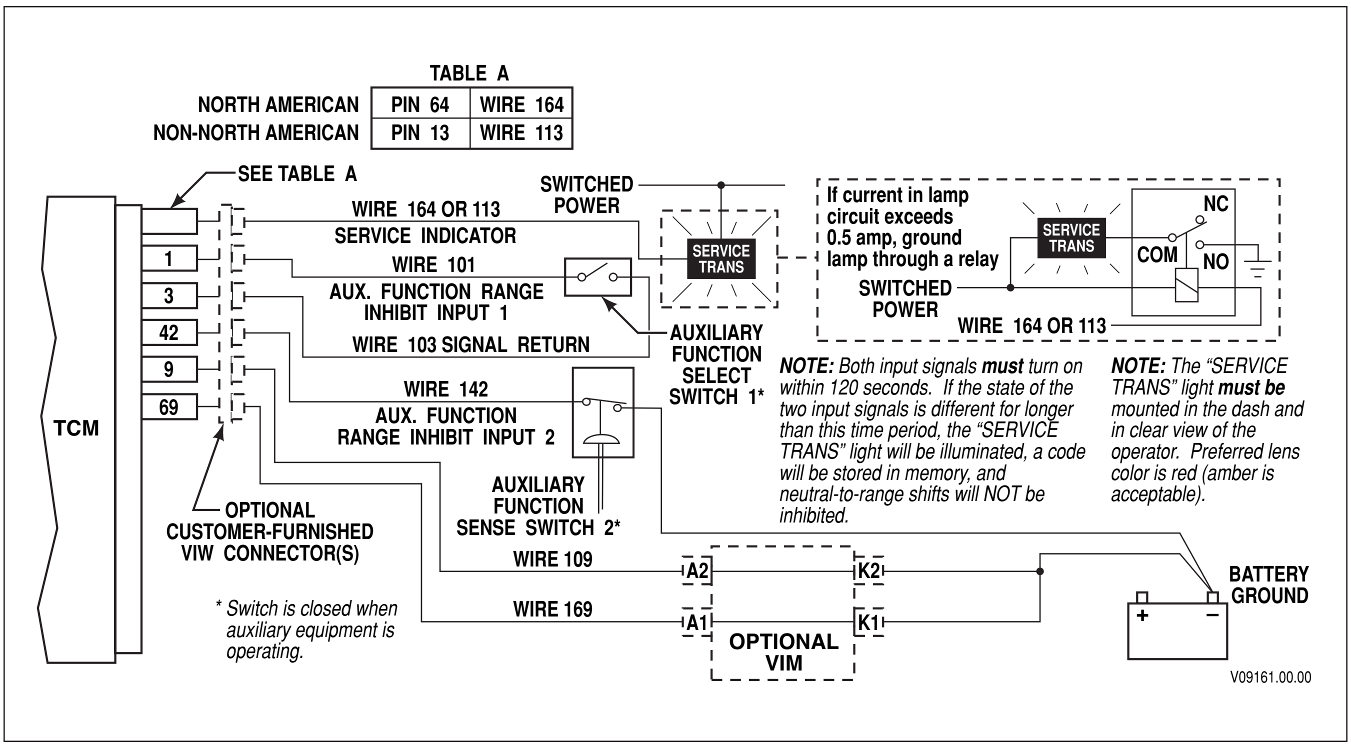


Figure P–8. Dual Input Auxiliary Function Range Inhibit

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION G. AUXILIARY HOLD

USES: Provide a discrete input to hold the transmission in present range.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

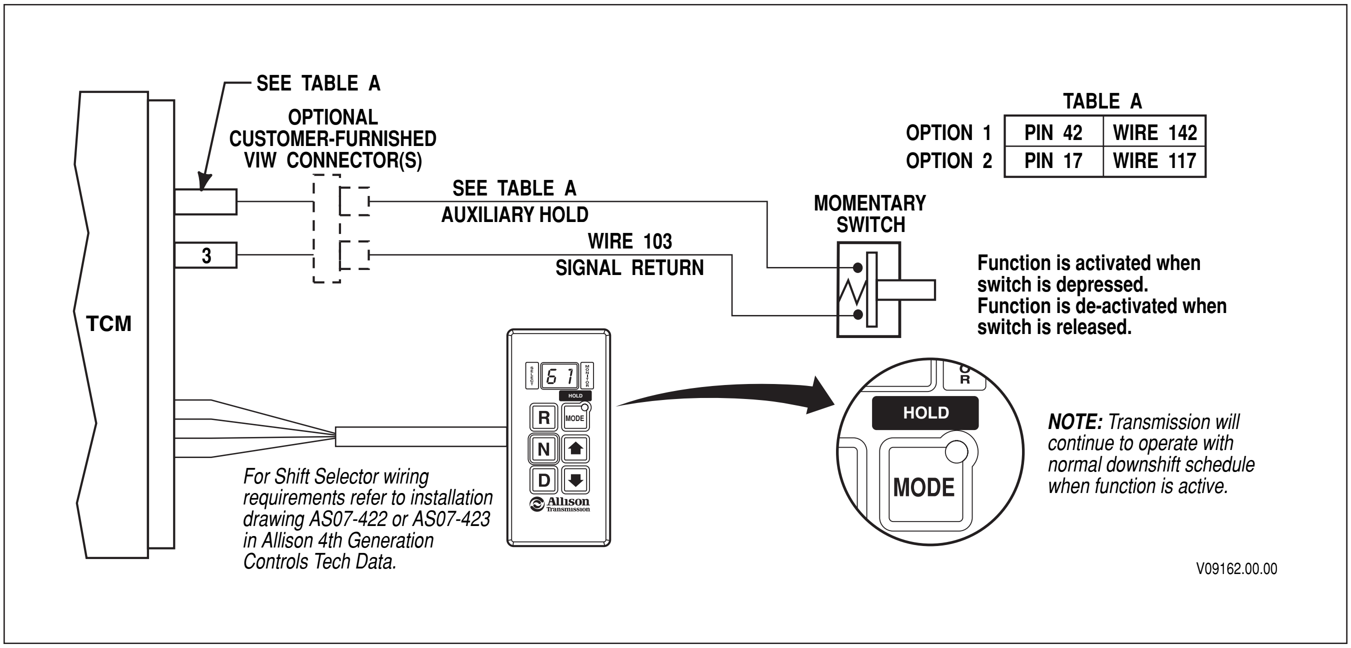


Figure P–9. Auxiliary Hold

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION H. ENGINE BRAKE ENABLE AND PRESELECT REQUEST PLUS ENGINE BRAKE ENABLE OUTPUT USING EXHAUST BRAKES

USES: Used with engine brakes to signal the TCM that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is second range.

VOCATIONS: Various

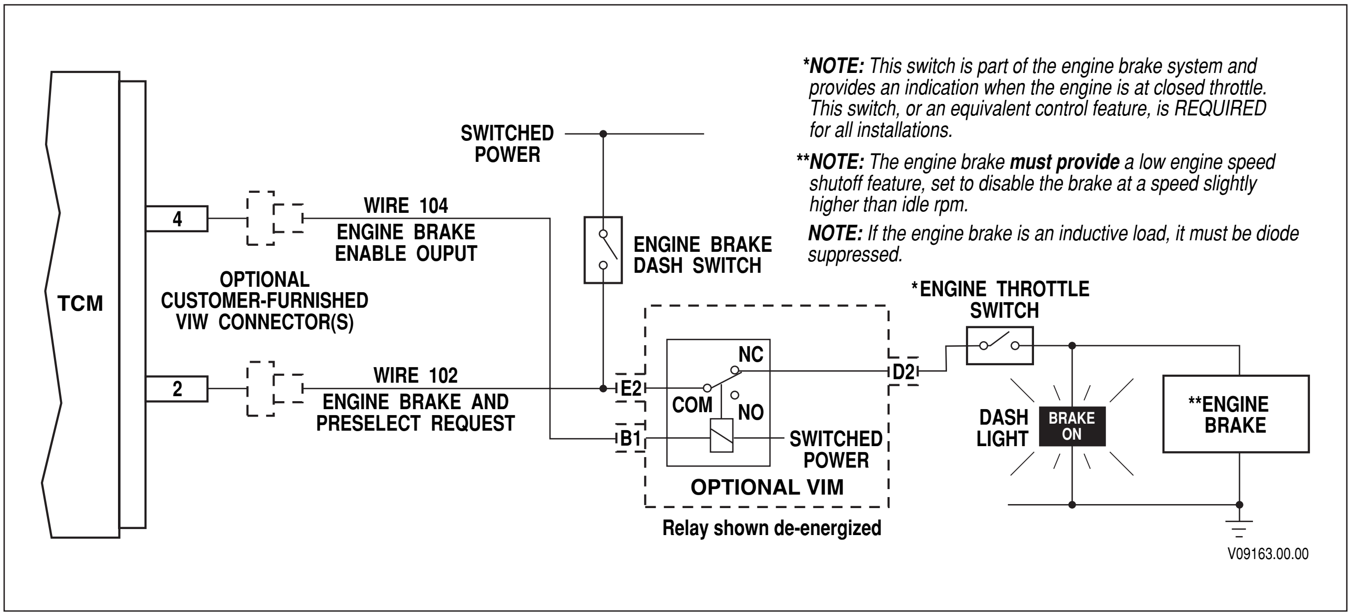


Figure P–10. Engine Brake Enable And Preselect Request Plus Engine Brake Enable Output Using Exhaust Brakes

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION H. ENGINE BRAKE ENABLE AND PRESELECT REQUEST PLUS ENGINE BRAKE ENABLE OUTPUT USING ECM CONTROLLED EXHAUST BRAKES

USES: Used with exhaust brakes controlled by electronic engines to signal the TCM that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is second range.

VOCATIONS: Various

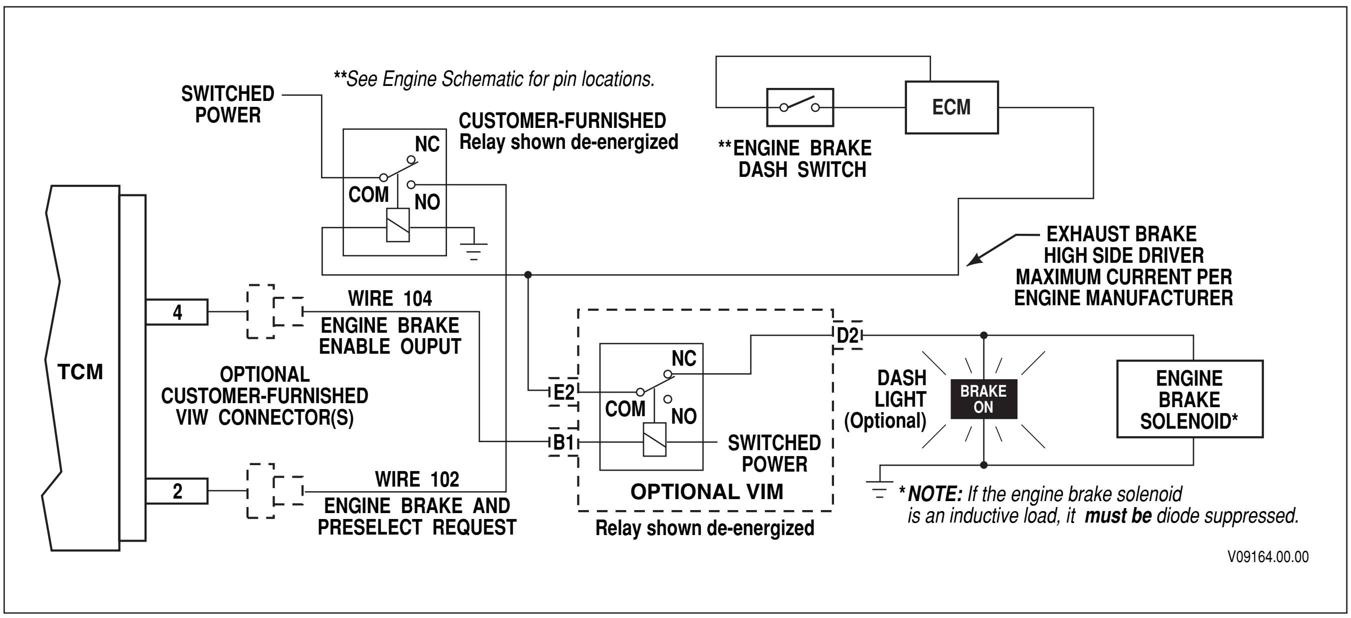


Figure P–11. Engine Brake Enable And Preselect Request Plus Engine Brake Enable Output Using ECM Controlled Exhaust Brakes

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION H. ENGINE BRAKE ENABLE AND PRESELECT REQUEST PLUS ENGINE BRAKE ENABLE OUTPUT WITH SINGLE LEVEL COMPRESSION BRAKES

USES: Used with engine brakes to signal the TCM that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is fourth range.

VOCATIONS: Various

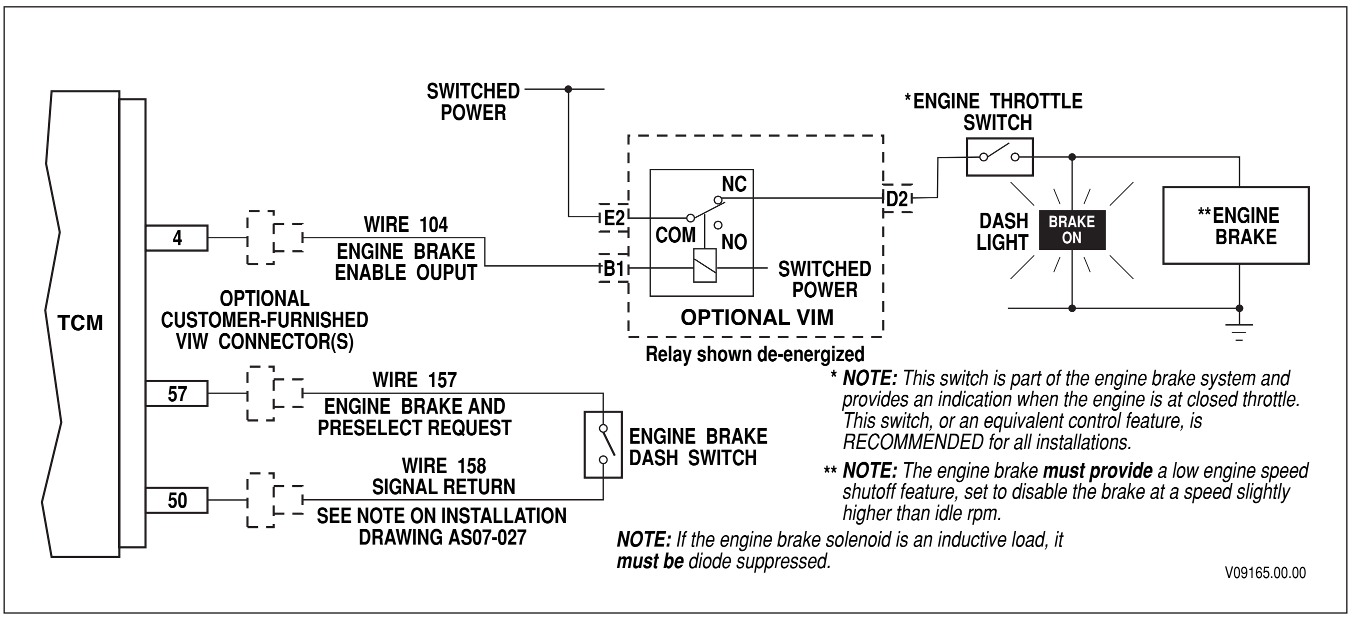


Figure P–12. Engine Brake Enable And Preselect Request Plus Engine Brake Enable Output With Single Level Compression Brakes

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION H. ENGINE BRAKE ENABLE AND PRESELECT REQUEST PLUS ENGINE BRAKE ENABLE OUTPUT WITH MULTI-LEVEL COMPESSION BRAKES

USES: Used with multiple-level compression brakes to signal the TCM that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is fourth range.

VOCATIONS: Various

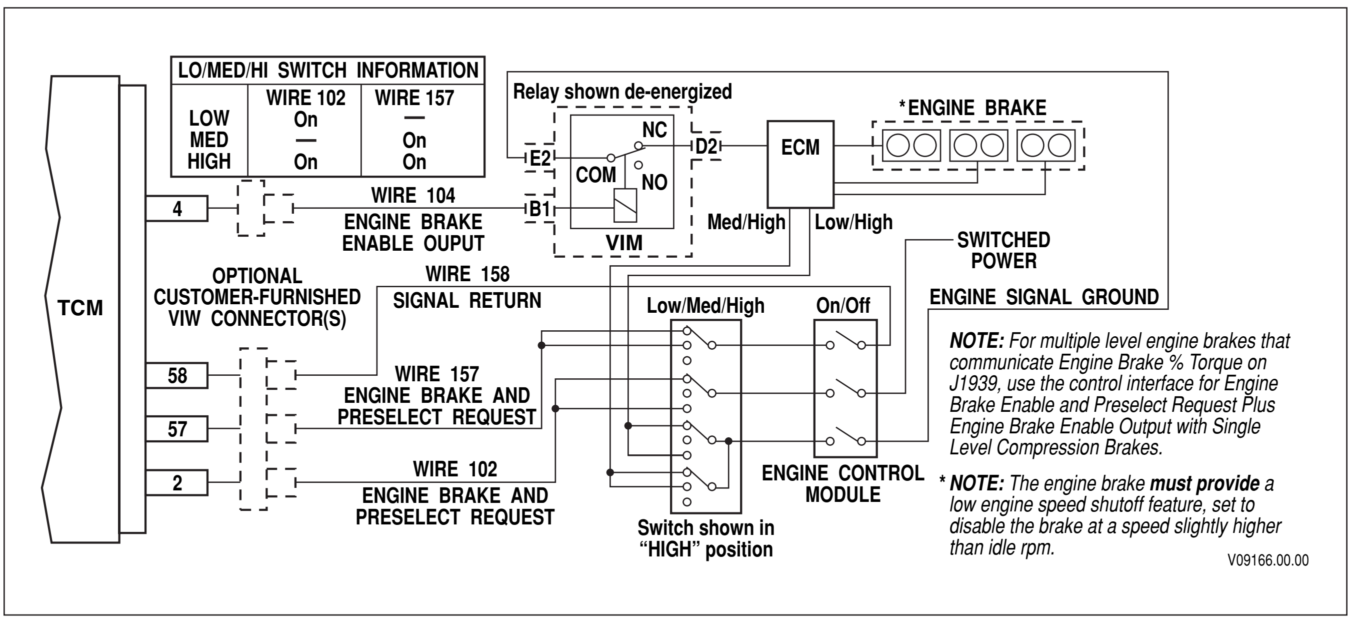


Figure P–13. Engine Brake Enable and Preselect Request Plus Engine Brake Enable Output With Multi-Level Compression Brakes

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION I. EUROPEAN ENGINE BRAKE ENABLE AND PRESELECT REQUEST PLUS ENGINE BRAKE ENABLE OUTPUT USING EXHAUST BRAKES

Used with engine brakes to provide a signal to the TCM that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is second range.

VOCATIONS: Various

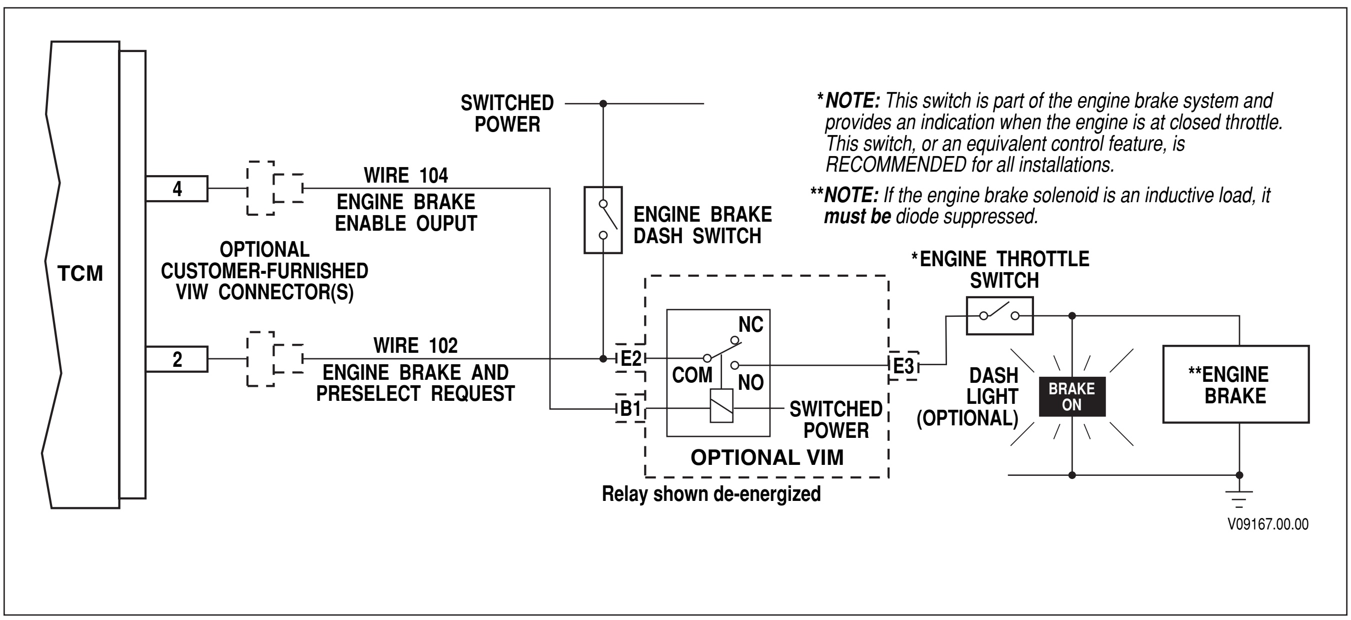


Figure P–14. European Engine Brake Enable and Preselect Request Plus Engine Brake Enable Output Using Exhaust Brakes

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION I. EUROPEAN ENGINE BRAKE ENABLE AND PRESELECT REQUEST PLUS ENGINE BRAKE ENABLE OUTPUT WITH SINGLE LEVEL COMPRESSION BRAKES

USES: Used with engine brakes to provide a signal to the TCM that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup off.

VARIABLES TO SPECIFY: Preselect range. Standard value is fourth range.

VOCATIONS: Various

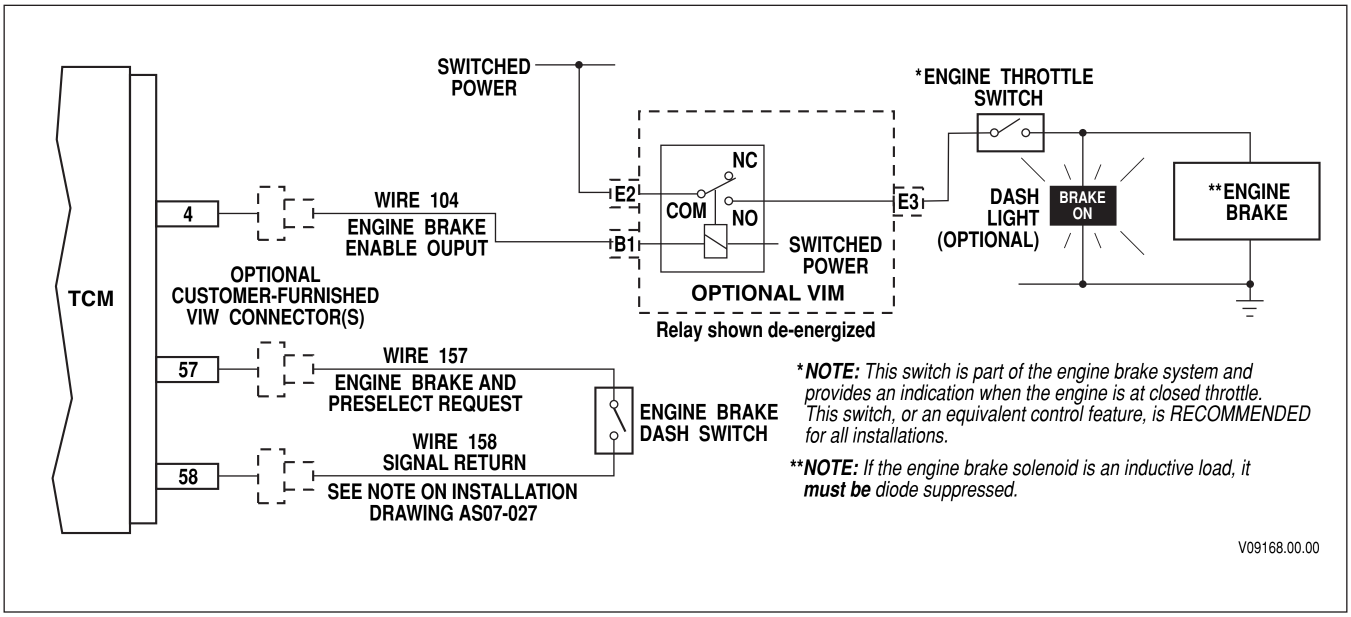


Figure P–15. European Engine Brake Enable and Preselect Request Plus Engine Brake Enable Output With Single Level Compression Brakes

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION J. FIRE TRUCK PUMP MODE—OPERATOR AND PUMP ACTIVATED (NORTH AMERICA)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup.

VARIABLES TO SPECIFY: None

VOCATIONS: Fire Truck Pumpers

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

SYSTEM OPERATION

OPERATOR ACTION—System Response

TO ENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral.
2. *APPLY PARK BRAKE*—None
3. *SELECT PUMP*—Turns on “Pump Mode Requested” light. Turns on input signal to TCM (wire 123) which activates “fire truck” mode. When split-shaft shifts, wire 122 is activated and “Pump Engaged” light is turned on.
4. *SELECT DRIVE*—Transmission shifts to fourth lockup. “OK To Pump” light is turned on.

TO DISENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral if output shaft speed is less than 1000 rpm.
2. *SELECT ROAD MODE*—PTO disengages. If output shaft rotation continues, press the Momentary Trans. Brake Switch before selecting Road Mode. This will cause the transmission output shaft to stop if transmission is in Neutral and output shaft speed is less than 175 rpm.

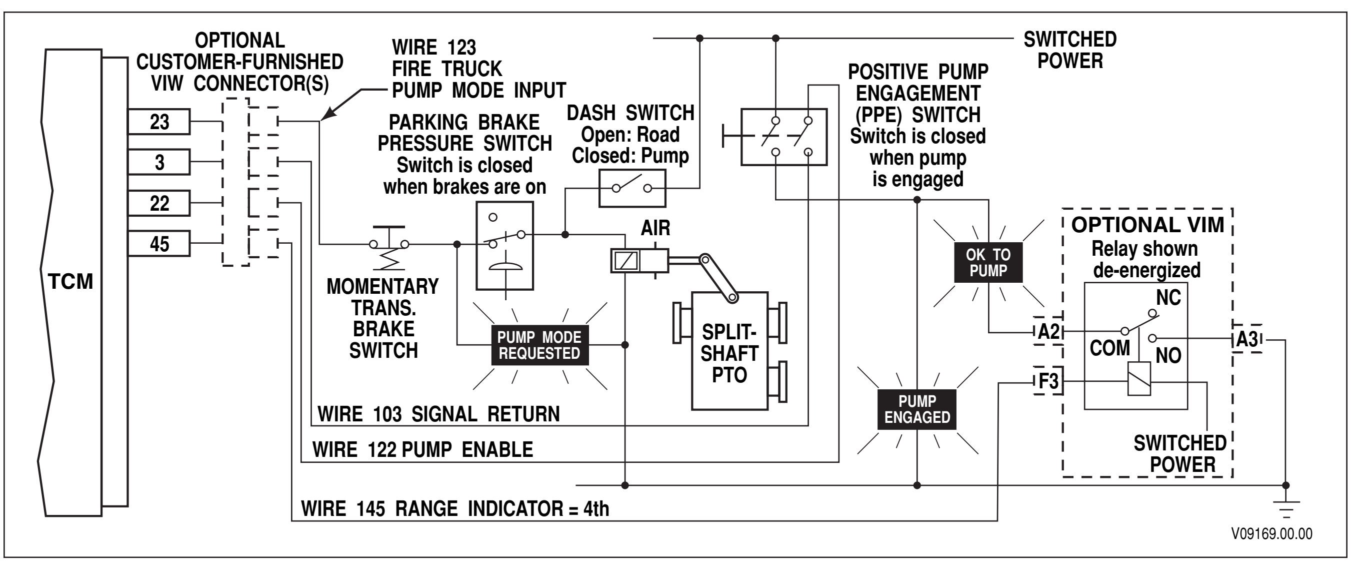


Figure P–16. Fire Truck Pump Mode—Operator and Pump Activated (North American)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION J. FIRE TRUCK PUMP MODE—OPERATOR ONLY ACTIVATED (NORTH AMERICA)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup.

VARIABLES TO SPECIFY: None

VOCATIONS: Fire Truck Pumpers

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

SYSTEM OPERATION

OPERATOR ACTION—System Response

TO ENGAGE:

1. SELECT NEUTRAL—Transmission shifts to Neutral.
2. APPLY PARK BRAKE—None
3. SELECT PUMP—Turns on “Pump Mode Requested” light. Turns on both input signals to TCM (wires 122 and 123) which activates “fire truck” mode. When split-shaft shifts, “Pump Engaged” light is turned on.
4. SELECT DRIVE—Transmission shifts to fourth lockup. “OK To Pump” light is turned on.

TO DISENGAGE:

1. SELECT NEUTRAL—Transmission shifts to Neutral if output shaft speed is less than 1000 rpm.
2. SELECT ROAD MODE—PTO disengages. If output shaft rotation continues, press the Momentary Trans. Brake Switch before selecting road mode. This will cause the transmission output shaft to stop if transmission is in Neutral and output shaft speed is less than 175 rpm.

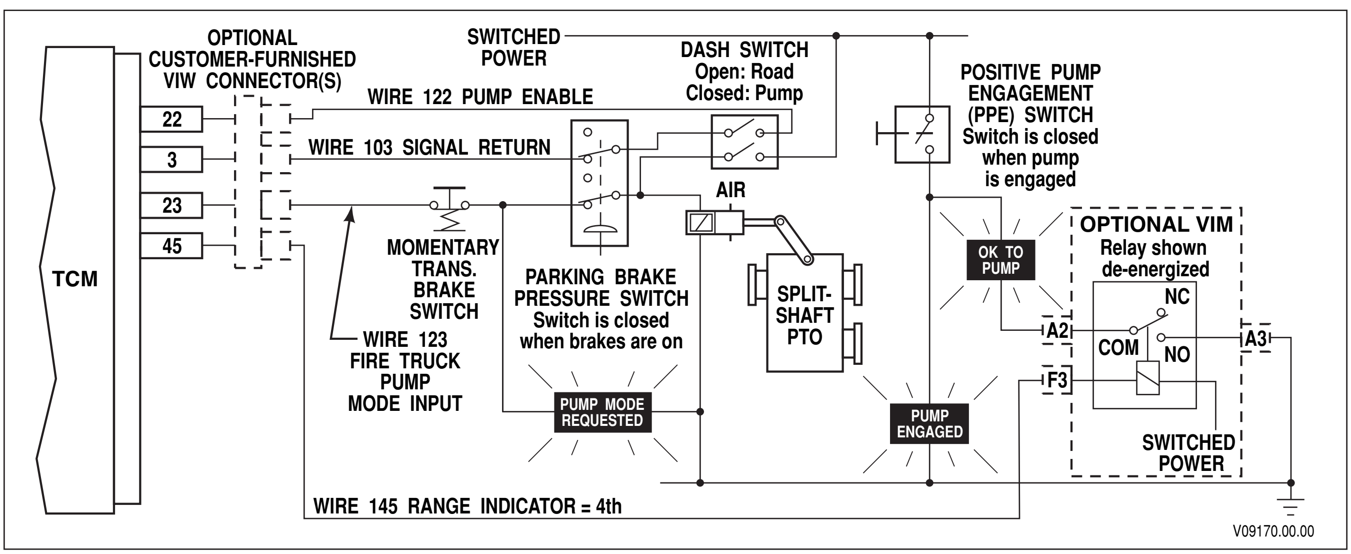


Figure P–17. Fire Truck Pump Mode—Operator Only Activated (North American)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION J. FIRE TRUCK PUMP MODE—OPERATOR AND PUMP ACTIVATED (NON-NORTH AMERICA)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup.

VARIABLES TO SPECIFY: None

VOCATIONS: Fire Truck Pumpers

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

SYSTEM OPERATION

OPERATOR ACTION—System Response

TO ENGAGE:

1. SELECT NEUTRAL—Transmission shifts to Neutral.
2. APPLY PARK BRAKE—None
3. SELECT PUMP—Turns on “Pump Mode Requested” light. Turns on both input signals to TCM (wire 143) which activates “fire truck” mode. When split-shaft shifts, WIRE 117 IS ACTIVE AND “Pump Engaged” light is turned on.
4. SELECT DRIVE—Transmission shifts to fourth lockup. “OK To Pump” light is turned on.

TO DISENGAGE:

1. SELECT NEUTRAL—Transmission shifts to Neutral if output shaft speed is less than 1000 rpm.
2. SELECT ROAD MODE—PTO disengages. If output shaft rotation continues, press the Momentary Trans. Brake Switch before selecting road mode. This will cause the transmission output shaft to stop if transmission is in Neutral and output shaft speed is less than 175 rpm.

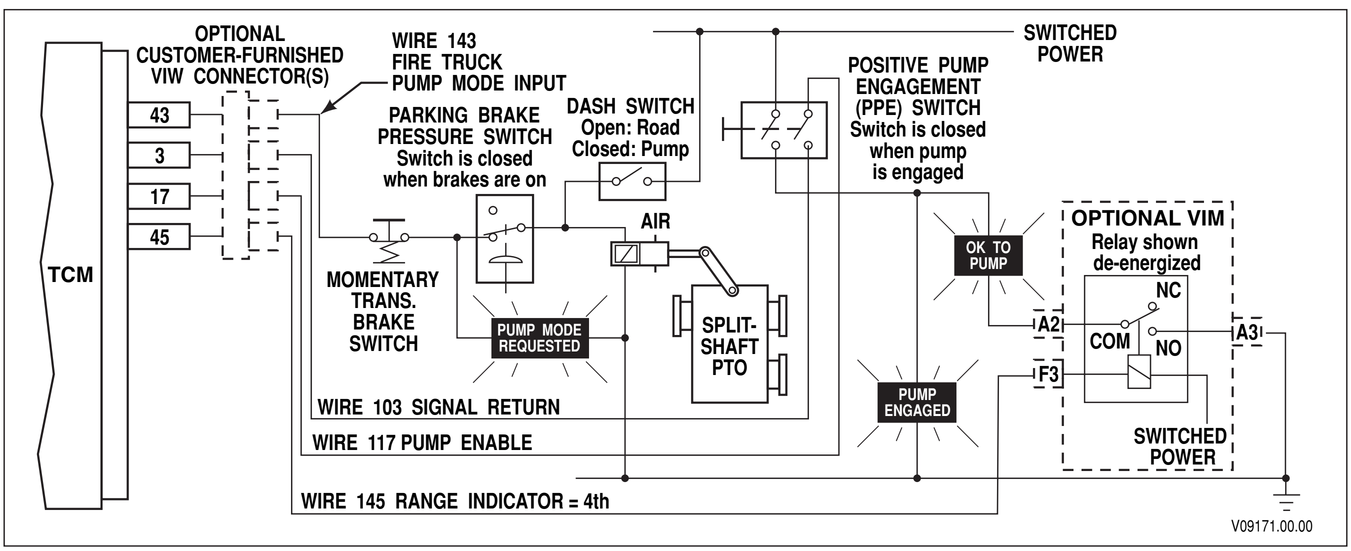


Figure P–18. Fire Truck Pump Mode—Operator and Pump Activated

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION J. FIRE TRUCK PUMP MODE—OPERATOR ONLY ACTIVATED (NON-NORTH AMERICA)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup.

VARIABLES TO SPECIFY: None

VOCATIONS: Fire Truck Pumpers

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

SYSTEM OPERATION

OPERATOR ACTION—System Response

TO ENGAGE:

1. SELECT NEUTRAL—Transmission shifts to Neutral.
2. APPLY PARK BRAKE—None
3. SELECT PUMP—Turns on “Pump Mode Requested” light. Turns on both input signals to TCM (wires 117 and 143) which activates “fire truck” mode. When split-shaft shifts, “Pump Engaged” light is turned on.
4. SELECT DRIVE—Transmission shifts to fourth lockup. “OK To Pump” light is turned on.

TO DISENGAGE:

1. SELECT NEUTRAL—Transmission shifts to Neutral if output shaft speed is less than 1000 rpm.
2. SELECT ROAD MODE—PTO disengages. If output shaft rotation continues, press the Momentary Trans. Brake Switch before selecting road mode. This will cause the transmission output shaft to stop if transmission is in Neutral and output shaft speed is less than 175 rpm.

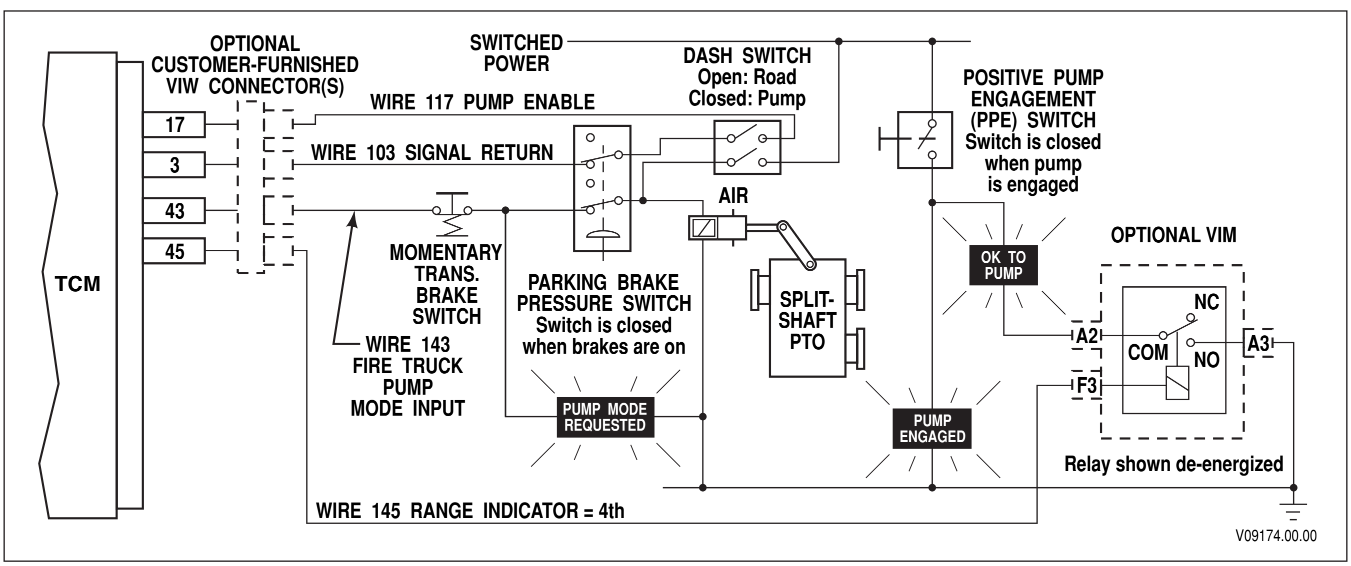


Figure P–19. Fire Truck Pump Mode—Operator Only Activated

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION L. AUTOMATIC NEUTRAL—SINGLE INPUT SWITCHED TO GROUND (WIRE 117)

USES: Provides for automatic selection of NEUTRAL when PTO is operated regardless of range selected. Requires re-selecting range to shift out of NEUTRAL. Shown with range indicator output.

VARIABLES TO SPECIFY: Maximum output speed for activating this function. Range indicator = neutral.

VOCATIONS: Various (with usage of PTO)

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.** **This function must not be used with Neutral Indicator For PTO (Output "S").**

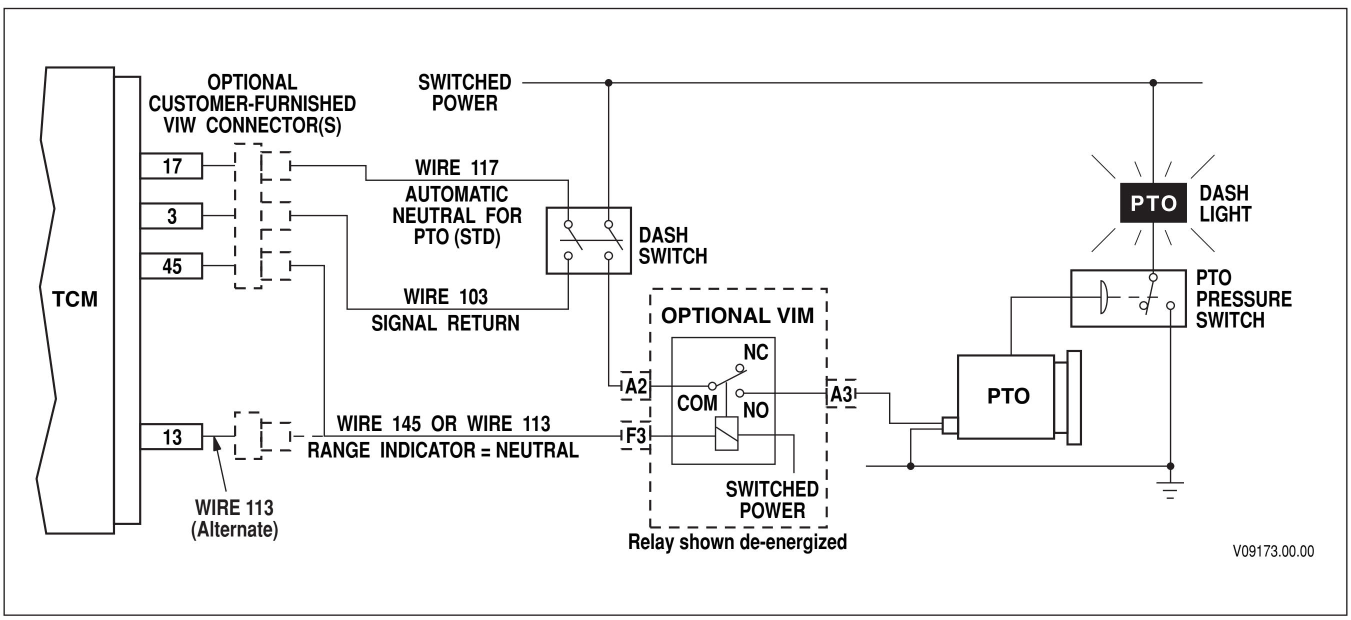


Figure P–20. Automatic Neutral—Single Input Switched to Ground (Wire 117)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION L. AUTOMATIC NEUTRAL—SINGLE INPUT SWITCHED TO POWER

USES: Provides for automatic selection of NEUTRAL when PTO is operated regardless of range selected. Requires re-selecting range to shift out of NEUTRAL. Shown with range indicator output.

VARIABLES TO SPECIFY: Maximum output speed for activating this function. Range indicator = neutral.

VOCATIONS: Various (with usage of PTO)

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.** **This function must not be used with Neutral Indicator For PTO (Output "S").**

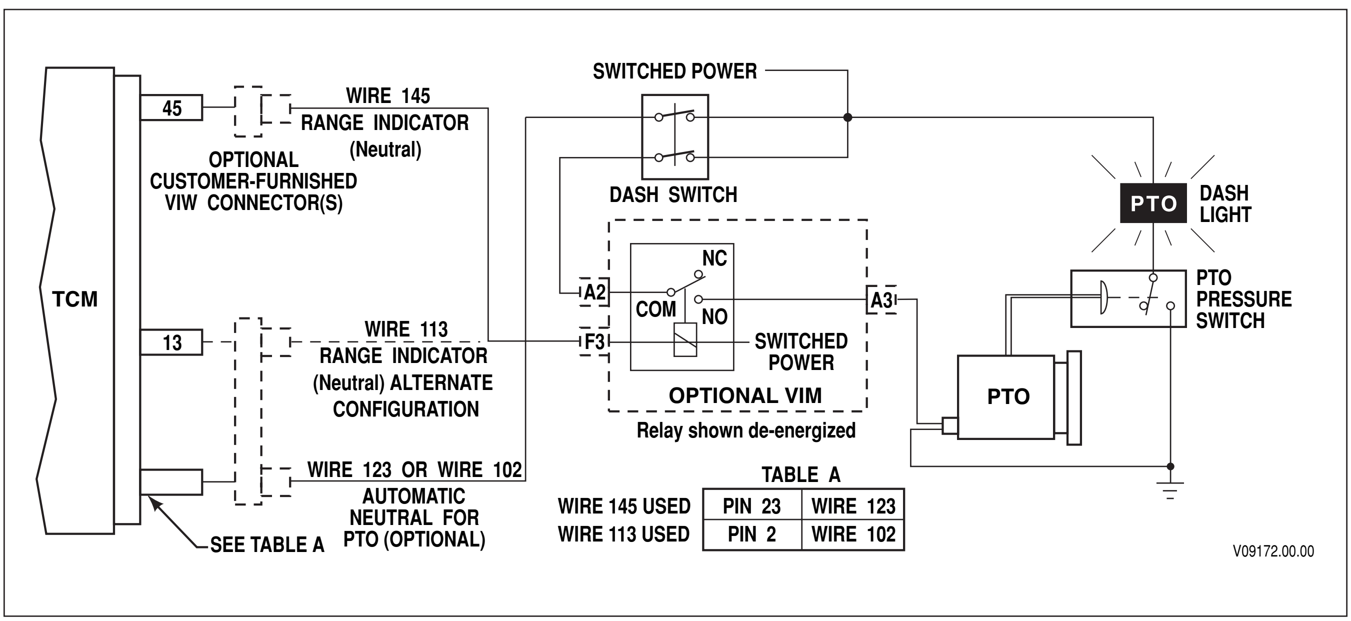


Figure P–21. Automatic Neutral—Single Input Switched to Power (Wire 123 or 102)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION Q. TWO-SPEED AXLE—INPUT AND OUTPUT

USES: Provides output speed interlock for axle engagement, input to ECU, and input to speedometer to adjust for axle ratio change.

VARIABLES TO SPECIFY: Output speed to activate, output speed to deactivate.

VOCATIONS: Dump truck, refuse packer, cement mixer, two-speed axle equipped vehicles.

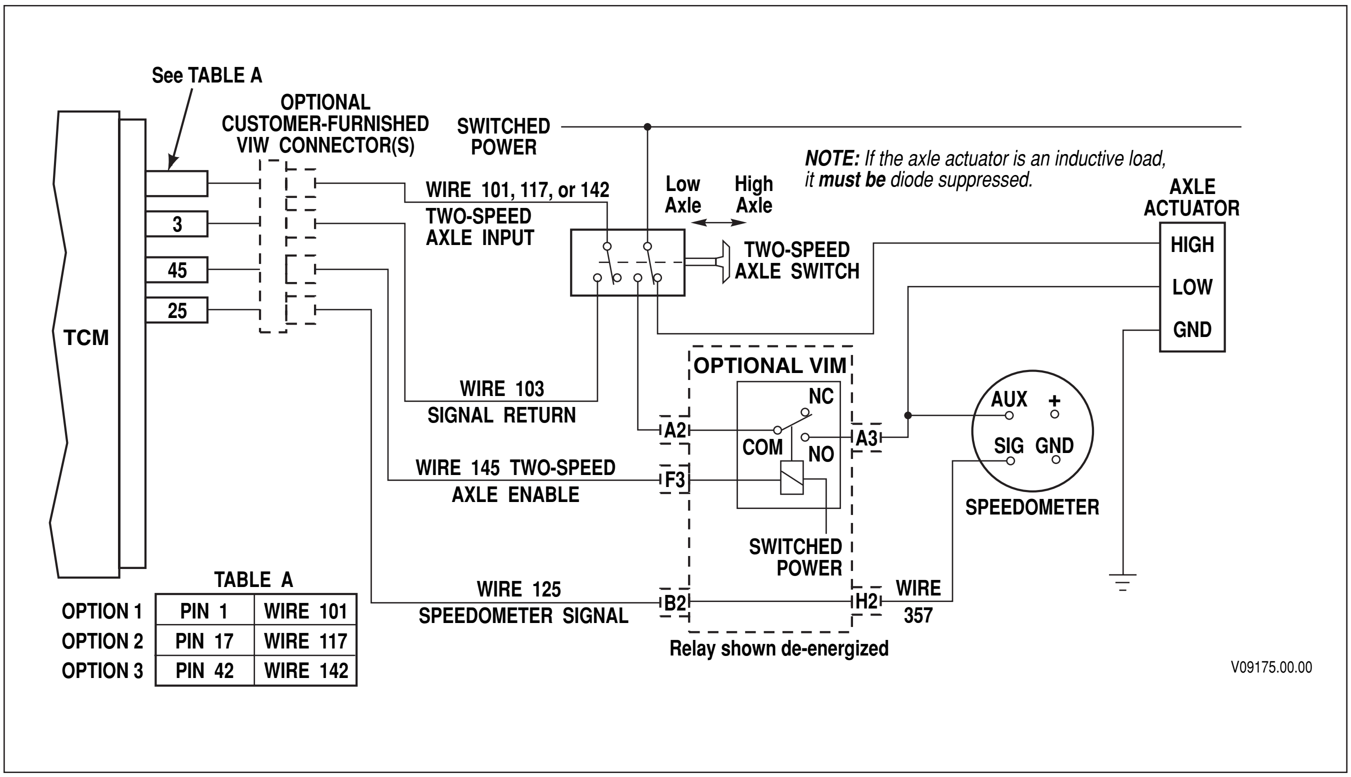


Figure P–22. Two-Speed Axle—Input and Output

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION V. REVERSE ENABLE SWITCHED TO GROUND

USES: Provides for a separate instrument panel-mounted switch which must be pressed simultaneously with the REVERSE button to achieve Reverse.

VARIABLES TO SPECIFY: None

VOCATIONS: European transit buses and tour buses

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

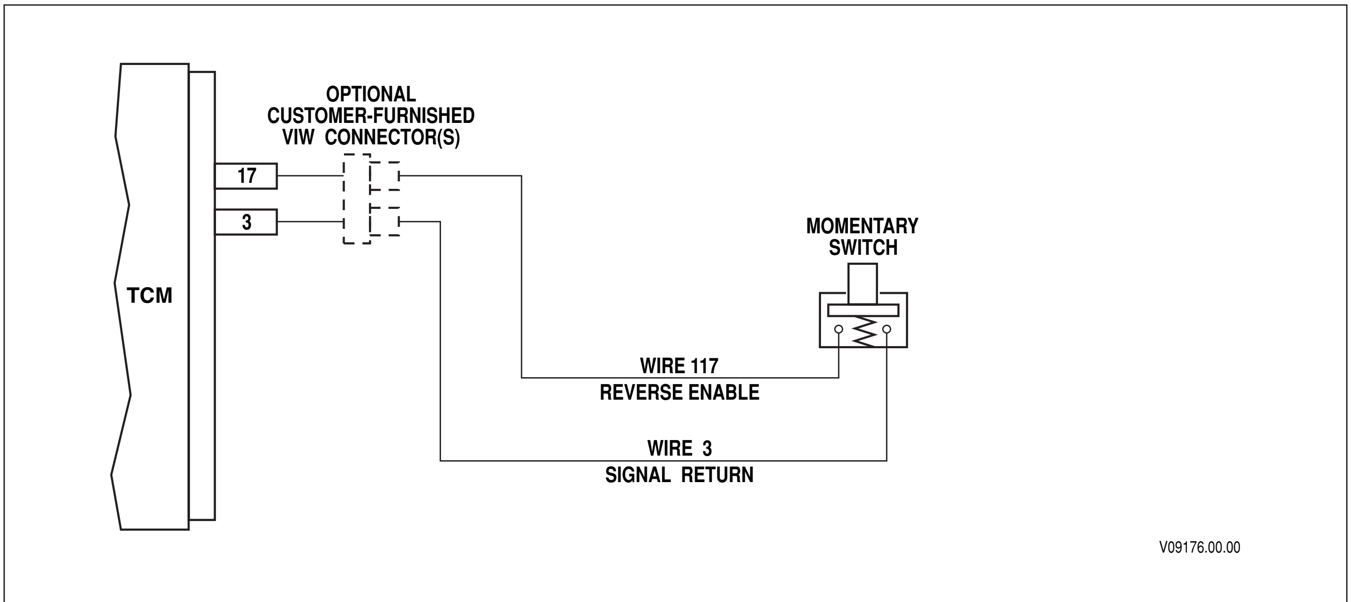


Figure P–23. Reverse Enable Switched to Ground

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION V. REVERSE ENABLE SWITCHED TO POWER

USES: Provides for a separate instrument panel-mounted switch which must be pressed simultaneously with the REVERSE button to achieve Reverse.

VARIABLES TO SPECIFY: None

VOCATIONS: European transit buses and tour buses

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

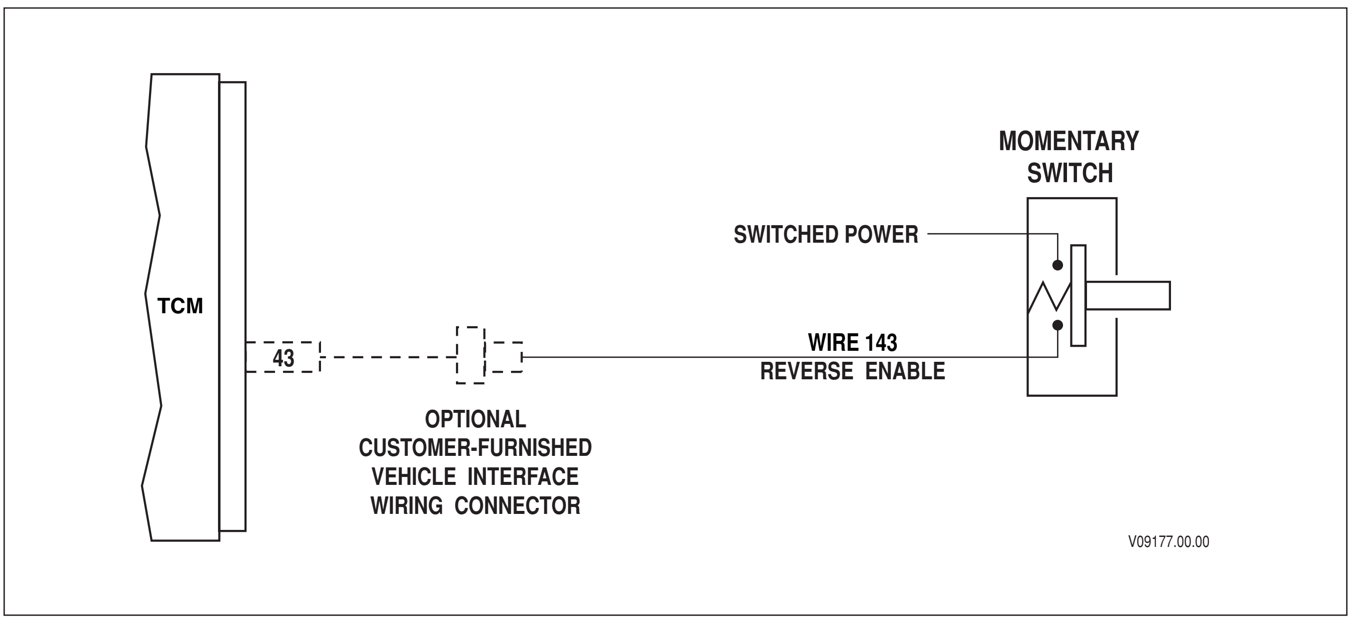


Figure P–24. Reverse Enable Switched to Power

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION W. DIRECTION CHANGE ENABLE SWITCHED TO GROUND

USES: An active input signals the TCM to permit a requested direction change shift (Neutral to Drive, Neutral to Reverse, Reverse to Drive, or Drive to Reverse). If the Direction Change Enable input is inactive and a direction change shift is requested, the TCM will inhibit the direction change shift by forcing the transmission to Neutral. The direction change inhibit remains in effect until the Direction Change Enable input becomes active AND a range (Reverse, Neutral, or Drive) is requested at the shift selector.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

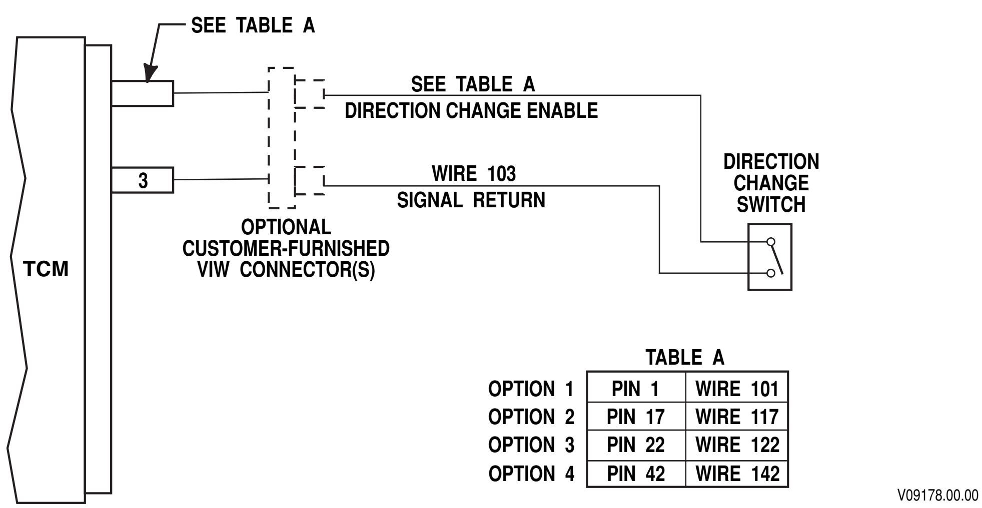


TABLE A

OPTION 1	PIN 1	WIRE 101
OPTION 2	PIN 17	WIRE 117
OPTION 3	PIN 22	WIRE 122
OPTION 4	PIN 42	WIRE 142

Figure P–25. Direction Change Enable Switched to Ground

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION W. DIRECTION CHANGE ENABLE SWITCHED TO POWER

USES: An active input signals the TCM to permit a requested direction change shift (Neutral to Drive, Neutral to Reverse, Reverse to Drive, or Drive to Reverse). If the Direction Change Enable input is inactive and a direction change shift is requested, the TCM will inhibit the direction change shift by forcing the transmission to Neutral. The direction change inhibit remains in effect until the Direction Change Enable input becomes active AND a range (Reverse, Neutral, or Drive) is requested at the shift selector.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

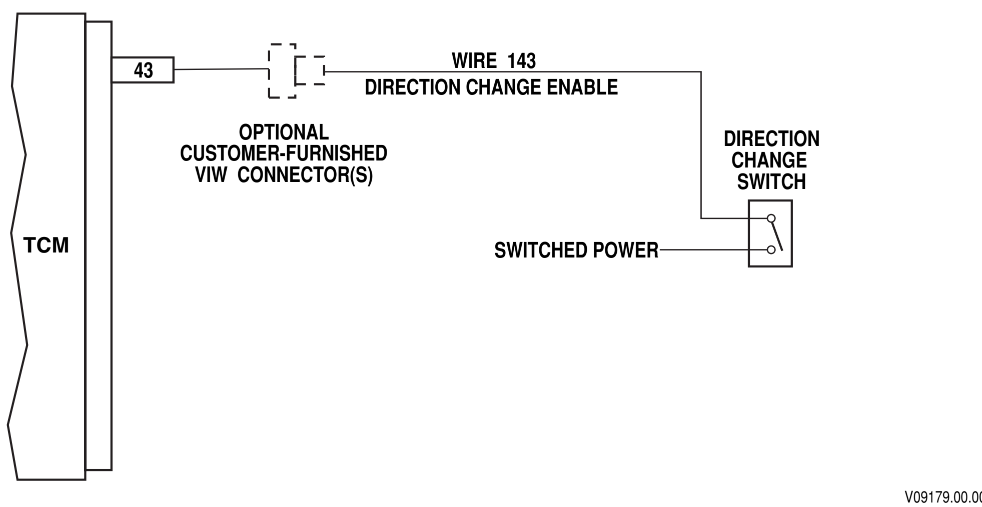


Figure P–26. Direction Change Enable Switched to Power

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION Y. ANTI-LOCK BRAKE RESPONSE WITH INPUT FROM ABS CONTROLLER

USES: Signals the TCM when ABS function is active, so that lockup clutch and retarder will be disabled.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

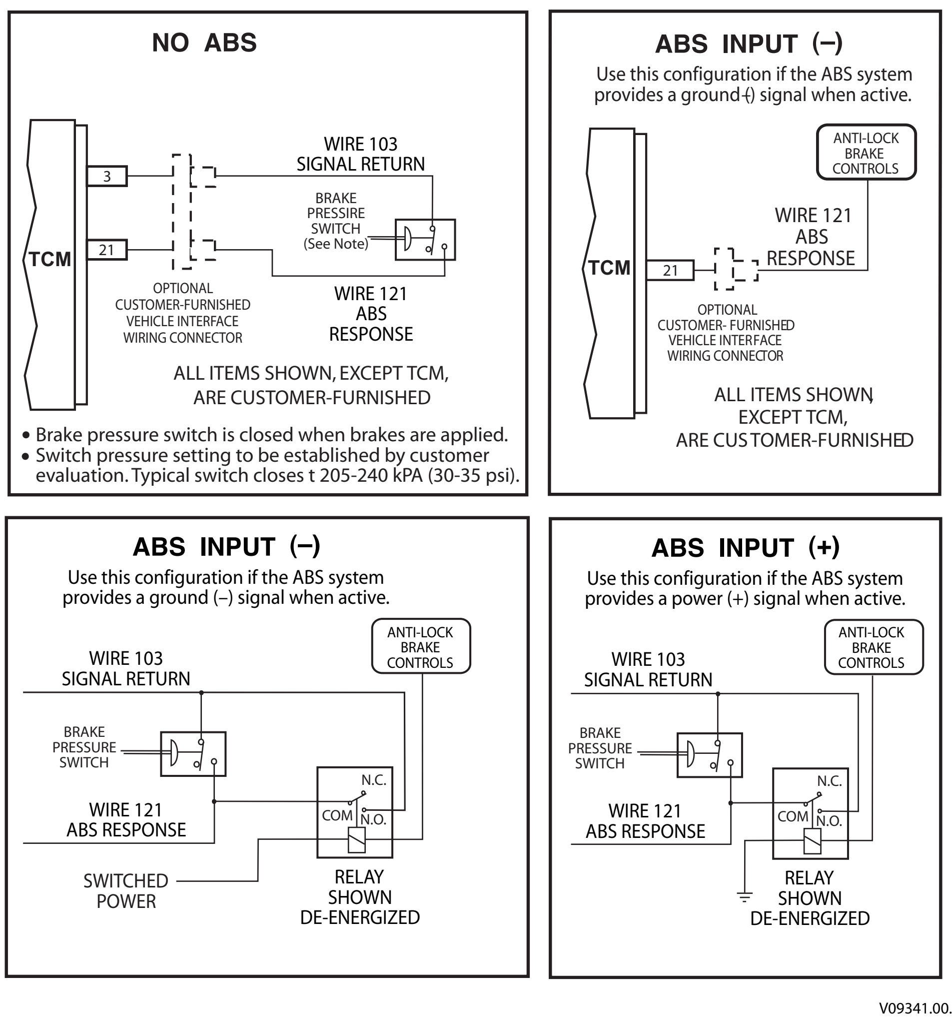


Figure P–27. Anti-Lock Brake Response With Input From ABS Controller

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION Y. ANTI-LOCK BRAKE RESPONSE VIA J1939 COMMUNICATIONS LINK

USES: Signals the TCM when ABS function is active so that the lockup clutch and retarder will be disabled. Signals the TCM during hard braking even if ABS is not activated, so that the lockup clutch and retarder will be disabled.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

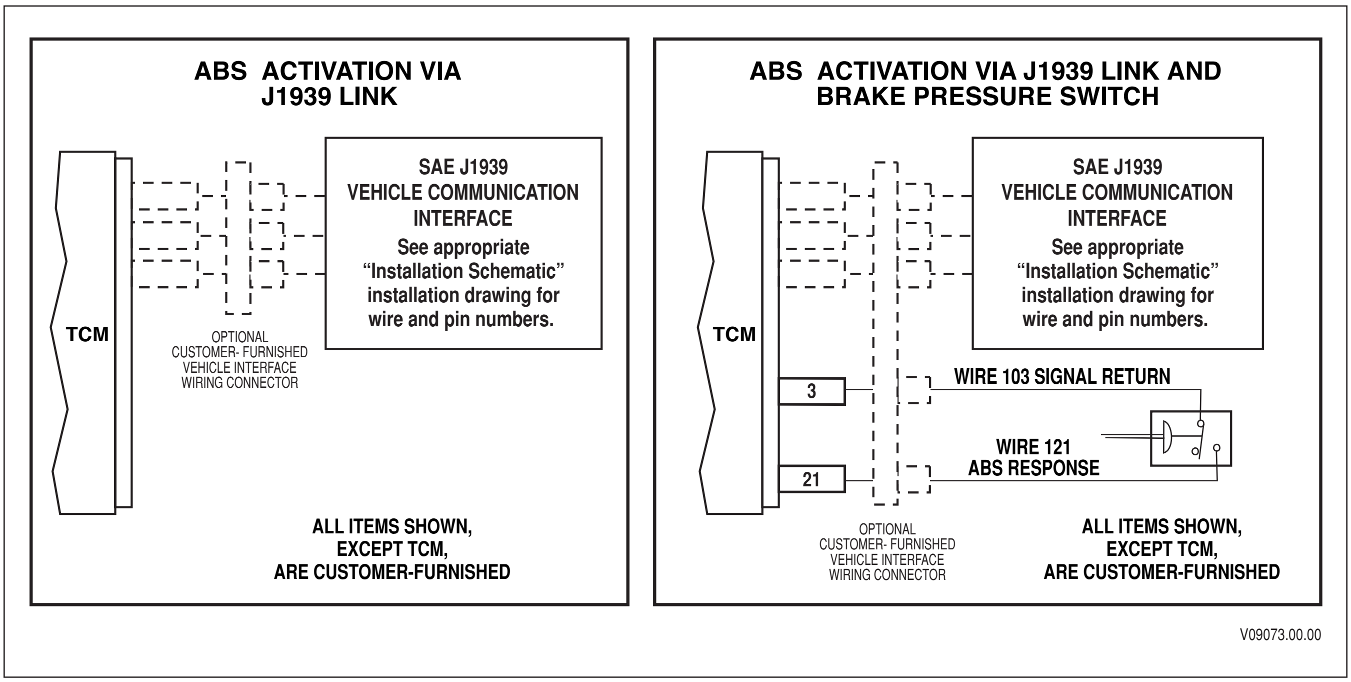


Figure P–28. Anti-Lock Brake Response Via J1939 Communications Link

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION Z. RETARDER ENABLE

USES: Provides for operator ON/OFF control of the retarder, transmission temperature indication, and brake lights during retarder operation.

USES: None

VOCATIONS: Various. This function is required for retarder-equipped transmissions.

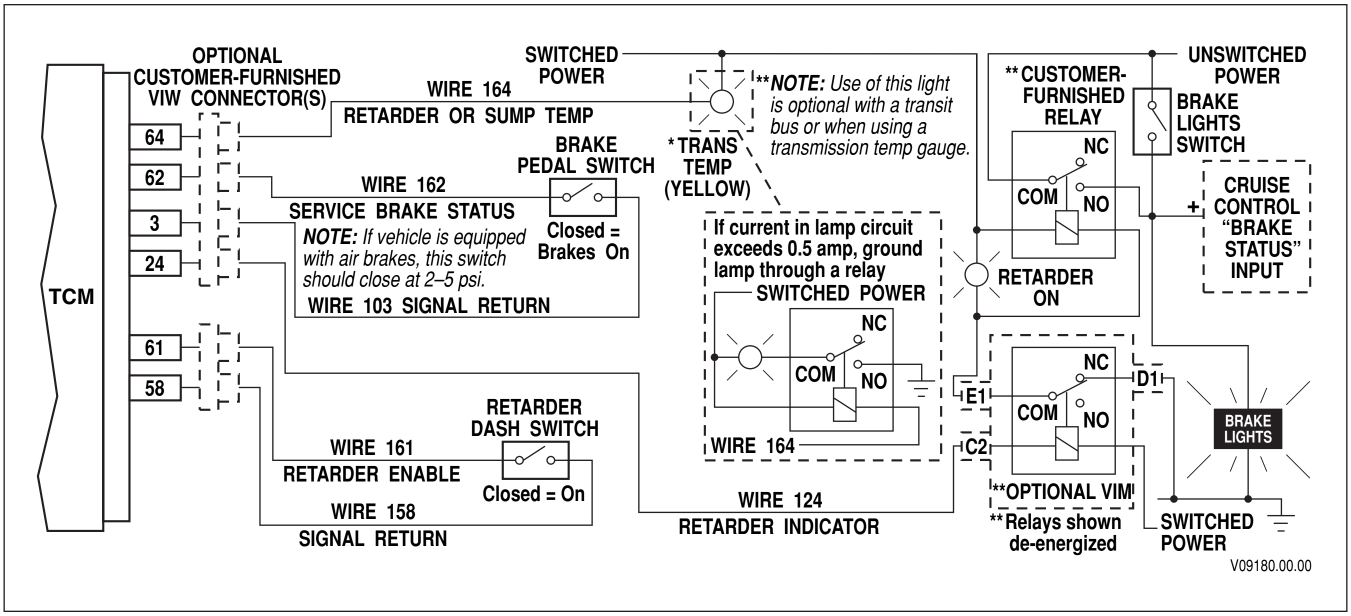


Figure P–29. Retarder Enable

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AA. SERVICE BRAKE STATUS

USES: Indicates to the TCM whether vehicle braking is being provided by the retarder or vehicle brakes, so that the transmission controls can be adapted accordingly.

VARIABLES TO SPECIFY: None

VOCATIONS: Various. This function is **required** for retarder-equipped transmissions.

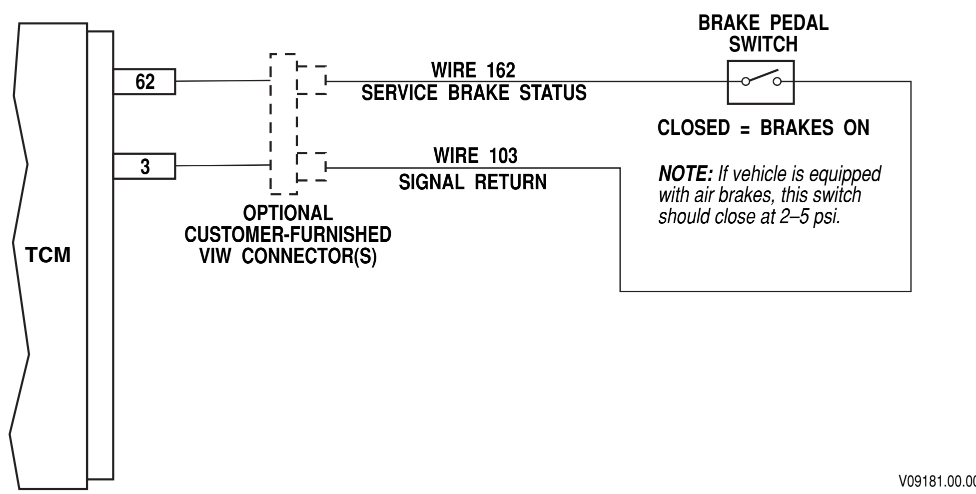


Figure P–30. Service Brake Status

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AF. DIFFERENTIAL CLUTCH REQUEST

USES: Provides for operator ON/OFF control of the differential locking clutch in the 3000 Product Family 7-speed transmission transfer case.

VARIABLES TO SPECIFY: None

VOCATIONS: Various. This function is **required** for all 3000 Product Family 7-speed transmissions and used only with this transmission.

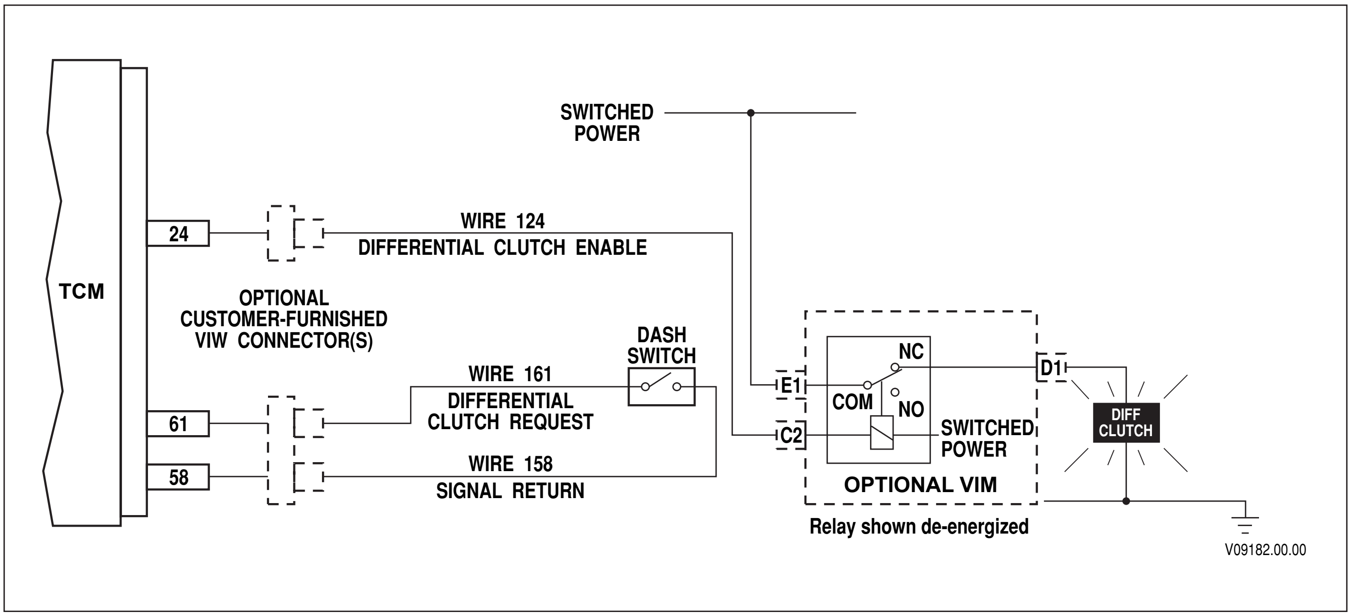


Figure P–31. Differential Clutch Request

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AG. AUTOMATIC NEUTRAL—DUAL INPUT—PARK BRAKE ACTIVATED

USES: Provides for automatic selection of NEUTRAL and activation of fast idle when park brake is applied. Automatically re-engages transmission when park brake is released. PTO can be enabled independent of transmission range.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck

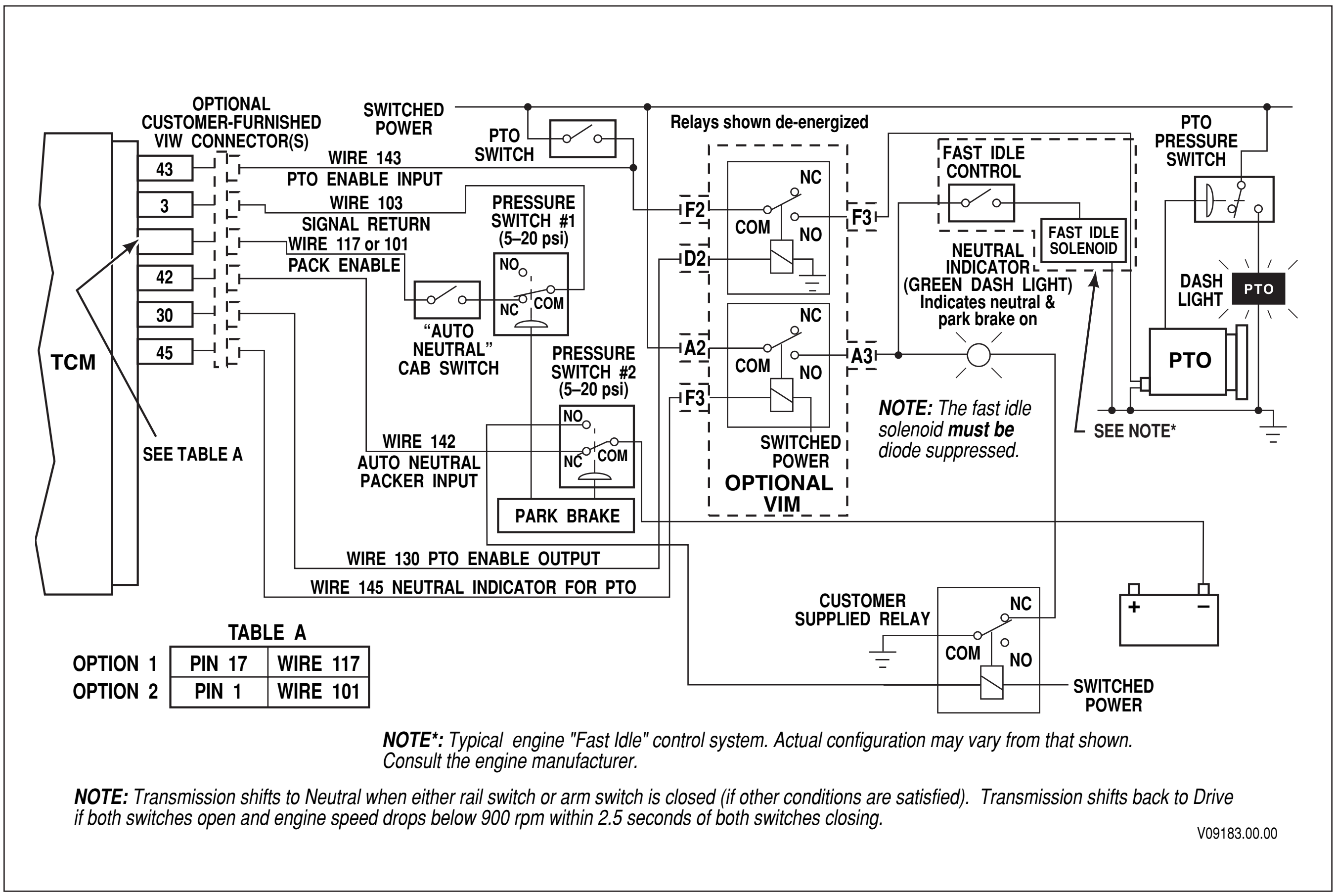


Figure P–32. Automatic Neutral—Dual Input—Park Brake Activated

APPENDIX P—INPUT/OUTPUT FUNCTIONS

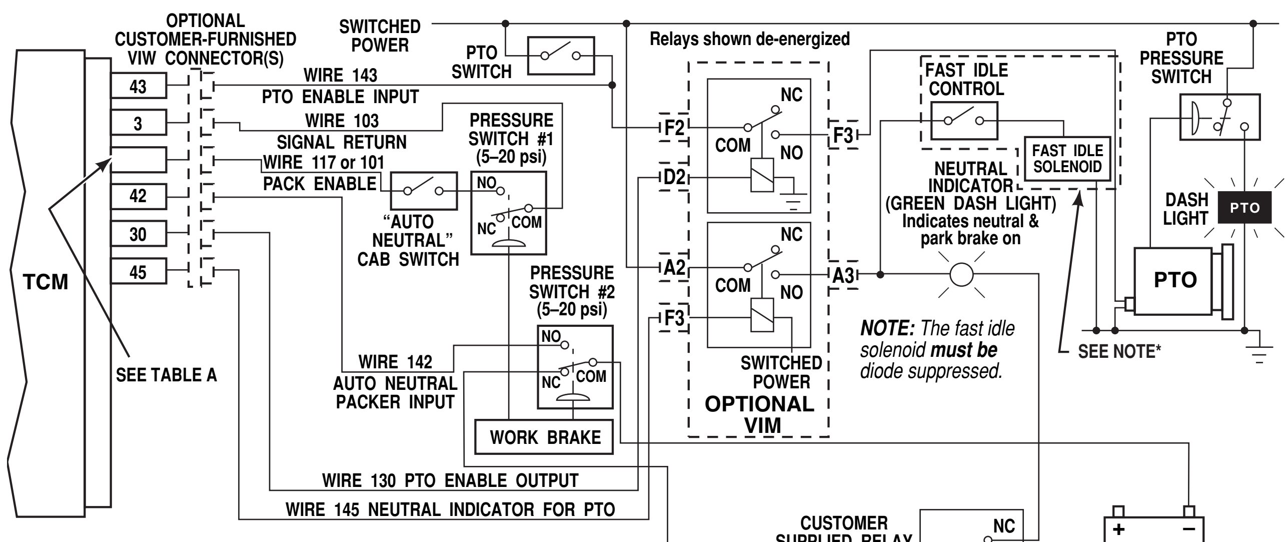
> **WARNING!** **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AG. AUTOMATIC NEUTRAL—DUAL INPUT—WORK BRAKE ACTIVATED

USES: Provides for automatic selection of NEUTRAL and activation of fast idle when work brake is applied. Automatically re-engages transmission when park brake is released. PTO can be enabled independent of transmission range.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck



OPTION 1	PIN 17	WIRE 117
OPTION 2	PIN 1	WIRE 101

NOTE: Typical engine "Fast Idle' control system. Actual configuration may vary from that shown. Consult the engine manufacturer.*

NOTE: Transmission shifts to Neutral when either rail switch or arm switch is closed (if other conditions are satisfied). Transmission shifts back to Drive if both switches open and engine speed drops below 900 rpm within 2.5 seconds of both switches closing.

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Figure P–33. Automatic Neutral—Dual Input—Work Brake Activated

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION AH. KICKDOWN

USES: Provides both economy and performance shift points at full throttle. Operator changes from economy to performance by stepping through a detent at the throttle pedal.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

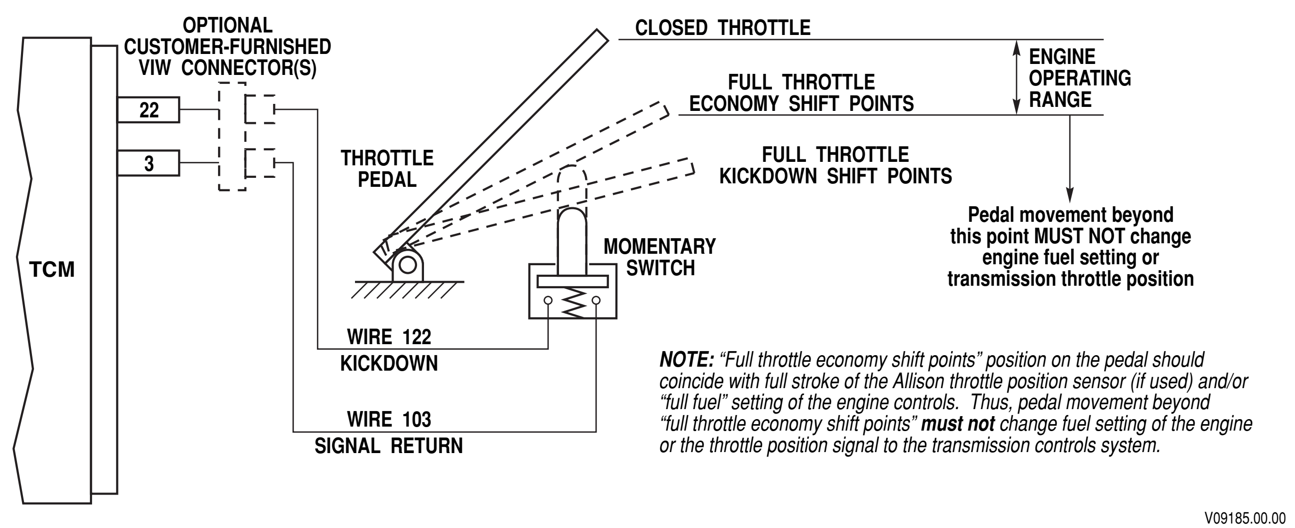


Figure P–34. Kickdown

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AI. MILITARY AUXILIARY FUNCTION RANGE INHIBIT (STANDARD)

USES: Prevents inadvertent range selection when auxiliary equipment is operating.

VARIABLES TO SPECIFY: None

VOCATIONS: Military wheeled vehicles

WARNING!	**If this function is turned "ON" in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be turned "OFF" in the calibration.**

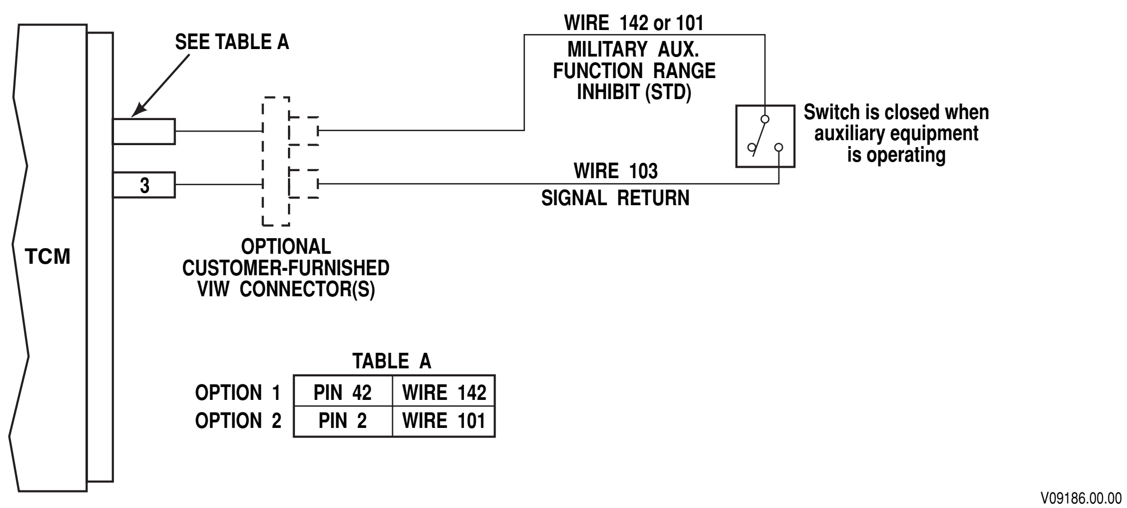


Figure P–35. Military Auxiliary Function Range Inhibit (Standard)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AJ. FOURTH LOCKUP PUMP MODE—OPERATOR AND PUMP ACTIVATED (NORTH AMERICA)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup for driving a vehicle-mounted pump.

VARIABLES TO SPECIFY: None

VOCATIONS: Street cleaners, sewer cleaners

WARNING!	**If this function is turned "ON" in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be turned "OFF" in the calibration.**

SYSTEM OPERATION

OPERATOR ACTION—System Response

TO ENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral.
2. *APPLY PARKING BRAKE*—None
3. *SELECT PUMP*—Turns on "Pump Mode Requested" light. Turns on input signal to TCM (wire 123) which activates pump mode. When split-shaft shifts, wire 122 is activated and "Pump Engaged" light is turned on.
4. *SELECT DRIVE*—Transmission shifts to fourth lockup. "OK To Pump" light is turned on.

TO DISENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral if output rpm is less than 1000.
2. *SELECT ROAD MODE*—PTO disengages. If output shaft rotation continues, press the "Momentary Trans. Brake" switch before selecting Road Mode. This will cause the transmission output shaft to stop if transmission is in Neutral and output shaft speed is less than 175 rpm.

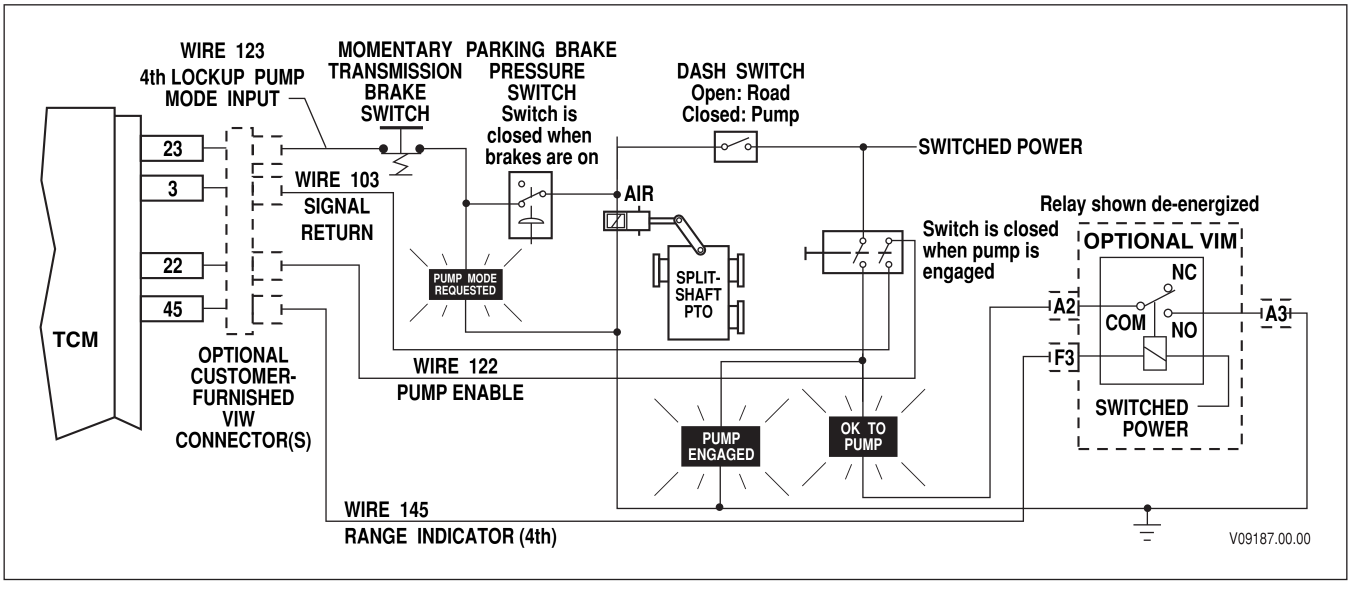


Figure P–36. Fourth Lockup Pump Mode—Operator and Pump Activated (North America)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AJ. FOURTH LOCKUP PUMP MODE—OPERATOR ONLY ACTIVATED (NORTH AMERICA)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup for driving a vehicle-mounted pump.

VARIABLES TO SPECIFY: None

VOCATIONS: Street cleaners, sewer cleaners

WARNING!	**If this function is turned "ON" in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be turned "OFF" in the calibration.**

SYSTEM OPERATION

OPERATOR ACTION—System Response

TO ENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral.
2. *APPLY PARKING BRAKE*—None
3. *SELECT PUMP*—Turns on "Pump Mode Requested" light. Turns on both input signals to TCM (wires 122 and 123) which activates pump mode. When split-shaft shifts, "Pump Engaged" light is turned on.
4. *SELECT DRIVE*—Transmission shifts to fourth lockup. "OK To Pump" light is turned on.

TO DISENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral if output rpm is less than 1000.
2. *SELECT ROAD MODE*—PTO disengages. If output shaft rotation continues, press the "Momentary Trans. Brake" switch before selecting Road Mode. This will cause the transmission output shaft to stop if transmission is in Neutral and output shaft speed is less than 175 rpm.

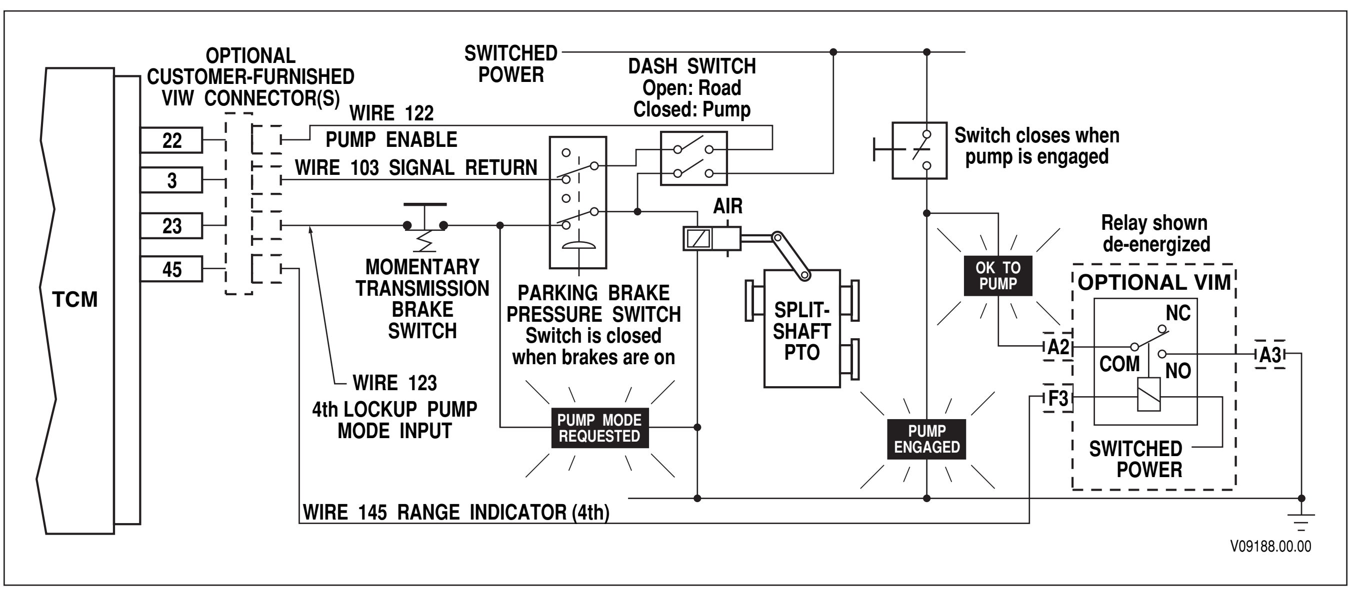


Figure P–37. Fourth Lockup Pump Mode—Operator Only Activated (North America)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AJ. FOURTH LOCKUP PUMP MODE—OPERATOR AND PUMP ACTIVATED (NON-NORTH AMERICA)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup for driving a vehicle-mounted pump.

VARIABLES TO SPECIFY: None

VOCATIONS: Street cleaners, sewer cleaners

WARNING!	**If this function is turned "ON" in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be turned "OFF" in the calibration.**

SYSTEM OPERATION

OPERATOR ACTION—System Response

TO ENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral.
2. *APPLY PARKING BRAKE*—None
3. *SELECT PUMP*—Turns on "Pump Mode Requested" light. Turns on both input signals to TCM (wires 143 and 123) which activates pump mode. When split-shaft shifts, "Pump Engaged" light is turned on.
4. *SELECT DRIVE*—Transmission shifts to fourth lockup. "OK To Pump" light is turned on.

TO DISENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral if output rpm is less than 1000.
2. *SELECT ROAD MODE*—PTO disengages. If output shaft rotation continues, press the "Momentary Trans. Brake" switch before selecting Road Mode. This will cause the transmission output shaft to stop if transmission is in Neutral and output shaft speed is less than 175 rpm.

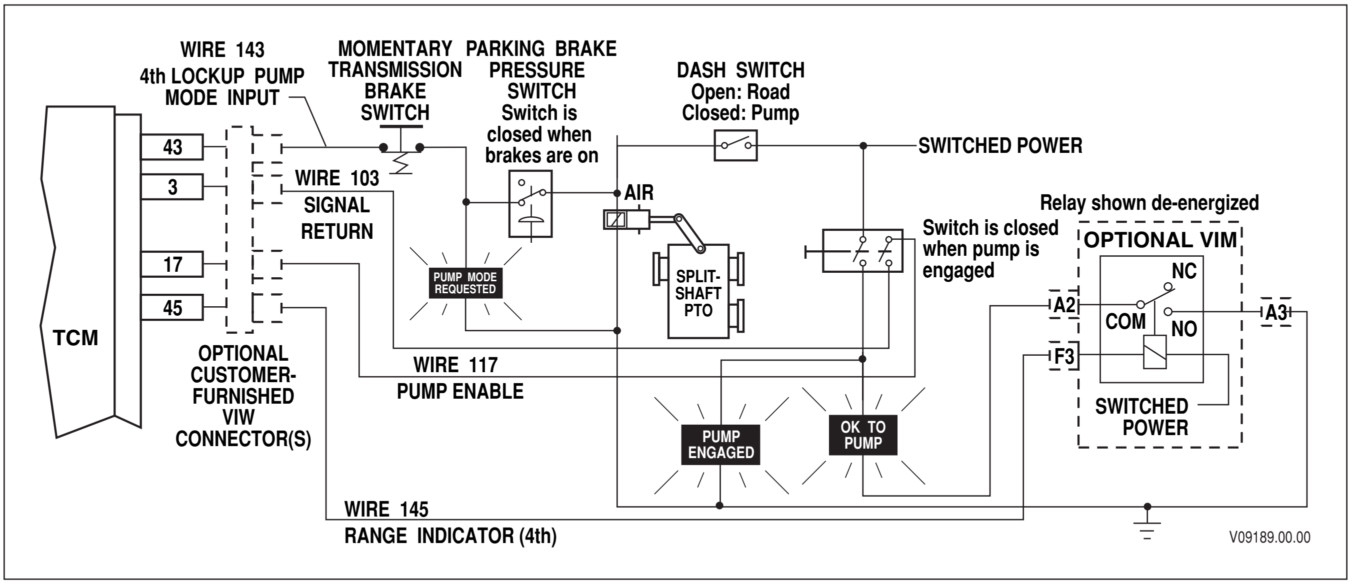


Figure P–38. Fourth Lockup Pump Mode—Operator and Pump Activated (Non-North America)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AJ. FOURTH LOCKUP PUMP MODE—OPERATOR ONLY ACTIVATED (NON-NORTH AMERICA)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup for driving a vehicle-mounted pump.

VARIABLES TO SPECIFY: None

VOCATIONS: Street cleaners, sewer cleaners

WARNING!	**If this function is turned "ON" in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be turned "OFF" in the calibration.**

SYSTEM OPERATION

OPERATOR ACTION—System Response

TO ENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral.
2. *APPLY PARKING BRAKE*—None
3. *SELECT PUMP*—Turns on "Pump Mode Requested" light. Turns on both input signals to TCM (wires 117 and 143) which activates pump mode. When split-shaft shifts, "Pump Engaged" light is turned on.
4. *SELECT DRIVE*—Transmission shifts to fourth lockup. "OK To Pump" light is turned on.

TO DISENGAGE:

1. *SELECT NEUTRAL*—Transmission shifts to Neutral if output rpm is less than 1000.
2. *SELECT ROAD MODE*—PTO disengages. If output shaft rotation continues, press the "Momentary Trans. Brake" switch before selecting Road Mode. This will cause the transmission output shaft to stop if transmission is in Neutral and output shaft speed is less than 175 rpm.

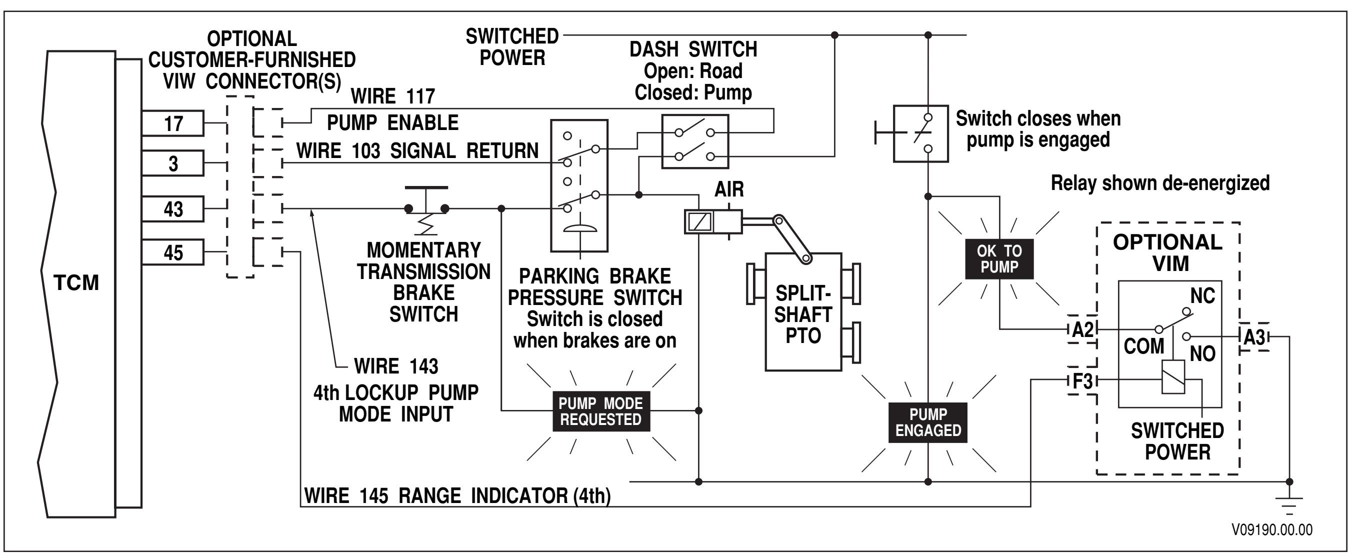


Figure P–39. Fourth Lockup Pump Mode—Operator Only Activated (Non-North America)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AK. AUTOMATIC NEUTRAL—DUAL INPUT WITH SERVICE BRAKE STATUS—AUTOMATED SIDE LOADER ACTIVATED

USES: Provides for automatic selection of NEUTRAL and activation of fast idle when loading arm is activated. Automatically re-engages transmission when loading arm is retracted if service brake is depressed. Only re-engagement of forward is allowed. Reverse is not re-engaged.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck

WARNING!	**This feature is meant to be used in applications where the vehicle operator remains in the cab. If the operator leaves the vehicle, the park brake must be engaged and Neutral must be selected prior to the operator exiting the cab. In addition, vehicles using this feature must have the following Warning sticker visible in the vehicle cab: “WARNING: Set Park Brake and select Neutral before exiting cab!”**

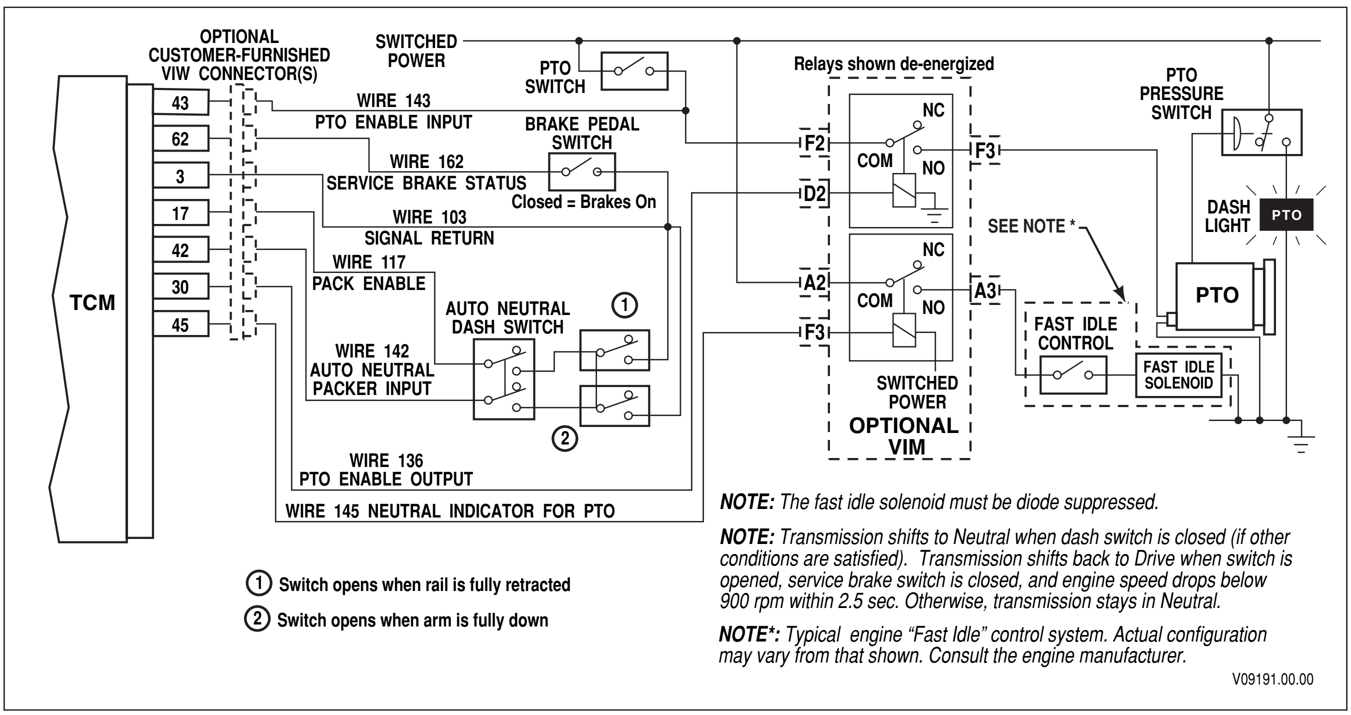


Figure P–40. Automatic Neutral—Dual Input With Service Brake Status—Automated Side Loader Activated

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AK. AUTOMATIC NEUTRAL—DUAL INPUT WITH SERVICE BRAKE STATUS—DASH SWITCH ACTIVATED

USES: Provides for selection of NEUTRAL and enabling fast idle through activation of a dash mounted switch. Automatically re-engages transmission when switch is opened if service brake is depressed Only re-engagement of forward is allowed. Reverse is not re-engaged.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck

WARNING!	**This feature is meant to be used in applications where the vehicle operator remains in the cab. If the operator leaves the vehicle, the park brake must be engaged and Neutral must be selected prior to the operator exiting the cab. In addition, vehicles using this feature must have the following Warning sticker visible in the vehicle cab: "WARNING: Set Park Brake and select Neutral before exiting cab!"**

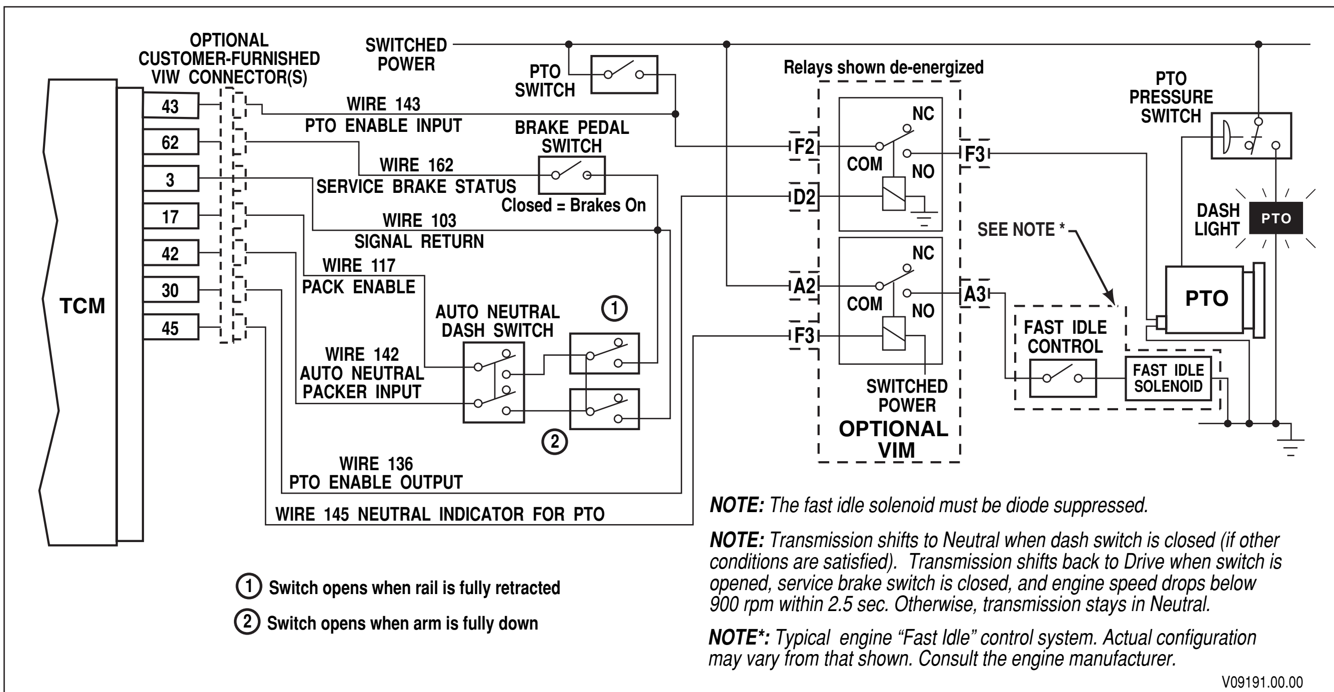


Figure P–41. Automatic Neutral—Dual Input With Service Brake Status—Dash Switch Activated

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AK. AUTOMATIC NEUTRAL—DUAL INPUT WITH SERVICE BRAKE STATUS—PARK BRAKE ACTIVATED

USES: Provides for automatic selection of NEUTRAL and activation of PTO when park brake is applied. Automatically re-engages transmission when park brake is released (if service brake is depressed). Only re-engagement of forward is permitted. Reverse is not re-engaged.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck, emergency equipment.

NOTE: ***This function is also available with emergency equipment calibration features.***

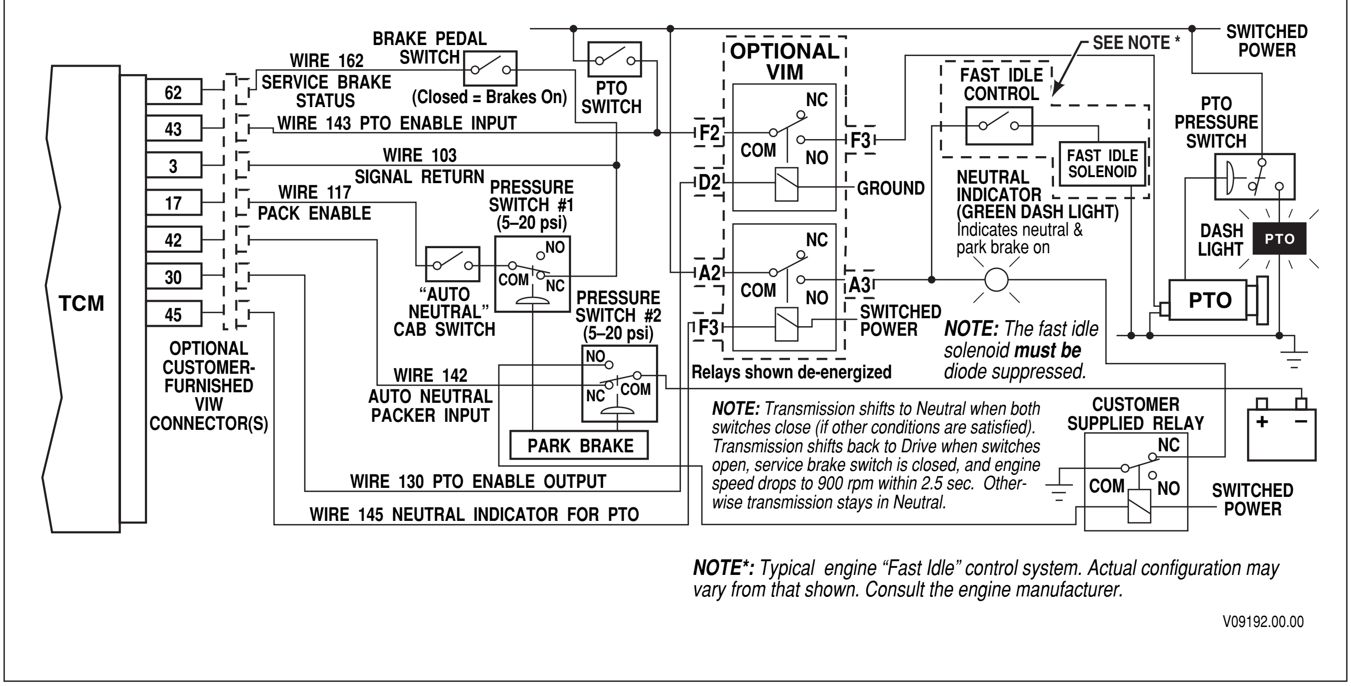


Figure P–42. Automatic Neutral—Dual Input With Service Brake Status—Park Brake Activated

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AK. AUTOMATIC NEUTRAL—DUAL INPUT WITH SERVICE BRAKE STATUS—WORK BRAKE ACTIVATED

USES: Provides for automatic selection of NEUTRAL and activation of PTO when work brake is applied. Automatically re-engages transmission when work brake is released (if service brake is depressed). Only re-engagement of forward is permitted. Reverse is not re-engaged.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck

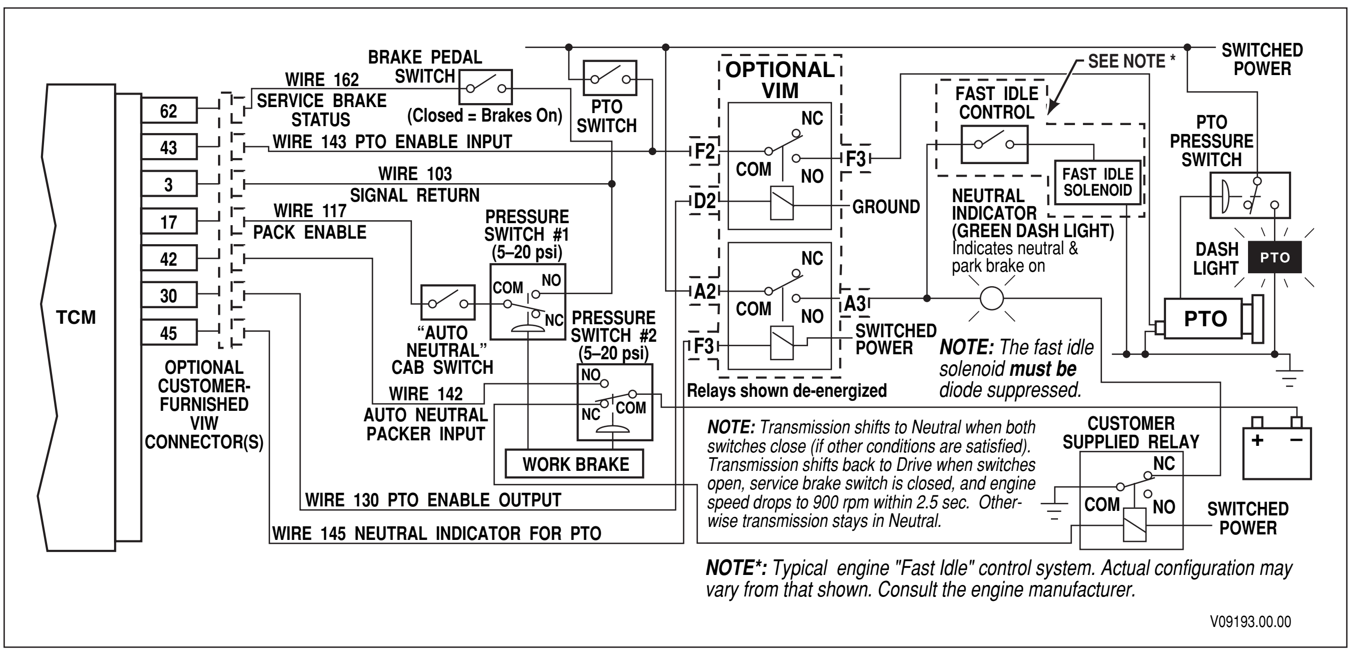


Figure P–43. Automatic Neutral—Dual Input With Service Brake Status—Work Brake Activated

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AK. INPUT FUNCTION AK.AUTOMATIC NEUTRAL—DUAL INPUT WITH SERVICE BRAKE STATUS—EMERGENCY VEHICLE OPTION

USES: Provides for automatic selection of NEUTRAL when park brake is applied. Reselection of DRIVE or REVERSE is required. The transmission does not shift out of Neutral when park brake is released, as with other variations of Function AK.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral.

VOCATIONS: Emergency vehicles

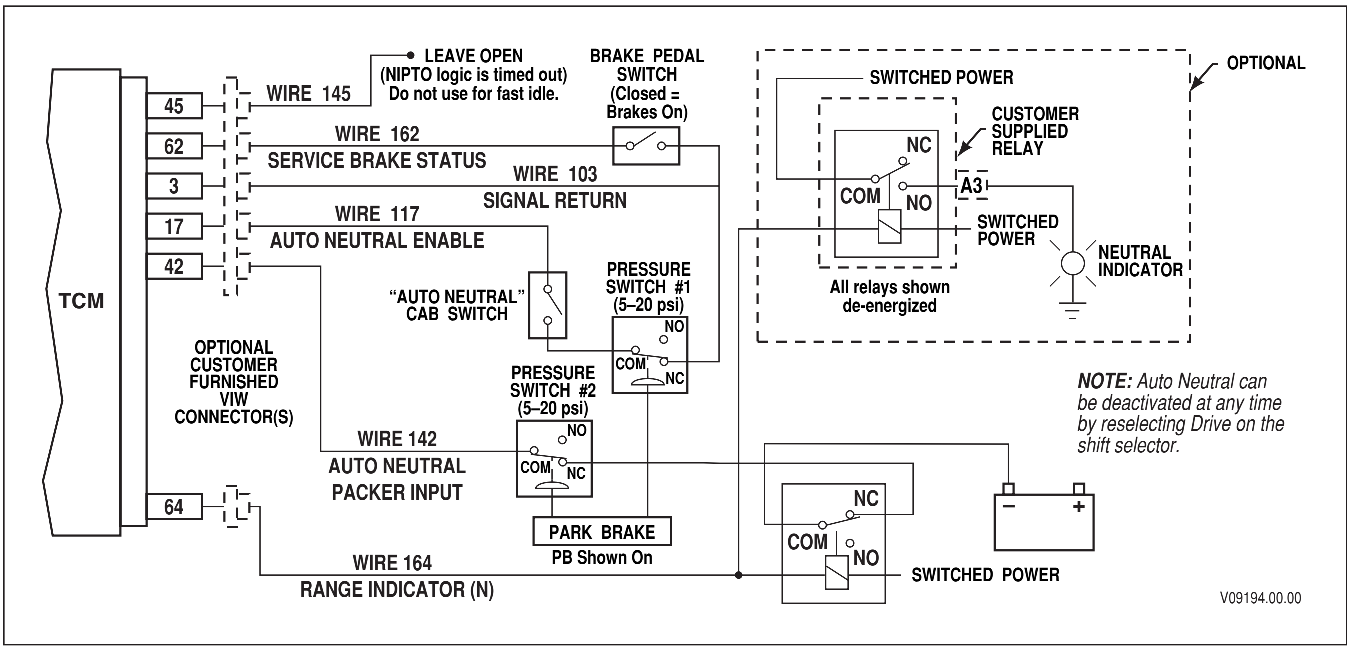


Figure P–44. Automatic Neutral—Dual Input With Service Brake Status—Emergency Vehicle Option

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AL. SHIFT SELECTOR TRANSITION AND SECONDARY SHIFT SCHEDULE WITHOUT AUTO NEUTRAL

USES: Provides for operator selection of dual shift selectors and shift schedules. Primary mode will always be active when shift selector 1 is selected, and secondary mode will always be active when shift selector 2 is selected.

VARIABLES TO SPECIFY: None

VOCATIONS: Dual-station refuse vehicles, crane carrier

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

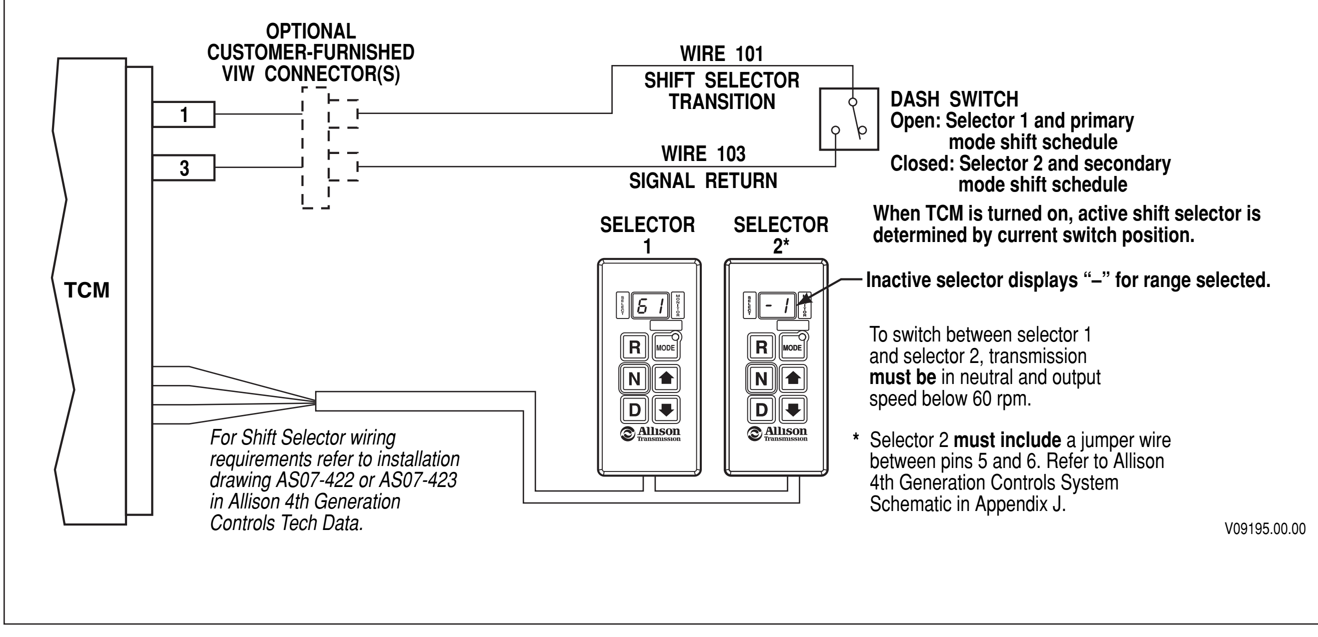


Figure P–45. Shift Selector Transition and Secondary Shift Schedule Without Auto Neutral

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AL. SHIFT SELECTOR TRANSITION AND SECONDARY SHIFT SCHEDULE WITH AUTO NEUTRAL

USES: Provides for operator selection of dual shift selectors and shift schedules. Primary mode will always be active when shift selector 1 is selected, and secondary mode will always be active when shift selector 2 is selected.

VARIABLES TO SPECIFY: None

VOCATIONS: Dual-station refuse vehicles

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it MUST be disabled in the calibration.**

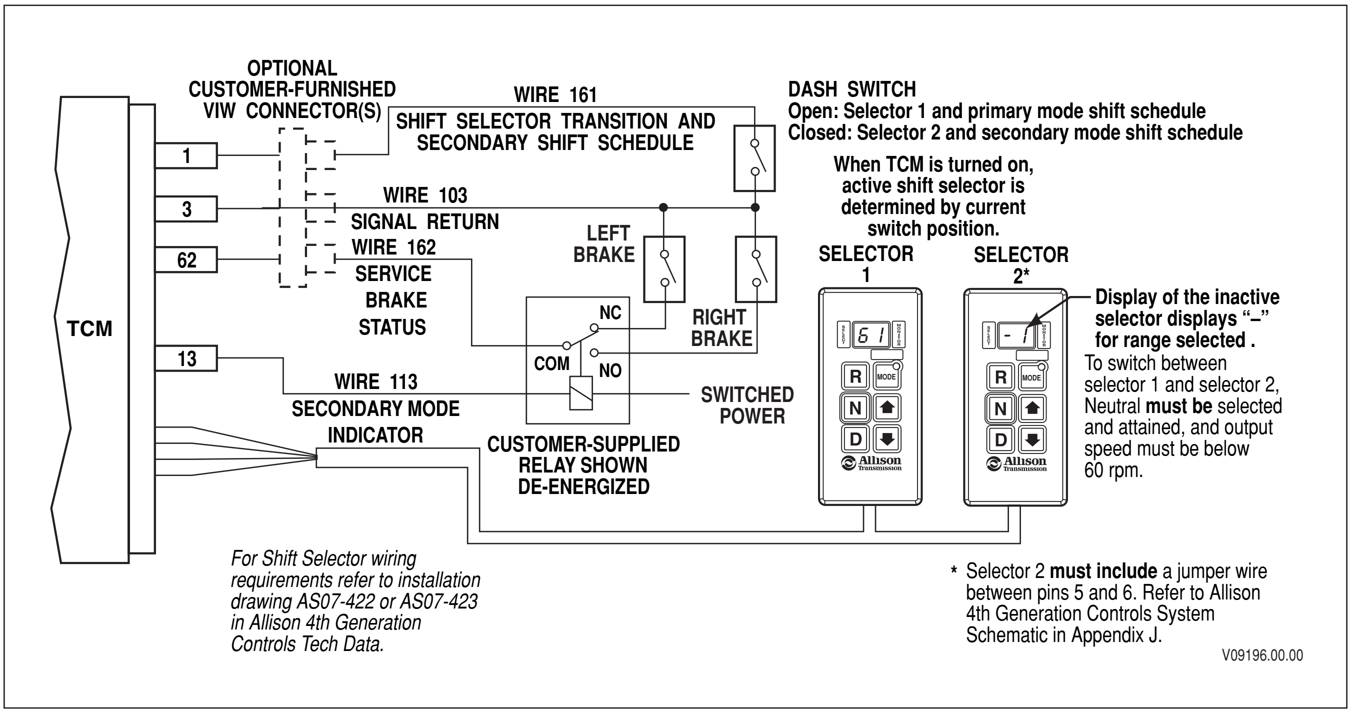


Figure P–46. Shift Selector Transition and Secondary Shift Schedule With Auto Neutral

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AM. REFUSE PACKER STEP SWITCH

USES: Limit operation of transmission to first range and inhibit reverse with presence of personnel on rear of vehicle.

VARIABLES TO SPECIFY: None

VOCATIONS: Refuse

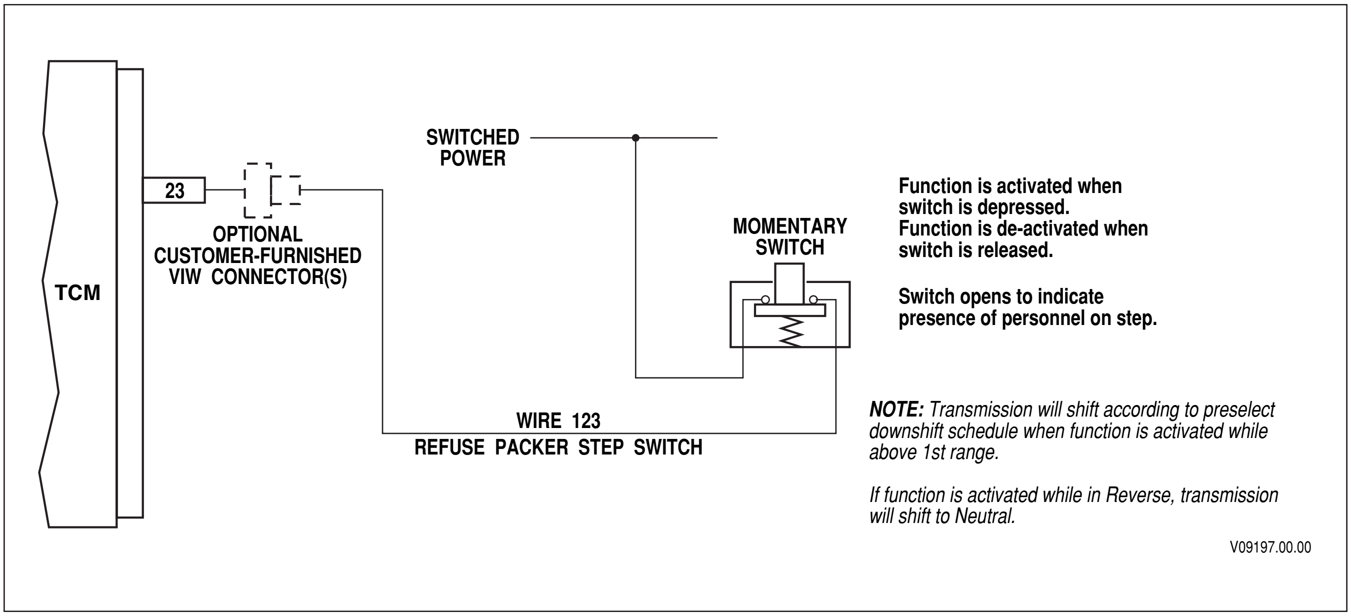


Figure P–47. Refuse Packer Step Switch

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AQ. SELECTOR DISPLAY BLANKING

USES: Blanks the digital display and mode on indicator on the lever or pushbutton shift selectors.

VARIABLES TO SPECIFY: None

VOCATIONS: Military wheeled vehicles

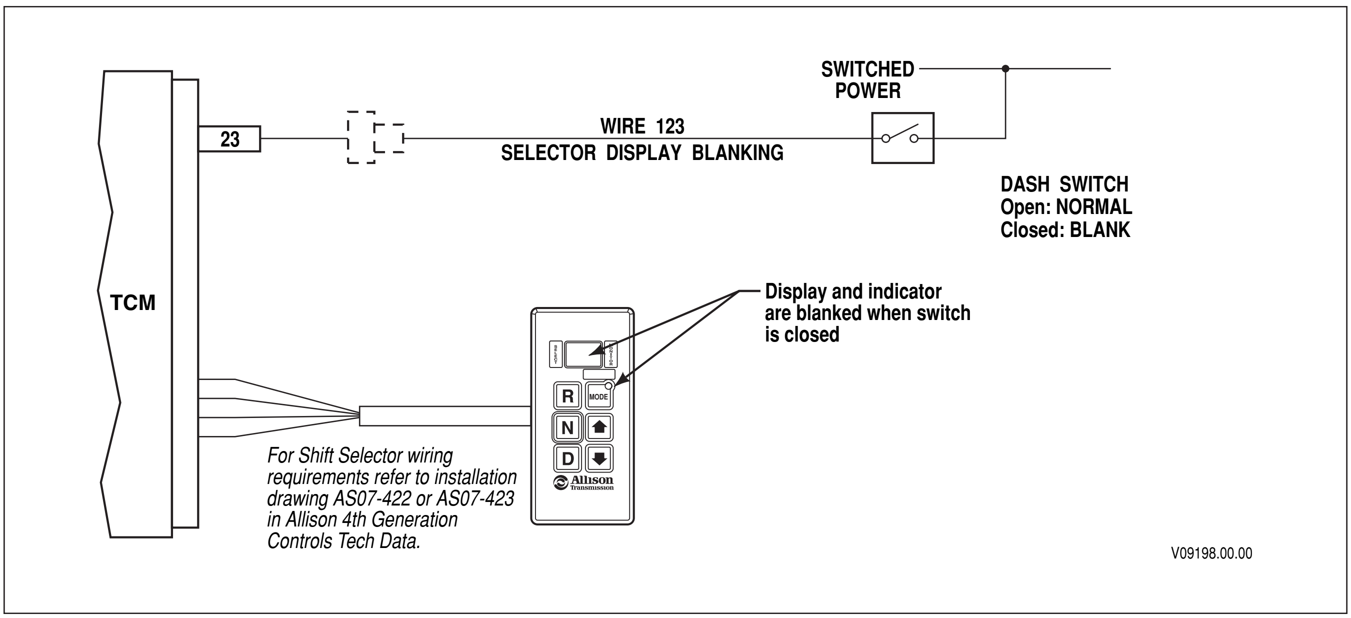


Figure P–48. Selector Display Blanking

APPENDIX P—INPUT/OUTPUT FUNCTIONS

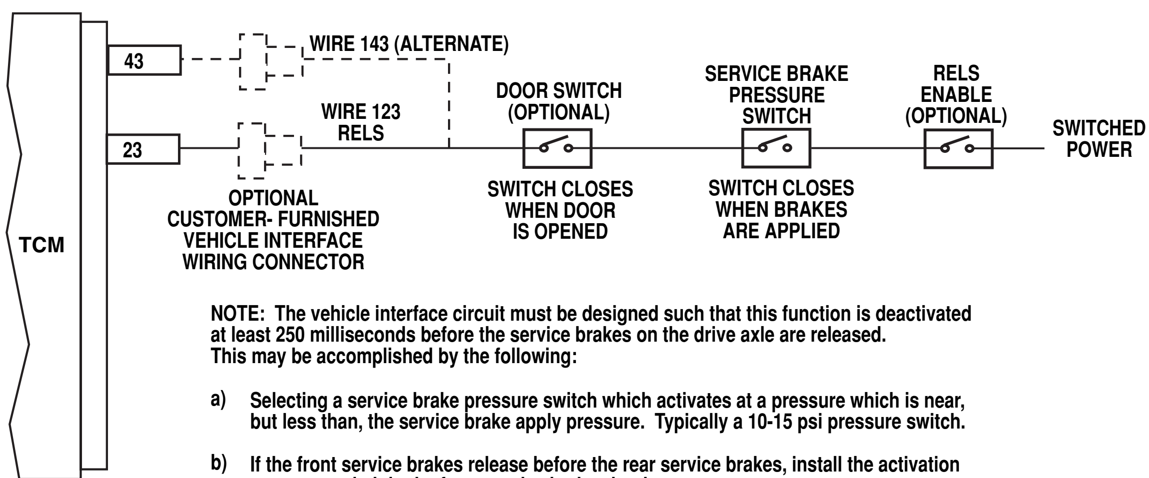
WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION AS. REDUCED ENGINE LOAD AT STOP (RELS)

USES: Automatically activates Reduced Engine Load at Stop (RELS) when vehicle service brakes are applied, vehicle is stopped, and throttle is closed. RELS deactivates when the service brakes are released, or the throttle is advanced, or Drive is selected at the shift selector. If an "Automatic Neutral" input is activated, RELS will be deactivated.

VARIABLES TO SPECIFY: None

VOCATIONS: Buses, coach, and on-highway trucks. Use of this function is not permitted in refuse vehicles, concrete mixers, or emergency vehicles. This feature is also not available in applications that utilize second-range start shift calibrations.



NOTE: The vehicle interface circuit must be designed such that this function is deactivated at least 250 milliseconds before the service brakes on the drive axle are released. This may be accomplished by the following:

a) Selecting a service brake pressure switch which activates at a pressure which is near, but less than, the service brake apply pressure. Typically a 10-15 psi pressure switch.

b) If the front service brakes release before the rear service brakes, install the activation pressure switch in the front service brake circuit.

c) Place the pressure switch as near as possible to the quickest releasing side of the service brake foot pedal (usually the front brake line).

ALL ITEMS SHOWN, EXCEPT TCM, ARE CUSTOMER-FURNISHED

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Figure P–49. Reduced Engine Load at Stops (RELS)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION BB. RELS WITH SERVICE BRAKE STATUS

USES: Combines functions AA and As on a single wire.

VARIABLES TO SPECIFY: None

VOCATIONS: Transit bus and tour coach

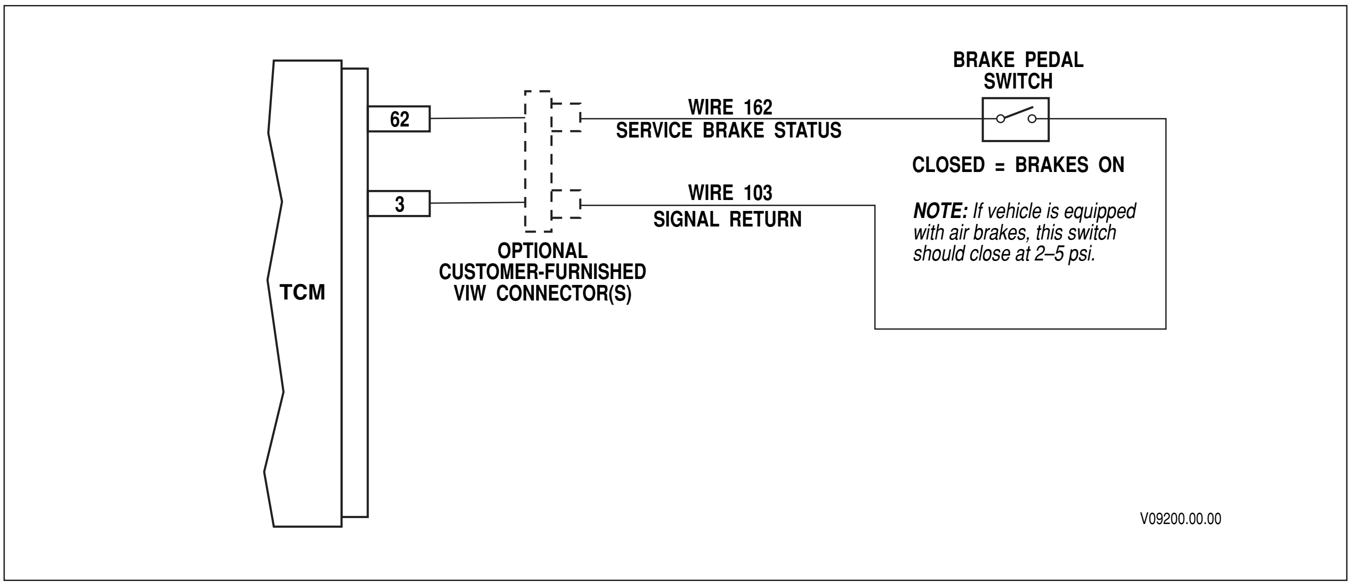


Figure P–50. RELS With Service Brake Status

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

INPUT FUNCTION BD. AUTO 2–1 PRESELECT FOR 7-SPEED

USES: Military vehicles and commercial heavy equipment transporters (HET) to help prevent transmission overheating. Allows an automatic 2–1 shift in a 7-speed if conditions are conducive to successfully completing the shift.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

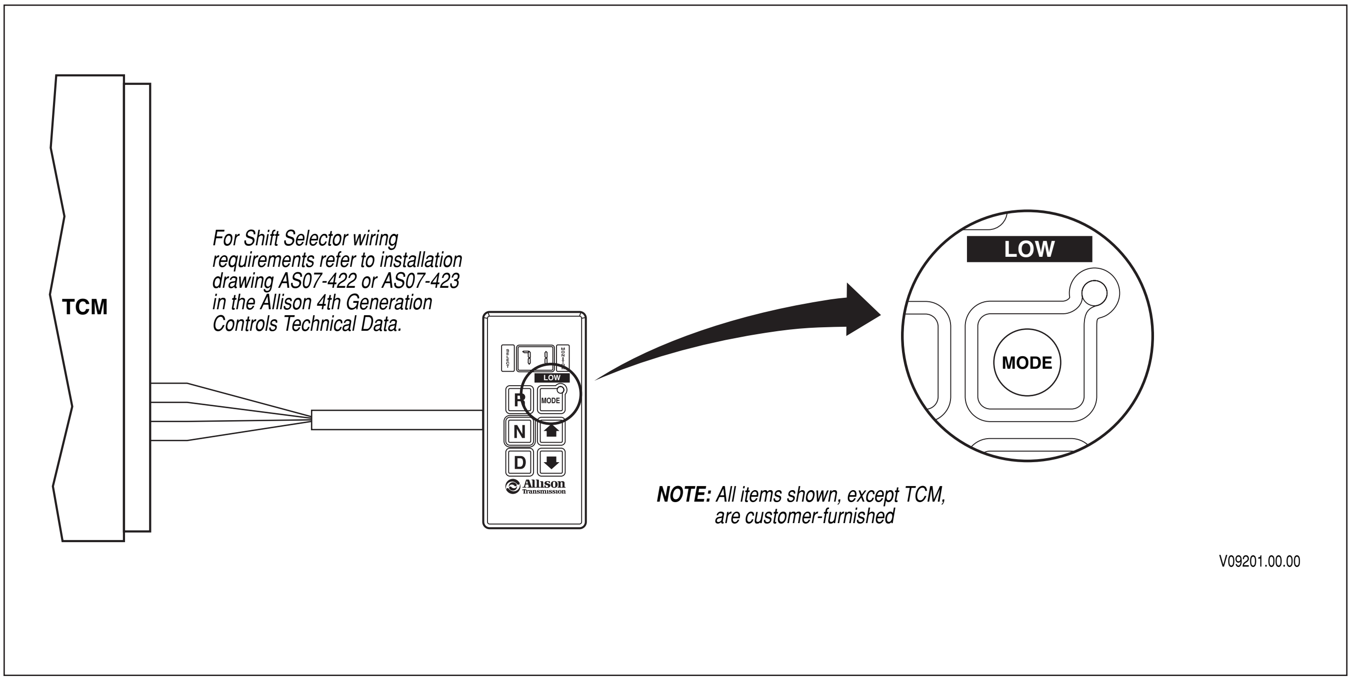


Figure P–51. Auto 2–1 Preselect For 7-speed

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION A. ENGINE BRAKE ENABLE

USES: Used with engine brakes to signal the ECU that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is second range.

VOCATIONS: Various

Refer to "*Inputs H and I: Engine Brake Enable and Preselect Request*." This output is inverted when used with Input H.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION B. SUMP/RETARDER TEMPERATURE INDICATOR

USES: Turn on dash indicator when transmission sump or retarder-out temperature has exceeded specified limits.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

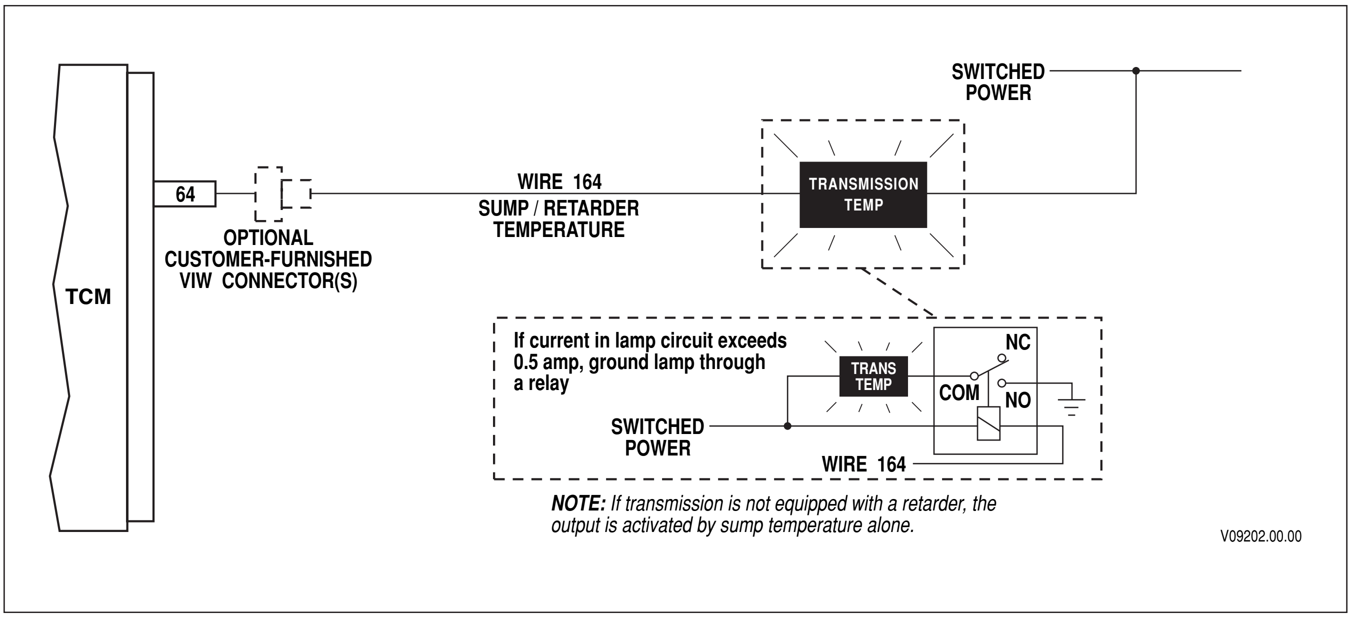


Figure P–52. Sump/Retarder Temperature Indicator

This function can be provided by a J-1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION C. RANGE INDICATOR

USES: Used with auxiliary vehicle systems to permit operation only in specified transmission range(s).

VARIABLES TO SPECIFY: Range or ranges to be indicated

VOCATIONS: Various

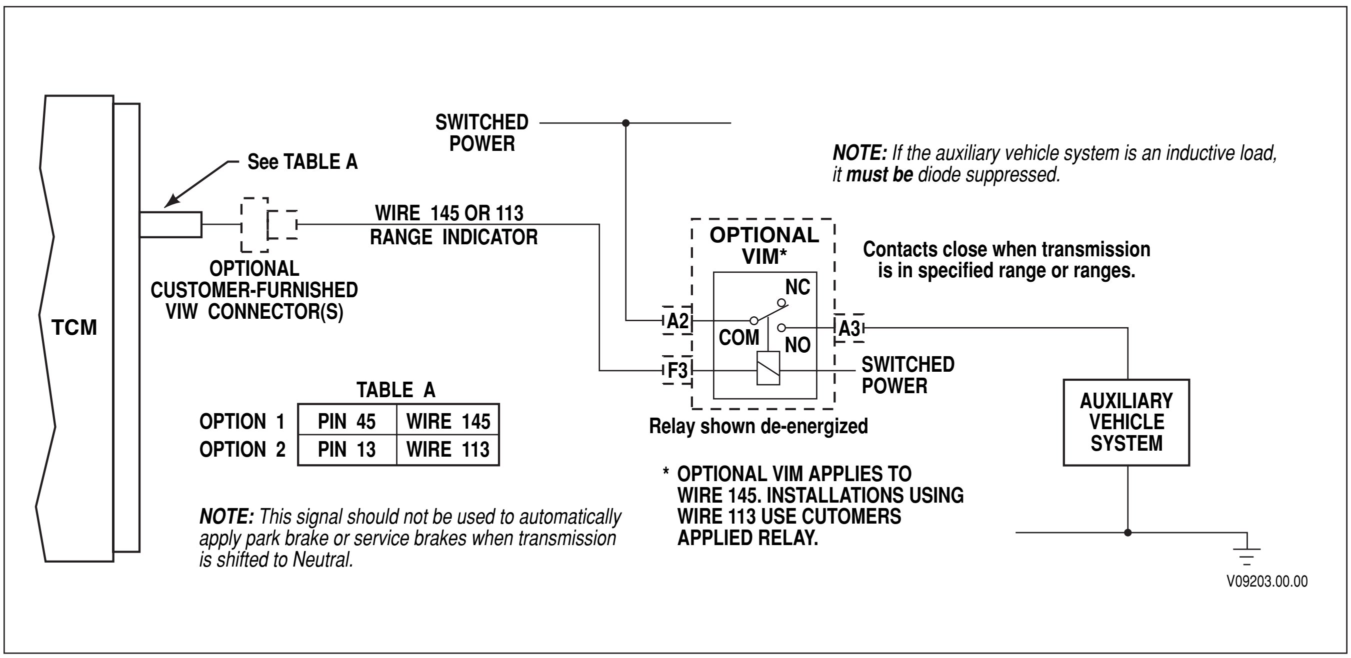


Figure P–53. Range Indicator

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION D. OUTPUT SPEED INDICATOR—A (SWITCHED TO GROUND)

USES: To signal that the transmission output shaft has exceeded a specified value.

VARIABLES TO SPECIFY: Rpm to turn output ON and to turn output OFF. The ON value must be higher than the OFF value.

VOCATIONS: Various

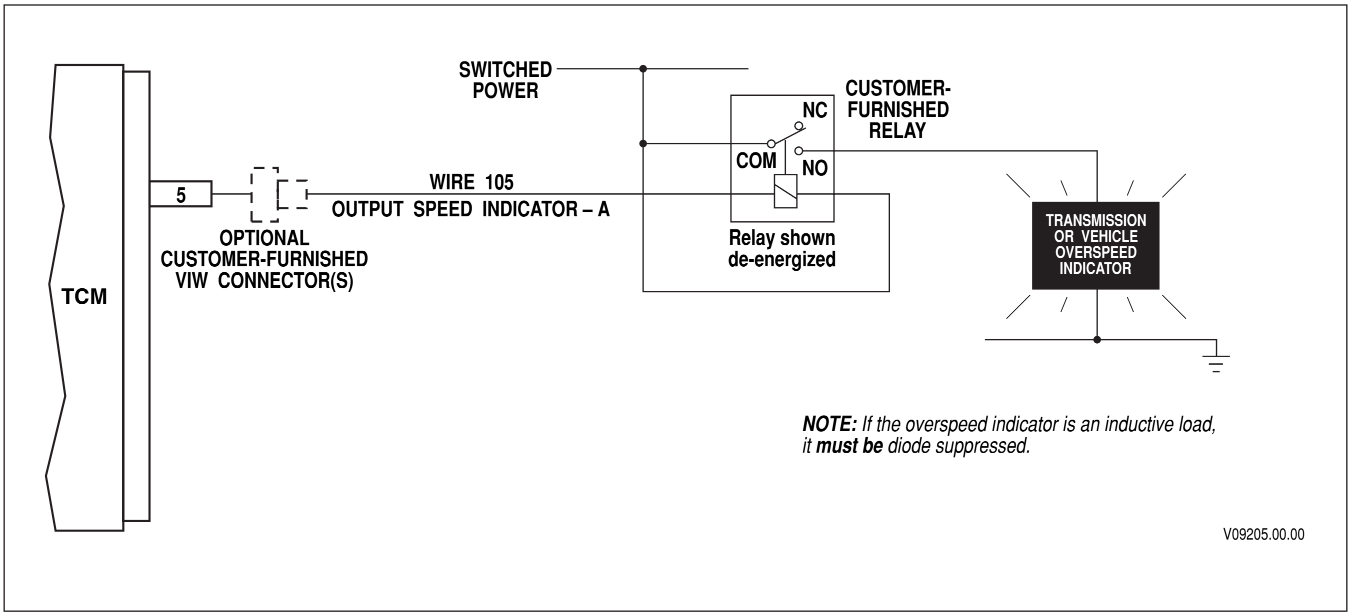


Figure P–54. Output Speed Indicator—A (Switched to Ground)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION D. OUTPUT SPEED INDICATOR—A (SWITCHED TO POWER)

USES: To signal that the transmission output shaft has exceeded a specified value.

VARIABLES TO SPECIFY: Rpm to turn ON output and to turn OFF output. The ON value must be higher than the OFF value.

VOCATIONS: Various

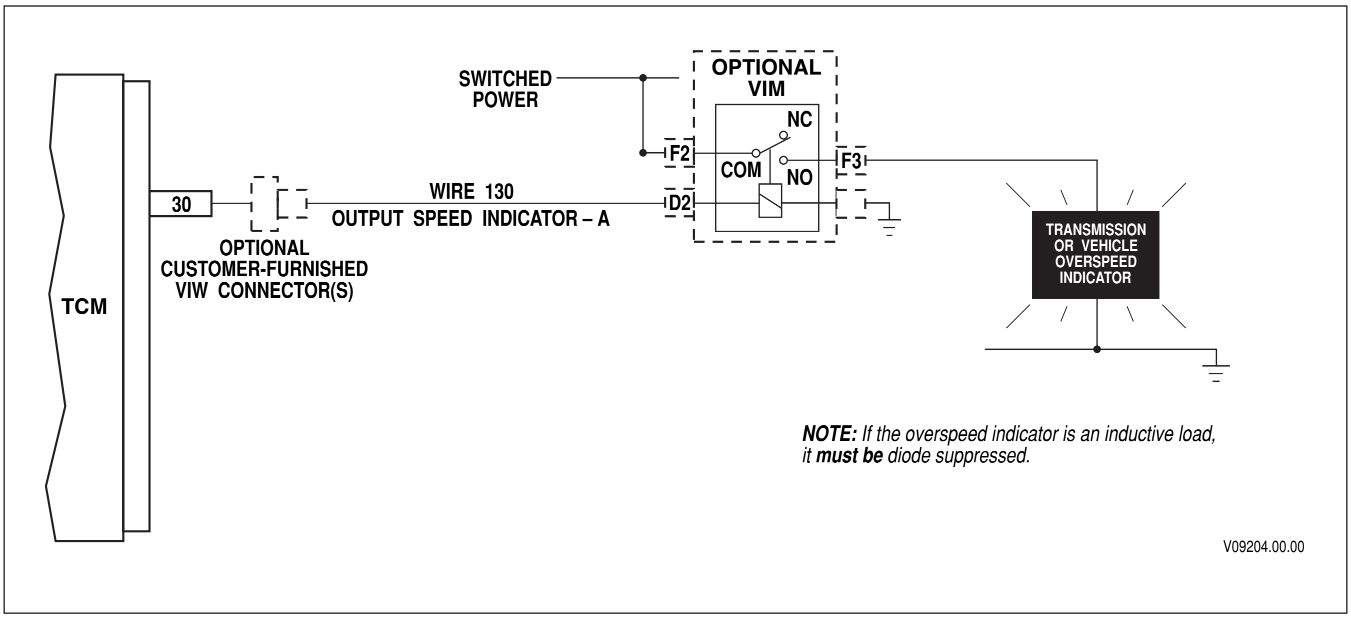


Figure P–55. Output Speed Indicator—A (Switched to Power)

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION E. OUTPUT SPEED INDICATOR—B

USES: To signal that the transmission output shaft has exceeded a specified value.

VARIABLES TO SPECIFY: Rpm to turn ON output and to turn OFF output. The ON value must be higher than the OFF value.

VOCATIONS: Various

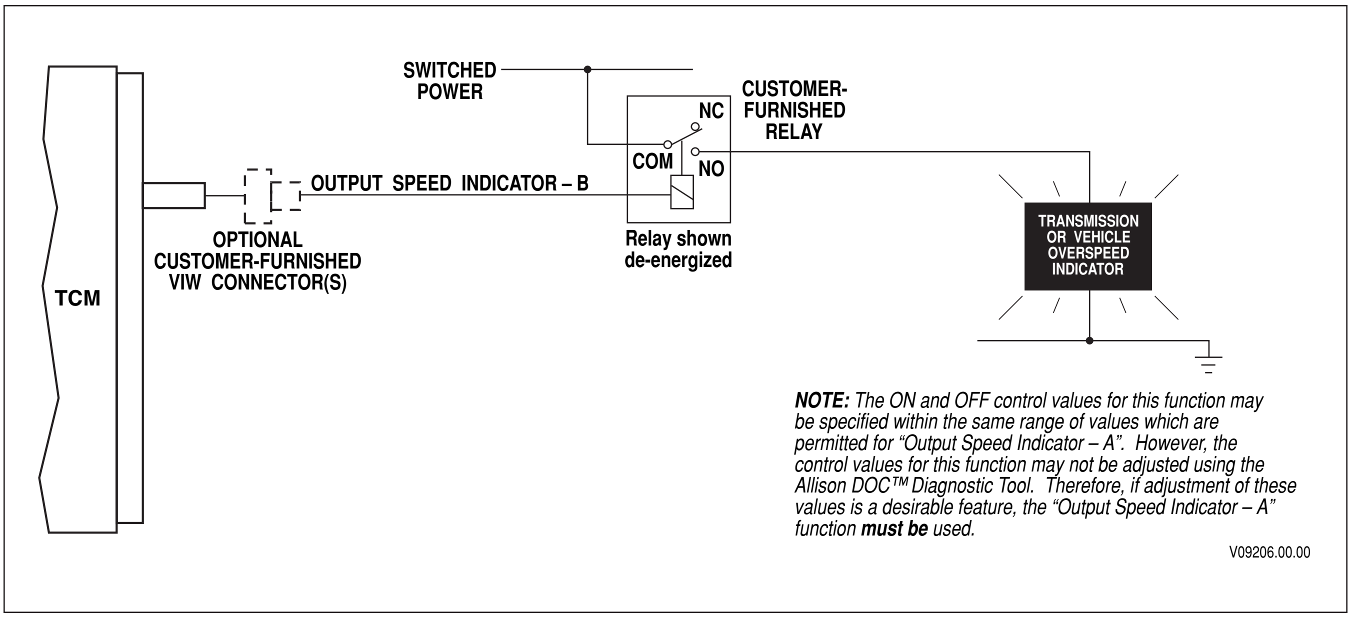


Figure P–56. Output Speed Indicator—B

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

INPUT FUNCTION G. PTO ENABLE

USES: Used with PTO Enable Input C. Permits PTO to be engaged only when engine speed and output speed are in allowable range and throttle is low. Also disengages PTO if speeds are exceeded.

VARIABLES TO SPECIFY: Minimum and maximum engine speed for engagement, maximum engine speed for allowable operation, minimum and maximum output speed for engagement, maximum output speed for allowable operation.

VOCATIONS: Various (with usage of PTO)

Refer to *"Input C: PTO Enable"* and *"Input AG: Automatic Neutral—Dual Input."*

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION I. ENGINE OVERSPEED INDICATOR SWITCHED TO POWER

USES: To turn on dash light when engine reaches an overspeed condition.

VARIABLES TO SPECIFY: Rpm to turn ON; rpm to turn OFF.

VOCATIONS: Various

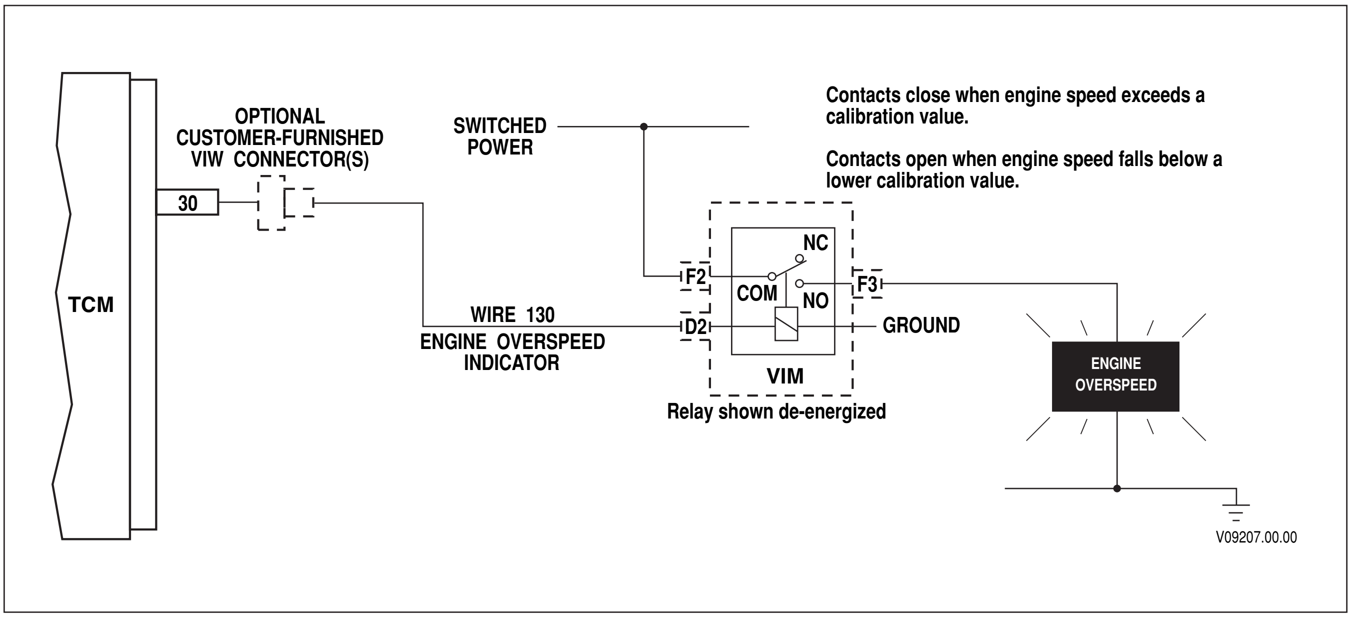


Figure P–57. Engine Overspeed Indicator Switched to Power

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION I. ENGINE OVERSPEED INDICATOR WITHOUT VIM—SWITCHED TO GROUND

USES: To turn on dash light when engine reaches an overspeed condition.

VARIABLES TO SPECIFY: Rpm to turn ON; rpm to turn OFF.

VOCATIONS: Various

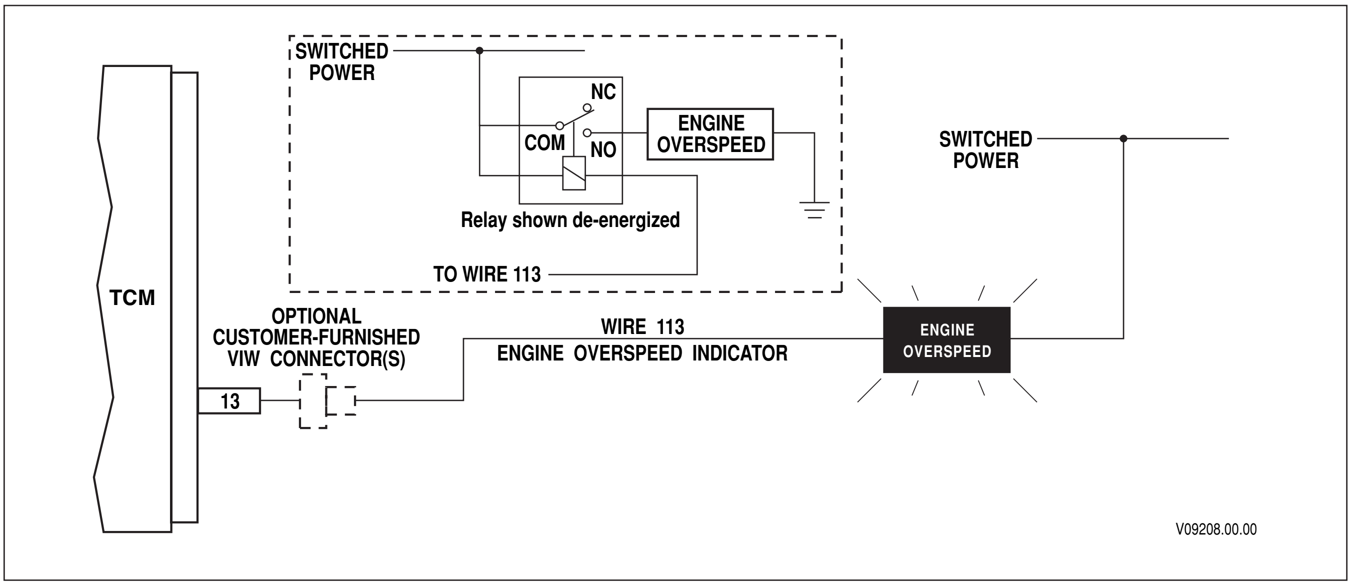


Figure P–58. Engine Overspeed Indicator Without VIM—Switched to Ground

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION J. TWO SPEED AXLE ENABLE

USES: Used with Two Speed Axle Enable input to provide a speed protected engagement of low axle.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

Refer to *"Input Q: Two Speed Axle Enable"*.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION K. LOCKUP INDICATOR

USES: Turn on dash indicator when transmission lockup clutch is engaged. Used to indicate when maximum engine braking is available.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

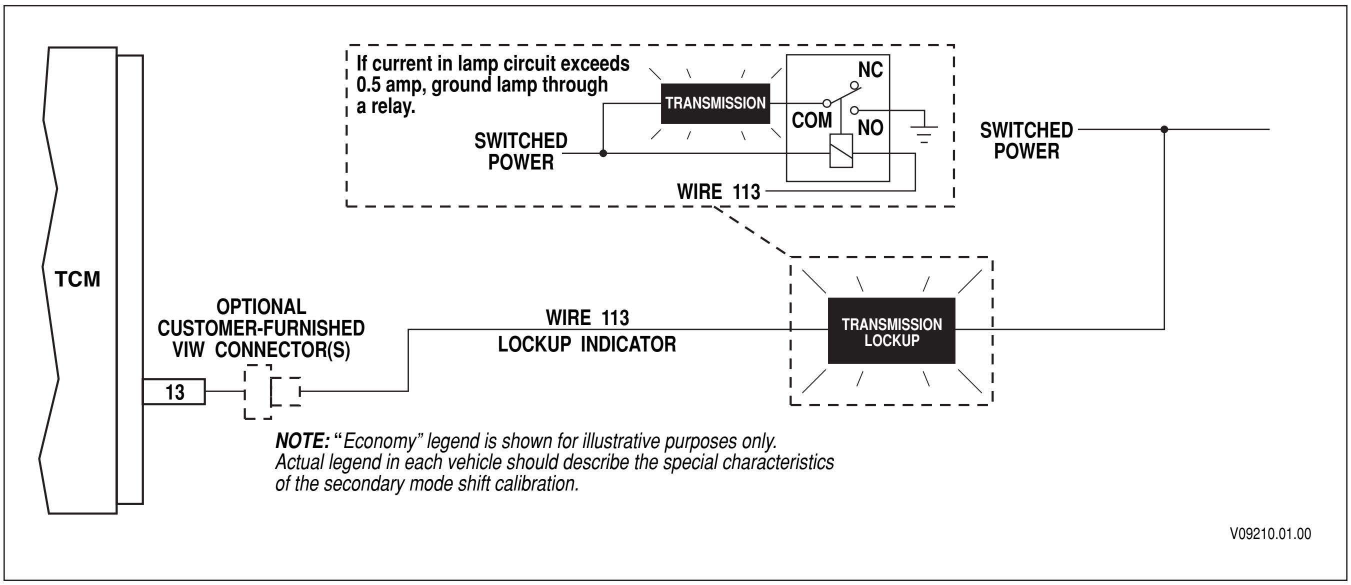


Figure P–59. Lockup Indicator

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION N. SECONDARY MODE INDICATOR

USES: To indicate that Secondary Mode is active.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

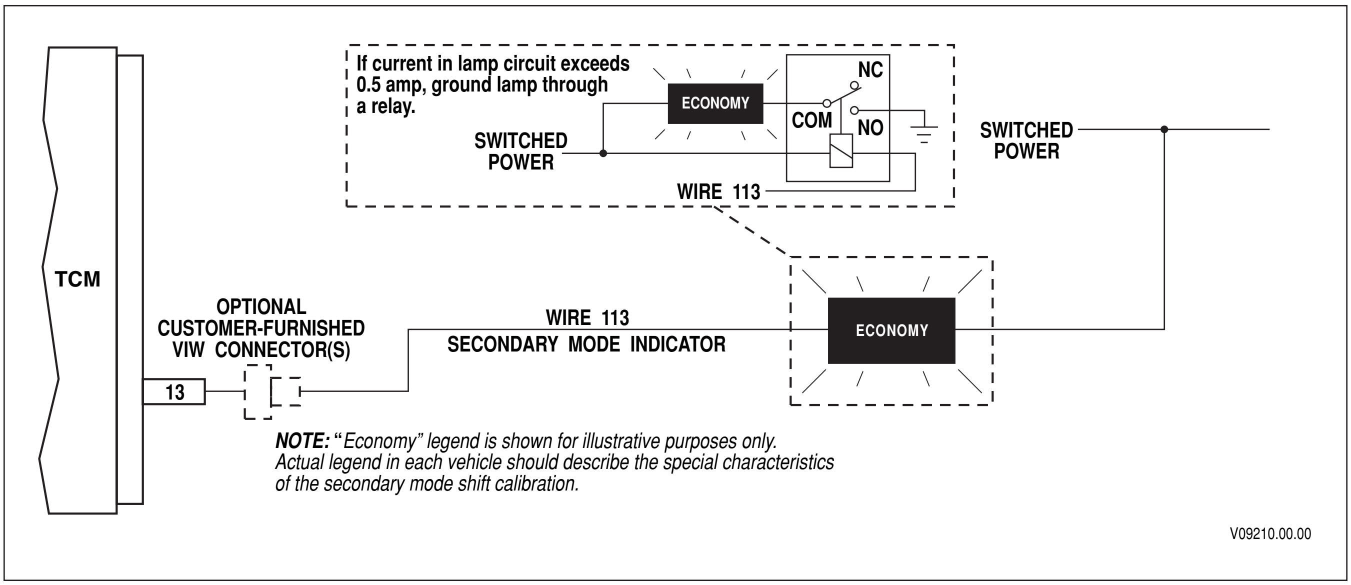


Figure P–60. Secondary Mode Indicator

This function can be provided by a J1939 message.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION N. SECONDARY MODE INDICATOR—SWITCHED TO POWER

USES: To indicate that Secondary Mode is active.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

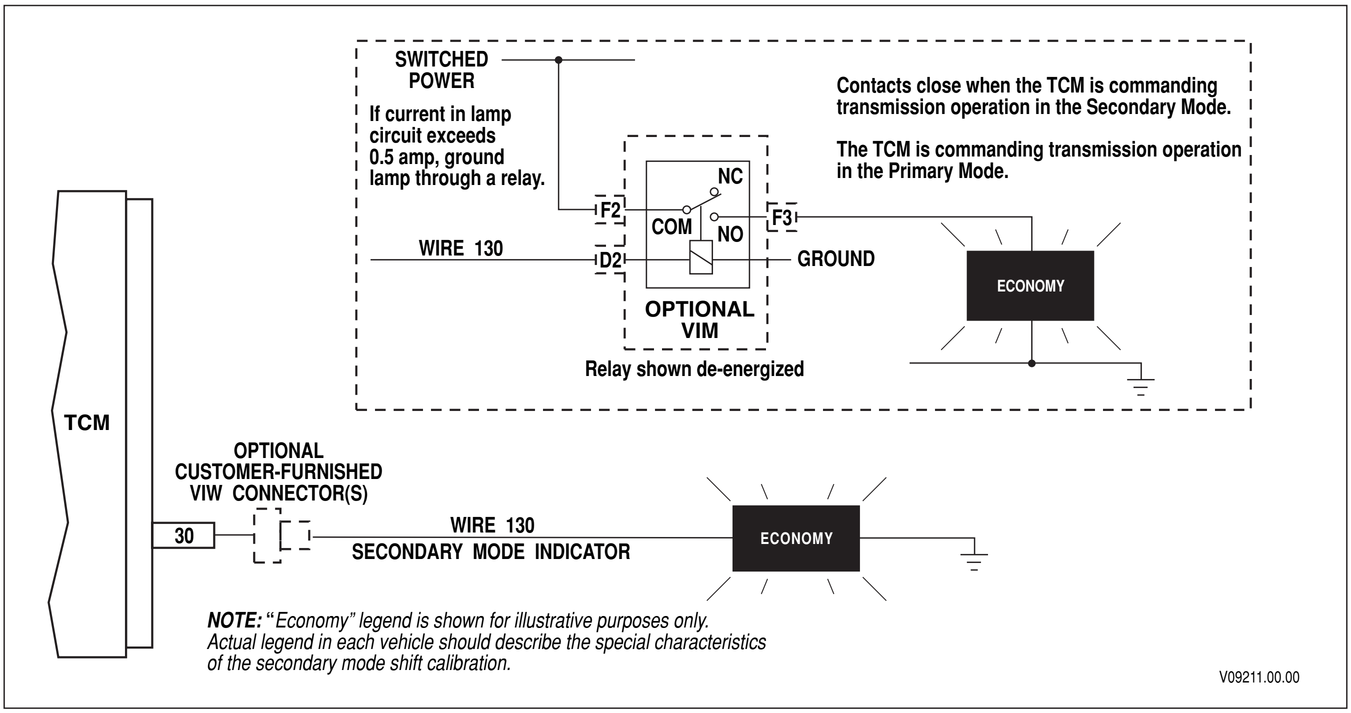


Figure P–61. Secondary Mode Indicator—Switched to Power

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION O. SERVICE INDICATOR

USES: This function is required with "*Input Function F: Dual Input Auxiliary Function Range Inhibit*" to indicate that there is a problem with the vehicle wiring for the input signal. This output signal is typically used to turn on a dash-mounted light to indicate to the operator or service personnel to check for diagnostic codes stored in the ECU.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

Refer to "*Input F: Dual Input Auxiliary Function Range Inhibit.*"

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION Q. RETARDER INDICATOR

USES: Signals that the retarder is active. Typically used to turn on the vehicle brake lights when the retarder is in use.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

This function is used in conjunction with Input Function "Z", Retarder Enable. Refer to schematic for Input Function "Z", noting the use of wire 125.

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION R. DIFFERENTIAL CLUTCH INDICATOR

USES: Signals the status of the differential clutch in the 3000 Product Family 7-Speed transfer case.

VARIABLES TO SPECIFY: None

VOCATIONS: Various. This function is required for all 3000 Product Family 7-Speed transmissions and used only with that model.

Refer to “*Input AF: Differential Clutch Request.*”

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING!	**These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION S. NEUTRAL INDICATOR FOR PTO AND PTO ENABLE—PACK-ON-THE-FLY OPTION

USES: Provides for fast idle operation in neutral, “pack-on-the-fly”, and PTO engagement with overspeed protection.

VARIABLES TO SPECIFY: Max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck.

SYSTEM OPERATION

Operator selects NEUTRAL to enable fast idle.

Transmission shifts to neutral if throttle and output speed are low.

When DRIVE is re-selected, fast idle is interrupted and transmission shifts to drive if engine speed drops below 900 rpm within approximately two seconds.

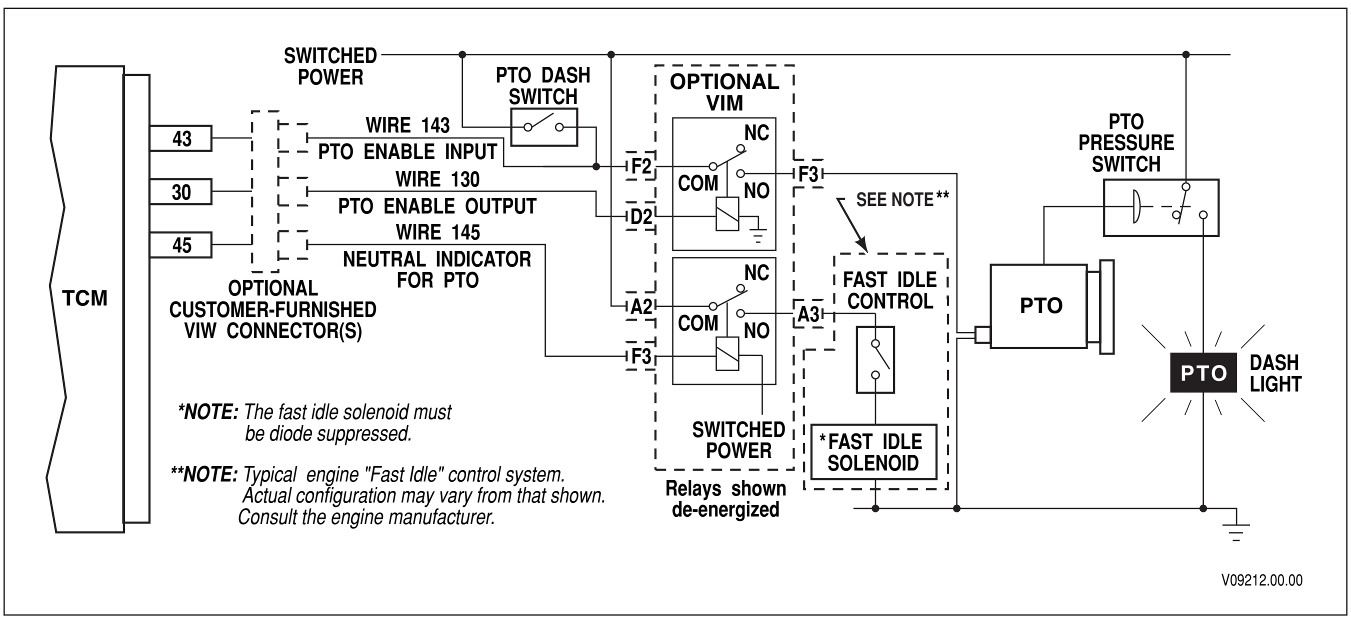


Figure P–62. Neutral Indicator for PTO and PTO Enable—Pack-On-The-Fly Option

APPENDIX P—INPUT/OUTPUT FUNCTIONS

WARNING! **These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

OUTPUT FUNCTION S. NEUTRAL INDICATOR FOR PTO AND PTO ENABLE—NEUTRAL OPERATION ONLY

USES: Provides for fast idle operation in neutral, and PTO engagement with overspeed protection.

VARIABLES TO SPECIFY: Max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck.

SYSTEM OPERATION

Operator selects NEUTRAL to enable fast idle.

Transmission shifts to neutral if throttle and output speed are low.

When DRIVE is re-selected, fast idle is interrupted and transmission shifts to drive if engine speed drops below 900 rpm within approximately two seconds.

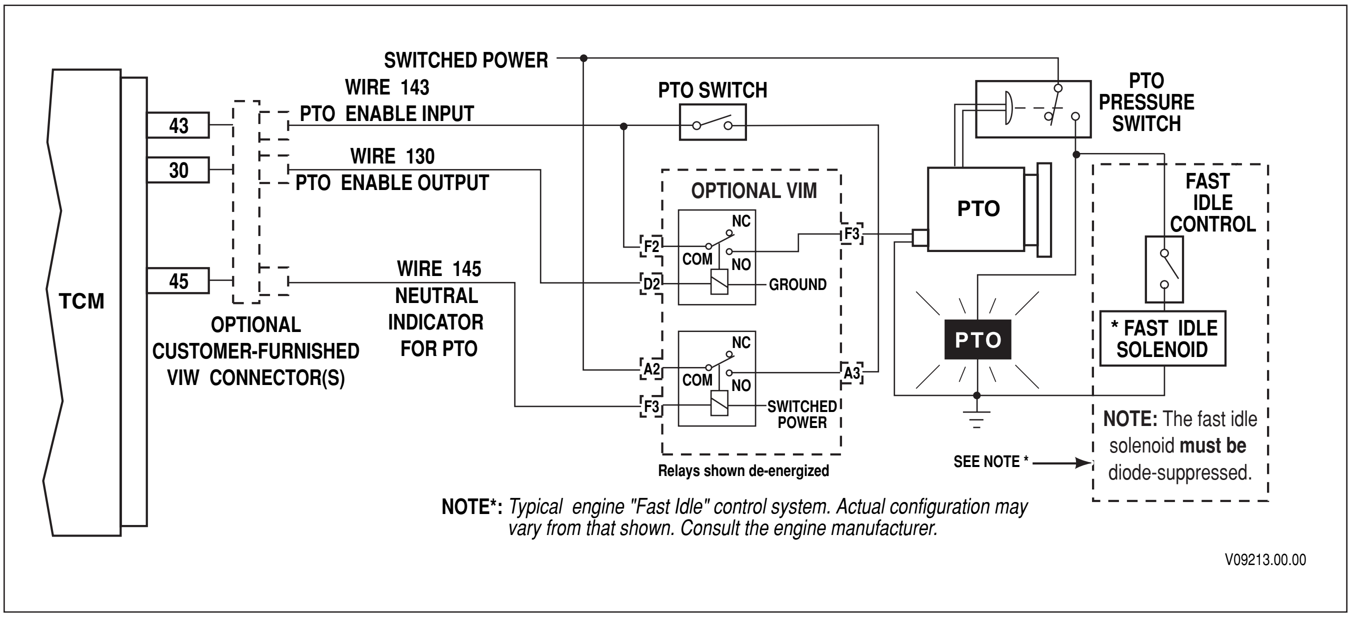


Figure P–63. Neutral Indicator for PTO and PTO Enable—Neutral Operation Only

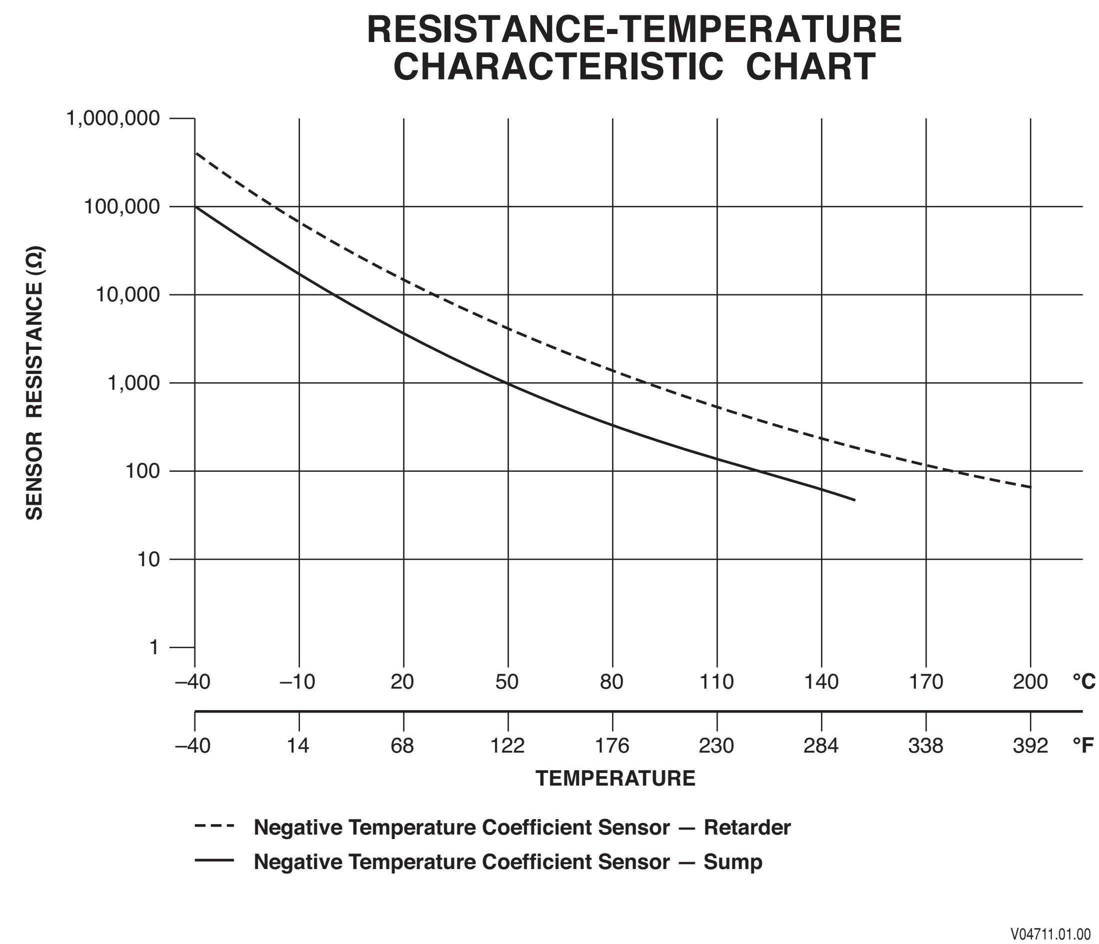
APPENDIX P—INPUT/OUTPUT FUNCTIONS

NOTES

APPENDIX Q—THERMISTOR TROUBLESHOOTING INFORMATION

Resistance Vs. Temperature Characteristics

Graph Q–1 is a graph of the temperature indicated by the resistance measured by the 3000 and 4000 Product Families product line sump and retarder temperature sensors. Both sensors have a have a negative temperature coefficient which means the indicated temperature increases as the measured resistance decreases within a range of about 200,000 Ohms down to about 50 Ohms for the sump thermistor and about 400,000 Ohms down to about 60 Ohms for the retarder thermistor.



Graph Q–1. TransID Thermistor Characteristics

NOTE: ***Look carefully at the graph. The scale for the resistance (on the left side) is not constant (linear). It is logarithmic which means it can display a great range of values within a small space. Each section of the graph is ten units, but the units vary from 1 to 100,000 Ohms. The range of resistance for the old thermistor is very small when compared with that of the new thermistors.***

The following table shows the range of resistance values that correspond to either retarder or sump fluid temperature shown in one degree increments over the operating range of the thermistors.

APPENDIX Q—THERMISTOR TROUBLESHOOTING INFORMATION

THERMISTORS—RESISTANCE (OHMS) VS. TEMPERATURE

Retarder Thermistor					Sump Thermistor				
Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms	Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms
					–50	–58	182288	202642	226183
					–49	–56.2	169859	188561	210206
					–48	–54.4	158357	175549	195459
					–47	–52.6	147708	163519	181840
					–46	–50.8	137844	152390	169255
					–45	–49	128702	142089	157621
					–44	–47.2	120224	132550	146860
					–43	–45.4	112359	123711	136900
					–42	–43.6	105057	115517	127678
					–41	–41.8	98276	107917	119134
–40	–40	352399	402392	452385	–40	–40	95956	100865	107181
–39	–38.2	329878	376270	422662	–39	–38.2	89769	94317	100181
–38	–36.4	308936	352005	395074	–38	–36.4	84019	88235	93681
–37	–34.6	289453	329454	369456	–37	–34.6	78674	82582	87642
–36	–32.8	271318	308486	345655	–36	–32.8	73701	77326	82030
–35	–31	254431	288981	323531	–35	–31	69073	72437	76811
–34	–29.2	238698	270827	302956	–34	–29.2	64764	67886	71956
–33	–27.4	224033	253923	283814	–33	–27.4	60749	63649	67497
–32	–25.6	210358	238177	265995	–32	–25.6	57008	59702	63228
–31	–23.8	197600	223501	249402	–31	–23.8	53520	56024	59308
–30	–22	185693	209817	233941	–30	–22	50266	52594	55654
–29	–20.2	174574	197053	219531	–29	–20.2	47229	49394	52247
–28	–18.4	164188	185140	206093	–28	–18.4	44394	46408	49069
–27	–16.6	154480	174018	193556	–27	–16.6	41746	43620	46102
–26	–14.8	145404	163630	181856	–26	–14.8	39271	41016	43332
–25	–13	136915	153923	170930	–25	–13	36958	38583	40745
–24	–11.2	128971	144848	160724	–24	–11.2	34794	36308	38328
–23	–9.4	121534.6	136360.5	151188	–23	–9.4	32770	34181	36088
–22	–7.6	114569.9	128419.6	142269.4	–22	–7.6	30875	32190	33954
–21	–5.8	108044.7	120987	133929.3	–21	–5.8	29101	30327	31976
–20	–4	101928.7	114027.2	126125.7	–20	–4	27439	28582	30125
–19	–2.2	96194	107507.5	118821	–19	–2.2	25881	26948	28391
–18	–0.4	90814.8	101397.8	111980.7	–18	–0.4	24420	25417	26767
–17	1.4	85767	95669.8	105572.7	–17	1.4	23051	23981	25245
–16	3.2	81028.5	90297.8	99567.2	–16	3.2	21766	22634	23818
–15	5	76578.5	85257.7	93937	–15	5	20660	21371	22480
–14	6.8	72397.9	80527.1	88656.4	–14	6.8	19427	20185	21225

APPENDIX Q—THERMISTOR TROUBLESHOOTING INFORMATION

THERMISTORS—RESISTANCE (OHMS) VS. TEMPERATURE *(cont'd)*

Retarder Thermistor					Sump Thermistor				
Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms	Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms
–13	8.6	68469	76085.4	83701.9	–13	8.6	18363	19072	20046
–12	10.4	64775.3	71913.4	79051.6	–12	10.4	17363	18026	18940
–11	12.2	61301.3	67993.3	74685.3	–11	12.2	16424	17043	17900
–10	14	58033	64308.5	70584	–10	14	15540	16120	16924
–9	15.8	54956.9	60843.6	66730.3	–9	15.8	14709	15251	16006
–8	17.6	52060.8	57584.4	63108	–8	17.6	13927	14434	15143
–7	19.4	49333.13	54517.51	59701.9	–7	19.4	13190	13666	14331
–6	21.2	46763.28	51630.64	56498	–6	21.2	12497	12942	13567
–5	23	44341.27	48912.25	53483.24	–5	23	11844	12261	12848
–4	24.8	42057.81	46351.65	50645.49	–4	24.8	11228	11619	12171
–3	26.6	39904.26	43938.84	47973.42	–3	26.6	10648	11014	11533
–2	28.4	37872.55	41664.54	45456.53	–2	28.4	10101	10444	10932
–1	30.2	35955	39520	43085	–1	30.2	9585	9906	10365
0	32	34145.1	37497.4	40850	0	32	9098	9399	9831
1	33.8	32430	35590	38750	1	33.8	8638	8921	9329
2	35.6	30810	33790	36770	2	35.6	8203	8470	8854
3	37.4	29282	32092	34903	3	37.4	7793	8044	8407
4	39.2	27838	30490	33142	4	39.2	7406	7643	7985
5	41	26474	28976	31479	5	41	7041	7263	7587
6	42.8	25184	27547	29910	6	42.8	6696	6905	7211
7	44.6	23965	26197	28428	7	44.6	6369	6567	6855
8	46.4	22813	24920	27028	8	46.4	6061	6247	6519
9	48.2	21722	23713	25704	9	48.2	5769	5944	6202
10	50	20690	22572	24454	10	50	5493	5658	5902
11	51.8	19712	21492	23271	11	51.8	5231	5387	5618
12	53.6	18787	20469	22152	12	53.6	4984	5131	5349
13	55.4	17910	19502	21093	13	55.4	4750	4888	5095
14	57.2	17079	18585	20091	14	57.2	4528	4659	4854
15	59	16292	17717	19141	15	59	4318	4441	4626
16	60.8	15545	16894	18242	16	60.8	4118	4235	4410
17	62.6	14836.8	16113.8	17391	17	62.6	3929	4039	4205
18	64.4	14164.8	15374.1	16583.5	18	64.4	3750	3854	4011
19	66.2	13527	14672.6	15818.2	19	66.2	3580	3678	3827
20	68	12921.4	14006.9	15092.4	20	68	3418	3511	3653
21	69.8	12346.4	13375.1	14403.8	21	69.8	3265	3353	3487
22	71.6	11800.1	12775.3	13750.5	22	71.6	3120	3202	3330
23	73.4	11281	12205.7	13130.3	23	73.4	2981	3060	3180
24	75.2	10787.6	11664.6	12541	24	75.2	2850	2924	3039

APPENDIX Q—THERMISTOR TROUBLESHOOTING INFORMATION

THERMISTORS—RESISTANCE (OHMS) VS. TEMPERATURE *(cont'd)*

Retarder Thermistor					Sump Thermistor				
Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms	Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms
25	77	10318.5	11150.4	11982.3	25	77	2725	2795	2904
26	78.8	9872.4	10661.7	11451	26	78.8	2606	2673	2776
27	80.6	9448	10197.1	10946.1	27	80.6	2493	2556	2655
28	82.4	9755.2	9755.2	10466.2	28	82.4	2385	2445	2540
29	84.2	8659.8	9334.9	10009.9	29	84.2	2282	2340	2430
30	86	8293.8	8934.9	9575.9	30	86	2185	2240	2326
31	87.8	7945.3	8554.2	9163.1	31	87.8	2092	2144	2227
32	89.6	7613.3	8191.7	8770.2	32	89.6	2003	2053	2132
33	91.4	7296.91	7846.57	8396.2	33	91.4	1919	1967	2043
34	93.2	6995.38	7517.77	8040.17	34	93.2	1839	1884	1957
35	95	6707.92	7204.5	7701.07	35	95	1763	1806	1875
36	96.8	6433.8	6905.92	7378.04	36	96.8	1690	1731	1797
37	98.6	6172.32	6621.29	7070.25	37	98.6	1620	1660	1723
38	100.4	5922.86	6349.87	6776.89	38	100.4	1554	1592	1653
39	102.2	5685	6091	6497	39	102.2	1491	1527	1585
40	104	5457.5	5844	6231	40	104	1430	1465	1521
41	105.8	5241	5608	5976	41	105.8	1373	1406	1459
42	107.6	5033	5383	5733	42	107.6	1318	1349	1401
43	109.4	4835	5169	5502	43	109.4	1265	1296	1345
44	111.2	4646	4963	5281	44	111.2	1215	1244	1291
45	113	4465	4768	5070	45	113	1167	1195	1240
46	114.8	4293	4580	4868	46	114.8	1122	1148	1192
47	116.6	4127	4402	4676	47	116.6	1078	1103	1145
48	118.4	3969	4231	4492	48	118.4	1036	1060	1100
49	120.2	3818	4067	4316	49	120.2	996.3	1019	1058
50	122	3673	3911	4148	50	122	958.1	980.3	1017
51	123.8	3535	3761	3988	51	123.8	921.6	942.9	978.4
52	125.6	3403	3619	3835	52	125.6	886.7	907.1	941.4
53	127.4	3276	3482	3688	53	127.4	853.3	872.9	905.9
54	129.2	3155	3352	3548	54	129.2	821.4	840.1	871.9
55	131	3039	3227	3414	55	131	790.8	808.8	839.4
56	132.8	2928	3107	3286	56	132.8	761.5	778.8	808.3
57	134.6	2821	2992	3163	57	134.6	733.5	750	778.5
58	136.4	2718.9	2882.4	3046	58	136.4	706.6	722.5	750
59	138.2	2621.1	2777.3	2933.5	59	138.2	680.9	696.2	722.7
60	140	2527.2	2676.5	2825.7	60	140	656.2	670.9	696.5
61	141.8	2437.3	2579.9	2722.5	61	141.8	632.6	646.7	671.4
62	143.6	2351	2487.3	2623.6	62	143.6	609.9	623.5	647.3

APPENDIX Q—THERMISTOR TROUBLESHOOTING INFORMATION

THERMISTORS—RESISTANCE (OHMS) VS. TEMPERATURE *(cont'd)*

Retarder Thermistor					Sump Thermistor				
Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms	Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms
63	145.4	2268.2	2398.5	2528.8	63	145.4	588.2	601.2	624.2
64	147.2	2188.8	2313.4	2438	64	147.2	567.4	579.9	602.1
65	149	2112.5	2231.7	2350.8	65	149	547.4	559.4	580.8
66	150.8	2039.3	2153.3	2267.3	66	150.8	528.2	539.8	560.5
67	152.6	1969.1	2078.1	2187.1	67	152.6	509.8	520.9	540.9
68	154.4	1901.6	2005.9	2110.2	68	154.4	492.1	502.8	522.2
69	156.2	1836.8	1936.6	2036.4	69	156.2	475.2	485.4	504.1
70	158	1774.5	1870	1965.5	70	158	458.9	468.7	486.8
71	159.8	1714.6	1806.1	1897.5	71	159.8	443.2	452.7	470.2
72	161.6	1657.1	1744.6	1832.2	72	161.6	428.2	437.3	454.2
73	163.4	1601.8	1685.6	1769.4	73	163.4	413.7	422.5	438.9
74	165.2	1548.65	1628.89	1709.1	74	165.2	399.8	408.3	424.1
75	167	1497.52	1574.36	1651.21	75	167	386.5	394.6	410
76	168.8	1448.33	1521.94	1595.54	76	168.8	373.6	381.5	396.3
77	170.6	1401.01	1471.52	1542.03	77	170.6	361.3	368.9	383.2
78	172.4	1355.47	1423.03	1490.58	78	172.4	349.4	356.7	370.6
79	174.2	1311.65	1376.38	1441.11	79	174.2	338	345	358.5
80	176	1269	1331	1394	80	176	327	333.8	346.8
81	177.8	1228.3	1288.3	1348	81	177.8	316.4	322.9	335.6
82	179.6	1190	1247	1304	82	179.6	306.2	312.5	324.7
83	181.4	1152	1207	1261	83	181.4	296.4	302.5	314.3
84	183.2	1116	1168	1220	84	183.2	288.9	292.8	304.3
85	185	1081	1131	1181	85	185	277.8	283.5	294.6
86	186.8	1047	1095	1143	86	186.8	269	274.5	285.4
87	188.6	1015	1061	1107	87	188.6	260.5	265.9	276.5
88	190.4	983	1028	1072	88	190.4	253.3	257.6	268
89	192.2	953	996	1038	89	192.2	244.3	249.5	259.7
90	194	924	965	1005	90	194	236.7	241.8	251.7
91	195.8	896	935	974	91	195.8	229.4	234.4	244
92	197.6	869	906	944	92	197.6	222.3	227.2	236.6
93	199.4	843	879	915	93	199.4	215.5	220.2	229.5
94	201.2	817	852	886	94	201.2	208.9	213.5	222.6
95	203	793	826	859	95	203	202.5	207.1	215.9
96	204.8	769	801	833	96	204.8	196.4	200.9	209.5
97	206.6	747	777	808	97	206.6	190.5	194.8	203.3
98	208.4	725	754	784	98	208.4	184.8	189	197.3
99	210.2	703.6	731.8	760	99	210.2	179.2	183.4	191.5
100	212	683.2	710.2	737.3	100	212	173.9	178	185.9

APPENDIX Q—THERMISTOR TROUBLESHOOTING INFORMATION

THERMISTORS—RESISTANCE (OHMS) VS. TEMPERATURE *(cont'd)*

Retarder Thermistor					Sump Thermistor				
Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms	Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms
101	213.8	663.4	689.4	715.3	101	213.8	168.8	172.8	180.5
102	215.6	644.4	669.3	694.1	102	215.6	163.8	167.8	175.3
103	217.4	626	649.8	673.7	103	217.4	159	162.9	170.3
104	219.2	608.2	631.1	653.9	104	219.2	154.4	158.2	165.4
105	221	591	612.9	634.9	105	221	149.9	159.6	160.7
106	222.8	574.3	595.4	616.5	106	222.8	145.6	149.2	156.2
107	224.6	558.2	578.4	598.7	107	224.6	141.4	145	151.8
108	226.4	542.6	562.1	581.5	108	226.4	137.4	140.9	147.5
109	228.2	527.6	546.2	564.9	109	228.2	133.5	136.9	143.4
110	230	513	530.9	548.8	110	230	129.7	133.1	139.4
111	231.8	498.8	516.1	533.3	111	231.8	126.1	129.4	135.6
112	233.6	485.2	501.8	518.3	112	233.6	122.6	125.8	131.9
113	235.4	471.9	487.9	503.9	113	235.4	119.2	122.3	128.2
114	237.2	459.1	474.5	489.8	114	237.2	115.9	118.9	124.8
115	239	446.73	461.51	476.3	115	239	112.7	115.7	121.4
116	240.8	434.72	448.95	463.18	116	240.8	109.6	112.5	118.1
117	242.6	423.08	436.79	450.5	117	242.6	106.6	109.5	114.9
118	244.4	411.8	425.02	438.23	118	244.4	103.7	106.5	111.9
119	246.2	400.88	413.61	426.35	119	246.2	100.91	103.7	108.9
120	248	390.29	402.57	414.86	120	248	98.2	100.9	106
121	249.8	380	392	404	121	249.8	95.58	98.23	103.2
122	251.6	370.1	381.5	393	122	251.6	93.04	95.63	100.5
123	253.4	360	371	383	123	253.4	90.58	93.12	97.9
124	255.2	351	362	372	124	255.2	88.2	90.68	95.36
125	257	342	352	363	125	257	85.89	88.32	92.9
126	258.8	333	343	353	126	258.8	83.65	86.03	90.51
127	260.6	325	334	344	127	260.6	81.49	83.8	88.19
128	262.4	316	326	335	128	262.4	79.38	81.65	85.95
129	264.2	308	317	326	129	264.2	77.35	79.56	83.77
130	266	301	309	318	130	266	75.37	77.54	81.65
131	267.8	293	302	310	131	267.8	73.46	75.58	79.6
132	269.6	286	294	302	132	269.6	71.6	73.67	77.61
133	271.4	279	287	294	133	271.4	69.8	71.82	75.68
134	273.2	272	279	287	134	273.2	68.05	70.03	73.8
135	275	265	272	280	135	275	66.35	68.29	71.98
136	276.8	258	266	273	136	276.8	64.7	66.6	70.21
137	278.6	252	259	266	137	278.6	63.11	64.96	68.5
138	280.4	246	253	260	138	280.4	61.56	63.37	66.83

APPENDIX Q—THERMISTOR TROUBLESHOOTING INFORMATION

THERMISTORS—RESISTANCE (OHMS) VS. TEMPERATURE *(cont'd)*

Retarder Thermistor					Sump Thermistor				
Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms	Degree C	Degree F	Lo Ohms	Nom Ohms	Hi Ohms
139	282.2	240	247	253	139	282.2	60.05	61.82	65.21
140	284	234.2	240.6	247	140	284	58.59	60.32	63.64
141	285.8	228.6	234.8	241.1	141	285.8	57.17	58.86	62.11
142	287.6	223.1	229.2	235.2	142	287.6	55.79	57.45	60.63
143	289.4	217.8	223.7	229.6	143	289.4	54.45	56.07	59.18
144	291.2	212.6	218.4	224.1	144	291.2	53.15	54.73	57.78
145	293	207.6	213.2	218.8	145	293	51.89	53.43	56.42
146	294.8	202.7	208.1	213.6	146	294.8	50.66	52.17	55.09
147	296.6	197.9	203.2	208.5	147	296.6	49.47	50.94	53.81
148	298.4	193.3	198.5	203.7	148	298.4	48.31	49.75	52.55
149	300.2	188.8	193.9	198.9	149	300.2	47.18	48.59	51.34
150	302	184.4	189.4	194.3	150	302	46.09	47.46	50.15
151	303.8	180.2	185	189.8	—	—	—	—	—
152	305.6	176	180.7	185.4	—	—	—	—	—
153	307.4	172	176.6	181.2	—	—	—	—	—
154	309.2	168.1	172.6	177.1	—	—	—	—	—
155	311	164.3	168.6	173	—	—	—	—	—
156	312.8	160.54	164.84	169.1	—	—	—	—	—
157	314.6	156.93	161.13	165.33	—	—	—	—	—
158	316.4	153.42	157.53	161.63	—	—	—	—	—
159	318.2	150.01	154.01	158.02	—	—	—	—	—
160	320	146.68	150.6	154.51	—	—	—	—	—
161	321.8	143.43	147.27	151.1	—	—	—	—	—
162	323.6	140	144	148	—	—	—	—	—
163	325.4	137.2	140.9	145	—	—	—	—	—
164	327.2	134	138	141	—	—	—	—	—
165	329	131	135	138	—	—	—	—	—
166	330.8	128	132	135	—	—	—	—	—
167	332.6	126	129	132	—	—	—	—	—
168	334.4	123	126	130	—	—	—	—	—
169	336.2	120	124	127	—	—	—	—	—
170	338	118	121	124	—	—	—	—	—
171	339.8	115	118	122	—	—	—	—	—
172	341.6	113	116	119	—	—	—	—	—
173	343.4	10	113	117	—	—	—	—	—
174	345.2	108	111	114	—	—	—	—	—
175	347	106	109	112	—	—	—	—	—
176	348.8	104	107	109	—	—	—	—	—

APPENDIX Q—THERMISTOR TROUBLESHOOTING INFORMATION

THERMISTORS—RESISTANCE (OHMS) VS. TEMPERATURE *(cont'd)*

Retarder Thermistor					Sump Thermistor				
Degree C	**Degree F**	**Lo Ohms**	**Nom Ohms**	**Hi Ohms**	**Degree C**	**Degree F**	**Lo Ohms**	**Nom Ohms**	**Hi Ohms**
177	350.6	101	104	107	—	—	—	—	—
178	352.4	99	102	105	—	—	—	—	—
179	354.2	97	100	103	—	—	—	—	—
180	356	95	98	101	—	—	—	—	—
181	357.8	93.4	96.1	99	—	—	—	—	—
182	359.6	91.5	94.1	96.8	—	—	—	—	—
183	361.4	89.6	92.3	94.9	—	—	—	—	—
184	363.2	87.8	90.4	93	—	—	—	—	—
185	365	86.1	88.6	91.1	—	—	—	—	—
186	366.8	84.3	86.8	89.4	—	—	—	—	—
187	368.6	82.7	85.1	87.6	—	—	—	—	—
188	370.4	81	83.4	85.9	—	—	—	—	—
189	372.2	79.4	81.8	84.2	—	—	—	—	—
190	374	77.8	80.2	82.6	—	—	—	—	—
191	375.8	76.3	78.7	81	—	—	—	—	—
192	377.6	74.8	77.1	79.4	—	—	—	—	—
193	379.4	73.4	75.6	77.9	—	—	—	—	—
194	381.2	71.9	74.2	76.4	—	—	—	—	—
195	383	70.5	72.8	75	—	—	—	—	—
196	384.8	69.2	71.4	73.6	—	—	—	—	—
197	386.6	67.84	70.02	72.20	—	—	—	—	—
198	388.4	66.54	68.70	70.86	—	—	—	—	—
199	390.2	65.27	67.41	69.54	—	—	—	—	—
200	392	64.03	66.14	68.25	—	—	—	—	—
201	393.8	62.82	64.91	65.99	—	—	—	—	—
202	395.6	61.64	63.70	65.76	—	—	—	—	—
203	397.4	60.00	63.00	65.00	—	—	—	—	—
204	399.2	59.30	61.40	63.00	—	—	—	—	—

APPENDIX R—SAE J1939 COMMUNICATION LINK

This Appendix is an overview of how Allison Transmission implements the J1939-based functions.

The Controller Area Network (CAN) defined by SAE J1939 enables the integration of various vehicle components into an overall vehicle system by providing a standard way of exchanging information between these modules in the vehicle. Use of a J1939 network, or datalink, for on-vehicle communication can greatly reduce the amount of wiring in a vehicle, and give many different components and subsystems access to a wider range of information.

Allison uses the J1939 communication link for vehicle operation controls, powertrain interaction, and conveying vehicle management information (Figure R–1).*

Details are found in the Vehicle Function Requirements section of the Datalink Communications Tech Data.

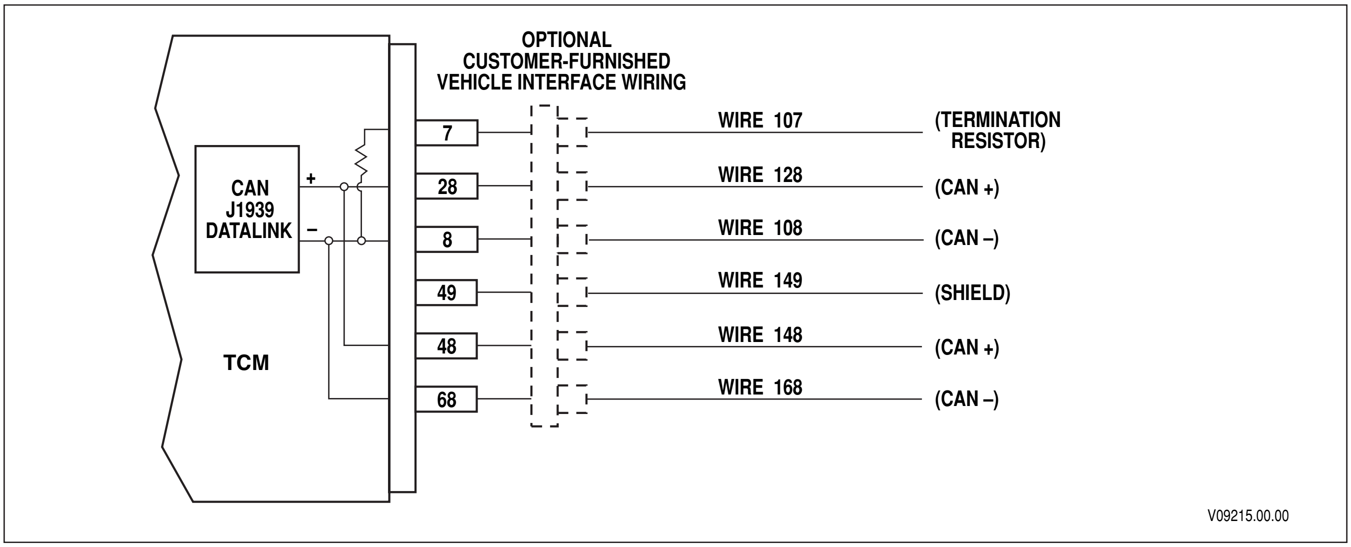


Figure R–1. J1939 Interface Wiring (TCM Pin-Out)

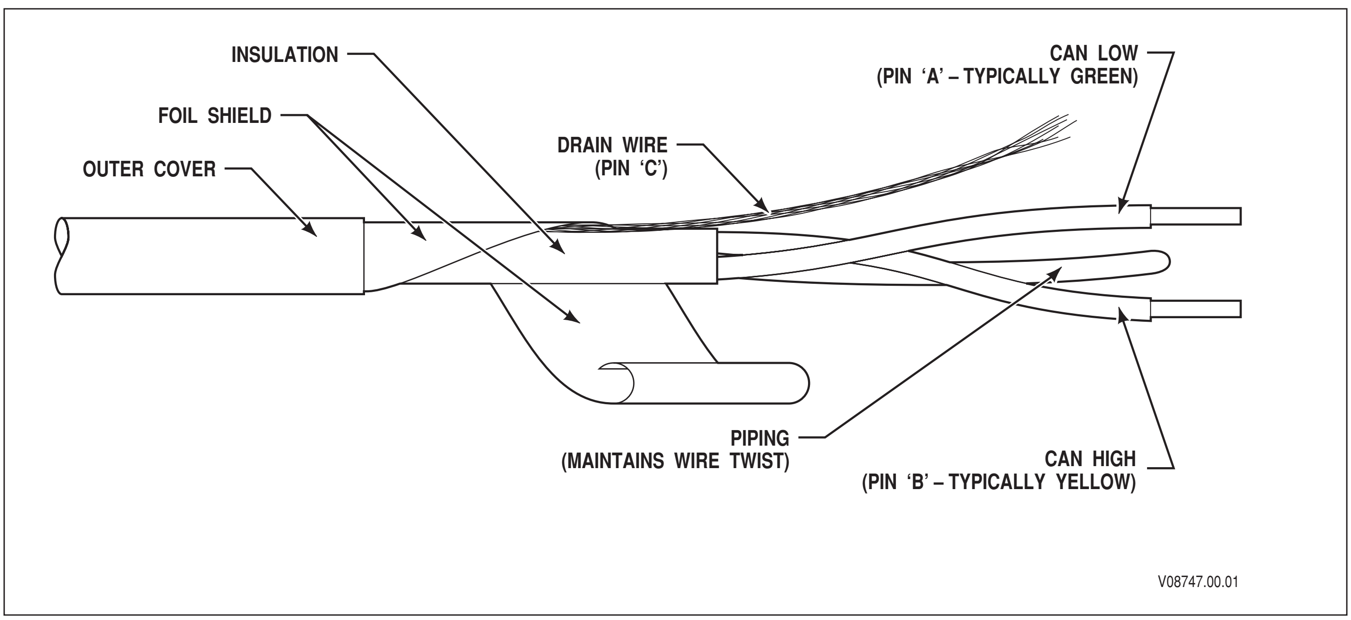


Figure R–2. J1939-11 Twisted, Shielded Pair Cable

**** NOTE: On Allison 4th Generation Controls Systems, off-board communications are only enabled via J1939.***

APPENDIX R—SAE J1939 COMMUNICATION LINK

Wiring

Allison recommends implementing J1939 network wiring per SAE J1939-11, which specifies 120 Ohm impedance twisted pair cable with shielding (Figure R–2). The shielding greatly reduces the communication link's susceptibility to induced electromagnetic interference.

The drain wire connects to a "shield" pin on each controller on the network. These "shield pins" are not the same as ground connections; there is circuitry between the shield pin and the controller's ground connection.

In addition to the above connections, the shield drain wire should break out of the backbone in one location, preferably as close to the center as possible, and connect directly to the battery ground terminal or grounding bus bar.

Allison Transmission does not recommend the use of unshielded cabling specified in J1939-15 (often referred to as "J1939 Lite"). The lack of shielding makes the J1939 network more susceptible to electromagnetic interference, which can be extremely difficult to diagnose and correct. Many vehicle OEMs, however, opt to use J1939-15 cable due to its lower cost and greater flexibility. J1939-11 (shielded) and J1939-15 (unshielded) cable should never be mixed in a vehicle installation.

Cable suppliers include:

- Belden Wire and Cable Co.
- BICC Brand-Rex Co.
- Champlain Cable Co.
- Raychem.

J1939 networks are laid out in a linear fashion, consisting of a central "backbone" with "stubs" branching off to individual controllers or "nodes" (refer to Figure R–3).

Regardless of the cable used, two 120 Ohm termination resistors are required, one at each end of the backbone cable (refer to Figure R–4). These resistors may be built into a receptacle connector or plug connector that contains a blue wedge lock.

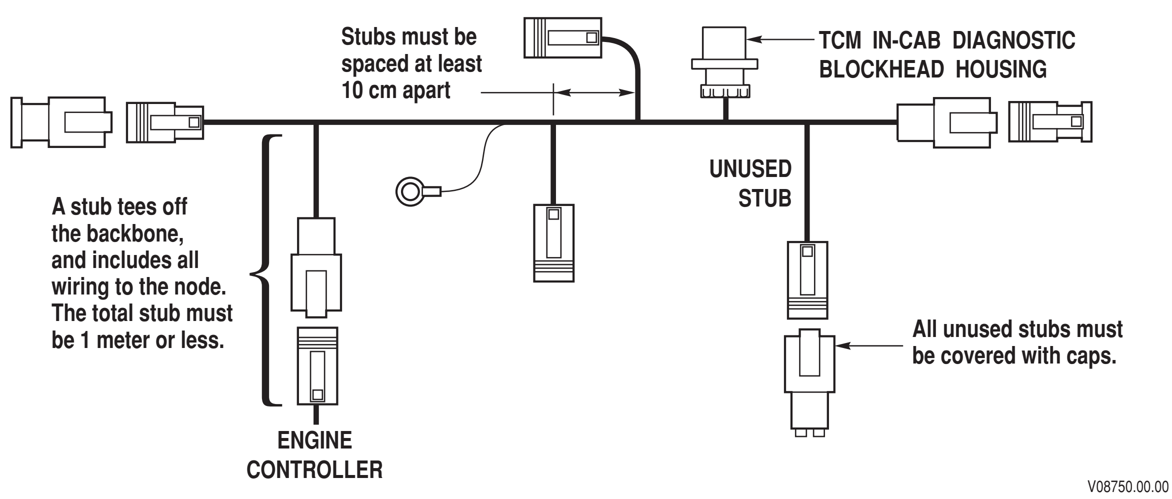


Figure R–3. J1939-11 Network Configuration

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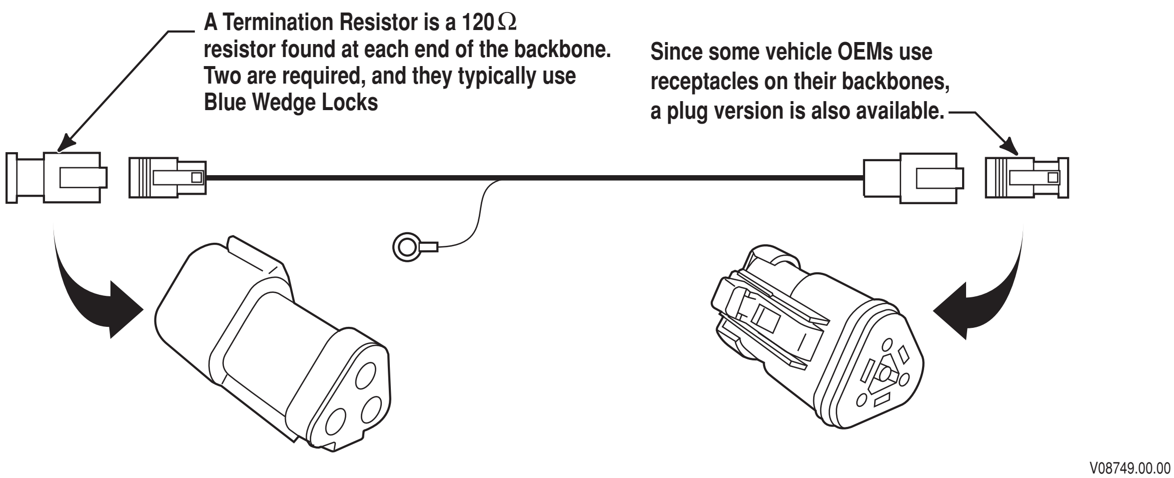

Figure R–4. Termination Resistors Requirement on J1939-11 Backbone

Typically, all connectors on the backbone and stubs are of the “plug” type. However, “receptacle” connectors may be used in some installations. Stubs and nodes use orange or green wedge locks.

The backbone may be no longer than 40 meters in length. A stub includes the length of wiring on the node, and the length from the backbone to the node must be one meter or less.

Figure R–3 shows a typical J1939-11 network cable configuration including controllers, or “nodes”. The connector for the Allison controller is a 3-way connector configured as follows (refer to Figure R–5):

- Terminal A = CAN High
- Terminal B = CAN Low
- Terminal C = CAN Shield.

Typically CAN High is a yellow wire and CAN Low is a green wire.

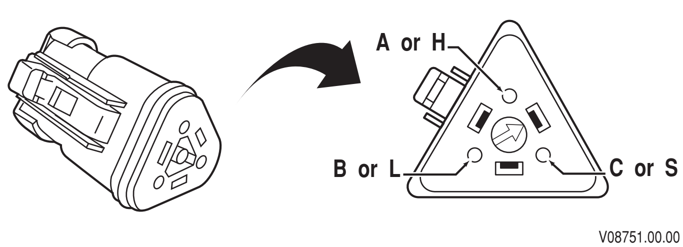

Figure R–5. 3-Way Allison Controller Connector

APPENDIX R—SAE J1939 COMMUNICATION LINK

A 9-way, in-cab, diagnostic bulkhead housing, if used, will be configured as follows (refer to Figure R–6):

- A = Ground
- B = +12 volts (unswitched)
- C = High (Yellow)
- D = Low (Green)
- E = Shield
- F = J1587 + (typically blue)
- G = J1587 – (typically white)
- H and J = For OEM use.

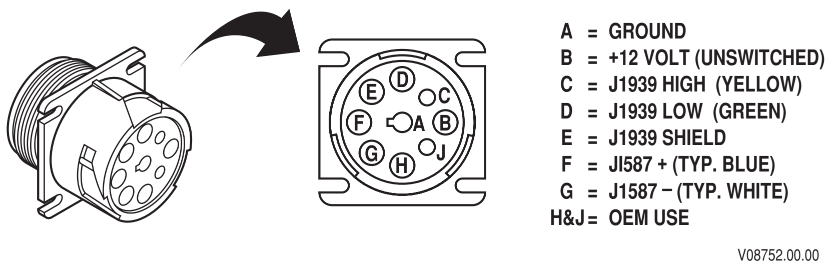

Figure R–6. 9-Way, In-Cab, Diagnostic Connector

Troubleshooting

In terms of J1939 communication, Allison Transmission is only responsible for the Allison TCM hardware, software, and calibration. Wiring issues belong solely to the vehicle manufacturer. The responsibility for putting valid data on the datalink, and properly using the data obtained from the datalink, belongs to each component supplier with a device connected to the datalink.

CAN vs. Traditional Wiring

A key difference between traditional analog wires and CAN datalinks is the detection of signal corruption between the communicating devices.

An analog electrical signal generated properly by a sender may be *corrupted* on the way to the receiver by such problems as electrical noise or shorts-to-ground or power. This corruption may or may not affect the value received.

CAN communication links are much more robust, as *wiring integrity cannot change the values being sent*. Wiring faults can only prevent messages from arriving at their destination. The CAN hardware makes sure that a message is accepted only and exactly as the sending node generated the message. CAN chips reject messages affected by electrical noise or wire faults.

When communication is possible and there are no wiring issues present, CAN makes certain that information is received exactly as it is sent. However, CAN cannot detect when a device is putting out bad information or when a device misuses information pulled off of the network. For example, if the ABS system sends information stating that it is active, whether it actually is or not, the TCM will still react as if the ABS is active.

APPENDIX R—SAE J1939 COMMUNICATION LINK

The CAN Community

A unique aspect of the J1939 datalink is that the TCM can be one of many controllers on the network. As such, intended communication with certain devices (such as the engine) may be impacted by other devices on the datalink, such as an instrument cluster or body controller.

The manufacturer of each individual controller on the network is responsible to make sure that correct information is placed on the network at all times. This work should be covered during the development of any device that will connect to the J1939 network. As such, troubleshooting here will deal only in the context of wiring and calibration issues, which are most often encountered in the field.

Datalink Diagnostic Tools

Digital Multi-Meters

A digital volt/ohmmeter (DVOM) can be used to detect datalink activity. However, datalink voltages change extremely fast, causing meter float. DVOMs are best suited to testing for proper termination resistance, or the presence of open- or short-circuits in the network wiring.

Temporary Backbone

The first step in any datalink-related problem is to determine who ‘owns’ the problem. Connecting a temporary backbone between the engine and transmission can be used to identify the source of the problem, eliminating many of the unknowns such as vehicle wiring, interference from another controller, etc. If the problem goes away while using the temporary backbone and returns when the OEM backbone is reconnected, it is not an Allison Transmission issue; there is a problem with the vehicle’s OEM wiring.

Wiring and Connector Failures

Wiring and connectors are the number one cause of problems in the field. Opens, shorts, and CAN high being connected to CAN low are among the most frequently encountered issues.

Termination Resistors

A J1939 network requires a 120 Ohm termination resistor at each end of the backbone (Figure R–3). With all controllers powered off and both termination resistors in place, an ohmmeter should read 60 Ohms across terminals A and B of the 3-way connector (Figure R–5), or Terminals C and D of the 9-way connector (Figure R–6). The test can be performed with controllers connected to the backbone because the impedance at the controllers is much higher than 60 Ohms and therefore does not affect the reading.

A measurement of 120 Ohms typically indicates that either one of the two termination resistors is not in place, or there is an open somewhere in the backbone of the network.

A measurement of 0 (zero) Ohms indicates that there is a short between the CAN high and CAN low wires of the network. The short may be in the backbone itself, or in one of the stubs connecting it to a controller.

Open Circuits

Open circuits in the CAN High (A) or CAN Low (B) sides of the backbone or in any of the stubs can affect one or more controllers on the network. While an open circuit in a stub will have the most impact on the controller attached to that stub, other devices on the network who normally receive information or expect a response from that controller will be impacted as well.

When there are multiple nodes attached to the network, and their connectors are accessible, an open circuit can be tracked by moving down the backbone from stub to stub looking at the datalink information present at each connector. When there is a difference in the amount of datalink traffic between two connection points, there is

APPENDIX R—SAE J1939 COMMUNICATION LINK

likely an open circuit somewhere on the stubs or the backbone between the two connection points. A DVOM may be used to detect activity.

Short Circuits

A short circuit can occur in the J1939 backbone or stubs between:

- CAN high and CAN low
- CAN high or CAN low and battery voltage
- CAN high or CAN low and ground

When a short circuit is present, typically multiple controllers on the network indicate an error of some sort, due to the loss of all communication between any of the nodes. For example, datalink-based instrument clusters will not function properly. Short circuits typically fall into one of the following categories:

- Mechanical failure—Insulation cut or scraped through, wires pinched, etc.
- Incorrectly wired pins on one or more of the controllers
- Missing connector seal(s), allowing water intrusion.

Inducted Noise

Inducted noise tends to be a much greater issue when J1939-15 (unshielded) cable is used. While the following routing tips are a good idea for shielded networks, they are critical when unshielded cable is used. J1939-15 cable routing must avoid the following by a minimum of 3 to 4 inches of physical separation:

- Solenoids
- Alternator
- Flasher modules
- High output CB radio
- Starter motor
- Relays
- Any high-current switching device.

Inducted noise is typically “event driven”, or associated with an activity that involves operation of a high-current load near the network wiring. For example, “everytime I use my left turn signal, the ABS lamp acts up...”

To find noise sources, monitor datalink traffic under the following conditions:

- With the key switch on: Operate every input the driver has access to, such as the CB, blower motors, fans, air conditioning, flashers, turn signals, lights, horn, brakes, etc.
- With the engine running: Exercise every function on the vehicle as is possible, such as engaging the engine fan, turning on the air conditioning compressor, operating the dump bed, etc.

If errors or pauses in datalink traffic are noted during any specific activity, investigate the network wiring near the associated component(s).

Calibrations

After wiring, calibrations are the number two cause of problems in the field. Inappropriate calibration changes in the field can affect the operation of the Allison transmission, or the entire vehicle.

If a particular transmission or vehicle function worked prior to a calibration update of one of the controllers on the J1939 datalink, but does not function properly *afterwards*, it is likely that a customer-programmable value was changed on one or more controllers during the update. The same situation can exist for software upgrades, as well.

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In either event, the cause can be narrowed down by reloading the previous software and/or calibration and determining if the issue goes away.

From an Allison perspective, there are two common causes of miscalibration:

- An internal "auto-detect" process was completed by the TCM before all of the appropriate controllers on the vehicle were connected to the J1939 datalink. In this case, Allison DOC™ For PC–Service Tool can be used to reset the auto-detection process.
- A calibration was constructed with an incorrect datalink package as specified in the Production Calibration Configuration System (PCCS). In this case, a new calibration with the correct package will have to be made. Table R–1 illustrates Allison J1939 broadcast and receive parameters versus PCCS datalink package.

Outside of the Allison TCM programming, engine TCM programming can have the greatest affect on transmission operation. Electronic engines typically have many "customer programmable" items that can affect transmission operation, such as:

- Transmission type set incorrectly
- Incompatible engine governor selected
- Engine brake (compression or exhaust) options set incorrectly
- J1939 communication not activated.

Tables R–1 through R–4, on the following pages, provide an overview of J1939 messages and parameters sent and received by Allison 4th Generation Controller System. Support varies versus the datalink package in PCCS. Refer to Datalink Tech Data for details.

Table R–1. J1939 Broadcasts—TCM

PGN	SA	Rate	Byte	Bits	Parameters Sent	Remarks
00000 TSC1	03	12.5 MS[1]			(See Datalink Tech Data for Details)	⑥
59904 PGN Request	03	As Req'd	1–3	—	PGN of Requested Message	ON
61184 Proprietary A	03	100 ms	1–8	—	Proprietary Shift Selector Information	ON
61440 ERC1	16	100 ms	1	4–1	Retarder Torque Mode	ON ③
			2	—	Actual Retarder—Percent Torque	ON ③
			3	—	Intended Retarder—Percent Torque	ON ③
			4	2, 1	Engine Coolant Load Increase	ON ③
			5	—	SA of Controlling Device for Retarder Control	ON ③
			7	—	Retarder Selection, Non-Engine	ON ③
			8	—	Actual Max. Available Retarder—Percent Torque	ON ③
61442 ETC1	03	12.5 ms[1]	1	6,5	Shift in Progress	ON
				4,3	Torque Converter Lockup Engaged	ON
				2,1	Driveline Engaged	ON
			2,3	—	Transmission Output Shaft Speed	ON
			5	4,3	Progressive Shift Disable	ON
			6,7	—	Transmission Input Shaft Speed	ON
			8	—	SA of Controlling Device For Transmission Control	ON

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Table R–1. J1939 Broadcasts—TCM *(cont'd)*

PGN	SA	Rate	Byte	Bits	Parameters Sent	Remarks
61445 ETC2	03	100 ms	1	—	Transmission Selected Gear (range commanded)	ON
			2,3	—	Transmission Actual Gear Ratio	ON
			4	—	Current range (AT range attained)	ON
			5,6	—	Transmission Request Range (range selected)	ON
			7,8	—	Transmission Current Range (range attained)	ON
61452 ETC8	03	Varies[2]	1,2	—	Transmission Torque Converter Ratio	⑥
65098 ETC7	03	100 ms	1	8,7	Trans. Requests Range Display Flash State	ON
				6,5	Trans. Requests Range Display Blank State	ON
			2	8,7	Shift Inhibit Indicator	ON
				6,5	Transmission Engine Crank Enable	ON
				4,3	Active Shift Console Indicator	ON
			3	8,7	Transmission Mode 1 Indicator	ON
				6,5	Transmission Mode 2 Indicator	ON
				2,1	Transmission Mode 4 Indicator	ON
			4	8,7	Transmission Request Gear Feedback	ON
65099 TCFG2	03	Varies	1,2	—	Transmission Torque Limit	ON
65226 DM1	03 or 16	1000 ms when active	1	4,3	Amber Warning Light Status	ON
			⑧	—	Suspect Parameter Number	ON
			⑧	—	Failure Mode Identifier	ON
65242 SOFT	03	Request	1	—	Number of Software Identification Fields	ON
			2–N	—	Software Identification	ON
65249 RCFG	16	At power up, on request, and on 10% map change	1	8–5	Retarder Location	ON③
				4–1	Retarder Type	ON③
			2	—	Retarder Control Method	ON③
			⑧	—	Torque and Speed Map (See text for details)	ON③
			17,18	—	Reference Retarder Torque	ON③
65250 TCFG	03	Request	1	—	Number of Reverse Ratios	ON
			2	—	Number of Forward Ratios	ON
			⑧	—	Transmission Gear Ratio	ON
65259 CI	03	Request	1–5	—	Make	ON
			⑧	—	Model	ON
65272 TF	03	Request	5,6	—	Transmission Oil Temperature	ON
			7	—	Transmission Oil Level High/Low	ON④
			8	8–5	Transmission Oil Level Measurement Status	ON④
			8	4–1	Transmission Oil Level Countdown Timer	ON④
65275 RF	16	1000 ms	2	—	Hydraulic Retarder Oil Temperature	ON③

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Table R–2. J1939 Reception—TCM

PGN	Rate	Byte	Bits	Parameters Sent	Remarks
00000 TSC1(to DA16)	50 ms	(See Datalink Tech Data text for details)			33, 17, 00, 11, 39⑦
00256 TC1	50 ms	3	—	Transmission Requested Gear	05, 06
		6	8,7	Transmission Mode 4	05, 06
			4,3	Transmission Mode 2	33
		7	8,7	Selector Display Mode Switch	05, 06
61440 ERC1	100 ms	2	—	Actual Retarder—Percent Torque	15, 41, 00⑤⑧
		1	6,5	Retarder Enable—Brake Assist Switch	15, 41, 33
		7	—	Retarder Selection, Non-Engine	33
61441 EBC1	100 ms	1	6,5	Anti-lock (ABS) Active	11
			2,1	ASR Engine Control Active	11
		5	—	Engine Retarder Selection	33, 00⑤
61444 EEC1	Varies With Engine Speed	1	4-1	Engine/Retarder Torque Mode	00
		2	—	Driver's Demand Engine—Percent Torque	00
		3	—	Actual Engine—Percent Torque	00
		6	—	SA of Controlling Device For Engine Control	00
		8	—	Engine Demand—Percent Torque	00
61443 EEC2	50 ms	1	6,5	Road Speed Limit Status	00
			4,3	AL Kickdown Switch	00, 33, 17⑤⑥
		2	—	Accelerator Pedal (AP) Position	00, 33, 17⑤
		3	—	Percent Load at Current Speed	00
		6	1,2	Vehicle Acceleration Rate Limit Status	00
65214 EEC4	Request	1,2	—	Rated Power	00
65247 EEC3	250 ms	1	—	Nominal Friction—Percent Torque	00
		5	—	Est. Engine Parasitic Losses—Percent Torque	00
65249 RCFG	Request	17,18	—	Reference Retarder Torque	15, 41, 33⑤⑧
65251 ECFG	5000 ms and on request	20,21	—	Reference Engine Torque	00
		31,32	—	Engine Inertia	00
		33,34	—	Engine Default Torque Limit	00
65259 C1	Request	1–5	—	Make	00
		⑧	—	Model	00
65262 ET	1 S	1	—	Engine Coolant Temperature	00
65265 CCVS	100 ms	2, 3	—	Wheel-Based Vehicle Speed	00
		4	6, 5	Brake Switch	00, 33, 17⑤
		6	—	Cruise Control Set Speed	00, 33, 17⑤
		7	8–6	Cruise Control State	00, 33, 17⑤
			5–1	PTO State	00

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Table R–3. J1939 Broadcasts—Allison Shift Selector

PGN	SA	Rate	Byte	Bits	Parameters Sent	Remarks
00256 TC1	05 06	50 ms	3	—	Transmission Requested Gear	ON
				8,7	Transmission Mode 4	ON
			7	8,7	Selector Display Mode Switch	ON
60928 Address Claimed	05 06	As Req'd	See Allison 4th Generation Control Datalink Tech Data for details			ON
652421 Soft	05 06	Request	1	—	Number of Software Identification Fields	ON
			2–N		Software Identification	ON

Table R–4. J1939 Reception—Allison Shift Selector

PGN	Rate	Byte	Bits	Parameters Sent	Remarks
59504 PGN Request	Varies	1–3	—	PGN of Requested Message	03
61184 Proprietary A	100 ms	1–8	—	Proprietary Shift Selector Information	03
65098 ETC7	100 ms	2	4,3	Active Shift Console Indicator	03
			2,1	Transmission Mode 4 Indicator	03

Footnotes:

① The TCM does not support SAE-specified broadcast rate of 10 ms.

② 25 ms when torque converter active, 100 ms when torque converter is in lockup. TCM does not support SAE-specified broadcast rate of 20 ms.

③ Only broadcast in applications where the presence of an Allison driveline retarder has been auto-detected or forced 'ON' via calibration.

④ Only broadcast in applications where the presence of an Allison oil level sensor has been auto-detected or forced 'ON' via calibration.

⑤ Of the listed acceptable source addresses, the TCM locks onto the 'most preferred' source, as determined by auto-detect logic.

⑥ This parameter is calibration dependent and may not be present on the Datalink.

⑦ TCM supports reception from all acceptable source addresses, not just one.

⑧ TCM can support reception from more than one acceptable source address in a given installation.