Allison Transmission®

Allison 4th Generation Controls

Troubleshooting Manual

1000 and 2000 Product Families

TS3977EN

Troubleshooting Manual

TS3977EN 200707

1000 AND 2000 PRODUCT FAMILIES ALLISON 4TH GENERATION CONTROLS

Allison Transmission®

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ALLISON 4TH GENERATION CONTROLS

1000 and 2000 Product Families

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FOREWORD — How to Use This Manual

This manual provides troubleshooting information for Allison Transmission 1000 and 2000 Product Families transmissions. Service Manual SM4006EN, Mechanics Tips MT4007EN, and Parts Catalog PC3062EN may be used in conjunction with this manual.

This manual includes:

- Description of the 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 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 service of wiring harnesses and wiring harness components as follows:***

- ***Repair parts for the internal wiring harness 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 the vehicle OEM or the OEM is responsible for warranty on these parts.***

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.

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SERVICE LITERATURE

This service literature provides fully illustrated instructions for operation, maintenance, service, overhaul, and parts support for your transmission. For maximum performance and service life from you unit, you may order publications from:

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

1000 and 2000 Product Families Service Literature

Publication Name	Publication No.
Allison DOC™ For PC–Service Tool User Guide	GN3433EN
Automatic Transmission Fluid Technician's Guide	GN2055EN
*Mechanic's Tips	MT4007EN
*In-Chassis Maintenance	GN4008EN
*Emergency Vehicle Series Operator's Manual	OM3761EN
*Highway Series Operator's Manual	OM3757EN
*Rugged Duty Series Operator's Manual	OM3759EN
*Motorhome Series Operator's Manual	OM3364EN
*Pupil Transport/Shuttle Series Operator's Manual	OM3758EN
*Bus Series Operator's Manual	OM3765EN
*1000, 2000, 2400 Operator's Manual	OM3063EN
*Owner's Manual (2000MH)	OM3364EN
*Parts Catalog	PC3062EN
Parts Catalog On CD-ROM	CD3062EN
Principles Of Operation	PO4009EN
Service Manual	SM4006EN
Troubleshooting Manual—Allison 4th Generation Controls	TS3977EN
* Also Available On The Internet At *www.allisontransmission.com*	

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SECTION 1—GENERAL DESCRIPTION

1–1. TRANSMISSION

The 1000 and 2000 Product Families Allison 4th Generation Controls system features closed-loop clutch control to provide superior shift quality over a wide range of operating conditions. The 1000 and 2000 Product Families configurations can be programmed to provide up to six forward speeds, neutral, and reverse. The fifth and sixth ranges are overdrive gear ratios. The 1000 and 2000 Product Families incorporates a variety of standard and optional design features.

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

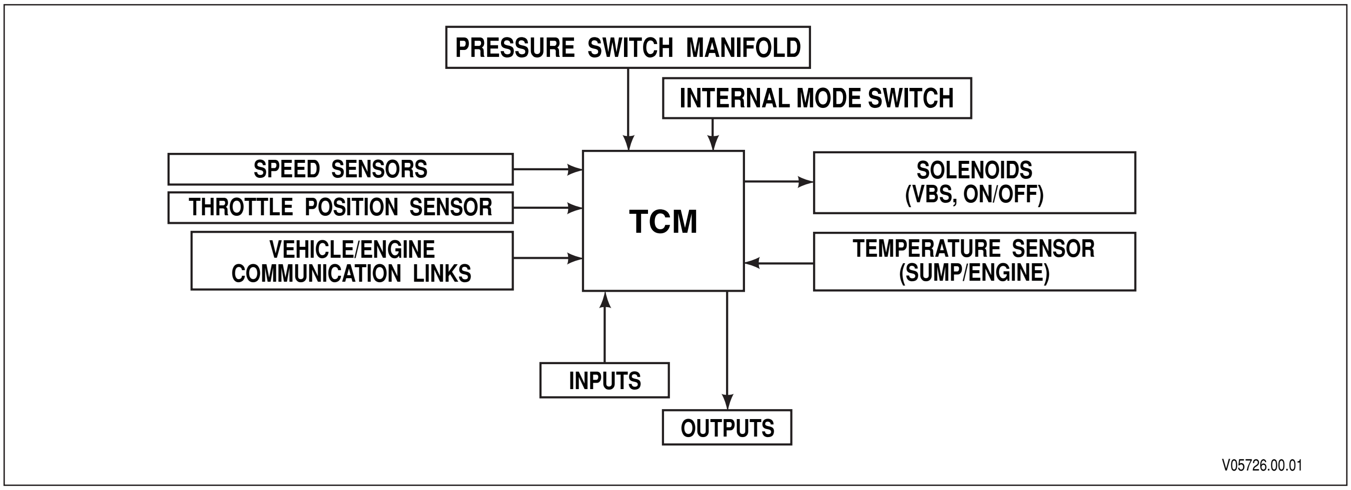


Figure 1–1. Transmission Control Module Block Diagram

Figure 1–2 shows the electronic control components.

Electronic Controls consist of the following elements:

- Remote 12V or 24V Transmission Control Module (TCM)
- Throttle Position Sensor (TPS), electronic engine throttle data, or PWM signal
- Speed Sensors—Input (Engine), Turbine, and Output
- Control Valve Assembly (Electro-Hydraulic Valve Body)
- Internal Mode Switch (IMS)
- Pressure Switch Manifold (PSM)
- Wiring Harnesses

NOTE: All external harnesses are OEM-supplied.

GENERAL DESCRIPTION

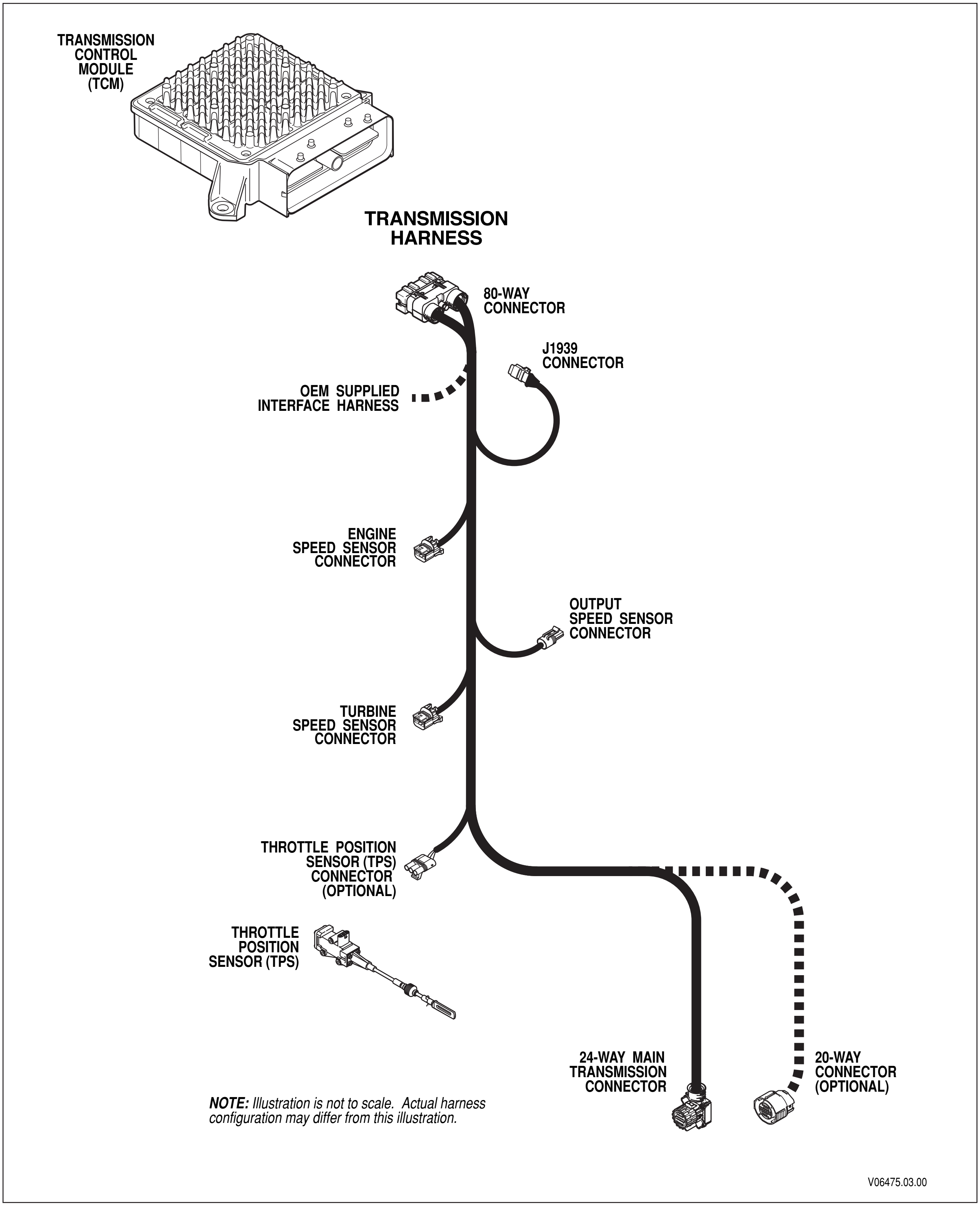


Figure 1–2. Electronic Control Components

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 24V configurations to match the configuration of the vehicle electrical system.

The TCM (refer to Figure 1–3) receives and processes signals from various switches and sensors. The TCM determines shift sequences, shift timing, and clutch apply and release pressures. The TCM uses the information to control transmission solenoids and valves, supply system status, and provide diagnostic information.

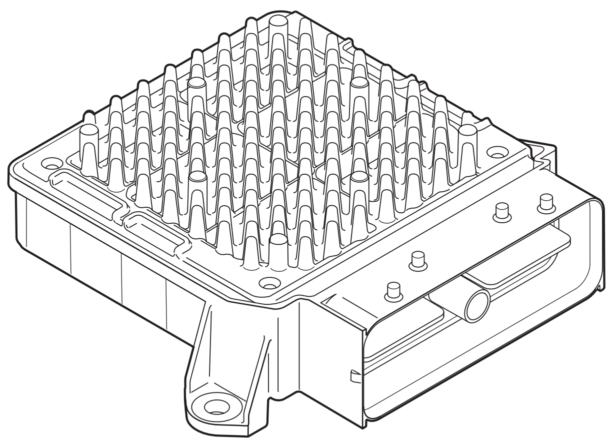


Figure 1–3. Transmission Control Module (TCM)

1–3. SHIFT SELECTOR

The vehicle is equipped with a lever-type shift selector (refer to Figure 1–4). In addition to the lever assembly provided for the operator, other components associated with the shift selector are the manual selector valve in the main control valve body and an Internal Mode Switch (IMS) mounted on the selector shaft inside the transmission oil pan. Shift selector components (with the exception of the transmission selector shaft) are customer-supplied.

A. Shift Selector Range Positions

The operator chooses the transmission range by moving the selector lever to the appropriate gate position (refer to Figure 1–4). When properly adjusted, the shifter gates prevent inadvertent shifting between ranges and correspond to the internal transmission detent positions. A positive detent is provided in the transmission to maintain the selector shaft in the selected position.

GENERAL DESCRIPTION

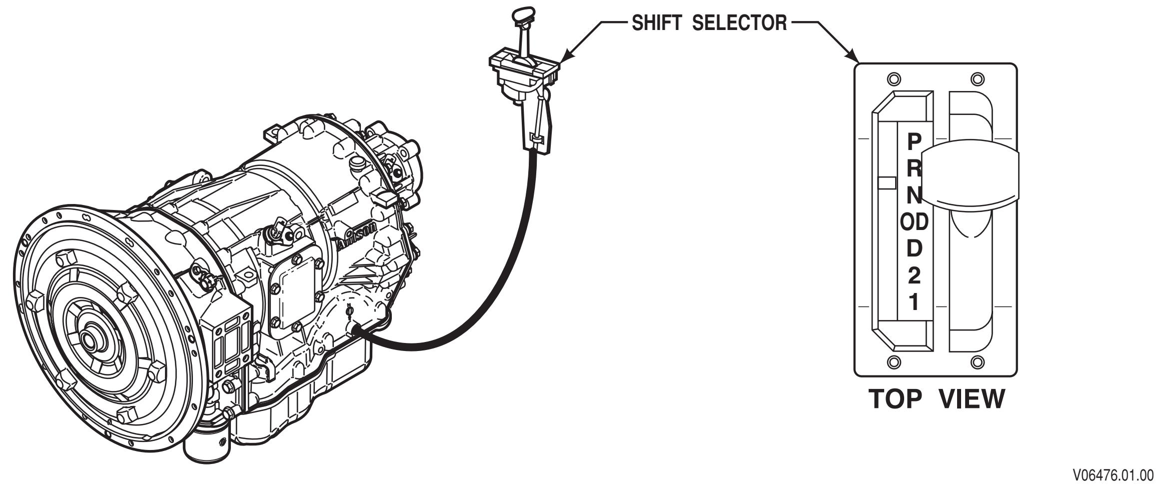


Figure 1–4. Typical Lever-Type Shift Selector

The TCM shift calibration determines the available forward ranges for each selector position. Although specific installations vary, typical selector positions for the 1000 and 2000 Product Families are:

P—Park. Parking pawl or parking brake is engaged, if available. This position is not available on all shift selectors.

R—Reverse.

N—Neutral. May be used when starting the engine and for stationary operations.

OD—Overdrive. The highest forward range used for normal driving. The transmission shifts to first range for starting, then automatically upshifts through the ranges (as operating conditions permit) until the highest range is attained.

D, **2**, **1**—Forward Range. The transmission shifts to first range for starting. The range selected on the shift selector is the highest range which will be attained during automatic shifting (on GM truck applications, a position **M** is used for Tap Up/Tap Down functionality).

B. Manual Selector Valve

The manual shift selector shaft is attached to the manual selector valve within the transmission main control valve body. The selector valve has three positions: reverse, neutral, and forward.

NOTE: For transmissions equipped with a P (Park) position, the selector valve remains in the neutral position when the selector is moved to P (Park).

The neutral and reverse selector valve positions (refer to Appendix H—Hydraulic Schematics) exhaust the C1 and C2 rotating clutches. By exhausting C1 and C2 clutches, forward range is inhibited. This provides the capability for the operator to override the electronically commanded ranges if neutral is required.

GENERAL DESCRIPTION

C. Internal Mode Switch (IMS)

An internally-mounted switch, commonly called an Internal Mode Switch or IMS (refer to Figure 1–5), mounts inside the transmission oil pan at the shift selector shaft. The IMS detects the angular position of the shift selector shaft. This position is communicated to the TCM so that certain vehicle control functions can be coordinated with the position of the shift controls. The neutral signal output of the IMS is typically used as confirmation that the transmission is in neutral before the engine starter is engaged.

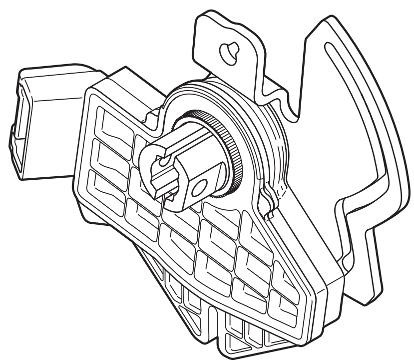


Figure 1–5. Internal Mode Sensor (IMS)

1–4. THROTTLE POSITION SENSOR (TPS)

The Throttle Position Sensor (TPS) can be mounted to the engine, chassis, or transmission. The TPS (refer to Figure 1–6) 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.

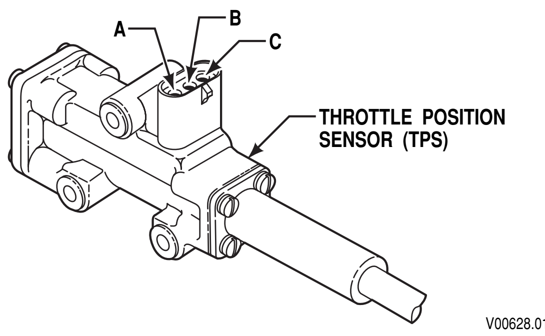


Figure 1–6. Throttle Position Sensor (TPS)

GENERAL DESCRIPTION

1–5. SPEED SENSORS

There are three speed sensors available for use with 1000 and 2000 Product Families transmissions: the input (engine) speed sensor, the turbine speed sensor, and the output speed sensor (refer to Figure 1–7). The speed sensors provide rpm information to the TCM. The speed ratios between the various sensors allow the TCM to determine the transmission operating range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the best possible shift quality.

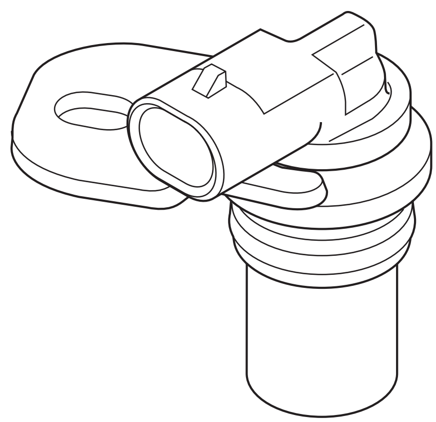


Figure 1–7. Typical Speed Sensor

The speed sensors are variable reluctance devices which 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 which is mounted adjacent to a rotating ferrous member (such as a gear tooth). 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 (such as a gear tooth) approaches and passes through the gap at the end of the pole piece, an AC voltage pulse is induced in the wire coil. The 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. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.

NOTE: Do not rotate the speed sensor in the retaining bracket. Orientation is fixed, and if changed, may cause improper operation.

A. Input (Engine) Speed Sensor

The input speed sensor is externally mounted in the torque converter housing directed at the ribs protruding from the torque converter. The input speed sensor connector should be positioned at approximately four o’clock, as viewed from the left side of the transmission (refer to Figure 1–8).

B. Turbine Speed Sensor

The turbine speed sensor is externally mounted in the main housing directed at the tone wheel or PTO drive gear attached to the rotating clutch module. The turbine speed sensor connector should be positioned at approximately three o’clock, as viewed from the left side of the transmission (refer to Figure 1–8).

GENERAL DESCRIPTION

C. Output Speed Sensor

The output speed sensor is externally mounted in the rear cover and directed at the teeth of a tone wheel splined to and rotating with the output shaft. The output speed sensor connector should be positioned at approximately five o'clock, as viewed from the left side of the transmission (refer to Figure 1–8).

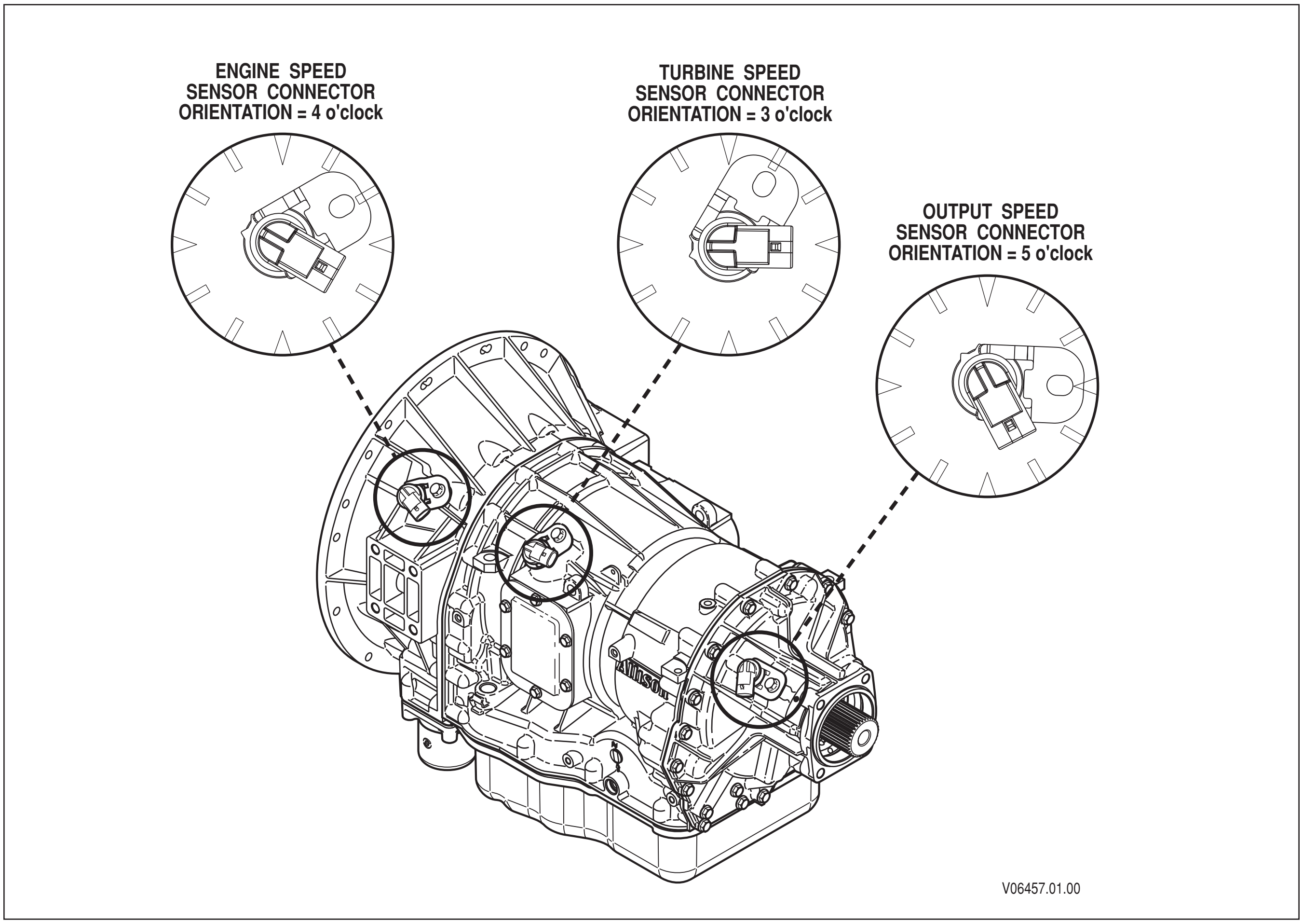


Figure 1–8. Speed Sensor Connector Orientation

1–6. CONTROL VALVE ASSEMBLY

The hydraulic control valve assembly (Figure 1–9) governs fluid flow to the clutches (including the torque converter clutch). Solenoids, actuated by the TCM, control valve movement.

The control valve assembly consists of two components, the main valve body and the control valve body. The main valve body contains the pressure control valves (PCV), the TCC valve, the exhaust backfill valve, and the control main relief valve. The shift valve body contains the shift valves, the control main pressure valve, and the manual selector valve. The control valve assembly attaches to the bottom of the gearbox module and is enclosed by the oil pan. An internal wiring harness connects the solenoids and Pressure Switch Manifold (PSM) to the main transmission connector and external wiring harness.

GENERAL DESCRIPTION

A. Main Modulation

Main pressure is reduced by utilizing an on/off Main Mod solenoid that is located in the control valve body assembly. The Main Mod solenoid body is bolted to the main valve body. Main pressure will be reduced under various conditions such as low throttle, low torque, low engine speeds, and low output speeds. The primary benefit of modulating main pressure is to increase cooler flow at low engine speeds.

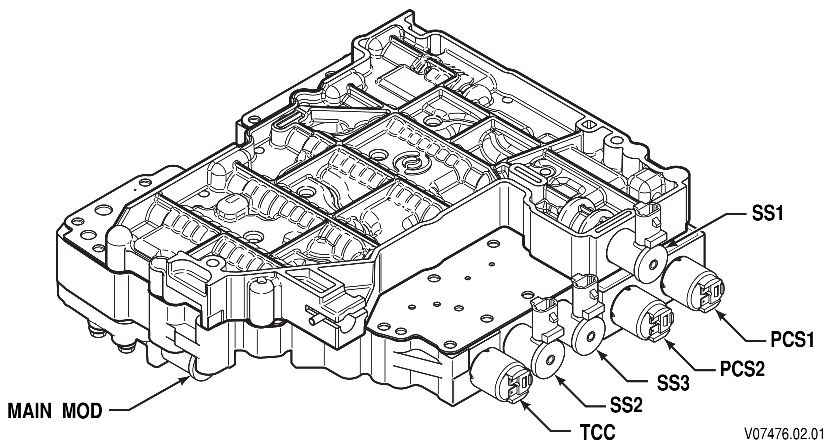


Figure 1–9. Control Valve Assembly

1–7. WIRING HARNESS

A. External Wiring Harness

The external wiring harness (refer to Figure 1–10) requirements are typically met through the use of a single harness with one branch connecting the TCM to the transmission, throttle position sensor, IMS, and speed sensors; another branch connecting the TCM to Allison DOC™ For PC–Service Tool and other vehicle interfaces. All wiring harnesses and mating connectors are OEM-supplied.

NOTE: Repair parts for the external harness and external harness components must be obtained through the vehicle OEM. The OEM is responsible for warranty on these parts.

GENERAL DESCRIPTION

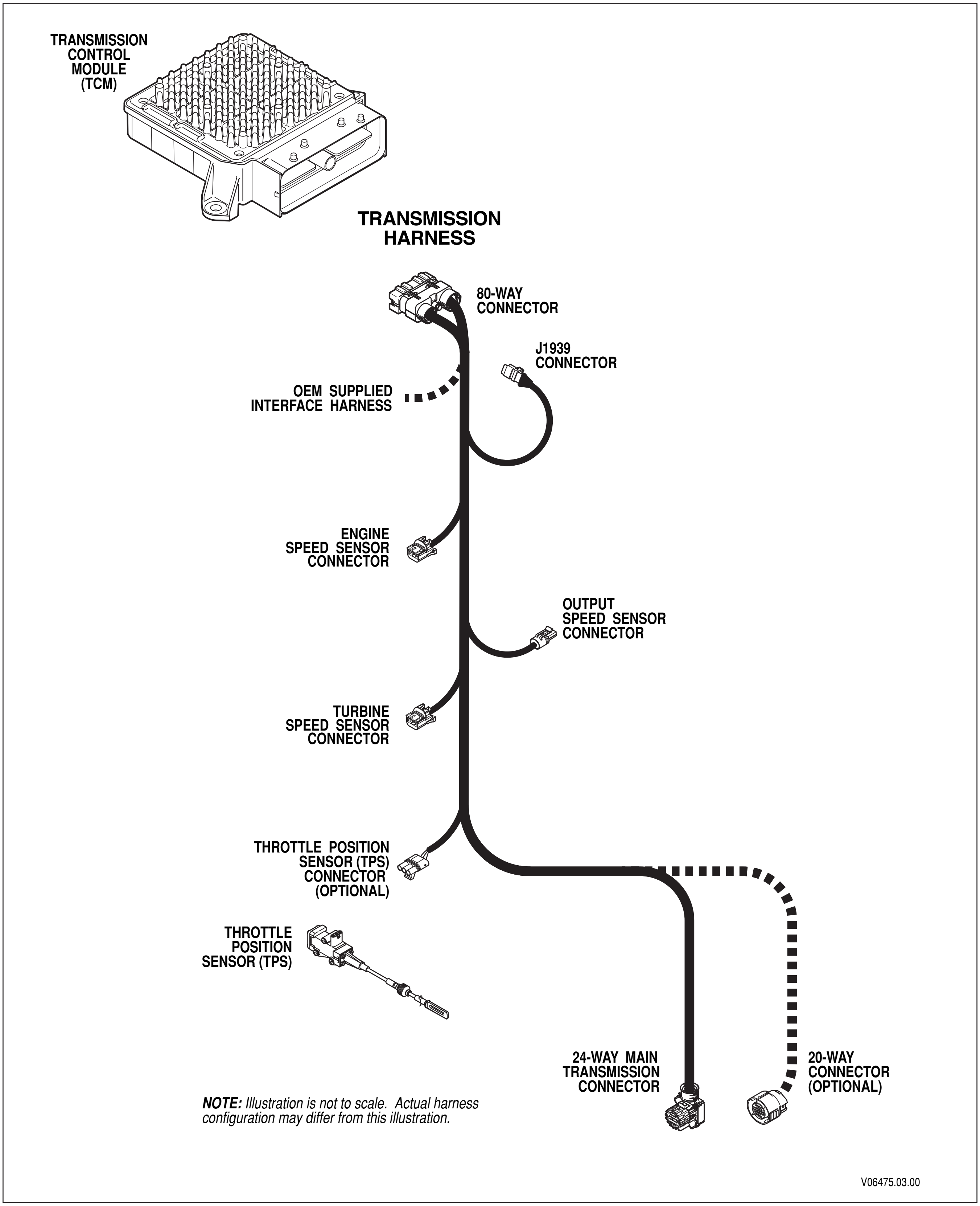


Figure 1–10. Typical External Wiring Harnesses

GENERAL DESCRIPTION

B. Internal Wiring Harness

An internal wiring harness (refer to Figure 1–11 and Figure 1–12) connects the shift solenoids (SS1, SS2, SS3), pressure control solenoids (PCS1, PCS2), torque converter clutch solenoid (TCC), internal mode switch (IMS), pressure switch manifold (PSM), and temperature sensor to the external harness leading to the TCM.

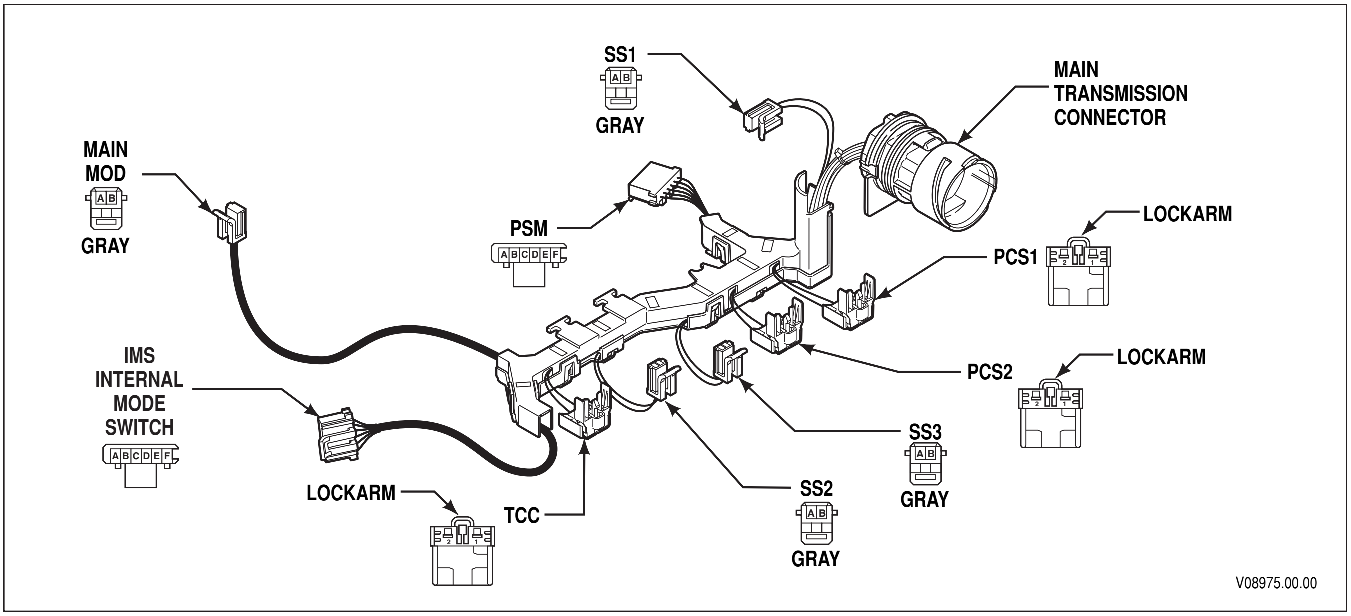


Figure 1–11. Typical Internal Wiring Harness (24-Way Connector)

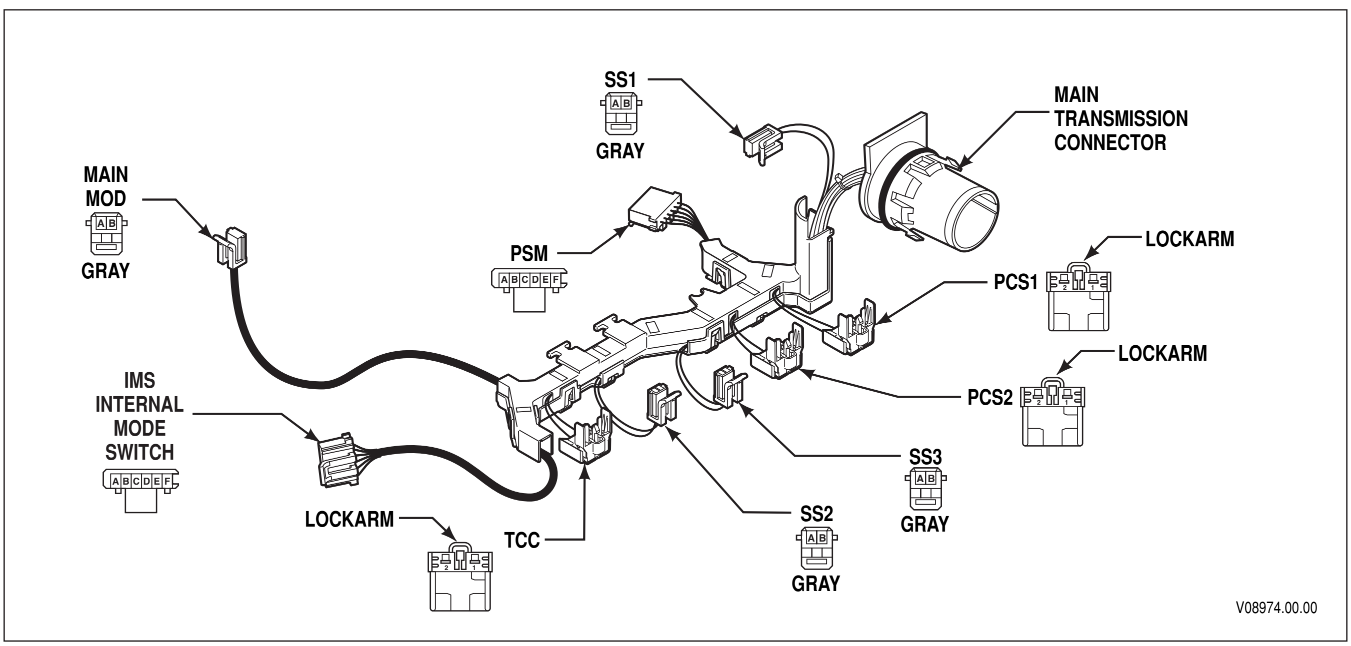


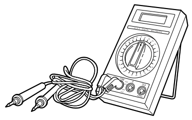
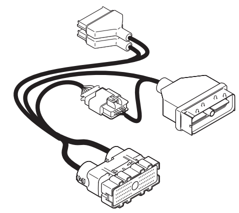
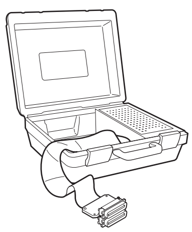
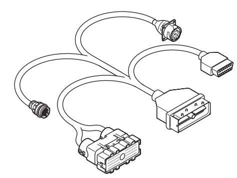
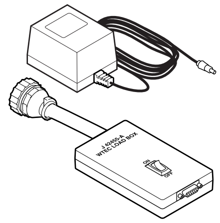
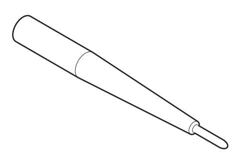
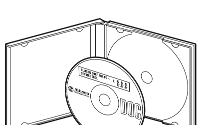
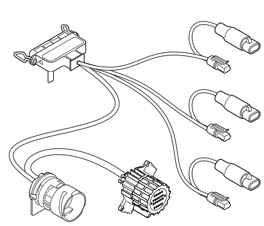
Figure 1–12. Typical Internal Wiring Harness (20-Way Connector for GM Applications Only)

GENERAL DESCRIPTION

1–8. SPECIAL ELECTRONIC/ELECTRICAL TOOLS

All tools listed are essential for overhaul, maintenance, and/or recalibration of the 1000 and 2000 Product Families electronic and electrical systems. The tools listed below are available for purchase from SPX/Kent-Moore.

Table 1–1. Essential Tools

	J 34520-A Digital Volt/Ohmmeter		J 47275 TCM Breakout Harness Adapter
	J 39700 Univeral Breakout Box		J 47276 "T" Breakout and TCM Reflashing Harness
	J 42455-A Load Box		J 47277 Terminal Probe ***NOTE: J 47277 is now included in the J 39197-A Kit.***
	J 44950 Allison DOC™ For PC–Service Tool		J 47278 1000 and 2000 Product Families Breakout Harness

GENERAL DESCRIPTION

Table 1–1. Essential Tools ***(cont'd)***

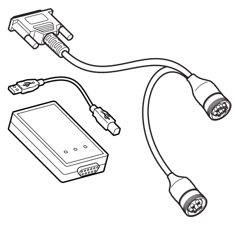
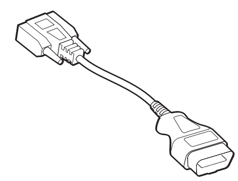
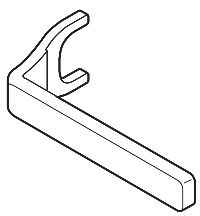
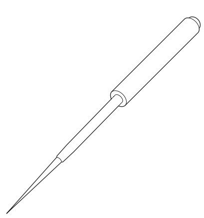
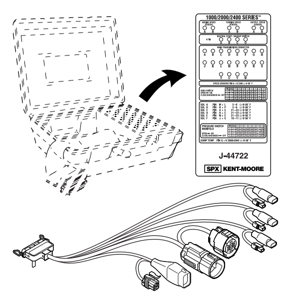
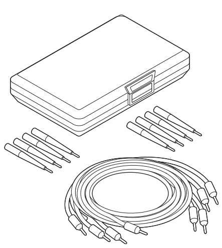
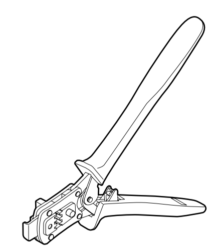
	J 47943 DPA4 USB Translator Device		J 47949 GMLAN Cable
	J 47944 1000 and 2000 Product Families Main Transmission Connector Removal Tool		

Table 1–2. Available Tools

	J 38125-12A Terminal Remover (80-way connector) GM P/N: 12094429		J 44722-3 Overlay J 44722-3 Cable ***NOTE: J-44722-3 overlay is for pick-up truck use only.***
	J 39197-A Jumper Kit		J 47139 Crimper

SECTION 2—DEFINITIONS AND ABBREVIATIONS

2–1. CHECK TRANS LIGHT

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, vehicle, and transmission. To do this, the TCM turns on the **CHECK TRANS** light on the instrument panel, which notifies the operator that a Diagnostic Trouble Code (DTC) has been stored.

Each time the engine is started, the TCM will illuminate the **CHECK TRANS** light, then turn it off after a few seconds. This is a circuit check to verify that the lamp and wiring are in proper working order. Illumination of the **CHECK TRANS** light at any time after start-up indicates that the TCM has set a DTC. Allison DOC™ For PC–Service Tool is used to verify that the TCM has set a DTC (refer to Section 2–2). While the **CHECK TRANS** light is on, upshifts and downshifts may be restricted and direction changes (**D**–**R**, **R**–**D**) may not occur. The torque converter clutch is inhibited when transmission shifting is restricted or during any critical transmission malfunction.

The 1000 and 2000 Product Families transmissions DTCs are latching DTCs. When a failure condition is detected, the DTC set by the TCM remains active for the entire time the ignition is on. When the ignition is turned off and then on again, the transmission DTCs will reset and the TCM will recheck for the failure condition. If the failure condition is not present, the previously set DTC will remain in history; the **CHECK TRANS** light will turn off after the circuit check, and the transmission will function normally unless another failure occurs. This feature allows the vehicle to be driven to a service outlet.

2–2. RANGE INHIBIT RESPONSES

The range inhibit feature is a function of the TCM logic. The TCM senses when certain input variables are exceeded and takes action to prevent transmission damage. The TCM inhibits neutral-to-range shifts and illuminates a light on the dash when the inhibit is active.

Listed below are three variables that, when exceeded, cause inhibited shifts (with thresholds listed).

- Engine speed above 1000 rpm
- Throttle setting above 40 percent
- Output speed above 225 rpm

There are two levels of the special logic inhibits.

- Self-clearing inhibit—This inhibit clears itself if one of the above conditions is not present after a calibrated time. This is three seconds in the case of medium-duty vehicles. If the shift inhibit is active, but not latched, the bulb will stay lit until self-cleared.
- Latching inhibit — This inhibit latches when one of the conditions listed above is still present after a calibrated time. This is above three seconds for medium duty vehicles. To clear a latching inhibit, move the selector into any other position than the one originally selected.

2–3. ALLISON DOC™ FOR PC–SERVICE TOOL INHIBITS

If an inhibit has occurred since the last DTC was cleared, the inhibit state will indicate **ON** and will stay **ON** until the next **manual DTC clear** with Allison DOC™ For PC–Service Tool. These latched inhibits do not turn **OFF** after a specified number ignition cycles.

DEFINITIONS AND ABBREVIATIONS

The range inhibit light will illuminate and/or an inhibited state will be shown on Allison DOC™ For PC–Service Tool when the transmission is inhibited to Neutral for the following reasons:

- **Low Main Pressure**

  If the transmission pressure switches do not indicate transmission pressurized at start-up, shifts-to-range may be inhibited and the range inhibit light will illuminate. Allison DOC™ For PC–Service Tool will indicate an active inhibit.

  Common causes are transmission low on fluid, transmission filter has just been changed, or pan has been removed and fluid recently drained.

  May produce DTC P0701.

- **Transfer Case Neutral**

  If the transfer case is shifted into neutral while the transmission is in drive or reverse at a speed above idle, the transmission will continue to command range until the output speed is reduced to a point where neutral range is commanded. The range inhibit light will illuminate and Allison DOC™ For PC–Service Tool will indicate an active inhibit.

- **Diagnostic Active**

  This indicates that an active diagnostic code was set and the driver attempted a range selection that was inhibited. In some failure modes, reverse cannot and will not be commanded. If reverse is selected during these failure modes a range inhibit light will illuminate in reverse.

  During diagnostic responses, Neutral-to-Range Inhibits and Direction Change Inhibits continue to operate, but they may latch under certain conditions. In these cases, shutting down ignition and waiting for at least 5 seconds before restarting will clear the inhibit condition. Allison DOC™ For PC–Service Tool will indicate an active inhibit.

- **Auto Neutral for PTO**

  Neutral-to-Drive and Neutral-to-Reverse shifts will be inhibited to neutral and Allison DOC™ For PC–Service Tool will show an inhibited state when TCM detects that auto neutral function input is active.

- **Reverse Enable**

  Neutral-to-Reverse shifts will be inhibited to neutral and Allison DOC™ For PC–Service Tool will show an inhibited state when no input is detected from dash or floor mounted reverse enable switch when selecting reverse range. Allison DOC™ For PC–Service Tool will indicate an active inhibit.

  This function is only used in European transit and tour buses applications.

- **Refuse Packer Step Switch**

  Transmission operation is limited to only 1st range. Neutral-to-reverse shifts will be inhibited to neutral and Allison DOC™ For PC–Service Tool will show an inhibited state when input is detected from a step switch indicating that personnel is present on rear step platform.

- **Auxiliary Function Range Inhibit**

  Neutral-to-Drive and Neutral-to-Reverse shifts will be inhibited to neutral and Allison DOC™ For PC–Service Tool will show an inhibited state when input is detected from an auxiliary switch or device. This inhibit will remain active until the auxiliary switch input is shut off and range is reselected.

DEFINITIONS AND ABBREVIATIONS

- **PTO Neutral Lockup**

  Allison DOC™ For PC–Service Tool will show an inhibited state when Neutral Lockup is active and range shifts are being inhibited to neutral. When the selector is moved, lockup is released and the inhibit clears.

- **Engine Speed**

  Neutral-to-Drive and Neutral-to-Reverse shifts will be inhibited to neutral and the range inhibit light will illuminate if the Engine Speed is greater than a calibrated value (1400 rpm for medium duty non-emergency vehicles). Allison DOC™ For PC–Service Tool will indicate an active inhibit.

- **Output Speed**

  Reverse-to-Drive, Drive-to-Reverse, and Neutral-to-Reverse shifts initiated above 300 rpm of output speed will be inhibited to neutral and the range inhibit light will illuminate. Allison DOC™ For PC–Service Tool will indicate an active inhibit.

- **Throttle**

  Reverse-to-Drive, Drive-to-Reverse, Neutral-to-Drive, and Neutral-to-Reverse shifts where throttle position is greater then 25 percent will be inhibited to neutral and the range inhibit light will illuminate. Allison DOC™ For PC–Service Tool will indicate an active inhibit.

- **IMS Function or Alignment**

  Reverse-to-Drive, Drive-to-Reverse, Neutral-to-Drive, and Neutral-to-Reverse shifts will be inhibited to neutral and the range inhibit light will illuminate when an IMS failure or misalignment is detected. A common cause would be an error in the four-bit IMS input signal that is sent to the TCM. Allison DOC™ For PC–Service Tool will indicate an active inhibit.

- **IMS PS4 Disagree**

  Reverse-to-Drive, Drive-to-Reverse, Neutral-to-Drive, and Neutral-to-Reverse shifts will be inhibited to neutral and the range inhibit light will illuminate when the Pressure Switch 4 (PS4) status is in the incorrect state when compared to the IMS state. Allison DOC™ For PC–Service Tool will indicate an active inhibit. This inhibit may be caused by a defective IMS, PSM, or valve body concerns.

- **MSV Mis-Alignment/Unable to detect ratio after shift to range**

  If the range verification test fails to detect turbine speed pull-down or valid gear ratio when the Manual Selector Valve (MSV) shifts to either forward or reverse range from neutral, the transmission will shift back to a neutral condition and the range inhibit light will illuminate.

  Conditions that may cause this include: Attempts to shift the transmission from Neutral-to-Drive or Neutral-to-Reverse with the transfer case in neutral; transmission low on fluid; misadjustment in the IMS or Selector Linkage; turbine or output speed sensor failure that may prevent the pull down test/ratio test from passing; solenoid A or B hydraulically failures; and possibly failed range clutch (C1 or C5 for 1st, C3 or C5 for Reverse).

  Allison DOC™ For PC–Service Tool will indicate an active inhibit response.

- **Wheel Spin or Lock**

  When the TCM detects that wheel lock or spin is occurring, the TCC is disengaged and a lock-to-range response is commanded for 6 seconds. Allison DOC™ For PC–Service Tool will indicate an active inhibit response.

DEFINITIONS AND ABBREVIATIONS

2–4. ALLISON DOC™ FOR PC–SERVICE TOOL

Allison DOC™ For PC–Service Tool v5.0.0 (or later) is available through Kent-Moore Heavy-Duty Division. When installed on a Windows® PC, the Allison DOC™ For PC–Service Tool (refer to Figure 2–1) transmits and receives data to and from the TCM via the vehicle data communications link, processes the data, and displays appropriate information. Use Allison DOC™ For PC–Service Tool during installation checkout and troubleshooting.

For more details on Allison DOC™ For PC–Service Tool features, refer to the User Guide for Allison DOC™ For PC–Service Tool Version 5.0.0, GN3433EN.

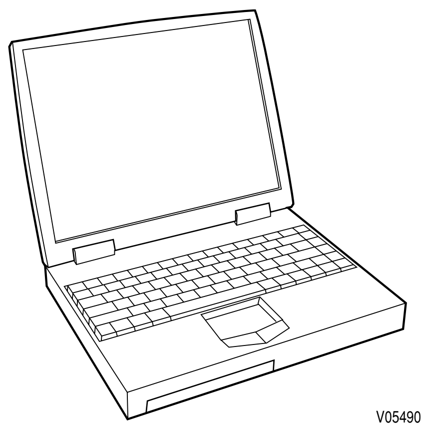


Figure 2–1. Allison DOC™ For PC–Service Tool

DEFINITIONS AND ABBREVIATIONS

2–5. ABBREVIATIONS

A/N	**A**ssembly **N**umber
ABS	**A**nti-lock **B**rake **S**ystem—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	**Amp**ere—Unit of electrical current
CAN	**C**ontroller **A**rea **N**etwork—A network for all SAE J1939 communications in a vehicle (engine, transmission, diagnostics, ABS, etc.)
CC	**C**alibration **C**ompatibility—First two digits of the CIN
CIN	**C**alibration **I**dentification **N**umber—Used to identify transmission controls software level
CMC	Customer Modifiable Constants
CT	**C**losed **T**hrottle
DNA	**D**oes **N**ot **A**dapt—Adaptive shift control is disabled.
DNS	**D**O **N**OT **S**HIFT—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.
DTC	**D**iagnostic **T**rouble **C**ode
DVOM	**D**igital **v**olt/**o**hm**m**eter
ECM	**E**ngine **C**ontroller **M**odule—Available on electronically-controlled engines—provides some relevant data to TCM.
EMI	**E**lectro**M**agnetic **I**nterference
GPI	**G**eneral **P**urpose **I**nput—Input signal to the TCM to request a special operating mode or condition.
GPO	**G**eneral **P**urpose **O**utput—Output signal from the TCM to control vehicle components (such as PTOs, backup lights, etc.) or allow a special operating mode or condition.
IMS	**I**nternal **M**ode **S**witch
IPC	**I**nstrument **P**anel **C**ontroller
J 1939	High-speed vehicle serial data communications standard.
LED	**L**ight-**E**mitting **D**iode—Electronic device used for illumination.
LRTP	**L**ow-**R**ange **T**orque **P**rotection—A feature limiting engine torque in lower ranges and reverse to protect the transmission from damage.
NVL	**N**eutral **V**ery **L**ow—The TCM has sensed turbine speed below 150 rpm. This is usually caused by a dragging C1 or C3 clutch or a failed turbine speed sensor. When attained, the C4 and C5 clutches are applied to lock the transmission output.
OBD II	**O**n **B**oard **D**iagnostics Second generation. EPA mandated specification for vehicle diagnostics.
OEM	**O**riginal **E**quipment **M**anufacturer—Maker of vehicle or equipment.
Ohm	Unit of electrical resistance.
PC	**P**ersonal **C**omputer
PCCS	**P**roduction **C**alibration **C**onfiguration **S**ystem

DEFINITIONS AND ABBREVIATIONS

2–5. ABBREVIATIONS *(cont'd)*

PCM	**P**owertrain **C**ontroller **M**odule—Electronic device used on some vehicles.
PCS	**P**ressure **C**ontrol **S**olenoid
PCV	**P**ressure **C**ontrol **V**alve
PDM	**P**arallel **D**ata **M**odule
PPC	**P**ressure **P**roportional to **C**urrent solenoid. Solenoid control of clutch pressure is proportional to the current being supplied to the solenoid.
PROM	**P**rogrammable **R**ead **O**nly **M**emory
PS	**P**ressure **S**witch
PSM	**P**ressure **S**witch **M**anifold—Part of transmission control system located inside the oil pan.
PTO	**P**ower **T**ake**o**ff
PWM	**P**ulse **W**idth **M**odulation
RFI	**R**adio **F**requency **I**nterference
RPR	**R**eturn to **P**revious **R**ange—Diagnostic response in which the transmission is commanded to return to previously commanded range.
SEM	**S**hift **E**nergy **M**anagement—Allows the TCM to request torque reduction from the ECM during upshifts for increased clutch life.
SOL OFF	All **SOL**enoids **OFF**
SS	**S**hift **S**olenoid
SV	**S**hift **V**alve
TBC	**T**ruck **B**ody **C**ontroller
TCC	**T**orque **C**onverter **C**lutch
TCM	**T**ransmission **C**ontrol **M**odule (also commonly referred to as the "computer")
TFT	**T**ransmission **F**luid **T**emperature—Data provided by thermistor that is part of the PSM.
TPS	**T**hrottle **P**osition **S**ensor—Potentiometer for signaling the position of the engine fuel control lever.
V	**V**ersion—Abbreviation used in describing TCM software levels.
VBS	**V**ariable **B**leed **S**olenoid—Another name for Pressure Proportional to Current (PPC) solenoid. Solenoid control of clutch pressure is proportional to the current being supplied to the solenoid.
VDC	**V**olts **D**irect **C**urrent (DC)
VIW	**V**ehicle **I**nterface **W**iring—Interfaces TCM programmed input and output functions with the vehicle wiring.
Volt	Unit of electrical force
VOM	**V**olt/**o**hm**m**eter
WOT	**W**ide **O**pen **T**hrottle
∞	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 1000 and 2000 Product Families Allison 4th Generation Controls, the technician must understand basic electrical concepts. Technicians need to know how to use a digital volt/ohmmeter (DVOM) to make resistance and continuity checks. Most troubleshooting checks consist of checking resistance and continuity, and checking for shorts between wires and to ground. 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—Main Pressure Check Procedure.

Input power, ground, neutral start circuitry, etc., can cause problems with electronic controls or vehicle functioning and may not generate a DTC. A working knowledge of 1000 and 2000 Product Families Allison 4th Generation Controls vehicle installation is necessary in troubleshooting installation-related problems.

Refer to Section 7 for information concerning performance complaints (non-DTC) troubleshooting. A complete wiring schematic is shown in Appendix J. Refer to the 1000 and 2000 Product Family Tech Data for information concerning electronic controls installation and the Installation Checklist. Reliable transmission operation and performance depend upon a correctly installed transmission. For proper installation, review the Installation Checklist in the 1000 and 2000 Product Family Tech Data, available on the extranet under Engineering at ***www.allisontransmission.com***.

3–2. USING THE TROUBLESHOOTING MANUAL

Use this manual as an aid to troubleshooting the 1000 and 2000 Product Families 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 ensure 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.

3–3. SYSTEM OVERVIEW

1000 and 2000 Product Families Allison 4th Generation Control functions are controlled by the TCM. The TCM reads shift selector range selection, output speed, and throttle position to determine when to command a shift. When a shift occurs, the TCM monitors turbine speed, output speed, and throttle position to control the oncoming and off-going clutches during the shift.

When the TCM detects an electrical fault, it logs a DTC 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 DTC. Once that shift has been retried, and a fault is still detected, the TCM sets a DTC and holds the transmission in a fail-to-range mode of operation.

BASIC KNOWLEDGE

The 1000 and 2000 Product Families transmission utilizes "**clutch to clutch**" shift control to achieve range changes. In every case (except shifts to or from neutral), one clutch is exhausted and another applied to make a range shift. The "handoff" between exhausting and applying clutches is very precisely controlled by use of two Variable-Bleed Solenoids (VBS), commonly known as Pressure Proportional to Current (PPC) solenoids. These solenoids are labelled PCS1 and PCS2 in the transmission, and are referred to as "pressure control" solenoids. For example, to make a 1–2 shift, PCS1 is used to trim pressure off C5 clutch, and PCS2 is used to trim pressure on C4 clutch.

The **TCM** (transmission control module) modulates the current to both PCS1 and PCS2, which translates to a proportional level of pressure to the clutch. In order to make a shift, the TCM uses software and calibration settings of several program parameters to determine the level of current sent to the respective pressure control solenoids. These parameters are referred to as "**adaptive values.**" With a new transmission and TCM calibration, the adaptive values are set to "**base calibration**" level. The transmission uses the base calibration to perform the first of each type of shift. However, once it has performed a shift, the TCM evaluates the actual shift and compares it to an "**ideal**" shift in the TCM's memory. Based on that comparison, the TCM changes the settings of the adaptive values to a level that it believes will result in a shift closer to the "ideal" shift the next time it makes that type of shift. This is referred to as "**adaptive shifting.**"

When the transmission/TCM calibration is new, the TCM is in "**fast adaptive**" mode. In other words, the TCM is allowed to make relatively large changes in the adaptive values after each shift. Once the TCM determines that a given shift is close to its ideal level it switches to "**slow adaptive**" mode. In slow adaptive the TCM still is evaluating shifts and changing adaptive values, but is only allowed to do so in smaller increments.

The TCM is programmed to try to switch from fast to slow adaptive mode within approximately five shifts. It is important to understand that there are many different distinct shifts recognized by the TCM, and each of these shifts has its own adaptive values. For example, there are upshift and downshifts to and from each range, as well as unique adaptive values for several different throttle regions for each upshift and downshift. The point is, it may take a significant amount of time before most of the shifts converge from fast to slow adaptive, and **thus it is not unusual to experience somewhat harsh or unpleasant shift quality until these shifts are adapted**.

TCC engagement is accomplished by a separate PPC (pressure proportional to current) TCC solenoid. There are adaptive values for this as well, and thus it will also require some driving for TCC engagement to adapt.

3–4. IMPORTANT INFORMATION IN THE TROUBLESHOOTING PROCESS

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

- Allison recommended wire numbers (i.e. 112) are a combination of the first digit indicating the TCM 80-way connector number and the last two digits indicating the pin-out information (i.e. 12).
- 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 that pulling force is applied to the connector itself and **not the wires** extending from the connector.
- Resistance checks involving the wiring between the TCM connectors and other components adds about one Ohm of resistance to the component resistance shown.

BASIC KNOWLEDGE

- Inspect all connector terminals for damage. Terminals may have 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®.

CAUTION:	**The cleaning solvent must not be chlorine based, contain petroleum distillates, or 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 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.**

- DTCs displayed after system power is turned on while a harness connector is disconnected can be ignored and cleared from memory. Refer to Section 5, DTCs, for the DTC clearing procedure.

3–5. BASIC TROUBLESHOOTING INFORMATION

1. Begin troubleshooting by checking the transmission fluid level and ignition voltage. Remember that some problems may be temperature related. Do troubleshooting, including the fluid level and ignition voltage checks, at the temperature level where the problem occurs.

NOTE: ***Fluid level and igniton voltage MUST be checked before any troubleshooting is performed.***

NOTE: ***If you are experiencing harsh shifts, it is important to use Allison DOC™ For PC–Service Tool to verify whether that particular shift is adapted. If it is not, the TCM is still "learning" how to adapt that shift and simply needs to be driven further while performing more of that particular type of shift.***

If a particular shift is in slow adapt but still objectionable, it's good troubleshooting practice to reset the adaptive values for that shift back to "base cal" level. This will automatically reset the TCM to fast adaptive mode. The vehicle should then be driven to allow the TCM to "re-learn" the shift. Many times this will correct the problem. It is possible to reset individual shifts without affecting the other shifts.

CAUTION:	**Whenever a transmission is overhauled, exchanged, or has undergone repairs, the Transmission Control Module (TCM) must be "RESET TO UNADAPTED SHIFTS." This will cause the TCM to erase previous adaptive information and begin to adapt in Fast Adaptive Mode from the base calibration. Failure to follow this procedure may cause premature failure of the overhauled, repaired, or replaced transmission.**

BASIC KNOWLEDGE

2. If a transmission has been overhauled, exchanged, or repaired, use Allison DOC™ For PC–Service Tool to "RESET ADAPTIVE SHIFT PARAMETERS."

   To reset Adaptive Shift Parameters:

   - Select the Action Request drop-down menu.
   - Click on the Reset Adaptive Shift Parameters menu item—the Reset Adaptive Parameters window displays.
   - The Reset Adaptive Shift Parameters window contains 10 tabs; one for each upshift and downshift region, garage shifts and a reset tab for All regions.
     - To reset all adaptive shift parameters, select the ALL tab.
     - The adaptive shift parameters are reset when you click on the RESET ADAPTIVE SHIFT PARAMETERS button—the Reset Adaptive Shift Parameters Successful window displays. Click the OK button.

3. For proper operation of Allison DOC™ For PC–Service Tool v5.0.0 or later, check the following:

   - The desktop or laptop computer must meet the minimum system requirements (see Allison DOC™ For PC–Service Tool Version 5.0.0 User Guide, GN3433EN):
     - Microsoft Windows® 2000 Professional (SP4 or later) or Windows® XP Professional
     - 600 MB free hard drive space
     - 20 GB hard drive (40 GB preferred)
     - 128 MB of RAM (256 MB preferred)
     - Intel® Pentium® III or IV processor
     - Available USB 1.1 or 2.0 port
     - 1024 x 768 screen resolution
     - 256-color palette
     - Small fonts
     - Internet connection (Internet Explorer 5.0 or greater)
     - A media player program (Windows Media Player® is provided on the Allison DOC™ For PC–Service Tool For PC CD)
     - Adobe® Acrobat® Reader® (provided on the Allison DOC™ For PC–Service Tool CD)
     - CD-ROM 16x minimum (48x preferred)

NOTE: Refer to the CD Readme.txt file for more information.

   - The proper driver (electronic file) is installed for the Computer Interface Module.
   - Power at the Deutsch 9-pin diagnostic connector (pin A is negative, pin B is positive).
   - The proper connections exist for communicating with Allison DOC™ For PC–Service Tool (Figure 3–1 and Figure 3–2).

     Presently there are two communication standards for Allison DOC™ For PC–Service Tool diagnostic software: J1939 and GMLAN J2284. Both standards are supported by Allison DOC™ For PC–Service Tool (versions 5.0).

BASIC KNOWLEDGE

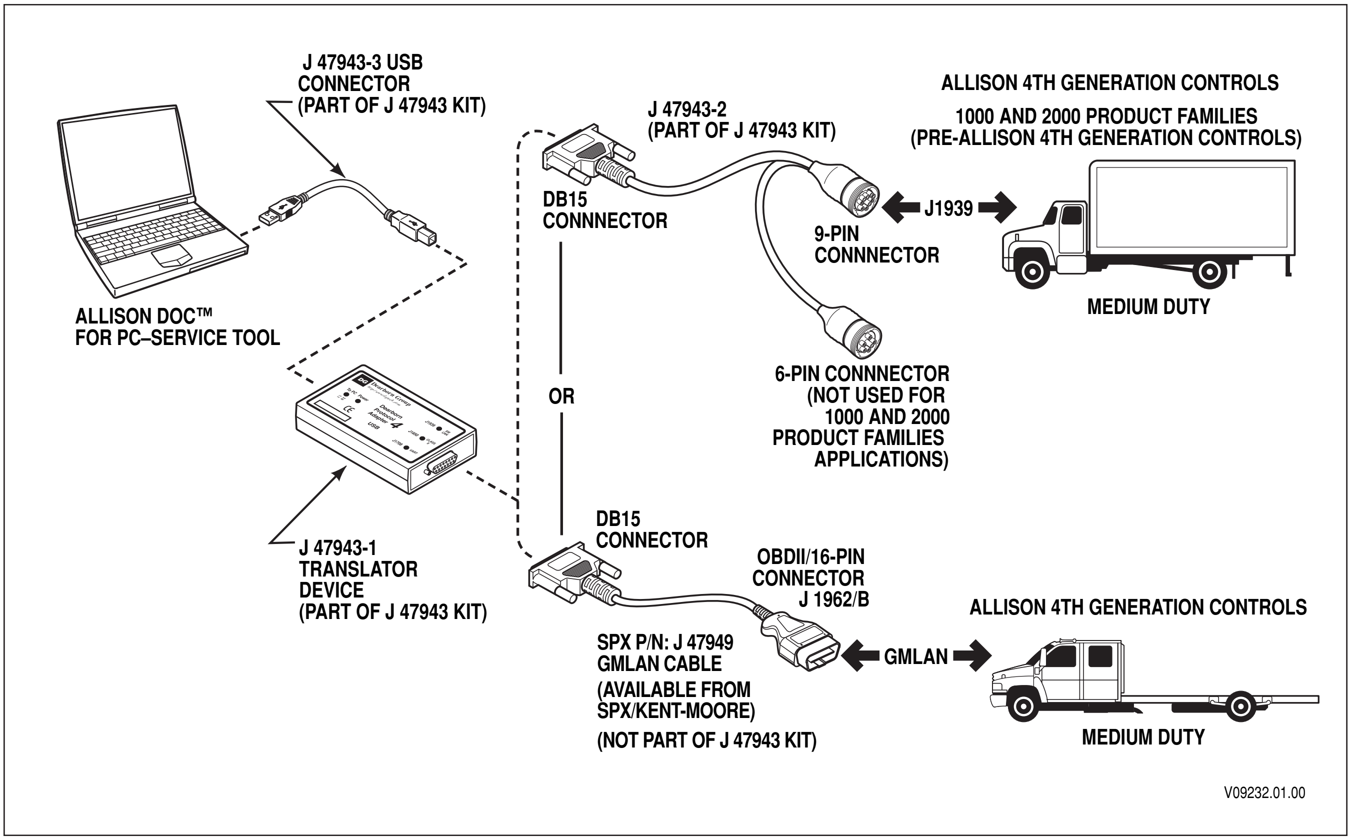


Figure 3–1. Proper Allison DOC™ For PC–Service Tool Connections

4. Check DTCs by using Allison DOC™ For PC–Service Tool.

TCM/Load Box Setup

For “TCM/Load Box” setup (no connection to vehicle) use the J 47276 “T” Breakout and TCM Reflashing Harness. This harness is required for bench-type reflashing of Allison 4th Generation Controls TCMs. Use one of the following methods for TCM reflashing (Figure 3–2).

- J1939-13 connector (for J1939 communication) in combination with J 42455-A Load Box/Power Supply
- J1962 connector (for GMLAN “high-speed CAN” communications) in combination with J 42455-A Load Box/TCM

The Dearborn DPA4 USB Translator Device Kit (P/N: J 47943) is required to establish connection between the PC and the TCM.

NOTE: ***To use the J1962 connector, an additional cable (J 47949) is required. J 47949 is available for purchase from SPX/Kent-Moore.***

BASIC KNOWLEDGE

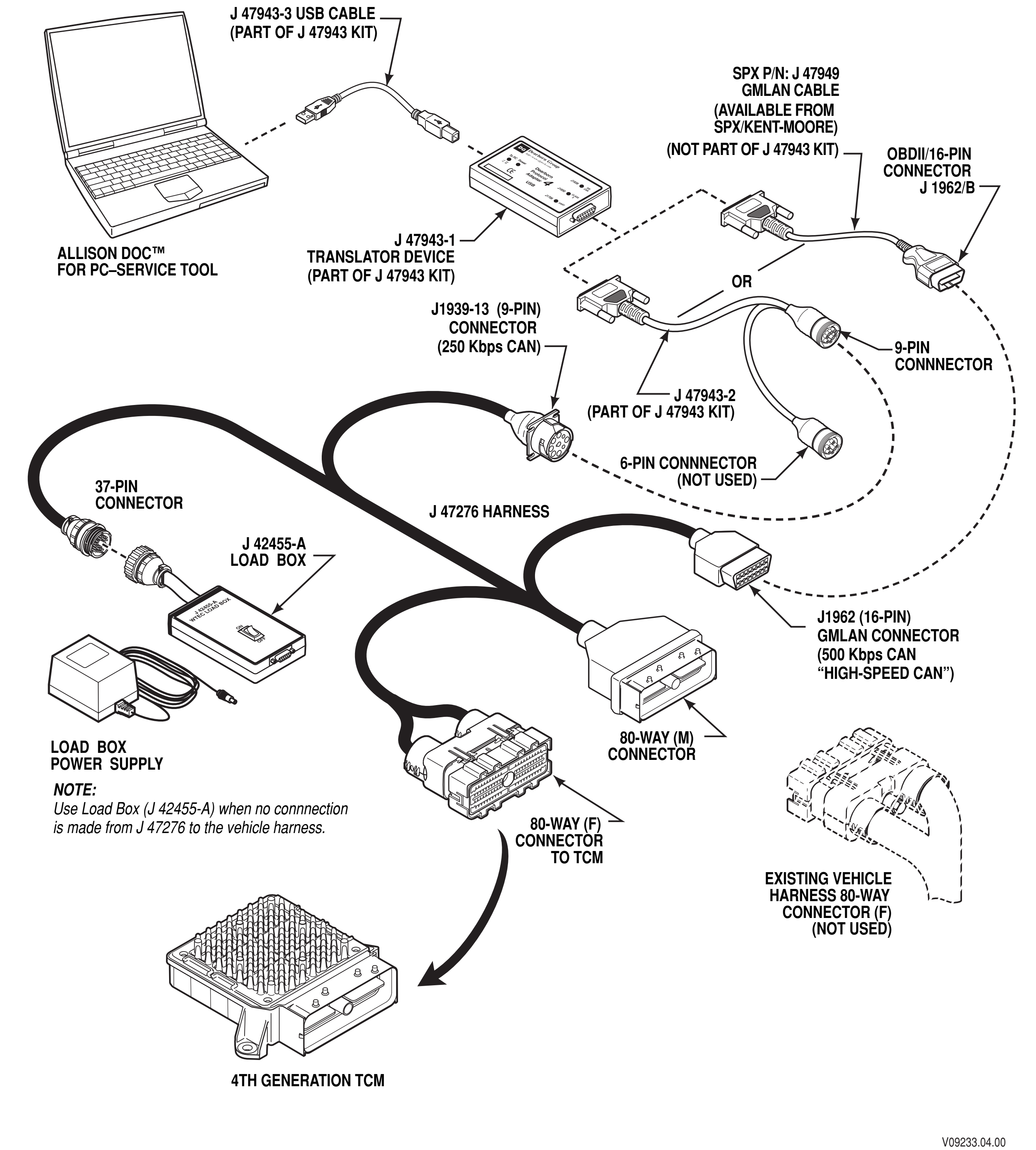


Figure 3–2. TCM/Load Box Setup

BASIC KNOWLEDGE

TCM/Vehicle Harness Setup

On the vehicle, use the J 47276 "T" Breakout and TCM Reflashing Harness to connect the Allison DOC™ For PC–Service Tool directly to the TCM to bypass the Diagnostic Tool Connector.

Use the Dearborn DPA4 USB Translator Device Kit (P/N: J 47943) to establish connection between the PC and the TCM.

Example: When communications are not available at the Diagnostic Tool Connector on the vehicle, DTCs can be read directly from the TCM using the Diagnostic Tool Connectors on the J 47276 "T" Breakout and TCM Reflashing Harness.

Use one of the following Diagnostic Tool Connectors on the harness to establish a diagnostic connection between the TCM and the Service Tool (refer to Figure 3–3):

- J1939-13 connector (for J1939 communication)
- J1962 connector (for GMLAN "high-speed CAN" communications)

NOTE: ***To use the J1962 connector, an additional cable (J 47949) is required. J 47949 is available for purchase from SPX/Kent-Moore.***

5. When a problem exists but a DTC is not indicated, refer to the General Troubleshooting Section (Section 7) for a listing of various electrical and hydraulic problems, their causes, and remedies.
6. If a DTC is found in the TCM memory, save all available DTC and failure record information before clearing the active indicator (refer to Section 5).
7. When certain DTCs are active, a range selection into reverse or forward may not be possible. To determine if a failure is electrical or hydraulic, perform the following "limp home" test.

WARNING!	**Never remove electronic control connectors while the engine is running. Always turn off the ignition, set parking brakes and chock the wheels. Failure to follow this procedure may result in unexpected vehicle movement.**

Limp Home Test

With the ignition in the **OFF** position (engine not running), the selector in **N** (Neutral), and the parking brake set, remove the 80-way connector at the TCM.

It will be necessary to provide battery power at pin 41 of the 80-way connector in order to energize the neutral start relay. This can be accomplished by using a jumper wire between pin 10 and 41 at the 80-way connector.

When the engine is restarted, the transmission will default to a "limp home" capability. In this state, PCS1 (de-energized) allows C3 clutch to be applied. If the selector valve is moved to the reverse range position, main pressure will be routed to C5 clutch, allowing reverse operation. If the selector valve is moved to the drive range position, main pressure will be routed to C1 clutch, allowing third range operation. This allows a technician to use "limp home" capability to determine if a hydraulic or an electrical problem exists. If reverse and third ranges are available in "limp home," an electrical failure may be indicated. If only one of the two ranges or neither was obtainable, this may indicate an internal hydraulic failure (failed clutch, stuck valve, or solenoid failure). The clutches that could possibly have an indicated failure in "limp home" are C1, C3, and C5.

BASIC KNOWLEDGE

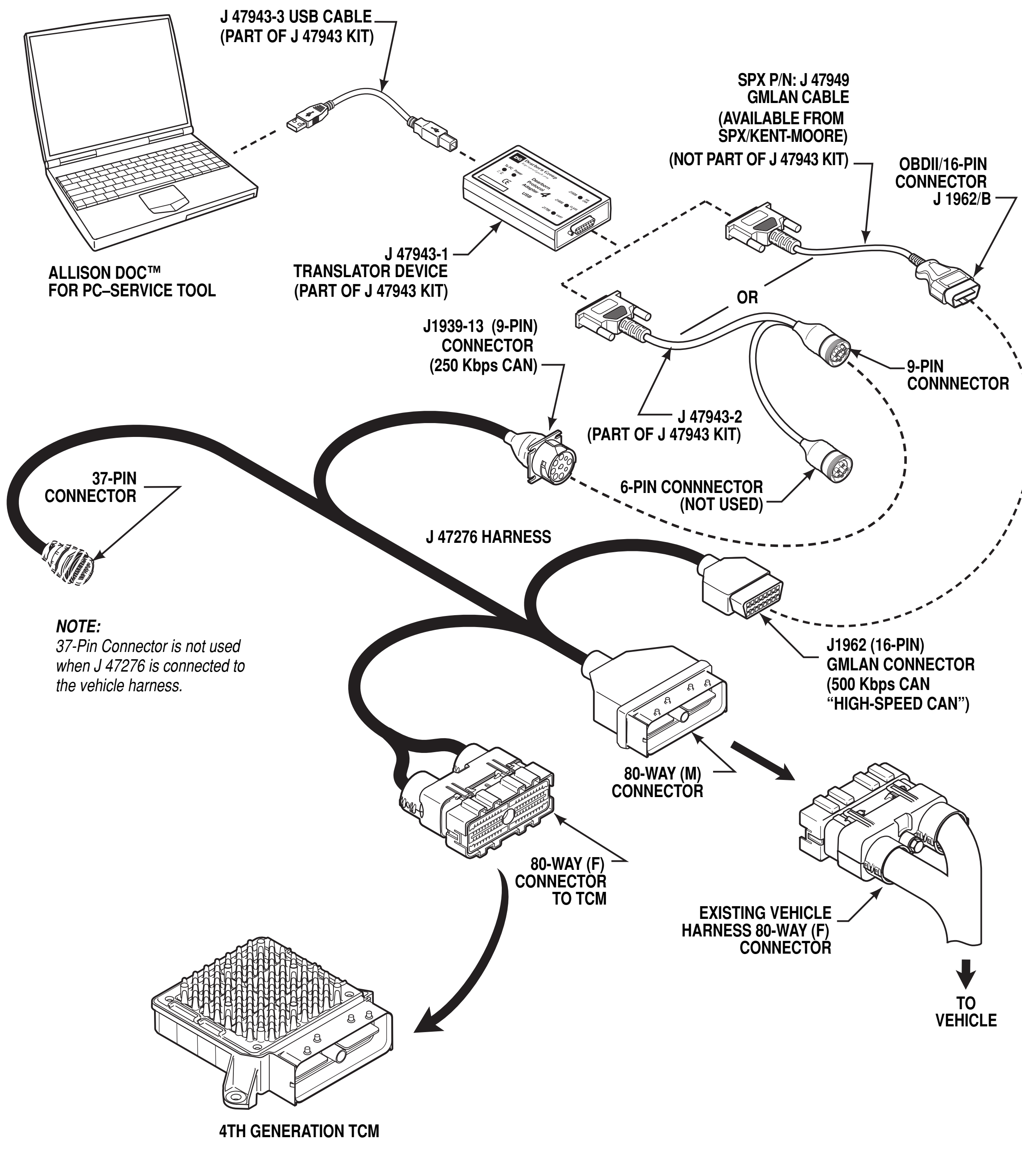


Figure 3–3. TCM/Vehicle Harness Setup

BASIC KNOWLEDGE

NOTE: ***Removing the 80-way connector may induce several DTCs. Make sure all codes are cleared before proceeding with further troubleshooting.***

8. Test drive the vehicle to confirm a DTC or performance complaint.
   - If the DTC reappears, refer to the DTC section (refer to Section 5) and the appropriate DTC table. The DTC section lists diagnostic codes and their description. Locate the appropriate troubleshooting table and follow the instructions.
   - If the DTC does not reappear and the test has passed, it may be an intermittent problem. Use Allison DOC™ For PC–Service Tool and the DTC (refer to Section 5). The DTC display procedure will identify possible causes of the problem.
   - Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.

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

- Using Allison DOC™ For PC–Service Tool, 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 80-way connector for damaged or bent pins.
- Replace TCM with a new or known good TCM from a similar vehicle.
- If the replacement TCM corrects the original complaint, reinstall the original TCM to verify the complaint returns. If original complaint is confirmed, reinstall a new TCM.
- If the complaint does not return, leave the original TCM installed.
- Clear any DTCs that may be present and test drive the vehicle to confirm the repair.

NOTE: ***All 1000 and 2000 Product Families TCMs are designed to be isolated from the vehicle chassis ground. Be sure that the TCM case is not contacting the vehicle frame or any other point that might provide a ground connection.***

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 engine 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 engine 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 engines 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 SEM AUTOSELECT

Verify a new engine rating by checking the engine data tag. The engine must be compatible with the transmission rating. If the 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.

- Click on the action requested button.
- On the drop down select Reset SEM Autoselect.

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 shifts to adapt.

SECTION 4—WIRE CHECK PROCEDURES

4–1. CHECKING OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND

(Use Digital Volt/Ohmmeter J 34520-A and Jumper Wire Set J 39197-A)

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

1. Make sure all connectors are tightly connected and re-check the circuit.
2. Disconnect and inspect all connectors.
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, or 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 for detailed information on the recommended cleaners.)**

4. Review the wire numbering system described in Paragraph 3–4.
5. If all connectors are clean and properly seated, determine which wires in the chassis harness are indicated by the DTC. For example, DTC P2727–P2729, indicates an open or a short-to-ground in the PCS1 circuit—wires 111 and 155.

   a. Check continuity of wires 111 and 155 by performing the following (refer to 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-A and the body connector probes in J 39775-CP, connect pin 14 and 15 to each other, being careful not to distort the terminals. Jumping the wires together creates a circuit between wires 111 and 155.

NOTE: Jumper wire kit J 39197-A adds a "female" probe J 47277.

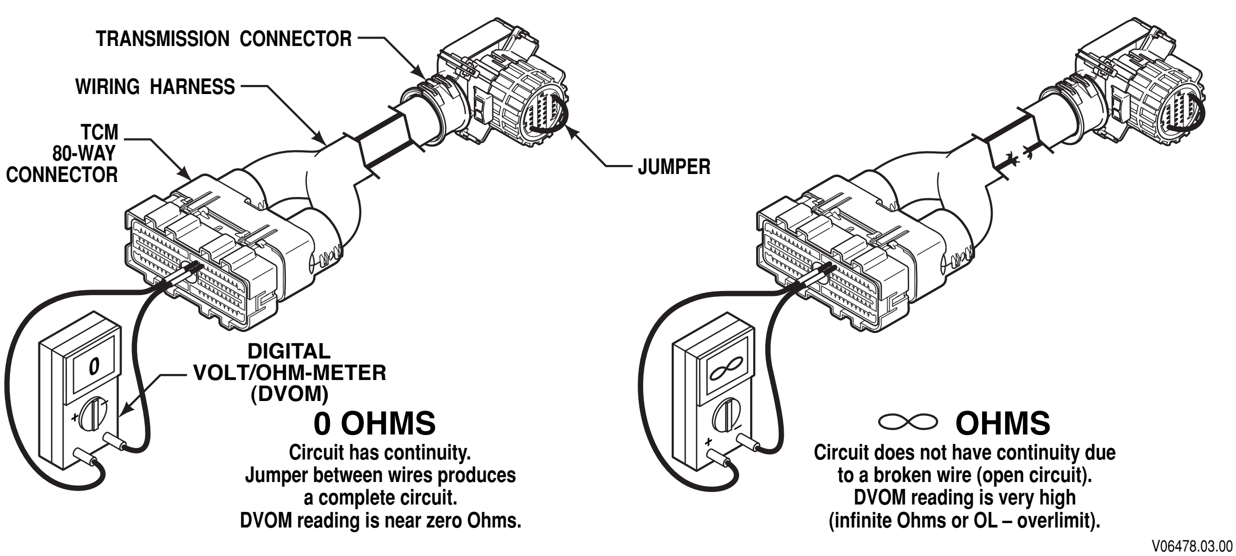


Figure 4–1. Checking Continuity (External Harness)

WIRE CHECK PROCEDURES

CAUTION:	**Do not insert test probes larger than 0.81 mm into the TCM 80-way and transmission 24-way connectors. Use the gray-colored 150 Series Metripack Flexible Male Connector probe contained in Jumper Wire Kit J 39197-A 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.**

(2) On the opposite end of the harness, check the continuity of the jumpered pair. No continuity in a jumpered pair circuit (infinite resistance reading) indicates an open in the wire being tested. Refer to OEM wiring harness repair procedure.

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

(1) At the TCM end of the harness, touch one DVOM probe 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.

(2) 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.

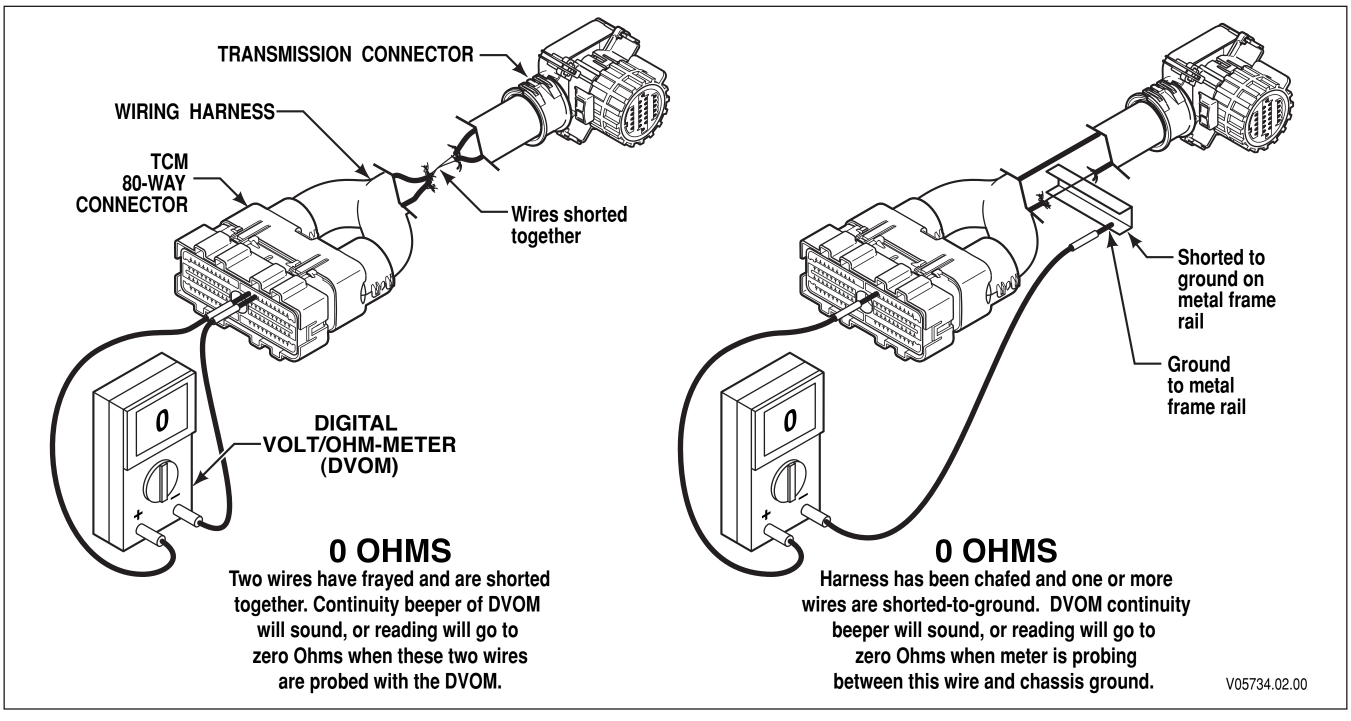


Figure 4–2. Short Between Wires and to Ground (External Harness)

WIRE CHECK PROCEDURES

4–2. CHECKING AT TRANSMISSION CONNECTOR AND THE INTERNAL HARNESS FOR 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, or 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 SIL17-TR-94 for detailed information on the recommended cleaners.)**

3. If the connectors are clean and properly seated, determine which wires in the harness to test. Use the diagnostic code system schematic to locate the wire terminals. For this example, DTC P2727 and P2729 indicate an open or a short-to-ground in the PCS1 circuit—wires 111 and 155 (refer to Figure 4–3 and Figure 4–4).

    a. At the transmission connector, check the resistance of the PCS1 circuit. Resistance of a solenoid circuit should be 5.5–8 Ohms—covering a temperature range of –18°C to 149°C (0°F to 300°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. Replace the internal harness, replace the feedthrough connector, or replace the solenoid.

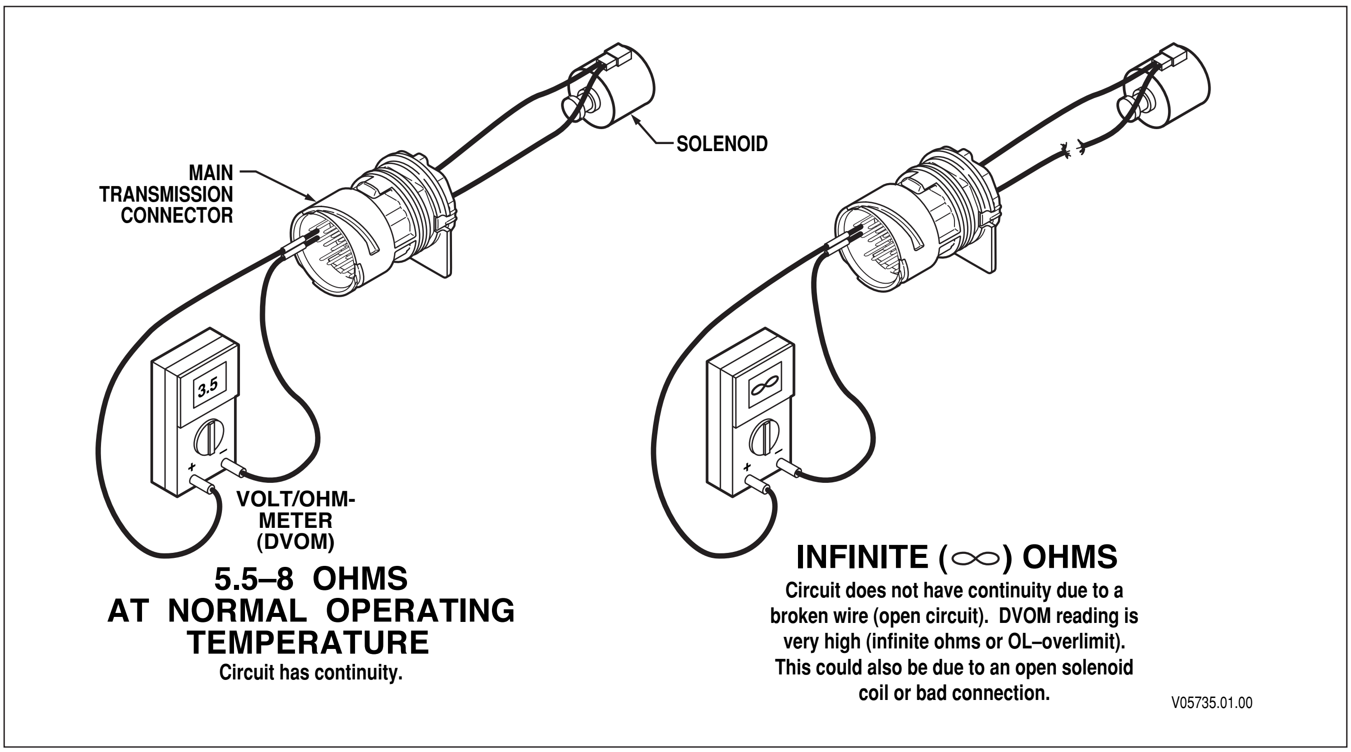


Figure 4–3. Checking Continuity (Internal Harness)

WIRE CHECK PROCEDURES

b. If the resistance check is good, check the harness for shorts between wires and to ground by performing the following (refer to 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. Check the wiring diagram in Appendix J for splice locations. If the short is not a splice, then isolate and repair the short.

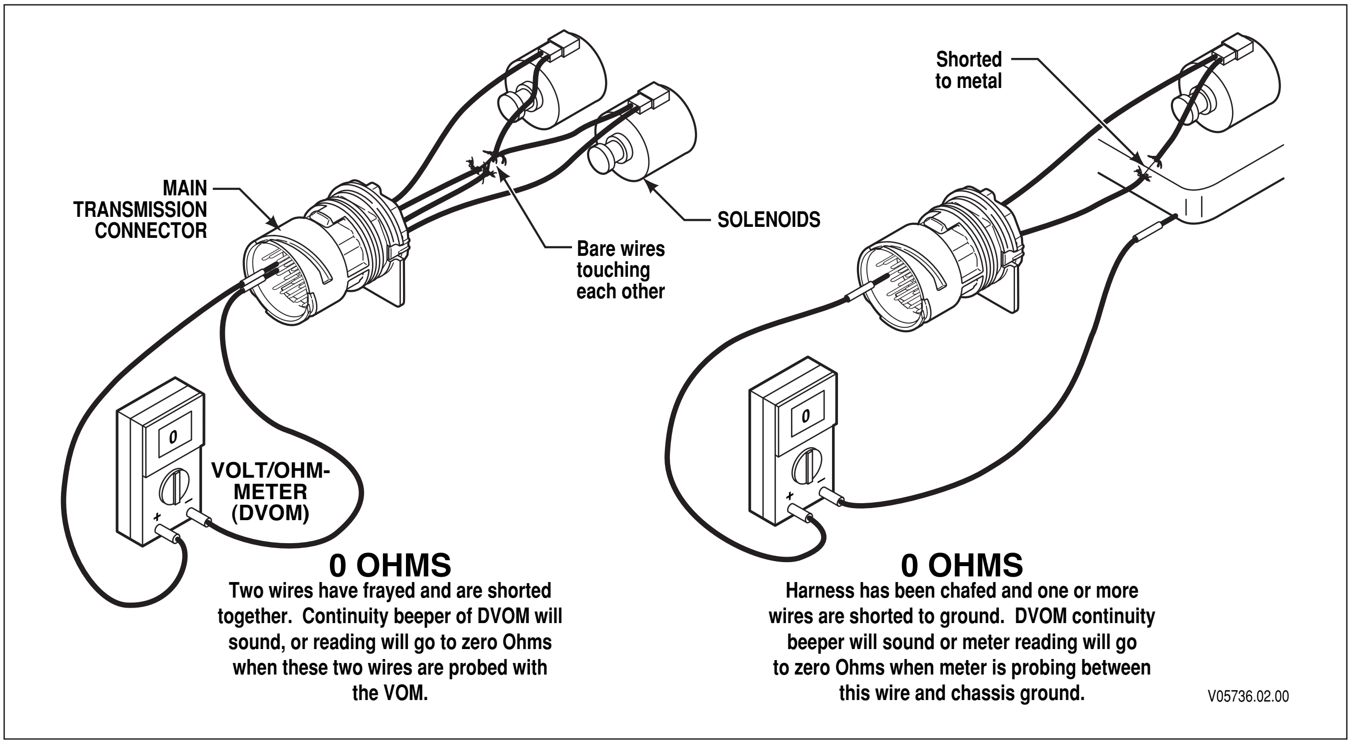


Figure 4–4. Short Between Wires and to Ground (Internal Harness)

SECTION 5—DIAGNOSTIC TROUBLE CODES (DTC)

5–1. DTC MEMORY

Diagnostic Trouble Codes (DTCs) are logged in a list in TCM memory. The DTCs contained in the list have information recorded as shown in Table 5–1 (DTC example). The TCM is capable of displaying all historical and active DTCs.

Table 5–1. DTC List

DTC	Active Indicator	Historic	Check Trans	Failure Record	Description
P0713	Y	Y	N	Y	Transmission Fluid Temperature Sensor Circuit High Input

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

A. **DTC.** The number assigned to a given fault condition in accordance with SAE J2012.

B. **Active Indicator.** Indicates when a DTC is active. If a DTC is active, Allison DOC™ For PC–Service Tool displays **Y**. If DTC is not active, **N** is displayed.

C. **Historic.** Indicates when an active DTC has had sufficient activity to be stored to the TCM. If a DTC has been stored to the TCM, Allison DOC™ For PC–Service Tool displays **Y**. If the DTC has not been stored to the TCM, **N** is displayed.

D. **Check Trans.** Indicates if **CHECK TRANS** Light is illuminated.

E. **Failure Record.** Indicates when a snapshot of transmission data has been stored in the TCM. The last five DTC failure can be viewed. If the DTC can be viewed as part of the failure record, Allison DOC™ For PC–Service Tool displays **Y**. If the DTC cannot be displayed, **N** is displayed.

F. **Description.** Name assigned to a given fault condition in accordance with SAE J2012.

5–2. FAILURE RECORDS

Failure records contain a snapshot of transmission data that is stored in the TCM when DTCs are logged. A limit of five failure records can be stored. When an additional DTC is logged, the new failure record pushes the oldest record from the TCM memory. Table 5–2 illustrates the failure record data stored in the TCM when a DTC is set.

DIAGNOSTIC TROUBLE CODES (DTC)

Table 5–2. Failure Record Data

Data Description
Freeze Frame Diagnostic Trouble Code
Distance at First Failure
Distance at Last Failure
Failure Record Fail Ignition Cycle Counter
Failure Record Pass Ignition Cycle Counter
Failure Record Not Run Ignition Cycle Counter
Gear Selected
Gear Commanded
Current Gear
Previous Gear
TCM Battery Voltage
Trans Fluid Temperature (TFT)
Trans Input Shaft Speed
Trans Output Shaft Speed
Turbine Speed
Diagnostic Transmission Gear Ratio
Accelerator Effective Position
Main Mod Solenoid Commanded Pressure
PCS2 Commanded Pressure
PCS1 Commanded Pressure
TCC Pressure Control Solenoid Command Pressure
Transmission Fluid Pressure Switch Status
Shift Solenoid Status
TCM Substrate Temperature
Drive Demanded Engine Torque
Engine Torque
Requested Torque
Normal Shift Pattern
Cold Shift Pattern
Hot Mode (Transmission)
Trailering/Hauling Shift Pattern
Engine in Default Mode Shift Pattern
Main Modulation Solenoid Fail Shift Pattern
Main Modulation Available
Engine Run Time
Driver Select Tap Up/Down Input
AC Enabled
Cruise Enabled
IMS A
IMS B
IMS C
IMS P
Number of Current Malfunctions
Transmission Input State #1
Transmission Input State #2
TCM Non-Volatile Inhibit Record

DIAGNOSTIC TROUBLE CODES (DTC)

5–3. DTC READING AND DTC CLEARING

DTCs can be read and cleared by using Allison DOC™ For PC–Service Tool. The use of Allison DOC™ For PC–Service Tool is described in the instruction manual furnished with each tool.

A. Clearing DTCs

- DTCs will automatically clear after 40 code-free warm-up cycles.
- DTCs can be manually cleared by the Allison DOC™ For PC–Service Tool.

B. Clearing Active Indicators

- A DTC's active indicator can be cleared, which removes the DTC's shift inhibitions while the DTC remains in the queue as inactive.
- The active indicator clearing method is to power down (all active indicators are cleared at TCM power down).

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. N (Neutral) must be manually selected.**

5–4. BEGINNING THE TROUBLESHOOTING PROCESS

A. Starting Procedure

NOTE: Review Paragraph 3–5, "Basic Troubleshooting Information" and check fluid level and ignition voltage before any troubleshooting is performed.

1. Begin troubleshooting by reading Paragraph 3–5, checking the transmission fluid level, and checking the TCM input voltage. Check for DTCs by using Allison DOC™ For PC–Service Tool.

2. When a problem exists, but a DTC is not indicated, refer to Section 7—General Troubleshooting Performance Complaint for a listing of various electrical and hydraulic problems, their causes, and remedies.

3. If a DTC is found in the TCM memory, record all available DTC information and failure record data before clearing the DTC (refer to Paragraph 5–3).

4. Test drive the vehicle to confirm a DTC or performance complaint.
   - If the DTC reappears, refer to the DTC paragraph (Paragraph 5–5) and the appropriate DTC table. The DTC section lists DTCs and their description. Locate the appropriate troubleshooting table and follow the instructions.
   - If the DTC does not reappear, it may be an intermittent problem. Use the Allison DOC™ For PC–Service Tool and the DTC display procedure described in Section 5. Refer to the troubleshooting table for possible causes of the problem.
   - Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.

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.

DIAGNOSTIC TROUBLE CODES (DTC)

B. Solenoid Locations

Solenoid locations in the control module are as illustrated in Figure 5–1. Refer to Figure 5–1 as necessary when using the DTC schematics.

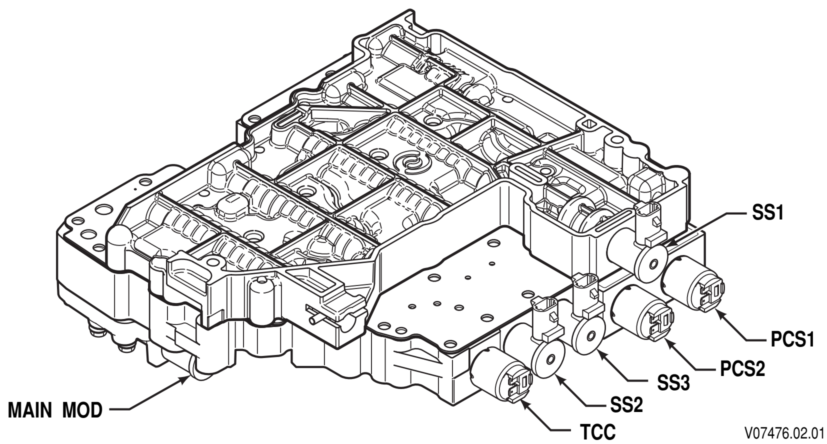


Figure 5–1. Solenoid Locations

C. Wire/Terminal Numbering Scheme

Allison Transmission recommended wire numbers (i.e. 112) consist of three digits, where the first digit indicates the TCM 80-way connector number, and the last two digits indicate the pin-out information (i.e. 12).

D. Available Diagnostic Adapters

Figures 5–2 and 5–3 show the J 47275 TCM Breakout Harness Adapter and J 47278 Transmission Breakout Harness that are available for use with the J 39700 Breakout Box. Figure 5–4 shows the J 47276 "T" Breakout and TCM Reflashing Harness.

DIAGNOSTIC TROUBLE CODES (DTC)

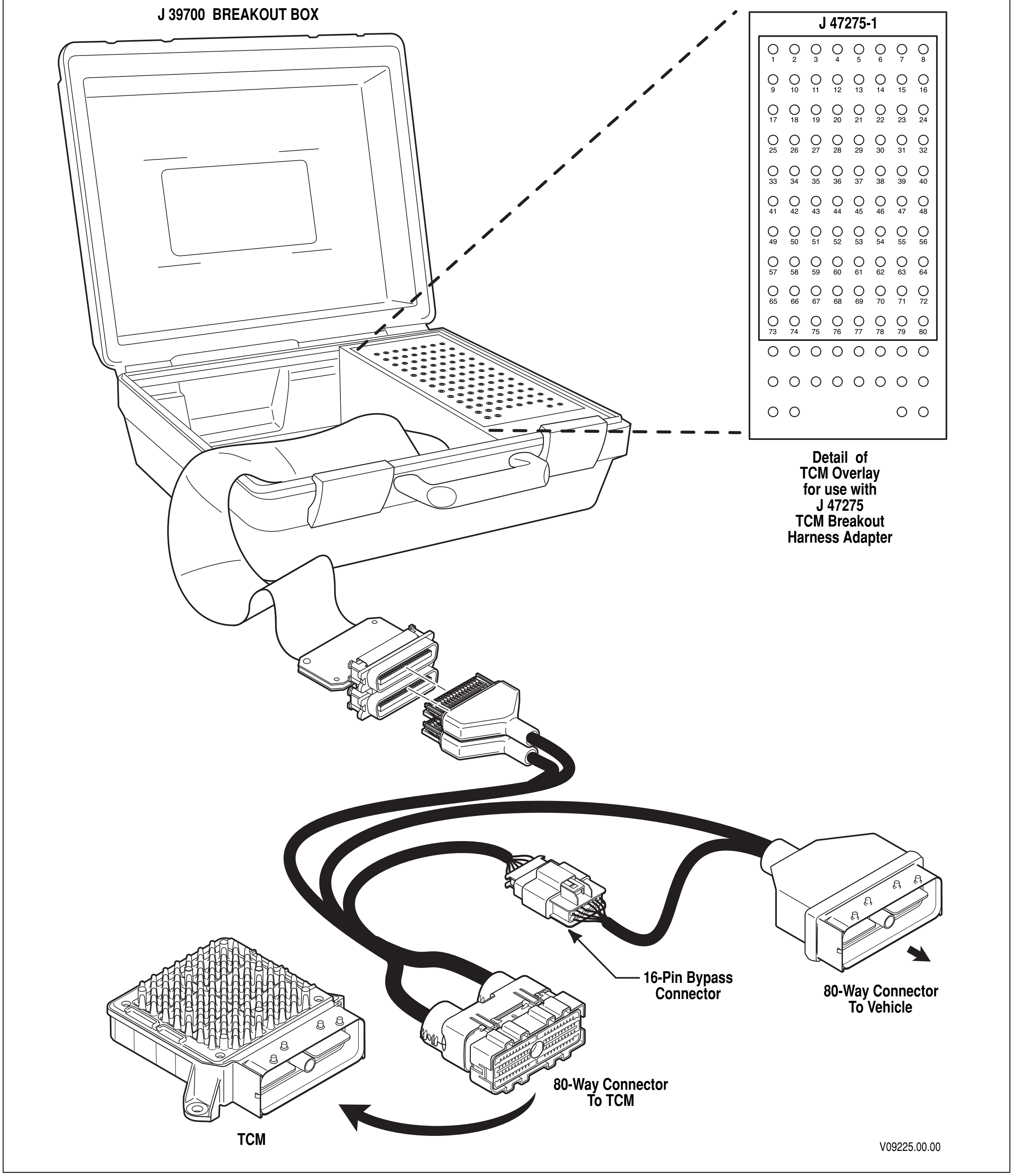


Figure 5–2. J 39700 Breakout Box and J 47275 TCM Breakout Harness Adapter

DIAGNOSTIC TROUBLE CODES (DTC)

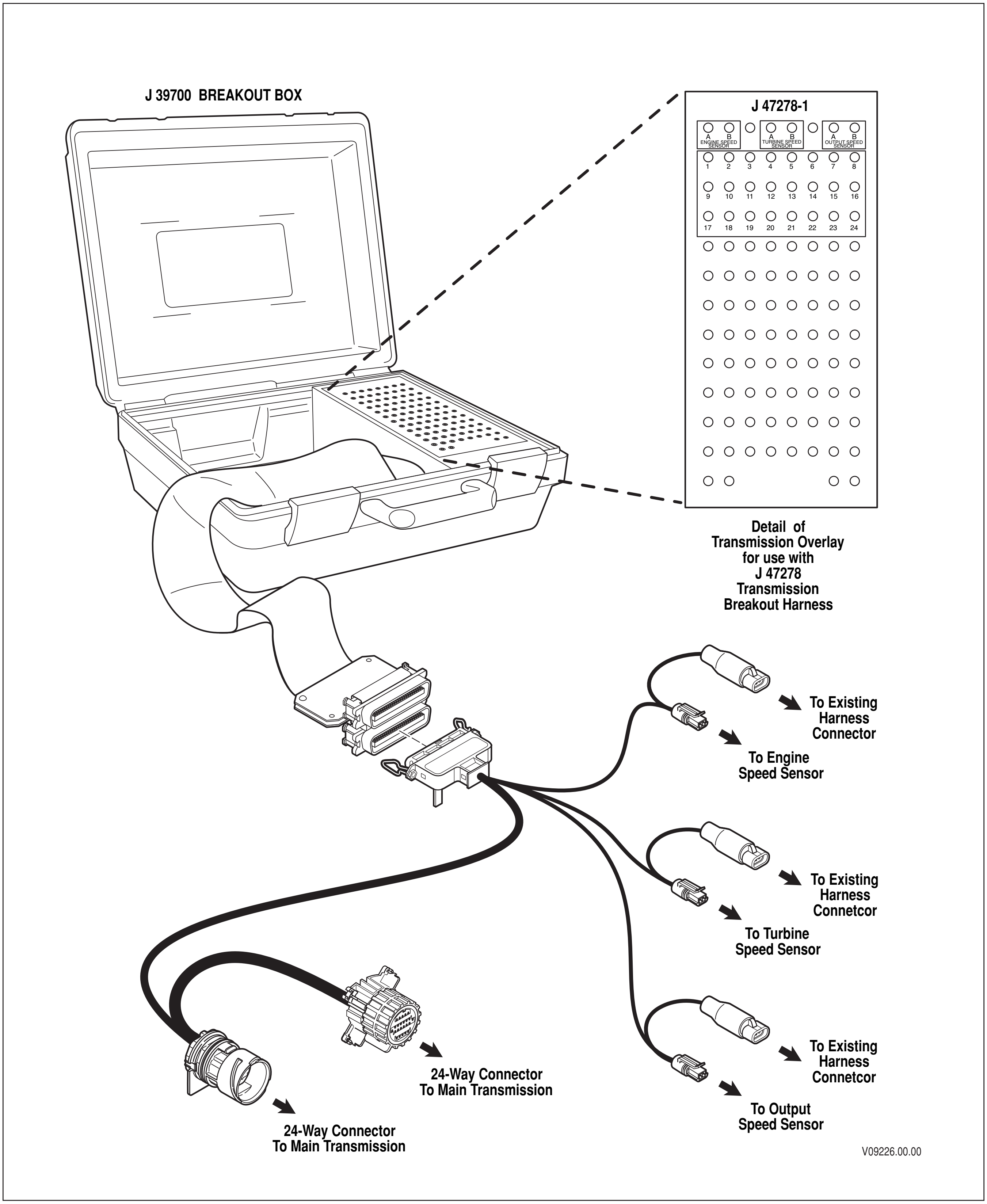


Figure 5–3. J 39700 Breakout Box and J 47278 Transmission Breakout Harness

DIAGNOSTIC TROUBLE CODES (DTC)

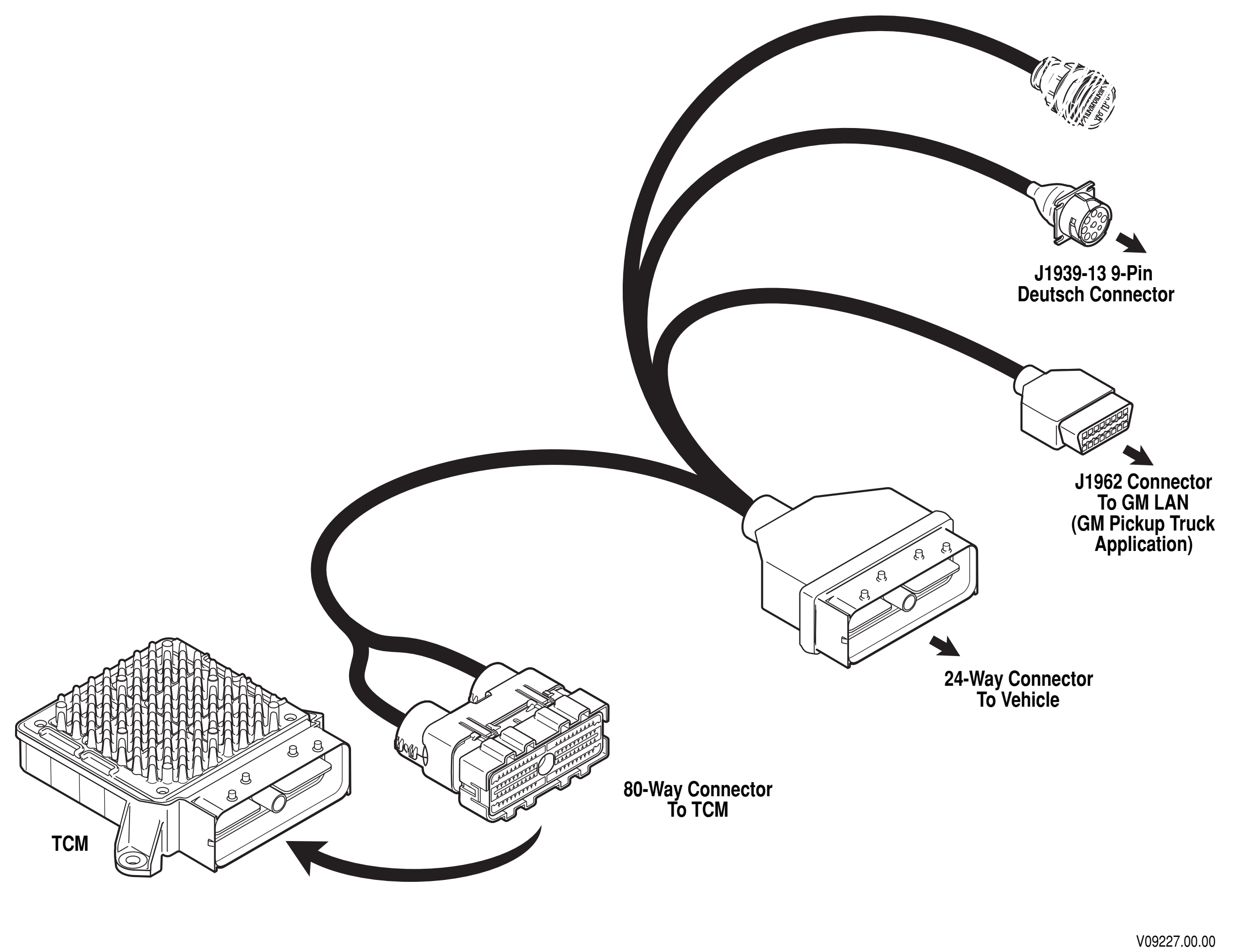


Figure 5–4. J 47276 "T" Breakout and TCM Reflashing Harness

DIAGNOSTIC TROUBLE CODES (DTC)

NOTES

TRANSMISSION COMPONENT WIRING DIAGRAMS AND DIAGNOSTICS

DIAGNOSTIC TROUBLE CODES (DTC)

5–5. DIAGNOSTIC TROUBLE CODES (DTCs)

Table 5–3. DTC LIST AND DESCRIPTION INDEX

DTC	Description	MIL (ODB II Strategy)	CHECK TRANS Light (Non-ODB II Strategy)	Page
P0122	Pedal Position Sensor Circuit—Low Voltage	—	On	5–19
P0123	Pedal Position Sensor Circuit—High Voltage	—	On	5–23
P0218	Transmission Fluid Overtemperature	Off	Off	5–27
P0561	System Voltage—Performance	Off	Off	5–30
P0562	System Voltage—Low	Off	Off	5–34
P0563	System Voltage—High	Off	Off	5–37
P0602	TCM Not Programmed	Off	Off	5–40
P0606	TCM Internal—Performance	—	Off	5–41
P0610	TCM Vehicle Options (TransID) Error	Off	On	5–42
P0613	TCM Processor	—	Off	5–45
P0614	Torque Control Data Mismatch—ECM/TCM	—	On	5–46
P0634	TCM Internal Temperature Too High	On	Off	5–49
P0658	Actuator Supply Voltage 1 (HSD1)—Low	On	On	5–51
P0659	Actuator Supply Voltage 1 (HSD1)—High (batt)	On	On	5–55
P0701	Transmission Control System—Performance	Off	Off	5–59
P0702	Transmission Control System Electrical (TransID)	Off	On	
P0703	Brake Switch Circuit	Off	—	5–64
P0706	Transmission Range Sensor Circuit—Performance	On	On	5–67
P0708	Transmission Range Sensor Circuit—High Input	On	On	5–71
P0711	Transmission Fluid Temperature (TFT) Sensor Circuit—Performance	On	Off	5–76
P0712	Transmission Fluid Temperature (TFT) Sensor Circuit—Low Input	On	Off	5–81
P0713	Transmission Fluid Temperature (TFT) Sensor Circuit—High Input	On	Off	5–86
P0716	Turbine Speed Sensor Circuit—Performance	On	On	5–90
P0717	Turbine Speed Sensor Circuit—No Signal	On	On	5–94
P0719	Brake Switch Circuit	—	Off	5–98
P0721	Output Speed Sensor Circuit—Performance	On	On	5–100
P0722	Output Speed Sensor Circuit—No Signal	On	On	5–104
P0726	Engine Speed Sensor Circuit—Performance	On	Off	5–108
P0727	Engine Speed Sensor Circuit—No Signal	On	Off	5–112
P0729	Incorrect 6th Gear Ratio	On	On	5–115
P0731	Incorrect 1st Gear Ratio	On	On	5–118
P0732	Incorrect 2nd Gear Ratio	On	On	5–121
P0733	Incorrect 3rd Gear Ratio	On	On	5–124
P0734	Incorrect 4th Gear Ratio	On	On	5–127
P0735	Incorrect 5th Gear Ratio	On	On	5–130
P0736	Incorrect Reverse Ratio	On	On	5–133
P0741	Torque Converter Clutch (TCC) System—Stuck Off	On	On	5–136
P0742	Torque Converter Clutch (TCC) System—Stuck On	On	On	5–138

DIAGNOSTIC TROUBLE CODES (DTC)

Table 5–3. DTC LIST AND DESCRIPTION INDEX *(cont'd)*

DTC	Description	MIL (ODB II Strategy)	CHECK TRANS Light (Non-ODB II Strategy)	Page
P0751	Shift Solenoid 1 (SS1) Valve Performance—Stuck Off	On	On	5–140
P0752	Shift Solenoid 1 (SS1) Valve Performance—Stuck On	On	On	5–146
P0756	Shift Solenoid 2 (SS2) Valve Performance—Stuck Off	On	On	5–152
P0757	Shift Solenoid 2 (SS2) Valve Performance—Stuck On	On	On	5–158
P0761	Shift Solenoid 3 (SS3) Valve Performance—Stuck Off	On	On	5–163
P0762	Shift Solenoid 3 (SS3) Valve Performance—Stuck On	On	On	5–169
P0776	Pressure Control Solenoid 2 (PCS2) Stuck Off	On	On	5–175
P0777	Pressure Control Solenoid 2 (PCS2) Stuck On	On	On	5–179
P0826	Up and Down Shift Switch Circuit	Off	—	5–183
P0827	Up and Down Shift Switch Circuit—Low	Off	—	5–186
P0828	Up and Down Shift Switch Circuit—High	Off	—	5–189
P0842	Transmission Pressure Switch 1 (PS1) Circuit—Low	On	On	5–192
P0843	Transmission Pressure Switch 1 (PS1) Circuit—High	On	On	5–197
P0847	Transmission Pressure Switch 2 (PS2) Circuit—Low	On	On	5–202
P0848	Transmission Pressure Switch 2 (PS2) Circuit—High	On	On	5–207
P0872	Transmission Pressure Switch 3 (PS3) Circuit—Low	On	On	5–212
P0873	Transmission Pressure Switch 3 (PS3) Circuit—High	On	On	5–217
P0877	Transmission Fluid Pressure Switch 4 (PS4) Circuit—Low	On	On	5–222
P0878	Transmission Fluid Pressure Switch 4 (PS4) Circuit—High	On	On	5–228
P0880	TCM Power Input Signal	Off	Off	5–234
P0881	TCM Power Input Signal—Performance	Off	On	5–237
P0882	TCM Power Input Signal—Low	Off	On	5–241
P0883	TCM Power Input Signal—High	Off	On	5–244
P0960	Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—Open	On	On	5–247
P0962	Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—Low	On	On	5–252
P0963	Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—High	On	On	5–256
P0964	Pressure Control Solenoid 2 (PCS2) Control Circuit—Open	On	On	5–260
P0966	Pressure Control Solenoid 2 (PCS2) Control—Low	On	On	5–265
P0967	Pressure Control Solenoid 2 (PCS2) Control—High	On	On	5–270
P0972	Shift Solenoid 1 (SS1) Control Circuit—Open	On	On	5–275
P0973	Shift Solenoid 1 (SS1) Control Circuit—Low	On	On	5–280
P0974	Shift Solenoid 1 (SS1) Control Circuit—High	On	On	5–284
P0975	Shift Solenoid 2 (SS2) Control Circuit—Open	On	On	5–289
P0976	Shift Solenoid 2 (SS2) Control Circuit—Low	On	On	5–294
P0977	Shift Solenoid 2 (SS2) Control Circuit—High	On	On	5–299
P0978	Shift Solenoid 3 (SS3) Control Circuit—Open	On	On	5–304
P0979	Shift Solenoid 3 (SS3) Control Circuit—Low	On	On	5–309
P0980	Shift Solenoid 3 (SS3) Control Circuit—High	On	On	5–314
P1688	Unmanaged Engine Torque Delivered to TCM Signal	On	On	5–318
P1779	Engine Torque Delivered to TCM Signal	On	On	5–320

DIAGNOSTIC TROUBLE CODES (DTC)

Table 5–3. DTC LIST AND DESCRIPTION INDEX *(cont'd)*

DTC	Description	MIL (ODB II Strategy)	CHECK TRANS Light (Non-ODB II Strategy)	Page
P1891	Throttle Position Sensor (TPS) PWM Signal—Low Input	—	Off	5–323
P1892	Throttle Position Sensor (TPS) PWM Signal—High Input	—	Off	5–327
P2637	Torque Management Feedback Signal—SEM	—	On	5–331
P2641	Torque Management Feedback Signal—LRTP	—	On	5–334
P2670	Actuator Supply Voltage 2 (HSD2)—Low	On	On	5–337
P2671	Actuator Supply Voltage 2 (HSD2)—High (batt)	On	On	5–341
P2723	Pressure Control Solenoid 1 (PCS1)—Stuck Off	On	On	5–346
P2724	Pressure Control Solenoid 1 (PCS1)—Stuck On	On	On	5–349
P2727	Pressure Control Solenoid 1 (PCS1) Control Circuit—Open	On	On	5–352
P2729	Pressure Control Solenoid 1 (PCS1) Control Circuit—Low	On	On	5–357
P2730	Pressure Control Solenoid 1 (PCS1) Control Circuit—High	On	On	5–362
P2761	TCC PCS Control Circuit—Open	On	On	5–366
P2763	TCC PCS Control Circuit—High	On	On	5–371
P2764	TCC PCS Control Circuit—Low	On	On	5–376
P2771	4-Wheel Drive Lo Switch Circuit	Off	—	5–381
U0010	CAN 1 Bus Reset Counter Overrun	On	Off	5–385
U0073	CAN 2 Bus Reset Counter Overrun	On	Off	5–389
U0100	Lost Communication with ECM/PCM (CAN 2)	Off	Off	5–393
U0115	Lost Communication with ECM/PCM (CAN 1)	Off	On	5–398
U0400	Invalid J1939 Communications	Off	Off	5–403
U0442	Invalid Data Received from ECM/PCM B (CAN 1/J1939)	Off	Off	5–405
U1016	Class 2 Powertrain Controller State of Health Failure	Off	Off	5–407
U1041	Class 2 Anti-lock Brake Controller (ABS) State of Health	Off	Off	5–410
U1064	Class 2 Truck Body Controller (TBC) State of Health	Off	Off	5–413
U1096	Class 2 Instrument Panel Controller (IPC) State of Health	Off	Off	5–416
U1300	Serial Data Communication Link Low (Class 2)	Off	Off	5–419
U1301	Serial Data Communication Link High (Class 2)	Off	Off	5–422

DIAGNOSTIC TROUBLE CODES (DTC)

DTC REFERENCE TABLES

Table 5–4. Gear Ratio

Range	Close Ratio	Wide Ratio
1	3.10:1	3.51:1
2	1.81:1	1.90:1
3	1.41:1	1.44:1
4	1.00:1	1.00:1
5	0.71:1	0.74:1
6	0.61:1	0.64:1
R	–4.49:1	–5.09:1

Table 5–5. Main Pressure Schedule

Range	Main Pressure @ 600 rpm	Main Pressure @ 2100 rpm
Forward/Reverse Converter with Main Mod Active (viewable in Allison DOC™)	590–720 kPa (85–105 psi)	634–758 kPa (92–110 psi)
Forward Converter with Main Mod Inactive	700–1380 kPa (101–200 psi)	1515–1795 kPa (220–260 psi)
Forward Lockup with Main Mod Active*		510–627 kPa (74–91 psi)
Forward Lockup with Main Mod Inactive*		1000–1170 kPa (145–170 psi)
Neutral/Park with Main Mod Active	590–720 kPa (85–105 psi)	
Neutral/Park with Main Mod Inactive	800–1655 kPa (130–240 psi)	1515–1795 kPa (220–260 psi)

* Medium duty gasoline engines only.

Table 5–6. Allison DOC™ For PC–Service Tool Internal Mode Switch (IMS) Status

Selector Position				A	B	C	P	Neutral Start
		P		OFF	ON	ON	OFF	ON
		R		OFF	OFF	ON	ON	OFF
		N		ON	OFF	ON	OFF	ON
D	5	5	5	ON	OFF	OFF	ON	OFF
*M	3	4	4	OFF	OFF	OFF	OFF	OFF
1	2	2	3	OFF	ON	OFF	ON	OFF
Blocked	1	1	1	ON	ON	OFF	OFF	OFF

When using a DVOM to check the IMS switch status of A, B, C, and P switches, note that the physical switch states are the opposite of Allison DOC™ For PC–Service Tool status shown above.

When using a DVOM to check the switch state of Neutral Start (NS), the switch state will be the same as the Allison DOC™ For PC–Service Tool status shown above.

The IMS Switch has four positions available in forward. Therefore, one range position will be omitted at the selector. The omitted position can be 2nd, 3rd, or 4th, depending upon chosen calibration.

*M mode allows tap-up tap-down feature functionally between 1st through 6th ranges.

DIAGNOSTIC TROUBLE CODES (DTC)

Table 5–7. Solenoid and Clutch Apply

Steady State	Upshifts	Clutch to Main	PCS1	PCS2	SS1	SS2	SS3	TCC	Main Mod
R Steady State with Throttle		—	OFF; C3 Applied	ON; C5 Applied	ON	ON	ON	OFF	OFF/ON Solenoid Status is Calibration Dependent on Engine, Turbine, Output, and other factors
*R Steady State at Closed Throttle	R	—	OFF; C5 Applied	ON; C3 Applied	OFF	ON	ON	OFF	ON
	R–N	—	ON; C3 Exhausting	ON; C5 Applied	OFF	ON	ON	OFF	—
	N–R	—	OFF; C3 Trimming on	ON; C5 Applied	ON	ON	ON	OFF	—
N			OFF; C5 Applied	OFF; — Exhausted	ON	ON	ON	OFF	ON at closed throttle
	N–1	—	OFF; C5 Applied	ON; C1 Trimming on	ON	ON	ON	OFF	—
	1–N	—	OFF; C5 Applied	OFF; — Exhausted	ON	ON	ON	OFF	—
1		C1	OFF; C5 Applied	OFF; C4 Exhausted	OFF	ON	OFF	OFF	ON at closed throttle
	1–2	C1	ON; C5 Exhausting	ON; C4 Trimming on	OFF	ON	OFF	OFF	—
	2–1	C1	OFF; C5 Trimming on	OFF; C4 Exhausting	OFF	ON	OFF	OFF	—
2		C1	ON; C3 Exhausted	ON; C4 Applied	OFF	OFF	OFF	ON; dependent on output speed	Vocation Dependent
	2–3	C1	OFF; C3 Trimming on	OFF; C4 Exhausting	OFF	OFF	OFF	ON	—
	3–2	C1	ON; C3 Exhausting	ON; C4 Trimming on	OFF	OFF	OFF	ON	—
3		C1	OFF; C3 Applied	OFF; C2 Exhausted	ON	OFF	OFF	ON	Vocation Dependent
	3–4	C1	ON; C3 Exhausting	ON; C2 Trimming on	ON	OFF	OFF	ON	—
	4–3	C1	OFF; C3 Trimming on	OFF; C2 Exhausting	ON	OFF	OFF	ON	—
4		C2	ON; C3 Exhausted	ON; C1 Applied	ON	OFF	ON	ON	Vocation Dependent
	4–5	C2	OFF; C3 Trimming on	OFF; C1 Exhausting	ON	OFF	ON	ON	—
	5–4	C2	ON; C3 Exhausting	OFF; C1 Trimming on	ON	OFF	ON	ON	—
5		C2	OFF; C3 Applied	OFF; C4 Exhausted	OFF	OFF	ON	ON	Vocation Dependent
	5–6	C2	ON; C3 Exhausting	ON; Trimming on	OFF	OFF	ON	ON	—

DIAGNOSTIC TROUBLE CODES (DTC)

Table 5–7. Solenoid and Clutch Apply *(cont'd)*

Steady State	Upshifts	Clutch to Main	PCS1	PCS2	SS1	SS2	SS3	TCC	Main Mod
	6–5	C2	OFF; Trimming on	OFF; Trimming off	OFF	OFF	ON	ON	—
6		C2	ON; C4 Applied	ON; C4 Applied	OFF	OFF	ON	ON	Vocation Dependent

* The following throttle dependent conditions occur in reverse range:
At closed throttle (Idle) SS1 is OFF, PCS1 controls C5 clutch, PCS2 controls C3 clutch.
Above 20 percent throttle* SS1 is ON, PCS1 controls C3, PCS2 controls C5.
Under 10 percent throttle* TCM reverts back to the close throttle (Idle) schedule.

Table 5–8. Pressure Switch Status

	(N/O)		(N/O)		(N/O)		(N/C)	
	PS1		PS2		PS3		PS4	
Range	Switch Status	Allison DOC™ Status	Switch Status	Allison DOC™ Status	Switch Status	Allison DOC™ Status	Switch Status	Allison DOC™ Status
R	Open	Exhausted/OFF*	Closed	Pressurized/ON	Closed	Pressurized/ON	Closed	Exhausted/ON
N	Closed	Pressurized/ON	Closed	Pressurized/ON	Closed	Pressurized/ON	Open	Pressurized/OFF
1	Open	Exhausted/OFF	Closed	Pressurized/ON	Open	Exhausted/OFF	Open	Pressurized/OFF
2	Open	Exhausted/OFF	Open	Exhausted/OFF	Open	Exhausted/OFF	Open	Pressurized/OFF
3	Closed	Pressurized/ON	Open	Exhausted/OFF	Open	Exhausted/OFF	Open	Pressurized/OFF
4	Closed	Pressurized/ON	Open	Exhausted/OFF	Closed	Pressurized/ON	Open	Pressurized/OFF
5	Open	Exhausted/OFF	Open	Exhausted/OFF	Closed	Pressurized/ON	Open	Pressurized/OFF
6	Open	Exhausted/OFF	Open	Exhausted/OFF	Closed	Pressurized/ON	Open	Pressurized/OFF

N/O = Normally Open, N/C = Normally Closed
* PS1 reverts to the CLOSED/ON state with throttle applied in reverse.

DIAGNOSTIC TROUBLE CODES (DTC)

Table 5–9. Calculated Solenoid Resistance vs. Temperature

Sump Temperature		TCC, PCS1, PCS2 (Ω)			SS1, SS2, SS3, MAIN MOD (Ω)		
(°C)	(°F)	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
–65	–85	3.23	3.36	3.50	13.98	14.65	15.32
–40	–40	3.71	3.86	4.01	16.05	16.81	17.58
–30	–22	3.90	4.06	4.22	16.87	17.68	18.48
–20	–4	4.09	4.26	4.42	17.70	18.54	19.38
–10	14	4.28	4.45	4.63	18.52	19.41	20.29
0	32	4.47	4.65	4.84	19.35	20.27	21.19
10	50	4.66	4.85	5.04	20.17	21.14	22.10
20	68	4.85	5.05	5.25	21.00	22.00	23.00
30	86	5.04	5.25	5.46	21.83	22.86	23.90
40	104	5.23	5.45	5.66	22.65	23.73	24.81
50	122	5.42	5.65	5.87	23.48	24.59	25.71
60	140	5.61	5.84	6.08	24.30	25.46	26.62
70	158	5.80	6.04	6.28	25.13	26.32	27.52
80	176	5.99	6.24	6.49	25.95	27.19	28.42
90	194	6.18	6.44	6.69	26.78	28.05	29.33
100	212	6.37	6.64	6.90	27.60	28.92	30.23
110	230	6.57	6.84	7.11	28.43	29.78	31.14
120	248	6.76	7.03	7.31	29.25	30.65	32.04
130	266	6.95	7.23	7.52	30.08	31.51	32.94
140	284	7.14	7.43	7.73	30.90	32.38	33.85
150	302	7.33	7.63	7.93	31.73	33.24	34.75
160	320	7.52	7.83	8.14	32.55	34.10	35.65
165	329	7.61	7.93	8.24	32.97	34.54	36.11

DIAGNOSTIC TROUBLE CODES (DTC)

Table 5–10. Speed Sensor vs. Temperature

Temperature		Resistance		
(°C)	(°F)	Minimum (Ω)	Nominal (Ω)	Maximum (Ω)
–25	–13	1929	2143	2358
0	32	2157	2397	2637
25	77	2340	2600	2860
50	122	2614	2904	3195
75	167	2842	3158	3474
100	212	3071	3412	3753
125	257	3299	3666	4032
150	302	3483	3870	4257

Table 5–11. Transmission Fluid Temperature (TFT) Sensor Resistance vs. Temperature

Temperature		Resistance		
(°C)	(°F)	Minimum (Ω)	Nominal (Ω)	Maximum (Ω)
–45	–49	128 565	141 951	155 338
–40	–40	95 826	100 735	105 644
–35	–31	68 952	72 315	75 679
–30	–22	50 153	52 480	54 807
–25	–13	36 854	38 478	40 103
–20	–4	27 345	28 488	29 631
–15	5	20 476	21 286	22 097
–10	14	15 467	16 045	16 624
–5	23	11 781	12 197	12 612
0	32	9045	9345	9646
5	41	6998	7219	7441
10	50	5458	5623	5787
15	59	4291	4413	4536
20	68	3398	3490	3582
25	77	2710	2779	2849
30	86	2173	2228	2282
35	95	1754	1797	1840
40	104	1424	1459	1493
45	113	1163	1191	1218
50	122	955.0	977.1	999.2
55	131	788.6	806.5	824.5

DIAGNOSTIC TROUBLE CODES (DTC)

Table 5–11. Transmission Fluid Temperature (TFT) Sensor Resistance vs. Temperature *(cont'd)*

Temperature		Resistance		
(°C)	(°F)	Minimum (Ω)	Nominal (Ω)	Maximum (Ω)
60	140	654.7	669.3	683.9
65	149	546.3	558.3	570.2
70	158	458.1	467.9	477.8
75	167	385.9	394.1	402.2
80	176	326.6	333.3	340.1
85	185	277.5	283.2	288.9
90	194	236.5	241.6	246.7
95	203	202.4	206.9	211.5
100	212	173.8	177.9	182.0
105	221	149.8	153.6	157.3
110	230	129.7	133.0	136.4
115	239	112.6	115.6	118.7
120	248	98.17	100.88	103.6
125	257	85.87	88.29	90.71
130	266	75.35	77.52	79.69
135	275	66.34	68.27	70.21
140	284	58.58	60.31	62.04
145	293	51.88	53.42	54.97
150	302	46.08	47.46	48.84
155	311	41.04	42.27	43.50
160	320	36.65	37.74	38.84

Table 5–12. TPS—Distance (mm) of Travel vs. Volts

mm	Volts
0	0
1	0.110
2	0.220
3	0.329
4	0.439
5	0.549
6	0.659
7	0.768
8	0.878
9	0.988
10	1.098
11	1.207

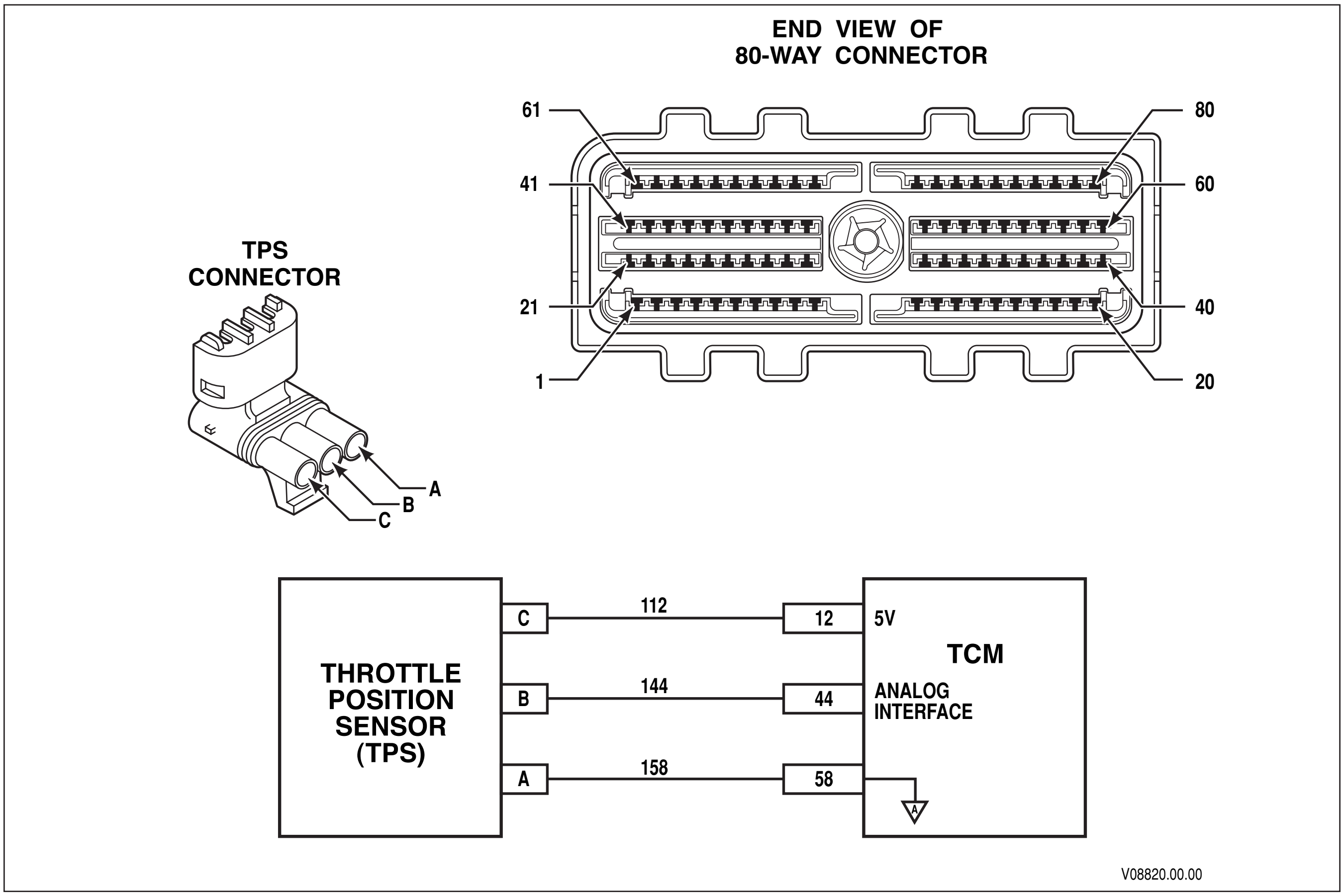
mm	Volts
12	1.317
13	1.427
14	1.537
15	1.646
16	1.756
17	1.866
18	1.976
19	2.085
20	2.195
21	2.305
22	2.415
23	2.524

mm	Volts
24	2.634
25	2.744
26	2.854
27	2.964
28	3.073
29	3.183
30	3.293
31	3.403
32	3.512
33	3.622
34	3.732
35	3.842

mm	Volts
36	3.951
37	4.061
38	4.171
39	4.281
40	4.390
41	4.500
42	4.610
43	4.720
44	4.829
45	4.939
46	5.049

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0122 Pedal Position Sensor Circuit—Low 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 0.178 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 18V and less than 32V (24V TCM).
- DTC P0123 Pedal Position Sensor Circuit—High Voltage is not active.

DIAGNOSTIC TROUBLE CODES (DTC)

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

- DTC P0122 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).
- The TCM inhibits TCC engagement.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).

Conditions for Clearing the DTC/CHECK TRANS Light

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 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 circuit condition, 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

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

2. This step tests for the proper ignition voltage.
3. This step tests for the proper reference voltage from TCM.
4. This step tests shorting condition or opens in TPS harness.
5. This step tests for proper TPS adjustment.
6. This step tests for internal TPS intermittent shorts or open conditions.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0122 Pedal Position Sensor Circuit—Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
3	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. (To perform the following test the 16 pin bypass connector located on J 47275 TCM Breakout must be disconnected.) 3. With the engine OFF turn the ignition to the RUN position. 4. Using a digital volt/ohmmeter (DVOM), measure the voltage at pins 12 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 4*	*Go to Step 10*
4	1. With the J 39700 Breakout Box and J 47275 TCM Breakout installed as in Step 3, reconnect the 16 pin breakout connector. 2. With the engine OFF turn the ignition to the RUN position. 3. Using a DVOM, measure the voltage at pins 12 and 58. Is the voltage reading within specified value?	4.75–5.0V	*Go to Step 5*	*Go to Step 7*
5	1. With the J 39700 Breakout box and J 47275 TCM Breakout installed as in Step 4, refer to Appendix F, Section B. 2. Using a DVOM, measure the voltage at pins 44 and 58. 3. Perform a voltage reading at Idle and full throttle. Is the voltage reading at Idle and Full Throttle within the specified value?	Idle > 0.98V Full Throttle < 3.921V	*Go to Step 6*	*Go to Step 8*
6	1. With the engine OFF and the ignition in the ON position, measure the voltage at pins 44 and 58. 2. Slowly increase the throttle from Idle to Full throttle. 3. The increase in voltage should be steady, without dropouts, as throttle is increased. Was the voltage steady?		*Go to Diagnostic Aids*	*Go to Step 9*

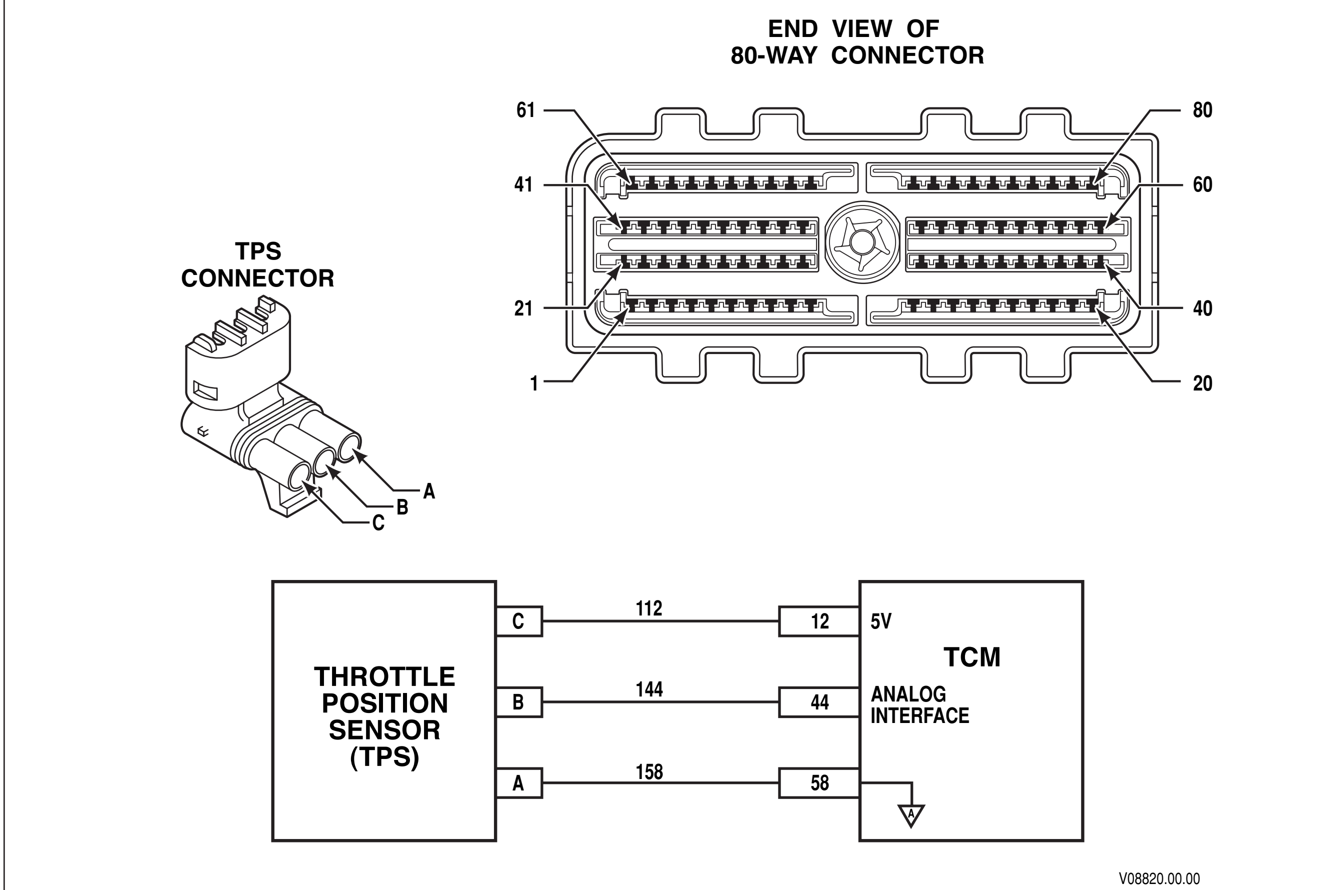
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
7	With the J 39700 Breakout Box and J 47275 TCM Breakout unplugged at the TCM and the TPS connector unplugged at the TPS, use a jumper wire between pins A, B, and C. Using a DVOM at J 39700 Breakout Box check the TPS harness continuity at pin locations 112, 144, and 158. Were there any opens or short between the three wires?		*Go to Step 8*	*Go to Step 9*
8	Repair the wiring harness (refer to OEM wiring harness repair procedure). Is the repair complete?		*Go to Step 11*	
9	Replace the (TPS) throttle position sensor. Is the repair 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. 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 Circuit—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 0.178 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.

DIAGNOSTIC TROUBLE CODES (DTC)

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 18V and less than 32V (24V TCM).
- DTC P0122 Pedal Position Sensor Circuit—Low Voltage is not active.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

- 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).
- The TCM inhibits TCC engagement.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).

Conditions for Clearing the DTC/CHECK TRANS Light

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 circuit condition, 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

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

2. This step tests for the proper ignition voltage.
3. This step tests for the proper reference voltage from TCM.
4. This step tests shorting condition or opens in TPS harness.
5. This step tests for proper TPS adjustment.
6. This step tests for internal TPS intermittent shorts or open conditions.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0123 Pedal Position Sensor Circuit—High Voltage

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
3	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. (To perform the following test the 16 pin bypass connector located on J 47275 TCM Breakout must be disconnected.) 3. With the engine OFF turn the ignition to the RUN position. 4. Using a digital volt/ohmmeter (DVOM), measure the voltage at pins 12 and 58. Is the voltage within the specified value?	4.75–5.0V	*Go to Step 4*	*Go to Step 10*
4	1. With the J 39700 Breakout Box and J 47275 TCM Breakout installed as in Step 3, reconnect the 16 pin breakout connector. 2. With the engine OFF turn the ignition to the RUN position. 3. Using a DVOM, measure the voltage at pins 12 and 58. 4. Is the voltage reading within specified value?		*Go to Step 5*	*Go to Step 7*
5	1. With the J 39700 Breakout box and J 47275 TCM Breakout installed as in Step 4, refer to Appendix F, Section B. 2. Using a DVOM, measure the voltage at pins 44 and 58. 3. Perform a voltage reading at Idle and full throttle. Is the voltage reading at Idle and Full Throttle within the specified value?	Idle > 0.98V Full Throttle < 3.921V	*Go to Step 6*	*Go to Step 8*
6	1. With the engine OFF and the ignition in the ON position, measure the voltage at pins 44 and 58. 2. Slowly increase the throttle from Idle to Full throttle. The increase in voltage should be steady, without dropouts, as throttle is increased. Was the voltage steady?		*Go to Diagnostic Aids*	*Go to Step 9*

DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
7	1. With the J 39700 Breakout Box and J 47275 TCM Breakout unplugged at the TCM and the TPS connector unplugged at the TPS, use a jumper wire between pins A, B, and C. 2. Using a DVOM at J 39700 Breakout Box check the TPS harness continuity at pin locations 112, 144, and 158. Were there any opens or short between the three wires?		*Go to Step 8*	*Go to Step 9*
8	Repair the wiring harness (refer to OEM wiring harness repair procedure). Is the repair complete?		*Go to Step 11*	
9	Replace the (TPS) throttle position 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. 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

REFER TO HYDRAULIC SCHEMATICS (APPENDIX H)

Circuit Description

The flow of transmission fluid starts in the transmission pan. Fluid is then drawn through the filter and internal passages into the oil pump assembly. The oil pump pressurizes the fluid into main-pressure that is regulated at the main-pressure regulator valve. From this point, fluid is directed to the TCC solenoid and to the control-main regulator and control-main relief valve into the control-main filter assembly and on to all solenoids for use as control pressure. Hot fluid leaving the torque converter is routed through the converter flow valve to cooler lines and into the cooler assembly. The transmission oil cooler is located in the radiator. The vehicle may be equipped with an auxiliary oil cooler. The cooled fluid is returned to the transmission through the return cooler line and to the transmission lube circuit. The automatic transmission fluid temperature (TFT) sensor, which is part of the PSM, is located in the oil pan.

If the Transmission Control Module (TCM) detects a high TFT for an extended period of time, then DTC P0218 sets.

Conditions for Running the DTC

- DTCs P0711, P0712, P0713 are not active.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm for more than 5 seconds.

Conditions for Setting the DTC

DTC P0218 sets when the TCM detects a transmission sump temperature greater than 122°C (251°F) for 10 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM records the operating conditions when the conditions for setting the DTC are met. The TCM stores this information as Failure Records.
- DTC P0218 is stored in the TCM history.
- The TCM defaults to “hot mode” shift schedule where 4th range is held and TCC is inhibited to increase engine speed and improve cooler flow.

Conditions for Clearing the DTC/CHECK TRANS Light

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

DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Aids

- Verify the customer's driving habits, such as trailer towing, etc.
- Using Allison DOC™ For PC–Service Tool, monitor transmission fluid temperature (TFT). TFT 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 for DTC P0218. Repairing the condition that set DTC P0711 will likely eliminate DTC P0218.
- DTC P0218 sets first, before DTCs P0711 and P0712.
- If DTC P0711 is set, temperature is defaulted and diagnostics are shut off, P0218 cannot be set.

Test Description

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

3. This step inspects for air restriction and loss of transmission fluid flow, causing an extremely high TFT.
4. This step tests main-pressure.
5. This step inspects for a stuck torque converter stator.

DTC P0218 Transmission Fluid Over Temperature

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Was the Allison Transmission fluid level check performed?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	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 • Debris • Damaged cooler lines or hoses Did you find and correct the condition?		*Go to Step 6*	*Go to Step 4*

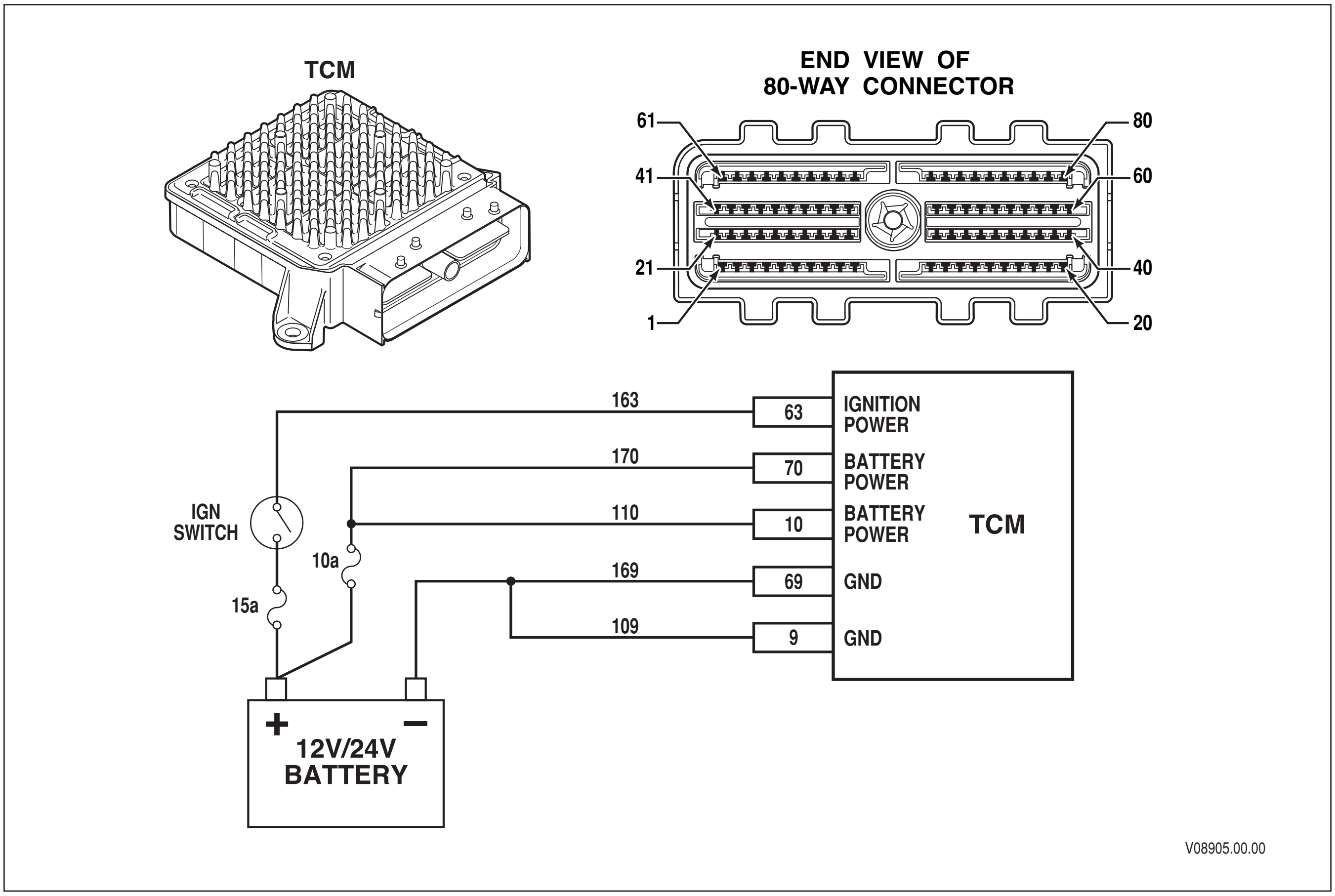
DIAGNOSTIC TROUBLE CODES (DTC)

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

4	Perform the Main Pressure Check Procedure (refer to Appendix B). Did you find and correct a pressure problem?		*Go to Step 6*	*Go to Step 5*
5	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 Section 7). Did you find and correct the condition?		*Go to Step 6*	*Go to General Troubleshooting (Section 7)*
6	Perform the following procedure in order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™, monitor the transmission fluid temperature (TFT). 3. Operate the vehicle under the following conditions. • Turn ON the ignition, with the engine OFF. • The TFT must be less than 126°C (258°F) for at least 10 seconds. 4. Using Allison DOC™, verify that the test to detect this DTC has run. Has the test run and passed?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0561 System Voltage—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 163 in the 80-way connector at the TCM. Battery direct voltage is supplied to pins 110 and 170 at the 80-way connector.

Conditions for Running the DTC

- The test becomes enabled when the engine has been running above 400 rpm for at least 0.5 seconds.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V and less than 32V (24V TCM).

Conditions for Setting the DTC

P0561 sets when the TCM detects a large variation in ignition voltage or battery direct voltage. When an ignition or battery direct voltage variation of 4.0V or greater is detected for 0.5 seconds, a fault pending is reported. After 1.0 second of 4.0V or greater variation, a DTC is set with a failure response.

DIAGNOSTIC TROUBLE CODES (DTC)

Action Taken When the DTC Sets

When DTC P0561 is active, the following conditions will occur:

- DTC P0561 is stored in the TCM history.
- Hydraulic default is commanded. Shift selector position and hydraulic state of logic valves determine the range attained.
- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

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

- You may have to drive the vehicle in order to experience a fault.
- This DTC indicates a variation in ignition voltage or battery direct voltage. Common ignition circuit problems for this DTC are a fault in the feed wires to the TCM, a defective ignition switch, or a large vehicle accessory load on the ignition circuit. Battery direct voltage problems may be due to loose or corroded battery cables, a bad connection at the battery direct feed terminal (110 and 170), or an internal TCM failure due to a burnt trace.
- A vehicle charging system failure may cause this DTC under certain circumstances.
- This DTC 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 circuit condition, massage the wiring harness while watching the test equipment for a change.

Test Description

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

2. This step tests for an active DTC after clearing.
3. This step tests for the proper battery direct input voltage.
4. This step tests for the proper ignition input voltage.
5. This step tests for shorts or open conditions at battery direct input circuit.
6. This step tests for shorts or open conditions at ignition input circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0561 System Voltage—Performance

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Start vehicle and test drive. 6. Duplicate same operating conditions observed in failure records. ***NOTE: This DTC indicates that a voltage variation exists in the ignition voltage or at the battery direct input. This variation is measured from min. and max. voltage values. If the voltage variation is present for a predetermined amount of time, this DTC sets.*** Did DTC P0561 return?		*Go to Step 3*	*Go to Step 4*
3	1. Turn the ignition OFF. 2. Disconnect TCM 80-way connector at the TCM. 3. Install J 39700 Breakout Box and J 47275 TCM Breakout at the 80-way connector. 4. Using a digital volt/ohmmeter (DVOM), measure voltage at 80-way connector pins 9, 10, and 70. Is the voltage within the specified value?	11.5–12.5V (12V TCM) 18.5–24.0V (24V TCM)	*Go to Step 4*	*Go to Step 5*
4	1. Using a digital multimeter (DVOM), sequentially measure voltage at 80-way connector pin 63 using 80-way connector pins 9 or 69 as ground return. 2. Turn ON the ignition, with the engine OFF. Is the voltage within the specified value?	11.5–12.5V (12V TCM) 18.5–24.0V (24V TCM	*Go to Diagnostic Aids*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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 • Loose or corroded connections at battery or connection points • Defective battery. Was one of these conditions discovered and repaired?		*Go to Step 8*	*Go to Step 7*

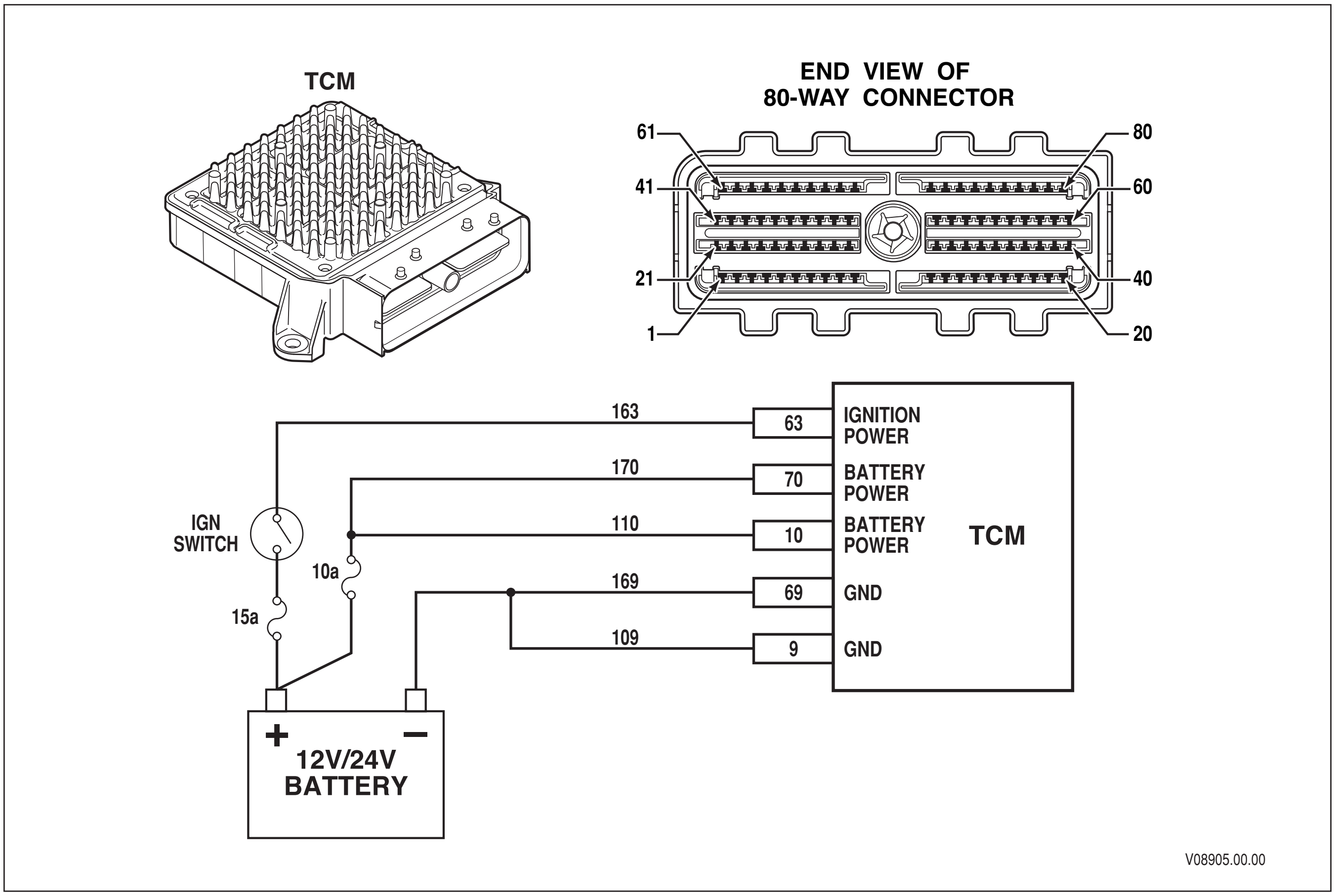
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0561 System Voltage—Performance *(cont'd)*

Step	Action	Value(s)	Yes	No
6	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Inspect the TCM ignition input circuit for one of the following conditions: • Intermittent open or short at ignition input circuits 109, 169, or 163. • Loose or corroded connections at ignition switch or ignition relay assembly. • Defective ignition switch or relay. • Loading of ignition circuit by defective vehicle accessories. Was one of these conditions discovered and repaired?		*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. Drive the vehicle under conditions shown in failure records. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0562 System Voltage—Low



Circuit Description

The Transmission Control Module (TCM) requires a switched ignition voltage input to operate. This switched ignition voltage signal originates from the ignition switch or an ignition relay to supply voltage to pin 163 in the 80-way connector at the TCM.

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 18V and less than 32V (24V TCM).
- The engine speed is greater than 450 rpm for 10 seconds.

Conditions for Setting the DTC

DTC P0562 sets when the TCM detects the following condition:

- 12V TCM—Ignition voltage is detected below 8V at 0°C (32°F) for a total of 5 out of 7 seconds. The voltage threshold is temperature dependent varying from 5V at –60°C (–75°F) to 9V at 20°C (68°F).
- 24V TCM—Ignition voltage is detected below 17V at 0°C (32°F) for a total of 5 out of 7 seconds. The voltage threshold is temperature dependent varying from 14V at –60°C (–75°F) to 18V at 20°C (68°F).

DIAGNOSTIC TROUBLE CODES (DTC)

Action Taken When the DTC Sets

- If the DTC is active while vehicle is in a forward range, transmission shifts to neutral, 1st, 3rd, or 5th range.
- If the DTC is active while in reverse or neutral, transmission shifts to neutral.
- If the shift selector is moved to forward range, transmission shifts to neutral, 1st, 3rd, or 5th range.
- If the shift selector is moved to **R** (Reverse) or **N** (Neutral), transmission shifts to neutral. Diagnostic response honors the inhibit latched at the time the DTC is set. If a latched inhibit is present and PRNDL is incorrect, transmission shifts to neutral range. GPI request is responded to if PRNDL is correct.
- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

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

- 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.
- Vehicle components such as an ignition switch or TCM ignition relay may cause this DTC to set and not be active, this indicates that an intermittent condition may exist in these components.
- 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 the step numbers on the diagnostic table.

2. This step tests for the proper ignition input voltage.
3. This step tests for an active DTC after clearing.
4. This step tests vehicle battery per OEM guidelines.
5. This step tests vehicle charging system per OEM guidelines.

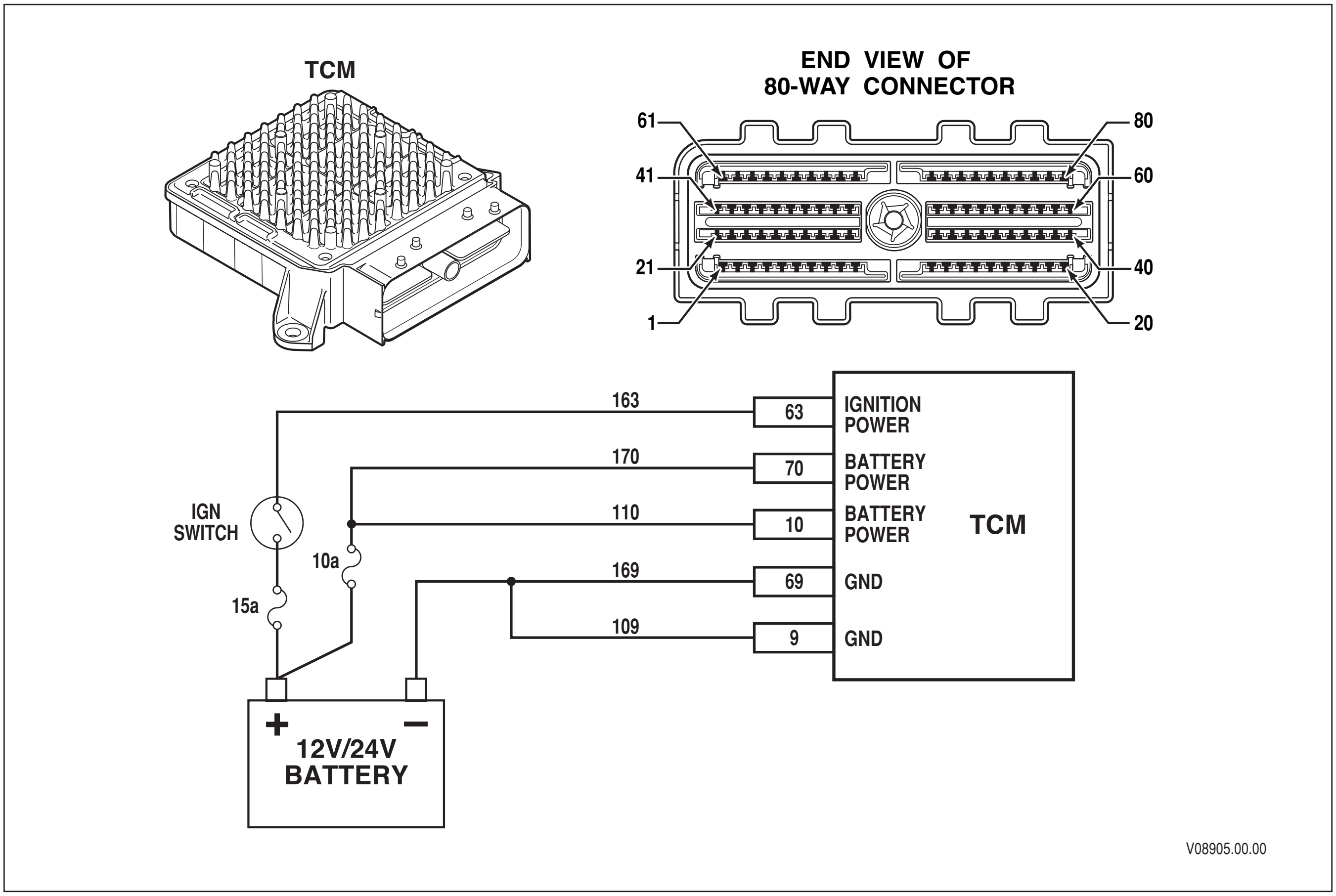
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0562 System Voltage—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Inspect the ignition voltage value on Allison DOC™. ***NOTE: This DTC sets when ignition voltage drops below a predetermined level that is temperature dependent for 5 out of 7 seconds.*** Is the ignition voltage below specified value?	Voltage should be above 9V (12V TCM) or 18V (24V TCM) at 20°C (68°F). See conditions for setting the 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 battery per OEM instructions, including a voltage test and a load test. Does test indicate the battery is good?	See OEM for correct battery specifications	*Go to Step 5*	*Replace the vehicle battery and go to Step 6*
5	Test the vehicle charging system per the OEM recommended testing procedure. Is the charging system operating properly?	See OEM for correct charging system specifications	*Go to Diagnostic Aids*	*Repair the charging system and go to Step 6*
6	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions shown in the failure records when the DTC set. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0563 System Voltage—High



Circuit Description

The Transmission Control Module (TCM) requires a switched ignition voltage input to operate. This switched ignition voltage signal originates from the ignition switch or an ignition relay to supply voltage to pin 163 in the 80-way connector at the TCM.

Conditions for Running the DTC

- The engine speed is greater than 450 rpm for one second.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V and less than 32V (24V TCM).

Conditions for Setting the DTC

DTC P0563 sets when the TCM detects the following condition:

- 12V TCM—Ignition voltage is above 18V for 6 out of 10 seconds.
- 24V TCM—Ignition voltage is above 32V for 6 out of 10 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

Action Taken When the DTC Sets

- If the DTC is active while the vehicle is in a forward range, the transmission shifts to neutral, 1st, 3rd, or 5th range.
- If the DTC is active while in reverse or neutral, the transmission shifts to neutral.
- If the shift selector is moved to a forward range, the transmission shifts to neutral, 1st, 3rd, or 5th range. If the shift selector is moved to **R** (Reverse) or **N** (Neutral), the transmission shifts to neutral. Diagnostic response honors the inhibit latched at the time the DTC is set. If a latched inhibit is present and PRNDL is incorrect, the transmission shifts to neutral range. GPI request is responded to if PRNDL is correct.
- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

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

- A defective vehicle charging system that is overcharging may cause 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.
- This DTC can set if an A40–A42 model TCM is installed in a 24V system, when an A43 TCM is required.

Test Description

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

2. This step tests for the proper ignition input voltage.
3. This step tests for an active DTC after clearing.
4. This step tests vehicle charging system per OEM guidelines.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0563 System Voltage—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?	—	*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4))*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Start vehicle engine and inspect the ignition voltage value on Allison DOC™. ***NOTE: This DTC sets when ignition voltage is detected above 18V for 12V systems or 32V for 24V systems for 6 out of 10 seconds.*** Is the ignition voltage above specified value?	See Conditions for Setting the 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 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?	—	*Go to Diagnostic Aids*	*Repair the charging system and go to Step 5*
5	In order to verify your repair: 1. Clear DTC. 2. Drive vehicle under conditions shown in failure records when DTC set. Did the DTC return?	—	*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0602 TCM Not Programmed

NO SCHEMATIC FOR THIS DTC

Circuit Description

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

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 18V and less than 32V (24V TCM).
- 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.

Action Taken When the DTC Sets

- DTC P0602 is stored in the TCM history.
- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- The TCM returns to the boot program, and then waits to be recalibrated.
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

TCM must be recalibrated.

DTC P0602 TCM Not Programmed

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 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 Allison DOC™. 2. Start the vehicle. Did the DTC return?		*Go to Step 3*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0606 TCM Internal—Performance

NO SCHEMATIC FOR THIS DTC

Circuit Description

The Transmission Control Module (TCM) completes numerous scheduled tasks during normal operation. If one of the scheduled tasks fails to complete within a specific time limit the TCM will re-attempt this task.

NOTE: The presence of DTC P0606 indicates a TCM software error has occurred and the Allison Transmission Service Department should be contacted at 1-800-252-5283.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V for a 12V TCM, or greater than 18V and less than 32V for a 24V TCM.
- This test is run during the entire ignition cycle.

Conditions for Setting the DTC

DTC P0606 sets if a task fails to complete after two consecutive attempts.

Action Taken When the DTC Sets

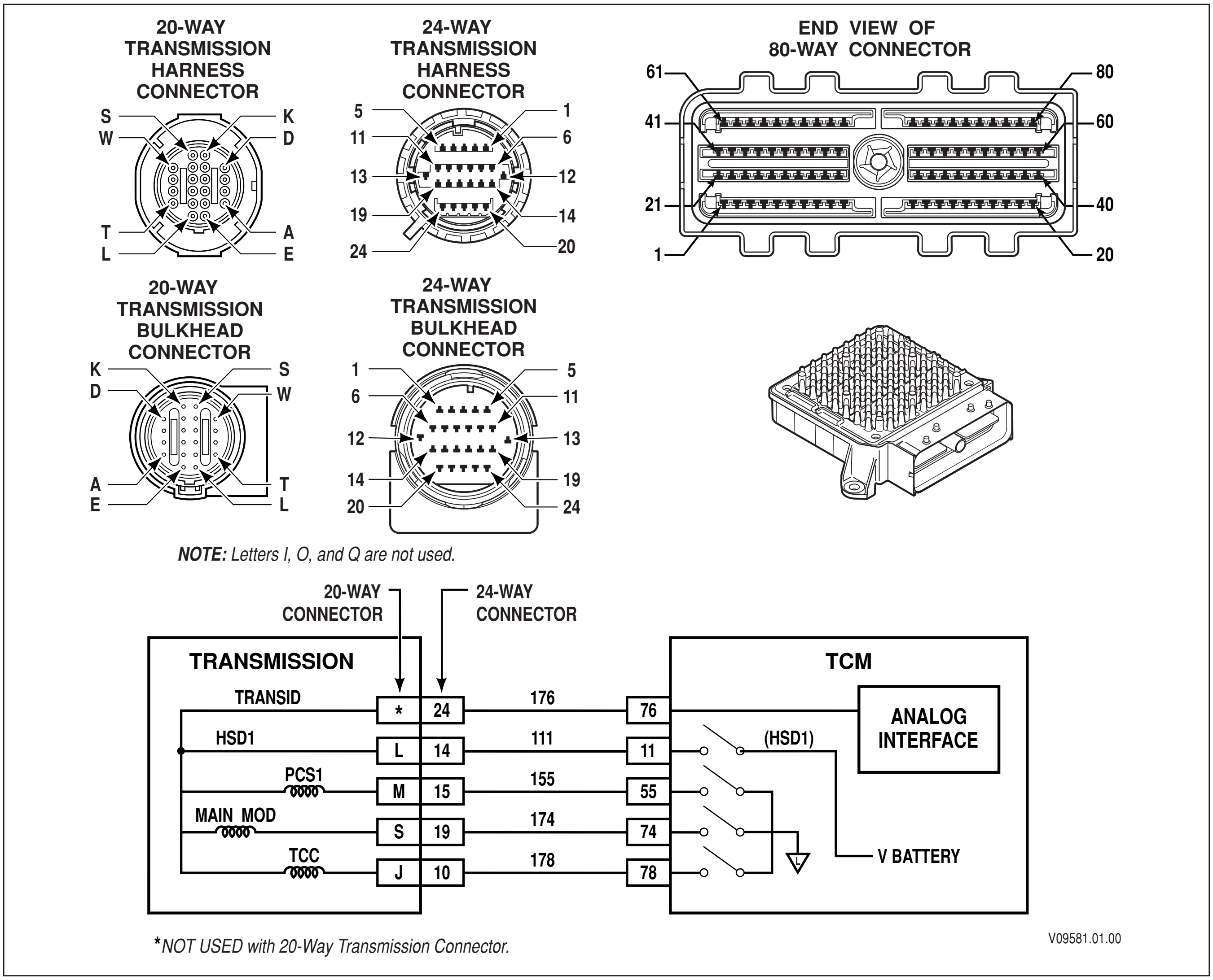
- When DTC P0606 is active, the transmission will lock in **N** (Neutral).
- DTC P0606 is stored in the TCM history.
- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC–Service Tool can 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 P0610 TCM Vehicle Options (TransID) Error



Circuit Description

The TransID feature enables the TCM to recognize various transmission hardware configurations and verify that the proper compatible calibration is used. The TCM senses the transmission configuration by using TID wire 176. In the initial versions of Allison 4™ Generation Controls, wire 176 is connected to the High Side Driver 1 (HSD1) via wire 111. 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 when the TCM determines the TCM software level is incompatible with transmission hardware.

Action Taken When the DTC Sets

- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- DTC P0610 will be stored in the TCM history.
- The TCM defaults to TID A.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Clearing the MIL/DTC

Allison DOC™ For PC can 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 TCM software and the internal harness are not compatible. If this DTC occurs after a TCM recalibration, inspect for incorrect TCM software level.

DTC P0610 TCM Vehicle Options (TransID) Error

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition. 3. Using Allison DOC™, determine the highest available TransID level supported by the TCM calibration. 3. Consult the transmission bill of material or the build history to determine the actual TransID level of the transmission. 3. Compare the highest available TransID level in the calibration to the actual transmission hardware. Is the highest available TransID level greater than or equal to the actual TransID of the transmission?		*Go to Step 3*	*Go to Step 4*
3	1. Reset Autoselect using Allison DOC™. 2. Monitor "TransID level used" on Allison DOC™. 3. Compare the TransID level indicated on Allison DOC™ to the actual TransID level of the transmission. Did the TCM detect the correct TransID level?		*Go to Step 6*	*Go to Step 5*
4	Recalibrate the TCM with a TransID calibration that matches the actual TransID level of the transmission. Is the calibration 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™, reset Autoselect. 3. Verify the TCM detects the correct TransID 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

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V and less than 32V (24V TCM).
- 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).
- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- DTC is stored in TCM history.
- The TCM freezes shift adapts (DNA).
- TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 certain limits, Lower Range Torque Protection (LRTP) is used. This feature limits engine torque in lower ranges to protect the transmission from damage if a stall condition occurs.

Conditions for Running the DTC

- No DTC U0115 CAN bus error.
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V and less than 32V (24V TCM).
- This test runs for 30 seconds for the first 20 engine starts after the engine is detected on the J1939 CAN. If P0614 is active, the test runs for an unlimited number of engine starts.
- Engine must be identified by the TCM (via J1939 communications) as an approved make and model.

NOTE: Engines identified during the cal ordering process (PCCS/CSS) as "low torque" will operate without setting a P0614.

Conditions for Setting the DTC

P0614 sets when the TCM detects one of the following conditions:

- The PCCS/CSS calibration process has determined that the particular engine rating and transmission configuration requires SEM/LRTP but the TCM detects the ECM software is not supporting all the messaging necessary for SEM and/or LRTP, or the engine is not on the SEM/LRTP validation list
- All engine ratings that have been identified during the PCCS/CSS calibration process as requiring SEM/LRTP must have software that is compatible with SEM and LRTP or a P0614 is set.

NOTE: Valid engines with a torque rating exceeding 580 lb ft (786 N·m) must have software that is compatible with LRTP or a P0614 is set.

Action Taken When the DTC Sets

- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- If the TCM and engine ECM software are not compatible, the transmission will be restricted to reverse, neutral, and 3rd range.

Conditions for Clearing the DTC/CHECK TRANS Light

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 TROUBLE CODES (DTC)

Diagnostic Aids

- If DTC P0614 is set in combination with DTCs P2637 and/or P2641, engine control software is not correct. Verify that the proper software is installed then reset the SEM Autoselect parameters with Allison DOC™ For PC–Service Tool.
- This DTC may set if attempting to reflashing the TCM with the engine running; always reflash with the engine off, ignition on.

Test Description

The numbers below refer to the 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?	—	*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
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 7*	*Go to Step 3*
3	1. Install Allison DOC™. 2. Turn ON the ignition. 3. Refer to Engine Hardware Status in SEM/LRTP AND AUTODETECT INFO display of Allison DOC™. Is the engine recognized as a SEM/LRTP engine?	Allison DOC™ indicates “SEM/LRTP Recognized” or “Not SEM/LRTP 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™. Does the ECM support SEM?	Allison DOC™ indicates “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™. Does the ECM support LRTP?	Allison DOC™ indicates “ECM supports LRTP” or “ECM doesn’t support LRTP”	*Go to Step 6*	*Go to Step 7*

DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
6	This indicates that 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 the vehicle over to the engine manufacturer to verify proper software and calibration are installed to support SEM and/or LRTP. Has the proper software and calibration been installed?	—	*Go to Step 8*	
8	In order to verify your repair: 1. Clear P2637 or P2641, if present. 2. Using Allison DOC™, reset Autoselect (refer to Section 3–8). 3. Clear P0614. 4. Drive the vehicle under normal operating conditions. 5. Refer to Allison DOC™ "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 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 18V 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 TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- DTC is stored in TCM history.
- The TCM commands OFF all solenoids (SOLOFF).
- TCM inhibits TCC engagement.

Conditions for clearing the DTC/CHECK TRANS Light

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.

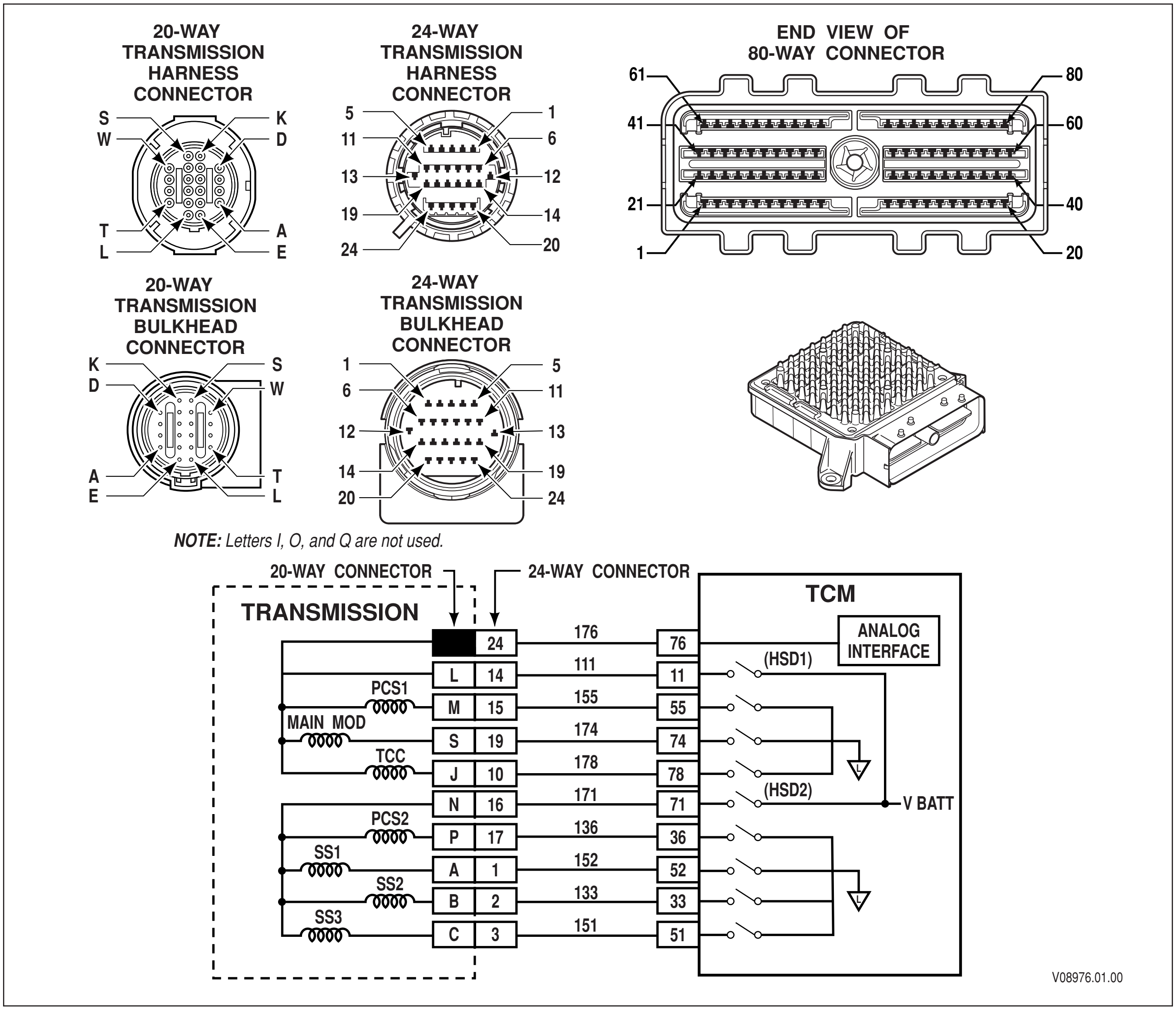
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0634 TCM Internal Temperature Too High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn the ignition ON. 3. Record the DTC Failure Record data. 4. Clear the DTCs. 5. Drive the vehicle and monitor TCM internal temperature on Allison DOC™. Did DTC P0634 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Inspect the TCM and surrounding area. 2. Make sure there are no high temperature components such as exhausted lines 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	1. Install Allison DOC™. 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 P0658 Actuator Supply Voltage 1 (HSD1)—Low



Circuit Description

High Side Driver 1 (HSD1) supplies battery voltage to the Main Mod, TCC and PCS1 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 P0658 indicates the TCM has detected that all solenoids connected to the HSD1 are inactive with a supply voltage in the HSD1 circuit of 6V or less. DTC P0658 indicates a short-to-ground has occurred in the high side wiring attached to HSD1 (wire 111) or TransID (wire124).

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V and less than 32V (24V TCM).
- HSD1 is commanded ON.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

DTC P0658 is set when the TCM detects all the solenoids connected to the HSD1 are inactive and the high-side voltage is less then 6V. These conditions indicate a short-to-ground has occurred at the high-side wire 111 or TransID wire 176.

Actions taken when the DTC Sets

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

- If the failure occurs while in a forward range a shift to first, third, or fifth range is made.
- While diagnostic response is active, if shift selector is moved to neutral, transmission will shift to neutral; if the shift selector is moved to reverse, transmission shifts to reverse. If the shift selector is moved to forward range or reverse and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- 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

- HSD1 and HSD2 will reset opening the high side circuit whenever a short-to-ground is detected.
- 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 chaffing could occur leading to an open 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.
- A short-to-ground at TransID wire 176 could allow this DTC to set. To check for this condition, isolate wire 176 by removing pin 24 at the transmission connector and pin 76 at the 80-way TCM connector. Clear DTCs and watch for an active DTC P0658 to return.

NOTE: Be aware that a TransID DTC P0702 will be set by performing this test.

If P0658 code does not return inspect wire 176 for possible shorting concern.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 ignition OFF. 2. Disconnect the 80-way connector at the TCM. 3. Install TCM Breakout J 47275 to the OEM 80-way connector. Leave the TCM 80-way connector disconnected. 4. Disconnect the OEM 24-way connector from the transmission. 5. Inspect the routing of wire 111 in the chassis harness between the TCM and the transmission connector. 6. At TCM Overlay J 47275-1, 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 5*	*Go to Step 6*

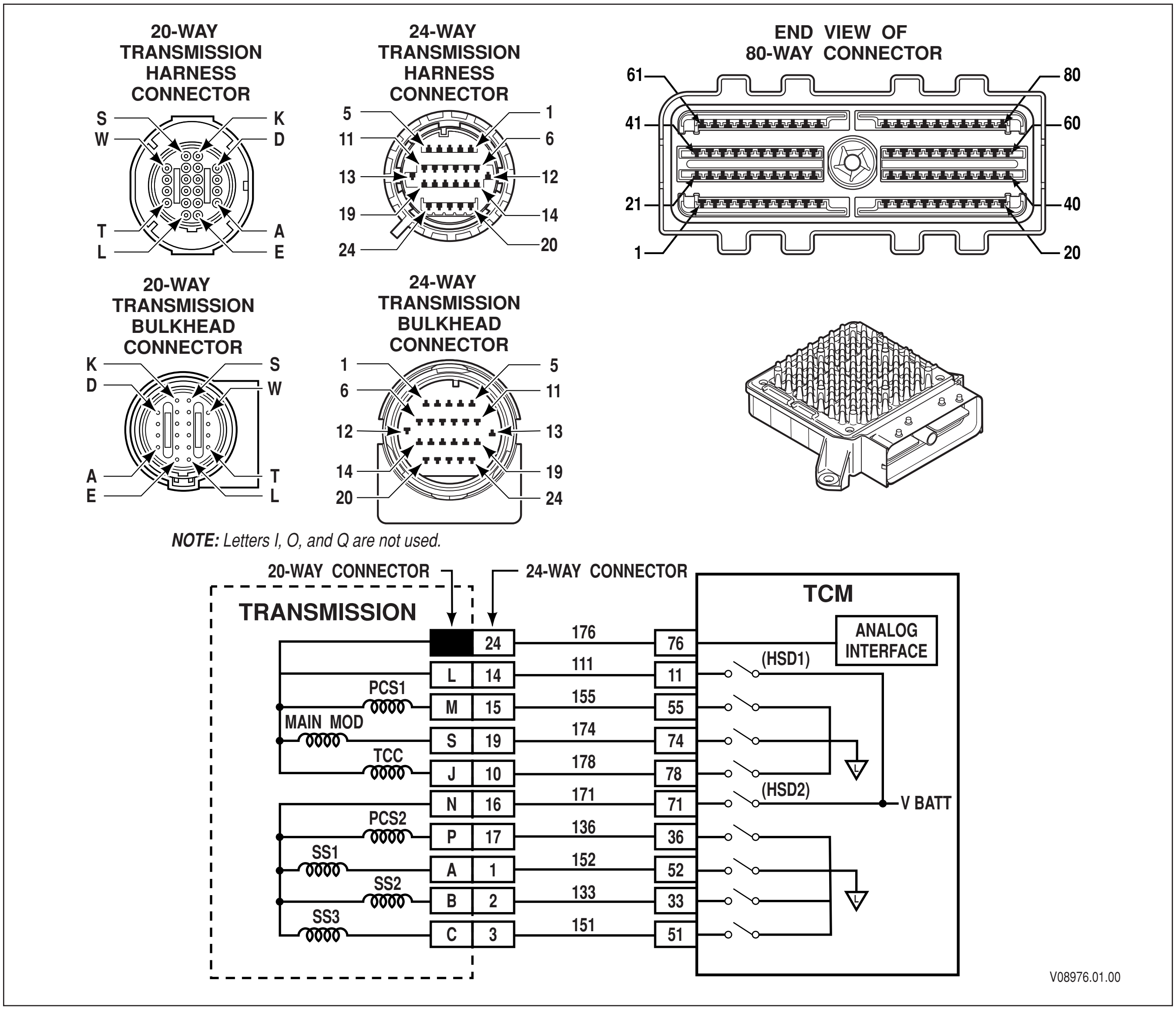
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 9*	
6	1. Turn the ignition OFF. 2. Disconnect the OEM 24-way connector from Transmission Breakout J 47278. Connect the transmission 24-way connector to the J 39700 Breakout Box. 3. Using a digital volt/ohmmeter multimeter (DVOM), test for wire-to-wire shorts between pin 14 and all other pins in the 24-way connector. ***NOTE: The resistance value between pins 14 and pins 10, 15, and 19 should read normal solenoid resistance.*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 7*	*Go to Step 8*
7	1. Remove the transmission oil pan. 2. Repair or replace the internal wiring harness (refer to the 1000 and 2000 Product Families Service Manual, SM4006EN or In-Chassis Maintenance, GN4008EN). 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 (batt)



Circuit Description

High Side Driver 1 (HSD1) supplies battery voltage to the Main Mod, TCC and PCS1 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 a greater than or equal to 6V in the HSD1 circuit when HSD1 is OFF during initialization. DTC P0659 could be caused by a short-to-battery or open condition in the high side wiring attached to HSD1 (wire 111).

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or less than 32V (24V TCM).
- HSD1 is commanded ON.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

DTC P0659 is set when the TCM detects a high voltage condition (greater than or equal to 6V) in three solenoids in the HSD1 circuit.

Actions taken when the DTC Sets

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

- If the failure occurs while in a forward range a shift to 1st, 3rd or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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 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

The numbers below refer to the 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 wire 111 of the OEM chassis harness.
5. This step tests for a wire-to-wire short in 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 HSD1 electrical circuit.*** Did DTC P0659 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4, Wire Check Procedures before performing steps.*** 1. Turn ignition OFF. 2. Install TCM Breakout J 47275 between the OEM and TCM 80-way connector. 3. Install Transmission Breakout J 47278 between the OEM and transmission 24-way connector. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, enter Solenoid Test mode and command PCS1 ON. 6. Determine the voltage drop in the high side of the PCS1 circuit as follows: • At TCM Overlay J 47275-1, measure voltage between pin 11 and an isolated ground. • At Transmission Overlay J 47278-1 measure voltage between pin 14 and ground. It will be necessary to use J 39700 Breakout Box at TCM Breakout J 47275 and Transmission Breakout J 47278. • 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 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 the ignition OFF. 2. Disconnect the TCM Breakout J 47275 from the TCM. Leave the OEM 80-way connector connected. 3. Disconnect the OEM 24-way connector from Transmission Breakout J 47278. 4. Inspect the routing of wire 111 in the chassis harness between the TCM and the transmission connector. 5. At TCM Overlay J 47275-1, test for wire-to-wire shorts between pin 11 and all other pins in the 80-way connector, and shorts-to-ground between pin 11 and chassis ground. 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 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 chassis harness. Is the repair complete?		*Go to Step 10*	
7	1. Turn the ignition OFF. 2. If not performed in Step 5 above, disconnect the OEM 24-way connector from Transmission Breakout J 47278. Leave the transmission 24-way connector connected to the Breakout Box. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 14 and all other pins in the 24-way connector, and shorts-to-ground between pin 14 and chassis ground. ***NOTE: The resistance value between pins 14 and pins 10, 15, and 19 should read normal solenoid resistance.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	1. Remove the oil pan. 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 P0701 Transmission Control System—Performance

NO SCHEMATIC FOR THIS DTC

Circuit Description

The Transmission Control Module (TCM) monitors the status of the pressure switches at start-up to detect the presence of hydraulic pressure.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- This test is run after engine start-up and runs as part of the transmission hydraulic initialization.

Conditions for Setting the DTC

DTC P0701 sets when transmission fluid temperature is above –25°C (–13°F) with an engine speed above 500 rpm for 6 seconds or 400 rpm for 15 seconds and forward or reverse range is selected and all the pressure switches do not indicate pressure.

Action Taken When the DTC Sets

- DTC P0701 is stored in the TCM history.
- The TCM inhibits TCC engagement.
- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).

Conditions for Clearing the MIL/DTC

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 failure.

Diagnostic Aids

- DTC P0701 may be logged if a forward or reverse range is selected immediately after the engine is started and before the TCM detects pressure at the switches (2 to 6 seconds after engine start).
- A plugged control main filter may cause this DTC to set. The control main filter is to be changed after the first 8000 km (5000 miles). Failure to change the filter at this interval may cause this DTC and other pressure switch DTCs to set.
- A cracked internal suction filter tube or damaged tube seal may cause this DTC to set.
- A stuck lube regulator valve (located in the front support) may cause this DTC to set. A high static oil level with the vehicle running is often a good indication of this complaint. Often pressure switch DTCs are set in this scenario.
- You may have to drive the vehicle in order to experience a fault.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

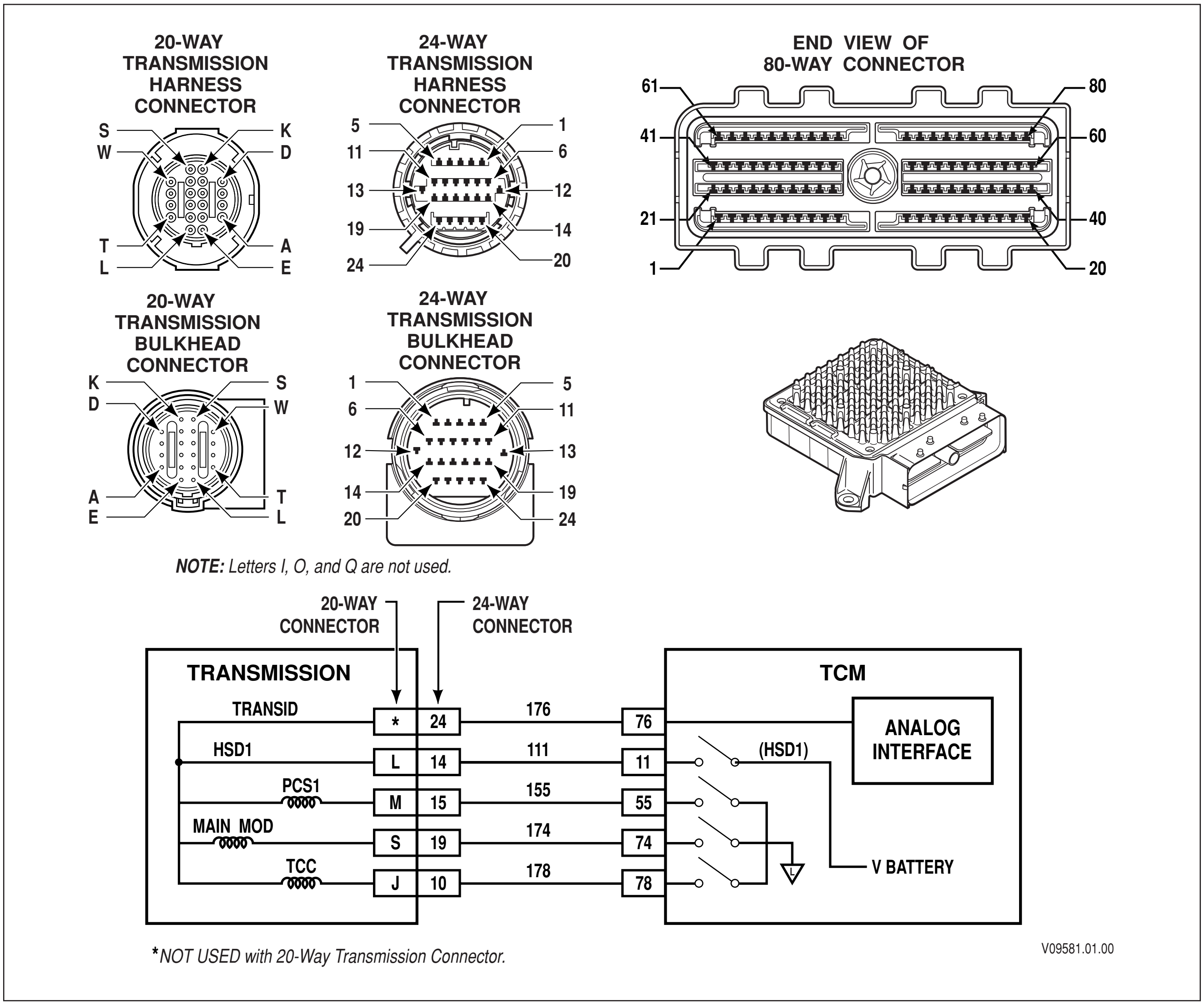
2. This step tests for proper fluid level.
5. This step tests for main pressure.

DTC P0701 Transmission Control System—Performance

Step	Action	Value	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn the ignition to ON, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Start the engine; check the transmission fluid level. Is the fluid at the appropriate level?		*Go to Step 3*	*Go to Step 4*
3	This DTC can be set after performing fluid service and filter change, after replacement of the PSM, or after a long period of storage. Have any of these conditions occurred?		*Go to Step 7*	*Go to Step 5*
4	Add fluid to the proper level. Is the fluid at the appropriate level?		*Go to Step 5*	—
5	Check main pressure (refer to Main Pressure Check Procedure, Appendix B). Is the pressure within the specified value?		*Go to Step 7*	*Go to Step 6*
6	No main pressure at idle may be an indication of the following: • Stuck or sticking lube regulator valve • Stuck or sticking main pressure regulator valve • Loose or damaged suction filter • Defective suction filter seal Was the reason for no main pressure condition found and repaired?		*Go to Step 7*	*Go to General Troubleshooting (Section 7)*
7	In order to verify your repair: 1. Clear the DTC. 2. Start the vehicle. 3. Use Allison DOC™, in the test passed section, to confirm the diagnostic test was run. Did the DTC return?		*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 identify the current transmission hardware configuration level and verify that compatible software calibration is used. The TCM senses the transmission configuration using TID wire 176. Initially, wire 176 will be connected to the High Side Driver (HSD1) via wire 111 in Allison 4th Generation Controls. This wiring configuration is designated TID A.

Condition for Running the DTC

The test is enabled by the TCM calibration.

Condition for Setting the DTC

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

DIAGNOSTIC TROUBLE CODES (DTC)

Action Taken When the DTC Sets

- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).

Conditions for Clearing the MIL/DTC

Allison DOC™ For PC can 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.
- DTC 702 could be caused by an open circuit in wire 176 in the chassis harness.
- 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

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

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

DTC P0702 Transmission Control System Electrical (TransID)

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Turn OFF the ignition. 2. Disconnect the 24-way connector at the TCM. 3. Using a digital volt/ohmmeter (DVOM), test for continuity between pins 24 (TID wire 176) and pin 14 in the transmission 24-way connector. 4. Consult values to determine the TransID level. 5. Compare the continuity test results from sub-step 3 with the TID in the build history of the transmission bill of material. Does continuity test results in sub-step 3 agree with the TransID of the transmission?	Wire 176 will be connected to the following wire in the transmission internal harness: TID A—pin 24 connected to pin 14 (wire 111) TID B—TBD	*Go to Step 4*	*Go to Step 3*
3	Repair or replace the internal transmission harness. Is the repair complete?		*Go to Step 8*	

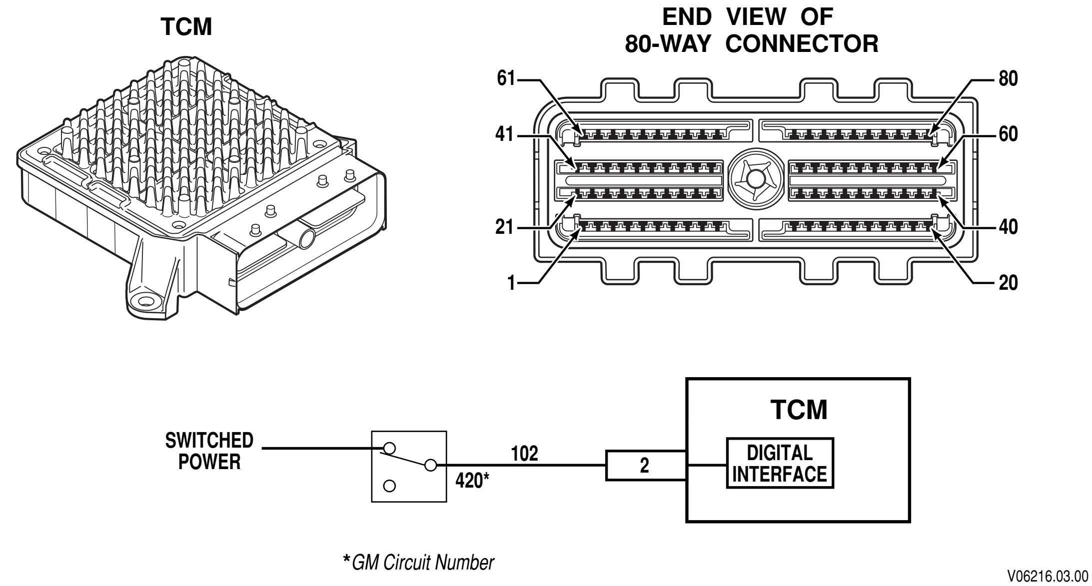
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
4	1. Turn OFF the 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 24-way connector. 5. Using a DVOM, test for continuity between pin 76 (TID wire) and pin 11 in the 80-way connector. 6. Consult values determine the TransID configuration of each TID level. 7. Compare the continuity test results from sub-step 5 with the TID in the build history of the transmission bill of material. Does the continuity test results in sub-step 5 agree with the TransID of the transmission?	Wire 176 will be connected to the following wire in the transmission internal harness: TID A—pin 76 connected to pin 11 (wire 111) TID B—TBD	*Go to Step 6*	*Go to Step 5*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. 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*	
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 conditions noted in failure records. Did the DTC return?		*Go to Step 1*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit



Circuit Description

A mechanical switch is used at the service brakes to send a positive voltage signal to the Transmission Control Module (TCM) indicating that the service brake has been applied. This feature is used on vehicle platforms where the Grade Braking feature is implemented. Input wire 102 is used to send a positive signal to the TCM.

Conditions for Running the DTC

- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM).
- No DTC P0721or P0722.

Conditions for Setting the DTC

The TCM sets a DTC with either of the following conditions:

- Condition 1—The vehicle has accelerated 10 or more times with TCM input indicating brakes applied.
- Condition 2—The vehicle has decelerated 10 or more times with TCM input indicating brakes released.

Action taken when the DTC Sets

- The MIL is not illuminated.
- No Grade Braking is allowed.
- Use the default assumption that the brake is off.
- TCM inhibits TCC engagement.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Clearing the DTC/CHECK TRANS Light

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 active.

Diagnostic Aids

DTC 703 indicates the TCM did not see the proper positive input signal for service brake status during an acceleration or deceleration cycle. This may indicate an open or short at the brake switch.

- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - A bent terminal
  - A backed-out
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation
- When diagnosing for an intermittent short or open condition, 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.
- Currently, this DTC is specific to vehicle applications that use grade braking feature only. Contact a GM dealer for proper troubleshooting procedure and switch pin locations.

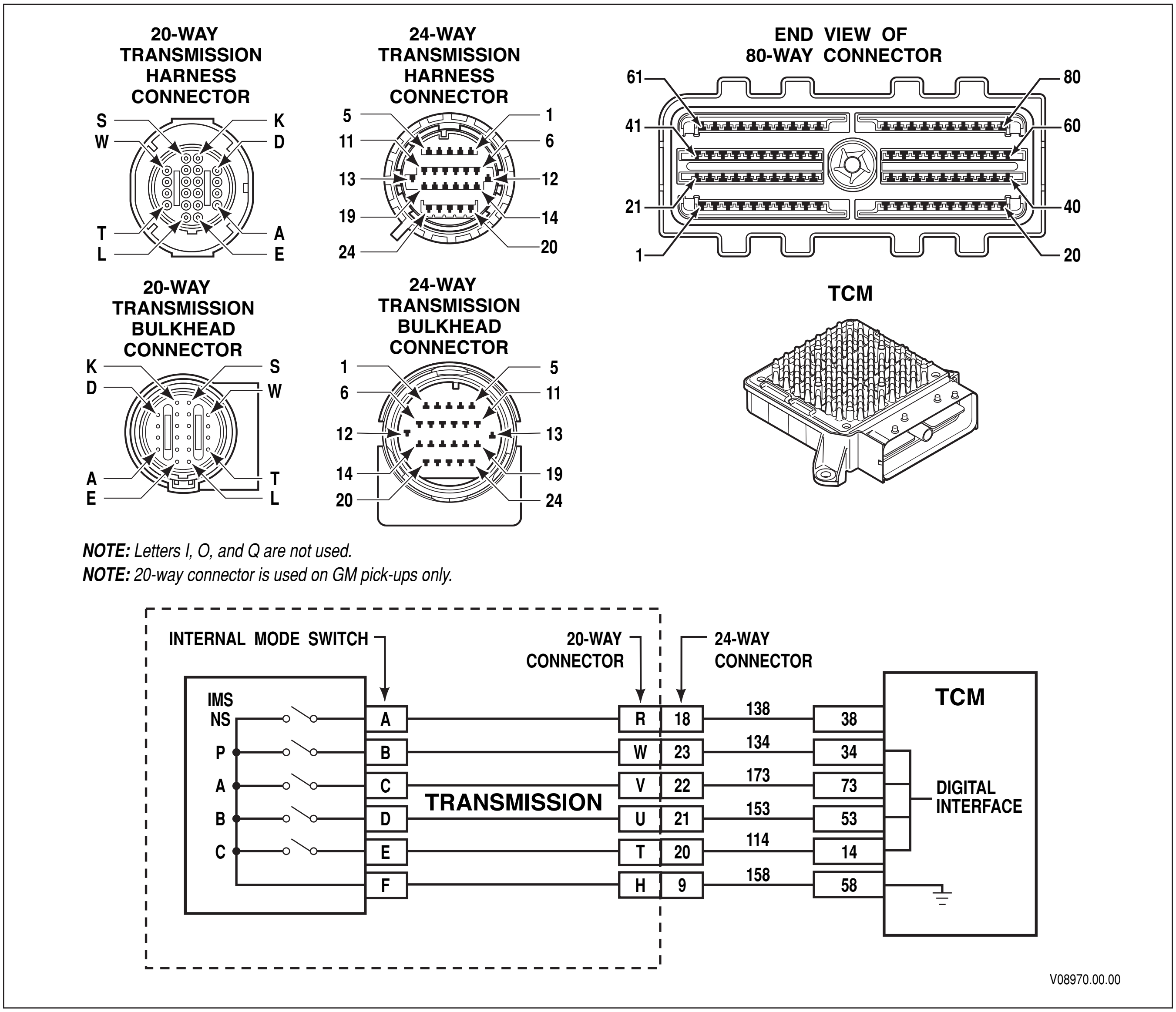
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit

Step	Action	Value	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn the ignition ON, with the engine OFF. 3. Record the DTC Failure Record Data. 4. Apply and release the service brake. Does Allison DOC™ indicate that brake switch is toggling off and on at input wire 102?		*Go to Diagnostic Aids*	*Go to Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the 80-way connector at the TCM. 3. Install J 39700 Breakout Box and J 47275 Breakout Box Adaptor. 4. Turn ON the ignition. 5. Measure the voltage at pin 2 on the Magnetic Overlay. 6. Apply and release the service brake. Is the voltage within the specified value?	Brakes applied 0.0V Brakes released 12.0V	*Go to Diagnostic Aids*	*Go to Step 4*
4	Go to the vehicle brake switch. With a digital volt/ohmmeter (DVOM), probe terminal C of the brake switch. Supply a ground connection at the other lead. With a DVOM, probe terminal C of the stop lamp switch. Supply a ground connection at other lead. Is voltage available?	Battery +	*Go to Step 5*	*Go to Step 6*
5	With a DVOM, probe terminal D of the brake switch Is voltage available?	Battery +	*Go to Step 8*	*Go to Step 7*
6	1. Remove the brake fuse. 2. Inspect the fuse for an open condition. Did you find and repair the condition?		*Go to Step 9*	
7	Repair or replace the brake switch assembly. Is repair complete?		*Go to Step 9*	
8	Check the input wiring harness running to the TCM for an open condition or short-to-ground. Did you find and correct the problem?		*Go to Step 9*	
9	In order to verify your repair: 1. Clear the DTC. 2. Using Allison DOC™, monitor status of input wire 102. 3. Drive the vehicle making at least 10 accelerations and decelerations cycles. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0706 Transmission Range Sensor Circuit—Performance



Circuit Description

An internal mode switch (IMS) is used by the TCM to detect the angular position of the shift selector shaft. There are five internal switches in the IMS: A, B, C, P, and NS. The TCM uses four of these switch inputs to determine the proper gear range that is selected. The fifth switch (NS), located in the IMS, is used as confirmation that the transmission is in neutral before the engine starter is engaged.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V.
- Engine speed is less than 350 rpm.

Conditions for Setting the DTC

DTC P0706 sets in GM medium duty applications when the engine control module allows a start in reverse or forward range. The TCM will inhibit to neutral. This DTC is set in the TCM and engine PCM/ECM.

DIAGNOSTIC TROUBLE CODES (DTC)

Actions taken when the DTC Sets

- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates on the second occurrence (OBD II Strategy).
- The diagnostic response is to shut all solenoids off, allowing the transmission to fail to hydraulic default "limp home". Shift selector and hydraulic state of logic valves determines range.
- DTC P0706 is stored in the TCM history.
- The TCM inhibits TCC engagement.
- Due to this failure and associated response, P0722 can also set.
- A shift to **R** (Reverse) will allow reverse range if a P0878 is not active.
- Main Mod is disabled.

Conditions for clearing the MIL/DTC

Allison DOC™ For PC–Service Tool can 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.

Diagnostics Aids

- 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.
- 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

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

3. This step tests IMS switch status.
4. This step tests TCM input response.
5. This step tests the wiring harness for opens or shorts
6. This step tests the switch status of the IMS.
7. This step tests the electrical integrity of the internal harness.

DTC P0706 Transmission Range Sensor Circuit—Performance

Step	Action	Value	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0706 Transmission Range Sensor Circuit—Performance *(cont'd)*

Step	Action	Value	Yes	No
2	Is the shift linkage properly adjusted?		*Go to Step 3*	*Go to Mechanic's Tips*
3	1. Install Allison DOC™. 2. Turn ignition ON with the engine OFF. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, monitor PRNDL A, B, C, and P status while moving the shift selector through each range. Does each switch toggle ON and OFF in the correct sequence, and does the range selected displayed on Allison DOC™ match the actual selected range?	Refer to Table 5–6, Allison DOC™ For PC–Service Tool Internal Mode Switch (IMS) Status	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Turn the ignition OFF. 2. Install J 47275 TCM Breakout inline at the TCM (to perform the following test the 16 pin bypass connector located on TCM Breakout J 47275 must be disconnected). 3. Turn the ignition ON. 4. At the TCM Overlay J 47275-1 connect in sequence pin 58 to pins 14, 34, 53, and 73. 5. Monitor the switch status on Allison DOC™. Does each switch toggle ON and OFF in the correct sequence as each pin is grounded?	A=pin 73 B=pin 53 C=pin 14 P=pin 34 Allison DOC™ Status: ON=Open circuit OFF=Grounded circuit	*Go to Step 5*	*Go to Step 11*
5	1. Turn the ignition OFF. 2. Remove J 47275 TCM Breakout. 3. Reconnect the 16-way bypass connector to the TCM. 4. Disconnect the 24-way connector at the transmission and install J 47278 Transmission Breakout. Connect only the 24-way vehicle harness end to the J 47278 Transmission Breakout. 5. Turn the ignition ON. 6. At the Transmission Overlay J 47278-1 connect pin 9 in sequence to 20, 21, 22, and 23. 7. Monitor the switch status on Allison DOC™. Does Allison DOC™ indicate the proper switch status for each switch when grounded?	Allison DOC™ Status: ON=Open circuit OFF=Grounded circuit 9=wire 158	*Go to Step 6*	*Go to Step 10*

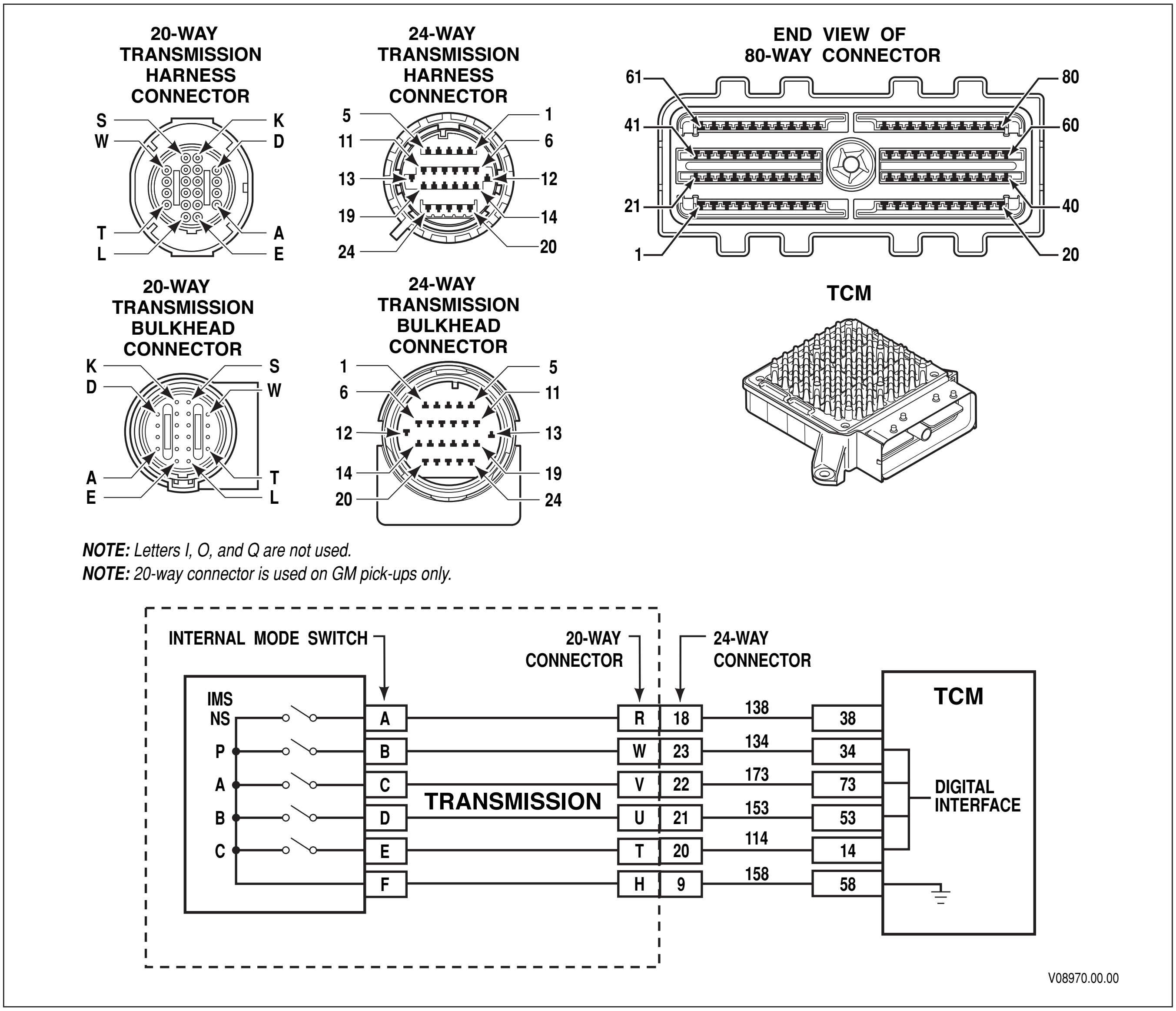
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0706 Transmission Range Sensor Circuit—Performance *(cont'd)*

Step	Action	Value	Yes	No
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout so only the transmission side of the adapter harness is connected at the transmission bulkhead connector. 3. At J 47278-1 Transmission Overlay, connect a digital volt/ohmmeter (DVOM) from pin 9 to each of the following pins (20, 21, 22, 23). 4. Selecting each range at the selector use the IMS chart in Section 5 to verify the proper switch states for each range. Are the IMS switch states proper for each range selected?	Pin 20=C Pin 21=B Pin 22=A Pin 23=P See Table 5–6, Allison DOC™ For PC–Service Tool Internal Mode Switch (IMS) Status ON=Open OFF=Closed	*Go to Diagnostic Aids*	*Go to Step 7*
7	1. Remove the transmission oil pan. 2. Disconnect the IMS internal connector. 3. With Transmission Breakout J 47278 still installed, as in Step 6, at the Transmission Overlay J 47278-1 connect one lead of the DVOM at each of the numbered terminals and the other lead to the corresponding B, C, D, E, F 6-pin connector terminals. 4. Check for continuity and wire-to-wire shorts at each of the internal harness wires. Did the internal harness check out?	B=23 C=22 D=21 E=20 F=9	*Go to Step 8*	*Go to Step 9*
8	Replace the IMS switch (refer to 1000 and 2000 Product Families Service Manual, SM4006EN). Is the replacement complete?		*Go to Step 12*	
9	Replace the internal wiring harness (refer to 1000 and 2000 Product Families Service Manual, SM4006EN). Is the replacement complete?		*Go to Step 12*	
10	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring. Harness repair performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair 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 10*	
12	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™, monitor PRNDL switch status while moving selector through all positions. Are the switch states proper according to Table 5–6, Allison DOC™ For PC–Service Tool Internal Mode Switch (IMS) Status?	Refer to Table 5–6, Allison DOC™ For PC–Service Tool Internal Mode Switch (IMS) Status	*System OK*	*Begin the diagnosis again. Go to Step 1*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0708 Transmission Range Sensor Circuit—High Input



Circuit Description

An internal mode switch (IMS) is used by the TCM to detect the angular position of the shift selector shaft. There are five internal switches in the IMS: A, B, C, P, and NS. The TCM uses four of these switch inputs to determine the proper gear range that is selected. The fifth switch (NS), located in the IMS, is used as confirmation that the transmission is in neutral before the engine starter is engaged.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V.
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

DTC P0708 sets when the TCM detects and invalid switch condition and parity errors occur over consecutive ignition cycles.

Actions Taken When the DTC Sets

- The **CHECK TRANS** light illuminates but no diagnostic response is implemented until after 50 warm-up cycles occur when an IMS switch parity error is active. A warm up cycle is defined as a 20 degree change in transmission temperature (Non-OBD II Strategy).
- The diagnostic response is to shut all solenoids off, allowing the transmission to fault to hydraulic default "limp home." Shift selector and hydraulic state of logic valves determines range.
- DTC P0708 is stored in the TCM history.
- The TCM inhibits TCC engagement.
- Due to this failure and associated response, P0722 can also be set.
- A shift to **R** (Reverse) will allow reverse range if a P0878 is not active.

Conditions for Clearing the MIL/DTC

Allison DOC™ For PC–Service Tool can 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.
- 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.

NOTE: Due to the TCM logic used to detect and set a P0708, this DTC can remain active even after an IMS switch replacement is complete and the ignition has been cycled. It is important to clear all active DTCs from the TCM after servicing the IMS switch.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

3. This step tests IMS switch status.
4. This step tests for proper TCM input response.
5. This step tests the wiring harness for opens or shorts.
6. This step tests the switch status of the IMS.
7. This step tests the electrical integrity of the internal harness.

DTC P0708 Transmission Range Sensor Circuit—High Input

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Is the shift linkage properly adjusted?		*Go to Step 3*	*Go to Mechanic's Tips*
3	1. Install Allison DOC™. 2. Turn the ignition ON with the engine OFF. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, monitor PRNDL A, B, C, P status while moving the shift selector through each range. Does each switch toggle ON and OFF in the correct sequence, and does the range selected displayed on Allison DOC™ match the actual physically selected range?	Refer to Table 5–6, Allison DOC™ For PC–Service Tool Internal Mode Switch (IMS) Status	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Turn the ignition OFF. 2. Install J 47275 TCM Breakout inline at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At the TCM Overlay J 47275-1, in sequence, connect pin 58 to pins 14, 34, 53, and 73. 5. Monitor the switch status on Allison DOC™. Does each switch toggle ON and OFF in the correct sequence as each pin is grounded?	A=pin 73 B=pin 53 C=pin 14 P=pin 34 Allison DOC™ Status ON=Open circuit OFF=Grounded circuit	*Go to Step 5*	*Go to Step 11*

DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Reconnect the 80-way connector to the TCM. 3. Disconnect the 24-way connector at the transmission and install J 47278 Transmission Breakout. Connect only the 24-way vehicle harness end to the J 47278 Transmission Breakout. 4. At the Transmission Overlay J 47278-1, in sequence, connect pin 9 to pins 20, 21, 22, 23. 5. Monitor the switch status on Allison DOC™. Does Allison DOC™ indicate the proper switch status for each switch when grounded?	Allison DOC™ Status ON=Open circuit OFF=Grounded circuit 9=wire 158	*Go to Step 6*	*Go to Step 10*
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout so only the transmission side of the adapter harness is connected at the transmission bulkhead connector. 3. At the Transmission Overlay J 47278-1 connect a digital volt/ohmmeter (DVOM) from pin 9 to each of the following pins: 20, 21, 22, and 23. 4. Selecting each range at the selector use the IMS chart in Section 5 to verify the proper switch states for each range. Are the IMS switch states proper for each range selected?	A=pin 22 B=pin 21 C=pin 20 P=pin 23 (refer to IMS chart in Section 5) ON=Open OFF=Closed	*Go to Diagnostic Aids*	*Go to Step 7*
7	1. Remove the transmission oil pan. 2. Disconnect the IMS internal connector. 3. With J 47278 Transmission Breakout installed, as in Step 6, at the J 47278-1 Transmission Overlay, connect one lead of the DVOM at each of the numbered terminals and the other lead to the corresponding B, C, D, E, and F 6-pin connector terminals. 4. Check for continuity and wire-to-wire shorts at each of the internal harness wires. Did the internal harness check out?	B=23 C=22 D=21 E=20 F=9	*Go to Step 8*	*Go to Step 9*
8	Replace the IMS switch (refer to SM4006EN, 1000 and 2000 Product Families Service Manual). Is the replacement complete?		*Go to Step 12*	
9	Replace the internal wiring harness (refer to SM4006EN, 1000 and 2000 Product Families Service Manual). Is the replacement complete?		*Go to Step 12*	

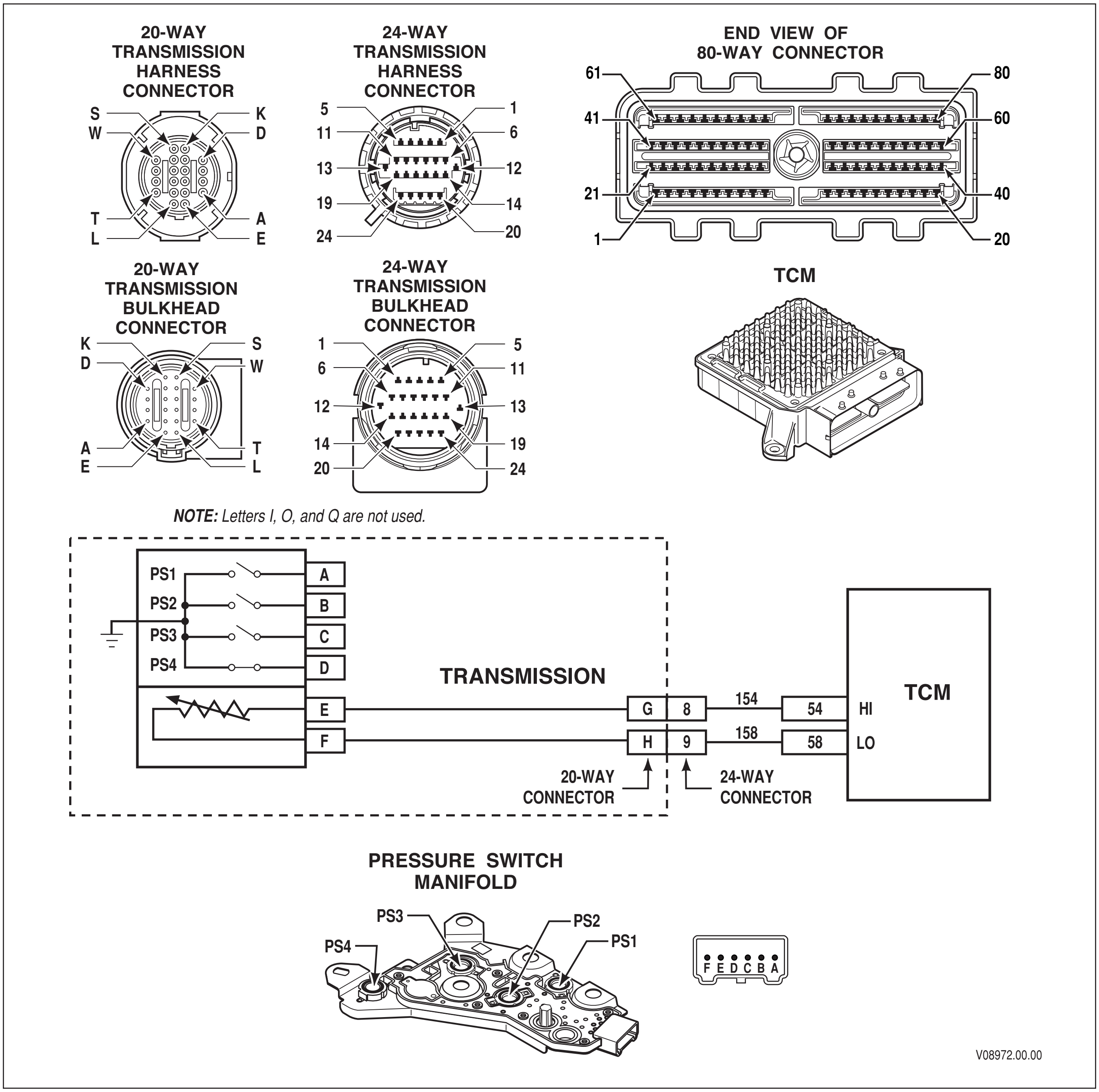
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
10	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Is the repair 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. 3. Using Allison DOC™, monitor PRNDL switch status while moving selector through all positions. Does each switch toggle according to IMS table?	Refer to Table 5–6, Allison DOC™ For PC–Service Tool Internal Mode Switch (IMS) Status	*System OK*	*Begin the diagnosis again. Go to Step 1*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0711 Transmission Fluid Temperature Sensor Circuit—Performance



Circuit Description

The Transmission Fluid Temperature (TFT) sensor is incorporated into the Pressure Switch Manifold (PSM), which is located in the transmission oil pan. The TFT sensor is a thermistor that changes its resistance value based on the temperature of the transmission fluid. The Transmission Control Module (TCM) measures the voltage drop across the TFT sensor. As the TFT sensor resistance changes the voltage drop recorded across the thermistor will increase or decrease proportionately. The TCM uses this information to determine sump temperature.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- DTC P0721, P0722, P0717, P0716, P0713, or P0712 is not active.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM).
- The engine rpm is greater than 200 rpm for more than 5 seconds.
- The engine rpm is greater than 450 rpm for more than 2 seconds with output speed of 100 rpm or above, indicating that a range is selected.
- A valid start-up temperature is detected.

Conditions for Setting the DTC

One of the following conditions occur:

- The TCM detects a temperature change that is under a set 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 decreases 40°C (104°F) or more within a duration of 6 or more seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The MIL illuminates on the second occurrence (OBD II Strategy).
- The TCM stores DTC P0711 in TCM history.
- The TCM uses calibration default for temperature values, 93ºC (199ºF).

Conditions for Clearing the DTC/CHECK TRANS Light

- 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.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition has been cycled.

DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Aids

- If DTC P0711 does not return when cleared, but was once present, an intermittent condition has occurred on the circuit shown in the thumbnail drawing. Due to the nature of intermittent conditions, it may be necessary to eliminate all of the components associated with the transmission before returning the vehicle to the vehicle manufacturer for harness replacement. The following components should be tested as indicated before suspecting an OEM vehicle harness.
  - TCM—Substitute a known good TCM and drive vehicle, if concern is eliminated, reinstall old TCM to confirm complaint returns.
  - Internal Harness and PSM—Remove the transmission oil pan, remove internal harness and PSM assembly. Using a digital volt/ohmmeter (DVOM), check for open or shorting conditions and check the thermistor for the proper resistance value.
- Inspect the wiring for poor electrical connections at the TCM and the transmission connector. Look for the following conditions:
  - A bent terminal
  - A back-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.
- Using Allison DOC™ For PC–Service Tool monitor transmission fluid temperature (TFT). TFT should rise steadily during warm-up cycles and then stabilize.
- DTC P0218 may set after DTC P0711 has set. Follow the diagnostic table for DTC P0711 before proceeding to the diagnostic for DTC P0218.

Test Description

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

2. This step tests for proper AT fluid level and condition.
3. This step tests for the proper reference voltage.
4. This step verifies which condition has set DTC P0711.
5. This step tests the resistance value of the internal wiring harness and TFT sensor.
6. This step tests for opens and shorts in the main wiring harness.
8. This step tests the resistance value of the internal TFT sensor.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0711 Transmission Fluid Temperature Sensor Circuit—Performance

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Allison Transmission Fluid check procedure (Appendix R)*
3	1. Install Allison DOC™. 2. With the engine OFF, turn the ignition to the ON position. 3. Record the DTC Failure Record data. 4. Clear the DTCs. 5. Monitor the TFT on Allison DOC™. 6. Drive the vehicle and observe Allison DOC™ for one of the following conditions: • No transmission temperature change • An unrealistic transmission temperature change of greater than 1.5ºC (2.7ºF) in 1 second. Did either of the fail conditions occur?	1.5ºC (2.7ºF)	*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn the ignition OFF. 2. Install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. 3. In order to properly perform this test the TCM must be disconnected from the temperature sensor circuit. To perform the following test the 16-pin bypass connector located on J 47275 TCM Breakout must be disconnected (refer to Figure 5.2 in Beginning the Troubleshooting Process section). 4. Turn the ignition ON. 5. At the J 47275-1 TCM Overlay connect a DVOM, measure voltage at pin 54 to pin 58. Is the voltage within the specified values	4.75 to 5.0V	*Go to Step 5*	*Go to Step 11*
5	1. Turn the ignition OFF. 2. Reconnect 16-pin bypass connector. 3. With the 80-way vehicle harness connector disconnected from the TCM, install the harness at the J 47275 TCM Breakout. The TCM needs to be disconnected to properly perform this test. 4. At J 47275-1 TCM Overlay, connect a DVOM, measure voltage at pin 54 to pins 58. Is the resistance within the specified value?	3398–3582 Ohms at 20ºC (68ºF)	*Go to Diagnostic Aids*	*Go to Step 6*

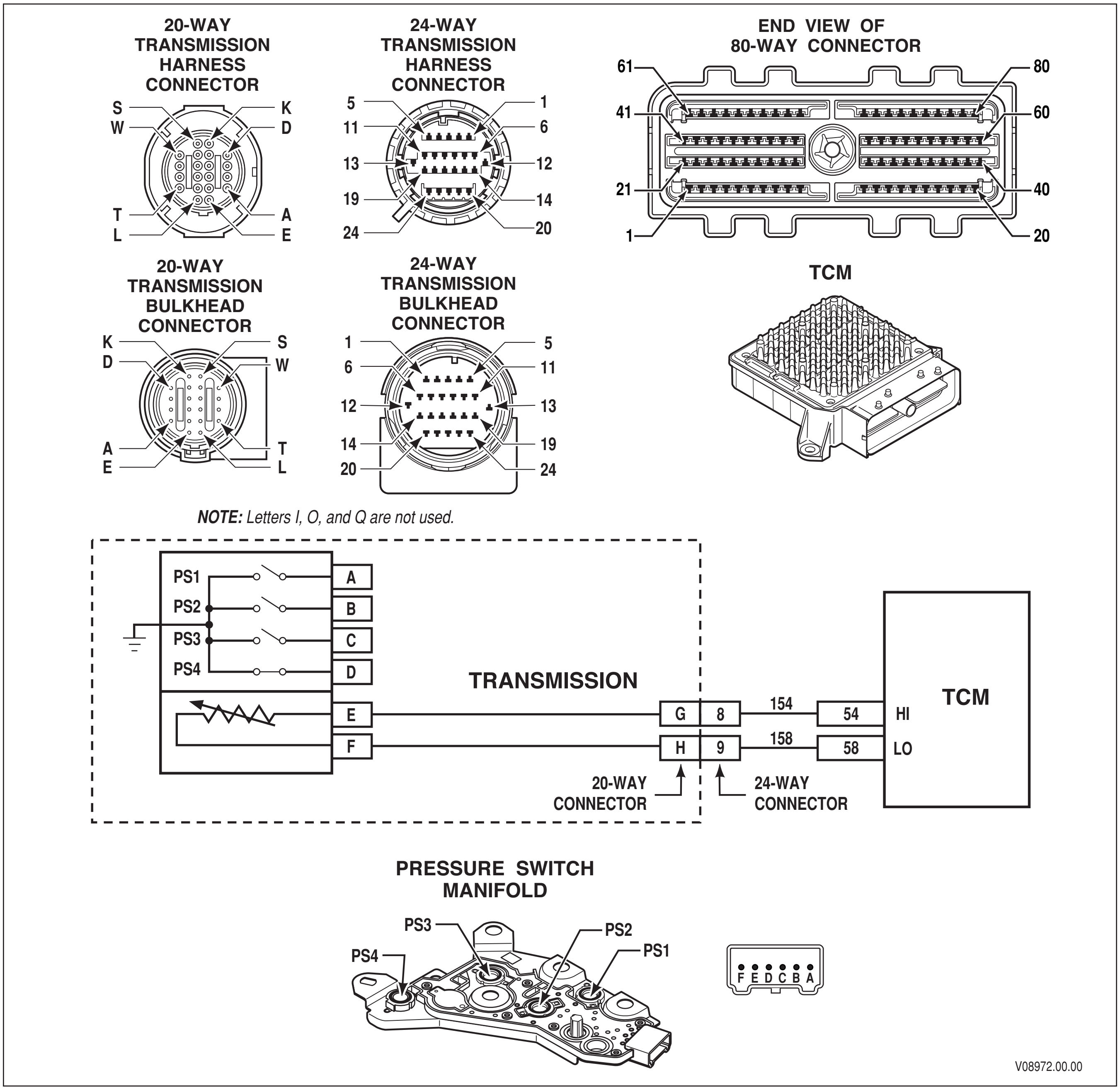
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
6	1. Disconnect the 24-way connector at the transmission and install J 47278 Transmission Breakout. Connect only the J 47278 Transmission Breakout to the transmission, the vehicle side of the harness should be isolated for the test. 2. At the J 47278-1 Transmission Overlay, using a DVOM, measure resistance at main transmission connector pins 8 or 9. Is the resistance within the specified value?	3398–3582 Ohms at 20ºC (68ºF)	*Go to Step 7*	*Go to Step 8*
7	Have vehicle-wiring harness repaired. ***NOTE: The vehicle OEM has responsibility for all external wiring. The OEM should perform vehicle harness repairs.*** Is the repair complete?		*Go to Step 12*	
8	1. Remove the oil pan. 2. Disconnect the PSM from the internal wiring harness. 3. Using a DVOM, measure Pressure Switch Manifold (PSM) resistance at pins E and F. Is resistance within the specified values?		*Go to Step 9*	*Go to Step 10*
9	Replace the internal harness (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 12*	
10	Replace the PSM (refer to Mechanic's Tips). Is 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. Using Allison DOC™, 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 P0712 Transmission Fluid Temperature Sensor Circuit—Low Input



Circuit Description

The Transmission Fluid Temperature (TFT) sensor is incorporated into the Pressure Switch Manifold (PSM), which is located in the transmission oil pan. The TFT sensor is a thermistor that changes its resistance value based on the temperature of the transmission fluid. The Transmission Control Module (TCM) measures the voltage drop across the TFT sensor. As the TFT sensor resistance changes the voltage drop recorded across the thermistor will increase or decrease proportionately. The TCM uses this information to determine sump temperature.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- DTC P0711, P0713 are not active.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM).
- The engine rpm is greater than 200 rpm for more than 5 seconds.
- The engine has been running for 20 seconds with a coolant temperature above 20°C (68°F).

Conditions for Setting the DTC

DTC P0712 sets when the TFT sensor indicates a voltage of less than 313mV for 2.5 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The MIL illuminates on the second occurrence (OBD II Strategy).
- The TCM stores DTC P0712 in TCM history.
- TCM uses calibration default for temperature values.

Conditions for Clearing the DTC/CHECK TRANS Light

- 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.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition has been cycled.

Diagnostic Aids

- If DTC P0712 does not return when cleared, but was once present, an intermittent condition has occurred on the circuit shown in the thumbnail drawing. Due to the nature of intermittent conditions, it may be necessary to eliminate all of the components associated with the transmission before returning the vehicle to the vehicle manufacturer for harness replacement. The following components should be tested as indicated before suspecting an OEM vehicle harness.
  - TCM—Substitute a known good TCM and drive vehicle, if concern is eliminated, reinstall old TCM to confirm complaint returns.
  - Internal Harness and PSM—Remove the transmission oil pan, remove internal harness and PSM assembly. Using a digital volt/ohmmeter (DVOM), check for open or shorting conditions and check the thermistor for the proper resistance value.
- Inspect the wiring for poor electrical connections at the TCM and the transmission connector. Look for the following conditions:
  - A bent terminal
  - A back-out terminal
  - A damaged terminal—loss of terminal tension
  - 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.
- DTC P0218 may set after DTC P0712 has set. Follow the diagnostic table for DTC P0712 before proceeding to the diagnostic for DTC P0218.

DIAGNOSTIC TROUBLE CODES (DTC)

- A short-to-ground on wire 154 may allow a DTC P0712 to set. A default value of 160ºC (320ºF) TFT on Allison DOC™ For PC–Service Tool may indicate that this has occurred.

Test Description

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

2. This step tests for proper AT fluid level and condition.
3. This step verifies which condition has set the DTC P0712.
4. This step tests for the proper reference voltage at TCM.
5. This step tests the resistance value of the internal wiring harness and TFT sensor.
6. This step tests for opens and shorts in the main wiring harness.
8. 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Install Allison DOC™. 2. With the engine OFF, turn the ignition to the ON position. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Monitor the TFT on Allison DOC™. 6. Drive the vehicle and observe Allison DOC™ for one of the following conditions: • No transmission temperature change • An unrealistic transmission temperature change of greater than 1.5ºC (2.7ºF) in 1 second. Did either of the fail conditions occur?	1.5ºC (2.7ºF)	*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition OFF. 2. Install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. 3. In order to properly perform this test the TCM must be disconnected from the temperature sensor circuit. To perform the following test the 16-pin bypass connector located on J 47275 TCM Breakout must be disconnected (refer to Figure 5–2 in Beginning the Troubleshooting Process section). 4. Turn the ignition ON. 5. At J 47275-1 TCM overlay, connect a DVOM, measure voltage at pin 54 to pin 58. Is the voltage within the specified values?	4.75–5.0V	*Go to Step 5*	*Go to Step 11*
5	1. Turn the ignition OFF. 2. Reconnect 16-pin bypass connector. 3. With the 80-way vehicle harness connector disconnect from the TCM, install it at J 47275 TCM Breakout. The TCM needs to be disconnected to properly perform this test. 4. At J 47275-1 TCM overlay, connect a DVOM, measure the resistance at pin 54 and 58. Is the resistance within the specified value?	3398–3582 Ohms at 20°C (68°F) Refer to Table 5–11, Transmission Fluid Temperature (TFT) Sensor Resistance vs. Temperature)	*Go to Diagnostic Aids*	*Go to Step 6*
6	1. Disconnect the 24-way connector at the transmission and install J 47278 Transmission Breakout. Connect only the J 47278 Transmission Breakout to the transmission, the vehicle side of the harness should be disconnected for this test. 2. At J 47278-1 Transmission Overlay, using a DVOM, measure resistance at main transmission connector, pins 8 and 9. Is the resistance within the specified values?	3398–3582 Ohms at 20°C (68°F) Refer to Table 5–11, Transmission Fluid Temperature (TFT) Sensor Resistance vs. Temperature)	*Go to Step 7*	*Go to Step 8*
7	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Have the vehicle wiring harness repaired. Is the repair complete?		*Go to Step 12*	
8	1. Remove the oil pan. 2. Disconnect the PSM from the internal wiring harness. 3. Using a DVOM, measure PSM resistance at pins E and F. Is resistance within the specified values?	3398–3582 Ohms at 20°C (68°F) Refer to Table 5–11, Transmission Fluid Temperature (TFT) Sensor Resistance vs. Temperature)	*Go to Step 9*	*Go to Step 10*
9	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 12*	

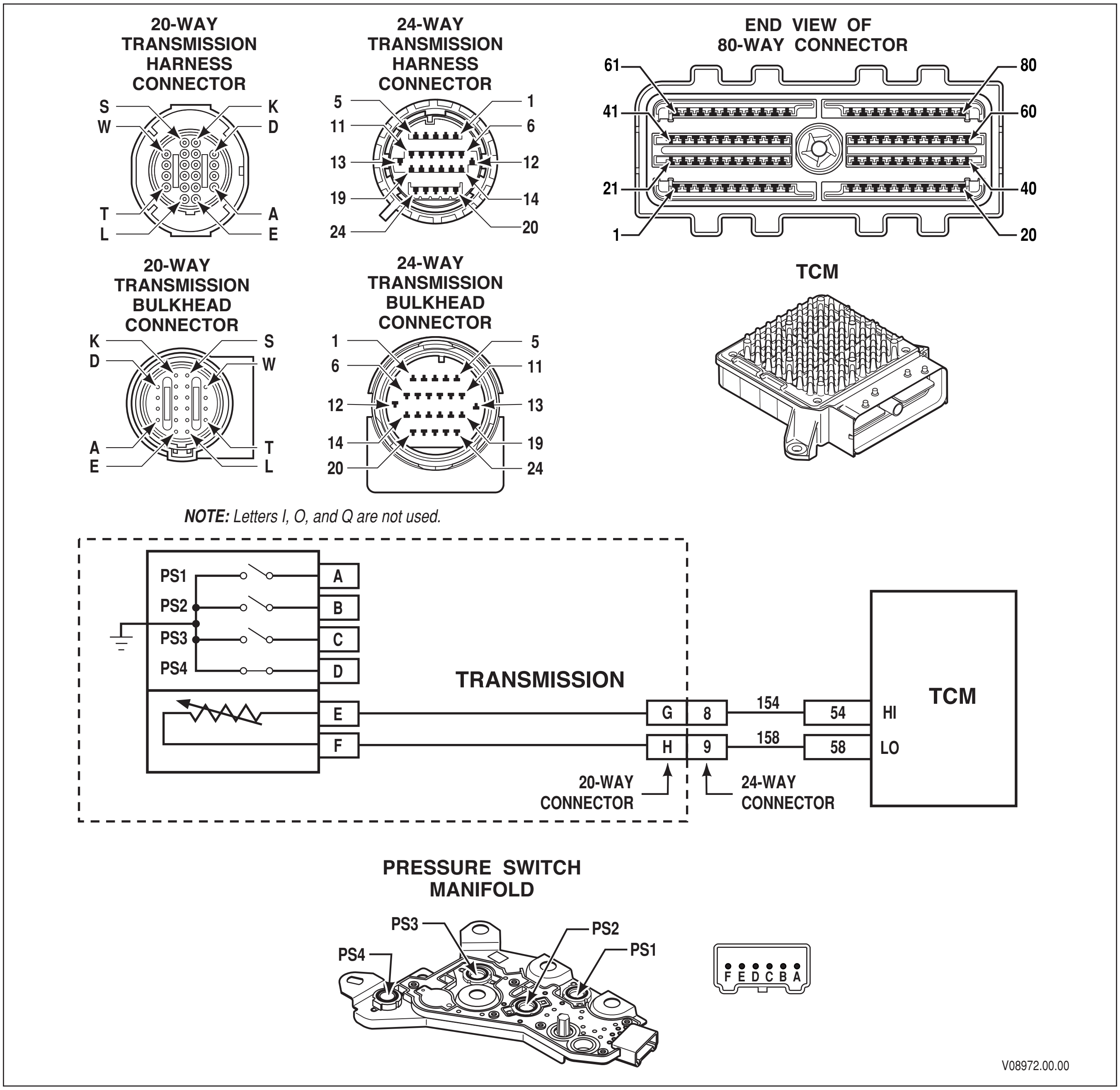
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
10	Replace the PSM (refer to Mechanic's Tips). 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. Using Allison DOC™, monitor the transmission fluid temperature. 3. Drive the vehicle under normal operating conditions. 4. 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 P0713 Transmission Fluid Temperature Sensor Circuit—High Input



Circuit Description

The Transmission Fluid Temperature (TFT) sensor is incorporated into the Pressure Switch Manifold (PSM), which is located in the transmission oil pan. The TFT sensor is a thermistor that changes its resistance value based on the temperature of the transmission fluid. The Transmission Control Module (TCM) measures the voltage drop across the TFT sensor. As the TFT sensor resistance changes the voltage drop recorded across the thermistor will increase or decrease proportionately. The TCM uses this information to determine sump temperature.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- DTC P0711, P0712 are not active.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM).
- The engine rpm is greater than 200 rpm for more than 5 seconds.
- The engine has been running for 20 seconds with a coolant temperature above 20ºC (68ºF).

Conditions for Setting the DTC

DTC P0713 sets when the TCM detects a voltage greater than 4.84V for 2.5 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The MIL illuminates on the second occurrence (OBD II Strategy).
- The TCM stores DTC P0713 in TCM history.
- TCM uses calibration default for temperature values.

Conditions for Clearing the DTC/CHECK TRANS Light

- 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 a diagnostic fault occurring.
- The TCM cancels the DTC default actions when the fault no longer exists and the ignition has been cycled.

Diagnostic Aids

- If DTC P0713 does not return when cleared, but was once present, an intermittent condition has occurred on the circuit shown in the thumbnail drawing. Due to the nature of intermittent conditions, it may be necessary to eliminate all of the components associated with the transmission before returning the vehicle to the vehicle manufacturer for harness replacement. The following components should be tested as indicated before suspecting an OEM vehicle harness.
  - TCM—Substitute a known good TCM and drive vehicle, if concern is eliminated, reinstall old TCM to confirm complaint returns.
  - Internal Harness and PSM—Remove the transmission oil pan, remove internal harness and PSM assembly. Using a digital volt/ohmmeter (DVOM), check for open or shorting conditions and check the thermistor for the proper resistance value.
- Inspect the wiring for poor electrical connections at the TCM and the transmission connector. Look for the following conditions:
  - A bent terminal
  - A back-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.
- DTC P0218 may set after DTC P0713 has set. Follow the diagnostic table for DTC P0713 before proceeding to the diagnostic for DTC P0218.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

2. This step tests for proper AT fluid level and condition
3. This step verifies which condition has set the DTC P0713.
4. This step tests for the proper 5-voltage reference voltage at TCM.
5. This step tests the resistance value of the internal harness and TFT sensor.
6. This step tests for opens and shorts in the main harness.
8. 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Is the transmission fluid level correct?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Install Allison DOC™. 2. With the engine OFF, turn the ignition to the ON position. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Monitor the TFT on Allison DOC™. 6. Drive the vehicle and observe Allison DOC™ for one of the following conditions: • No transmission temperature change. • An unrealistic transmission temperature change of greater than 1.5ºC (2.7ºF) in 1 second. Did either of the fail conditions occur?	1.5ºC (2.7ºF)	*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn the ignition OFF. 2. Install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. 3. In order to properly perform this test, the TCM must be disconnected from the temperature sensor circuit. To perform the following test the 16-pin bypass connector located on J 47275 TCM Breakout must be disconnected (refer to Figure 5–2 in Beginning the Troubleshooting Process section). 4. Turn the ignition ON. 5. At J 47275-1 TCM Overlay, connect a DVOM, measure voltage at pin 54 to pin 58. Is the voltage within the specified values?	4.75–5.0V	*Go to Step 5*	*Go to Step 11*

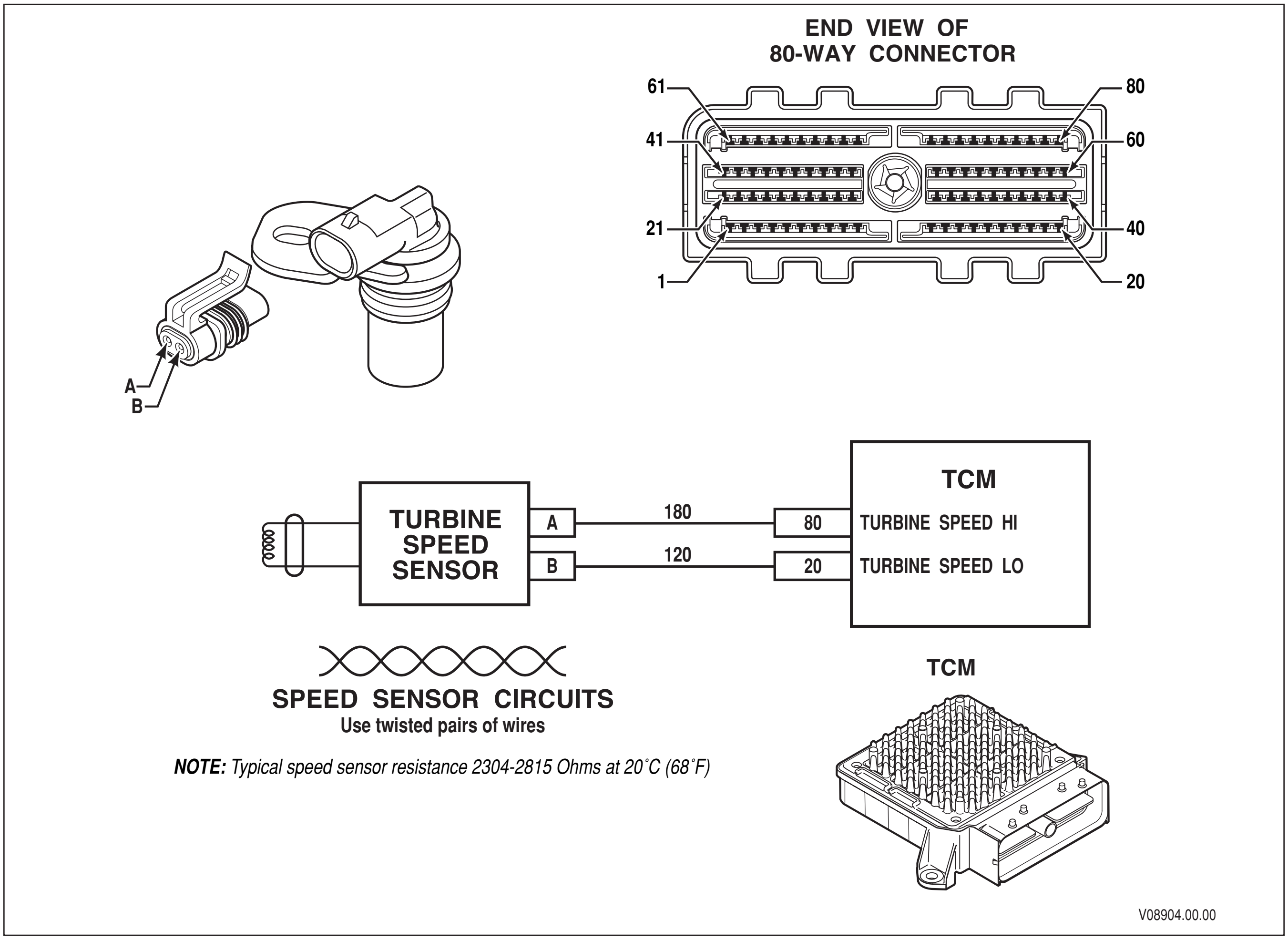
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Reconnect 16-pin bypass connector. 3. With the 80-way vehicle harness connector disconnected from the TCM, install it at J 47275 TCM Breakout. The TCM needs to be disconnected to properly perform this test. 4. At J 47275-1 TCM Overlay, connect a DVOM, measure the resistance at pin 54 and 58. Is the resistance within the specified value?	3398–3582 Ohms at 20°C (68°F)	*Go to Diagnostic Aids*	*Go to Step 6*
6	1. Disconnect the 24-way connector at the transmission and install J 47278 Transmission Breakout. Connect only the J 47278 Transmission Breakout to the transmission, the vehicle side of the harness should be disconnected for this test. 2. At J 47278-1 Transmission Overlay, using a DVOM, measure resistance at main transmission connector pins 8 and 9. Is the resistance within the specified value?	3398–3582 Ohms at 20°C (68°F)	*Go to Step 7*	*Go to Step 8*
7	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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 12*	
8	1. Remove the oil pan. 2. Disconnect the PSM from the internal wiring harness. 3. Using a DVOM, measure PSM resistance at pins E and F. Is resistance within the specified values?	3398–3582 Ohms at 20°C (68°F)	*Go to Step 9*	*Go to Step 10*
9	Replace the internal wiring harness (refer to Mechanic's Tips). Is the repair or replacement complete?		*Go to Step 12*	
10	Replace the PSM (refer to Mechanic's Tips). 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. Using Allison DOC™, monitor the transmission fluid temperature. 3. Drive the vehicle under normal operating conditions making sure coolant temperature is over 20°C (68°F). 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



Circuit Description

The speed sensors are variable reluctance devices which 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 which 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 (such as a gear tooth) 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. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.

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 18V and less than 32V (24V TCM).
- DTC P0717, P0721, or P0722 is not active.
- Turbine speed is above 200 rpm.
- Shift is complete and range attained is not neutral.
- For fire truck vocations, pump is not pumping.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

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

- Unrealistic large change 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 signal. 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.

Action 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 the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM inhibits TCC engagement.
- The TCM freezes shift adapts.

Conditions for Clearing the DTC/CHECK TRANS Light

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.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and select 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)
- 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.
- Inspect the turbine speed tone wheel/PTO gear for possible damage.

Test Description

The numbers below refer to the 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 turbine speed sensor resistance.

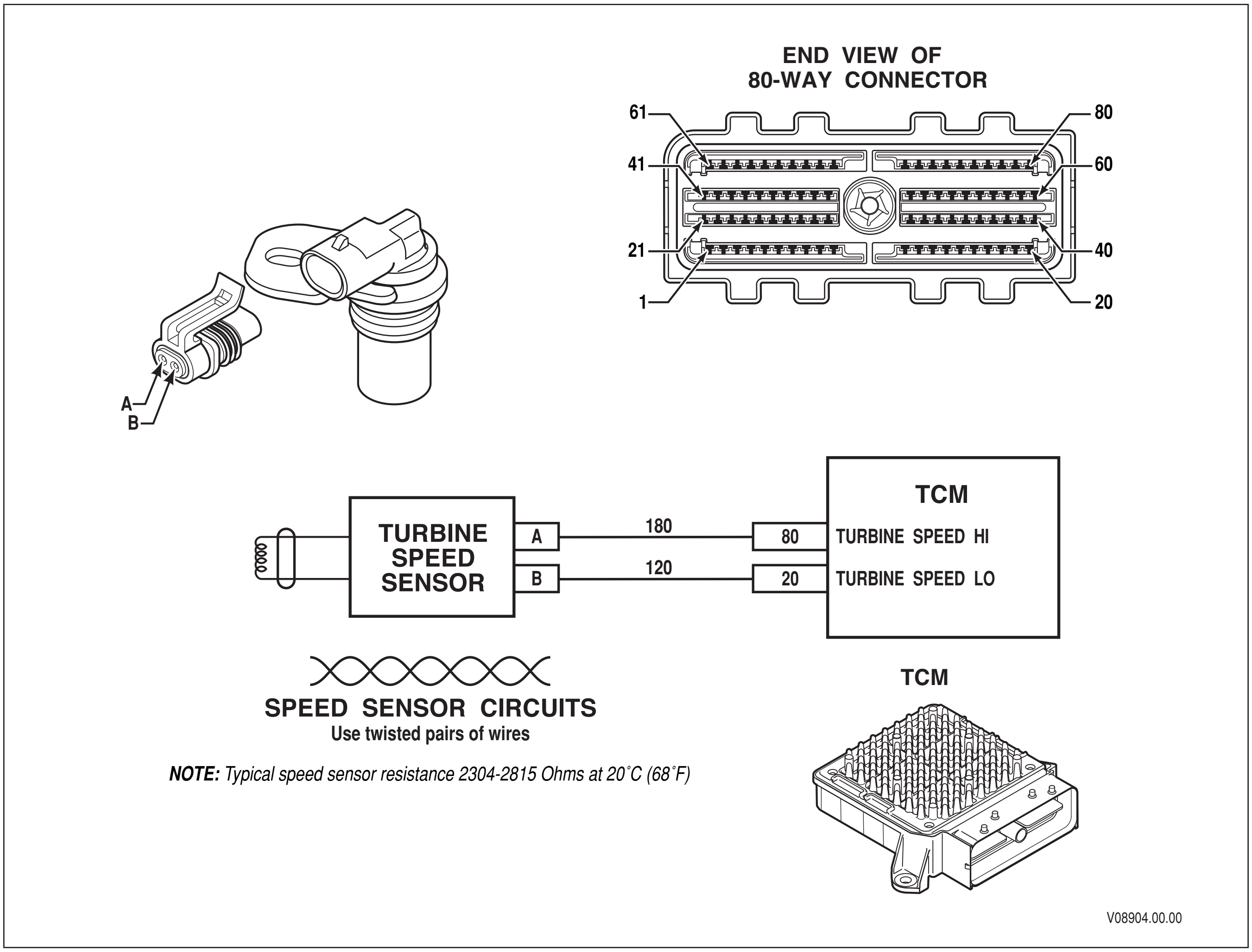
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0716 Turbine Speed Sensor Circuit—Performance

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
3	1. Turn the ignition OFF. 2. Disconnect the 80-way connector at the TCM. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. 3. Using a digital volt/ohmmeter (DVOM), measure the resistance between connector pins 20 and 80. Is the speed sensor resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*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. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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*	
6	***NOTE: Do not rotate the speed sensor in the retaining bracket. Orientation is fixed, and if changed, may cause improper operation.*** Replace the turbine speed sensor (refer to Mechanic's Tips). Is the replacement complete?	Refer to Figure 1–8	*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™, monitor turbine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0717 Turbine Speed Sensor Circuit—No Signal



Circuit Description

The speed sensors are variable reluctance devices which 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 which 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 (such as a gear tooth) 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. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or less than 32V (24V TCM).
- DTC P0721, P0722, P0731, P0732, P0733, P0734, P0735, or P0736 is not active.
- When unrealistic large change in turbine speed is detected.
  - Engine is running.
  - Shift is not in process.
  - Range attained is not neutral.
  - Transmission fluid temperature is above –25°C (–13°F).
  - For fire truck vocations, pump is not pumping.
- When unrealistic low turbine speed is detected.
  - Engine is running.
  - Shift is not in process.
  - Range attained is not neutral.
  - Transmission fluid temperature is above –25°C (–13°F).
  - Transmission output speed is at or above 150 rpm or engine speed is at or above 400 rpm.
  - For fire truck vocations, pump is not pumping.

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 an unrealistic change in transmission turbine speed is detected at or above 800 rpm. The failure pending response is to lock in the current range.
- 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.

Action 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.
  - If failure occurs under other conditions, the transmission shifts to 1st, 3rd, or 5th.
  - If the shift selector is moved to **N** (Neutral), **R** (Reverse), or any other forward range, the transmission will lock in **N** (Neutral).
- DTC P0717 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Clearing the DTC/CHECK TRANS Light

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.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and select 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).
- 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 the 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 turbine speed sensor resistance at the sensor.

DTC P0717 Turbine Speed Sensor Circuit—No Signal

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*

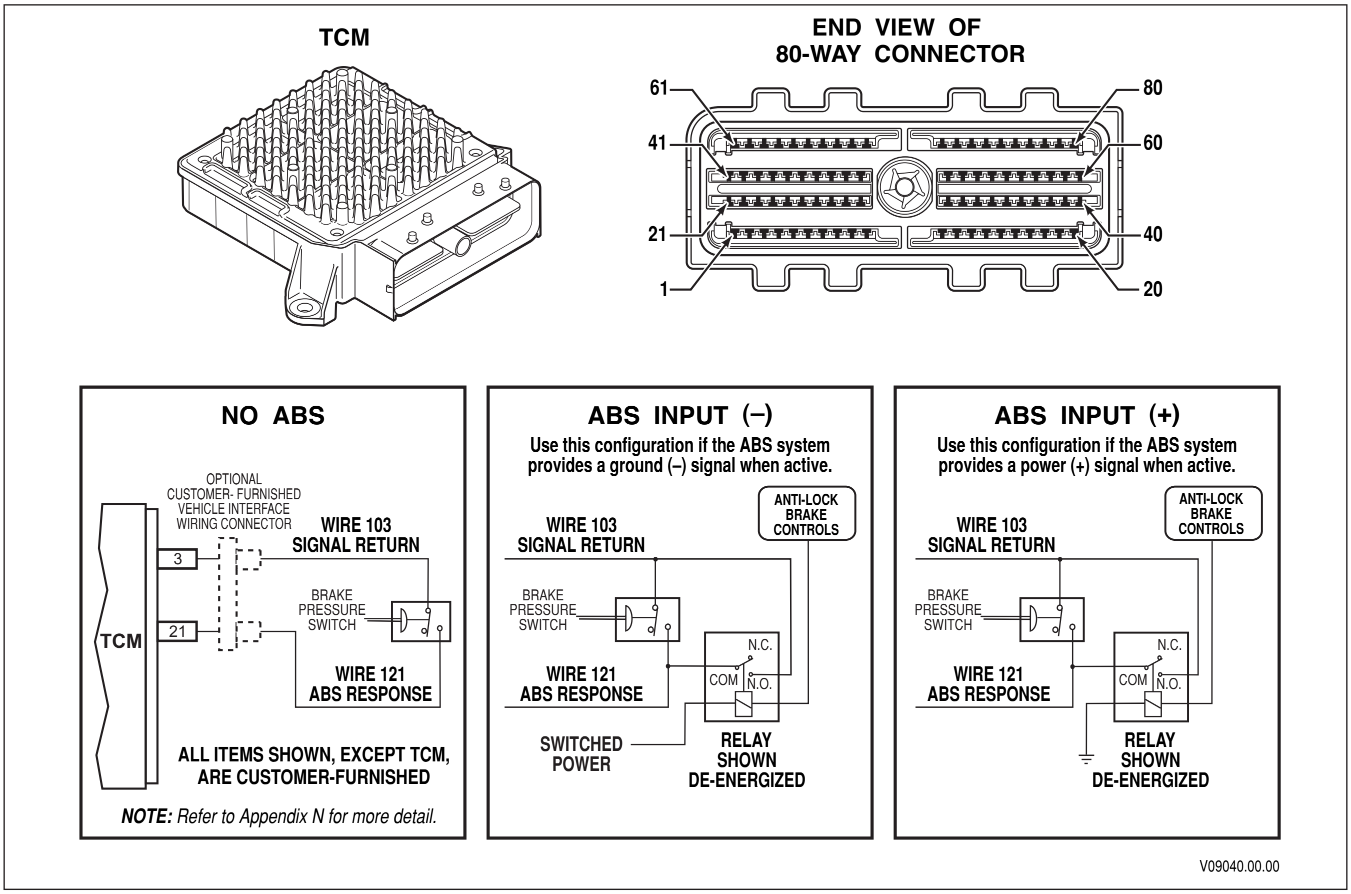
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition OFF. 2. Disconnect 80-way connector from the TCM. 3. Using a digital volt/ohmmeter (DVOM), measure resistance at 80-way connector pins 20 and 80. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the turbine speed sensor. 2. Using a DVOM, measure resistance at the speed sensor terminals. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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*	
6	***NOTE: Do not rotate the speed sensor in the retaining bracket. Orientation is fixed, and if changed, may cause improper operation.*** Replace the turbine speed sensor (refer to Mechanic's Tips). Is the replacement complete?	Refer to Figure 1–8	*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™, monitor turbine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0719 Brake Switch Circuit



Circuit Description

Vehicles equipped with anti-lock brake system (ABS) have an option to use an physical interface between the ABS and TCM. This interface allows disengagement of the Torque Converter Clutch when the ABS is activated.

This ABS action is initiated with a discrete input from the ABS system, when the ABS is activated a ground signal is sent to TCM input wire. This may be a ground signal direct from the ABS controller or a positive signal from the ABS controller that powers a relay field coil to supply a ground through the relay contacts (some ABS systems require that the ground signal be switched through a relay).

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 18V and less than 32V (24V TCM).
- DTCs P0721, and P0722 are not active.

Conditions for Setting the DTC

This DTC will set after the TCM detects one or more vehicle acceleration cycles where the TCM ABS brake switch input is in the ON activated state.

Action Taken when DTC Sets

- The TCM uses the default assumption that the ABS is OFF.
- DTC P0719 is stored in the TCM history.
- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Clearing the DTC/ CHECK TRANS Light

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

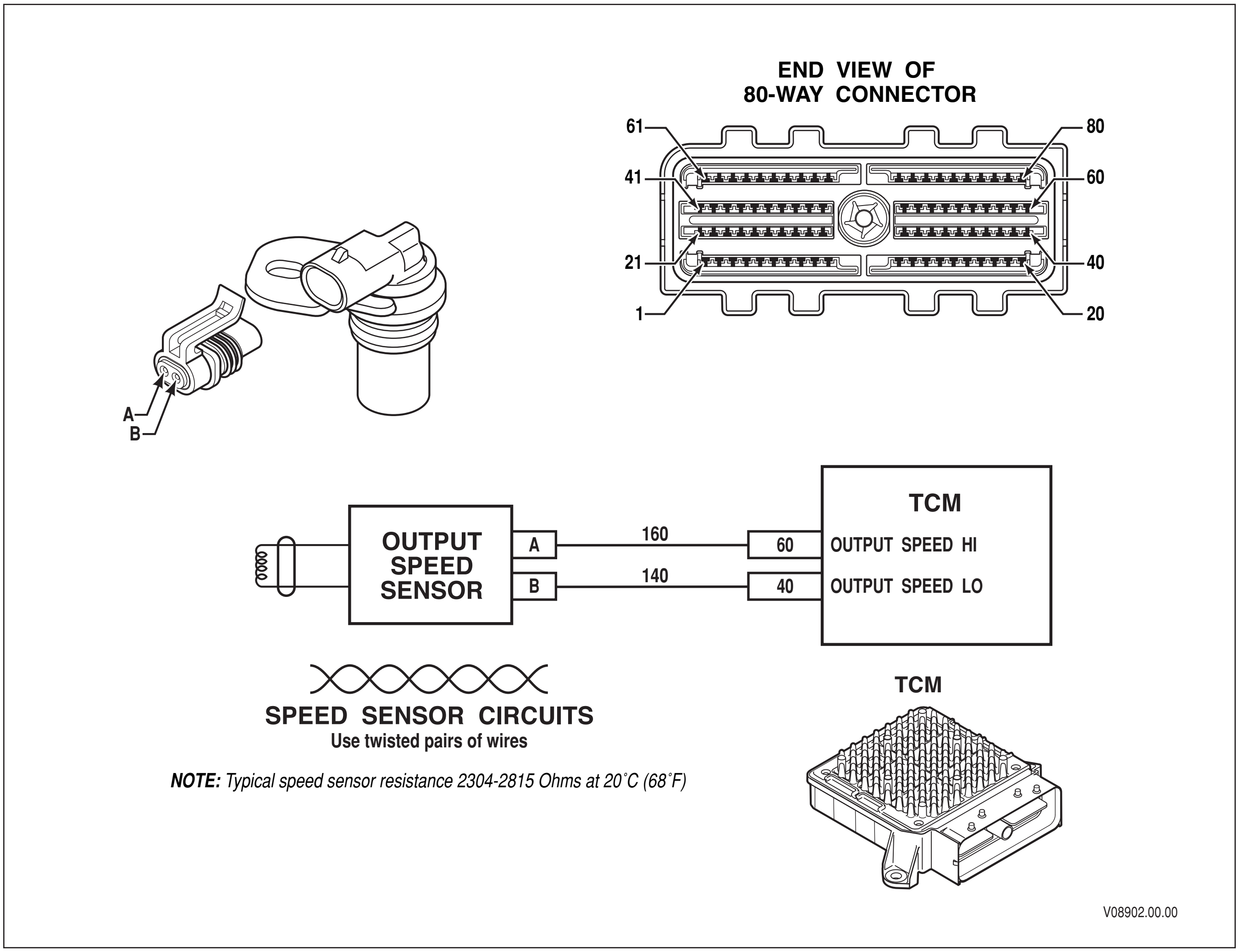
- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - A bent terminal
  - A back-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A chafed wire
  - A broken wire inside the insulation.
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change.
- The Allison DOC™ For PC–Service Tool J1939 CAN databus viewer may be used in some applications to view the current status of ABS input. This may be useful in troubleshooting an ABS module concern.
- ABS system interface to the TCM input can be wired one of three different ways, check with the OEM for proper wiring information concerning ABS applied input before troubleshooting.

DTC P0719 Brake Switch Circuit

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Remove ABS input wire (121) from 80-way connector. 2. Clear DTC and test-drive vehicle. Did the DTC return?		*Go to Step 4*	*Go to Step 3*
3	Return vehicle to OEM for troubleshooting of wiring leading to ABS controller. Was the problem found and corrected?		*Go to Step 5*	
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. Operate the vehicle under normal driving conditions. 3. Check for proper operation of ABS. 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



Circuit Description

The speed sensors are variable reluctance devices which 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 which 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 (such as a gear tooth) 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. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

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 18V and less than 32V (24V TCM).
- DTC P0716, P0717, or P0722 is not active.
- Turbine speed is above 200 rpm.
- Shift is complete and range attained is not neutral.
- For fire truck vocations, pump is not pumping.

Conditions for Setting the DTC

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

- Unrealistic large change in output speed. A failure pending is set if an unrealistic change in transmission output speed is detected at or above 500 rpm. The failure pending response is to lock in the current range.
- Noisy output speed signal. Noise is determined with two counters. A low counter is incremented when output speed change is below 500 rpm for 2.5 seconds. A high counter is incremented when output speed change is above 500 rpm. When both counters accumulate 5 events, a failure is set.

Action 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.
  - If failure occurs under other conditions, the transmission shifts to 1st, 3rd, or 5th.
  - If the shift selector is moved to **N** (Neutral), **R** (Reverse), or any other forward range, the transmission will lock in **N** (Neutral).
  - If a latched inhibit is present, the transmission locks to neutral.
- DTC P0721 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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.

DIAGNOSTIC TROUBLE CODES (DTC)

- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and select 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.
- 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 the step numbers on the diagnostic table.

2. This step tests ignition voltage.
3. This step tests for proper output speed sensor resistance.
4. This step tests for proper resistance at the output speed sensor.

DTC P0721 Output Speed Sensor Circuit—Performance

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
3	1. Turn the ignition OFF. 2. Disconnect 80-way connector from the TCM. 3. Using a digital volt/ohmmeter (DVOM), measure resistance at 80-way connector pins 40 and 60. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the output speed sensor. 2. Using a DVOM, measure resistance at the speed sensor terminals. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	2304–2815 Ohms at 20°C (68°F) Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Step 5*	*Go to Step 6*

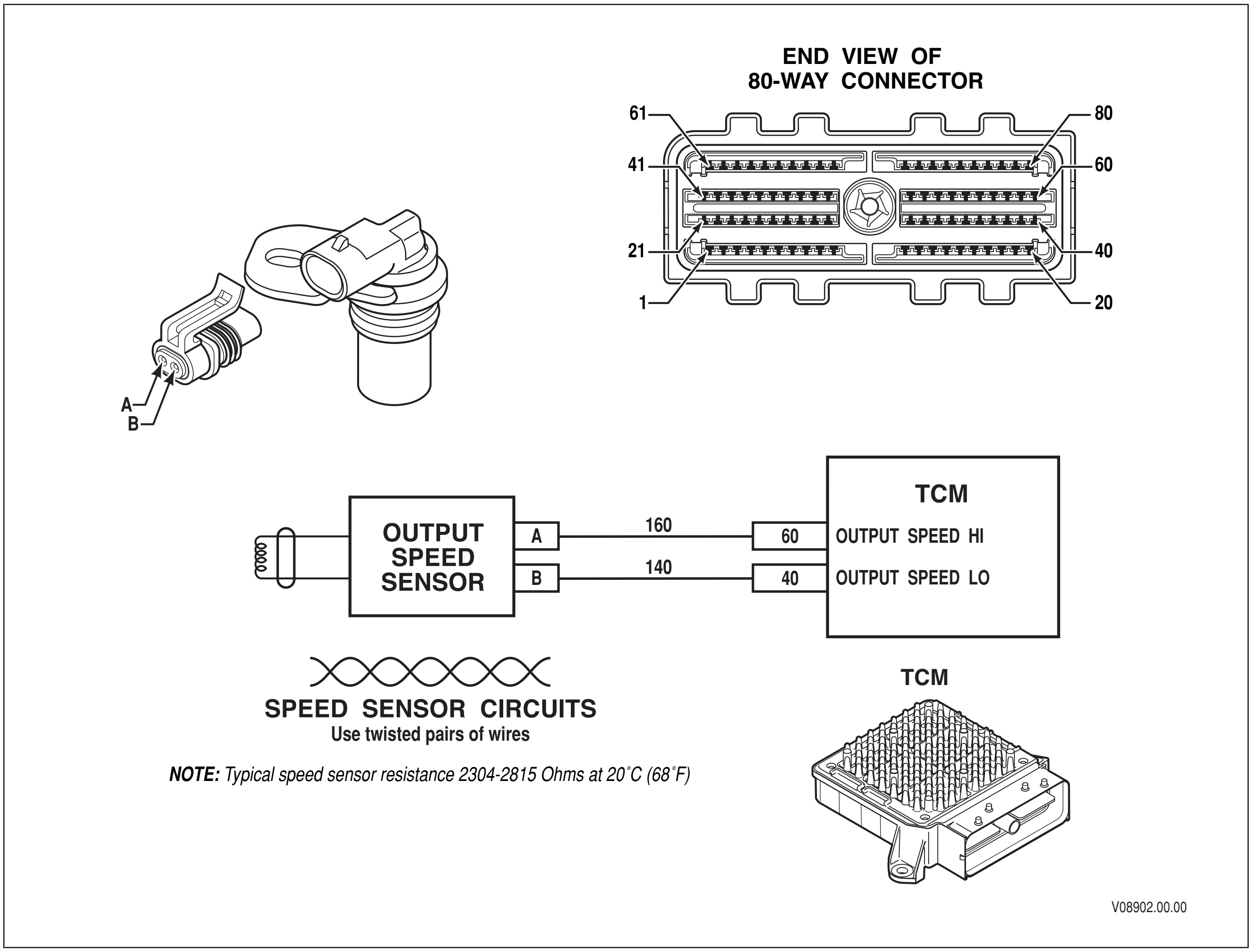
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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*	
6	***NOTE: Do not rotate the speed sensor in the retaining bracket. Orientation is fixed, and if changed, may cause improper operation.*** Replace the output speed sensor (refer to Mechanic's Tips). Is the replacement complete?	Refer to Figure 1–8	*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™, monitor output speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0722 Output Speed Sensor Circuit—No Signal



Circuit Description

The speed sensors are variable reluctance devices which 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 which 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 (such as a gear tooth) 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. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

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 18V and less than 32V (24V TCM).
- DTC P0716, P0717, P0721, P0731, P0732, P0733, P0734, P0735, or P0736 is not active.
- When unrealistic large change in output speed is detected, output speed is at or above 600 rpm for more than 1 second.
- When unrealistically low output speed is detected:
  - Engine is running
  - Shift is not in process
  - Range attained is not neutral
  - Transmission fluid temperature is above –25°C (–13°F)
  - Transmission turbine speed is at or above 1050 rpm
  - Manual selector valve is not being moved to a forward range
  - For fire truck. vocations, pump is not pumping.

Conditions for Setting the DTC

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

- Unrealistic large change in output speed. A failure pending is set if an unrealistic change in transmission output speed is detected at or above 600 rpm. A failure is set if neutral range is attained.
- 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 and transmission range is 3rd, 4th, or 5th for more than 1 second.

Action 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.
  - If failure occurs under other conditions, the transmission shifts to 1st, 3rd, or 5th.
  - If the shift selector is moved to **N** (Neutral), **R** (Reverse), or any other forward range while the diagnostic response is active, the transmission will lock in **N** (Neutral).
  - If a latched inhibit is present, the transmission locks in neutral.
- DTC P0722 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 TROUBLE CODES (DTC)

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.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and select 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.
- 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 the step numbers on the diagnostic table.

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

DTC P0722 Output Speed Sensor Circuit—No Signal

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*

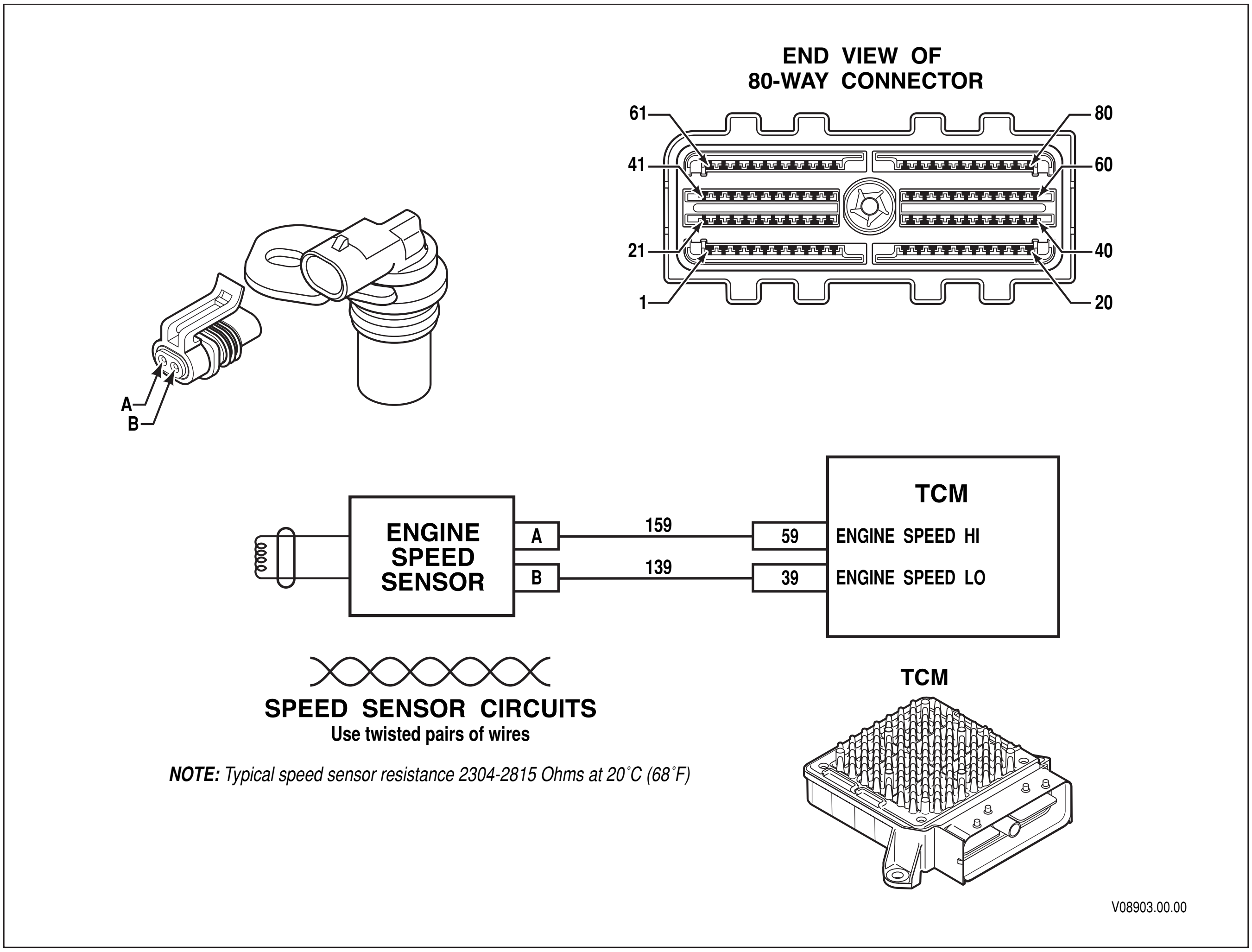
DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
3	1. Turn the ignition OFF. 2. Disconnect 80-way connector from the TCM. 3. Using a digital volt/ohmmeter (DVOM), measure resistance at 80-way connector pins 40 and 60. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the output speed sensor. 2. Using a DVOM, measure resistance at the speed sensor terminals. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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?	Refer to Figure 1–8	*Go to Step 7*	
6	***NOTE: Do not rotate the speed sensor in the retaining bracket. Orientation is fixed, and if changed, may cause improper operation.*** Replace the output speed sensor (refer to Mechanic's Tips). Is the 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™, monitor output speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0726 Engine Speed Sensor Circuit—Performance



Circuit Description

The speed sensors are variable reluctance devices which 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 which 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 (such as a gear tooth) 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. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

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 18V and less than 32V (24V TCM).
- DTC P0716, P0717, P0721, or P0727 is not active.
- Engine speed is above 600 rpm for 1 second.
- 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 change in engine speed. Failure is set if an unrealistic change in transmission engine speed is detected at or above 600 rpm.
- Noisy input speed signal. Noise is determined with two counters. A low counter is incremented when engine speed change is below 650 rpm for 2.5 seconds. A high counter is incremented when engine speed change is above 650 rpm. When both counters accumulate 5 events, a failure is set.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM illuminates the MIL on the second occurrence (OBD II Strategy).
- DTC P0726 is stored in the TCM history.
- 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

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.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and select 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.
- 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.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

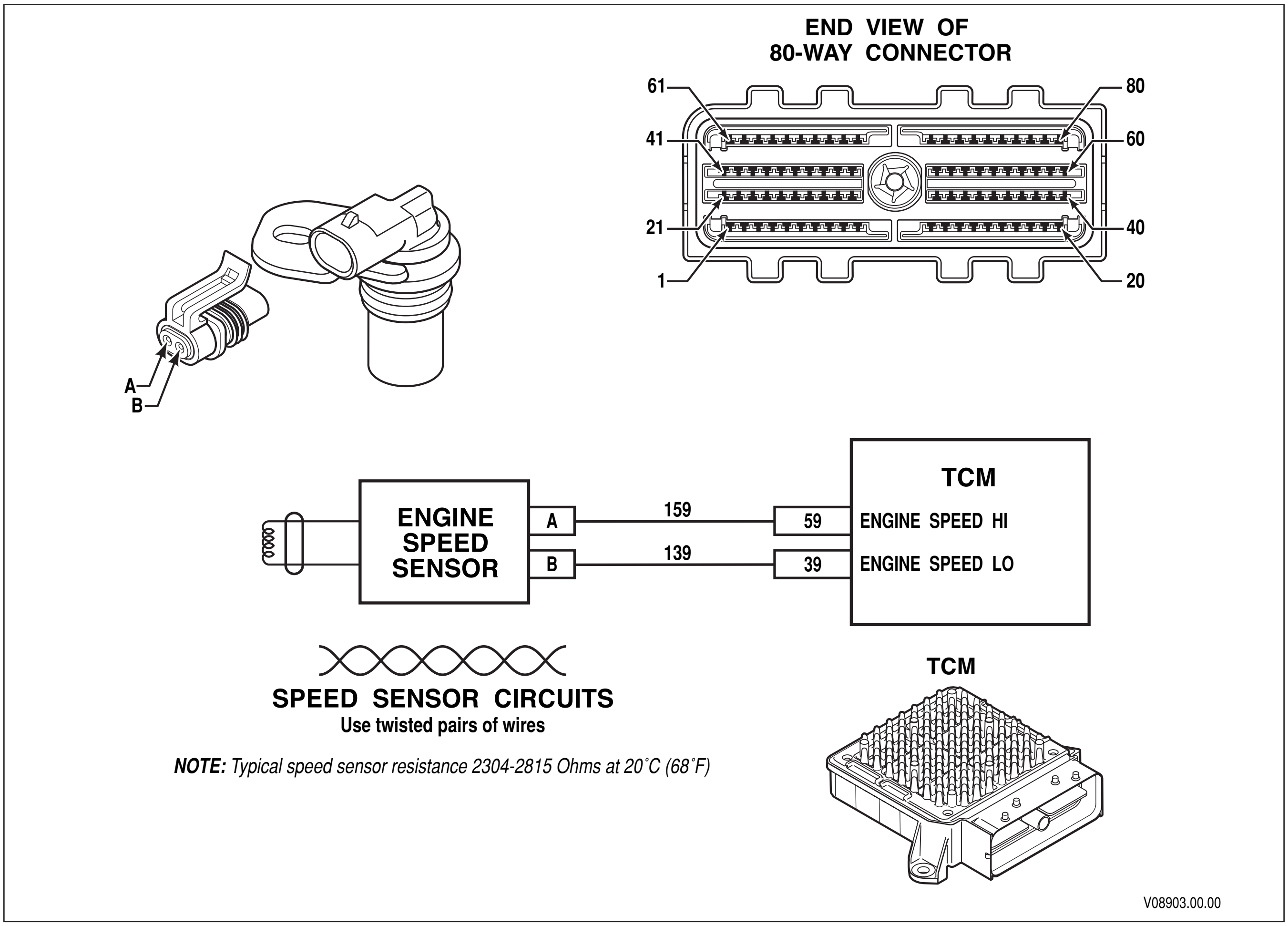
2. This step tests ignition voltage.
3. This step tests for proper engine speed sensor resistance at the TCM side of the wiring harness.
4. This step tests for proper resistance value at the engine speed sensor.

DTC P0726 Engine Speed Input Circuit—Performance

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
3	1. Turn the ignition OFF. 2. Disconnect 80-way connector from the TCM. 3. Using a digital volt/ohmmeter (DVOM), measure resistance at 80-way connector pins 39 and 59. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the engine speed sensor. 2. Using a DVOM, measure resistance at the speed sensor terminals. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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*	
6	***NOTE: Do not rotate the speed sensor in the retaining bracket. Orientation is fixed, and if changed, may cause improper operation.*** Replace the engine speed sensor (refer to Mechanic's Tips). Is the replacement complete?	Refer to Figure 1–8	*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™, monitor engine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0727 Engine Speed Sensor Circuit—No Signal



Circuit Description

The speed sensors are variable reluctance devices which 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 which 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 (such as a gear tooth) 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. Noise from other sources is eliminated by using two-wire differential inputs at the TCM.

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 18V and less than 32V (24V TCM).
- DTC P0716, P0717, or P0726 is not active.
- Unrealistically low engine speed detected.
- Engine is running.
- Transmission turbine speed is at or above 400 rpm.
- Ignition is in the ON position.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

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

- Unrealistic large change in engine speed. Failure pending is set if an unrealistic change in engine speed is detected at or above 1140 rpm.
- Unrealistic low value in engine speed. Failure is set if engine speed is detected below 61 rpm for 4 seconds.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM illuminates the MIL on the second occurrence (OBD II Strategy).
- The TCM defaults engine speed to turbine speed. Turbine speed is used to determine missing engine speed.
- TCM inhibits TCC momentarily.
- DTC P0727 is stored in TCM history

Conditions for Clearing the DTC/CHECK TRANS Light

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.
- You may have to drive the vehicle in order to experience a fault.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and select 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.
- 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 the step numbers on the diagnostic table.

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0727 Engine Speed Input Circuit—No Signal

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
3	1. Turn the ignition OFF. 2. Disconnect 80-way connector from the TCM. 3. Using a digital volt/ohmmeter (DVOM), measure resistance at 80-way connector pins 39 and 59. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Diagnostic Aids*	*Go to Step 4*
4	1. Disconnect the wiring harness from the engine speed sensor. 2. Using a DVOM, measure resistance at the speed sensor terminals. J 47275 TCM Breakout and J 47278 Transmission Breakout may be used. Is resistance within the specified values?	Refer to Table 5–10, Speed Sensor vs. Temperature	*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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*	
6	***NOTE: Do not rotate the speed sensor in the retaining bracket. Orientation is fixed, and if changed, may cause improper operation.*** Replace the engine speed sensor (refer to Mechanic's Tips). Is the replacement complete?	Refer to Figure 1–8	*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™, monitor engine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0729 Incorrect 6th Gear Ratio

REFER TO 6th RANGE HYDRAULIC SCHEMATIC (APPENDIX H)

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.
- Shift to 6^{th} is complete.
- Output speed is above 200 rpm.
- Engine initialization or shutdown is not in process.
- DTCs P0708, P0716, P0717, P0721, P0722, P0877, P0878 are not active.

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. The TCM detects this through the use of a timer that accumulates when the transmission is in 6th gear and output speed is 100 rpm or more with a gear slip (the different between turbine and output speed) exceeding 100 rpm for 2 seconds.

Actions taken when the DTC Sets

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

- A shift to 5^{th} range is made when the failure occurs.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral. If the shift selector is moved to **D** (Forward) range and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- DTC is stored in TCM history.
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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 speed sensor wiring and connectors for poor electrical connections. 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 or Allison DOC™ For PC–Service Tool for a change.
- Output or turbine tone wheel damage may cause erratic speed sensor input allowing this DTC to set.
- Use Allison DOC™ For PC–Service Tool to record a snapshot of the occurrence, monitor the engine, turbine and output speed signal on the strip chart. Look for erratic or noisy signals, which may indicate an intermittent concern at one of the speed sensor circuits.
- Drive the vehicle in 4th range where signals are the same to better determine if signals have a problem.
- 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 DTCs typically indicate mechanical problems with specific clutches for range indicated.
- An incorrect ratio DTC may indicate a mechanically failed trim solenoid. Check 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.

DTC P0729 Incorrect 6th Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (refer to Appendix R)*
3	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record Data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

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

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. 2. Using Allison DOC™, monitor turbine, engine, and output speed sensor readings. 3. Drive the vehicle in 4th range with lockup. 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)...and** • **Apply the parking brake and service brake...and** • **Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: Do not perform a clutch test in fourth or fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select the clutch test mode. 2. With brakes applied, select **D** (Drive). 3. At idle, select and attain the range indicated by DTC. Turbine speed should go to zero. 4. Increase engine speed to 1400 rpm. Watch for turbine speed (turbine speed should remain at zero). Did turbine speed remain at zero in range indicated?		*Go to Diagnostic Aids* *Engine power upgrade packages can cause this DTC to set.* *These packages are not approved by Allison Transmission and can void the transmission warranty if clutch damage is the determined cause.*	*Go to Step 6*
6	Remove oil pan and inspect fluid for signs of clutch debris or odor. Are there signs of a clutch failure?		*Go to Step 7*	*Go to Step 8*
7	Remove transmission for overhaul or replacement.		*Go to Step 10*	
8	Inspect the control valve body for stuck or sticking trimmer valves. Were stuck valves found?		*Go to Step 10*	*Go to Step 9*
9	Replace PCS2. Is replacement complete?		*Go to Step 10*	
10	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 P0731 Incorrect 1st Gear Ratio

REFER TO 1st RANGE HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

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

Conditions for Running the DTC

- Output speed exceeds 200 rpm.
- 1^{st} range is selected and attained.
- DTC P0716, P0717, P0721, P0722, P0877, or P0878 is not active.

Conditions for Setting the DTC

DTC P0731 sets when the calculated 1^{st} range ratio (steady state) differs from the known 1^{st} range ratio.

Action Taken When the DTC Sets

- When DTC P0731 is active, the following conditions will occur:
  - The transmission will fail to 2^{nd} or 5^{th} range.
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **N** (Neutral).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **R** (Reverse) unless the transmission is compromised by overspeeding or a direction change; then it will lock in **N** (Neutral).
- DTC P0731 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 speed sensor wiring and connectors for poor electrical connections. 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 or Allison DOC™ For PC–Service Tool for a change.
- Output or turbine tone wheel damage may cause erratic speed sensor input allowing this DTC to set.
- Incorrect ratio DTCs typically indicate mechanical problems with specific clutches, i.e. C1 or C5 for 1^{st} range.

DIAGNOSTIC TROUBLE CODES (DTC)

- An incorrect ratio DTC could indicate a hydraulically failed solenoid. Check the DTC information for the specific solenoid.
- You may have to drive the vehicle to experience the fault.
- Clutch test mode can be used to detect turbine pull-down. If turbine speed is detected, clutch damage may be indicated.
- Incorrect TCM calibrations will cause this DTC to set. Verify that the proper TCM calibration is being used with the correct transmission family. There are different gear ratios for the 1000 and 2000 Product Families transmissions (refer to Table 5–4, Gear Ratio).
- Be aware, in four-wheel drive applications, DTC P0731 may set due to a transfer case concern. In these applications, the output speed sensor is normally located in the transfer case and not in the rear transmission cover.

Test Description

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

3. This step tests ignition voltage.
4. This step tests for current 1st range ratio.
5. This step tests speed sensor readings.
6. This step tests for clutch slippage in 1st range.
7. This step checks for evidence of clutch failure.

DTC P0731 Incorrect 1st Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Start the engine. 2. Record the DTC Failure Record data. 3. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
4	1. Install Allison DOC™. 2. Monitor the gear ratio. 3. Pre-select 1st range. Is the correct 1st range ratio shown?	3.1—close ratio 3.51—wide ratio	*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition ON and drive the vehicle under normal operating conditions. 2. Using Allison DOC™, monitor engine, turbine, and output speed readings. Is speed sensor data erratic or are signal dropouts detected?		*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)...and** • **Apply the parking brake and service brake...and** • **Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: Do not perform a clutch test in fourth or fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select clutch test mode. 2. With brakes applied, move the selector lever to **D** (Drive). 3. With engine at idle, select and attain the range indicated by the DTC. Turbine speed should go to zero. 4. Monitor turbine speed while increasing engine speed to 1400 rpm. Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 7*
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 8*	*Go to Step 9*
8	Remove the transmission for overhaul or replacement (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 11*	
9	Inspect the control valve body for stuck or sticking trimmer valves (refer to Mechanic's Tips). Was a valve problem found and repaired?		*Go to Step 11*	*Go to Step 10*
10	Replace PCS1 (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Operate the vehicle in all ranges under normal driving 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 2nd RANGE HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

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

Conditions for Running the DTC

- Output speed exceeds 200 rpm.
- 2nd range is selected and attained.
- DTC P0716, P0717, P0721, or P0722 is not active.

Conditions for Setting the DTC

DTC P0732 sets when the calculated second 2nd ratio (steady state) differs from the known 2nd range ratio.

Action Taken When the DTC Sets

- When DTC P0732 is active, the following conditions will occur:
  - The transmission will fail to 3rd range.
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **N** (Neutral).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **R** (Reverse) unless the transmission is compromised by overspeeding or a direction change; then it will lock in **N** (Neutral).
- DTC P0732 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 speed sensor wiring and connectors for poor electrical connections. 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 or Allison DOC™ For PC–Service Tool for a change.

DIAGNOSTIC TROUBLE CODES (DTC)

- Output or turbine tone wheel damage may cause erratic speed sensor input allowing this DTC to set.
- Incorrect ratio DTCs typically indicate mechanical problems with specific clutches, i.e. C1 and C4 for 2nd range.
- An incorrect ratio DTC could indicate a hydraulically failed solenoid. Check the DTC information for the specific solenoid.
- You may have to drive the vehicle to experience the fault. Clutch test mode can be used to check stall speed.
- Incorrect TCM calibrations will cause this DTC to set. Verify that the proper TCM calibration is being used with the correct transmission family. There are different gear ratios for the 1000 and 2000 Product Families transmissions (refer to Table 5–4, Gear Ratio).

Test Description

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

3. This step tests ignition voltage.
4. This step tests speed sensor readings.
5. This step tests for turbine speed not remaining at zero in 2nd range.
6. This step checks for evidence of clutch failure.

DTC P0732 Incorrect 2nd Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Start the engine. 2. Record the DTC Failure Record data. 3. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. 2. Using Allison DOC™, monitor engine, turbine, and output speed readings. Is speed sensor data erratic or are signal dropouts detected?		*Go to appropriate speed sensor DTC*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0732 Incorrect 2nd 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)...and** • **Apply the parking brake and service brake...and** • **Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: Do not perform a clutch test in fourth or fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select clutch test mode. 2. With brakes applied, move the selector lever to **D** (Drive). 3. With engine at idle, select and attain the range indicated by the DTC. Turbine speed should go to zero. 4. Monitor turbine speed while increasing engine speed to 1400 rpm. Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 6*
6	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 7*	*Go to Step 8*
7	Remove the transmission for overhaul or replacement (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
8	Inspect the control valve body for stuck or sticking trimmer valves (refer to Mechanic's Tips). Was a valve problem found and repaired?		*Go to Step 10*	*Go to Step 9*
9	Replace PCS2 (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Operate the vehicle in all ranges under normal driving 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 3rd RANGE HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

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

Conditions for Running the DTC

- Output speed exceeds 200 rpm.
- 3rd range is selected and attained.
- DTC P0716, P0717, P0721, or P0722 is not active.

Conditions for Setting the DTC

DTC P0733 sets when the calculated 3rd range ratio (steady state) differs from the known 3rd range ratio.

Action Taken When the DTC Sets

- When DTC P0733 is active, the following conditions will occur:
  - The transmission will fail to 4th range.
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **N** (Neutral).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **N** (Neutral).
  - If the shift selector is returned to a forward range and the transmission is compromised by overspeeding or a direction change, the transmission will lock in **N** (Neutral).
- DTC P0733 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 speed sensor wiring and connectors for poor electrical connections. 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 or Allison DOC™ For PC–Service Tool for a change.
- Output or turbine tone wheel damage may cause erratic speed sensor input allowing this DTC to set.
- Incorrect ratio DTCs typically indicate mechanical problems with specific clutches, i.e. C1 and C3 for 3rd range.
- An incorrect ratio DTC could indicate a hydraulically failed solenoid. Check the DTC information for the specific solenoid.
- You may have to drive the vehicle to experience the fault. Clutch test mode can be used to check stall speed.
- Incorrect TCM calibrations will cause this DTC to set. Verify that the proper TCM calibration is being used with the correct transmission family. There are different gear ratios for the 1000 and 2000 Product Families transmissions (refer to Table 5–4, Gear Ratio).

Test Description

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

3. This step tests ignition voltage.
4. This step tests speed sensor readings.
5. This step tests for turbine speed not remaining at zero in 3rd range.
6. This step checks for evidence of clutch failure.

DTC P0733 Incorrect 3rd Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Start the engine. 2. Record the DTC Failure Record data. 3. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. 2. Using Allison DOC™, monitor engine, turbine, and output speed readings. Is speed sensor data erratic or are signal dropouts detected?		*Go to appropriate speed sensor DTC*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0733 Incorrect 3rd 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)...and** **• Apply the parking brake and service brake...and** **• Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: Do not perform a clutch test in fourth or fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select clutch test mode. 2. With brakes applied, move the selector lever to **D** (Drive). 3. With engine at idle, select and attain the range indicated by the DTC. Turbine speed should go to zero. 4. Monitor turbine speed while increasing engine speed to 1400 rpm. Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 6*
6	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 7*	*Go to Step 8*
7	Remove the transmission for overhaul or replacement (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
8	Inspect the control valve body for stuck or sticking trimmer valves (refer to Mechanic's Tips). Was a valve problem found and repaired?		*Go to Step 10*	*Go to Step 9*
9	Replace PCS1 (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Operate the vehicle in all ranges under normal driving 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 4th RANGE HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

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

Conditions for Running the DTC

- Output speed exceeds 200 rpm.
- 4th range is selected and attained.
- DTC P0716, P0717, P0721, or P0722 is not active.

Conditions for Setting the DTC

DTC P0734 sets when the calculated 4th range ratio (steady state) differs from the known 4th range ratio.

Action Taken When the DTC Sets

- When DTC P0734 is active, the following conditions will occur:
  - The transmission will fail to 5th range.
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **N** (Neutral).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **R** (Reverse) unless the transmission is compromised by a direction change; then the transmission will shift to **N** (Neutral).
  - If the shift selector is returned to a forward range and the transmission is compromised by overspeeding or a direction change, the transmission will lock in **N** (Neutral).
- DTC P0734 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 speed sensor wiring and connectors for poor electrical connections. 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 or Allison DOC™ For PC–Service Tool for a change.
- Output or turbine tone wheel damage may cause erratic speed sensor input allowing this DTC to set.
- Incorrect ratio DTCs typically indicate mechanical problems with specific clutches, i.e. C1 and C2 for 4th range.
- An incorrect ratio DTC could indicate a hydraulically failed solenoid. Check the DTC information for the specific solenoid.
- You may have to drive the vehicle to experience the fault.
- Clutch test mode can be used to detect turbine pull-down. If turbine speed is detected, clutch damage may be indicated.

Test Description

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

3. This step tests ignition voltage.
4. This step tests speed sensor readings.
5. This step tests for turbine speed not remaining at zero in 4th range.
6. This step checks for evidence of clutch failure.

DTC P0734 Incorrect 4th Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Start the engine. 2. Record the DTC Failure Record data. 3. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. 2. Using Allison DOC™, monitor engine, turbine, and output speed readings. Is speed sensor data erratic or are signal dropouts detected?		*Go to 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)...and** • **Apply the parking brake and service brake...and** • **Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: Do not perform a clutch test in fourth or fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select clutch test mode. 2. With brakes applied, move the selector lever to **D** (Drive). 3. With engine at idle, select and attain the range indicated by the DTC. Turbine speed should go to zero. 4. Monitor turbine speed while increasing engine speed to 1400 rpm. Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 6*
6	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 7*	*Go to Step 8*
7	Remove the transmission for overhaul or replacement (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
8	Inspect the control valve body for stuck or sticking trimmer valves (refer to Mechanic's Tips). Was a valve problem found and repaired?		*Go to Step 10*	*Go to Step 9*
9	Replace PCS2 (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Operate the vehicle in all ranges under normal driving 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 5th RANGE HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

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

Conditions for Running the DTC

- Output speed exceeds 200 rpm.
- 5th range is selected and attained.
- DTC P0716, P0717, P0721, or P0722 is not active.

Conditions for Setting the DTC

DTC P0735 sets when the calculated fifth 5th ratio (steady state) differs from the known 5th range ratio.

Action Taken When the DTC Sets

- When DTC P0735 is active, the following conditions will occur:
  - The transmission will fail to 4th range.
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **N** (Neutral).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **R** (Reverse) unless the transmission is compromised by a direction change; then the transmission will shift to **N** (Neutral).
  - If the shift selector is returned to a forward range and the transmission is compromised by overspeeding or a direction change, the transmission will lock in **N** (Neutral).
- DTC P0735 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 speed sensor wiring and connectors for poor electrical connections. 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 or Allison DOC™ For PC–Service Tool for a change.
- Output or turbine tone wheel damage may cause erratic speed sensor input allowing this DTC to set.
- Incorrect ratio DTCs typically indicate mechanical problems with specific clutches, i.e. C2 and C3 for 5th range.
- An incorrect ratio DTC could indicate a hydraulically failed solenoid. Check the DTC information for the specific solenoid.
- You may have to drive the vehicle to experience the fault.
- Clutch test mode can be used to detect turbine pull-down. If turbine speed is detected, clutch damage may be indicated.
- Incorrect TCM calibrations will cause this DTC to set. Verify that the proper TCM calibration is being used with The correct transmission family. There are different gear ratios for the 1000 and 2000 Product Families transmissions (refer to Table 5–4, Gear Ratio).
- Be aware, in four-wheel drive applications, DTC P0731 may set due to a transfer case concern. In these applications, the output speed sensor is normally located in the transfer case and not on the rear transmission cover.

Test Description

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

3. This step tests ignition voltage.
4. This step tests speed sensor readings.
5. This step tests for turbine speed not remaining at zero in 5th range.
6. This step checks for evidence of clutch failure.

DTC P0735 Incorrect 5th Gear Ratio

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Start the engine. 2. Record the DTC Failure Record data. 3. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. 2. Using Allison DOC™, monitor engine, turbine, and output speed readings. Is speed sensor data erratic or are signal dropouts detected?		*Go to appropriate speed sensor DTC*	*Go to Step 5*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0735 Incorrect 5th 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)...and** • **Apply the parking brake and service brake...and** • **Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: Do not perform a clutch test in fourth or fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select clutch test mode. 2. With brakes applied, move the selector lever to **D** (Drive). 3. With engine at idle, select and attain the range indicated by the DTC. Turbine speed should go to zero. 4. Monitor turbine speed while increasing engine speed to 1400 rpm. Did turbine speed remain at zero?		*Go to Diagnostic Aids* *Engine power upgrade packages can cause this DTC to set.* *These packages are not approved by Allison Transmission and can void the transmission warranty if clutch damage is the determined cause.*	*Go to Step 6*
6	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 7*	*Go to Step 8*
7	Remove the transmission for overhaul or replacement (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
8	Inspect the control valve body for stuck or sticking trimmer valves (refer to Mechanic's Tips). Was a valve problem found and repaired?		*Go to Step 10*	*Go to Step 9*
9	Replace PCS1 (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Operate the vehicle in all ranges under normal driving conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0736 Incorrect Reverse Ratio

REFER TO REVERSE RANGE HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

The Transmission Control Module (TCM) uses input from the turbine speed sensor and output speed sensor to determine gear ratios. The TCM then compares the known gear ratio to the calculated gear ratio for the current gear.

Conditions for Running the DTC

- Output speed exceeds 200 rpm.
- Reverse is selected and attained.
- DTC P0716, P0717, P0721, or P0722 is not active.

Conditions for Setting the DTC

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

Action Taken When the DTC Sets

- When DTC P0736 is active, the transmission will lock in **N** (Neutral).
- DTC P0736 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 speed sensor wiring and connectors for poor electrical connections. 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 or Allison DOC™ For PC–Service Tool for a change.
- Output or turbine tone wheel damage may cause erratic speed sensor input allowing this DTC to set.
- Incorrect ratio DTCs typically indicate mechanical problems with specific clutches, i.e. C3 and C5 for reverse range.
- An incorrect ratio DTC could indicate a hydraulically failed solenoid. Check the DTC information for the specific solenoid.

DIAGNOSTIC TROUBLE CODES (DTC)

- You may have to drive the vehicle to experience the fault.
- Clutch test mode can be used to detect turbine pull-down. If turbine speed is detected, clutch damage may be indicated.
- Be aware, in four-wheel drive applications, DTC P0736 may set due to a transfer case concern. In these applications, the output speed sensor is normally located in the transfer case and not in the rear transmission cover.

Test Description

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

3. This step tests ignition voltage.
4. This step tests for current reverse range ratio.
5. This step tests for noise induced from the engine speed sensor.
6. This step tests for turbine speed not remaining at zero in reverse range.
7. This step checks for evidence of clutch failure.

DTC P0736 Incorrect Reverse Ratio

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Start the engine. 2. Record the DTC Failure Record data. 3. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
4	Using Allison DOC™, monitor the reverse gear ratio. Is the gear ratio correct for the transmission family that is installed in the vehicle?	4.49—close ratio; 5.09—wide ratio	*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition ON. 2. Start the engine and run at idle. 3. Using Allison DOC™, monitor engine, turbine, and output speed readings in reverse range with the vehicle brakes applied. Is noise indicated on the output speed sensor or turbine speed sensor data?		*Go to appropriate speed sensor DTC*	*Go to Step 6*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0736 Incorrect Reverse 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)...and** • **Apply the parking brake and service brake...and** • **Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: NEVER perform a full throttle stall test (brakes held) in reverse range, or damage to the vehicle driveline or axle may occur.** 1. Apply vehicle brakes and select **R** (Reverse). 2. With engine at idle and reverse range attained, turbine speed should go to zero. 3. Using Allison DOC™, monitor turbine speed while increasing engine speed to 1000 rpm. Did turbine speed remain at zero?		*Go to Diagnostic Aids*	*Go to Step 7*
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 9*	*Go to Step 8*
8	1. Using Allison DOC™, monitor turbine speed while selecting 1st range. 2. If turbine speed is ever greater than zero after 1st range is attained, there may be a problem with PCS1 or Pressure Control Valve 1 (PCV1) valve. 3. If shift to 1st range is harsh and delayed, there may be a problem with PCS2 or Pressure Control Valve 2 (PCV2). 4. Remove the control valve body and inspect for stuck or sticking pressure control valves. If valves are moving freely, replace either PCS1 or PCS2 (refer to Mechanic's Tips) based on the shift characteristics described. Is replacement complete?		*Go to Step 10*	
9	Remove the transmission for overhaul or replacement (refer to Mechanic's Tips). Is replacement complete?		*Go to Step 10*	
10	In order to verify your repair: 1. Clear the DTC. 2. Operate the vehicle in all ranges under normal driving conditions. The ratio must fall within the specified range. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0741 Torque Converter Clutch (TCC) System—Stuck Off

REFER TO HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

The transmission torque converter clutch (TCC) solenoid is a pressure control solenoid used to control the rate of TCC apply and release. The TCM applies and releases the TCC by varying the amount of electrical current through a low side driver. The TCM uses data received from the engine speed sensor and the turbine speed sensor to calculate torque converter slip values. It can detect if the torque converter is stuck off (unlocked) or stuck on (locked) by comparing TCC slip speed to a preset value in the TCM calibration.

Conditions for Running the DTC

- DTC P0122, P0123, P0716, P0717, P0721, P0722 P0743 (P1860) are not active.
- Engine speed is greater than 200 rpm for five second.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater 18V and less than 32V (24V TCM).
- Transmission is in a valid forward range.
- Throttle percentage is over 10 percent but less than 90 percent.
- Six or more seconds have elapsed since last range with TCC.

Conditions for Setting the DTC

P0741 sets when the TCM detects a slip speed exceeding 80 rpm for 15 or more seconds. Indicating no TCC apply.

Action taken when the DTC Sets

- DTC is stored in the TCM history.
- The **CHECK TRANS** light illuminates on the second occurrence (non-OBD II Strategy)
- The MIL illuminates on the second occurrence (OBD II Strategy)
- No response

Conditions for Clearing the DTC/CHECK TRANS Light.

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 sets when converter slip speed indicates TCC is not applied when the TCC solenoid is commanded ON for a period of time that is calibration dependent. This may indicate an internal failure of the TCC or a stuck or sticking TCC valve.
- Residue or contamination may cause shift valves to stick intermittently.
- This concern may indicate a torque converter flow valve that is stuck or sticking.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

2. This step tests for a slip speed indicating the TCC is not applied, when it should be.
4. This step verifies the repair performed.

DTC P0741 Torque Converter Clutch (TCC) System—Stuck Off

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Drive the vehicle. 6. With Allison DOC™, monitor converter slip speed indicated when converter lockup is attained. The TCC solenoid status should indicate ON. ***NOTE: This DTC sets when converter slip speed is detected above 80 rpm for 15 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?	More than 80 rpm	*Go to Step 3*	*Go to Diagnostic Aids*
3	This condition indicates that the TCC is mechanically stuck OFF. Check for the following conditions: • Worn TCC clutch • Mechanically faulty TCC solenoid • Stuck TCC valve • Clogged or restricted converter relief passage • Converter flow valve stuck Did you find and repair a problem?		*Go to Step 4*	
4	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Using Allison DOC™, monitor TCC slip speed. The TCC must engage/disengage when commanded. 4. Use Allison DOC™, in the test passed section, to confirm the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0742 Torque Converter Clutch (TCC) System—Stuck On

REFER TO HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

The transmission torque converter clutch (TCC) solenoid is a pressure control solenoid used to control the rate of TCC apply and release. The TCM applies and releases the TCC by varying the amount of electrical current through a low side driver. The TCM uses data received from the engine speed sensor and the turbine speed sensor to calculate torque converter slip values. It can detect if the torque converter is stuck off (unlocked) or stuck on (locked) by comparing TCC slip speed to a preset value in the TCM calibration.

Conditions for Running the DTC

- DTC P0122, P0123, P0716, P0717, P0721, P0722, P0743 (P1860) are not active.
- Engine speed is greater than 200 rpm for 5 second.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater 18V and less than 32V (24V TCM).
- Transmission is in a valid forward range.
- TCC is off.

Conditions for Setting the DTC

- P0742 sets when the conditions listed below are present and the TCM detects converter slip speed between –5 and –40 rpm for over 2 seconds
- Transmission output speed at 100 rpm or higher.
- Engine throttle percentage at 15 percent or higher.
- Engine torque at 130 N·m or higher
- Engine and turbine speed under 5500 rpm.

Action taken when the DTC Sets

- Not enabled (non-OBD II Strategy).
- The MIL illuminates on the second occurrence (OBD II Strategy).
- Response is calibration dependent.
- If response is disabled, no action is performed.
- If enabled, reverse operation is disabled when active.

Conditions for Clearing the DTC/CHECK TRANS Light

Allison DOC™ for PC–Service Tool may 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

- This DTC sets when converter slip speed indicates TCC is staying applied when it should be released for a period of time that is calibration dependent. This may indicate an internal failure of the TCC or a stuck or sticking TCC valve.
- This concern may indicate a torque converter flow valve that is stuck or sticking.

Test Description

2. This step tests for a slip speed indicating TCC is locked up when is should be off.
4. This step verifies the repair performed.

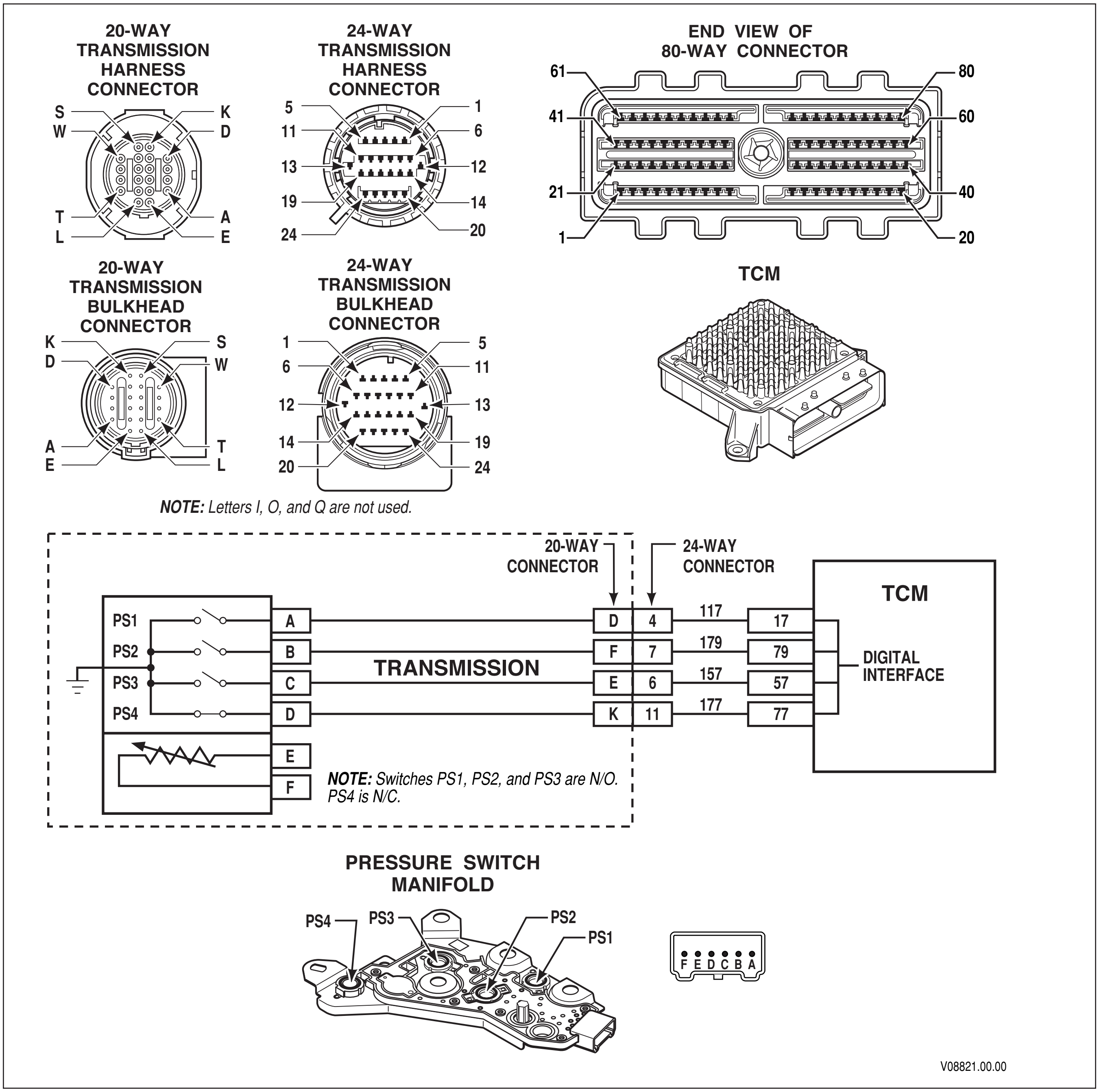
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0742 Torque Converter Clutch (TCC) System—Stuck On

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Drive the vehicle. 6. With Allison DOC™, monitor converter slip speed indicated when converter lockup is commanded OFF. The TCC solenoid status should indicate OFF. ***NOTE: This DTC sets when converter slip speed is detected between –5 and –40 rpm for over 2 seconds. This indicates that TCC did not release properly and remained in a locked state for over a calibration dependent time.*** Is the slip speed value between the specified values?	–5 to –40 rpm for more than 2 seconds See Conditions for Setting the DTC	*Go to Step 3*	*Go to Diagnostic Aids*
3	This condition indicates that the TCC is mechanically stuck ON, check for the following conditions: • Worn TCC clutch • Faulty TCC solenoid • Stuck TCC valve • Clogged converter relief passage • Converter flow valve stuck Did you find and repair a problem?		*Go to Step 4*	
4	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions in failure records. 3. Using Allison DOC™, monitor TCC slip speed. The TCC must engage/disengage when commanded. 4. Confirm with Allison DOC™, 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 P0751 Shift Solenoid 1 (SS1) Valve Performance—Stuck Off



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. The Pressure Switch 1 (PS1) monitors Shift Solenoid Valve 1 (SV1) positioning and relays it to the TCM. When PS1 is in the open state, SV1 should be in the destroked position.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.
- SV1 is commanded to the ON (stroked) position.

Conditions for Setting the DTC

DTC P0751 is set when Shift Solenoid 1 (SS1) is commanded ON and Pressure Switch 1 (PS1) status remains Exhausted/OFF for a period of time that is temperature dependent (5 seconds at a temperature of 0ºC to –40ºC). The intent of this DTC is to detect a shift valve timeout condition which normally indicates a stuck shift valve in the destroked state, mechanical solenoid failure or an open circuit condition.

Actions taken when the DTC Sets

When DTC P0751 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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.
- When a P0843 and P0751 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern exists. Refer to P0843 for further instruction.
- 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 check for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures and Appendix A, Section B).

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.
- Whenever performing any internal valve body repair be sure that your work area is free of airborne dust and dirt that might contaminate the valve body assembly. Always store any reusable oil in a clean, covered container. It is recommended that a funnel which incorporates a screen filter be used to refill or strain the oil through an appropriate screen.

Test Description

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

2. This step tests for proper fluid level.
3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0751 Shift Solenoid 1 (SS1) Valve Performance—Stuck Off

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (refer to Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (refer to Appendix R)*
3	Perform the Main Pressure Check Procedure (refer to Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (refer to Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0751 Shift Solenoid 1 (SS1) Valve Performance—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF. If pressure switch is Pressurized/ON, indicates a short-to-ground or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Verify the pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC intent is to detect a shift valve timeout occurrence, which indicates a shift valve that is stuck in the destroked state. Under certain conditions it may also indicate a solenoid mechanically failed, open in the switch circuit or defective PSM.*** Did DTC P0751 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 17 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate PS1 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 15*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0751 Shift Solenoid 1 (SS1) Valve Performance—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 4 (wire 117) to a known good ground. Does Allison DOC™ indicate PS1 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 14*
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin A. Does Allison DOC™ indicate PS1 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 13*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on PS1 membrane. Does Allison DOC™ indicate PS1 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 9*	*Go to Step 12*
9	Remove the valve body and inspect for a stuck or sticking SV1. Was SV1 stuck or sticking?		*Go to Step 11*	*Go to Step 10*
10	Remove SS1 and replace. Is replacement complete?		*Go to Step 16*	
11	Clean the sticking valve to restore free movement. If this does not restore free movement, replace the valve or control valve body assembly if necessary (refer to the 1000 and 2000 Product Families Service Manual). Was free movement restored or the valve or body replaced?		*Go to Step 16*	
12	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
13	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	

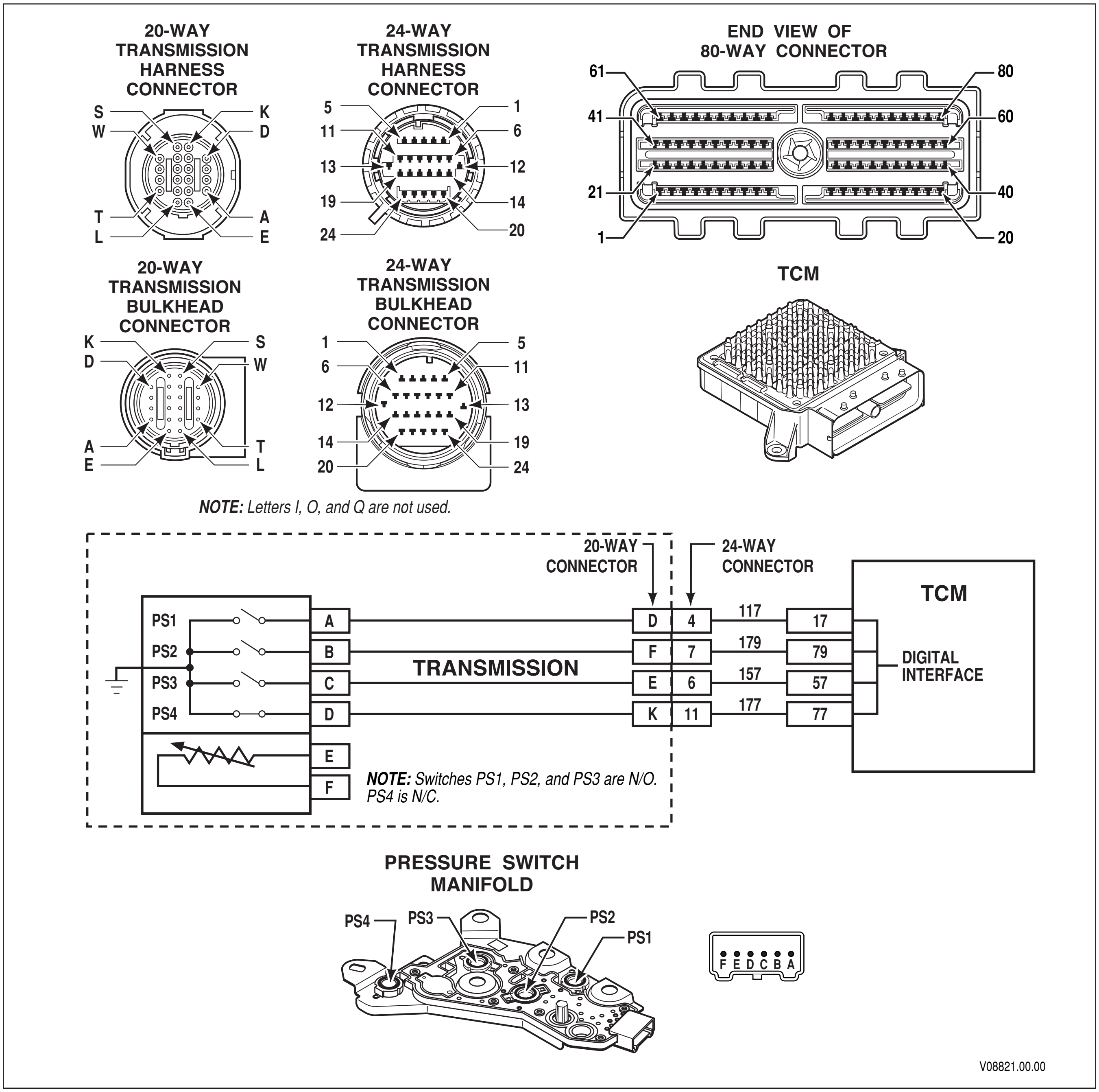
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0751 Shift Solenoid 1 (SS1) Valve Performance—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
14	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 16*	
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 16*	
16	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0752 Shift Solenoid 1 (SS1) Valve Performance—Stuck On



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. The Pressure Switch 1 (PS1) monitors Shift Valve 1 (SV1) positioning and relays it to the TCM. When PS1 is in the open state, SV1 should be in the destroked position.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.
- SV1 is commanded to the OFF (destroked) position.

Conditions for Setting the DTC

DTC P0752 is set when Shift Solenoid 1 (SS1) is commanded OFF and PS1 status remains Pressurized/ON for a period of time that is temperature dependent (2 seconds at a temperature of 0ºC up to 4 seconds at –40ºC). The intent of this DTC is to detect a shift valve timeout condition which normally indicates a stuck shift valve in the stroked state, mechanical solenoid failure or a circuit short-to-ground.

Actions taken when the DTC Sets

When DTC P0752 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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.
- When a P0842 and P0752 are set in combination, the TCM logic re-attempted to command the shift solenoid on. This indicates a circuit or pressure switch concern exists. Refer to P0842 for further instruction.

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 check for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures and Appendix A, Section B).
- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.
- Whenever performing any internal valve body repair be sure that your work area is free of airborne dust and dirt that might contaminate the valve body assembly. Always store any reusable oil in a clean, covered container. It is recommended that a funnel which incorporates a screen filter be used to refill or strain the oil through an appropriate screen.

Test Description

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

2. This step tests for proper fluid level.
3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0752 Shift Solenoid 1 (SS1) Valve Performance—Stuck On

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (refer to Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0752 Shift Solenoid 1 (SS1) Valve Performance—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF. If pressure switch is Pressurized/ON, indicates a short-to-ground or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Verify the pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC intent is to detect a shift valve timeout occurrence, which indicates a shift valve that is stuck in the stoked state. Under certain conditions it may also indicate a solenoid mechanically failed, short-to-ground in switch circuit or defective PSM.*** Did DTC P0752 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 17 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 1 (PS1) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 15*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 4 (wire 117) to a known good ground. Does Allison DOC™ indicate Pressure Switch 1 (PS1) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 14*

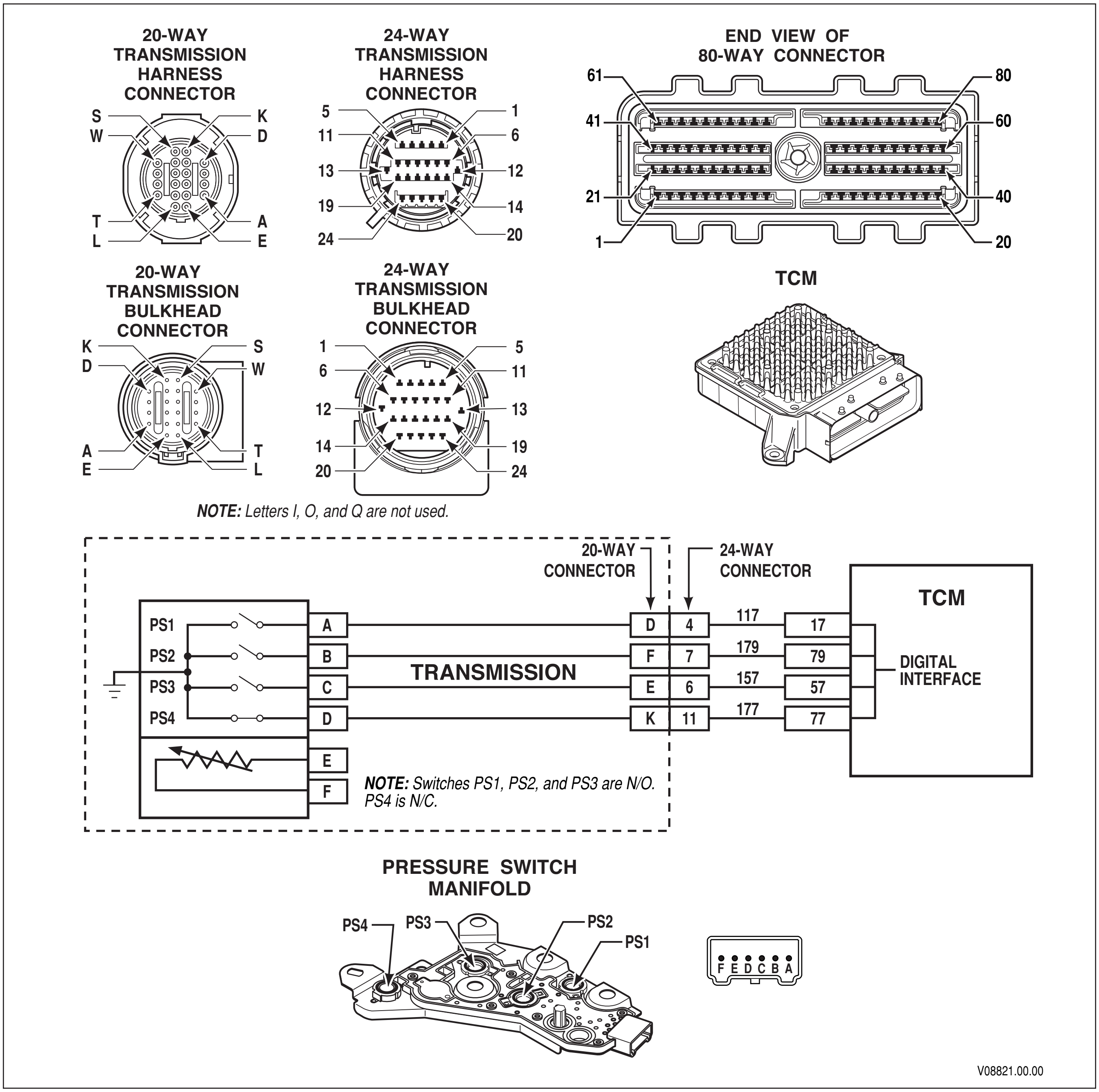
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0752 Shift Solenoid 1 (SS1) Valve Performance—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin A. Does Allison DOC™ indicate Pressure Switch 1 (PS1) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 13*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on PS1 membrane. Does Allison DOC™ indicate Pressure Switch 1 (PS1) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 9*	*Go to Step 12*
9	Remove the valve body and inspect for a stuck or sticking shift valve 1. Was shift valve 1 stuck or sticking?		*Go to Step 11*	*Go to Step 10*
10	Remove SS1 and replace. Is replacement complete?		*Go to Step 16*	
11	Clean the sticking valve to restore free movement. If this does not restore free movement, replace the valve or control valve body assembly if necessary (refer to the 1000 and 2000 Product Families Service Manual, SM4006EN). Was free movement restored or the valve or body replaced?		*Go to Step 16*	
12	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
13	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
14	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 16*	
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 16*	
16	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0756 Shift Solenoid 2 (SS2) Valve Performance—Stuck Off



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. The Pressure Switch 2 (PS2) monitors Shift Valve 2 (SV2) positioning and relays it to the TCM. When PS2 is in the open state, SV2 should be in the destroked position.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.
- Shift SV2 is commanded to the ON (stroked) position.

Conditions for Setting the DTC

DTC P0756 is set when Shift Solenoid 2 (SS2) is commanded ON and Pressure Switch 2 (PS2) status remains Exhausted/OFF for a period of time that is temperature dependent (5 seconds at a temperature between 0ºC and –40ºC (32ºF and –40ºF). The intent of this DTC is to detect a shift valve timeout condition which normally indicates a stuck shift valve in the destroked state, mechanical solenoid failure or a open circuit condition.

Actions taken when the DTC Sets

When DTC P0756 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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.
- When a P0848 and P0756 are set in combination, the TCM logic re-attempted to command the shift solenoid on. This indicates a circuit or pressure switch concern exists. Refer to P0848 for further instruction.
- 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 check for an open condition at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures and Appendix A, Section B).

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.
- Whenever performing any internal valve body repair be sure that your work area is free of airborne dust and dirt that might contaminate the valve body assembly. Always store any reusable oil in a clean, covered container. It is recommended that a funnel which incorporates a screen filter be used to refill or strain the oil through an appropriate screen.

Test Description

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

2. This step tests for proper fluid level.
3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0756 Shift Solenoid 2 (SS2) Valve Performance—Stuck Off

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (refer to Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0756 Shift Solenoid 2 (SS2) Valve Performance—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF. If pressure switch is Pressurized/ON, indicates a short-to-ground or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Verify the pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC intent is to detect a shift valve timeout occurrence, which indicates a shift valve that is stuck in the destroked state. Under certain conditions it may also indicate a solenoid mechanically failed, open in the switch circuit or defective PSM.*** Did DTC P0756 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 79 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 15*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 7 (wire 179) to a known good ground. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 14*

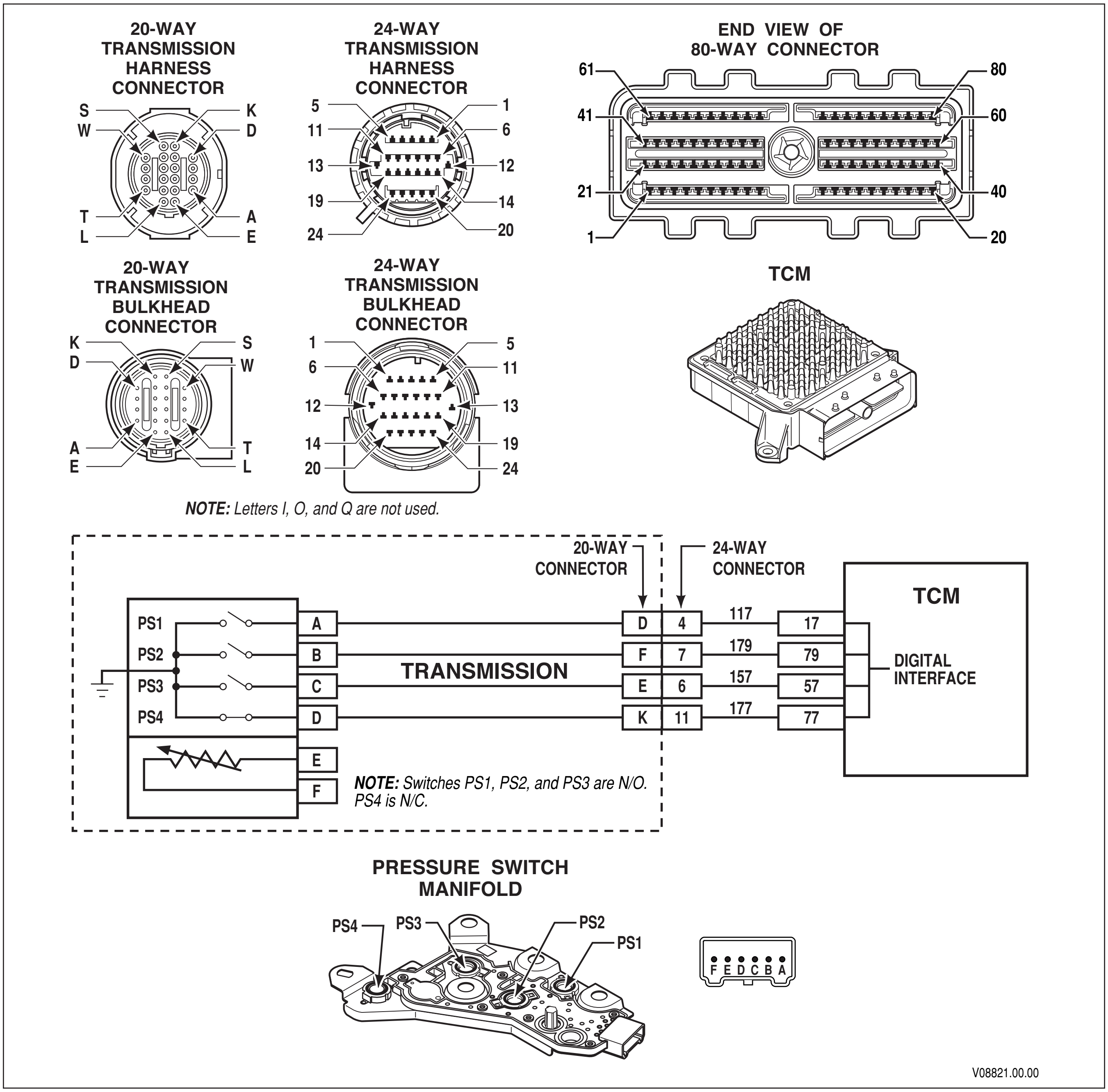
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0756 Shift Solenoid 2 (SS2) Valve Performance—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin B. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 13*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on Pressure Switch 2 (PS2) membrane. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 9*	*Go to Step 12*
9	Remove the valve body and inspect for a stuck or sticking shift valve 2. Was SS2 stuck or sticking?		*Go to Step 11*	*Go to Step 10*
10	Remove SS2 and replace. Is replacement complete?		*Go to Step 16*	
11	Clean the sticking valve to restore free movement. If this does not restore free movement, replace the valve or control valve body assembly if necessary (refer to the 1000 and 2000 Product Families Service Manual). Was free movement restored or the valve or body replaced?		*Go to Step 16*	
12	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
13	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
14	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 16*	
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 16*	
16	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0757 Shift Solenoid 2 (SS2) Valve Performance—Stuck On



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. The Pressure Switch 2 (PS2) monitors shift solenoid valve 2 positioning and relays it to the TCM. When PS2 is in the open state, shift solenoid valve 2 should be in the destroked position.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.
- Shift Solenoid valve 2 is commanded to the OFF (destroked) position.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

DTC P0757 is set when Shift Solenoid 2 (SS2) is commanded OFF and Pressure Switch 2 (PS2) status remains Pressurized/ON for a period of time that is temperature dependent (2 seconds at a temperatures above 0ºC, up to 7 seconds at –40ºC). The intent of this DTC is to detect a shift valve timeout condition which normally indicates a stuck shift valve in the stroked state, mechanical solenoid failure or a circuit short-to-ground.

Actions taken when the DTC Sets

When DTC P0757 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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.
- When a P0847 and P0757 are set in combination, the TCM logic re-attempted to command the shift solenoid on. This indicates a circuit or pressure switch concern exists. Refer to P0847 for further instruction.
- 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 check for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures and Appendix A, Section B).
- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.
- Whenever performing any internal valve body repair be sure that your work area is free of airborne dust and dirt that might contaminate the valve body assembly. Always store any reusable oil in a clean, covered container. It is recommended that a funnel which incorporates a screen filter be used to refill or strain the oil through an appropriate screen.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

2. This step tests for proper fluid level.
3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0757 Shift Solenoid 2 (SS2) Valve Performance—Stuck On

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (refer to Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (refer to Appendix R)*
3	Perform the Main Pressure Check Procedure (refer to Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (refer to Section 7)*
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF. If pressure switch is Pressurized/ON, indicates a short-to-ground or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Verify the pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC intent is to detect a shift valve timeout occurrence, which indicates a shift valve that is stuck in the stoked state. Under certain conditions it may also indicate a solenoid mechanically failed, short-to-ground in switch circuit or defective PSM.*** Did DTC P0757 return?		*Go to Step 5*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0757 Shift Solenoid 2 (SS2) Valve Performance—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 79 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 15*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 7 (wire 179) to a known good ground. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 14*
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin B. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 13*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on Pressure Switch 2 (PS2) membrane. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 9*	*Go to Step 12*
9	Remove the valve body and inspect for a stuck or sticking shift valve 2. Was shift valve 2 stuck or sticking?		*Go to Step 11*	*Go to Step 10*

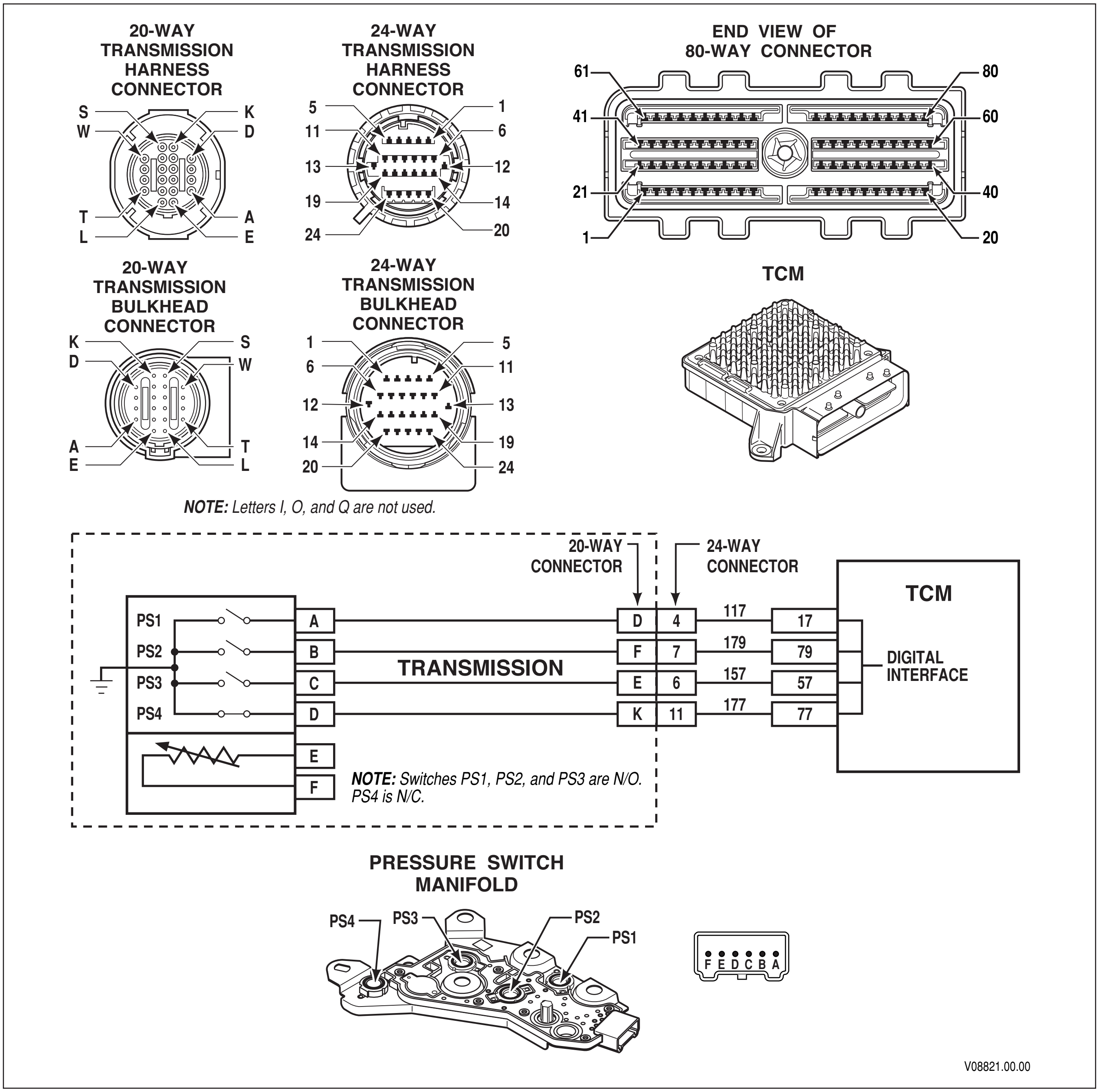
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0757 Shift Solenoid 2 (SS2) Valve Performance—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
10	Remove SS2 and replace. Is replacement complete?		*Go to Step 16*	
11	Clean the sticking valve to restore free movement. If this does not restore free movement, replace the valve or control valve body assembly if necessary (refer to the 1000 and 2000 Product Families Service Manual). Was free movement restored or the valve or body replaced?		*Go to Step 16*	
12	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
13	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
14	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 16*	
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 16*	
16	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0761 Shift Solenoid 3 (SS3) Valve Performance—Stuck Off



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. The Pressure Switch 3 (PS3) monitors shift solenoid valve 3 positioning and relays it to the TCM. When PS3 is in the open state, shift solenoid valve 3 should be in the destroked position.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.
- Shift Solenoid valve 3 is commanded to the ON (stroked) position.

Conditions for Setting the DTC

DTC P0761 is set when Shift Solenoid 3 (SS3) is commanded ON and Pressure Switch 3 (PS3) status remains Exhausted/OFF for a period of time that is temperature dependent (5 seconds at temperatures between 0ºC and –40ºC (32ºF and –40ºF)). The intent of this DTC is to detect a shift valve timeout condition which normally indicates a stuck shift valve in the destroked state, mechanical solenoid failure or an open circuit condition.

Actions taken when the DTC Sets

When DTC P0761 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or reverse and transmission is compromised by overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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.
- When a P0873 and P0761 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern exists. Refer to P0873 for further instruction.
- 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 check for an open circuit condition at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures and Appendix A, Section B).

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.
- Whenever performing any internal valve body repair be sure that your work area is free of airborne dust and dirt that might contaminate the valve body assembly. Always store any reusable oil in a clean, covered container. It is recommended that a funnel which incorporates a screen filter be used to refill or strain the oil through an appropriate screen.

Test Description

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

2. This step tests for proper fluid level.
3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0761 Shift Solenoid 3 (SS3) Valve Performance—Stuck Off

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0761 Shift Solenoid 3 (SS3) Valve Performance—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF. If pressure switch is Pressurized/ON, it indicates a short-to-ground or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Verify the pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC intent is to detect a shift valve timeout occurrence, which indicates a shift valve that is stuck in the destroked state. Under certain conditions it may also indicate a solenoid mechanically failed, open condition in the switch circuit, or defective PSM.*** Did DTC P0761 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 57 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 15*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 6 (wire 157) to a known good ground. Does Allison DOC™ indicate Pressure Switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 14*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0761 Shift Solenoid 3 (SS3) Valve Performance—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin C. Does Allison DOC™ indicate Pressure Switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 13*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on Pressure Switch 3 (PS3) membrane. Does Allison DOC™ indicate Pressure Switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 9*	*Go to Step 12*
9	Remove the valve body and inspect for a stuck or sticking shift valve 3. Was shift valve 3 stuck or sticking?		*Go to Step 11*	*Go to Step 10*
10	Remove SS3 and replace. Is replacement complete?		*Go to Step 16*	
11	Clean the sticking valve to restore free movement. If this does not restore free movement, replace the valve or control valve body assembly if necessary. Refer the 1000 and 2000 Product Families Service Manual. Was free movement restored or the valve or body replaced?		*Go to Step 16*	
12	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
13	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
14	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 16*	

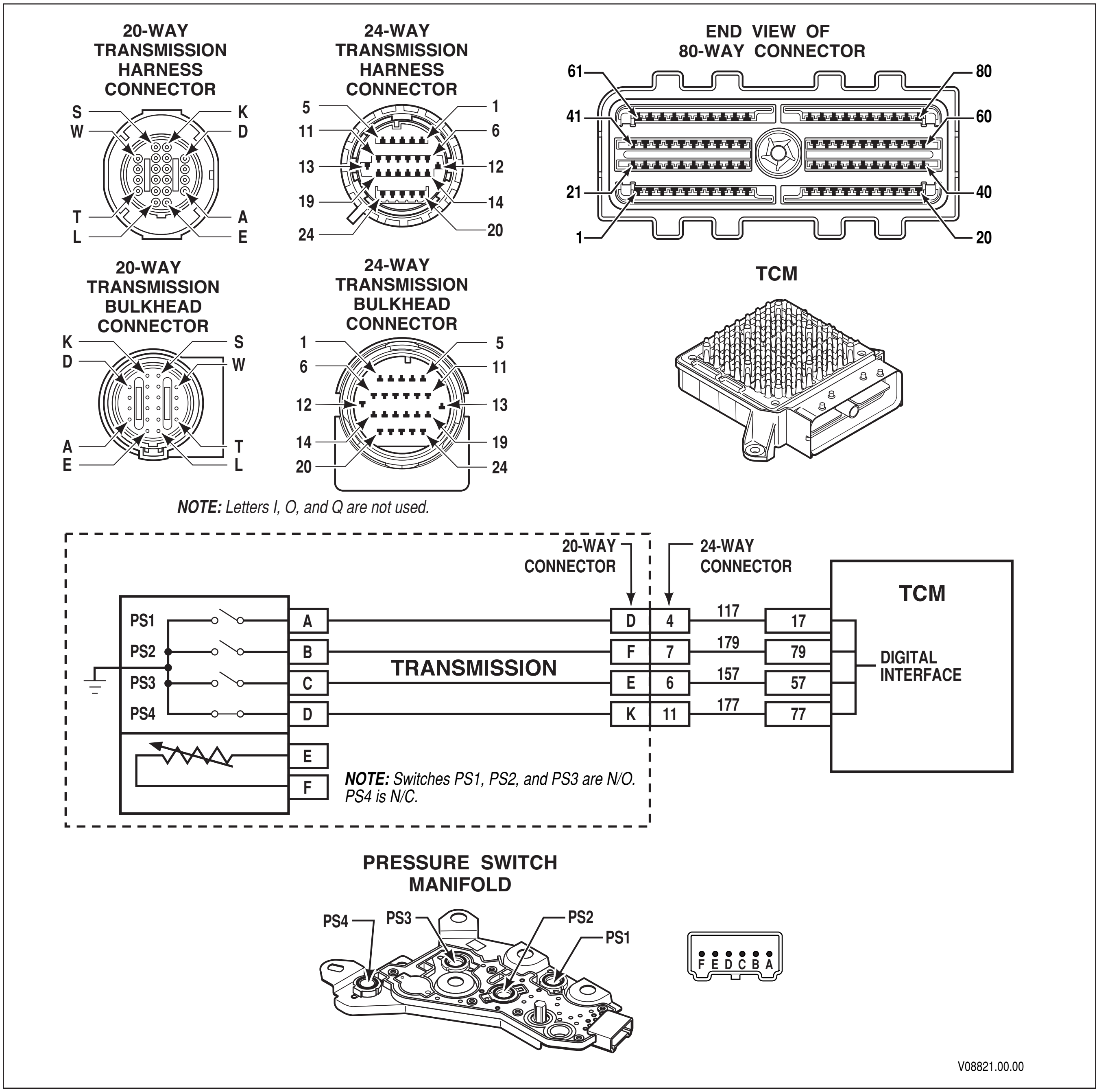
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0761 Shift Solenoid 3 (SS3) Valve Performance—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
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 16*	
16	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0762 Shift Solenoid 3 (SS3) Valve Performance—Stuck On



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. The Pressure Switch 3 (PS3) monitors shift solenoid valve 3 positioning and relays it to the TCM. When PS3 is in the open state, shift solenoid valve 3 should be in the destroked position.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.
- Shift Solenoid valve 3 is commanded to the OFF (destroked) position.

Conditions for Setting the DTC

DTC P0762 is set when Shift Solenoid 3 (SS3) is commanded OFF and Pressure Switch 3 (PS3) status remains Pressurized/ON for a period of time that is temperature dependent. (2 seconds at a temperature of 0ºC up to 15 seconds at –40ºC). The intent of this DTC is to detect a shift valve timeout condition which normally indicates a stuck shift valve in the stroked state, mechanical solenoid failure or a circuit short-to-ground.

Actions taken when the DTC Sets

When DTC P0762 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or reverse and transmission is compromised by overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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.
- When a P0872 and P0762 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern exists. Refer to P0872 for further instruction.
- 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 check for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures and Appendix A, Section B).

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.
- Whenever performing any internal valve body repair be sure that your work area is free of airborne dust and dirt that might contaminate the valve body assembly. Always store any reusable oil in a clean, covered container. It is recommended that a funnel which incorporates a screen filter be used to refill or strain the oil through an appropriate screen.

Test Description

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

2. This step tests for proper fluid level.
3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0762 Shift Solenoid 3 (SS3) Valve Performance—Stuck On

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0762 Shift Solenoid 3 (SS3) Valve Performance—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF. If pressure switch is Pressurized/ON, indicates a open condition or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Verify the pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC intent is to detect a shift valve timeout occurrence, which indicates a shift valve that is stuck in the stoked state. Under certain conditions it may also indicate a solenoid mechanically failed, short-to-ground in switch circuit or defective PSM.*** Did DTC P0762 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 6 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 15*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 57 (wire 157) to a known good ground. Does Allison DOC™ indicate Pressure Switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 14*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0762 Shift Solenoid 3 (SS3) Valve Performance—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin C. Does Allison DOC™ indicate Pressure Switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 13*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on Pressure Switch 3 (PS3) membrane. Does Allison DOC™ indicate Pressure Switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 9*	*Go to Step 12*
9	Remove the valve body and inspect for a stuck or sticking shift valve 3. Was shift valve 3 stuck or sticking?		*Go to Step 11*	*Go to Step 10*
10	Remove SS3 and replace. Is replacement complete?		*Go to Step 16*	
11	Clean the sticking valve to restore free movement. If this does not restore free movement, replace the valve or control valve body assembly if necessary (refer to the 1000 and 2000 Product Families Service Manual). Was free movement restored or the valve or body replaced?		*Go to Step 16*	
12	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
13	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 16*	
14	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 16*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0762 Shift Solenoid 3 (SS3) Valve Performance—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
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 16*	
16	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0776 Pressure Control Solenoid 2 (PCS2)—Stuck Off

REFER TO HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

PCS2 is used to control on-coming, off-going, and holding pressure to any one of the five clutches. This solenoid is referred to as a Pressure Proportional to Current (PPC) solenoid since the output hydraulic pressure supplied by this solenoid is proportional to the controlled current command.

The Transmission Control Module (TCM) uses information from the turbine and output speed sensors to detect if a clutch is slipping. The clutch being controlled by PCS2 will vary depending on the shift that was being completed.

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 18V and less than 32V (24V TCM).
- Turbine speed is greater than 60 rpm.
- Output speed is greater than 125 rpm.
- Transmission is at normal operating temperature.
- DTC P0708, P0716, P0717, P0721, P0722, P0875, or P0876 is not active.

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.

Action Taken When the DTC Sets

- When DTC P0776 is active, the following conditions will occur:
  - If failure occurs while in a forward range, the transmission will shift to the previous range.
  - If failure occurs while in **N** (Neutral) or **R** (Reverse), the transmission will lock in **N** (Neutral).
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **N** (Neutral) (some cases may lock in **N** (Neutral)).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **R** (Reverse) or **N** (Neutral).
  - If the shift selector is returned to a forward range and the transmission is compromised by overspeeding or a direction change, the transmission will shift to **N** (Neutral).
- DTC P0776 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Clearing the DTC/CHECK TRANS Light

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

- This DTC indicates the on-coming clutch being controlled by PCS2 is not applied or applied too slowly. This could indicate a leak or obstruction in a specific clutch apply circuit. Check Allison DOC™ For PC–Service Tool Failure Record data for previous or current range information when the DTC was set to determine the specific shift when the DTC was set. Refer to the Solenoid and Clutch Table (Appendix C) to determine which clutch circuit is suspect.
- If the condition is intermittent, connect Allison DOC™ For PC–Service Tool and select 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).
- Inspect and confirm that the OEM engine rating does not exceed the transmission model rating. Also inspect for the presence of an add-on engine power package or module. Whenever the engine horsepower or torque is increased over the transmission factory rating, a shift flare condition may occur leading to the DTC indicated.

NOTE: Clutch failure due to an OEM engine rating exceeding the Allison transmission rating, or the installation of a engine power package or module will not be covered under the Allison transmission warranty.

Test Description

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

3. This step tests the ignition voltage.
4. This step tests speed sensor readings.
5. This step tests for internal hydraulic leakage.
6. This step tests for clutch capacity.

DTC P0776 Pressure Control Solenoid 2 (PCS2)—Stuck Off

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Install Allison DOC™. 2. Start the engine. 3. Record DTC Failure Record data. 4. Use the Failure Record data to determine during which shift the DTC was set. 5. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0776 Pressure Control Solenoid 2 (PCS2)—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. Make the shift determined in Step 3. 2. Using Allison DOC™, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?		*Go to the appropriate speed sensor DTC*	*Go to Step 5*
5	1. Connect a 2000 kPa (300 psi) pressure gauge to the main-pressure tap (refer to Mechanic's Tips). 2. Use Allison DOC™, in clutch test mode, to cycle through all transmission ranges with the engine at idle and vehicle brakes applied. 3. Record main pressure in each range. Was the main pressure low in a specific range or in ranges where the same clutch was applied?		*Go to General Troubleshooting—Low Pressure (Section 7)*	*Go to Step 6*
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)...and** • **Apply the parking brake and service brake...and** • **Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: Do not perform a clutch test in fourth or fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select the clutch test mode. 2. With engine at idle speed, vehicle brakes applied, select **D** (Drive). 3. Using clutch test mode, select and attain first range. Turbine speed should go to zero. 4. Increase engine speed to 1400 rpm. Did turbine speed remain at zero? 5. Return to idle and repeat sub-steps 3 and 4 for 2nd through 5th range. Did turbine speed remain at zero in all ranges?	Refer to Table 5–5, Main Pressure Schedule	*Go to Diagnostic Aids*	*Go to Step 7*
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 8*	*Go to Step 9*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0776 Pressure Control Solenoid 2 (PCS2)—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
8	Remove the transmission for overhaul or replacement. Is the overhaul or replacement complete?		*Go to Step 11*	
9	Inspect the control valve body for stuck or sticking trimmer valves (refer to Mechanic's Tips). Was a valve problem found and repaired?		*Go to Step 11*	*Go to Step 10*
10	Replace PCS2. Is solenoid replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ to reset adaptive for all shifts. 3. Operate the vehicle in all ranges under normal driving 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 (PCS2)—Stuck On

REFER TO HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

Pressure Control Solenoid 2 (PCS2) is used to control on-coming, off-going, and holding pressure to any one of five clutches. This solenoid is referred to as a Pressure Proportional to Current (PPC) solenoid since the output hydraulic pressure supplied by this solenoid is proportional to the controlled current command.

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. The clutch being controlled by PCS2 will vary depending on the shift.

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 18V and less than 32V (24V TCM).
- One of the following conditions occurs:
  - Output speed is greater than 200 rpm.
  - Turbine speed is greater than 200 rpm.
- DTC P0708, P0716, P0717, P0721, P0722, P0877, or P0878 is not active.

Conditions for Setting the DTC

DTC P0777 sets when the TCM detects an incorrect off-going ratio, range-to-range, for an accumulated number of occurrences.

Action Taken When the DTC Sets

- When DTC P0777 is active, the following conditions will occur:
  - If failure occurs while in a forward range, the transmission will shift to the previous range.
  - If failure occurs while in **N** (Neutral) or **R** (Reverse), the transmission will lock in **N** (Neutral).
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **N** (Neutral).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **R** (Reverse) or **N** (Neutral) (some cases may lock in **N** (Neutral)).
  - If the shift selector is returned to a forward range and the transmission is compromised by overspeeding or a direction change, the transmission will shift to **N** (Neutral).
- DTC P0777 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 TROUBLE CODES (DTC)

Diagnostic Aids

- This DTC indicates the off-going clutch being controlled by PCS2 is not released or is released too slowly. This could indicate a leak or obstruction in a specific clutch apply circuit. Check Allison DOC™ For PC Failure Record data for previous or current range information when the DTC was set to determine the specific shift when the DTC was set. Refer to the Solenoid and Clutch Table (Appendix C) to determine which clutch circuit is suspect.
- If the condition is intermittent, connect Allison DOC™ For PC and select 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).
- Inspect and confirm that the OEM engine rating does not exceed the transmission model rating. Also inspect for the presence of an add-on engine power package or module. Whenever the engine horsepower or torque is increased over the transmission factory rating, a shift flare condition may occur leading to the DTC indicated.

NOTE: Clutch failure due to an OEM engine rating exceeding the Allison transmission rating, or the installation of a engine power package or module will not be covered under the Allison transmission warranty.

Test Description

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

3. This step tests the ignition voltage.
4. This step tests for correct speed sensor operation.
5. This step tests for internal hydraulic leakage.
6. This step tests for clutch capacity.

DTC P0777 Pressure Control Solenoid 2 (PCS2)—Stuck On

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Use the Failure Record Data to determine during which shift the DTC was set. 5. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0777 Pressure Control Solenoid 2 (PCS2)—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. Make the shift determined in Step 3. 2. Using Allison DOC™, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?		*Go to the appropriate speed sensor DTC*	*Go to Step 5*
5	1. Connect a 2000 kPa (300 psi) pressure gauge to the main-pressure tap. Refer to Mechanic's Tips. 2. Use Allison DOC™, in clutch test mode, to cycle through all transmission ranges with the engine at idle and vehicle brakes applied. 3. Record main pressure in each range. Was the main pressure low in a specific range or in ranges where the same clutch was applied?		*Go to General Troubleshooting—Low Pressure (Section 7)*	*Go to Step 6*
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)...and** • **Apply the parking brake and service brake...and** • **Chock the vehicle wheels and take any other steps necessary to prevent the vehicle from moving...and** **Warn personnel to keep clear of the vehicle and its path.** **CAUTION: Do not perform a clutch test in fourth or fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select the clutch test mode. 2. With engine at idle speed (600 rpm), vehicle brakes applied, select **D** (Drive). 3. Using clutch test mode, select and attain 1st range. Turbine speed should go to zero. 4. Increase engine speed to 1400 rpm. Did turbine speed remain at zero? 5. Return to idle and repeat sub-steps 3 and 4 for 2nd through 5th range. Did turbine speed remain at zero in all ranges?	Refer to Table 5–5, Main Pressure Schedule	*Go to Diagnostic Aids*	*Go to Step 7*
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 8*	*Go to Step 9*

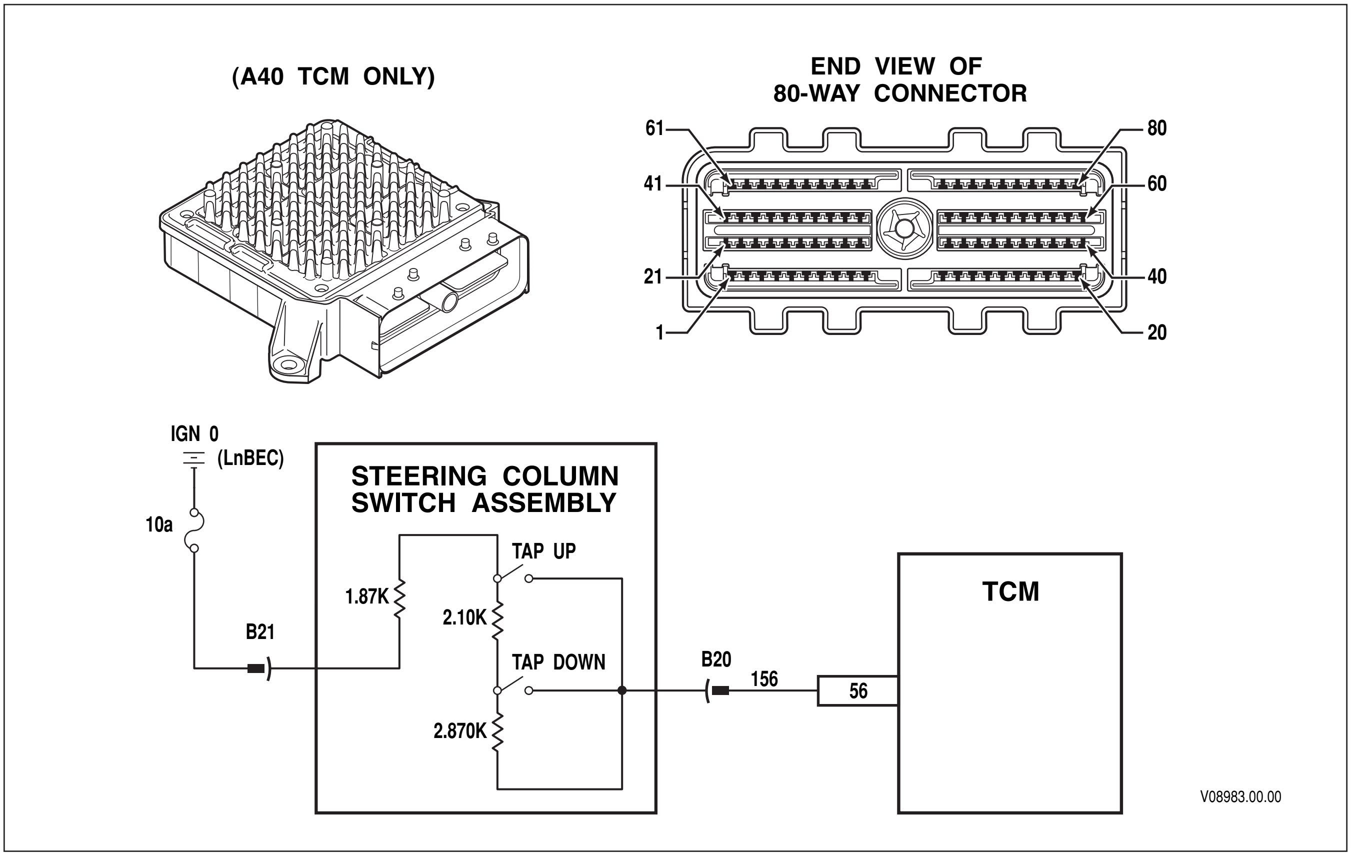
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0777 Pressure Control Solenoid 2 (PCS2)—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
8	Remove the transmission for overhaul or replacement. Is the overhaul or replacement complete?		*Go to Step 11*	
9	Inspect the control valve body for stuck or sticking trimmer valves. Refer to Mechanic's Tips. Was a valve problem found and repaired?		*Go to Step 11*	*Go to Step 10*
10	Replace PCS2. Is solenoid replacement complete?		*Go to Step 11*	
11	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ to reset adaptive for all shifts. 3. Operate the vehicle in all ranges under normal driving conditions. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0826 Up and Down Shift Switch Circuit



Circuit Description

The Tap Up/Down Shift system allows the driver to manually shift gears by using the Tap Shift switch located on the automatic transmission shift lever. The selector mounted two position switch is used to direct battery voltage through a series of resistors with varying resistance values. Depending on the switch position, three different voltage values are sent to the TCM to determine the range requested. The Tap Shift system is activated when the shift selector is in the manual (M) position.

NOTE: ***Tap Up/Down Shift is not used in medium duty diesel application.***

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- The output speed is greater than 200 rpm.
- Driver Shift Request is commanded.

Conditions for Setting the DTC

DTC P0826 sets when the TCM detects an open condition in the Tap Up/Down Shift Switch circuit for more than 6 seconds when Driver Shift Request is commanded.

DIAGNOSTIC TROUBLE CODES (DTC)

Action Taken When the DTC Sets

- The MIL illuminates (OBD II Strategy) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- DTC P0826 will be stored in the TCM history.
- The TCM disables Driver Shift Request operations.

Conditions for Clearing the MIL/DTC

Allison DOC™ For PC can 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.
- 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.
- An open condition at the ignition fuse may allow this DTC to set.

Test Description

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

3. This step tests signal voltage to TCM.
4. This step tests supply voltage to Driver Shift Request Switch.
5. This step tests resistance of Driver Shift Request Switch.

DTC P0826 Up and Down Shift Switch Circuit

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Install J 39700 Breakout Box, J 47275 TCM Breakout, and J 47275-1 TCM Overlay. 4. Turn ON the ignition, with the engine OFF. 5. Using a digital volt/ohmmeter (DVOM), measure voltage at terminal 56 and a known good ground. Is the voltage within the range specified?	2.5V	*Go to Diagnostic Aids*	*Go to Step 4*

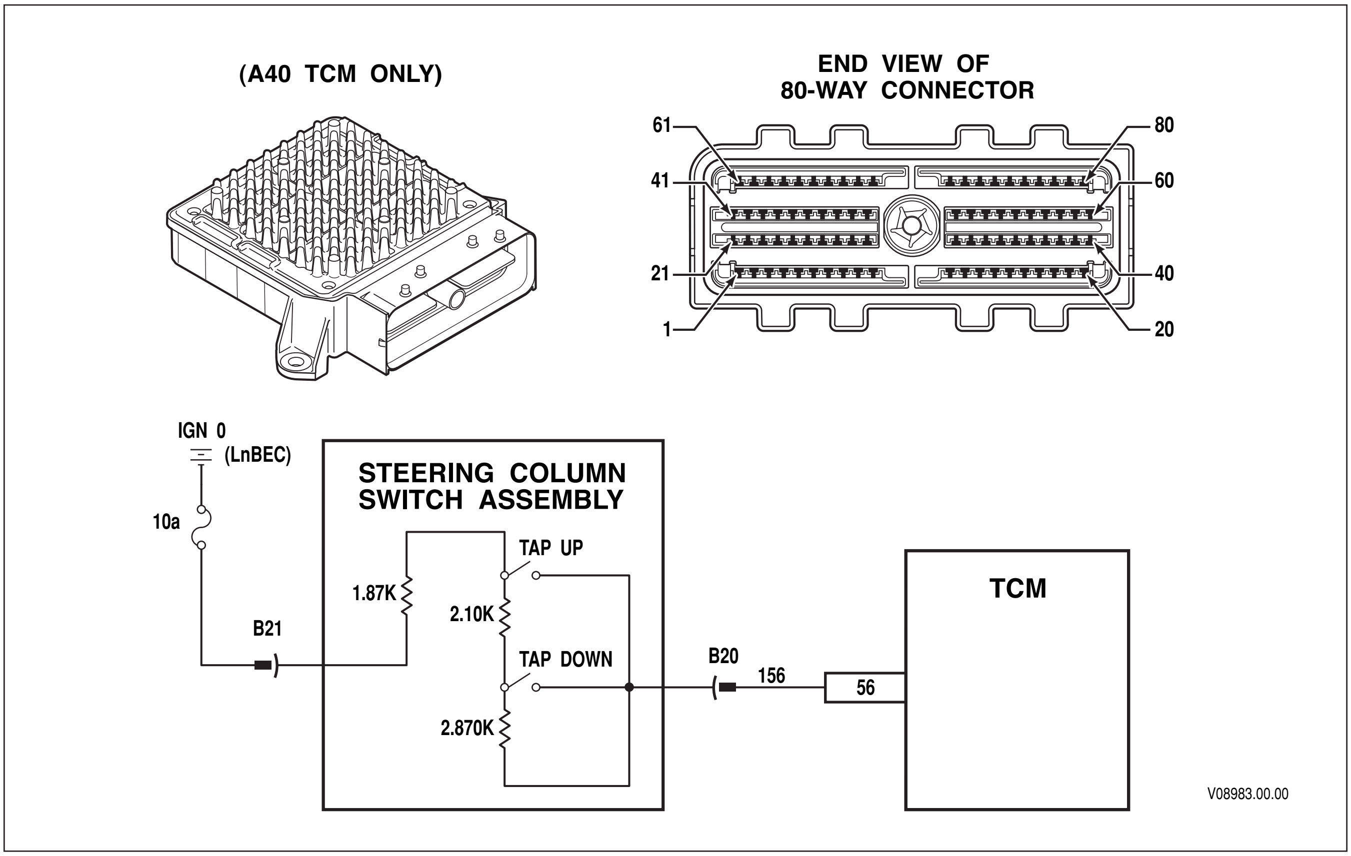
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0826 Up and Down Shift Switch Circuit *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn OFF the ignition. 2. Disconnect terminals 20 and 21 at the Driver Shift Request Switch. 3. Using the DVOM connect from terminal 21 to a known good chassis ground. 4. Turn the ignition ON. Is the voltage within the range specified?	11.75–12.75V	*Go to Step 5*	*Go to Step 6*
5	1. Turn OFF the ignition. 2. Using a DVOM connect between wires 20 and 21 at the Driver Shift Request Switch. 3. Operate the Driver Shift Request switch in the Tap Up and Tap Down position. Is the resistance within the range specified?	Off State 6.84K Ohms Tap up 1.87K Ohms Tap down 3.97K Ohms	*Go to Step 7*	*Go to Step 9*
6	***NOTE: The condition that affects this circuit may exist in other connecting branches of the circuit.*** 1. Inspect ignition 0 voltage circuit for an open. 2. Replace fuse if necessary. Was the fuse open?		*Go to Step 11*	*Go to Step 7*
7	Test the signal circuit for continuity between the Allison Transmission Driver Shift Request Switch and the TCM (inspect for an open condition). Did you find and correct the condition?		*Go to Step 11*	*Go to Step 10*
8	Test the ignition 0 voltage circuit of the Allison Transmission Driver Shift Request Switch for an open between the fuse block and the A/T Driver Shift Request Switch. Did you find and correct the condition?		*Go to Step 11*	*Go to Step 10*
9	Replace the Allison Transmission Driver Shift Request Switch. Did you complete the replacement?		*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?		*Go to Step 1*	*Go to Step 2*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0827 Up and Down Shift Switch Circuit—Low



Circuit Description

The Tap Up/Down Shift system allows the driver to manually shift gears by using the Tap Shift switch located on the automatic transmission shift lever. The selector mounted two position switch is used to direct battery voltage through a series of resistors with varying resistance values. Depending on the switch position, three different voltage values are sent to the TCM to determine the range requested. The Tap Shift system is activated when the shift selector is in the manual (M) position.

NOTE: ***Tap Up/Down Shift is not used in medium duty diesel application.***

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- The output speed is greater than 200 rpm.
- Driver Shift Request is commanded.

Conditions for Setting the DTC

DTC P0827 sets when the TCM detects a short-to-ground condition in the Tap Up/Down Shift Switch circuit for more than 6 seconds when Driver Shift Request is commanded.

DIAGNOSTIC TROUBLE CODES (DTC)

Action Taken When the DTC Sets

- The MIL illuminates (OBD II Strategy) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- DTC P0827 will be stored in the TCM history.
- The TCM disables Driver Shift Request operations.

Conditions for Clearing the MIL/DTC

Allison DOC™ For PC can 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.
- 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.
- A short at the ignition fuse may allow this DTC to set.

Test Description

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

3. This step tests signal voltage to TCM.
4. This step tests supply voltage to Driver Shift Request Switch.
5. This step tests resistance of Driver Shift Request Switch.

DTC P0827 Up and Down Shift Switch Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Install J 39700 Breakout Box, J 47275 TCM Breakout, and J 47275-1 TCM Overlay. 4. Turn ON the ignition, with the engine OFF. 5. Using a digital volt/ohmmeter (DVOM), measure voltage at terminal 56 and a known good ground. Is the voltage within the range specified?	2.5V	*Go to Diagnostic Aids*	*Go to Step 4*

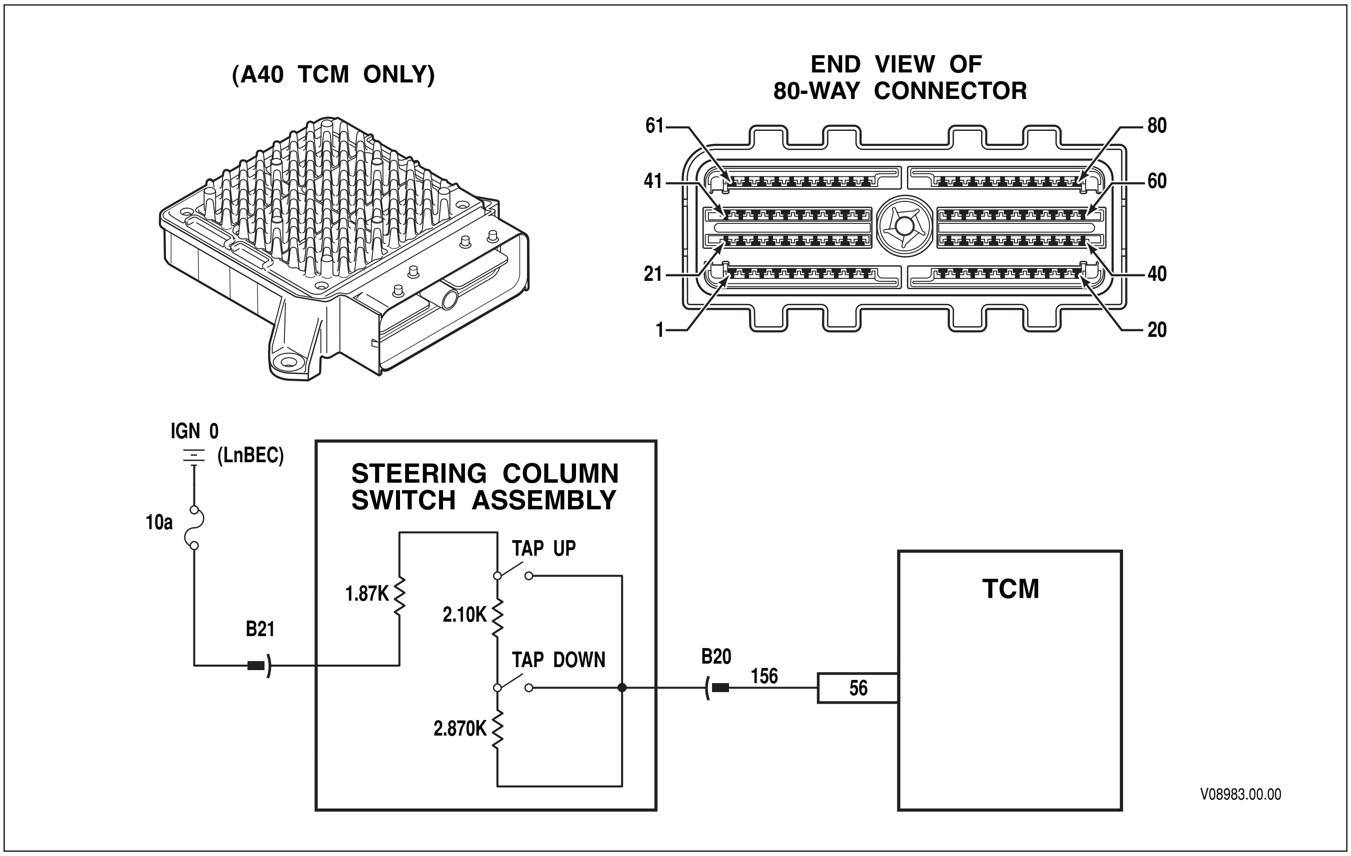
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0827 Up and Down Shift Switch Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn OFF the ignition. 2. Disconnect terminals 20 and 21 at the Driver Shift Request Switch. 3. Using the DVOM connect from terminal 21 to a known good chassis ground 4. Turn ON the ignition. Is the voltage within the range specified?	11.75–12.75V	*Go to Step 5*	*Go to Step 6*
5	1. Turn OFF the ignition. 2. Using a DVOM connect between wires 20 and 21 at the Driver Shift Request Switch. 3. Operate the Driver Shift Request switch in the Tap Up and Tap Down position. Is the resistance within the range specified?	Off State 6.84K Ohms Tap up 1.87K Ohms Tap down 3.97K Ohms	*Go to Step 7*	*Go to Step 9*
6	***NOTE: The condition that affects this circuit may exist in other connecting branches of the circuit.*** 1. Inspect ignition 0 voltage circuit for a continuity-to-ground. 2. Replace fuse if necessary. Did you find and correct the condition?		*Go to Step 11*	*Go to Step 7*
7	Test the signal circuit for a short-to-ground between the Allison Transmission Driver Shift Request Switch and the TCM. Did you find and correct the condition?		*Go to Step 11*	*Go to Step 10*
8	Test the ignition 0 voltage circuit of the Allison Transmission Driver Shift Request Switch for a short-to-ground between the fuse block and the Allison Transmission Driver Shift Request Switch. Did you find and correct the condition?		*Go to Step 11*	*Go to Step 10*
9	Replace the Allison Transmission Driver Shift Request Switch. Did you complete the replacement?		*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?		*Go to Step 1*	*Go to Step 2*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0828 Up and Down Shift Switch Circuit—High



Circuit Description

The Tap up/Down Shift system allows the driver to manually shift gears by using the Tap Shift switch located on the automatic transmission shift lever. The selector mounted two position switch is used to direct battery voltage through a series of resistors with varying resistance values. Depending on the switch position, three different voltage values are sent to the TCM to determine the range requested. The Tap Shift system is activated when the shift selector is in the manual (M) position.

NOTE: ***Tap Up/Down Shift is not used in medium duty diesel application.***

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- The output speed is greater than 200 rpm.
- Driver Shift Request is commanded.

Conditions for Setting the DTC

DTC P0828 sets when the TCM detects a short-to-voltage condition in the Tap Up/Down Shift Switch circuit for more than 6 seconds when Driver Shift Request is commanded.

DIAGNOSTIC TROUBLE CODES (DTC)

Action Taken When the DTC Sets

- The MIL illuminates (OBD II Strategy) during the second consecutive trip in which the Conditions for Setting the DTC are met.
- DTC P0828 will be stored in the TCM history.
- The TCM disables Driver Shift Request operations.

Conditions for Clearing the MIL/DTC

Allison DOC™ For PC can 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.
- 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

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

3. This step tests signal voltage to TCM.
4. This step tests supply voltage to Driver Shift Request Switch.
5. This step tests resistance of Driver Shift Request Switch.

DTC P0828 Up and Down Shift Switch Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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. Turn OFF the ignition. 2. Disconnect the 80-way connector at the TCM. 3. Install J 39700 Breakout Box, J 47275 TCM Breakout, and J 47275-1 TCM Overlay. 4. Turn ON the ignition, with the engine OFF. 5. Using a DMM, measure voltage at terminal 56 and a known good ground. Is the voltage within the range specified?	2.5V	*Go to Diagnostic Aids*	*Go to Step 4*

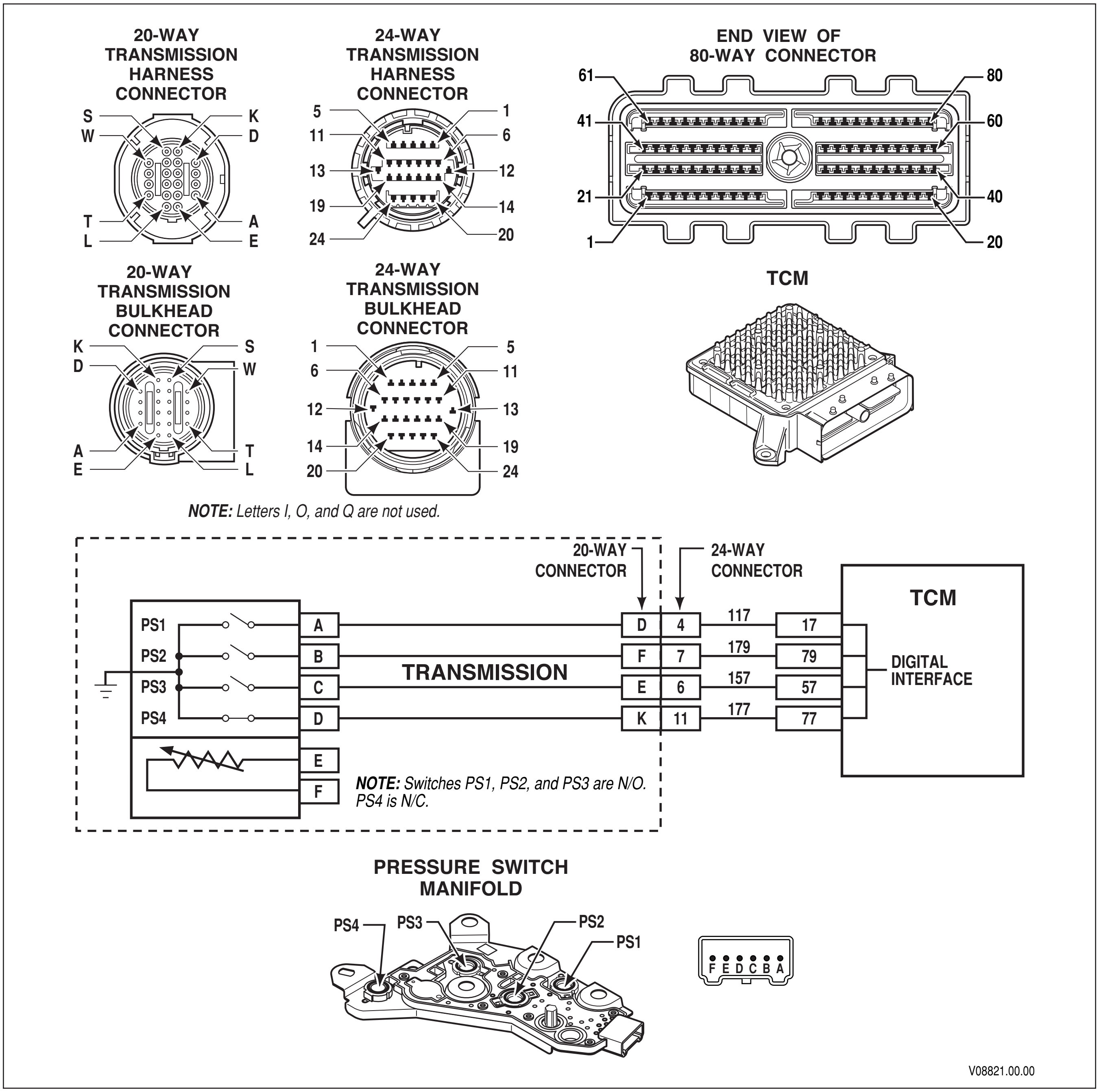
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0828 Up and Down Shift Switch Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn OFF the ignition. 2. Disconnect terminals 20 and 21 at the Driver Shift Request Switch. 3. Using the DVOM connect from terminal 21 to a known good chassis ground. 4. Turn the ignition ON. Is the voltage within the range specified?	11.75–12.75V	*Go to Step 5*	*Go to Step 6*
5	1. Turn OFF the ignition. 2. Using a DVOM connect between wires 20 and 21 at the Driver Shift Request Switch. 3. Operate the Driver Shift Request switch in the Tap Up and Tap Down position. Is the resistance within the range specified?	Off State 6.84K Ohms Tap up position 1.87K Ohms Tap down 3.97K Ohms	*Go to Step 7*	*Go to Step 9*
6	***NOTE: The condition that affects this circuit may exist in other connecting branches of the circuit.*** 1. Inspect ignition 0 voltage circuit for an open. 2. Replace fuse if necessary. Was the fuse open?		*Go to Step 11*	*Go to Step 8*
7	Test the signal circuit for a short-to-power between the Allison Transmission Driver Shift Request Switch and the TCM. Did you find and correct the condition?		*Go to Step 11*	*Go to Step 10*
8	Test the ignition 0 voltage circuit of the Allison Transmission Driver Shift Request Switch for a short-to-power between the fuse block and the Allison Transmission Driver Shift Request Switch. Did you find and correct the condition?		*Go to Step 11*	*Go to Step 10*
9	Replace the Allison Transmission Driver Shift Request Switch. Did you complete the replacement?		*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?		*Go to Step 1*	*Go to Step 2*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 (PS1) Circuit—Low



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. Pressure switch 1 (PS1) monitors shift valve 1 positioning and relays it to the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 5V.
- DTC P0561, P0562, P0563 are not active.
- Shift valve 1 is destroked.
- Transmission temperature is above –25ºC.
- Vehicle shutdown is not in process.

Conditions for Setting the DTC

DTC P0842 sets during steady state (all shift valves are commanded to their proper state and a valid range is attained) operation when shift valve 1 is in the destroked state (commanded OFF) and Pressure Switch 1 (PS1) status is detected as stroked (Pressurized/ON). The intent of this DTC is to detect shorts-to-ground in the pressure switch wiring circuit or the pressure switch. This diagnostic test is designed to compare the commanded shift valve position to the pressure switch feedback.

Actions taken when the DTC Sets

When DTC P0842 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or reverse and transmission is compromised by overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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.
- When only a P0842 is set look for an **intermittent** short-to-ground at pressure switch circuit. This DTC is set when the condition is present more than 3 occurrences during the current drive cycle (refer to Appendix A, Section B, Finding an Intermittent Fault).

DIAGNOSTIC TROUBLE CODES (DTC)

- When a P0842 and P0752 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern is still present or continuous and not intermittent in nature.
- When a P0752 and P0842 are set in combination this may indicate a short-to-ground is present at the pressure switch circuit or the shift valve is stuck in the stroked state (refer to Section 5–4, Beginning the Troubleshooting Process).
- 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 check for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures and Appendix A, Section B).
- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.

Test Description

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

3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0842 Transmission Pressure Switch 1 (PS1) Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 (PS1) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF. If pressure switch is Pressurized/ON, indicates a short-to-ground or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC indicates that a short circuit condition may exist in the OEM harness, the internal transmission wiring harness, or the PSM.*** Did DTC P0842 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 17 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate PS1 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 12*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 4 (wire 117) to a known good ground. Does Allison DOC™ indicate PS1 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 11*

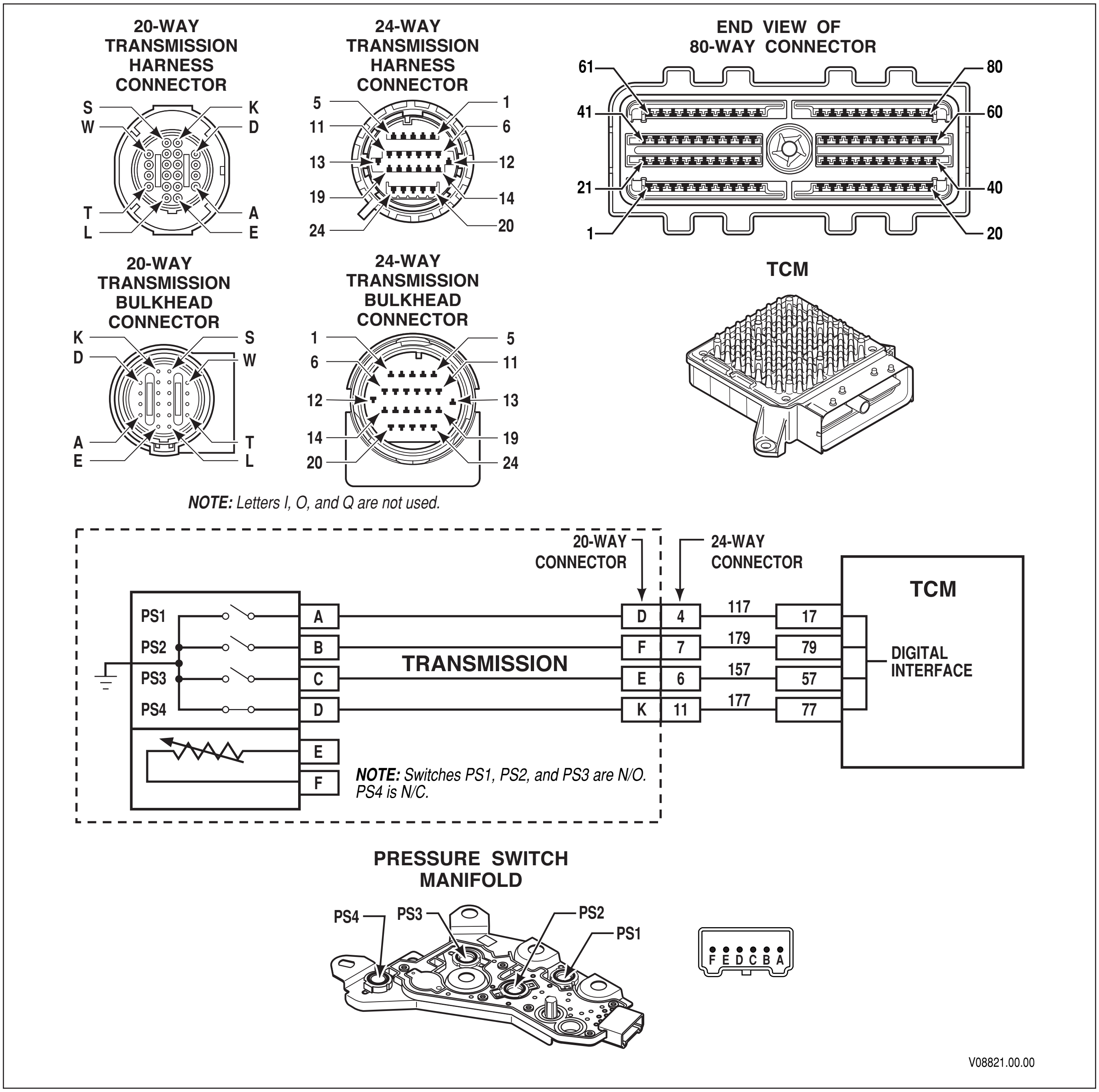
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0842 Transmission Pressure Switch 1 (PS1) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin A. Does Allison DOC™ indicate PS1 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 10*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on PS1 membrane. Does Allison DOC™ indicate PS1 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Diagnostic Aids*	*Go to Step 9*
9	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
10	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
11	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs.*** Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty. Is the repair complete?		*Go to Step 13*	
12	***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 13*	
13	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0843 Transmission Pressure Switch 1 (PS1) Circuit—High



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. Pressure switch 1 (PS1) monitors shift valve 1 positioning and relays it to the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 5V.
- DTC P0561, P0562, P0563 are not active.
- Shift valve 1 is stroked.
- Fluid temperature is above –25ºC.
- Shutdown is not in process.

Conditions for Setting the DTC

DTC P0843 sets during steady state (all shift valves are commanded to their proper state and a valid range is attained) operation when shift valve 1 is in the stroked state (commanded ON) and Pressure Switch 1 (PS1) status is detected as destroked (Exhausted/OFF). The intent of this DTC is to detect an open condition in pressure switch wiring circuit or the pressure switch. This diagnostic test is designed to compare the commanded shift valve position to the pressure switch feedback.

Actions taken when the DTC Sets

When DTC P0843 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised by overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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.
- When only a DTC P0843 is set look for an **intermittent** open condition at the pressure switch circuit. This DTC is set when the condition is present more than 3 occurrences during the current drive cycle (refer Appendix A, Section B, Finding an Intermittent Fault).

DIAGNOSTIC TROUBLE CODES (DTC)

- When a P0843 and P0751 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern is still present or continuous and not intermittent in nature.
- When a P0751 and P0843 are set in combination this may indicate a continuous open circuit condition is present at the pressure switch circuit or the shift valve is stuck in the destroked state (refer to Section 5–4, Beginning the Troubleshooting Process).
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change (refer to Section 4, Wire Check Procedures).
- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.

Test Description

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

3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0843 Transmission Pressure Switch 1 (PS1) Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning The Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0843 Transmission Pressure Switch 1 (PS1) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF. If pressure switch is Pressurized/ON, indicates a short-to-ground or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Verify pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC indicates that a open circuit condition may exist in the OEM harness, the internal transmission wiring harness, or the PSM.*** Did DTC P0843 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 17 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 1 (PS1) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 12*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 4 (wire 117) to a known good ground. Does Allison DOC™ indicate Pressure Switch 1 (PS1) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 11*

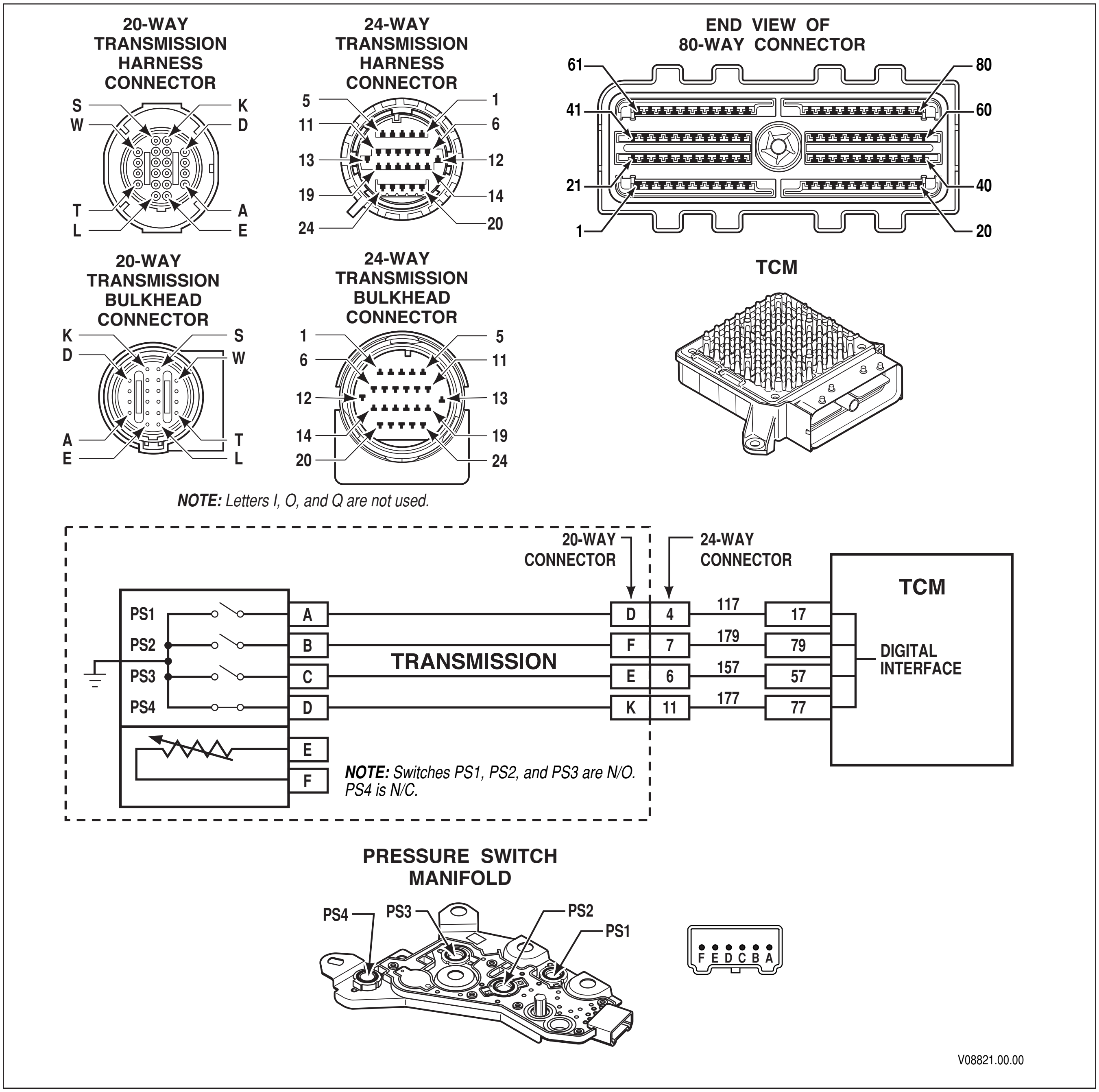
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0843 Transmission Pressure Switch 1 (PS1) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin A. Does Allison DOC™ indicate Pressure Switch 1 (PS1) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 10*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on Pressure Switch 1 (PS1) membrane. Does Allison DOC™ indicate Pressure Switch 1 (PS1) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Diagnostic Aids*	*Go to Step 9*
9	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
10	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
11	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 13*	
12	***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 13*	
13	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0847 Transmission Pressure Switch 2 (PS2) Circuit—Low



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. Pressure switch 2 (PS2) monitors shift valve 2 positioning and relays it to the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 5V.
- DTC P0561, P0562, P0563 are not active.
- Shift valve 2 is destroked.
- Transmission temperature is above –25ºC.
- Vehicle shutdown is not in process.

Conditions for Setting the DTC

DTC P0847 sets during steady state (all shift valves are commanded to their proper state and a valid range is attained) operation when shift valve 2 is in the destroked state (commanded OFF) and Pressure Switch 2 (PS2) status is detected as stroked (Pressurized/ON). The intent of this DTC is to detect shorts-to-ground in the pressure switch wiring circuit or the pressure switch. This diagnostic test is designed to compare the commanded shift valve position to the pressure switch feedback.

Actions taken when the DTC Sets

When DTC P0847 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **F** (Forward) range or **R** (Reverse) and transmission is compromised by overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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.
- When only a P0847 is set look for an **intermittent** short-to-ground at pressure switch circuit. This DTC is set when the condition is present more than 3 occurrences during the current drive cycle (refer to Appendix A, Section B, Finding an Intermittent Fault.)

DIAGNOSTIC TROUBLE CODES (DTC)

- When a P0847 and P0757 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern is still present or continuous and not intermittent in nature.
- When a P0757 and P0847 are set in combination this may indicate a short-to-ground is present at the pressure switch circuit or the shift valve is stuck in the stroked state (refer to Section 5–4, Beginning the Troubleshooting Process)
- 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 check for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures, and Appendix A, Section B, Finding an Intermittent Fault.)
- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.

Test Description

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

3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0847 Transmission Pressure Switch 2 (PS2) Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (refer to Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0847 Transmission Pressure Switch 2 (PS2) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be Exhausted/OFF (if pressure switch is Pressurized/ON, it indicates a short-to-ground or stuck pressure switch). 6. Start vehicle and monitor pressure switch states (should be Pressurized/ON in neutral). 7. Verify pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC indicates that a short circuit condition may exist in the OEM harness, the internal transmission wiring harness, or the PSM.*** Did DTC P0847 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 79 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when circuit is open?		*Go to Step 6*	*Go to Step 12*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 7 (wire 179) to a known good ground. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 11*

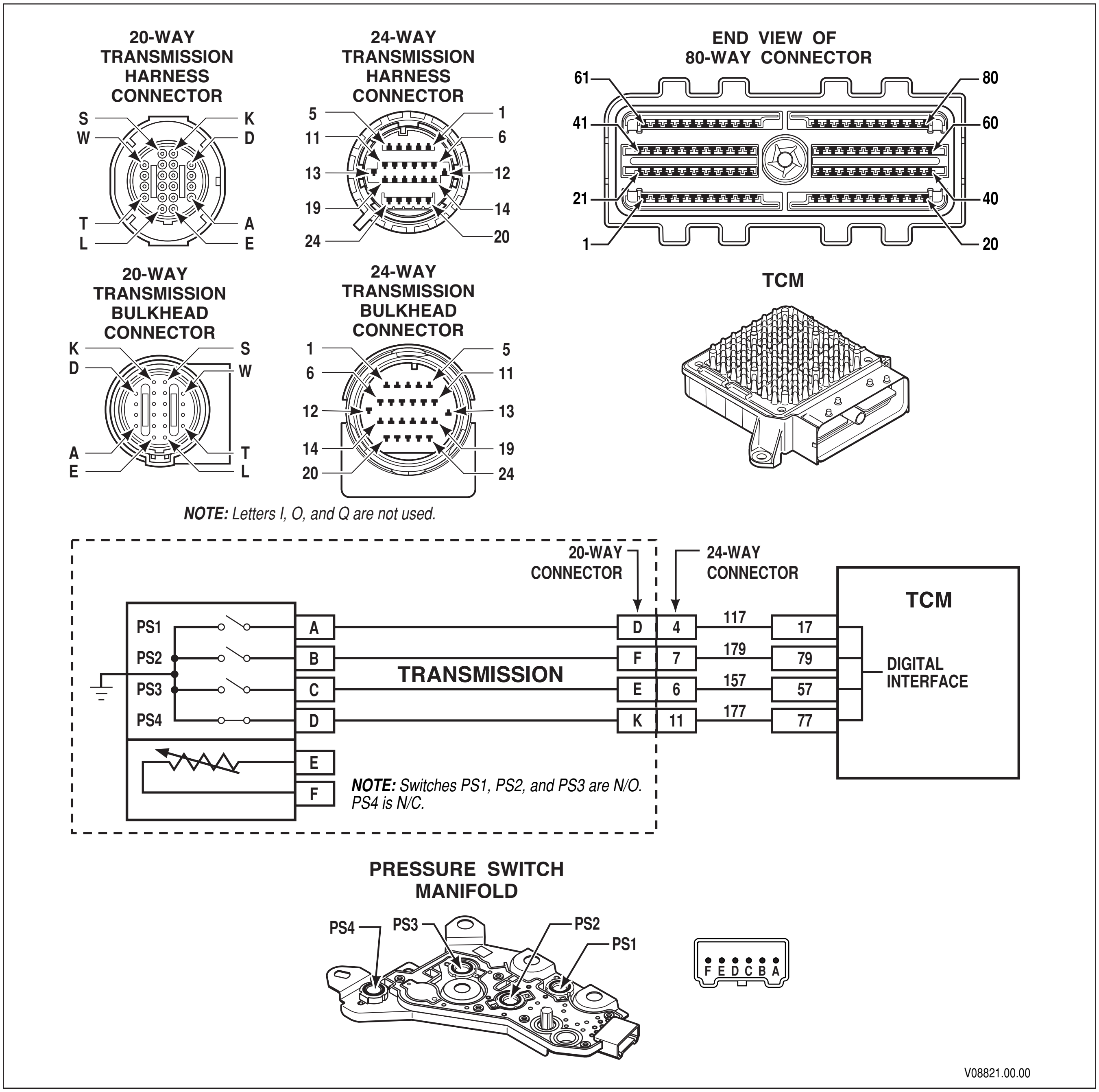
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0847 Transmission Pressure Switch 2 (PS2) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin B. Does Allison DOC™ indicate Pressure Switch 2 (PS2) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 10*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on PS2 membrane. Does Allison DOC™ indicate PS2 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Diagnostic Aids*	*Go to Step 9*
9	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
10	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
11	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 13*	
12	***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 13*	
13	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0848 Transmission Pressure Switch 2 (PS2) Circuit—High



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. Pressure Switch 2 (PS2) monitors Shift Valve 2 (SV2) positioning and relays it to the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 5V.
- DTC P0561, P0562, and P0563 are not active.
- SV2 is stroked.
- Fluid temperature is above –25ºC.
- Shutdown is not in process.

Conditions for Setting the DTC

DTC P0848 sets during steady state (all shift valves are commanded to their proper state and a valid range is attained) operation when SV2 is in the stroked state (commanded ON) and PS2 status is detected as destroked (Exhausted/OFF). The intent of this DTC is to detect an open condition in pressure switch wiring circuit or the pressure switch. This diagnostic test is designed to compare the commanded shift valve position to the pressure switch feedback.

Actions taken when the DTC Sets

When DTC P0848 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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.
- When only a DTC P0848 is set look for an **intermittent** open condition at the pressure switch circuit. This DTC is set when the condition is present more than 3 occurrences during the current drive cycle. (See Appendix A, Section B—Finding an Intermittent Fault.)

DIAGNOSTIC TROUBLE CODES (DTC)

- When a P0848 and P0756 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern is still present or continuous and not intermittent in nature.
- When a P0756 and P0848 are set in combination this may indicate a continuous open circuit condition is present at the pressure switch circuit or the shift valve is stuck in the destroked state (refer to Section 5–4, Beginning the Troubleshooting Process).
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change (refer to Section 4, Wire Check Procedures).
- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.

Test Description

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

3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0848 Transmission Pressure Switch 2 (PS2) Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0848 Transmission Pressure Switch 2 (PS2) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Start vehicle and test drive. 6. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC indicates that an open circuit condition may exist in the OEM harness, the internal transmission wiring harness, or the PSM.*** Did DTC P0848 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 79 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate PS2 status as Pressurized/ON when circuit is open?		*Go to Step 6*	*Go to Step 12*
6	1. Turn the ignition OFF and Reconnect the 80-way connector to the TCM. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 7 (wire 179) to a known good ground. Does Allison DOC™ indicate PS2 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 11*
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin B. Does Allison DOC™ indicate PS2 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 10*

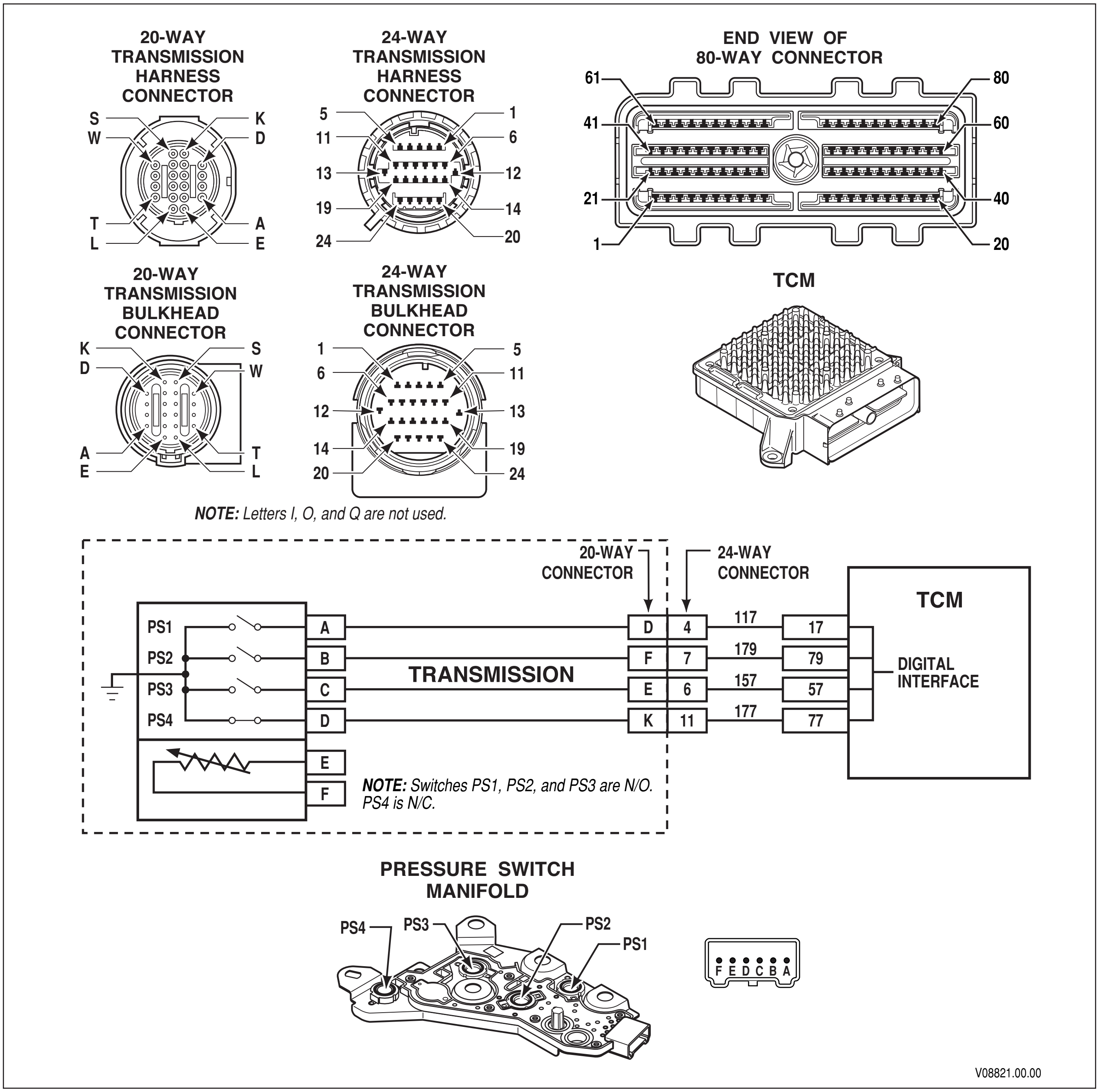
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0848 Transmission Pressure Switch 2 (PS2) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on PS2 membrane. Does Allison DOC™ indicate PS2 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Diagnostic Aids*	*Go to Step 9*
9	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
10	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
11	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 13*	
12	***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 13*	
13	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0872 Transmission Pressure Switch 3 (PS3) Circuit—Low



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. Pressure switch 3 (PS3) monitors shift valve 3 positioning and relays it to the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 5V.
- DTC P0561, P0562, P0563 are not active.
- Shift valve 3 is destroked.
- Transmission temperature is above –25ºC
- Vehicle shutdown is not in process.

Conditions for Setting the DTC

DTC P0872 sets during steady state (all shift valves are commanded to their proper state and a valid range is attained) operation when shift valve 3 is in the destroked state (commanded OFF) and Pressure Switch 3 (PS3) status is detected as stroked (Pressurized/ON). The intent of this DTC is to detect shorts-to-ground in the pressure switch wiring circuit or the pressure switch. This diagnostic test is designed to compare the commanded shift valve position to the pressure switch feedback.

Actions taken when the DTC Sets

When DTC P0872 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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.
- When only a P0872 is set look for an **intermittent** short-to-ground at pressure switch circuit. This DTC is set when the condition is present more than 3 occurrences during the current drive cycle (refer to Appendix A, Section B—Finding an Intermittent Fault).
- When a P0872 and P0762 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern is still present or continuous and not intermittent in nature.

DIAGNOSTIC TROUBLE CODES (DTC)

- When a P0762 and P0872 are set in combination this may indicate a short-to-ground is present at the pressure switch circuit or the shift valve is stuck in the stroked state (refer to Section 5–4, Beginning the Troubleshooting Process).
- 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 check for shorting-to-ground at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures and Appendix A, Section B).
- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.

Test Description

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

3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests TCM for proper switch status.
6. This step tests for shorts in OEM harness.
7. This step tests for shorts in internal harness.
8. This step tests PSM switch function.

DTC P0872 Transmission Pressure Switch 3 (PS3) Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Perform the Allison Transmission Fluid Checking Procedure (Appendix R). 2. Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Perform the Main Pressure Check Procedure (Appendix B). 2. Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0872 Transmission Pressure Switch 3 (PS3) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be OFF. If pressure switch is ON, it indicates a short-to-ground or stuck pressure switch. 6. Start vehicle and monitor pressure switch states (should be ON in neutral). 7. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC indicates that a short circuit condition may exist in the OEM harness, the internal transmission wiring harness, or the PSM.*** Did DTC P0872 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 57 to a known good ground. 5. Turn the ignition ON. 6. Does Allison DOC™ indicate pressure switch 3 (PS3) status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 12*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 6 (wire 157) to a known good ground. Does Allison DOC™ indicate PS3 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 11*

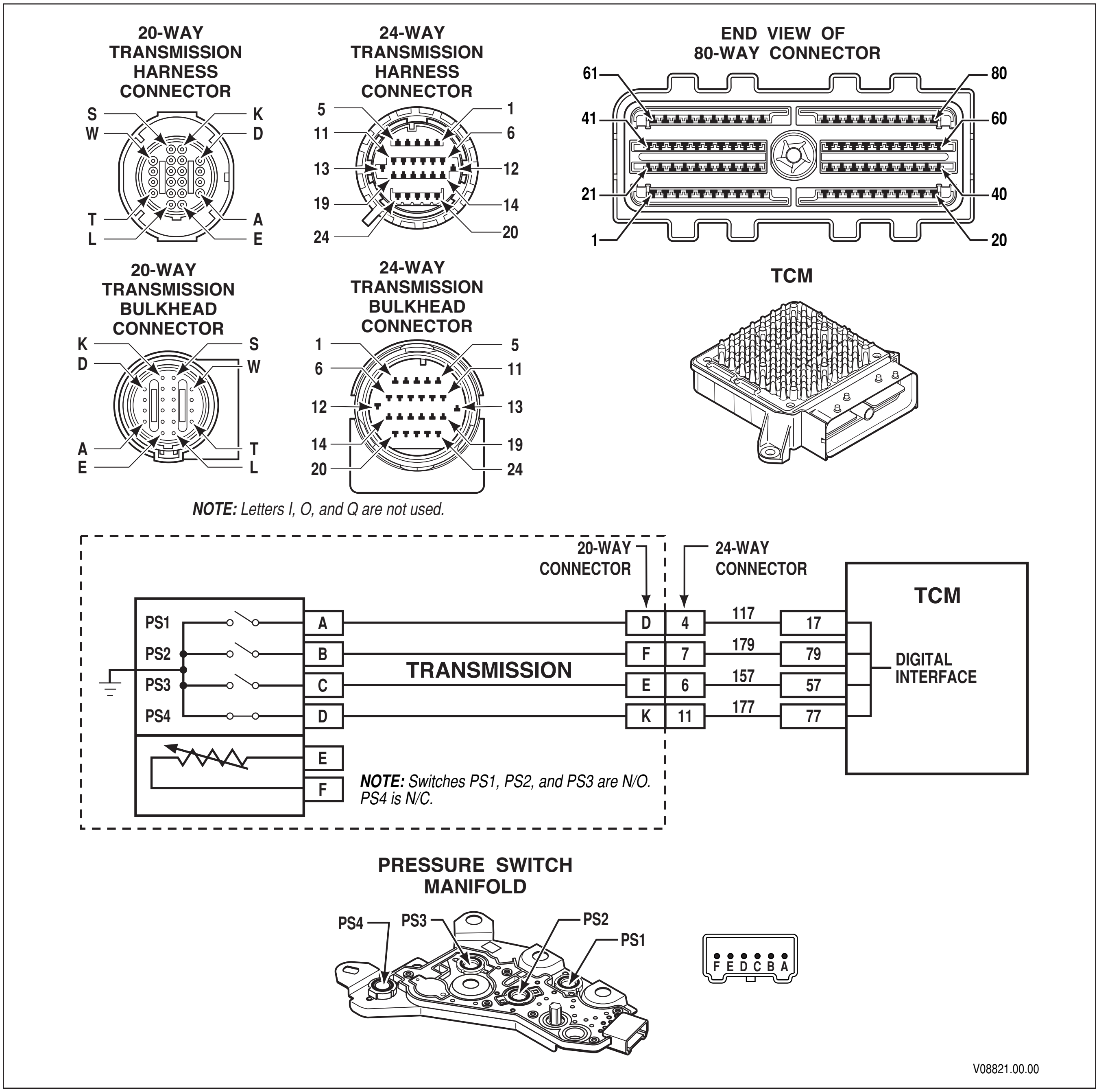
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0872 Transmission Pressure Switch 3 (PS3) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin C. Does Allison DOC™ indicate PS3 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 10*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on PS3 membrane. Does Allison DOC™ indicate PS3 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Diagnostic Aids*	*Go to Step 9*
9	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
10	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
11	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 13*	
12	***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 13*	
13	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0873 Transmission Pressure Switch 3 (PS3) Circuit—High



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. Pressure switch 3 (PS3) monitors shift valve 3 positioning and relays it to the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 5V.
- DTC P0561, P0562, P0563 are not active.
- Shift valve 3 is stroked.
- Fluid temperature is above –25ºC.
- Shutdown is not in process.

Conditions for Setting the DTC

DTC P0873 sets during steady state (all shift valves are commanded to their proper state and a valid range is attained) operation when shift valve 3 is in the stroked state (commanded ON) and Pressure Switch 3 (PS3) status is detected as destroked (Exhausted/OFF). The intent of this DTC is to detect an open condition in pressure switch wiring circuit or the pressure switch. This diagnostic test is designed to compare the commanded shift valve position to the pressure switch feedback.

Actions taken when the DTC Sets

When DTC P0873 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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.
- When only a DTC P0873 is set look for an **intermittent** open condition at the pressure switch circuit. This DTC is set when the condition is present more than 3 occurrences during the current drive cycle (refer to Appendix A, Section B, Finding an Intermittent Fault).
- When a P0873 and P0761 are set in combination, the TCM logic re-attempted to command the shift solenoid on. A circuit or pressure switch concern is still present or continuous and not intermittent in nature.

DIAGNOSTIC TROUBLE CODES (DTC)

- When a P0761 and P0873 are set in combination this may indicate a continuous open circuit condition is present at the pressure switch circuit or the shift valve is stuck in the destroked state (refer to Section 5–4, Beginning the Troubleshooting Process).
- When diagnosing for an intermittent short or open, massage the wiring harness while watching the test equipment for a change (refer to Section 4, Wire Check Procedures).
- 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 failures mode where DTC was set.
- Multiple inactive pressure switch DTCs may be due to a plugged Control main filter. Be sure that the initial 8000 km (5000 mile) filter change was performed.

Test Description

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

3. This step tests for proper main pressure.
1. This step tests for an active DTC.
2. This step tests TCM for proper switch status.
3. This step tests for shorts in OEM harness.
4. This step tests for shorts in internal harness.
5. This step tests PSM switch function.

P0873 Transmission Pressure Switch 3 (PS3) Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed? ***NOTE: Remember to record failure records prior to clearing DTC.***		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (refer to Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (refer to Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

P0873 Transmission Pressure Switch 3 (PS3) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be OFF. (If pressure switch is ON, indicates a short-to-ground or stuck pressure switch) 6. Start vehicle and monitor pressure switch states (should be ON in neutral). 7. Verify pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC indicates that a open circuit condition may exist in the OEM harness, the internal transmission wiring harness, or the PSM.*** Did DTC P0873 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. Turn the ignition ON. 4. At J 47275-1 TCM Overlay, connect pin 57 to a known good ground. 5. Turn the ignition ON. Does Allison DOC™ indicate PS3 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 6*	*Go to Step 12*
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 6 (wire 157) to a known good ground. Does Allison DOC™ indicate PS3 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 7*	*Go to Step 11*

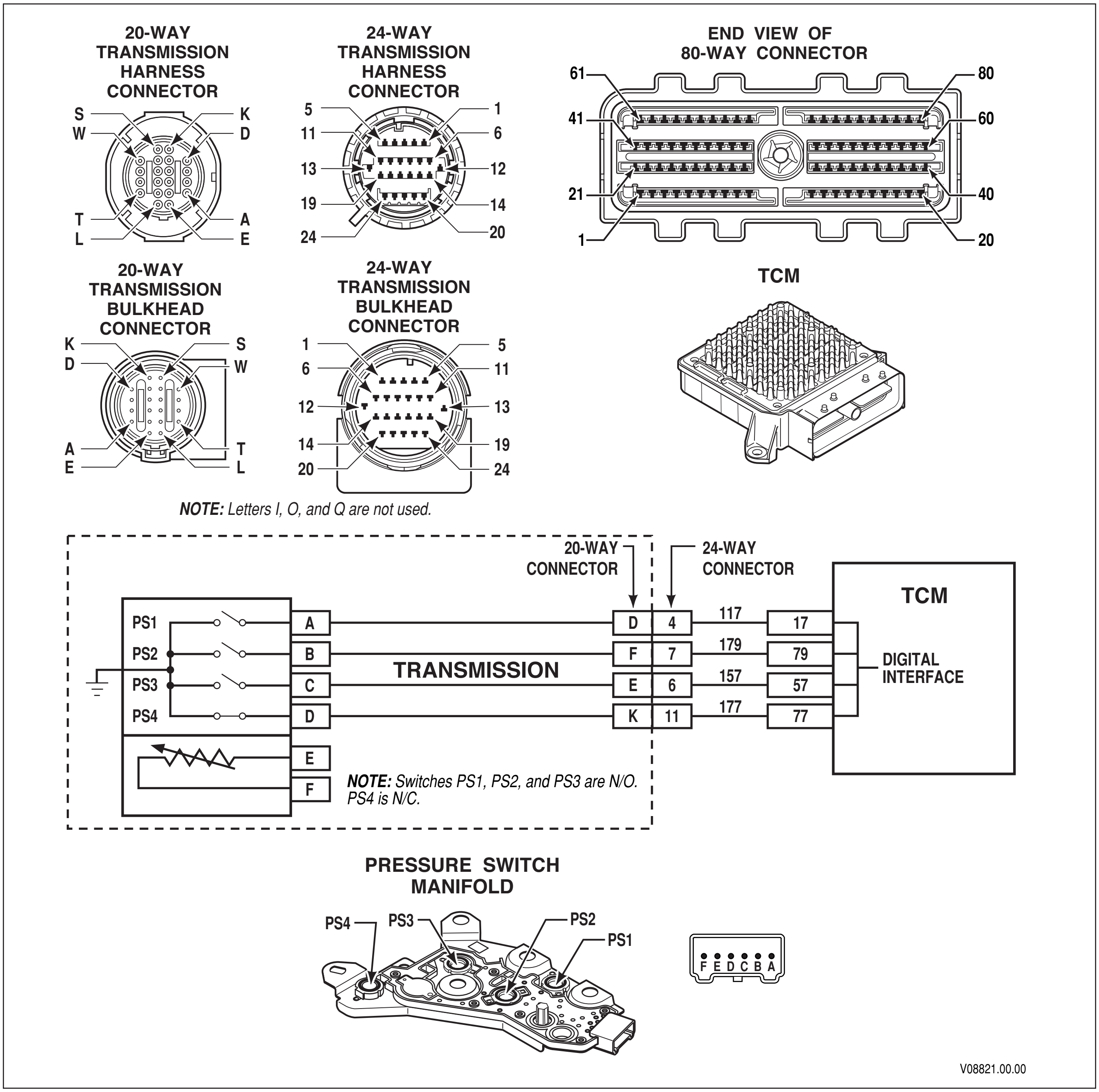
DIAGNOSTIC TROUBLE CODES (DTC)

P0873 Transmission Pressure Switch 3 (PS3) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Remove the oil pan (refer to Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM, and provide a ground at pin C. Does Allison DOC™ indicate PS3 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Step 8*	*Go to Step 10*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection for the PSM to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on PS3 membrane. Does Allison DOC™ indicate PS3 status as Pressurized/ON when grounded and Exhausted/OFF when circuit is open?		*Go to Diagnostic Aids*	*Go to Step 9*
9	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
10	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 13*	
11	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 13*	
12	***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 13*	
13	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P0877 Transmission Fluid Pressure Switch 4 (PS4) Circuit—Low



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. Fluid pressure is supplied to Pressure Switch 4 (PS4), holding it open when the manual selector valve is in any position except reverse. When the manual selector valve is moved to reverse, pressure to the Pressure Switch 4 (PS4) is cut off, allowing the switch to close.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V and less than 32V (24V TCM).
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- TFT is greater than 0ºC (32ºF).
- Hydraulic system is pressurized.
- DTC P0708 is not active.

Conditions for Setting the DTC

DTC P0877 sets when **P** (Park), **N** (Neutral), or a forward range is selected and the Pressure Switch 4 (PS4) state remains in the Exhausted/ON position for a period of time that is calibration dependent.

Actions taken when the DTC Sets

When DTC P0877 is active, the following conditions will occur:

- Calibration Dependent—Either lock to neutral or transmission will shift to 3rd or 5th range.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral. If output speed fault or IMS fault is present when this test fails, then hydraulic default is implemented.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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.
- This DTC could indicate a hydraulic leak path exhausting pressure from the reverse pressure switch (refer to hydraulic schematic).
- If a P0877, is shown in failure records as being logged first on the failure list followed by a P0762, combined with P0708, these DTCs may indicate an internal mode switch failure. Inspect the shift linkage carefully for proper adjustment.

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 check for a short-to-ground condition at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures).
- 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 failures mode where DTC was set.

Test Description

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

2. This step tests for proper fluid level.
3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests the TCM response function.
6. This step tests for a short-to-ground condition in external harness.
7. This step tests for a short-to-ground condition in the internal harness.
8. This step tests for a defective pressure switch.

DTC P0877 Transmission Fluid Pressure Switch 4 (PS4) Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0877 Transmission Fluid Pressure Switch 4 (PS4) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, pressure switch should be ON. 6. Start vehicle and monitor pressure switch states. The switch should be OFF in **N** (Neutral), if the pressure switch is ON this indicates a short-to-ground or a pressure switch stuck in the closed state. 7. Verify pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC is set when P (Park), N (Neutral), or forward range has been selected and the reverse pressure switch indicates exhausted/ON for a period of time that is calibration dependent. This DTC may indicate that a short circuit condition exists in the OEM harness, internal transmission harness or the PSM. A defective internal mode switch may also set this DTC. The intent of this DTC is to detect discrepancies between range selected at the internal mode switch and the actual position of the manual selector valve.*** Did DTC P0877 return?		*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. At J 47275-1 TCM Overlay, connect pin 77 to a known good ground. 4. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 4 (PS4) status as Exhausted/ON when grounded and Pressurized/OFF when circuit is open?		*Go to Step 6*	*Go to Step 13*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0877 Transmission Fluid Pressure Switch 4 (PS4) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF and remove J 47275 TCM Breakout. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 11 (wire 177) to a known good ground. Does Allison DOC™ indicate Pressure Switch 4 (PS4) status as Exhausted/ON when grounded and Pressurized/OFF when circuit is open?		*Go to Step 7*	*Go to Step 12*
7	1. Remove the oil pan (refer to Service Manual or Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM and ground D. Does Allison DOC™ indicate PS4 status as Exhausted/ON when grounded and Pressurized/OFF when circuit is open?		*Go to Step 8*	*Go to Step 11*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection to the PSM frame to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on PS4 membrane. Did Allison DOC™ indicate PS4 status as Exhausted/ON when grounded and Pressurized/OFF when circuit is open?		*Go to Step 10*	*Go to Step 9*
9	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 14*	
10	Inspect for a missing or a damaged seal at PS4 assembly or loose reverse transfer tube. Shift linkage out of adjustment can allow PS4 to apply pressure switch, inspect for proper adjustment. Check that the selector valve is properly staked at the end. Did you find and repair the following?		*Go to Step 14*	*Go to Diagnostic Aids*
11	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 14*	

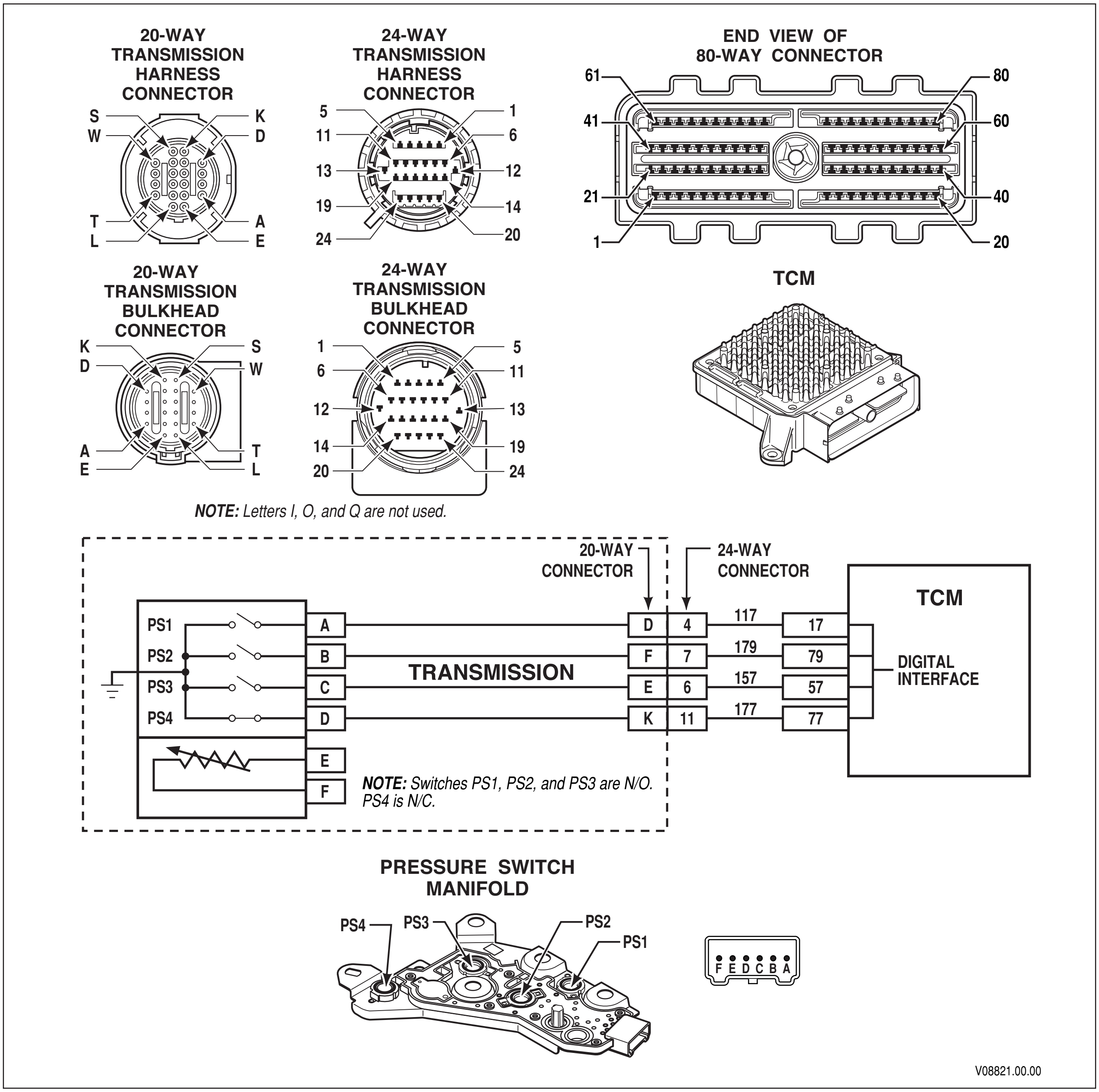
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0877 Transmission Fluid Pressure Switch 4 (PS4) Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
12	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair 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. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™, monitor PS4 operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0878 Transmission Fluid Pressure Switch 4 (PS4) Circuit—High



Circuit Description

The Pressure Switch Manifold (PSM) is a multiple-switch assembly made up of three normally open (N/O) and one normally closed (N/C) pressure switches. Fluid pressure is supplied to the reverse pressure switch, holding it open when the manual selector valve is in any position except reverse. When the manual selector valve is moved to reverse, pressure to the reverse pressure switch is cut off, allowing the switch to close.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- TFT is greater than 0ºC (32ºF).
- DTC P0706, P0708, P0877 is not active.
- There are two cases where this DTC runs:
  - **Case 1**
    Ignition voltage is above 9V for 12V TCM, 18V for 24V TCM.
    The PRNDL state and the Pressure Switch 4 (PS4) state do not agree.
  - **Case 2**
    Ignition voltage is under 9V for 12V TCM, 18V for 24V TCM.
    All speed sensors are under 50 rpm.

Conditions for Setting the DTC

DTC P0878 sets in two cases:

1. Internal Mode Switch PRNDL and PS4 do not agree. When reverse range is selected and the Pressure Switch 4 (PS4) is detected in the pressurized/OFF state for more than 1 second more than 40 occurrences.
2. Engine shutdown and PS4 does not agree. When engine shutdown is in process and the Pressure Switch 4 (PS4) is detected in an improper state, pressurized/OFF state, for more than a period of time that is temperature dependent (5 seconds at 35ºC to 30 seconds at –20ºC).

Actions taken when the DTC Sets

When DTC P0878 is active, the following conditions will occur:

- Calibration Dependent—Either lock to neutral or transmission will shift to 3rd or 5th range.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral. If output speed fault or IMS fault is present when this test fails, then hydraulic default is implemented.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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. 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. It may be necessary to check for a short-to-ground condition at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures).
- 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 failures mode where DTC was set.

Test Description

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

2. This step tests for proper fluid level.
3. This step tests for proper main pressure.
4. This step tests for an active DTC.
5. This step tests the TCM response function.
6. This step tests for an open condition in external harness.
7. This step tests for an open condition in the internal harness.
8. This step tests for a defective pressure switch.

DTC P0878 Transmission Fluid Pressure Switch 4 (PS4) Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R). Did you perform the procedure and correct fluid level, if necessary?		*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	Perform the Main Pressure Check Procedure (Appendix B). Is main pressure within the specified values?	Refer to Table 5–5, Main Pressure Schedule	*Go to Step 4*	*Go to General Troubleshooting (Section 7)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0878 Transmission Fluid Pressure Switch 4 (PS4) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. With key ON and engine OFF, Pressure Switch 4 should be ON. If pressure switch is OFF, indicates a open in the circuit or pressure switch stuck open. 6. Start vehicle and monitor pressure switch states (should be OFF in neutral). 7. Verify pressure switch states are correct as described in sub-steps 5 and 6. 8. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC is set when reverse range is selected and PS4 status remains in the mechanically open/ electrically OFF state for more than a time that is calibration dependent. This DTC can also set at engine shutdown when the PS4 is detected in the mechanically open/ electrically OFF state for a period of time that is temperature dependent.*** Did DTC P0878 return?	5 seconds at 35ºC to 30 seconds at –20ºC	*Go to Step 5*	*Go to Diagnostic Aids*
5	1. Turn the ignition OFF. 2. Disconnect the 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout at the TCM, Turn the ignition ON. ***NOTE: To perform the following test, the 16-pin bypass connector, located on J 47275 TCM Breakout, must be disconnected.*** 3. At J 47275-1 TCM Overlay, connect pin 77 to a known good ground. 4. Turn the ignition ON. Does Allison DOC™ indicate Pressure Switch 4 (PS4) status as Exhausted/ON when grounded and Pressurized/OFF when circuit is open?		*Go to Step 6*	*Go to Step 13*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0878 Transmission Fluid Pressure Switch 4 (PS4) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF and remove J 47275 TCM Breakout. 2. Disconnect the 24-way transmission connector. 3. Install J 39700 Breakout Box and J 47278 Transmission Breakout at the vehicle side of the 24-way connector, leave the transmission side disconnected. 4. Turn the ignition ON. 5. At J 47278-1 Transmission Overlay, connect pin 11 (wire 177) to a known good ground. Does Allison DOC™ indicate Pressure Switch 4 (PS4) status as Exhausted/ON when grounded and Pressurized/OFF when circuit is open?		*Go to Step 7*	*Go to Step 12*
7	1. Remove the oil pan (refer to Service Manual or Mechanic's Tips). 2. Disconnect the internal wiring harness from the PSM and ground D. Does Allison DOC™ indicate Pressure Switch 4 (PS4) status as Exhausted/ON when grounded and Pressurized/OFF when circuit is open?		*Go to Step 8*	*Go to Step 11*
8	1. Remove the PSM from valve body and leave the internal harness connected. 2. Provide a ground connection to the PSM frame to the valve body or the transmission main case. 3. Using your finger or the eraser end of a pencil push gently on Pressure Switch 4 (PS4) membrane. Does Allison DOC™ indicate Pressure Switch 4 (PS4) status as Exhausted/ON when grounded and Pressurized/OFF when circuit is open?		*Go to Step 10*	*Go to Step 9*
9	Replace the PSM (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 14*	
10	Inspect for a missing or a damaged seal at the Pressure Switch 4 (PS4) assembly or loose reverse transfer tube. Shift linkage out of adjustment can allow Pressure Switch 4 (PS4) to apply pressure switch, inspect for proper adjustment. Check that the selector valve is properly staked at the end. Did you find and repair the following?		*Go to Step 14*	*Go to Diagnostic Aids*
11	Replace the internal wiring harness (refer to Mechanic's Tips). Is the replacement complete?		*Go to Step 14*	

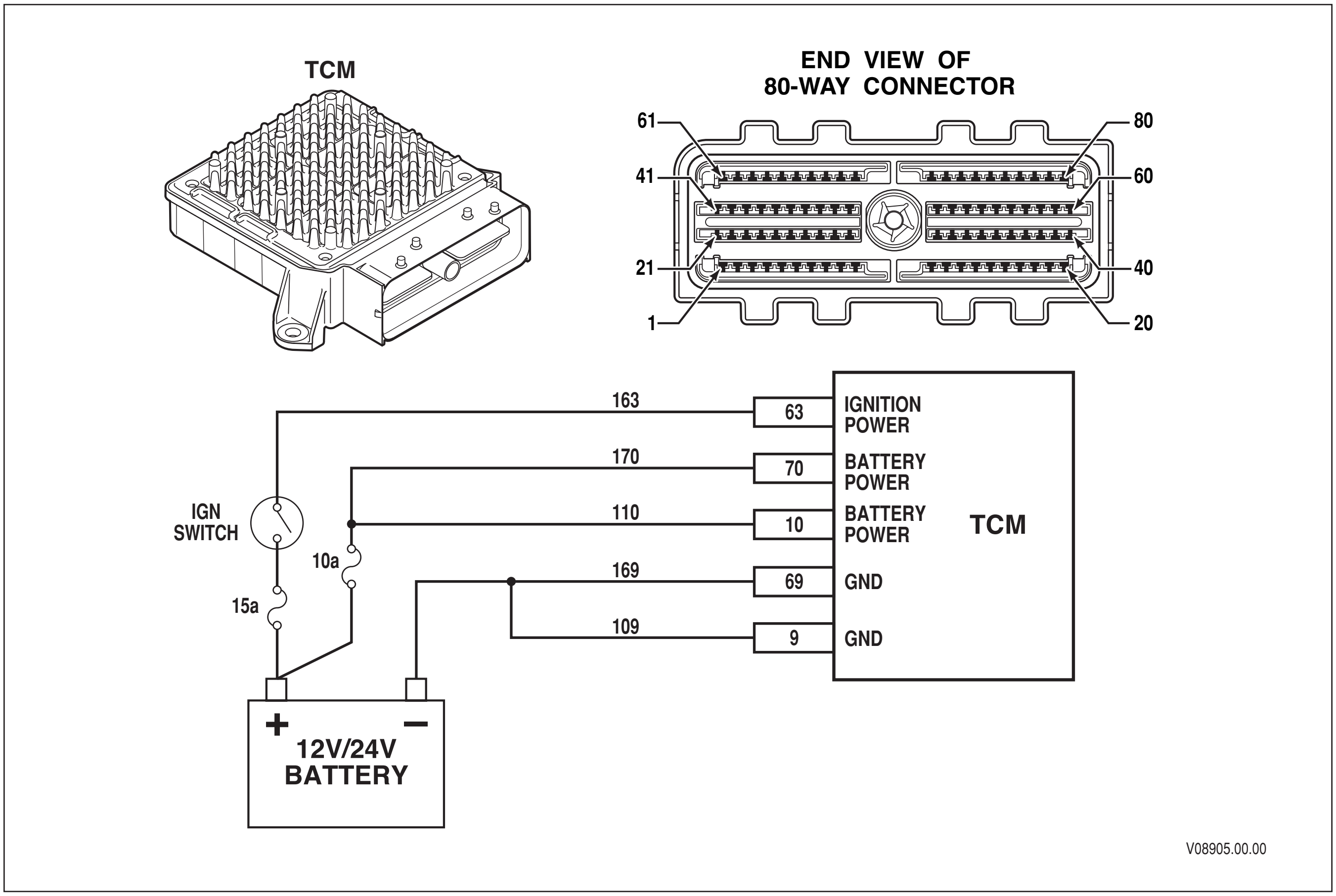
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0878 Transmission Fluid Pressure Switch 4 (PS4) Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
12	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair 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. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™, monitor Pressure Switch 4 (PS4) operation. 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.

Action Taken When the DTC Sets

When DTC P0880 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- DTC P0880 is stored in the TCM history.

DIAGNOSTIC TROUBLE CODES (DTC)

- The TCM loses adaptive information for the drive cycle.
- The TCM reverts to previous adaptive settings.

Conditions for Clearing the DTC/CHECK TRANS Light

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

- 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

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

2. This step tests for proper battery voltage.
3. This step tests for vehicle 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn the ignition to the RUN position with the engine OFF. 3. Record the DTC failure records. ***NOTE: If other DTCs are present refer to the applicable diagnostic tables before continuing.*** 4. Using a digital volt/ohmmeter (DVOM), measure and record voltage at the battery terminals. Is voltage greater than the specified value?	10.5V	*Go to Step 4*	*Resolve battery problem. Go to Step 8*

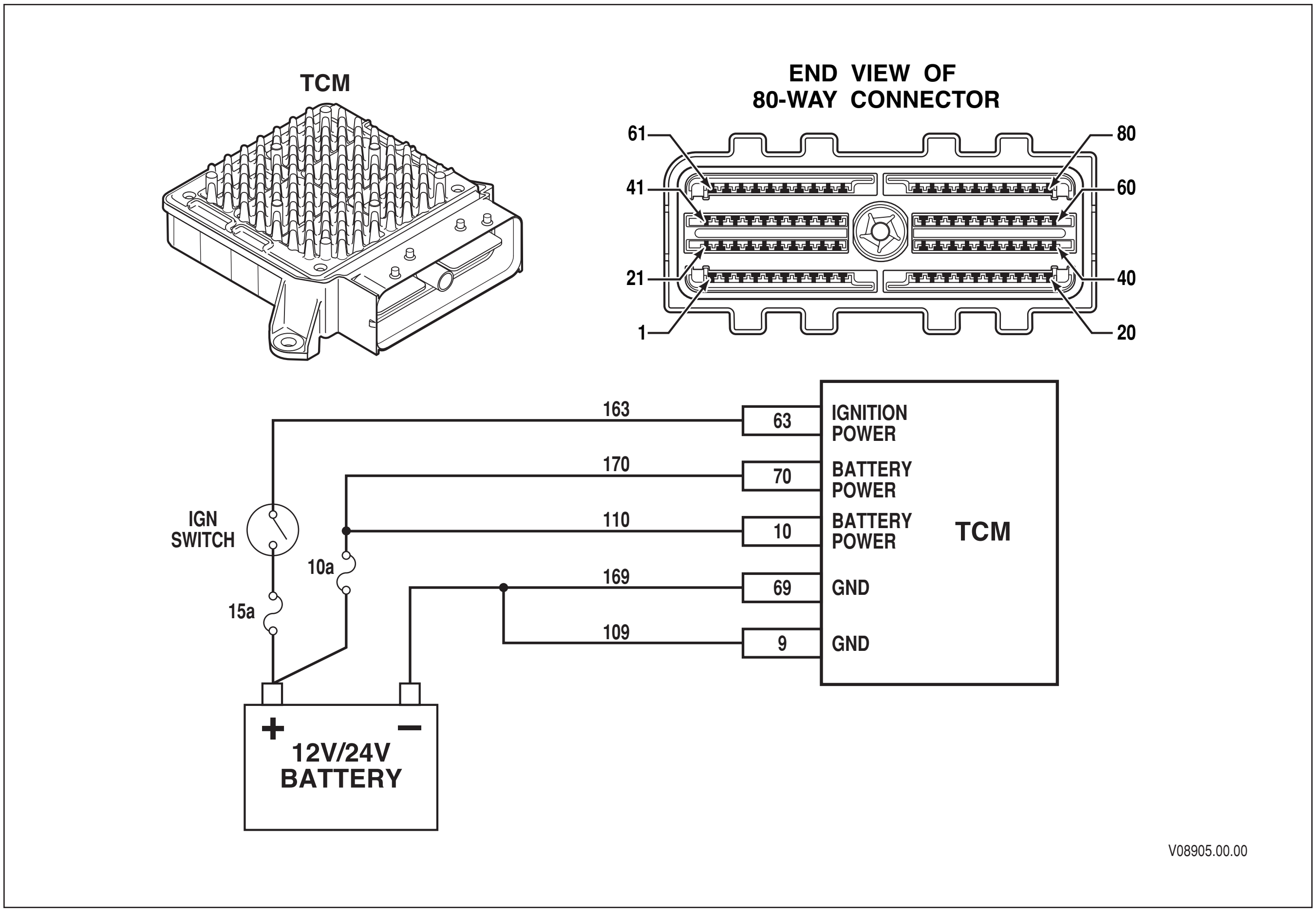
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0880 TCM Power Input Signal *(cont'd)*

Step	Action	Value(s)	Yes	No
3	Start the engine and warm to normal operating temperature. Is the Alternator/Check Engine lamp ON?		*Repair charging system*	*Go to Step 4*
4	1. Increase the engine speed to 1000–1500 rpm. 2. Using Allison DOC™, monitor system voltage. Is voltage within the specified value?	13–15V	*Go to Step 5*	*Repair charging system*
5	1. Turn the ignition OFF. 2. Disconnect 80-way connector from the TCM and install J 39700 Breakout Box and J 47275 TCM Breakout. 3. Using a DVOM, measure voltage at 80-way connector pins 9 and 10 with the ignition OFF. 4. Turn the ignition ON, leaving 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 sub-step 5 from the voltage reading obtained in sub-step 3. Is the voltage difference greater than the specified value?	0.5V	*Go to Step 6*	*Go to Step 7*
6	***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. 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 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. Start the engine and warm to normal operating temperature. 3. Using Allison DOC™, 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

Transmission Control Module (TCM) requires input battery voltage which originates direct from the vehicle battery and runs through a 10 amp fuse to TCM pins 10 (wire 110) and 70 (wire 170).

Conditions for Running the DTC

Engine speed is greater than 400 rpm for 0.5 seconds.

Conditions for Setting the DTC

P0881 sets when the TCM detects the following:

- Large variations in battery direct voltage.
- When a battery direct voltage variation of 4.0V or over is detected for 15 seconds a fault pending is reported, after 30 seconds a DTC is set with a failure response (4.0V variation is determined from minimum and maximum ignition voltage values).

DIAGNOSTIC TROUBLE CODES (DTC)

Action taken when the DTC Sets

- Hydraulic default is commanded. Shift selector position and hydraulic state of logic valves determine range.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM inhibits TCC engagement.
- Main Modulation is disabled.

Conditions for Clearing the DTC/CHECK TRANS Light.

Allison DOC™ For PC can 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. Allison DOC™ For PC can be used to record a snapshot for later review. Battery direct input is a viewable option in Allison DOC™ For PC. Using Allison DOC™ For PC, monitor for erratic voltage that may indicate a wiring concern.
- This DTC indicates a variation in battery direct voltage. Vehicle accessories imposing a large load on the battery circuit could also cause the DTC to set. Other possibilities include loose or corroded battery cables, or an internal TCM failure caused by a burn up circuit trace could allow this DTC to set.
- Vehicle charging system failure may cause this DTC under certain circumstances.
- This DTC may indicate that an internal voltage problem has occurred inside the TCM. The use of a substitute TCM would be a good way to diagnosis 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 pin
  - 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)

Test Description

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

2. This step tests for an active DTC after clearing.
3. This step tests for the proper battery direct input voltage.
4. This step tests for the proper battery direct input from chassis ground.
5. This step tests for open or high resistance at battery direct ground input.
6. This step tests for shorts or open conditions at battery direct input circuit.

DTC P0881 TCM Power Input Signal—Performance

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Start vehicle and test drive. 6. Attempt to duplicate same operating conditions observed in failure records. Input voltage is viewable on Allison DOC™. ***NOTE: This DTC indicates that a voltage variation may exist in the battery direct input. This variation is measured from min. and max. voltage values. If the voltage variation is present for a pre-determined amount of time this DTC sets.*** Did DTC P0881 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	1. Turn the ignition OFF. 2. Disconnect 80-way connector at the TCM. 3. Using J 39700 Breakout Box install J 47275 TCM Breakout inline at the TCM. 4. Use a DMM, measure voltage at TCM Overlay J 47275-1 pins 9, 10 and 69, 70. Is the voltage within the specified value?	11.5 to 12.5V	*Go to Step 4*	*Go to Step 5*
4	1. Use a DMM; in sequence measure voltage at TCM Overlay J 47275-1 pins 10, 70, and a chassis ground. 2. Turn ON the ignition, with the engine OFF. Is the voltage reading the same as recorded in Step 3?	11.5 to 12.5V	*Go to Step 5*	*Go to Step 6*

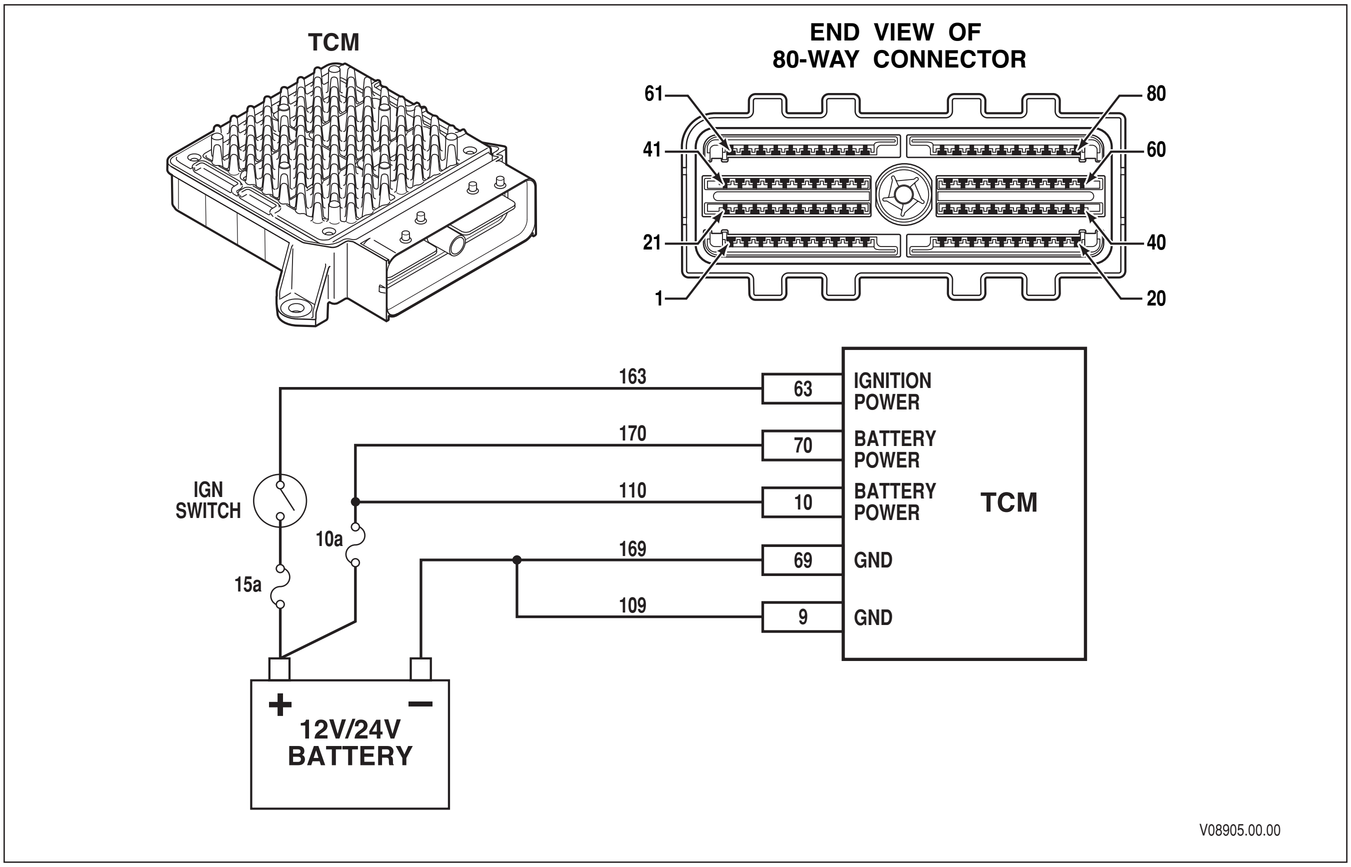
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0881 TCM Power Input Signal—Performance *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring, wherefore the OEM should perform vehicle harness repairs. Harness repair performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Inspect battery direct circuits (110, 170) for one of the following problems: • Intermittent open or shorting conditions at circuit (110, 170) • Loose or corroded connections at battery or pins 10 or 70) • Defective battery. Was one of the following conditions discovered and repaired?		*Go to Step 8*	*Go to Step 7*
6	***NOTE: The vehicle OEM has responsibility for all external wiring, wherefore the OEM should perform vehicle harness repairs. Harness repair performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Inspect the TCM direct battery input circuits for intermittent open or high resistance at ground input circuits (109, 169). Was one of the conditions discovered and repaired?		*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. Drive the vehicle under conditions shown in failure records. Did the DTC return?		*Return to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0882 TCM Power Input Signal—Low



Circuit Description

Transmission Control Module (TCM) requires input battery voltage which originates direct from the vehicle battery and runs through a 10 amp fuse to TCM pins 10 (wire 110) and 70 (wire 170).

Conditions for Running the DTC

Engine speed is greater than 400 rpm for 1 second.

Conditions for Setting the DTC

P0882 sets when the TCM detects the following condition:

- 12V TCM—Battery direct voltage is detected below 8V at 0ºC for a total of 5 out of 7 seconds. The voltage threshold is temperature dependent varying from 5V at –60ºC (–75ºF) to 9V at 20ºC (68ºF).
- 24V TCM—Battery direct voltage is detected below 17V at 0ºC for a total of 5 out of 7 seconds. The voltage threshold is temperature dependent varying from 14V at –60ºC (–75ºF) to 18V at 20ºC (68ºF).

DIAGNOSTIC TROUBLE CODES (DTC)

Action taken when the DTC Sets

- Hydraulic default is commanded. Shift selector position and hydraulic state of logic valves determine range.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM inhibits TCC engagement.
- Main Modulation is disabled.

Conditions for Clearing the DTC/CHECK TRANS Light.

Allison DOC™ For PC 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.
- Inspect the wiring for poor electrical connections at the TCM. Look for the following conditions:
  - A bent terminal
  - A backed-out pin
  - 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 the step numbers on the diagnostic table.

2. This step tests for the proper ignition input voltage.
3. This step tests for an active DTC after clearing.
4. This step tests vehicle battery per OEM guidelines.
5. This step tests vehicle charging system per OEM guidelines.

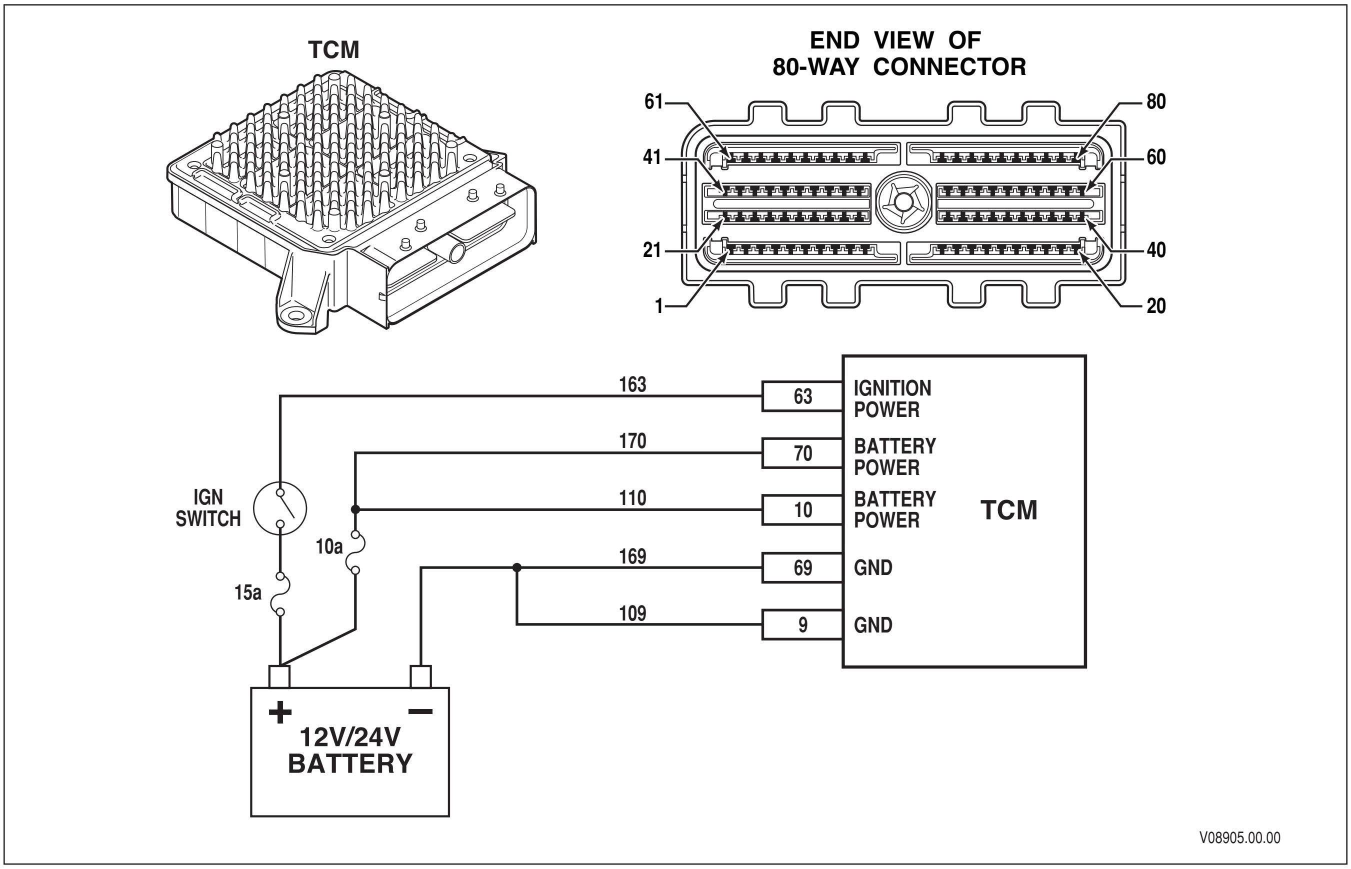
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0882 TCM Power Input Signal—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Inspect the Battery Input voltage value on Allison DOC™. ***NOTE: This DTC sets when battery direct voltage drops below a pre-determined level that is temperature dependent.*** Is the ignition voltage below specified value?	Voltage should be above 9V at 20ºC (68ºF). See conditions for setting the DTC.	*Go to Step 4*	*Go to Step 3*
3	1. Start vehicle if possible. 2. If the DTC is not active, drive the vehicle; attempt to duplicate same operating conditions observed in failure records. Did the DTC return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	Test the vehicle battery per OEM instructions, including a voltage and load test. Does test indicate the battery is good?	See OEM for correct minimum and maximum. Battery specifications.	*Go to Step 5*	*Replace vehicle battery and go to Step 6*
5	Test the vehicle charging system per the OEM recommended testing procedure. Is the charging system operating properly?	See OEM for correct minimum and maximum. Charging system specifications.	*Go to Diagnostic Aids*	*Repair charging system and go to Step 6*
6	In order to verify your repair: 1. Clear DTC. 2. Drive vehicle under conditions shown in failure records when DTC set. Did the DTC return?		*Return to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0883 TCM Power Input Signal—High



Circuit Description

Transmission Control Module (TCM) requires input battery voltage which originates direct from the vehicle battery and runs through a 10 amp fuse to TCM pins 10 (wire 110) and 70 (wire 170).

Conditions for Running the DTC

Engine speed is greater than 450 rpm for 1 second.

Conditions for Setting the DTC

P0883 sets when the TCM detects the following condition:

- 12V TCM—Battery direct voltage is above 18V for 6 out of 10 seconds.
- 24V TCM—Battery direct voltage is above 32V for 6 out of 10 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

Action taken when the DTC Sets

- Hydraulic default is commanded. Shift selector position and hydraulic state of logic valves determine range.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM inhibits TCC engagement.
- Main Modulation is disabled.

Conditions for Clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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 normally is set due to vehicle charging system concerns. Verify the concern and contact OEM for further repair details.

NOTE: Allison does not warranty charging system concerns.

Test Description

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

2. This step tests for the proper battery direct voltage.
3. This step tests for an active DTC after clearing.
5. This step tests vehicle charging system per OEM guidelines.

DTC P0883 TCM Power Input Signal—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. 3. Record the DTC Failure Record data. 4. Clear the DTC. 5. Start vehicle engine; inspect the Battery direct voltage value on Allison DOC™. ***NOTE: This DTC sets when battery direct voltage is detected above 18V for 12V systems and 32V for 24V systems for 6.0 of 10.0 seconds.*** Is the ignition voltage above specified value?	See conditions for setting the DTC.	*Go to Step 4*	*Go to Step 3*
3	1. Start vehicle and operate. 2. If the DTC is not active, drive the vehicle; attempt to duplicate voltage concern, monitor battery voltage with Allison DOC™, watch for spikes that may indicate a charging system concern. Did the DTC return?		*Go to Step 4*	*Go to Diagnostic Aids*

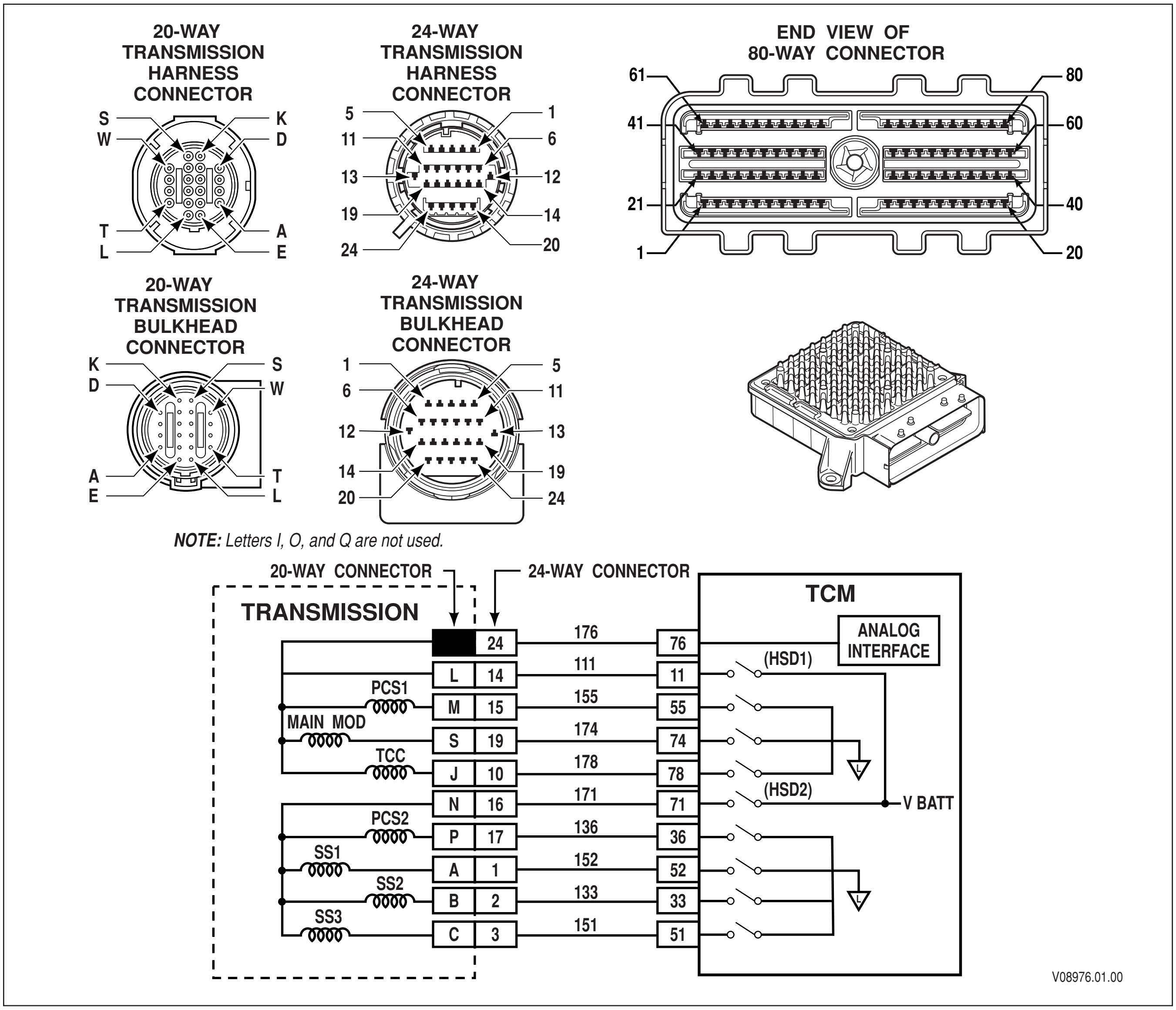
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0883 TCM Power Input Signal—High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	Test the vehicle charging system per the OEM recommended testing procedure. Is the charging system operating properly?	See OEM for correct minimum and maximum charging system specifications.	*Go to Diagnostic Aids*	*Repair charging system and go to Step 5*
5	In order to verify your repair: 1. Clear DTC. 2. Drive vehicle under conditions shown in failure records when DTC set. Did the DTC return?		*Return to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0960 Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—Open



Circuit Description

Pressure Control 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 MAIN MOD is commanded ON, pressure is routed to the main regulator valve lowering the main pressure schedule.

The TCM sends control current to MAIN MOD 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 MAIN MOD by switching MAIN MOD's low side driver ON and OFF. Wire 174 completes the circuit between MAIN MOD and its low side driver. DTC P0960 indicates that the TCM processor has detected an open condition in MAIN MOD's electrical circuit. The open condition may exist in the high side (wire 111) or low side (wire 174).

DIAGNOSTIC TROUBLE CODES (DTC)

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 18V 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 P0960 is set when the TCM detects an open circuit on the MAIN MOD 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 (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- DTC is stored in TCM history.

Conditions for clearing the DTC/CHECK TRANS Light

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. In addition to MAIN MOD, high side driver HSD1 also supplies power to PCS1 and TCC. If DTC P0960 is accompanied by DTC P2727 (PCS1 open circuit) and/or DTC P2761 (TCC 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 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)

- If the DTC appears to be temperature related, suspect a defective MAIN MOD. It is possible for a solenoid to be temperature sensitive causing resistance values to fluctuate. This may cause an intermittent DTC to be set.

Test Description

The numbers below refer to the 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 solenoid resistance.

DTC P0960 Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—Open

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 MAIN MOD 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 (MAIN MOD) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 47278 Transmission Breakout between the OEM and transmission 24-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, 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 overlay J 47275-1, measure voltage between pin 11 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 14 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 Main Mod solenoid circuit as follows: • At overlay J 47275-1, measure voltage between pin 74 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 19 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	

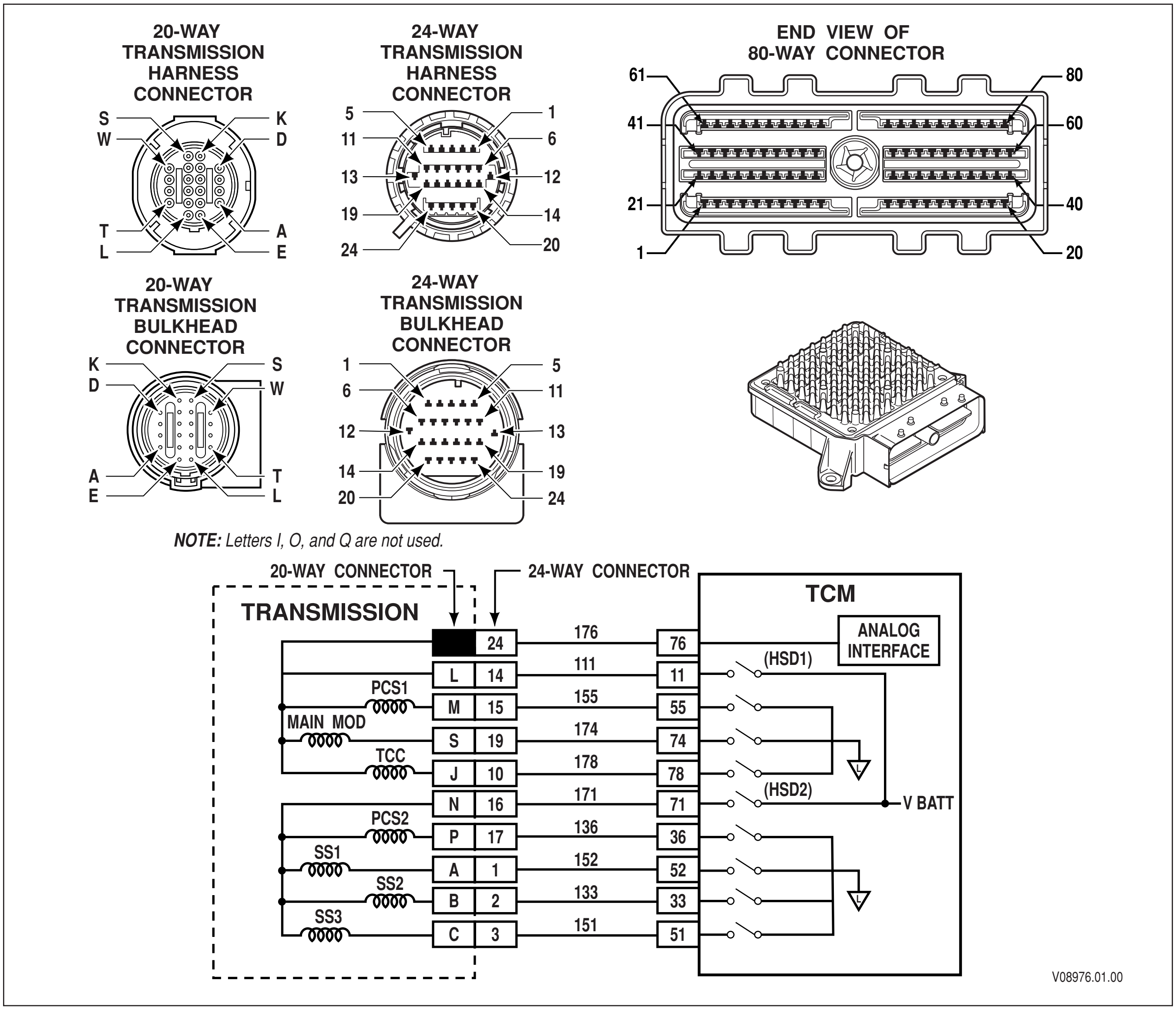
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0960 Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the OEM 24-way connector from J 47278 Transmission Breakout. Leave the transmission 24-way connector connected to the breakout. 3. Using a digital volt/ohmmeter (DVOM), measure the resistance between pin 14 and pin 19 of the transmission 24-way connector. Is the resistance within the specified value?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 10*	*Go to Step 7*
7	1. Remove the transmission oil pan (refer to Service Manual or In-Chassis Maintenance). 2. Disconnect MAIN MOD from the internal wiring harness. 3. Using a DVOM, measure MAIN MOD resistance at pins A and B. Is resistance within the specified values?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace MAIN MOD (refer to Service Manual or In-Chassis Maintenance). 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 P0962 Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—Low



Circuit Description

Pressure Control Solenoid 1 (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 solenoid MAIN MOD is commanded ON, pressure is routed to the main regulator valve lowering the main pressure schedule.

The TCM sends control current to solenoid MAIN MOD 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 MAIN MOD by switching MAIN MOD's low side driver ON and OFF. Wire 174 completes the circuit between MAIN MOD and its low side driver. DTC P0962 indicates that the TCM processor has detected a short-to-ground condition in the low side of solenoid MAIN MOD's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

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 18V 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.

Actions taken when the DTC Sets

When DTC P0962 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- DTC is stored in TCM history.
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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

- Code 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 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.
- If the DTC appears to be temperature related, suspect a defective Main Mod solenoid. It is possible for a solenoid to be temperature sensitive causing resistance values to fluctuate. This may cause an intermittent DTC to be set.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to the 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 transmission internal harness.

DTC P0962 Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 MAIN MOD solenoid electrical circuit.*** Did DTC P0962 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4, Wire Check 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 24-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 6*	*Go to Step 7*

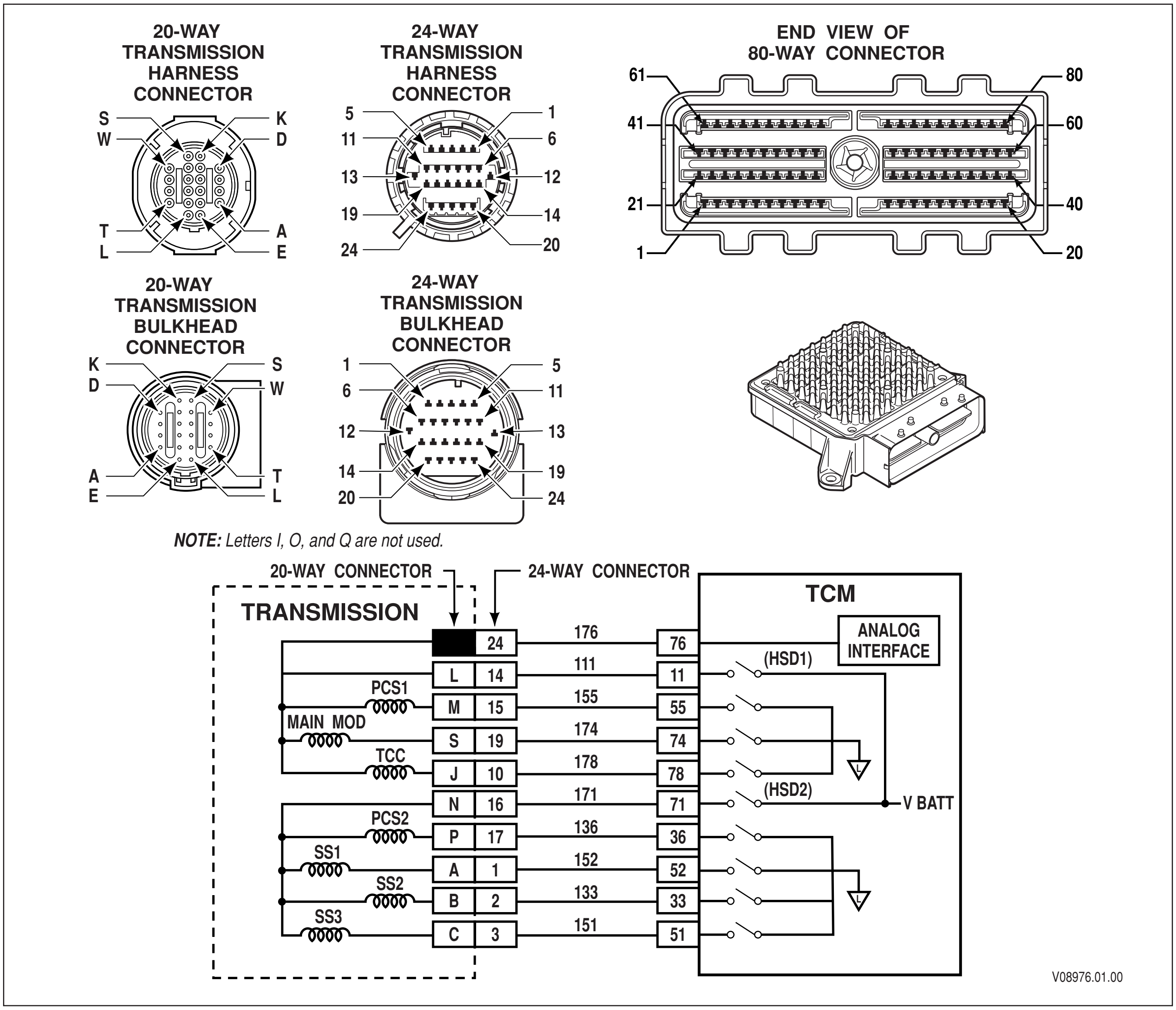
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0962 Pressure Control Solenoid Main Mod (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 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 19 and all other pins in the 24-way connector, and shorts-to-ground between pin 19 and chassis ground. ***NOTE: The resistance value between pins 14 and 19, and between pins 19 and 24 will read normal solenoid resistance. The resistance value between pins 19 and 10, and between pins 19 and 15 will be twice normal solenoid resistance*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 2. Inspect the internal harness for wire-to-wire shorts or shorts-to-ground. Were any shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace solenoid MAIN MOD (refer to Service Manual or In-Chassis Maintenance). 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 P0963 Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—High



Circuit Description

Pressure Control Solenoid 1 (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 solenoid MAIN MOD is commanded ON, pressure is routed to the main regulator valve lowering the main pressure schedule.

The TCM sends control current to solenoid MAIN MOD 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 MAIN MOD by switching MAIN MOD's low side driver ON and OFF. Wire 174 completes the circuit between MAIN MOD and its low side driver. DTC P0963 indicates that the TCM processor has detected a short-to-battery condition in the low side of solenoid MAIN MOD's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

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 18V 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.

Actions taken when the DTC Sets

When DTC P0963 is active, the following conditions will occur:

- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- DTC is stored in TCM history.

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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 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.
- If the DTC appears to be temperature related, suspect a defective Main Mod solenoid. It is possible for a solenoid to be temperature sensitive causing resistance values to fluctuate. This may cause an intermittent DTC to be set.

Test Description

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

DIAGNOSTIC TROUBLE CODES (DTC)

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 174.
6. This step tests for wire-to-wire shorts in the transmission internal harness.

DTC P0963 Pressure Control Solenoid Main Mod (MAIN MOD) Control Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 MAIN MOD solenoid electrical circuit.*** Did DTC P0963 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4, Wire Check 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 24-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 found?		*Go to Step 5*	*Go to Step 6*

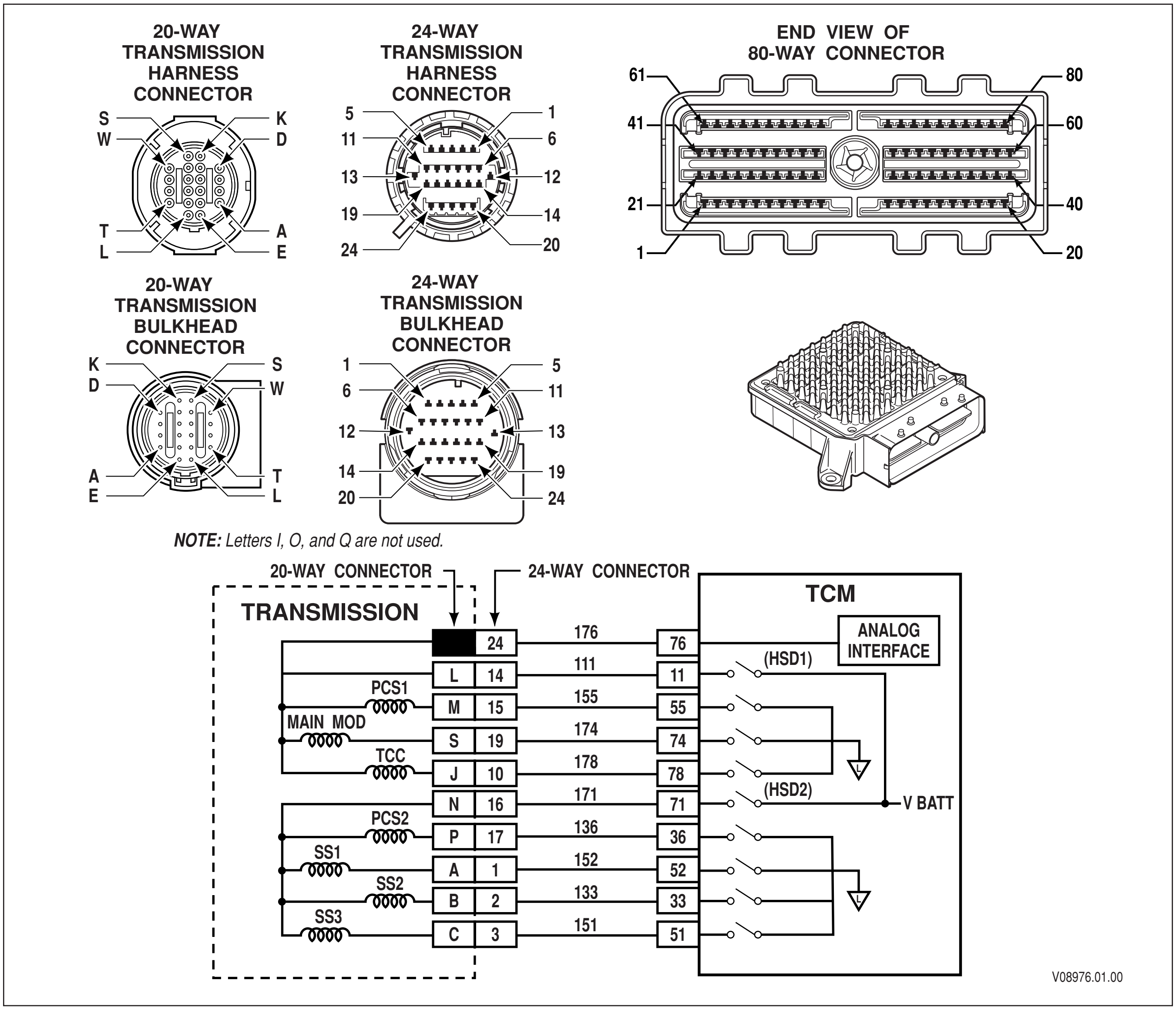
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0963 Pressure Control Solenoid Main Mod (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 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 19 and all other pins in the 24-way connector, and shorts-to-ground between pin 19 and chassis ground. ***NOTE: The resistance value between pins 14 and 19, and between pins 19 and 24 will read normal solenoid resistance. The resistance value between pins 19 and 10, and between pins 19 and 15 will be twice normal solenoid resistance.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 2. Inspect the internal harness for wire-to-wire shorts. Is resistance within the specified values?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace solenoid MAIN MOD (refer to Service Manual or In-Chassis Maintenance). 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 P0964 Pressure Control Solenoid 2 (PCS2) Control Circuit—Open



Circuit Description

Pressure Control Solenoid 2 (PCS2) is a Pressure Proportional to Current (PPC) solenoid used to control on-coming and off-going and holding pressure to any one of five clutches.

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's low side driver ON and OFF. Wire 136 completes the circuit between PCS2 and its low side driver. DTC P0964 indicates that the TCM processor has detected an open condition in solenoid PCS2's electrical circuit. The open condition may exist in the high side (wire 171) or low side (wire 136).

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Associated high side driver (HSD2) is enabled and no HSD2 DTCs are active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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.
- Engine crank time is not extended.

Conditions for Setting the DTC

DTC P0964 is set when the TCM detects an open circuit on the PCS2 solenoid return circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0964 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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 PCS2. In addition to PCS2, HSD2 also supplies power to solenoids SS1, SS2, SS3. If DTC P0964 is accompanied by an open circuit DTC P0972 for SS1 **and/or** open circuit DTC P0975 for SS2 **and/or** P0978 for SS3 the open is most likely in the high side of the circuit.
- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage etc.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to an open circuit condition.
- When diagnosing for an intermittent open condition, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent open condition.
- 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 where DTC was set.

Test Description

The numbers below refer to the 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 136 or wire 171 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 solenoid resistance.

DTC P0964 Pressure Control Solenoid 2 (PCS2) Control Circuit—Open

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 PCS2 solenoid electrical circuit.*** Did DTC P0964 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0964 Pressure Control Solenoid 2 (PCS2) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 47278 Transmission Breakout between the OEM and transmission 24-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, enter Solenoid Test mode and command the PCS2 solenoid ON. 6. Determine the voltage drop in the high side of the PCS2 solenoid circuit as follows: • At overlay J 47275-1, measure voltage between pin 71 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 16 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 solenoid circuit as follows: • At overlay J 47275-1, measure voltage between pin 36 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 17 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	

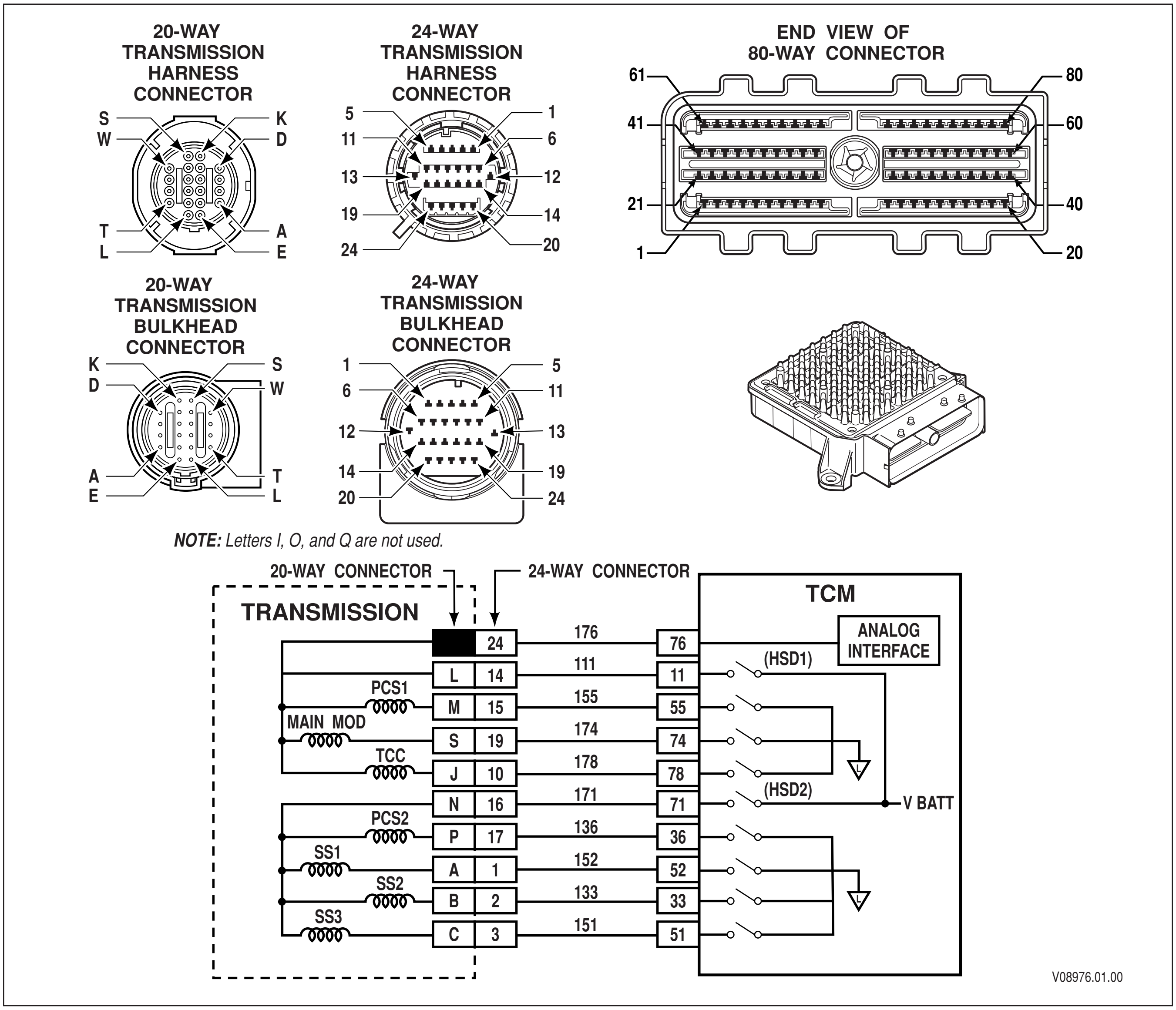
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0964 Pressure Control Solenoid 2 (PCS2) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the OEM 24-way connector from J 47278 Transmission Breakout. Leave the transmission 24-way connector connected to the breakout. 3. Using a digital volt/ohmmeter (DVOM), measure the resistance between pin 16 and pin 17 of the transmission 24-way connector. Is the resistance within the specified value?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 10*	*Go to Step 7*
7	1. Remove the transmission oil pan. 2. Disconnect the PCS2 from the internal wiring harness. 3. Using a DVOM, measure the PCS2 resistance at pins A and B. Is resistance within the specified values?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace PCS2 (refer to Service Manual or In-Chassis Maintenance). 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 P0966 Pressure Control Solenoid 2 (PCS2) Control Circuit—Low



Circuit Description

Pressure Control Solenoid 2 (PCS2) is a Pressure Proportional to Current (PPC) solenoid used to control on-coming and off-going and holding pressure to any one of five clutches.

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's low side driver ON and OFF. Wire 136 completes the circuit between PCS2 and its low side driver. DTC P0966 indicates that the TCM processor has detected a short-to-ground condition in the low side of solenoid PCS2's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Associated high side driver (HSD2) is enabled and no HSD2 DTCs are active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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.
- Engine crank time is not extended.

Conditions for Setting the DTC

DTC P0966 is set when the TCM detects a short-to-ground on the PCS2 circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P966 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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

- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to a short to a circuit ground condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage etc.
- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to a circuit ground condition.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent circuit ground conditions, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent circuit ground condition.
- 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 where DTC was set.

Test Description

The numbers below refer to the 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 wire-to-wire shorts or a short-to-ground in the transmission internal harness.

DTC P0966 Pressure Control Solenoid 2 (PCS2) Control Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start engine. 3. Record DTC failure records. 4. Monitor the ignition voltage. Is the voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem*
3	1. Clear the DTC. 2. Start vehicle and test drive. 3. Attempt to duplicate same operating conditions observed in failure records (gear attained, transmission temperature, etc.). ***NOTE: This DTC intent is to detect a short-to-ground at PCS2 return circuit.*** Did DTC P0966 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0966 Pressure Control Solenoid 2 (PCS2) Control Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 24-way connector. 5. Inspect the routing of wire 136 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 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 17 and all other pins in the 24-way connector, and shorts-to-ground between pin 17 and chassis ground. ***NOTE: The resistance value between pins 17 and 16 will read normal solenoid resistance. The resistance value between pins 17 and 1, 2 and 3 will be the sum of PCS2 and one shift solenoid.*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 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 (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	

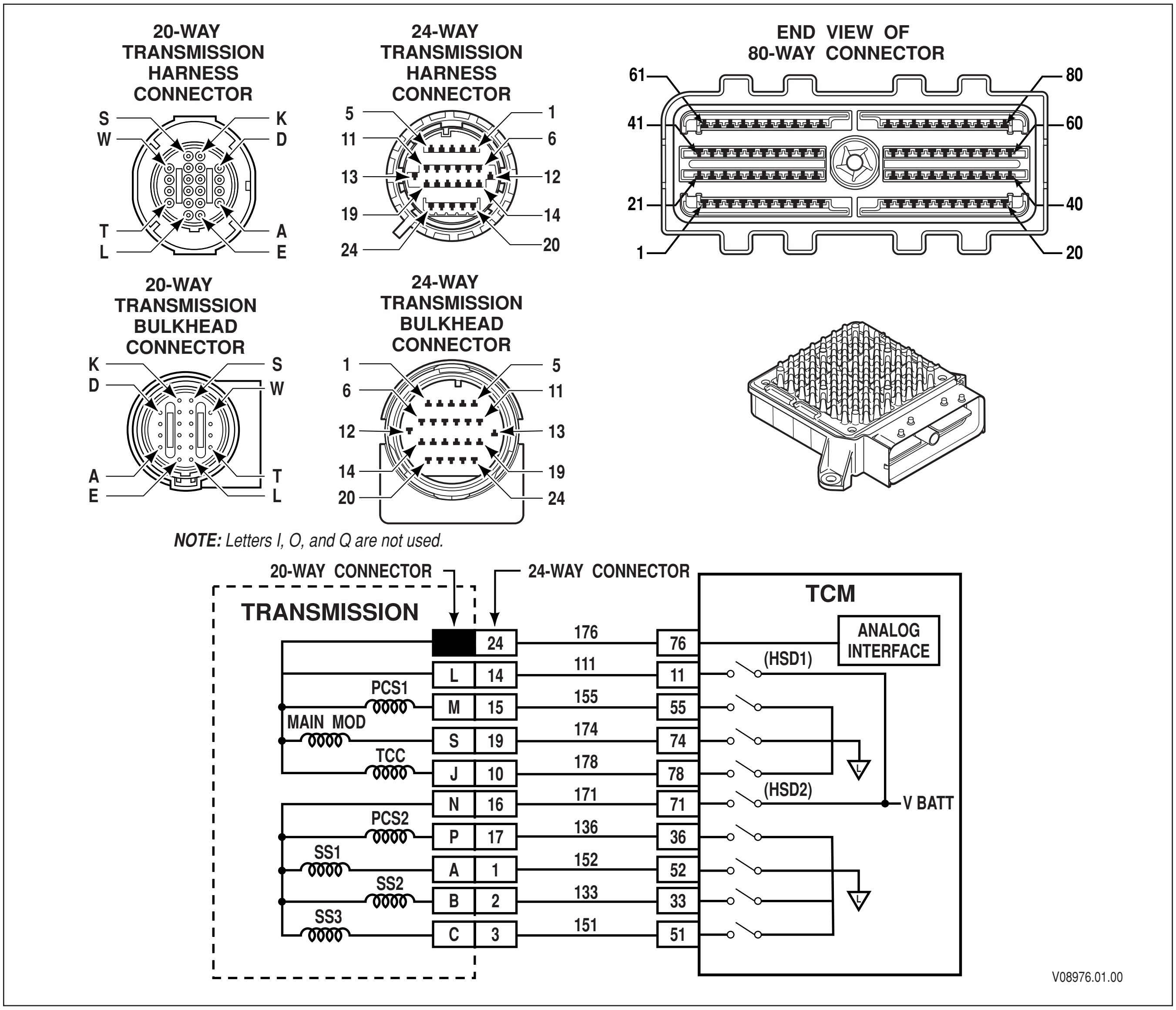
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0966 Pressure Control Solenoid 2 (PCS2) Control Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Replace PCS2 (refer to Service Manual or In-Chassis Maintenance). 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*	
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 P0967 Pressure Control Solenoid 2 (PCS2) Control Circuit—High



Circuit Description

Pressure Control Solenoid 2 (PCS2) is a Pressure Proportional to Current (PPC) solenoid used to control on-coming and off-going and holding pressure to any one of five clutches.

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's low side driver ON and OFF. Wire 136 completes the circuit between PCS2and its low side driver. DTC P0967 indicates that the TCM processor has detected a short-to-battery condition in the low side of PCS2's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Associated high side driver (HSD2) is enabled and no (HSD2) DTCs are active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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.
- Engine crank time is not extended.

Conditions for Setting the DTC

DTC P0967 is set when the TCM detects an short to power on the PCS2 circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0967 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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

- Code P0967 indicates a short-to-battery in the electrical circuit for the PCS2.
- 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 circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.

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. 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.

Test Description

The numbers below refer to the 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 136.
6. This step tests for 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 PCS2 electrical circuit.*** Did DTC P0963 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0967 Pressure Control Solenoid 2 (PCS2) Control Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 24-way connector. 5. Inspect the routing of wire 136 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 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 found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 17 and all other pins in the 24-way connector, and shorts-to-ground between pin 17 and chassis ground. ***NOTE: The resistance value between pins 17 and 16 will read normal solenoid resistance. The resistance value between pins 17 and 1, 2, and 3 will be the sum of PCS2 and one shift solenoid.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 11*
7	1. Remove the transmission oil pan. 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	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace PCS2 (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 12*	

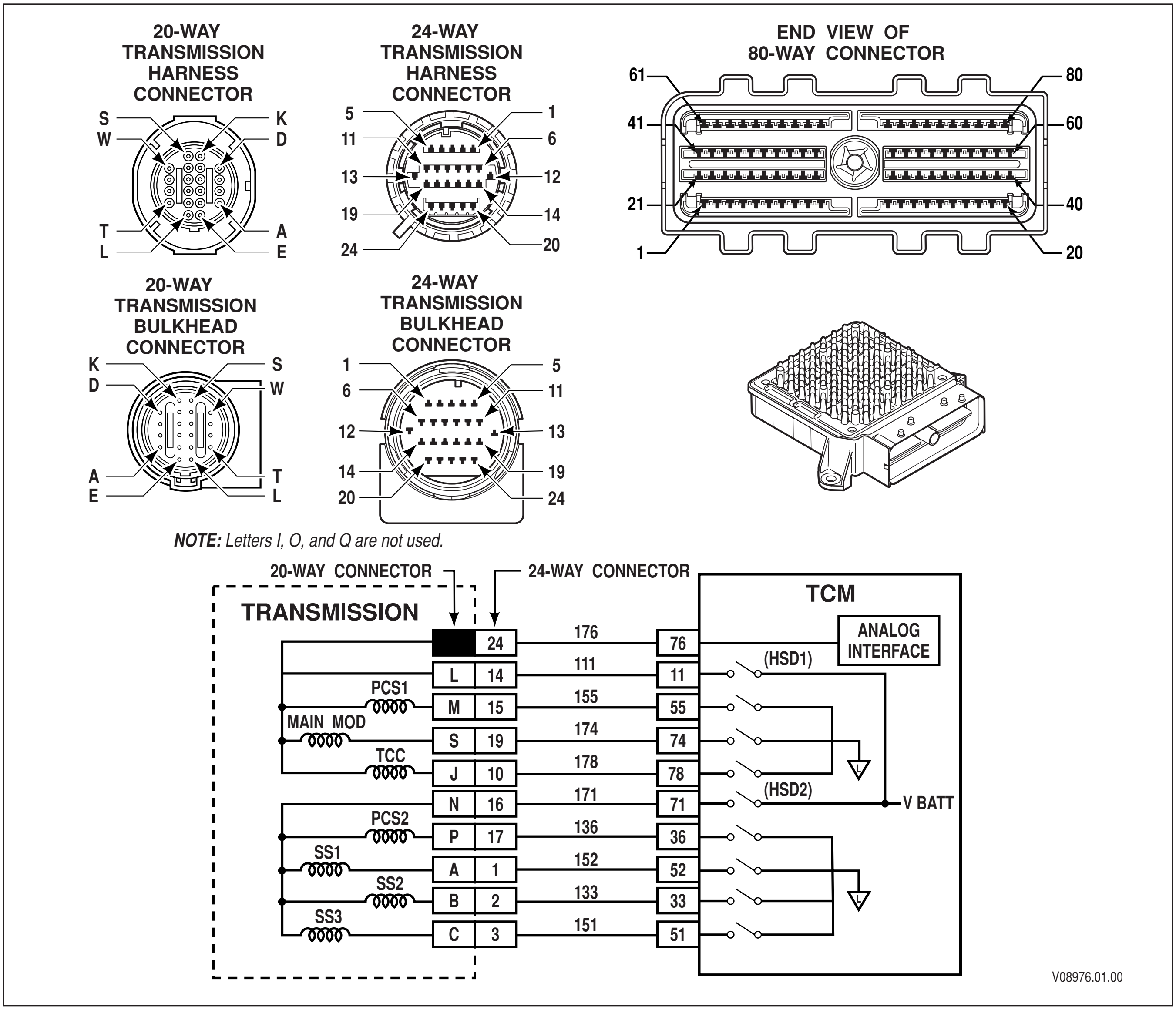
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0967 Pressure Control Solenoid 2 (PCS2) 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 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 P0972 Shift Solenoid 1 (SS1) Control Circuit—Open



Circuit Description

Shift solenoid 1 (SS1) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 1 (SV1) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

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 regulates the amount of current to SS1 by switching SS1's low side driver ON and OFF. Wire 152 completes the circuit between SS1 and its low side driver. DTC P0972 indicates that the TCM processor has detected an open condition in SS1's electrical circuit. The open condition may exist in the high side (wire 171) or low side (wire 152).

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 P0972 is set when the TCM detects an open circuit on the SS1 Pressure Control Solenoid return circuit for more than 2 seconds.

Actions taken when the DTC Sets

- When DTC P0972 is active, the following conditions will occur:
- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **F** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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

- Code P0972 indicates an open in the electrical circuit for the SS1. In addition to SS1, high side driver HSD2 also supplies power to SS2, PCS2, and SS3. If DTC P0972 is accompanied by DTC P0975 (SS2 open circuit) and/or DTC P0952 (SS3 open circuit) and/or P0964 (PCS2 open circuit), the open is most likely in the high side of the circuit.
- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage etc.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to an open circuit condition.
- When diagnosing for an intermittent open condition, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent open condition.
- 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 where DTC was set.

Test Description

The numbers below refer to the 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 152 or wire 171 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 SS1 resistance.

DTC P0972 Shift Solenoid 1 (SS1) Control Circuit—Open

Step	Action	Value(s)	Yes	No
1	Was the Beginning The Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 SS1 electrical circuit.*** Did DTC P0972 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0972 Shift Solenoid 1 (SS1) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 47278 Transmission Breakout between the OEM and transmission 24-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, enter Solenoid Test mode and command the SS1 ON. 6. Determine the voltage drop in the high side of the SS1 circuit as follows: • At overlay J 47275-1, measure voltage between pin 71 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 16 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 SS1 circuit as follows: • At overlay J 47275-1, measure voltage between pin 52 and an isolated ground. • At transmission connector breakout J 47278, 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 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	

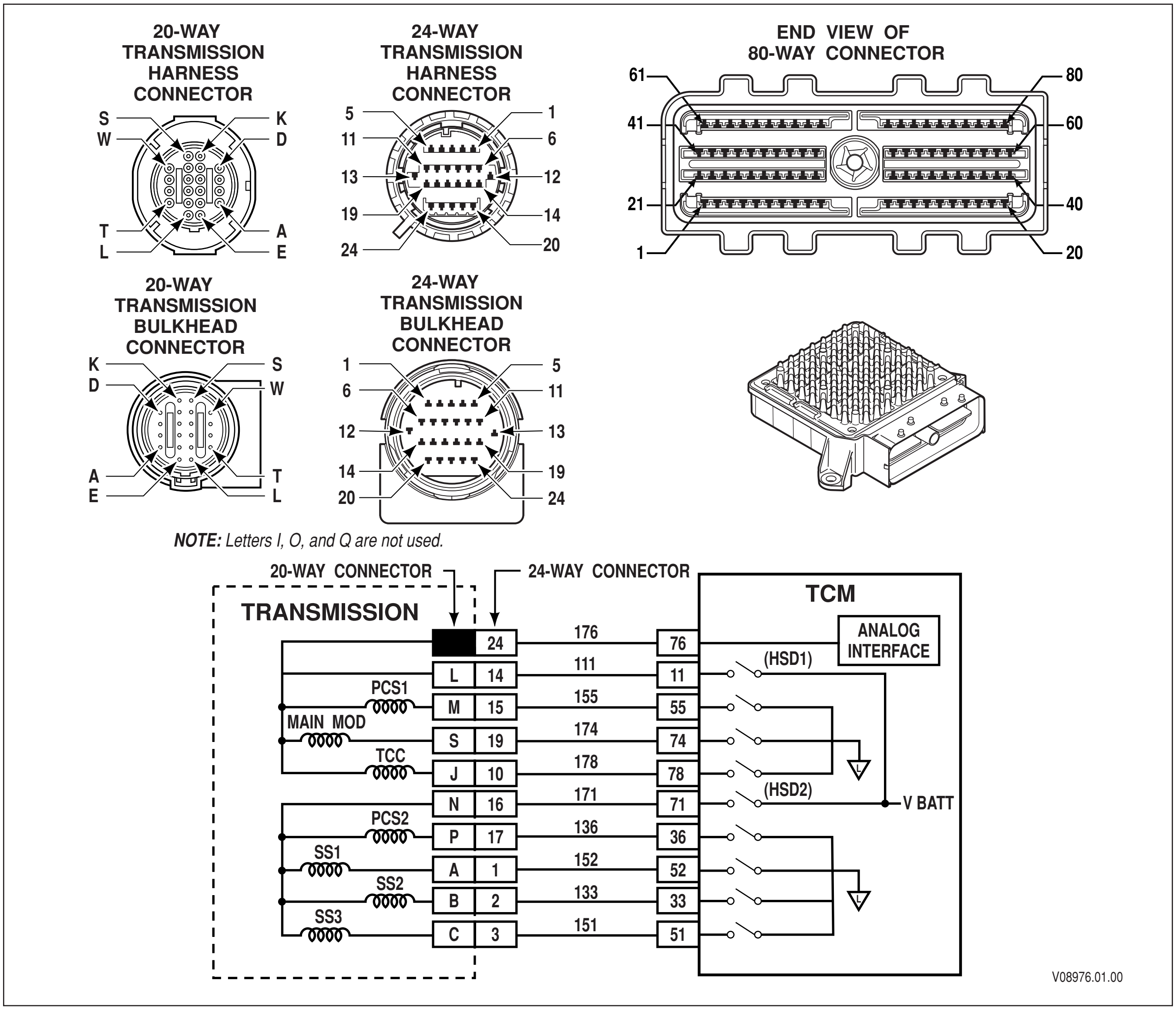
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0972 Shift Solenoid 1 (SS1) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector, if not disconnected in Step 4 above. 3. Install Transmission Breakout J 47278 to the transmission 24-way connector. Leave the OEM harness disconnected. 4. Using a digital volt/ohmmeter (DVOM), measure the resistance between pin 1 and pin 16. Is the resistance within the specified value?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 10*	*Go to Step 7*
7	1. Remove the transmission oil pan (refer to Service Manual or In-Chassis Maintenance). 2. Disconnect SS1 from the internal wiring harness. 3. Using a DVOM, measure SS1 resistance at pins A and B. Is resistance within the specified values?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace SS1 (refer to Service Manual or In-Chassis Maintenance). 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 P0973 Shift Solenoid 1 (SS1) Control Circuit—Low



Circuit Description

Shift solenoid 1 (SS1) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 1 (SV1) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

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 regulates the amount of current to SS1 by switching SS1's low side driver ON and OFF. Wire 152 completes the circuit between SS1 and its low side driver. DTC P0973 indicates that the TCM processor has detected a short-to-ground condition in the low side of SS1's electrical circuit.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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)

Conditions for Setting the DTC

DTC P0973 is set when the TCM detects a short-to-ground on the SS1 Pressure Control Solenoid return circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0973 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ For PC 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

- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage etc.
- When diagnosing for an intermittent circuit ground conditions, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent circuit ground condition.
- 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 where DTC was set.

Test Description

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

DIAGNOSTIC TROUBLE CODES (DTC)

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 P0973 Shift Solenoid 1 (SS1) Control Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 SS1 electrical circuit.*** Did DTC P0973 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4, Wire Check 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 24-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 shorts-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*

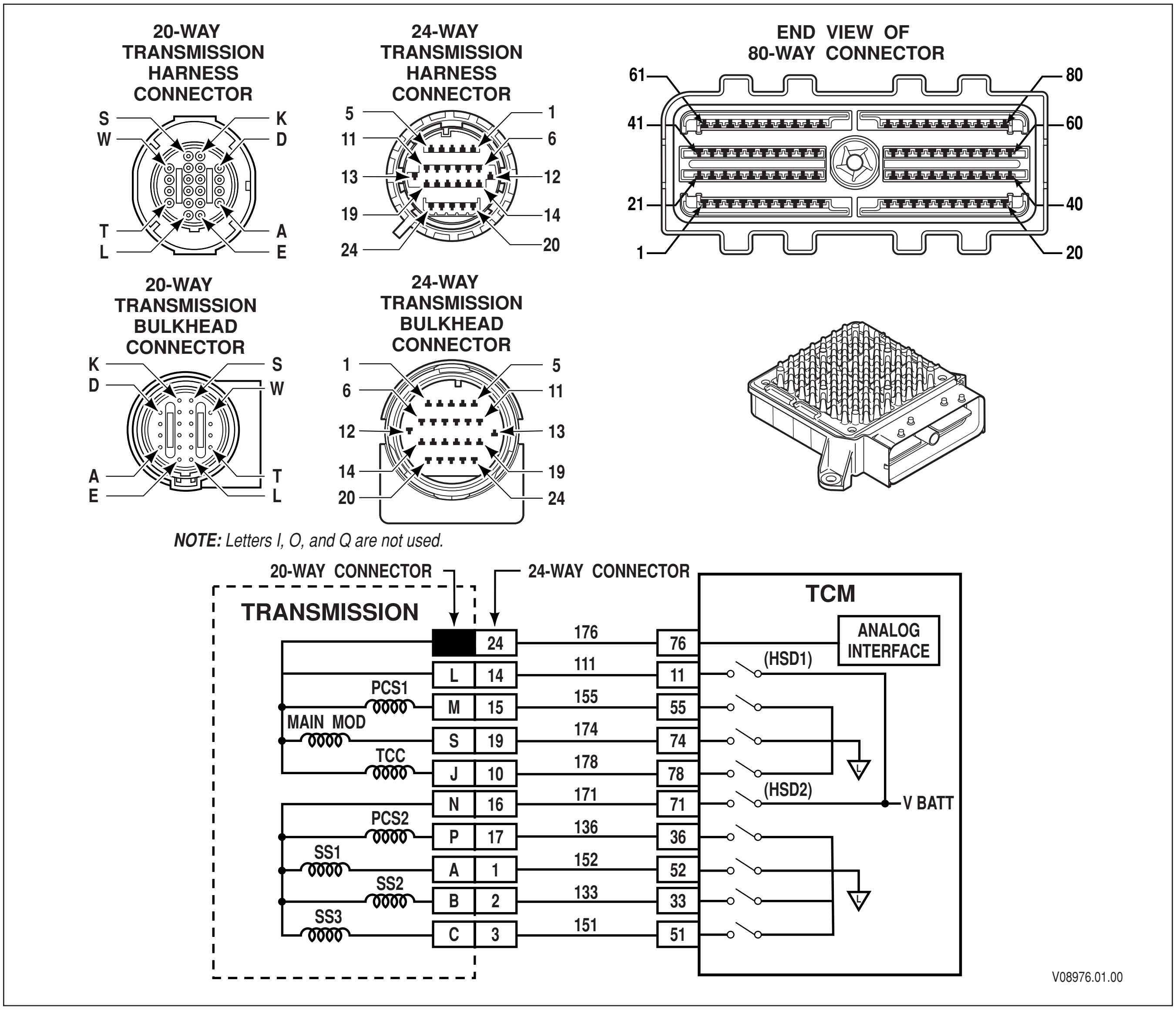
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0973 Shift Solenoid 1 (SS1) Control Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 1 and all other pins in the 24-way connector, and shorts-to-ground between pin 1 and chassis ground. ***NOTE: The resistance value between pins 1 and 16 will read normal solenoid resistance. The resistance value between pins 1 and 2, and pins 1 and 3 will be twice normal solenoid resistance. The resistance between pin 1 and pin 17 will be the sum of PCS2 and SS1.*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 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 (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace SS1 (refer to Service Manual or In-Chassis Maintenance). 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 the replacement 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 P0974 Shift Solenoid 1 (SS1) Control Circuit—High



Circuit Description

Shift solenoid 1 (SS1) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 1 (SV1) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

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 regulates the amount of current to SS1 by switching SS1's low side driver ON and OFF. Wire 152 completes the circuit between SS1and its low side driver. DTC P0974 indicates that the TCM processor has detected a short-to-battery condition in the low side of SS1's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 power on the SS1 circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0974 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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

- Code P0974 indicates a short-to-battery in the electrical circuit for the SS1.
- 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 circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.

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. 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.

Test Description

The numbers below refer to the 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 152.
6. This step tests for 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0974 Shift Solenoid 1 (SS1) Control Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 24-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 shorts-to-ground between pin 52 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 1 and all other pins in the 24-way connector, and shorts-to-ground between pin 1 and chassis ground. ***NOTE: The resistance value between pins 1 and 16 will read normal solenoid resistance. The resistance value between pins 1 and 2, and pins 1 and 3 will be twice normal solenoid resistance. The resistance between pin 1 and pin 17 will be the sum of PCS2 and SS1.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 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	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	

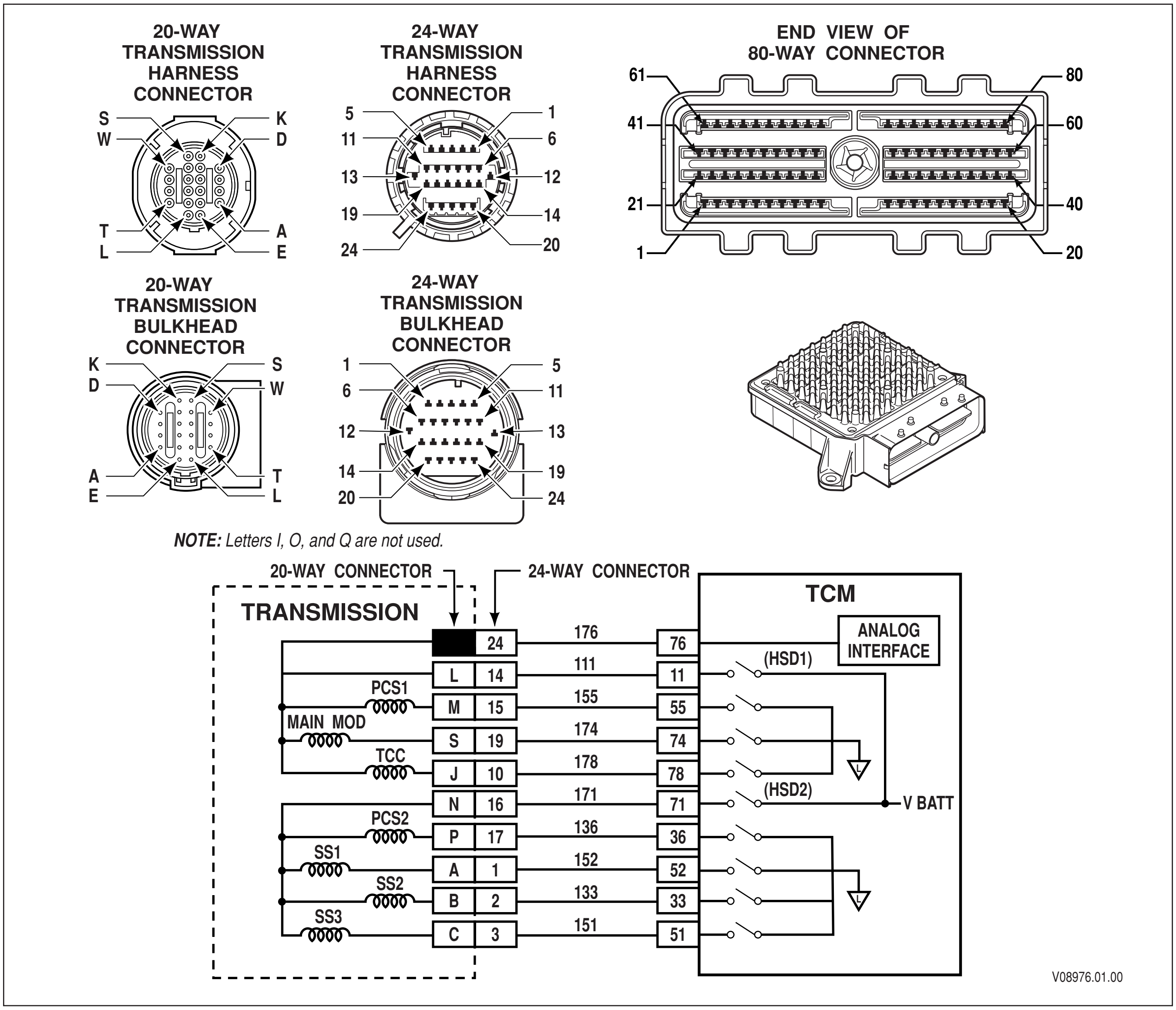
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0974 Shift Solenoid 1 (SS1) Control Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Replace SS1 (refer to Service Manual or In-Chassis Maintenance). 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 P0975 Shift Solenoid 2 (SS2) Control Circuit—Open



Circuit Description

Shift solenoid 2 (SS2) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 2 (SV2) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

The TCM sends control current to SS2 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 SS2 by switching SS2's low side driver ON and OFF. Wire 133 completes the circuit between SS2 and its low side driver. DTC P0975 indicates that the TCM processor has detected an open condition in SS2's electrical circuit. The open condition may exist in the high side (wire 171) or low side (wire 133).

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 Pressure Control Solenoid return circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0975 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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

- Code P0975 indicates an open in the electrical circuit for the SS2. In addition to SS2, high side driver HSD2 also supplies power to SS1, PCS2 and SS3. If DTC P0975 is accompanied by DTC P0972 (SS1 open circuit) and/or DTC P0978 (SS3 open circuit) and/or P0964 (PCS2 open circuit), the open is most likely in the high side of the circuit.
- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage, etc.
- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to an open circuit condition.
- When diagnosing for an intermittent open condition, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent open condition.
- 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 where DTC was set.

Test Description

The numbers below refer to the 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 133 or wire 171 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 solenoid resistance.

DTC P0975 Shift Solenoid 2 (SS2) Control Circuit—Open

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 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 Check 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 47278 Transmission Breakout between the OEM and transmission 24-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, enter Solenoid Test mode and command the SS2 ON. 6. Determine the voltage drop in the high side of the SS2 circuit as follows: • At overlay J 47275-1, measure voltage between pin 71 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 16 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 overlay J 47275-1, measure voltage between pin 33 and an isolated ground. • At transmission connector breakout J 47278, 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*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	

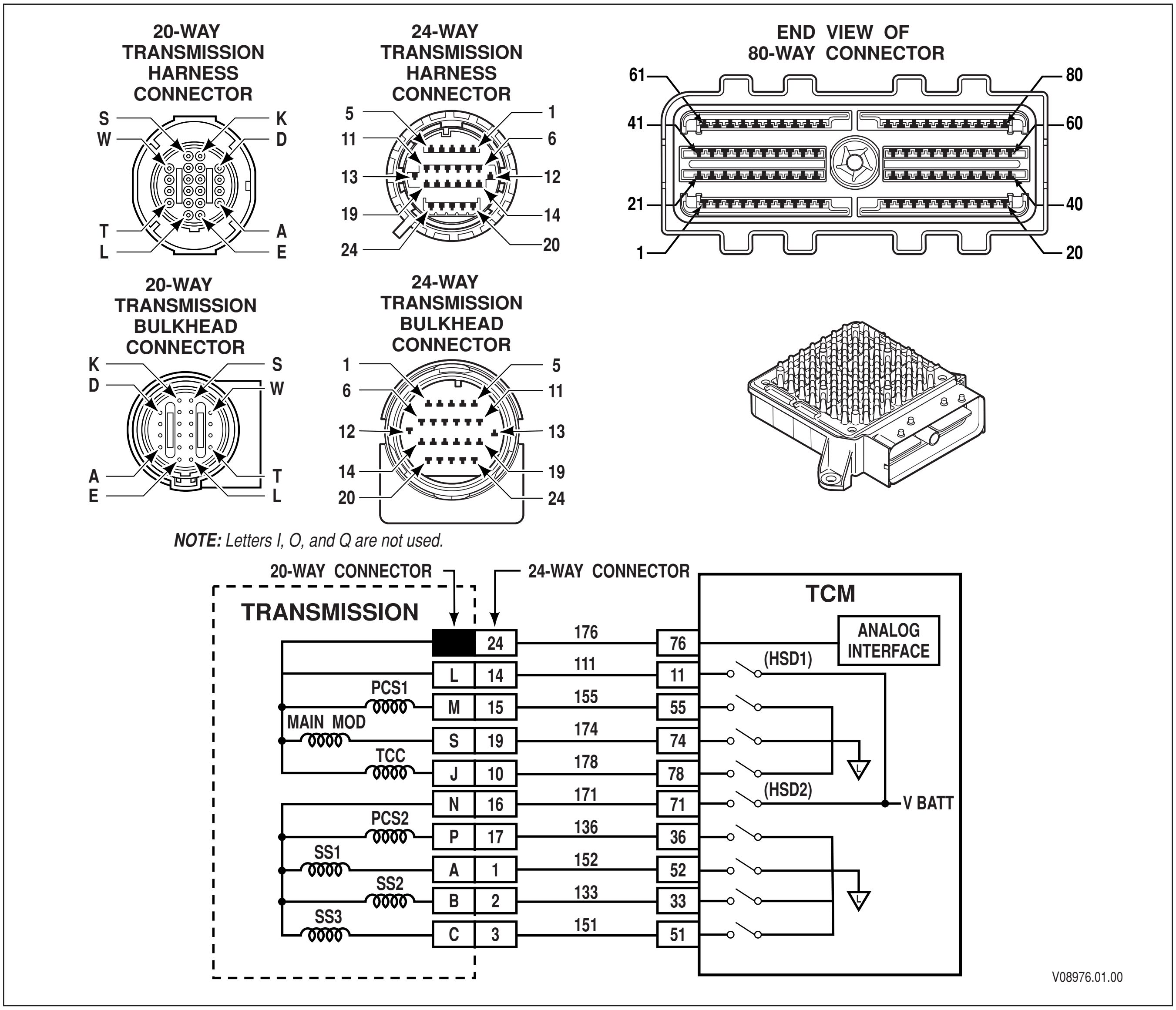
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0975 Shift Solenoid 2 (SS2) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the 24-way transmission connector, if not disconnected in Step 4 above. 3. Install Transmission Breakout J 47278 to the transmission 24-way connector. Leave the OEM harness disconnected. 4. Using a digital volt/ohmmeter (DVOM), measure the resistance between pin 2 and pin 16. Is the resistance within the specified value?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 10*	*Go to Step 7*
7	1. Remove the transmission oil pan. 2. Disconnect the SS2 from the internal wiring harness. 3. Using a DVOM, measure the SS2 resistance at pins A and B. Is resistance within the specified values?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace SS2 (refer to Service Manual or In -Chassis Maintenance). 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 P0976 Shift Solenoid 2 (SS2) Control Circuit—Low



Circuit Description

Shift solenoid 2 (SS2) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 2 (SV2) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

The TCM sends control current to SS2 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 SS2 by switching SS2's low side driver ON and OFF. Wire 133 completes the circuit between SS2 and its low side driver. DTC P0976 indicates that the TCM processor has detected a short-to-ground condition in the low side of SS2's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 on the SS2 Pressure Control Solenoid return circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0976 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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

- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage, etc.
- When diagnosing for an intermittent circuit ground conditions, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent circuit ground condition.

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 where DTC was set.

Test Description

The numbers below refer to the 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 wire-to-wire shorts or a short-to-ground in the transmission internal harness.

DTC P0976 Shift Solenoid 2 (SS2) Control Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 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 Check 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 24-way connector. 5. Inspect the routing of wire 133 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 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 wiring defects found?		*Go to Step 5*	*Go to Step 6*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 2 and all other pins in the 24-way connector, and shorts-to-ground between pin 2 and chassis ground. ***NOTE: The resistance value between pins 2 and 16 will read normal solenoid resistance. The resistance value between pins 2 and 1, and pins 2 and 3 will be twice normal solenoid resistance. The resistance between pin 2 and pin 17 will be the sum of PCS2 and SS2.*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
7	1. Remove the Transmission oil pan (refer to Service Manual or In-Chassis Maintenance). 2. Inspect the internal harness for shorts-to-ground. Were any shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*

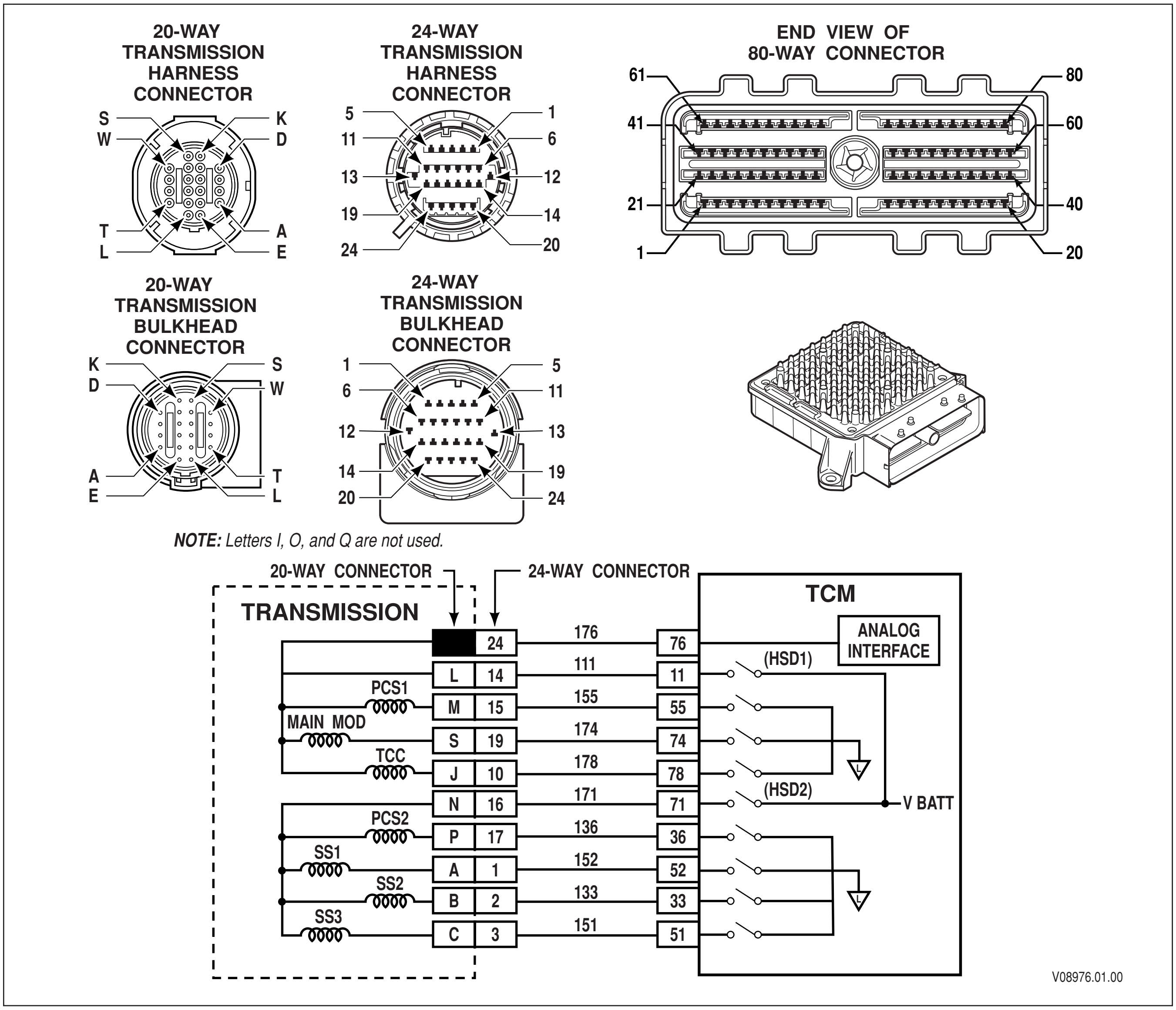
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0976 Shift Solenoid 2 (SS2) Control Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace SS2 (refer to Service Manual or In-Chassis Maintenance). 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 P0977 Shift Solenoid 2 (SS2) Control Circuit—High



Circuit Description

Shift solenoid 2 (SS2) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 2 (SV2) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

The TCM sends control current to SS2 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 SS2 by switching SS2's low side driver ON and OFF. Wire 133 completes the circuit between SS2 and its low side driver. DTC P0977 indicates that the TCM processor has detected a short-to-battery condition in the low side of SS2's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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-power on the SS2 circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0977 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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 SS2.
- 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 circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, etc.

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. 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.

Test Description

The numbers below refer to the 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 133.
6. This step tests for wire-to-wire shorts in the transmission internal harness.

DTC P0977 Shift Solenoid 2 (SS2) Control Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 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 Check 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 24-way connector. 5. Inspect the routing of wire 133 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 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*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 2 and all other pins in the 24-way connector, and shorts-to-ground between pin 2 and chassis ground. ***NOTE: The resistance value between pins 2 and 16 will read normal solenoid resistance. The resistance value between pins 2 and 1, and pins 2 and 3 will be twice normal solenoid resistance. The resistance between pin 2 and 17 will be the sum of PCS2 and SS2.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 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	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	

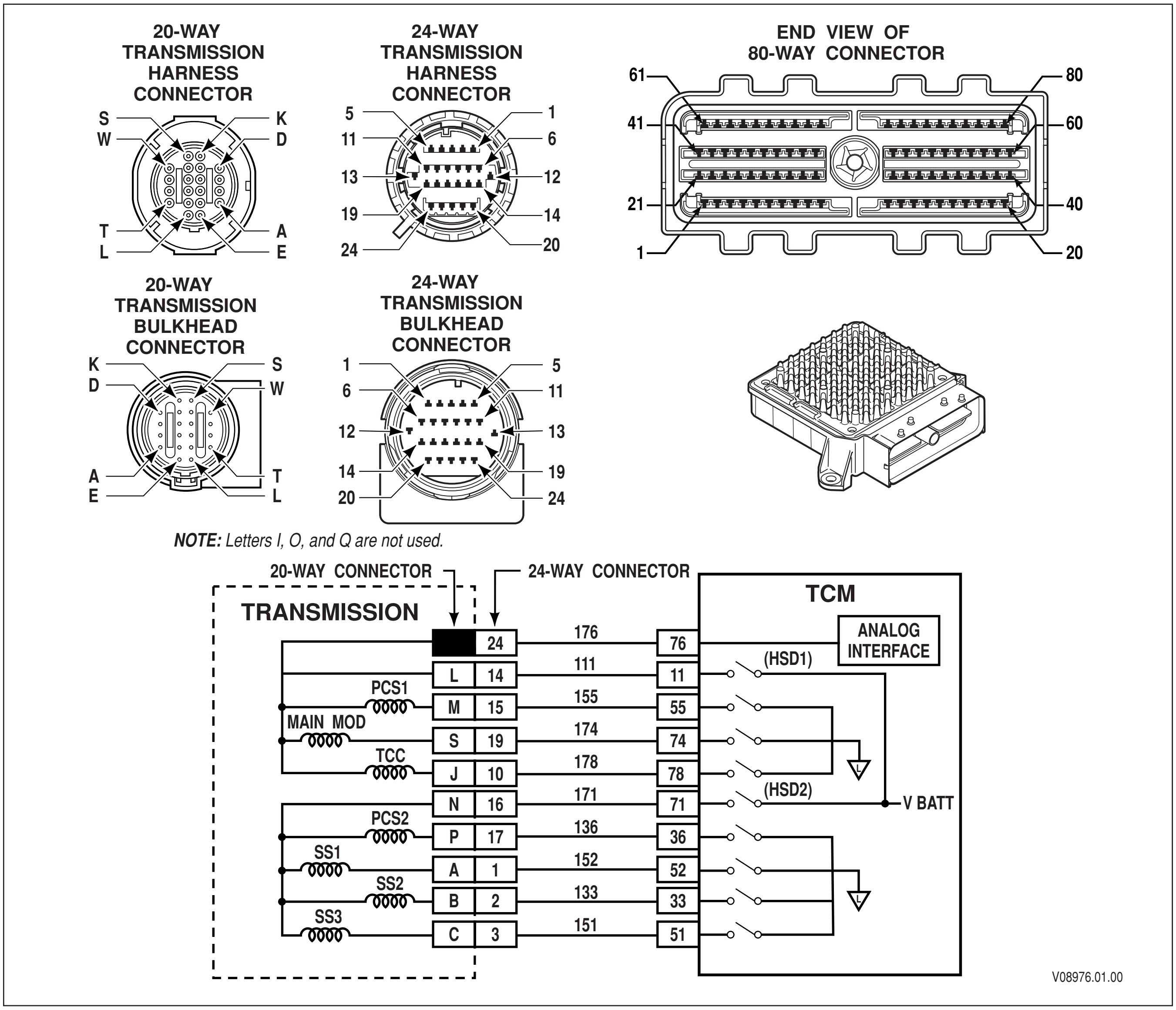
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0977 Shift Solenoid 2 (SS2) Control Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Replace SS2 (refer to Service Manual or In-Chassis Maintenance). 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 P0978 Shift Solenoid 3 (SS3) Control Circuit—Open



Circuit Description

Shift solenoid 3 (SS3) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 3 (SV3) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

The TCM sends control current to SS3 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 SS3 by switching SS3's low side driver ON and OFF. Wire 151 completes the circuit between SS3 and its low side driver. DTC P0978 indicates that the TCM processor has detected an open condition in SS3's electrical circuit. The open condition may exist in the high side (wire 171) or low side (wire 151).

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 P0978 is set when the TCM detects an open circuit on the SS3 Pressure Control Solenoid return circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0978 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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 P0978 indicates an open in the electrical circuit for SS3. In addition to SS3, high side driver HSD2 also supplies power to SS1, PCS2 and SS2. If DTC P0978 is accompanied by DTC P0972 (SS1 open circuit) and/or DTC P0975 (SS2 open circuit) and/or P0964 (PCS2 open circuit), the open is most likely in the high side of the circuit.
- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage, etc.
- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to an open circuit condition.
- When diagnosing for an intermittent open condition, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent open condition.
- 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 where DTC was set.

Test Description

The numbers below refer to the 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 151 or wire 171 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 solenoid resistance.

DTC P0978 Shift Solenoid 3 (SS3) Control Circuit—Open

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 SS3 electrical circuit.*** Did DTC P0978 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0978 Shift Solenoid 3 (SS3) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 47278 Transmission Breakout between the OEM and transmission 24-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, enter Solenoid Test mode and command the SS3 ON. 6. Determine the voltage drop in the high side of the SS3 circuit as follows: • At overlay J 47275-1, measure voltage between pin 71 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 16 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 SS3 circuit as follows: • At overlay J 47275-1, measure voltage between pin 51 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 3 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	

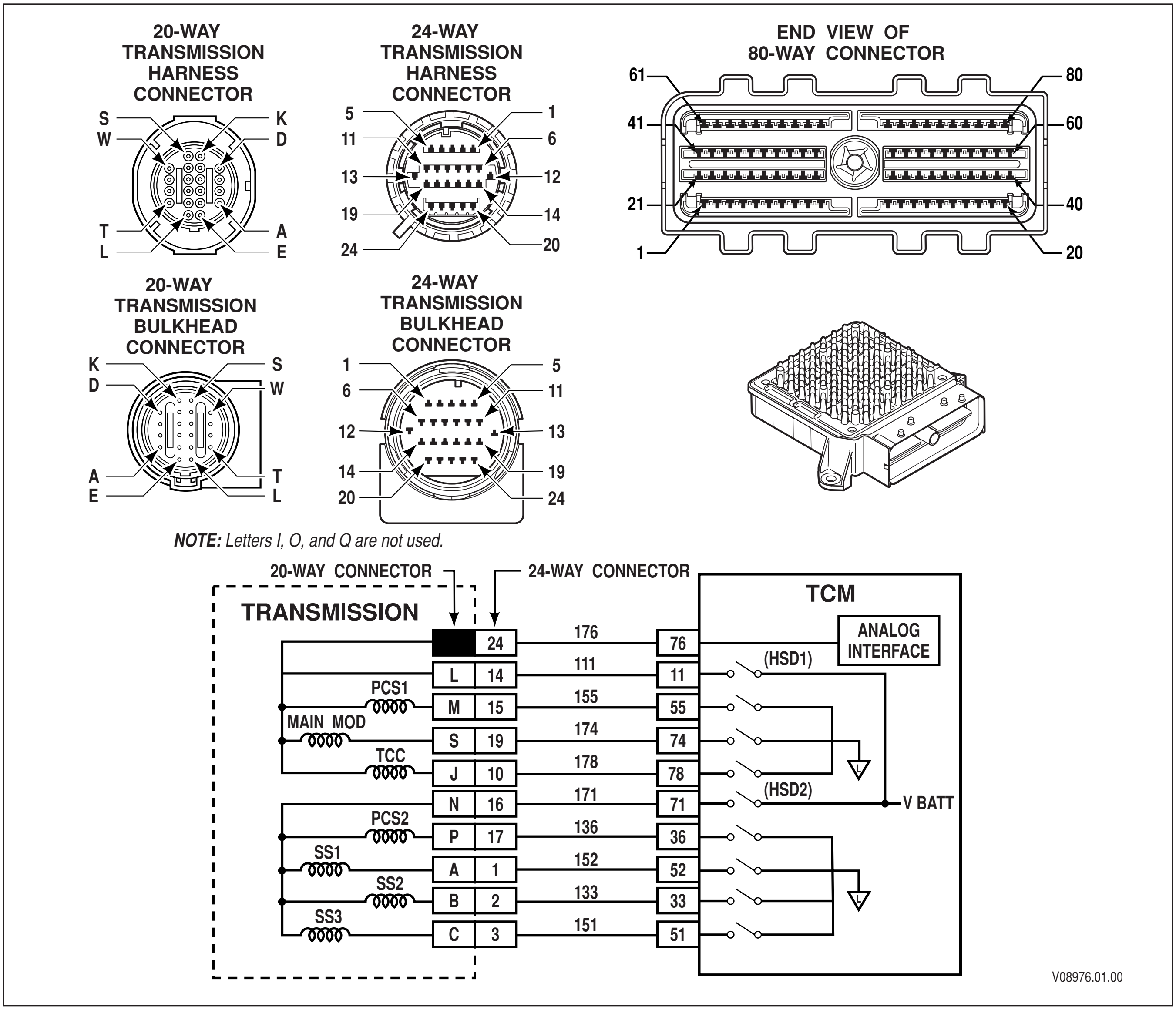
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0978 Shift Solenoid 3 (SS3) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the OEM 24-way connector from J 47278 Transmission Breakout. Leave the transmission 24-way connector connected to the breakout. 3. Using a digital volt/ohmmeter (DVOM), measure the resistance between pin 16 and pin 3 of the transmission 24-way connector. Is the resistance within the specified value?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 10*	*Go to Step 7*
7	1. Remove the transmission oil pan (refer to Service Manual or In-Chassis Maintenance). 2. Disconnect SS3 from the internal wiring harness. 3. Using a DVOM, measure SS3 resistance. Is resistance within the specified values?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace SS3 (refer to Service Manual or In-Chassis Maintenance). 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 P0979 Shift Solenoid 3 (SS3) Control Circuit—Low



Circuit Description

Shift solenoid 3 (SS3) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 3 (SV3) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

The TCM sends control current to SS3 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 SS3 by switching SS3's low side driver ON and OFF. Wire 151 completes the circuit between SS3 and its low side driver. DTC P0979 indicates that the TCM processor has detected a short-to-ground condition in the low side of SS3's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 P0979 is set when the TCM detects a short-to-ground on the SS3 Pressure Control Solenoid return circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0979 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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

- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage, etc.
- When diagnosing for an intermittent circuit ground conditions, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent circuit ground condition.

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 where DTC was set.

Test Description

The numbers below refer to the 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 151.
6. This step tests for wire-to-wire shorts or a short-to-ground in the transmission internal harness.

DTC P0979 Shift Solenoid 3 (SS3) Control Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 SS3 lowside electrical circuit.*** Did DTC P0979 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0979 Shift Solenoid 3 (SS3) Control Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 24-way connector. 5. Inspect the routing of wire 151 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 51 and all other pins in the 80-way connector, and shorts-to-ground between pin 51 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 3 and all other pins in the 24-way connector, and shorts-to-ground between pin 3 and chassis ground. ***NOTE: The resistance value between pins 3 and 16 will read normal solenoid resistance. The resistance value between pin 3 and 1, and pins 3 and 2 will be twice normal solenoid resistance. The resistance between pin 3 and 17 will be the sum of PCS2 and SS3.*** Were any wire-to-wire shorts or shorts-to-ground found?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 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*

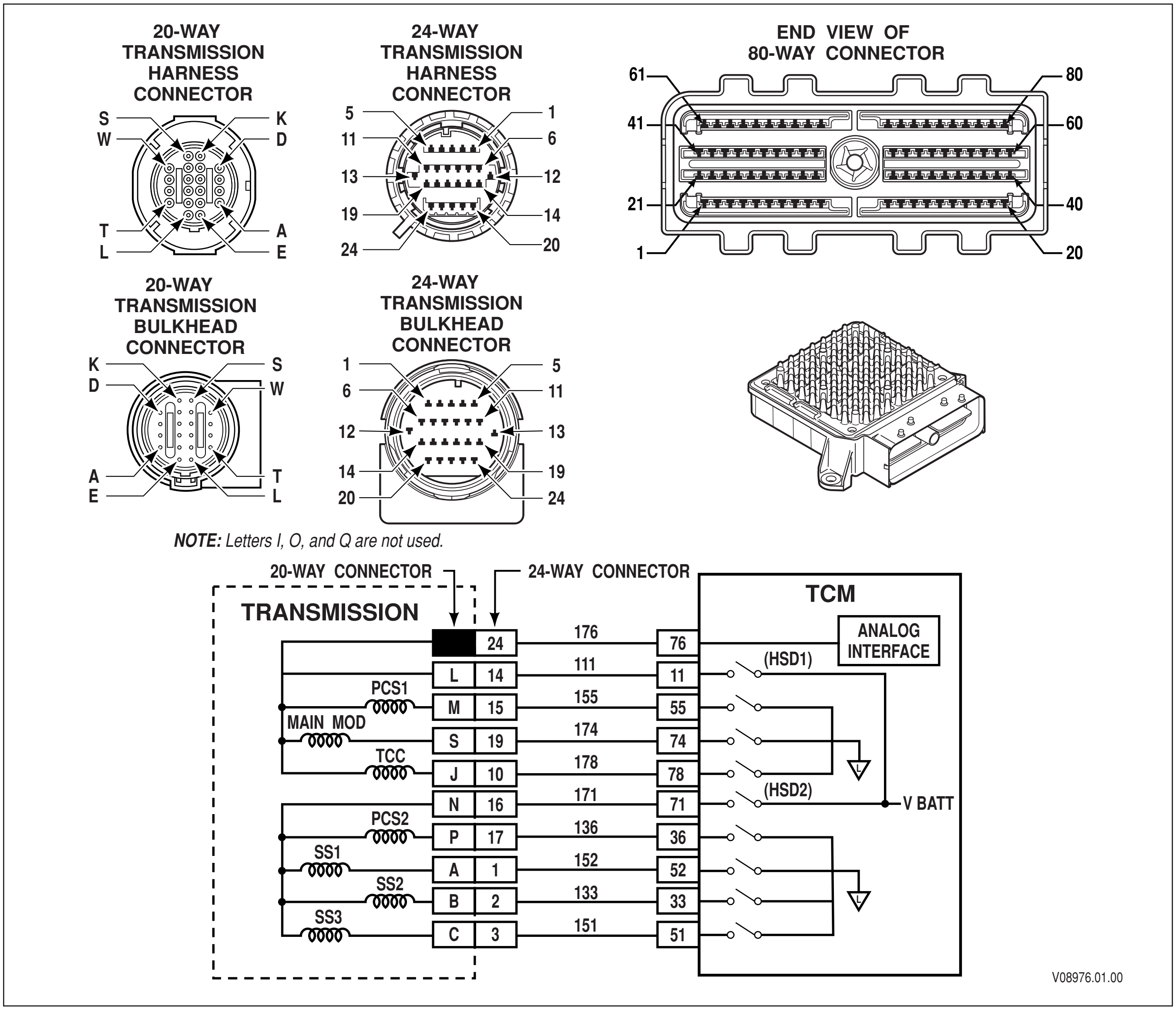
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0979 Shift Solenoid 3 (SS3) Control Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance), Is the replacement complete?		*Go to Step 11*	
9	Replace SS3 (refer to Service Manual or In-Chassis Maintenance). 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 P0980 Shift Solenoid 3 (SS3) Control Circuit—High



Circuit Description

Shift solenoid 3 (SS3) is a normally closed (N/C) solenoid that provides control main pressure to stroke shift valve 3 (SV3) to attain a particular range needed for the next upshift or downshift. A pressure switch is located at the end of the shift valve to send valve position status back to the TCM.

The TCM sends control current to SS3 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 SS3 by switching SS3's low side driver ON and OFF. Wire 151 completes the circuit between SS3 and its low side driver. DTC P0980 indicates that the TCM processor has detected a short-to-battery condition in the low side of SS3's electrical circuit.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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)

Conditions for Setting the DTC

DTC P0980 is set when the TCM detects a short to power on the SS3 circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P0980 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to neutral or reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- TCM inhibits TCC engagement.
- TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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 P0980 indicates a short-to-battery in the electrical circuit for SS3.
- 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 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.
- 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 where DTC was set.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

The numbers below refer to the 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 151.
6. This step tests for wire-to-wire shorts in the transmission internal harness.

DTC P0980 Shift Solenoid 3 (SS3) Control Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 SS3 electrical circuit.*** Did DTC P0980 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4. Wire Check 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 24-way connector. 5. Inspect the routing of wire 151 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 51 and all other pins in the 80-way connector, and shorts-to-ground between pin 51 and chassis ground. Were any wire-to-wire shorts found?		*Go to Step 5*	*Go to Step 6*

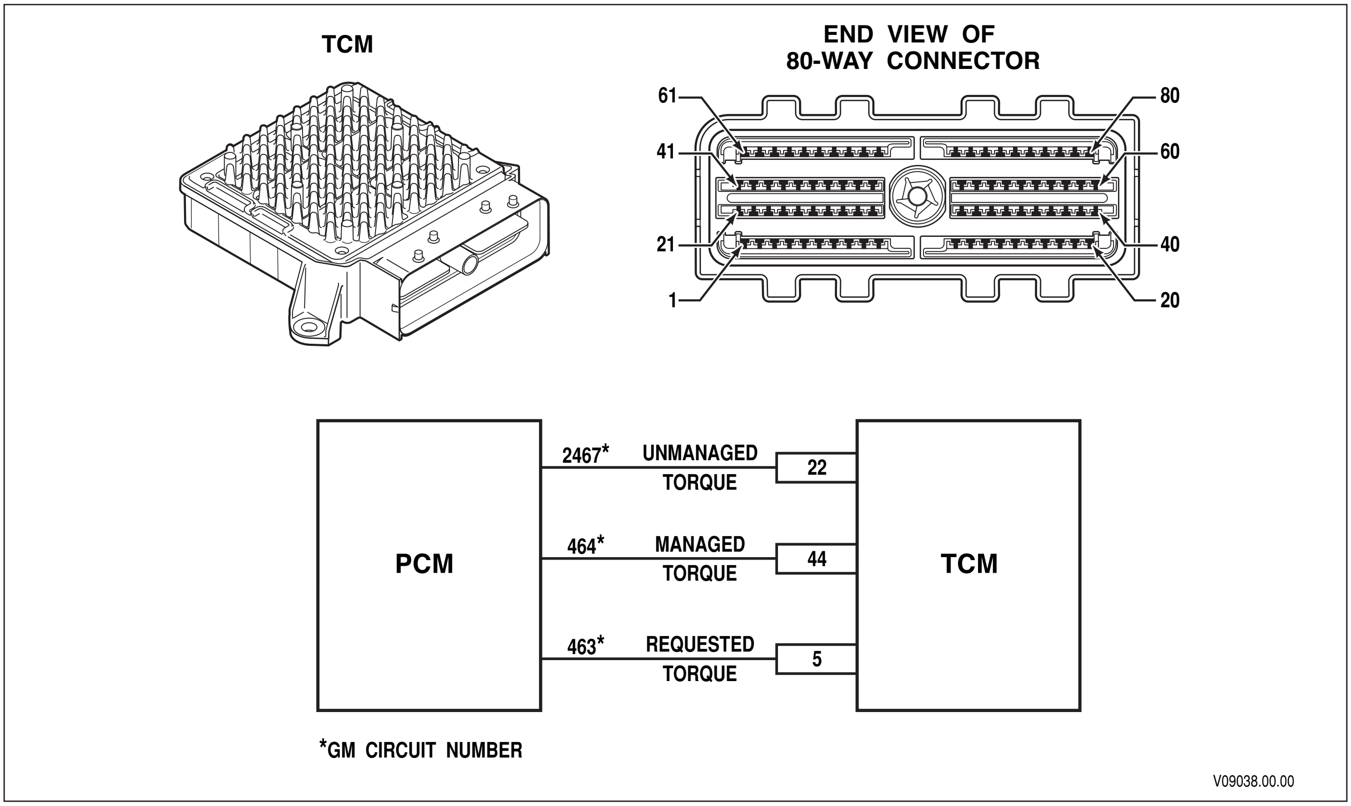
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0980 Shift Solenoid 3 (SS3) Control Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 3 and all other pins in the 24-way connector, and shorts-to-ground between pin 3 and chassis ground. ***NOTE: The resistance value between pins 3 and 16 will read normal solenoid resistance. The resistance value between pins 3 and 1, and 3 and 2 will be twice normal solenoid resistance. The resistance between pins 3 and 17 will be the sum of PCS2 and SS3.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 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	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace SS3 (refer to Service Manual or In-Chassis Maintenance). 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 P1688 Unmanaged Engine Torque Delivered to TCM Signal



Circuit Description

GM 8.1 gasoline engine is used in some medium duty applications. The 8.1 engine uses a 3-wire system to communicate engine torque data/requests between the powertrain control module (PCM) and the transmission control module (TCM).

Unmanaged engine torque is sent from the PCM to the TCM over wire 122 (GM wire 2467).

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V.
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- Pulse Width Modulation (PWM) driver demand torque option is selected in transmission calibration.

Conditions for Setting the DTC

DTC P1688 sets if unmanaged engine torque (gross) signal is under 1.5 percent or over 98.5 percent for more than a 2 second period.

Actions taken when the DTC Sets

- DTC 1688 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- MIL illuminates on the second occurrence (OBD II Strategy).
- TCM defaults to a calculated unmanaged torque (gross) input value using throttle and engine speed.
- TCM inhibits TCC engagement.

Conditions for clearing the MIL/DTC

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

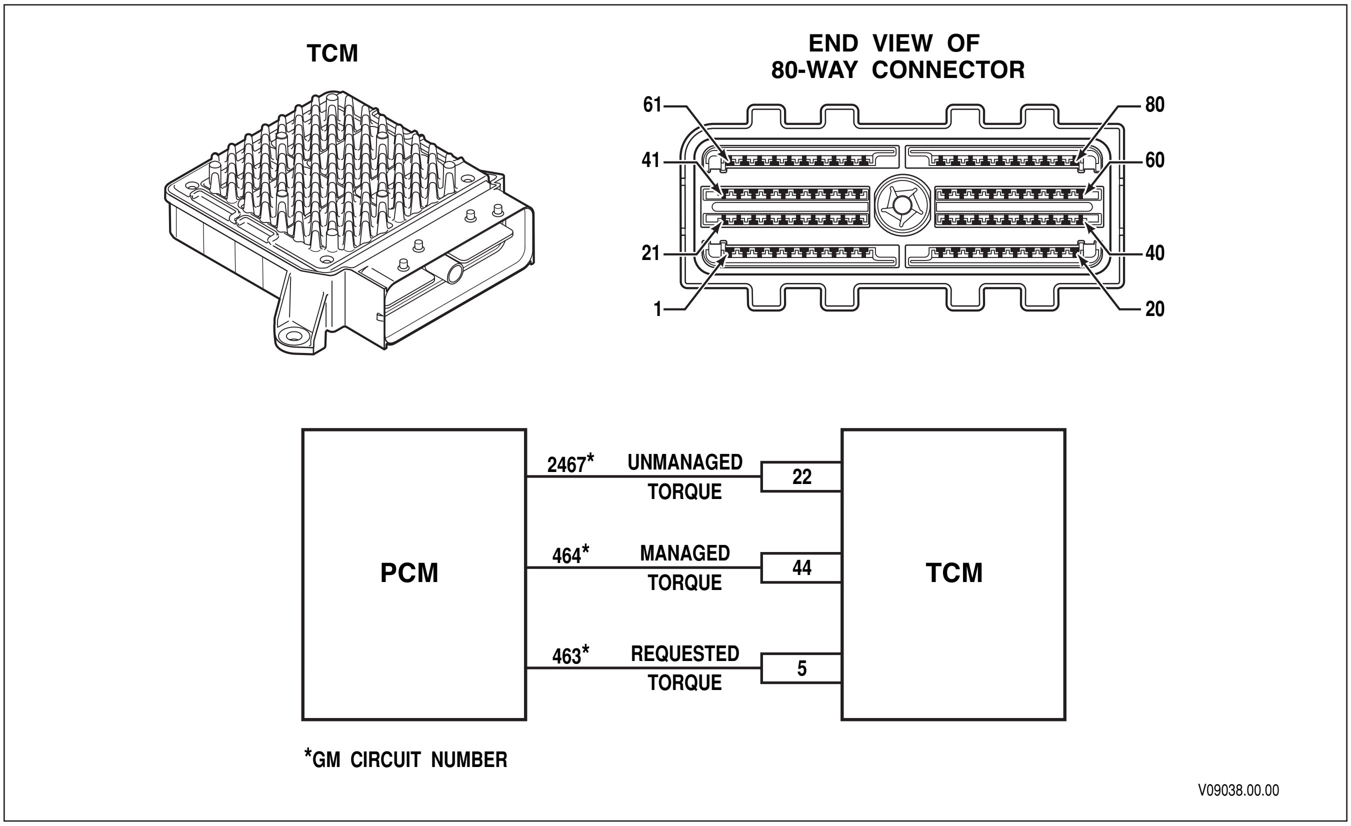
Intermittent condition may be the cause of problem. Return vehicle to OEM for further troubleshooting.

P1688 Unmanaged Engine Torque Delivered to TCM Signal

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start engine. 3. Record DTC failure records. 4. Clear the DTC and drive vehicle. 5. Attempt to duplicate the same operating conditions observed in failure records. ***NOTE: This DTC indicates that unmanaged engine torque signal sent from the engine PCM to the transmission TCM is either under or over a set percentage value for a set period of time.*** Did DTC P1688 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	Inspect routing of wire 122 (GM wire 2467) between TCM and PCM. Was chafing or wire damage found?		*Go to Step 4*	*Go to Step 5*
4	Repair or replace the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 6*	
5	Return vehicle to OEM to troubleshoot for cause of low or high torque signal. Below are some possible causes for this DTC. • Defective engine PCM. • Circuit fault at wire 122 (GM wire 2467). • Improper calibration for engine PCM. Is repair complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P1779 Engine Torque Delivered to TCM Signal



Circuit Description

GM 8.1 gasoline engine is used in some medium duty applications. The 8.1 engine uses a 3-wire system to communicate engine torque data/requests between the powertrain control module (PCM) and the transmission control module (TCM).

Managed engine torque is sent from the PCM to the TCM over wire 144 (GM wire 464).

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- Pulse Width Modulation (PWM) driver demand torque option is selected in transmission calibration.
- No DTC is active at the time of this test.

Conditions for Setting the DTC

DTC P1779 sets if managed engine torque (net) signal (to be determined) is under 1.5 percent, or over 98.5 percent for over a 2 second period.

DIAGNOSTIC TROUBLE CODES (DTC)

Actions taken when the DTC Sets

- DTC 1779 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- MIL illuminates on the second occurrence (OBD II Strategy).
- TCM defaults to a calculated managed torque (net) input value using throttle and engine speed.
- TCM defaults to a calculated unmanaged torque (gross) input value using throttle and engine speed.
- TCM inhibits TCC engagement.

Conditions for clearing the MIL/DTC

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

Intermittent condition may be the cause of problem. Return vehicle to OEM for further troubleshooting.

DTC P1779 Engine Torque Delivered to TCM Signal

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start engine. 3. Record DTC failure records. 4. Clear the DTC and drive vehicle. 5. Attempt to duplicate the same operating conditions observed in failure records. ***NOTE: This DTC indicates that managed engine torque signal sent from the engine PCM to the transmission TCM is either under or over a set percentage value for a set period of time.*** Did DTC P1779 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	Inspect routing of wire 144 (GM wire 464) between TCM and PCM. Was chafing or wire damage found?		*Go to Step 4*	*Go to Step 5*
4	Repair or replace the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 6*	

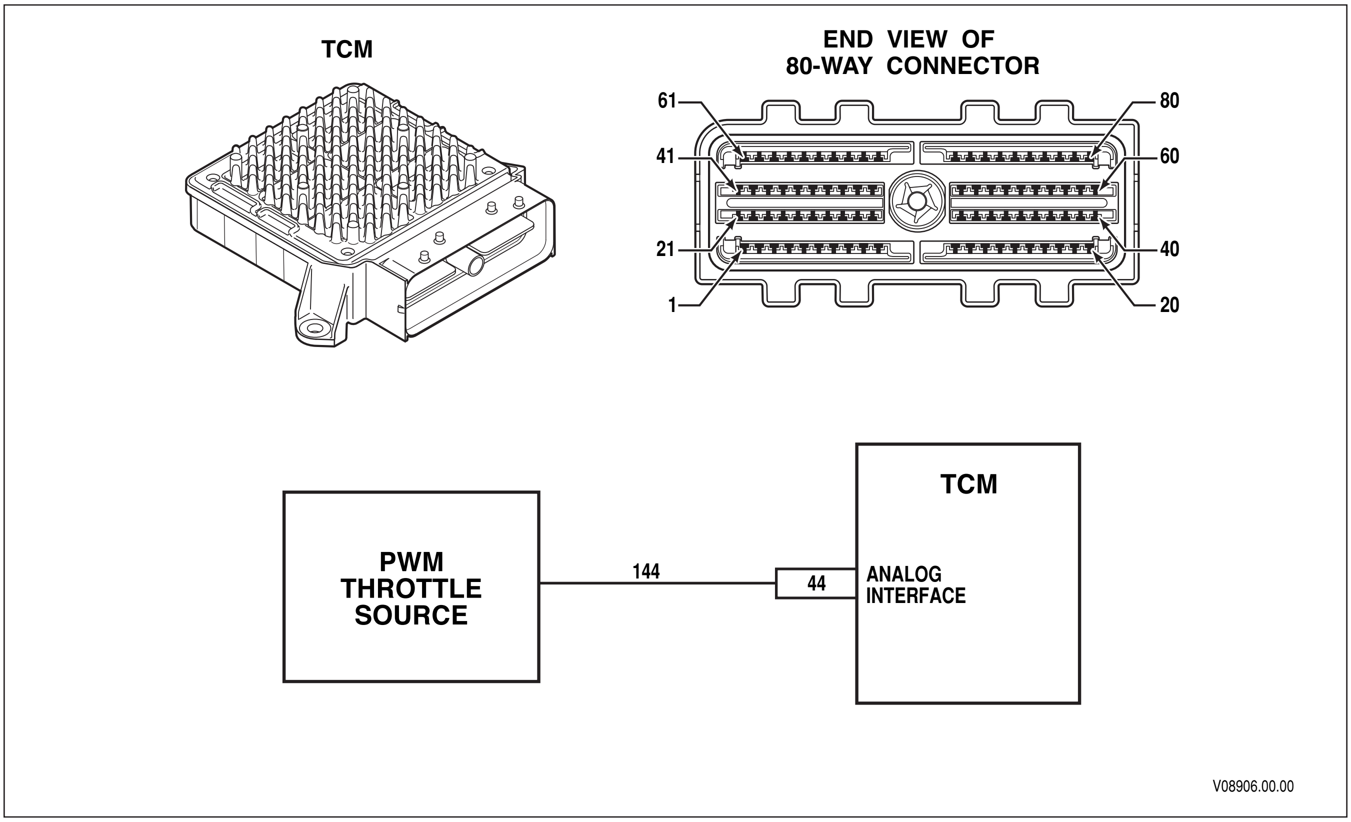
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1779 Engine Torque Delivered to TCM Signal *(cont'd)*

Step	Action	Value(s)	Yes	No
5	Return vehicle to OEM to troubleshoot for cause of low or high torque signal. Below are some possible causes for this DTC. • Defective engine PCM. • Circuit fault at wire 144 (GM wire 464). • Improper calibration for engine PCM. Is repair complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under conditions noted in failure records. 3. Confirm with Allison DOC™ 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 P1891 Throttle Position Sensor (TPS) 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.
- Engine speed is greater than 200 rpm and less than 3500 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.

Action Taken When the DTC Sets

When DTC P1891 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- DTC is stored in TCM history.
- TCM freezes shift adapts (DNA).
- TCM uses default throttle values.
- TCM inhibits the torque converter clutch (TCC).

Conditions for Clearing the DTC/CHECK TRANS Light

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 TROUBLE CODES (DTC)

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:

- 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.

Test Description

The numbers below refer to the 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 135.
6. This step inspects for damage or corrosion to the TCM and engine control module connectors.

DTC P1891 Throttle Position Sensor (TPS) PWM Signal—Low Input

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
3	1. Reconnect the TCM 80-way connector. 2. Reconnect the PWM throttle sensor connector. 3. Install Allison DOC™. 4. Turn the ignition ON. Leave the engine OFF. 5. Verify the throttle source is functioning correctly. Is PWM signal OK?		*Go to Diagnostic Aids*	*Go to Step 4*

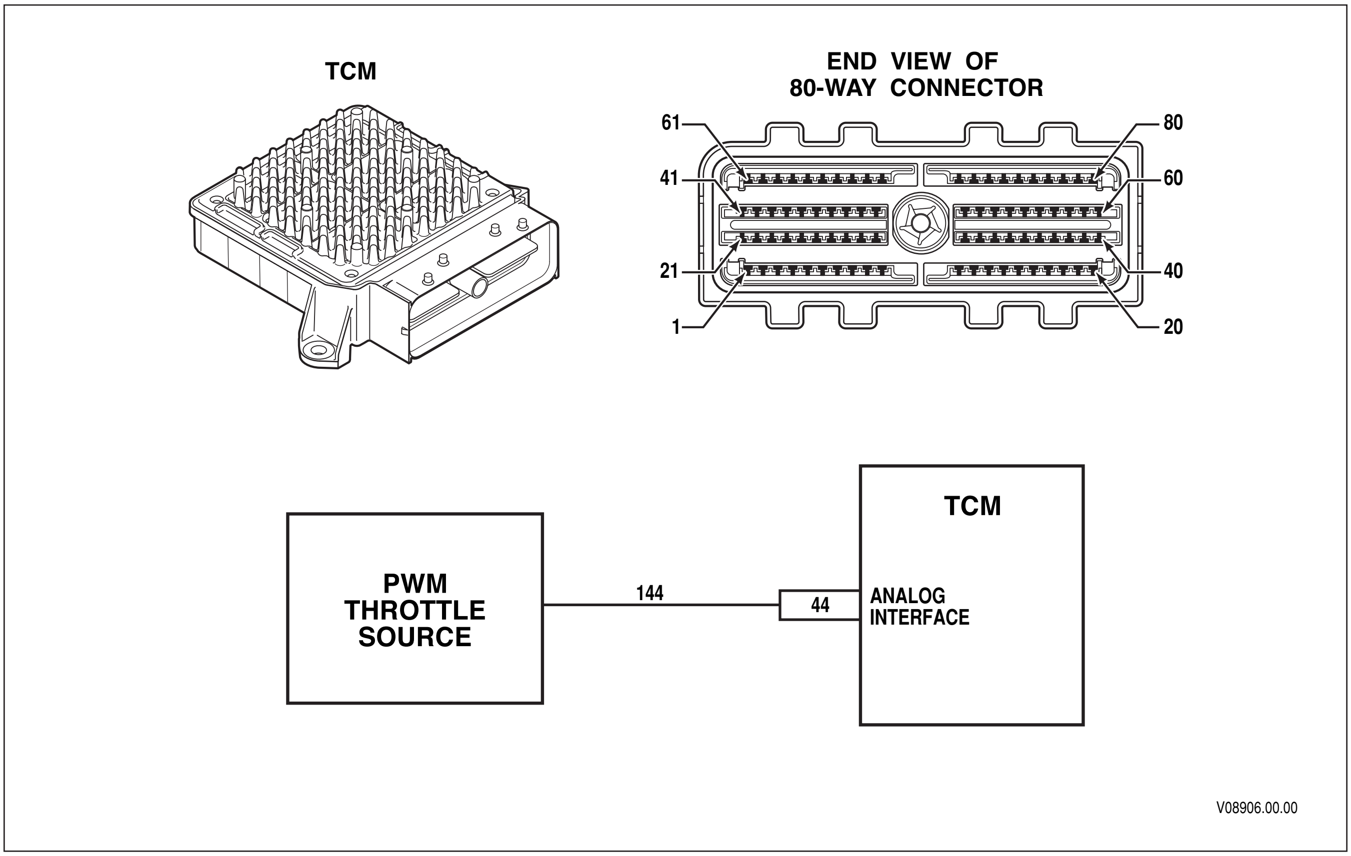
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1891 Throttle Position Sensor (TPS) PWM Signal—Low Input *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition OFF 2. Disconnect the 80-way connect at the TCM. 3. Connect the J 47275 TCM Breakout to the 80-way OEM harness connector. The TCM should not be connected to properly perform this test. 4. Disconnect the PWM throttle sensor connector. 5. Using a digital volt/ohmmeter (DVOM) at TCM overlay J 47275-1, 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 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 '0*	
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*	
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*	
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™, 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 (TPS) 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.
- Engine speed is greater than 200 rpm and less than 3500 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.

Action Taken When the DTC Sets

When DTC P1891 is active, the following conditions will occur:

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- DTC is stored in TCM history.
- TCM freezes shift adapts (DNA).
- TCM uses default throttle values.
- TCM inhibits the torque converter clutch (TCC).

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Clearing the DTC/CHECK TRANS Light

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

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. 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.

Test Description

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

2. This step tests for proper ignition voltage.
3. This step for operation of the PWM throttle sensor.
4. This step tests for wire-to-wire shorts, shorts-to-ground, or an open on wire 135.
6. This step tests for damage or corrosion to the TCM and engine control module connectors.

DTC P1892 Throttle Position Sensor (TPS) PWM Signal—High Input

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 3*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*
3	1. Reconnect the TCM 80-way connector. 2. Reconnect the PWM throttle sensor connector. 3. Install Allison DOC™. 4. Turn the ignition ON. Leave the engine OFF. 5. Verify the throttle source is functioning correctly. Is PWM signal OK?		*Go to Diagnostic Aids*	*Go to Step 4*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P1892 Throttle Position Sensor (TPS) PWM Signal—High Input *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition OFF 2. Disconnect the 80-way connect at the TCM. 3. Connect the J 47275 TCM Breakout to the 80-way OEM harness connector. The TCM should not be connected to properly perform this test. 4. Disconnect the PWM throttle sensor connector. 5. Using a digital volt/ohmmeter (DVOM) at TCM overlay J 47275-1, 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 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 '0*	
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*	
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*	
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™, monitor throttle percentage. 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 clutches 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 18V 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 (Non-OBD II Strategy).
- DTC is stored in TCM history.
- TCM will not allow 4th to 5th range or 5th to 6th range upshifts.

Conditions for clearing the DTC/CHECK TRANS Light

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

- Poor engine performance can allow this code to set, have the OEM inspect for possible exhaust manifold pressure sensor concern or other engine related subsystems.
- It will be necessary to drive the vehicle with heavy to moderate throttle settings for at least four upshift cycles in order to set a DTC P2637.
- If DTC P0614 is set in combination with DTCs P2637 and/or P2641, engine control software is not correct. Verify that the proper software is installed then reset the SEM Autoselect parameters with Allison DOC™ for PC–Service Tool.
- Refer to Watch 330, Section II for overview of SEM/LRTP.

Test Description

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

2. This step tests for proper ECM SEM torque request response.
3. This step tests to identify the device causing the torque request to be ignored.
4. This step tests for the offending device by removing it from the J1939 network.
5. This steps 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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	If DTC P0614 is present, troubleshoot and resolve before going to the next step. Is DTC P0614 present?		*Go to DTC P0614 and resolve before proceeding to Step 3*	*Go to Step 4*
3	1. Install Allison DOC™. 2. Turn the ignition ON. 3. Refer to the SEM torque reduction status display in Allison DOC™. Does Allison DOC™ indicate the ECM response to SEM torque reduction as incorrect?	Allison DOC™ indicates with a Correct Response or Incorrect Response	*Go to Step 6*	*Go to Step 4*
4	Use Allison DOC™ to identify an unapproved SEM torque reduction device. Is the unapproved device one of the following? 1. Engine 2. N/A or All/Any (info not valid)?	Allison DOC™ shows the actual device at fault	*Go to Step 6*	*Go to Step 5*
5	1. If Allison DOC™ 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 inspect for poor engine performance or other engine subsystems concerns. Was the software correct or engine performance concern found?		*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™. 2. Clear the DTC. 3. Warm the vehicle to normal operating temperature. 4. Drive the vehicle under moderate to heavy throttle setting for at least four up shift cycles. Refer to Allison DOC™ "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 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 18V 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 (Non-OBD II Strategy).
- DTC is stored in TCM history.
- TCM will restrict operation to only reverse, neutral and 1st or 3rd range.

Conditions for clearing the DTC/CHECK TRANS Light

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

- Poor engine performance can allow this code to set, have the OEM inspect for possible exhaust manifold pressure sensor concern or other engine related subsystems.
- There may be no output broadcast to the speedometer when this code is active.
- If DTC P0614 is set in combination with DTCs P2637 and/or P2641, engine control software is not correct. Verify that the proper software is installed then reset the SEM Autoselect parameters with Allison DOC™ for PC–Service Tool.
- Refer to Watch 330, Section II for overview of SEM/LRTP.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

2. This step tests for proper ECM LRTP torque request response.
3. This step tests to identify the device causing the torque request to be ignored.
4. This step tests for the offending device by removing it from the J1939 network.
5. This steps tests for the presence of proper engine controller software.

DTC P2641 Torque Management Feedback Signal—LRTP

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	If P0614 is present, troubleshoot and resolve before going to the next step. Is P0614 present?		*Go to DTC P0614 and resolve before proceeding to Step 3*	*Go to Step 3*
3	1. Install Allison DOC™. 2. Turn the ignition ON. 3. Refer to the LRTP torque reduction status display in Allison DOC™. Does Allison DOC™ indicate the TCM response to LRTP torque reduction as incorrect?	Allison DOC™ indicates with a Correct Response or Incorrect Response	*Go to Step 6*	*Go to Step 4*
4	Use Allison DOC™ to identify an unapproved LRTP torque reduction device. Is the unapproved device one of the following? 1. Engine 2. Null Address or All/Any (info not valid)?	Allison DOC™ shows the actual device at fault	*Go to Step 6*	*Go to Step 5*
5	1. If Allison DOC™ 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 headway controller may only send commands under certain 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*	

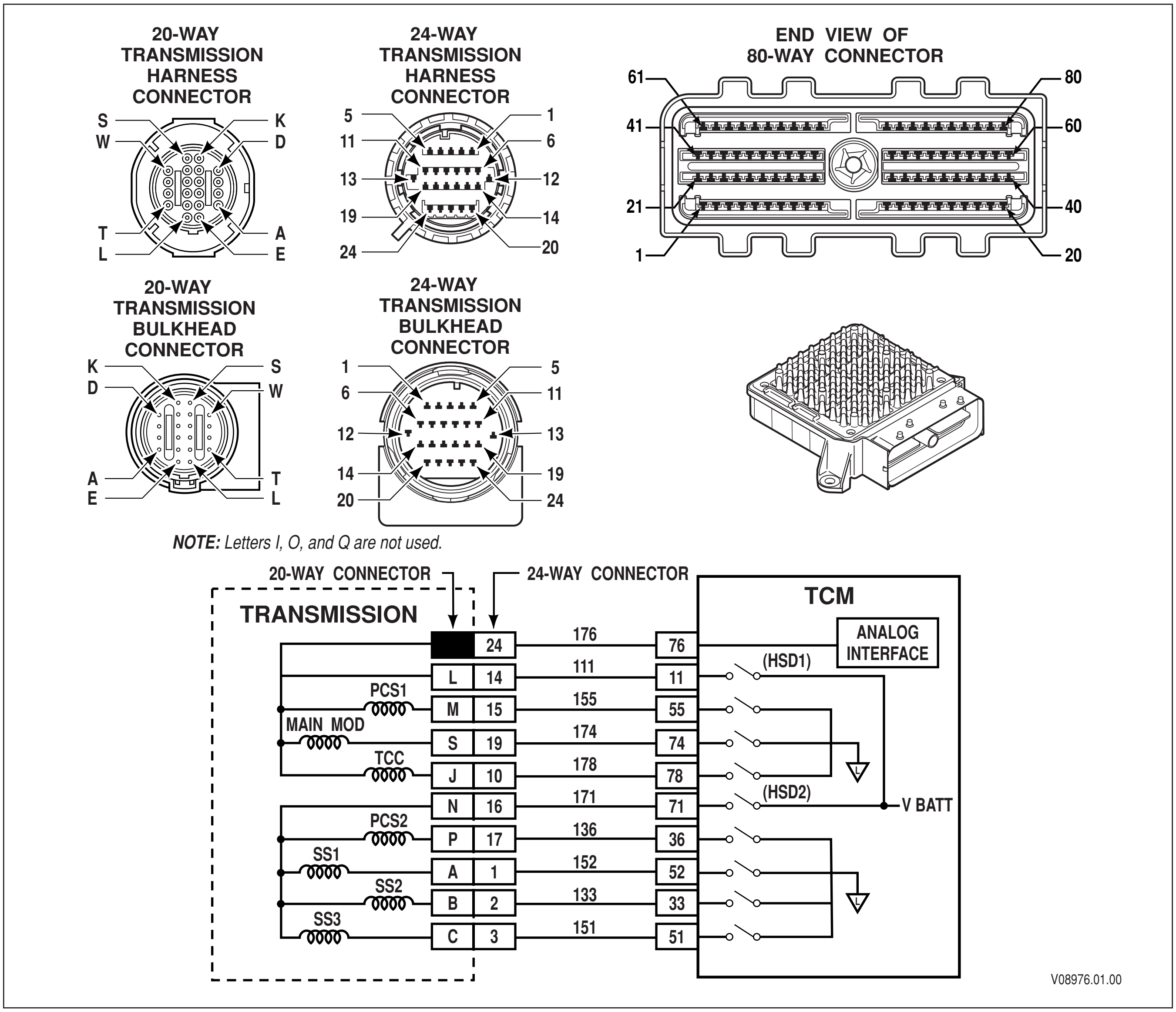
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2641 Torque Management Feedback Signal—LRTP *(cont'd)*

Step	Action	Value(s)	Yes	No
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 inspect for poor engine performance or other engine subsystems concerns. Was the software correct or engine performance concern found?		*Go to Step 7*	
7	In order to verify your repair: 1. Install Allison DOC™. 2. Clear the DTC. 3. Warm the vehicle to normal operating temperature. 4. Drive the vehicle, try to duplicate the driving condition experienced when DTC was set. It may be necessary to load the vehicle at moderate to heavy throttle setting. Refer to Allison DOC™ "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 P2670 Actuator Supply Voltage 2 (HSD2)—Low



Circuit Description

High Side Driver 2 (HSD2) supplies battery voltage to the PCS2, SS1, SS2, SS3 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 ON and OFF. DTC P2670 indicates the TCM has detected that all solenoids connected to the HSD2 are inactive with a supply voltage in the HSD2 circuit of 6V or less. DTC P2670 indicates a short-to-ground has occurred in the high-side wiring attached to HSD2 (wire 171).

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V and less than 32V (24V TCM).
- HSD2 is commanded ON.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

DTC P2670 is set when the TCM detects all the solenoids connected to the HSD2 are inactive and the high side voltage is less then 6V. These conditions indicate a short-to-ground has occurred at the high side wire 171.

Actions taken when the DTC Sets

When DTC P2670 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to first, third, or fifth range is made.
- While diagnostic response is active, if shift selector is moved to neutral, transmission will shift to neutral; if the shift selector is moved to reverse, transmission shifts to reverse. If the shift selector is moved to forward range or reverse and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- 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 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 High Side Drivers (HSD1 and HSD2) will reset opening the high side circuit whenever a short-to-ground is detected.
- 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 chaffing could occur leading to an open 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, massage the wiring harness while watching the test equipment for a change.

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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 shorts-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 the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 HSD2 electrical circuit.*** Did DTC P2670 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	1. Turn ignition OFF. 2. Disconnect the 80-way connector at the TCM. 3. Install TCM Breakout J 47275 to the OEM 80-way connector. Leave the TCM 80-way connector disconnected. 4. Disconnect the OEM 24-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 TCM Overlay J 47275-1, test for wire-to-wire shorts between pin 71 and all other pins in the 80-way connector. Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 5*	*Go to Step 6*

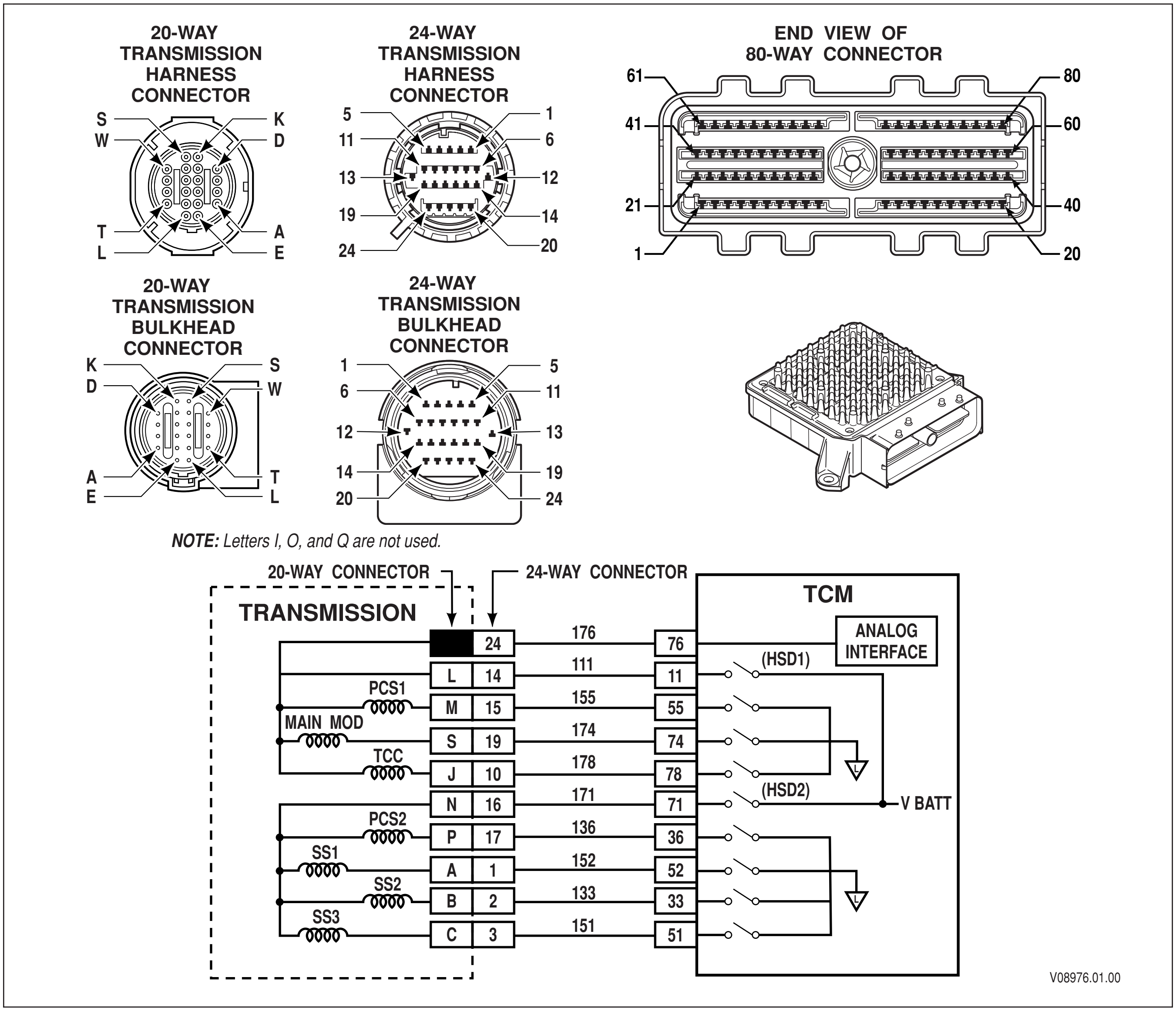
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2670 Actuator Supply Voltage 2 (HSD2)—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 9*	
6	1. Turn the ignition OFF. 2. Disconnect the OEM 24-way connector from Transmission Breakout J 47278. Connect the transmission 24-way connector to the Breakout Box J 39700. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 16 and all other pins in the 24-way connector. ***NOTE: The resistance value between pins 16 and pins 1, 2, 3, and 17 should read normal solenoid resistance.*** Were any wire-to-wire shorts or shorts-to-ground found?		*Go to Step 7*	*Go to Step 8*
7	1. Remove the transmission oil pan. 2. Repair or replace the internal wiring harness (refer to the 1000 and 2000 Product Families Service Manual, SM4006EN or In-Chassis Maintenance, GN4008EN). 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 (HSD2)—High (batt)



Circuit Description

High Side Driver 2 (HSD2) supplies battery voltage to the PCS2, SS1, SS2, and SS3 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 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 short-to-battery or an open condition in the high side wiring attached to HSD2 (wire 171).

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or less than 32V (24V TCM).
- HSD2 is commanded ON.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

DTC P2671 is set when the TCM detects a high voltage condition (greater than or equal to 6V) in three solenoids in the HSD2 circuit.

Actions taken when the DTC Sets

When DTC P2671 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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 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

The numbers below refer to the 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 wire 171 of the OEM chassis harness.
5. This step tests for a wire-to-wire short in wire 171 of the OEM chassis harness.
7. This step tests for wiring defects in the transmission internal harness.

DTC P2671 Actuator Supply Voltage 2 (HSD2)—High (batt)

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 HSD2 electrical circuit.*** Did DTC P2671 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2671 Actuator Supply Voltage 2 (HSD2)—High (batt) *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check Procedures before performing steps.*** 1. Turn ignition OFF. 2. Install TCM Breakout J 47275 between the OEM and TCM 80-way connector. 3. Install Transmission Breakout J 47278 between the OEM and transmission 24-way connector. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, enter Solenoid Test mode and command PCS2 ON. 6. Determine the voltage drop in the high side of the PCS1 circuit as follows: • At TCM Overlay J 47275-1, measure voltage between pin 71 and an isolated ground. • At Transmission Overlay J 47278-1 measure voltage between pin 16 and ground. It will be necessary to use J 39700 Breakout Box at J 47275 TCM Breakout and J 47278 Transmission Breakout. • 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 the high-side voltage drop exceed 0.5V DC?		*Go to Step 6*	*Go to Step 5*
5	1. Turn the ignition OFF. 2. Disconnect the TCM Breakout J 47275 from the TCM. Leave the OEM 80-way connector connected. 3. Disconnect the OEM 24-way connector from Transmission Breakout J 47278. 4. Inspect the routing of wire 171 in the chassis harness between the TCM and the transmission connector. 5. At TCM Overlay J 47275-1, test for wire-to-wire shorts between pin 71 and all other pins in the 80-way connector, and shorts-to-ground between pin 71 and chassis ground. 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 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 chassis harness. Is the repair complete?		*Go to Step 10*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2671 Actuator Supply Voltage 2 (HSD2)—High (batt) *(cont'd)*

Step	Action	Value(s)	Yes	No
7	1. Turn the ignition OFF. 2. If not performed in Step 5 above, disconnect the OEM 24-way connector from Transmission Breakout J 47278. Leave the transmission 24-way connector connected to the Breakout Box. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 16 and all other pins in the 24-way connector, and shorts-to-ground between pin 16 and chassis ground. ***NOTE: The resistance value between pins 16 and pins 1, 2, 3, and 17 should read normal solenoid resistance.*** Were any wire-to-wire shorts found?		*Go to Step 8*	*Go to Step 9*
8	1. Remove the oil pan. 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 P2723 Pressure Control Solenoid 1 (PCS1)—Stuck Off

REFER TO HYDRAULIC SCHEMATIC (APPENDIX H)

Circuit Description

Pressure Control Solenoid 1 (PCS1) is used to control on-coming, off-going, and holding pressure in any one of five clutches. This solenoid is referred to as a Pressure Proportional to Current (PPC) solenoid since the output hydraulic pressure supplied by this solenoid is proportional to the controlled current command.

The Transmission Control Module (TCM) uses information from the turbine and output speed sensors to detect if a clutch is slipping. The clutch being controlled by PCS1 will vary depending on the shift that is being completed.

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 18V and less than 32V (24V TCM).
- Turbine speed is greater than 60 rpm.
- Output speed is greater than 125 rpm.
- Transmission is at normal operating temperature.
- DTC P0708, P0716, P0717, P0721, P0722, P0877, or P0878 is not active.

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.

Action Taken When the DTC Sets

- When DTC P2723 is active, the following conditions will occur:
  - If failure occurs while in a forward range, the transmission will shift to the previous range.
  - If failure occurs while in **N** (Neutral) or **R** (Reverse), the transmission will lock in **N** (Neutral).
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **N** (Neutral) (some cases may lock in **N** (Neutral)).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **R** (Reverse) or **N** (Neutral).
  - If the shift selector is returned to a forward range and the transmission is compromised by overspeeding or a direction change, the transmission will shift to **N** (Neutral).
- DTC P2723 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 TROUBLE CODES (DTC)

Diagnostic Aids

- This DTC indicates the on-coming clutch being controlled by PCS1 is not applied or applied too slowly. This could indicate a leak or obstruction in a specific clutch apply circuit. Check Allison DOC™ For PC Failure Record data for previous or current range information when the DTC was set to determine the specific shift when the DTC was set. Refer to the Solenoid and Clutch Table (Appendix C) to determine which clutch circuit is suspect.
- If the condition is intermittent, connect Allison DOC™ For PC and select 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)
- Inspect and confirm that the OEM engine rating does not exceed the transmission model rating. Also inspect for the presence of an add-on engine power package or module. Whenever the engine horsepower or torque is increased over the transmission factory rating, a shift flare condition may occur leading to the DTC indicated.

NOTE: Clutch failure due to an OEM engine rating exceeding the Allison transmission rating, or the installation of a engine power package or module will not be covered under the Allison transmission warranty.

Test Description

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

3. This step tests the ignition voltage.
4. This step tests for erratic speed sensor readings or signal dropout.
5. This step tests for internal hydraulic leakage.
6. This step tests for clutch capacity.

DTC P2723 Pressure Control Solenoid 1 (PCS1)—Stuck Off

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?	—	*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?	—	*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Use the Failure Record data to determine during which shift the DTC was set. 5. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2723 Pressure Control Solenoid 1 (PCS1)—Stuck Off *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. Make the shift determined in Step 3. 2. Using Allison DOC™, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	—	*Go to the appropriate speed sensor DTC*	*Go to Step 5*
5	1. Connect a 2000 kPa (300 psi) pressure gauge to the main-pressure tap (refer to Mechanic's Tips). 2. Use Allison DOC™, in clutch test mode, to cycle through all transmission ranges with the engine at idle and vehicle brakes applied. 3. Record main pressure in each range. Was the main pressure low in a specific range or in ranges where the same clutch was applied?	—	*Go to General Troubleshooting—Low Pressure (Section 7)*	*Go to Step 6*
6	**CAUTION: Do not perform a clutch test on fourth and fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select the clutch test mode. 2. With engine at idle speed, vehicle brakes applied, select **D** (Drive). 3. Using clutch test mode, select and attain first range. Turbine speed should go to zero. 4. Increase engine speed to 1400 rpm. Did turbine speed remain at zero? 5. Return to idle and repeat sub-steps 3 and 4 for 2nd through 5th range. Did turbine speed remain at zero in all ranges?	Refer to Table 5–5, Main Pressure Schedule	*Go to Diagnostic Aids*	*Go to Step 7*
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 8*	*Go to Step 9*
8	Remove the transmission for overhaul or replacement. Is the overhaul or replacement complete?	—	*Go to Step 11*	—
9	Inspect the control valve body for stuck or sticking trimmer valves (refer to Mechanic's Tips). Was a valve problem found and repaired?	—	*Go to Step 11*	*Go to Step 10*
10	Replace PCS3. Is solenoid replacement complete?	—	*Go to Step 11*	—
11	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ to reset adaptive for all shifts. 3. Operate the vehicle in all ranges under normal driving 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 (APPENDIX H)

Circuit Description

Pressure Control Solenoid 1 (PCS1) is used to control on-coming, off-going, and holding pressure in any one of five clutches. This solenoid is referred to as a Pressure Proportional to Current (PPC) solenoid since the output hydraulic pressure supplied by this solenoid is proportional to the controlled current command.

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 3 clutches are applied. The clutch being controlled by PCS1 will vary depending on the shift.

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 18V and less than 32V (24V TCM).
- One of the following conditions occur:
  - Output speed is greater than 200 rpm.
  - Turbine speed is greater than 200 rpm.
- DTC P0708, P0716, P0717, P0721, P0722, P0877, or P0878 is not active.

Conditions for Setting the DTC

DTC P2724 sets when the TCM detects an incorrect offgoing ratio (range-to-range) for an accumulated number of occurrences.

Action Taken When the DTC Sets

- When DTC P2724 is active, the following conditions will occur:
  - If failure occurs while in a forward range, the transmission will shift to the previous range.
  - If failure occurs while in **N** (Neutral) or **R** (Reverse), the transmission will lock in **N** (Neutral).
  - If the shift selector is moved to **N** (Neutral), the transmission will shift to **R** (Reverse) or **N** (Neutral) (some cases may lock in **N** (Neutral)).
  - If the shift selector is moved to **R** (Reverse), the transmission will shift to **R** (Reverse) or **N** (Neutral).
  - If the shift selector is returned to a forward range and the transmission is compromised by overspeeding or a direction change, the transmission will shift to **N** (Neutral).
- DTC P2724 is stored in the TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 TROUBLE CODES (DTC)

Diagnostic Aids

- This DTC indicates the off-going clutch being controlled by PCS1 is not releasing or is slow to release. This could indicate a leak or obstruction in a specific clutch apply circuit. Check Allison DOC™ For PC Failure Record data for previous or current range information when the DTC was set to determine the specific shift when the DTC was set. Refer to the Solenoid and Clutch Table (Appendix C) to determine which clutch circuit is suspect.
- If the condition is intermittent, connect Allison DOC™ For PCC and select 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).
- Inspect and confirm that the OEM engine rating does not exceed the transmission model rating. Also inspect for the presence of an add-on engine power package or module. Whenever the engine horsepower or torque is increased over the transmission factory rating, a shift flare condition may occur leading to the DTC indicated.

NOTE: ***Clutch failure due to an OEM engine rating exceeding the Allison transmission rating, or the installation of a engine power package or module will not be covered under the Allison transmission warranty.***

Test Description

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

3. This step tests the ignition voltage.
4. This step tests for erratic speed sensor readings or signal dropout.
5. This step tests for internal hydraulic leakage.
6. This step tests for clutch capacity.

DTC P2724 Pressure Control Solenoid 1 (PCS1)—Stuck On

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?	—	*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Perform the Allison Transmission Fluid Checking Procedure (Appendix R) and correct the fluid level if necessary. Did you perform the procedure?	—	*Go to Step 3*	*Go to Allison Transmission Fluid Checking Procedure (Appendix R)*
3	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 4. Use the Failure Record data to determine during which shift the DTC was set. 5. Using Allison DOC™, measure ignition voltage. Is voltage within the specified value?	9–18V (12V TCM) 18–32V (24V TCM)	*Go to Step 4*	*Resolve voltage problem (Refer to DTC P0562 and P0563)*

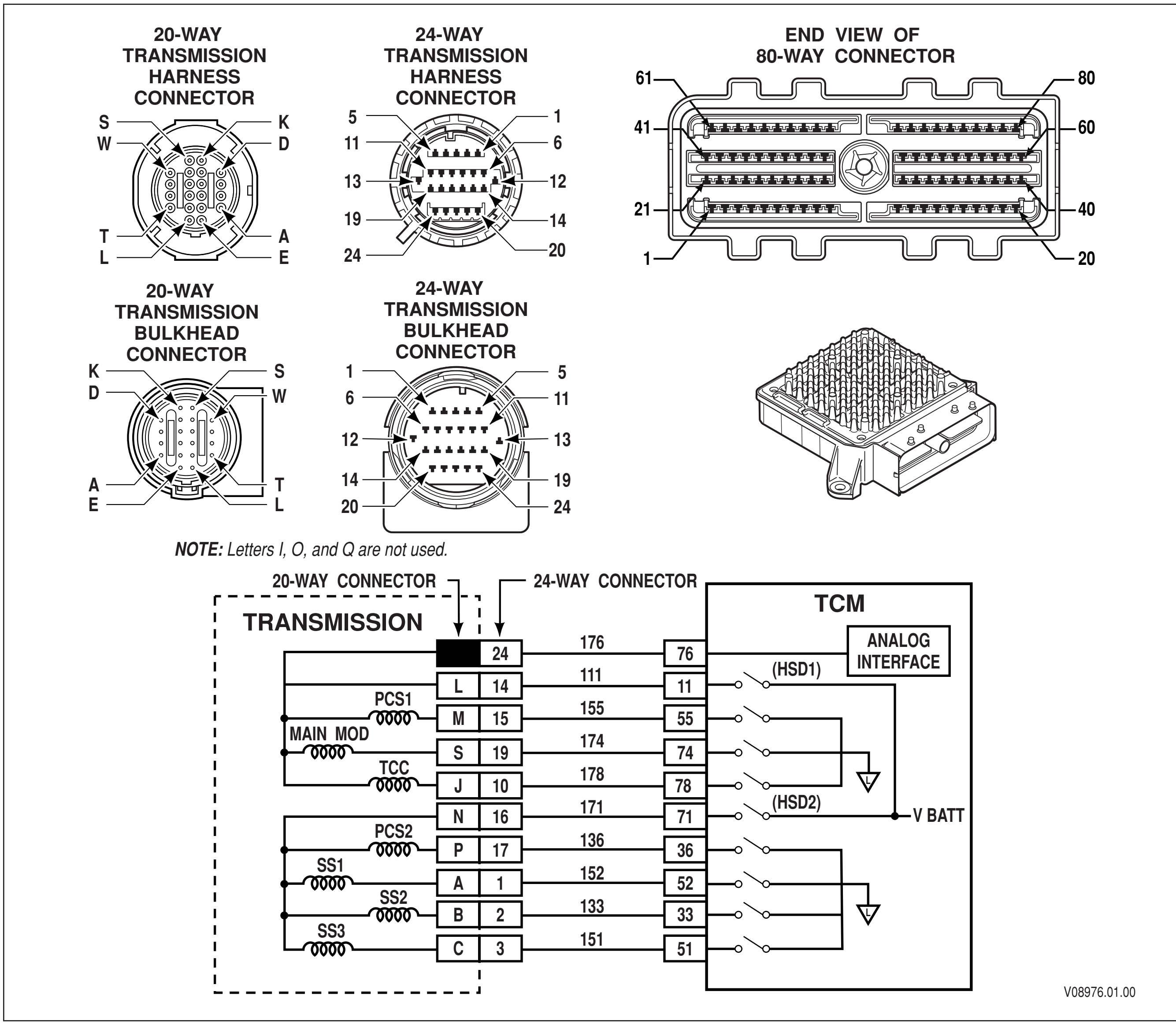
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2724 Pressure Control Solenoid 1 (PCS1)—Stuck On *(cont'd)*

Step	Action	Value(s)	Yes	No
4	1. Turn the ignition ON and drive the vehicle under normal operating conditions. Make the shift determined in Step 3. 2. Using Allison DOC™, monitor turbine, engine, and output speed sensor readings. Is speed sensor data erratic or are dropouts in signal indicated?	—	*Go to the appropriate speed sensor DTC*	*Go to Step 5*
5	1. Connect a 2000 kPa (300 psi) pressure gauge to the main-pressure tap (refer to Mechanic's Tips). 2. Use Allison DOC™, in clutch test mode, to cycle through all transmission ranges with the engine at idle and vehicle brakes applied. 3. Record main pressure in each range. Was the main pressure low in a specific range or in ranges where the same clutch was applied?	—	*Go to General Troubleshooting—Low Pressure (Section 7)*	*Go to Step 6*
6	**CAUTION: Do not perform a clutch test on fourth and fifth range under stall conditions (above 1400 rpm with brakes held), or possible clutch damage could occur.** 1. Using Allison DOC™, select the clutch test mode. 2. With engine at idle speed, vehicle brakes applied, select **D** (Drive). 3. Using clutch test mode, select and attain first range. Turbine speed should go to zero. 4. Increase engine speed to 1400 rpm. Did turbine speed remain at zero? 5. Return to idle and repeat sub-steps 3 and 4 for 2nd through 5th range. Did turbine speed remain at zero in all ranges?	Refer to Table 5–5, Main Pressure Schedule	*Go to Diagnostic Aids*	*Go to Step 7*
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 8*	*Go to Step 9*
8	Remove the transmission for overhaul or replacement. Is the overhaul or replacement complete?	—	*Go to Step 11*	—
9	Inspect the control valve body for stuck or sticking trimmer valves (refer to Mechanic's Tips). Was a valve problem found and repaired?	—	*Go to Step 11*	*Go to Step 10*
10	Replace PCS3. Is solenoid replacement complete?	—	*Go to Step 11*	—
11	In order to verify your repair: 1. Clear the DTC. 2. Use Allison DOC™ to reset adaptive for all shifts. 3. Operate the vehicle in all ranges under normal driving 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 Pressure Proportional to Current (PPC) solenoid used to control on-coming and off-going and holding pressure to any one of five clutches.

The TCM sends control current to PCS1 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 PCS1 by switching PCS1's low side driver ON and OFF. Wire 155 completes the circuit between PCS1 and its low side driver. DTC P2727 indicates that the TCM processor has detected an open condition in PCS1's electrical circuit. The open condition may exist in the high side (wire 111) or low side (wire 155).

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Associated high side driver (HSD1) is enabled and no (HSD1) DTCs are active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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.
- Engine crank time is not extended.

Conditions for Setting the DTC

DTC P2727 is set when the TCM detects an open circuit on the PCS1 circuit for more than 2 seconds.

Actions taken when the DTC Sets

When DTC P2727 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).

Conditions for clearing the DTC/CHECK TRANS Light

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, high side driver HSD1 also supplies power to the Main Mod and TCC solenoids. If DTC P2727 is accompanied by P0960 (Main Mod open circuit) and/or P2761 (TCC open circuit), the open is most likely in the high side of the circuit.
- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage, etc.
- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to an open circuit condition.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent open condition, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent open condition.
- 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 where DTC was set.

Test Description

The numbers below refer to the 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 the solenoid resistance.

DTC P2727 Pressure Control Solenoid 1 (PCS1) Control Circuit—Open

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2727 Pressure Control Solenoid 1 (PCS1) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 47278 Transmission Breakout between the OEM and transmission 24-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, enter Solenoid Test mode and command the PCS1 solenoid ON. 6. Determine the voltage drop in the high side of the Main Mod solenoid circuit as follows: • At overlay J 47275-1, measure voltage between pin 11 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 14 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 PCS1 circuit as follows: • At overlay J 47275-1, measure voltage between pin 55 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 15 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	

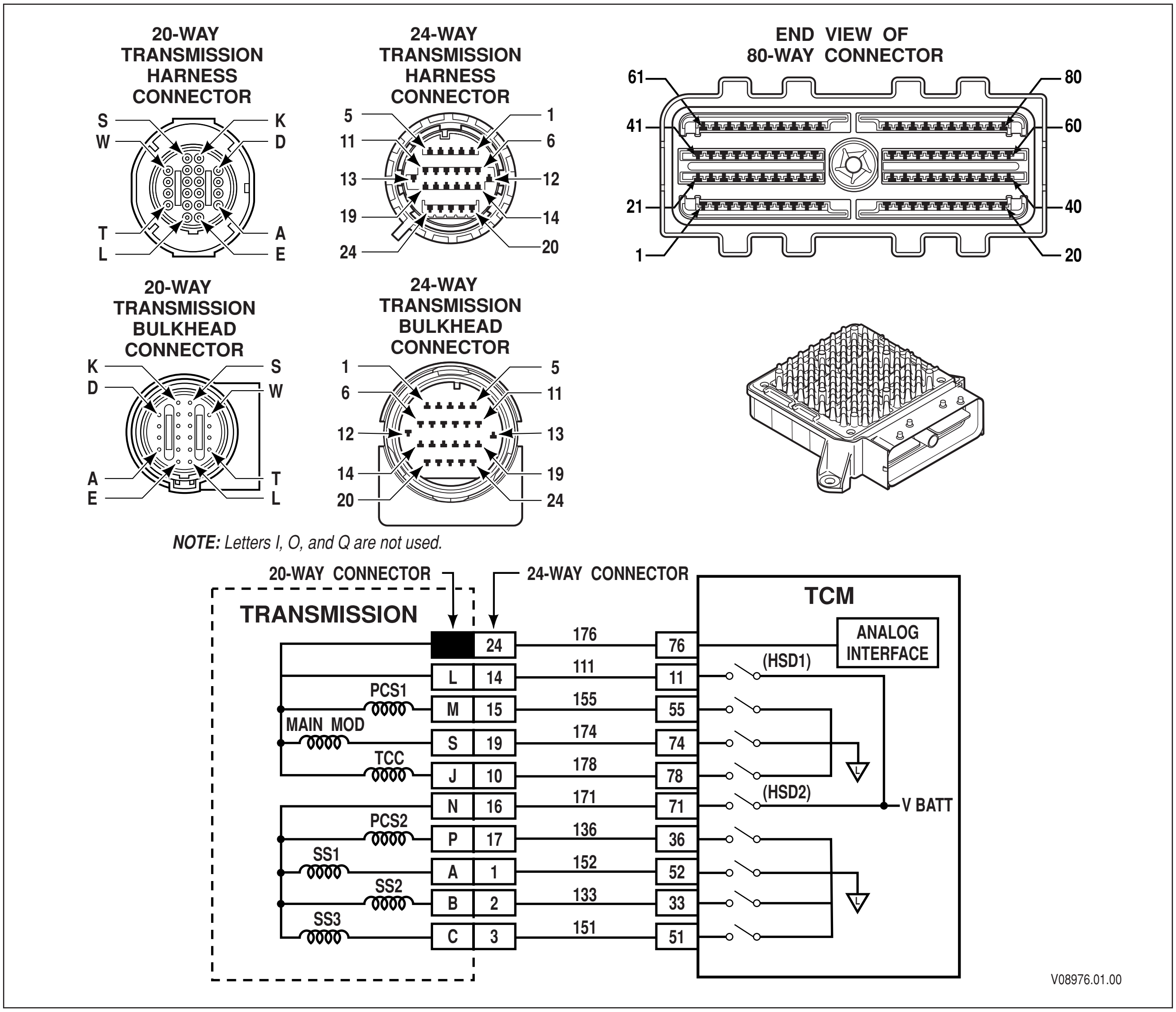
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2727 Pressure Control Solenoid 1 (PCS1) Control Circuit—Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the OEM 24-way connector from J 47278 Transmission Breakout. Leave the transmission 24-way connector connected to the breakout. 3. Using a digital volt/ohmmeter (DVOM), measure the resistance between pin 14 and pin 15 of the transmission 24-way connector. Is the resistance within the specified value?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature.	*Go to Step 10*	*Go to Step 7*
7	1. Remove the transmission oil pan. 2. Disconnect the PCS1 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 Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace PCS1 (refer to Service Manual or In-Chassis Maintenance). 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 Pressure Proportional to Current (PPC) solenoid used to control on-coming and off-going and holding pressure to any one of five clutches.

The TCM sends control current to PCS1 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 PCS1 by switching PCS1's low side driver ON and OFF. Wire 155 completes the circuit between PCS1 and its low side driver. DTC P2729 indicates that the TCM processor has detected a short-to-ground condition in the low side of PCS1's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Associated high side driver (HSD1) is enabled and no (HSD1) DTCs are active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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.
- Engine crank time is not extended.

Conditions for Setting the DTC

DTC P2729 is set when the TCM detects a short-to-ground on 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:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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

- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to a short to a circuit ground condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage, etc.
- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to a circuit ground condition.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent circuit ground conditions, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent circuit ground condition.
- 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 where DTC was set.

Test Description

The numbers below refer to the 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 wire-to-wire shorts or a short-to-ground in the transmission internal harness.

DTC P2729 Pressure Control Solenoid 1 (PCS1) Control Circuit—Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 PCS1 electrical circuit.*** Did DTC P2729 return?		*Go to Step 4*	*Go to Diagnostic Aids*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2729 Pressure Control Solenoid 1 (PCS1) Control Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
4	***NOTE: Review Section 4, Wire Check 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 24-way connector. 5. Inspect the routing of wire 155 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 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*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 15 and all other pins in the 24-way connector, and shorts-to-ground between pin 15 and chassis ground. ***NOTE: The resistance value between pins 15 and 14 will read normal solenoid resistance. The resistance value between pins 15 and 10, and between pins 15 and 19 will be twice normal solenoid resistance.*** Were any wire-to-wire shorts or shorts-to-ground found?	Pin 24 is a Trans ID wire	*Go to Step 8*	*Go to Step 9*
7	1. Remove the Transmission oil pan (refer to Service Manual or In-Chassis Maintenance). 2. Inspect the internal harness for shorts-to-ground. Were any shorts-to-ground found?		*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	

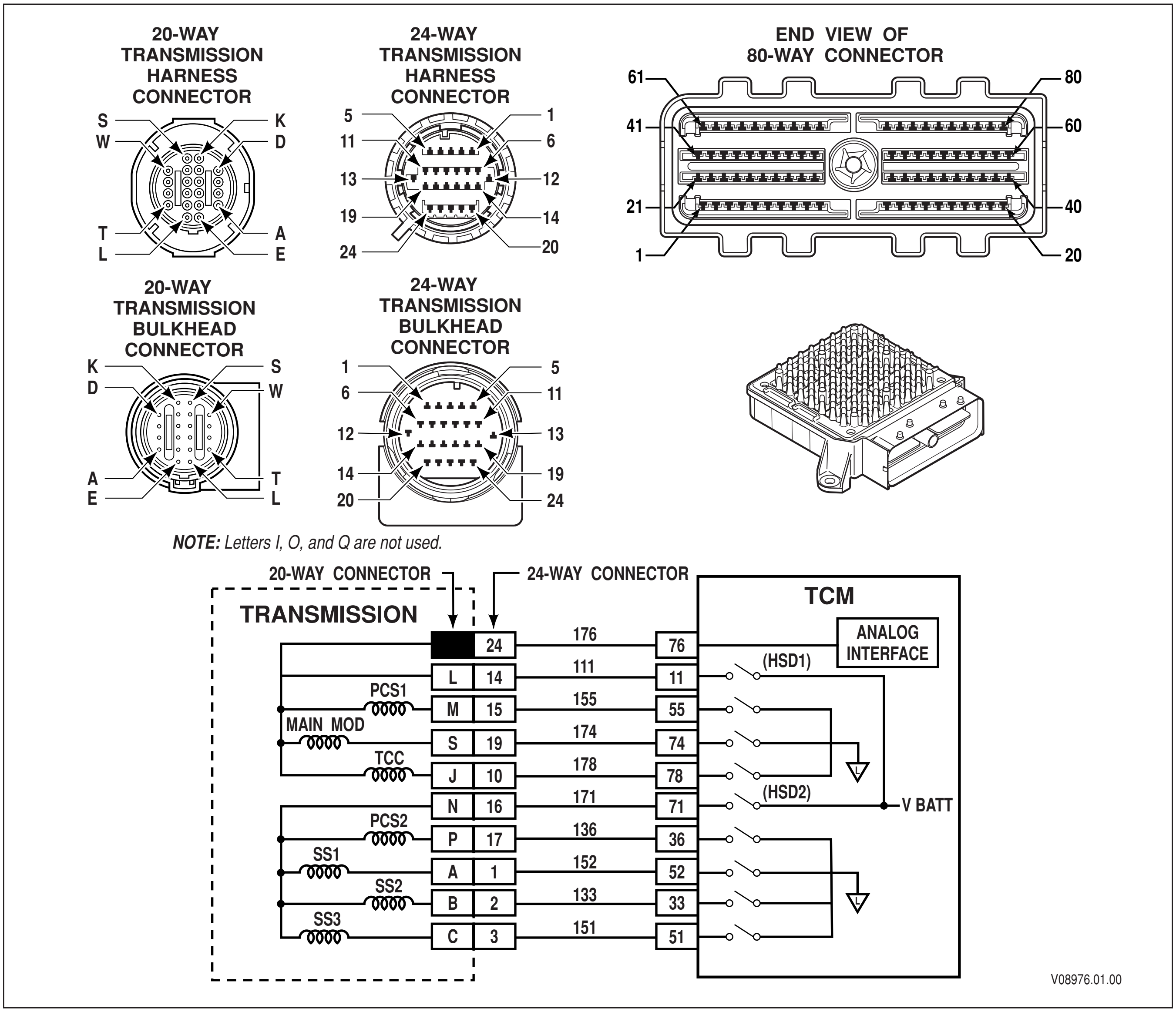
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2729 Pressure Control Solenoid 1 (PCS1) Control Circuit—Low *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Replace PCS1 (refer to Service Manual or In-Chassis Maintenance). 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 P2730 Pressure Control Solenoid 1 (PCS1) Control Circuit—High



Circuit Description

Pressure Control Solenoid (PCS1) is a Pressure Proportional to Current (PPC) solenoid used to control on-coming and off-going and holding pressure to any one of five clutches.

The TCM sends control current to PCS1from 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 PCS1 by switching PCS1's low side driver ON and OFF. Wire 155 completes the circuit between PCS1 and its low side driver. DTC P2730 indicates that the TCM processor has detected a short-to-battery condition in the low side of PCS1's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Associated high side driver (HSD1) is enabled and no (HSD1) DTCs are active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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-power on 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:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- The TCM freezes shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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

- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to a circuit short to power condition. Inspect for a harness that may be rubbing up against a battery power source cable or alternator battery feed cable.
- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to a shorting to power circuit condition.
- When diagnosing for an intermittent shorting condition, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent shorting to power condition.

DIAGNOSTIC TROUBLE CODES (DTC)

- 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 where DTC was set.

Test Description

The numbers below refer to the 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 155.
6. This step tests for wire-to-wire shorts in the transmission internal harness.

DTC P2730 Pressure Control Solenoid 1 (PCS1) Control Circuit—High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 PCS1 electrical circuit.*** Did DTC P2730 return?		*Go to Step 4*	*Go to Diagnostic Aids*
4	***NOTE: Review Section 4, Wire Check 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 24-way connector. 5. Inspect the routing of wire 155 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 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 found?		*Go to Step 5*	*Go to Step 6*

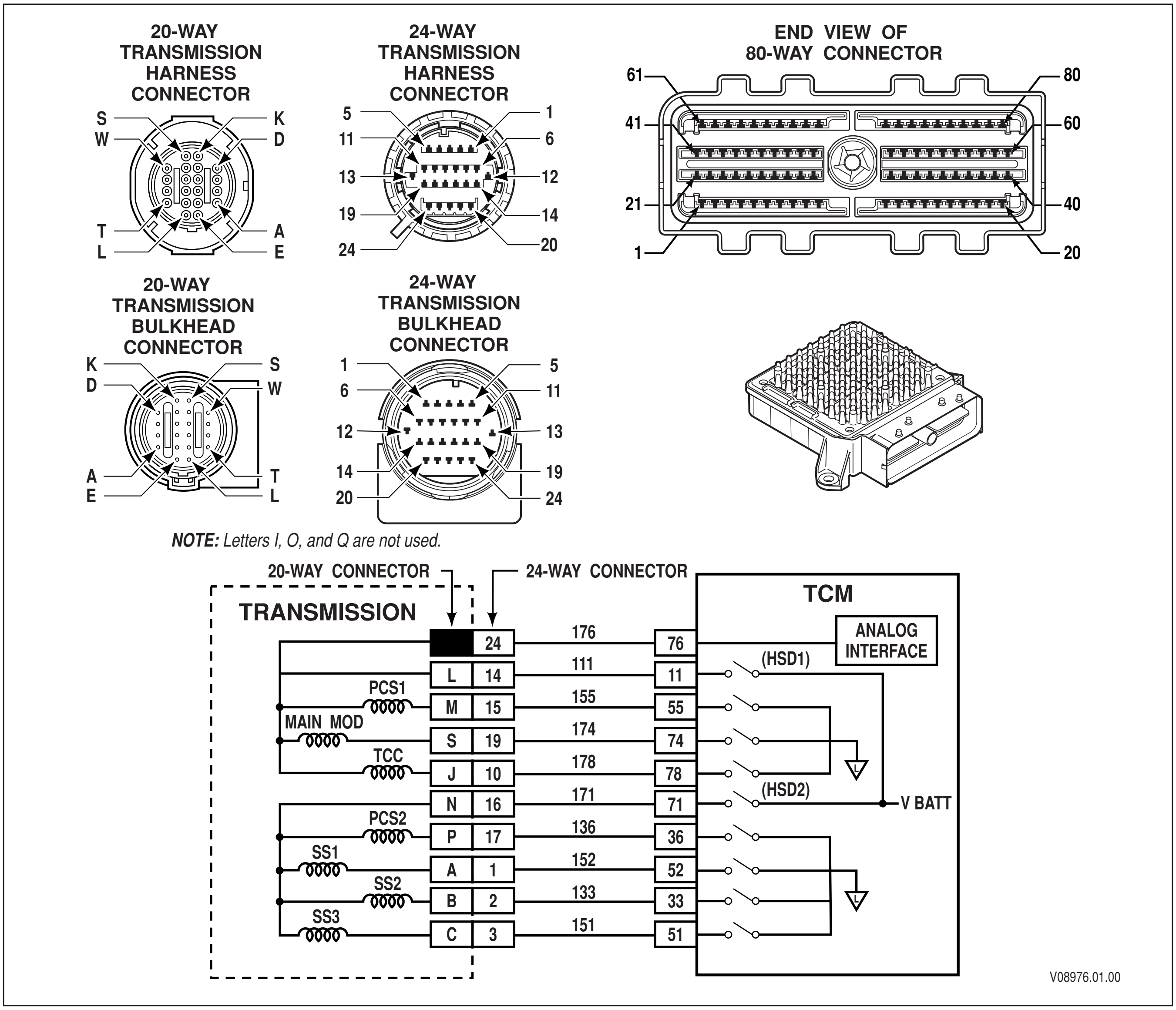
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2730 Pressure Control Solenoid 1 (PCS1) Control Circuit—High *(cont'd)*

Step	Action	Value(s)	Yes	No
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 15 and all other pins in the 24-way connector, and shorts-to-ground between pin 15 and chassis ground. ***NOTE: The resistance value between pins 15 and 14 will read normal solenoid resistance. The resistance value between pins 15 and 10, and between pins 15 and 19 will be twice normal solenoid resistance.*** Were any wire-to-wire shorts found?	Pin 24 is a TransID wire	*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 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	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace PCS1 (refer to Service Manual or In-Chassis Maintenance). 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 P2761 TCC PCS Control Circuit Open



Circuit Description

TCC Pressure Control Solenoid is a Pressure Proportional to Current (PPC) solenoid used to control the torque converter clutch apply and release.

The TCM sends control current to solenoid TCC 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 TCC by switching TCC's low side driver ON and OFF. Wire 178 completes the circuit between TCC and its low side driver. DTC P2761 indicates that the TCM processor has detected an open condition in solenoid TCC's electrical circuit. The open condition may exist in the high side (wire 111) or low side (wire 178).

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- DTC P0122, P0123, P0716, P0717, P0721, P0722 are not active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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.
- TCC is commanded on.

Conditions for Setting the DTC

DTC P2761 is set when the TCM detects an open circuit on the TCC Pressure Control Solenoid return circuit for more than 6 seconds.

Actions taken when the DTC Sets

When DTC P2761 is active, the following conditions will occur:

- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates on the second occurrence (OBD II Strategy).
- Reverse operation is disabled.

Conditions for clearing the DTC/CHECK TRANS Light

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

- Code P2761 indicates an open in the electrical circuit for the TCC solenoid. In addition to TCC, high side driver HSD1 also supplies power to solenoids PCS1 and Main Mod. If DTC P2761 is accompanied by DTC P0960 (Main Mod open circuit) and/or DTC P2727 (PCS1 open circuit), the open is most likely in the high side of the circuit.
- When this DTC is set there can be a noticeable reduction of engine performance.
- An intermittent circuit condition can allow this DTC to set. Make sure you check for the following conditions at the OEM harness first, then at the transmission internal harness.
- Inspect the wiring for poor electrical connections at the TCM connector and the transmission main connector. Look for the following conditions:
  - A bent terminal
  - A backed-out terminal
  - A damaged terminal
  - Poor terminal tension
  - A broken wire inside the insulation.
- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open circuit condition. Moving parts on the vehicle could be contacting the harness; this includes parking brake drum, suspension components, transmission shift linkage etc.
- Inspect internal transmission harness wiring for possible contact areas where chafing may occur leading to an open circuit condition.

DIAGNOSTIC TROUBLE CODES (DTC)

- When diagnosing for an intermittent open condition, massage the wiring harness while watching the test equipment for a change. It may be necessary to check continuity at individual wires within a harness to isolate an intermittent open condition.
- 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 where DTC was set.

Test Description

The numbers below refer to the 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 the solenoid resistance.

DTC P2761 TCC PCS Control Circuit Open

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 Check 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 47278 Transmission Breakout between the OEM and transmission 24-way connectors. 4. Turn ignition ON, leave engine OFF. 5. Using Allison DOC™, enter Solenoid Test mode and command the TCC solenoid ON. 6. Determine the voltage drop in the high side of the TCC solenoid circuit as follows: • At overlay J 47275-1, measure voltage between pin 11 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 14 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 TCC solenoid circuit as follows: • At overlay J 47275-1, measure voltage between pin 78 and an isolated ground. • At transmission connector breakout J 47278, measure voltage between pin 10 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 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 chassis harness. Is the repair complete?		*Go to Step 11*	

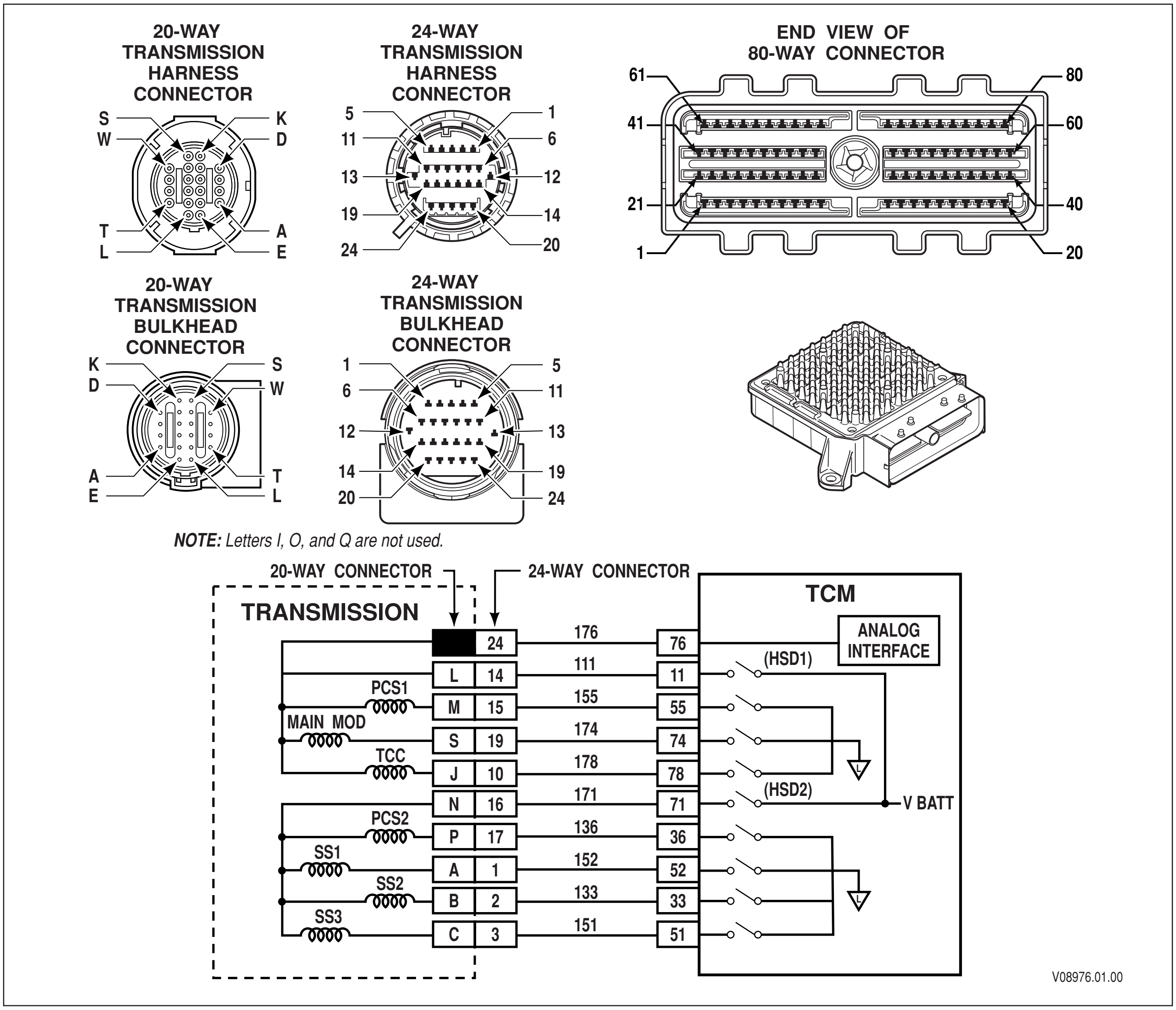
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2761 TCC PCS Control Circuit Open *(cont'd)*

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF. 2. Disconnect the OEM 24-way connector from J 47278 Transmission Breakout. Leave the transmission 24-way connector connected to the breakout. 3. Using a digital volt/ohmmeter (DVOM), measure the resistance between pin 14 and pin 10 of the transmission 24-way connector. Is the resistance within the specified value?	Refer to Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 10*	*Go to Step 7*
7	1. Remove the transmission oil pan (refer to Service Manual or In-Chassis Maintenance) 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 Table 5–9, Calculated Solenoid Resistance vs. Temperature	*Go to Step 8*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	
9	Replace solenoid TCC (refer to Service Manual or In-Chassis Maintenance). 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 P2763 TCC PCS Control Circuit High



Circuit Description

TCC Pressure Control Solenoid is a Pressure Proportional to Current (PPC) solenoid used to control the torque converter clutch apply and release.

The TCM sends control current to the TCC 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 TCC by switching TCC's low side driver ON and OFF. Wire 178 completes the circuit between TCC and its low side driver. DTC P2763 indicates that the TCM processor has detected a short-to-battery condition in the low side of TCC's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- DTC P0122, P0123, P0716, P0717, P0721, P0722 are not active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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.
- TCC is commanded on.

Conditions for Setting the DTC

DTC P2763 is set when the TCM detects a short-to-battery in the TCC return circuit for more than 6 seconds.

Actions taken when the DTC Sets

When DTC P2763 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to **D** (Forward) range or **R** (Reverse) and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates on the second occurrence (OBD II Strategy).
- The TCM freezes shift adapts (DNA).
- Reverse operation is disabled.

Conditions for clearing the DTC/CHECK TRANS Light

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.
- 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)

- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open 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

The numbers below refer to the 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 178.
6. This step tests for wire-to-wire shorts in the transmission internal harness.

DTC P2763 TCC PCS Control Circuit High

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 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 Check 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 24-way connector. 5. Inspect the routing of wire 178 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 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 6*	*Go to Step 7*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 10 and all other pins in the 24-way connector, and shorts-to-ground between pin 10 and chassis ground. ***NOTE: The resistance value between pins 10 and 14, and 10 and 24 will read normal solenoid resistance. The resistance value between pins 10 and pins 15 and 19 will be twice normal solenoid resistance.*** Were any wire-to-wire shorts found?	Pin 24 is a TransID wire	*Go to Step 8*	*Go to Step 9*
7	1. Remove the Transmission oil pan (refer to Service Manual or In-Chassis Maintenance). 2. Inspect the internal harness for wire-to-wire shorts. Were any shorts-to-ground found?		*Go to Step 9*	*Go to Step 9*
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 11*	

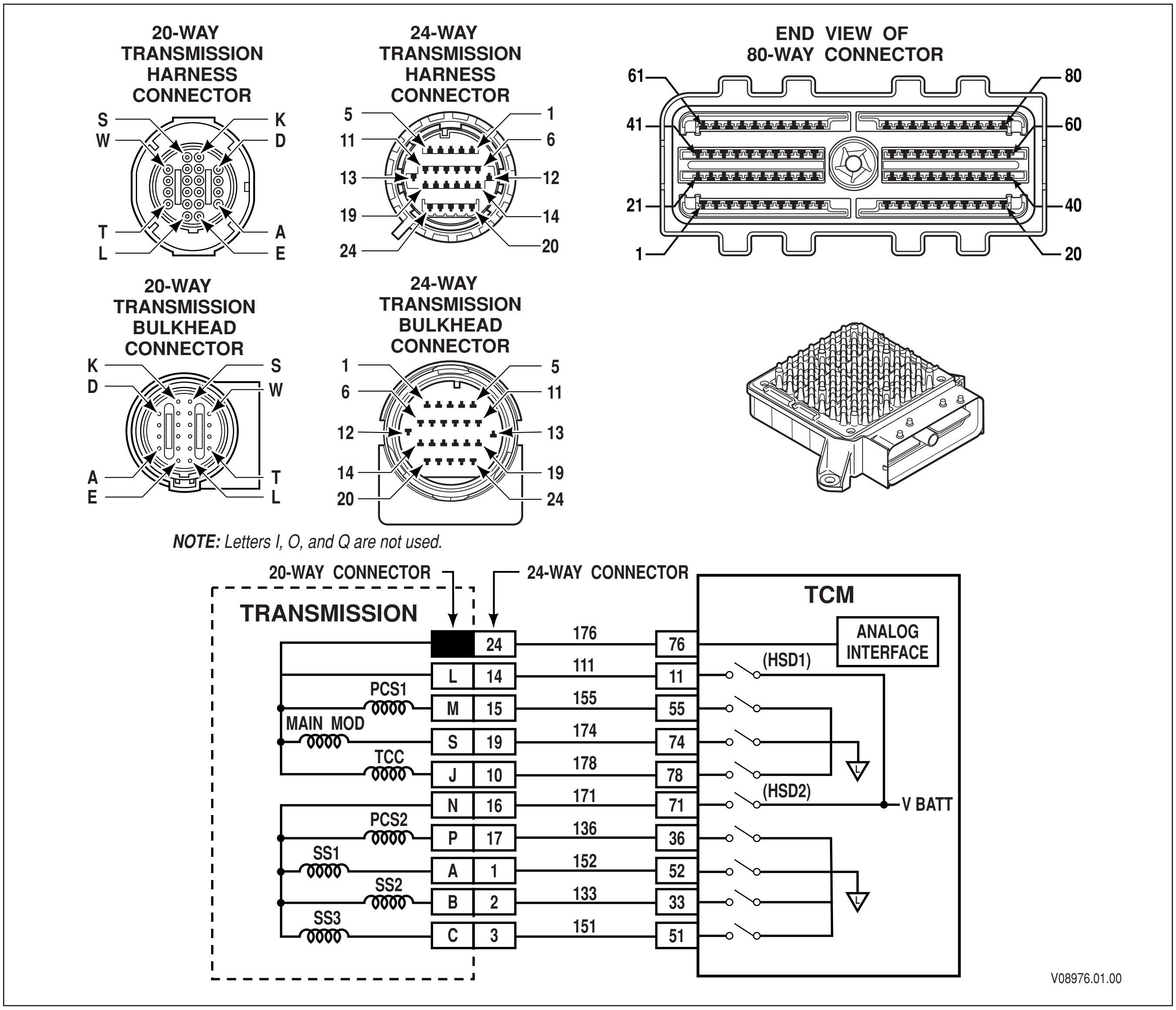
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2763 TCC PCS Control Circuit High *(cont'd)*

Step	Action	Value(s)	Yes	No
9	Replace TCC (refer to Service Manual or In-Chassis Maintenance). 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 P2764 TCC PCS Control Circuit Low



Circuit Description

TCC Pressure Control Solenoid is a Pressure Proportional to Current (PCC) solenoid used to control the torque converter clutch apply and release.

The TCM sends control current to solenoid TCC 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 TCC by switching TCC's low side driver ON and OFF. Wire 178 completes the circuit between TCC and its low side driver. DTC P2764 indicates that the TCM processor has detected a short-to-ground condition in the low side of solenoid TCC's electrical circuit.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- DTC P0122, P0123, P0716, P0717, P0721, P0722 are not active.
- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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.
- TCC is commanded on.

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 6 seconds.

Actions taken when the DTC Sets

When DTC P2764 is active, the following conditions will occur:

- If the failure occurs while in a forward range a shift to 1st, 3rd, or 5th range is made.
- While diagnostic response is active, if shift selector is moved to **N** (Neutral), transmission will shift to neutral; if the shift selector is moved to **R** (Reverse), transmission shifts to reverse. If the shift selector is moved to forward range or reverse and transmission is compromised be overspeeding or direction change, transmission shifts to neutral.
- TCC engagement is inhibited.
- Main Modulation is inhibited.
- DTC is stored in TCM history.
- The **CHECK TRANS** light illuminates (Non-OBD II Strategy).
- The MIL illuminates on the second occurrence (OBD II Strategy).
- The TCM freezes shift adapts (DNA)
- Reverse operation 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 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.

DIAGNOSTIC TROUBLE CODES (DTC)

- Inspect OEM wiring harness routing, look for possible contact points where chafing could occur leading to an open 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

The numbers below refer to the 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 wire-to-wire shorts or a short-to-ground in the transmission internal harness.

DTC P2764 TCC PCS Control Circuit Low

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning the Troubleshooting Process*
2	1. Install Allison DOC™. 2. Start the engine. 3. Record the DTC Failure Record data. 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 Check 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 24-way connector. 5. Inspect the routing of wire 178 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 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*
5	***NOTE: The vehicle OEM has responsibility for all external wiring harness 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 chassis harness. Is the repair complete?		*Go to Step 11*	
6	1. Turn the ignition OFF. 2. Install J 47278 Transmission Breakout to the transmission 24-way connector. Leave the OEM harness disconnected. 3. Using a digital volt/ohmmeter (DVOM), test for wire-to-wire shorts between pin 10 and all other pins in the 24-way connector, and shorts-to-ground between pin 10 and chassis ground. ***NOTE: The resistance value between pins 10 and 14, and 10 and 24 will read normal solenoid resistance. The resistance value between pin 10 and pins 15 and 19 will be twice normal solenoid resistance.*** Were any wire-to-wire shorts or shorts-to-ground found?	Pin 24 is a TransID wire	*Go to Step 8*	*Go to Step 9*
7	1. Remove the transmission oil pan. 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*

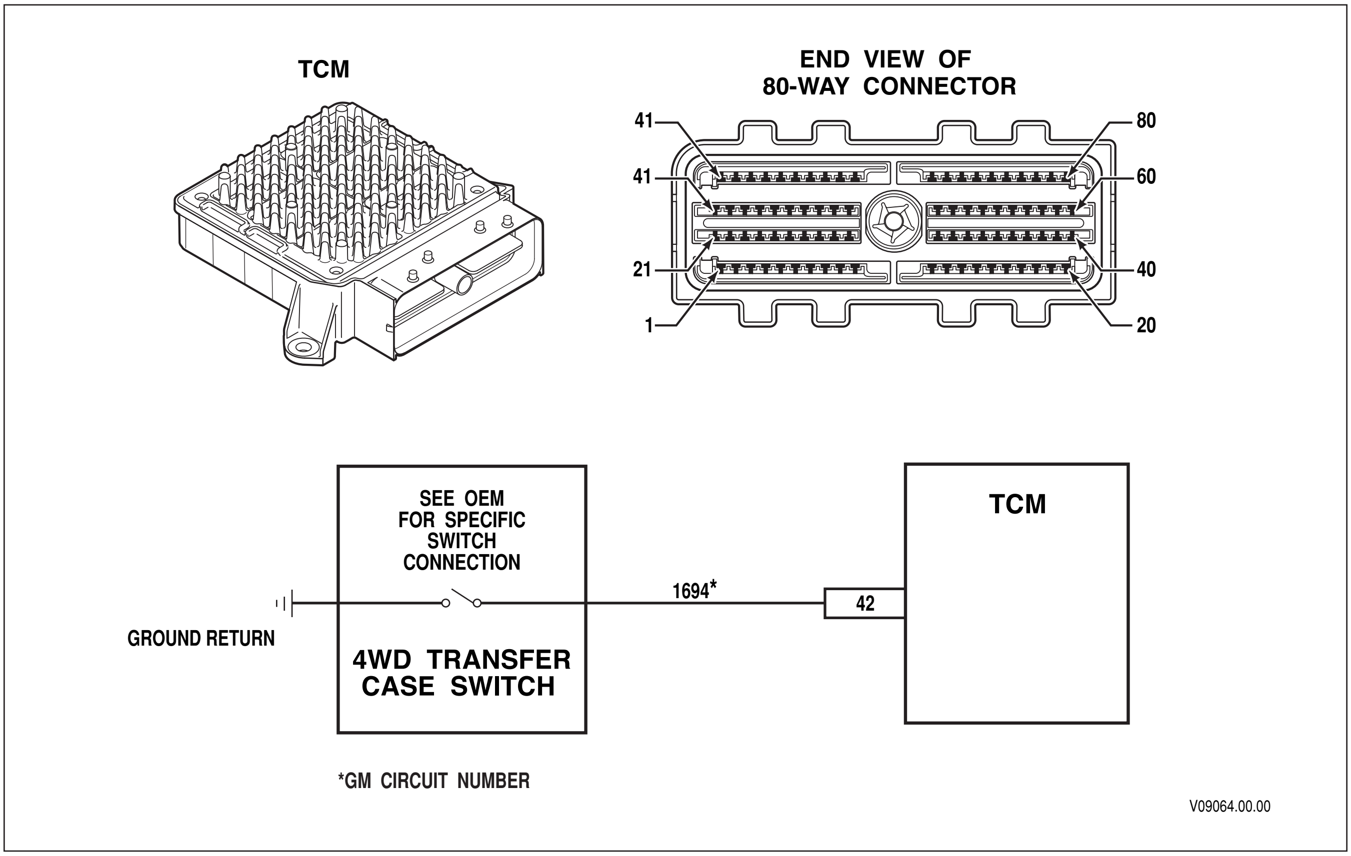
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2764 TCC PCS Control Circuit Low *(cont'd)*

Step	Action	Value(s)	Yes	No
8	Replace the internal wiring harness (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 12*	
9	Replace solenoid TCC (refer to Service Manual or In-Chassis Maintenance). Is the replacement complete?		*Go to Step 12*	
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 P2771 4-Wheel Drive Lo Switch Circuit



Circuit Description

The 4WD low signal circuit is used to notify the transmission control module (TCM) that the vehicle is in 4WD low range. The TCM uses this input to provide earlier upshifts in low range and to prevent overspeed conditions.

Conditions for Running the DTC

- Engine speed is greater than 200 rpm but less than 7500 rpm for 5 seconds.
- The components are powered and ignition voltage is greater than 9V and less than 18V (12V TCM) or greater 18V and less than 32V (24V TCM).
- DTCs P0721 and P0722 (output speed sensor circuits) are not active.
- Output speed is above 60 rpm.
- Transmission fluid temperature is between 20ºC (68ºF) and 130ºC (266ºF).
- The shift is complete and **N** (Neutral) range is 24V TCM) not selected.

Conditions for Setting the DTC

P2771 sets when one of the following conditions occurs:

- This DTC sets on the 200th occurrence of the transfer case switch indicating high range while the calculated range is low for 5 seconds or more.

DIAGNOSTIC TROUBLE CODES (DTC)

- This DTC sets on the 200th occurrence of the transfer case switch indicating low range while the calculated range is high for 5 seconds or more.

Action taken when the DTC Sets

- DTC P2771 will be stored in the TCM memory.
- The TCM does not illuminate the MIL (OBD II Strategy).
- The TCM inhibits TCC engagement.

Conditions for Clearing the DTC/CHECK TRANS Light

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 a fault.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the TCM. Inspect 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 condition.
- Inspect for any transmission DTCs that may have set again.

Test Description

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

2. This step tests the status of the 4WD Low switch.
3. This step tests for a 4WD switch failure to ground.
4. This step tests for a short in the wiring harness.
9. This step tests for a 4WD switch failure to an open state.
10. This step tests for an open in the wiring harness.

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2771 4-Wheel Drive Lo Switch Circuit

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed? (Remember to record failure records prior to clearing DTC)		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition, with the engine OFF. ***Important: Before clearing the DTC, use Allison DOC™ in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data.*** 3. Record the DTC Freeze Frame and Failure Records. 4. Clear the DTC. 5. Using Allison DOC™, monitor 4WD Low status and select 4HI followed by 4LO with the transfer case selector. Does Allison DOC™ indicate 4WD low status as OFF when 4HI is selected, and ON when 4LO is selected?		*Go to Diagnostic Aids*	*Go to Step 3*
3	Select 4HI followed by 4LO using the transfer case selector. Does Allison DOC™ indicate 4WD low status as ON for both selector positions?		*Go to Step 4*	*Go to Step 9*
4	Remove connector at the transfer case selector. Does Allison DOC™ indicate 4WD low status as ON?		*Go to Step 5*	*Go to Step 7*
5	Inspect 4WD Low Signal Circuit for a short-to-ground. Did you find a condition?		*Go to Step 6*	*Go to Step 15*
6	Inspect and repair the short-to-ground in 4WD Low Signal Circuit (refer to OEM repair procedures). Is the repair complete?		*Go to Step 16*	
7	Inspect the transfer case switch for proper operation or a short-to-ground (refer to OEM repair procedures). Did you find a condition?		*Go to Step 8*	*Go to Step 15*
8	Replace the transfer case switch (refer to OEM repair procedures). Did you complete the replacement?		*Go to Step 16*	
9	Select 4HI followed by 4LO using the transfer case selector. Does Allison DOC™ indicate 4WD Low status as OFF for both selector positions?		*Go to Step 10*	*Go to Step 15*

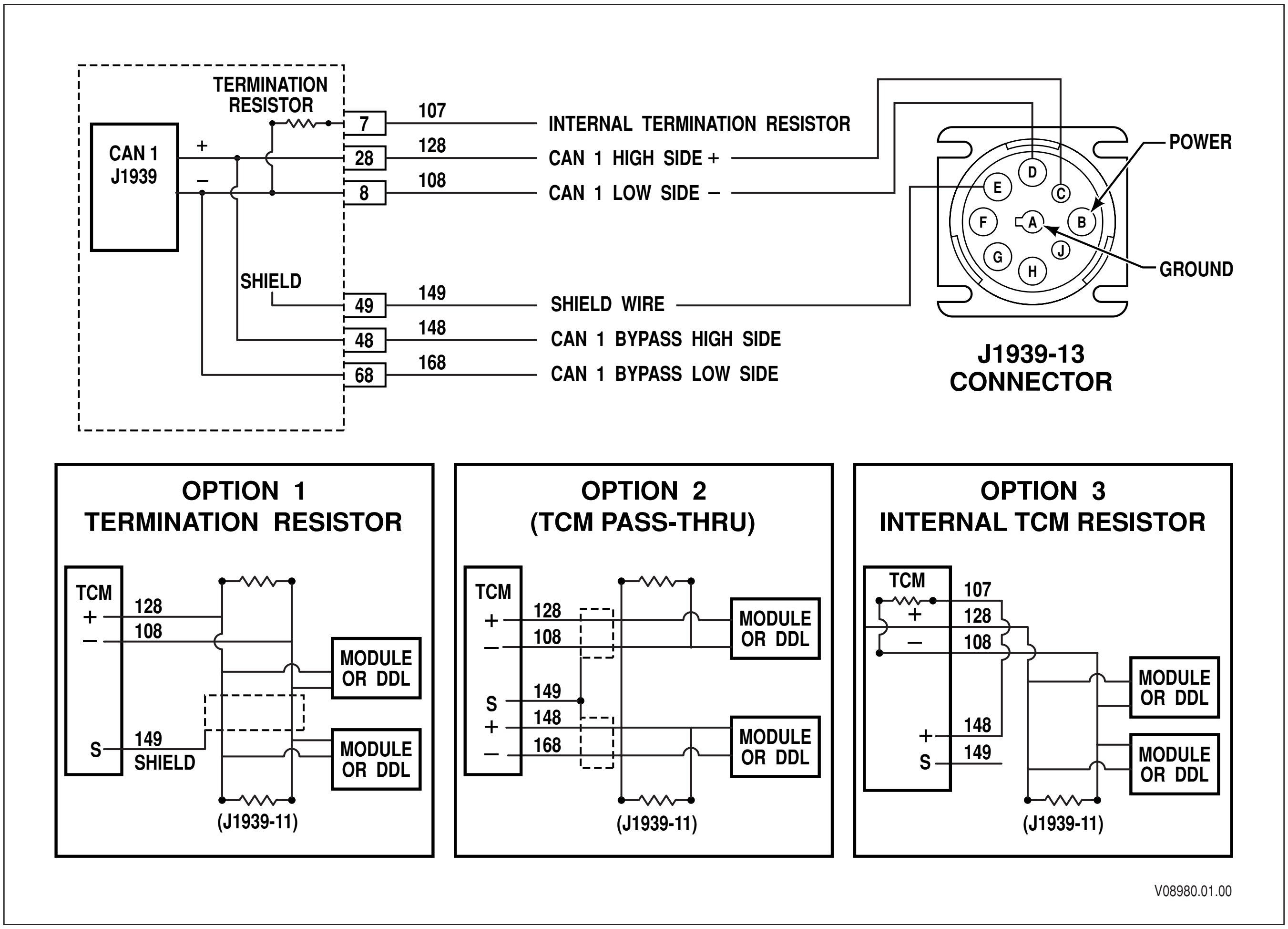
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P2771 4-Wheel Drive Lo Switch Circuit *(cont'd)*

Step	Action	Value(s)	Yes	No
10	1. Remove the connector at the transfer case switch. 2. Ground 4WD Low Signal Circuit to a known ground. Does Allison DOC™ indicate 4WD low status as OFF?		*Go to Step 11*	*Go to Step 13*
11	Inspect the short-to-ground in Brake Switch Signal Circuit (refer to OEM repair procedures). Did you find a condition?		*Go to Step 12*	*Go to Step 15*
12	Repair the open condition 4WD Low Signal Circuit (refer to OEM repair procedures). Is the repair complete?		*Go to Step 16*	
13	Inspect the transfer case switch for an open condition. Did you find an open condition?		*Go to Step 14*	*Go to Step 15*
14	Replace the transfer case switch (refer to OEM repair procedures). Is the repair complete? Did you complete the replacement?		*Go to Step 16*	
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 16*	
16	Perform the following procedure in order to verify the repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. Monitor the 4WD Low status with Allison DOC™. The 4WD Low status must indicate OFF when 4WDHI is selected, and ON when 4WDLO is selected. Did the DTC return?		*System OK*	*Go to Step 1*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0010 CAN 1 Bus Reset Counter Overrun



Circuit Description

The Controller Area Network (CAN) defined by SAE J1939 allows the integration of various vehicle components into an overall vehicle system by providing a standard way of exchanging information between the various modules used in a vehicle. Use of a J1939 network, or data link, for on-vehicle communication reduces the amount of wiring in a vehicle, and allows the many different components and subsystems access to a wider range of information. Allison utilizes the J1939 communication link for vehicle operation controls, power train interaction, and conveying vehicle management information.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 is set when the TCM detects no communication on the Controller Area Network (CAN) backbone harness for 3 seconds or more. This indicates that the CAN communication has reset due to a short-to-ground or power on wires 108 or 128.

DIAGNOSTIC TROUBLE CODES (DTC)

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The MIL illuminates (OBD II Strategy).
- DTC U0010 is stored in the TCM history.
- TCM defaults to last used adaptive shift values and engine throttle percentage is calculated from torque converter slip speed.
- TCM inhibits shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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

- If an active U0010 is present, Allison DOC™ For PC communication will not be possible.
- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 "T" Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 "T" Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC interface device at J 47276 "T" Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete "T" harness hook-up information).
- Install J 47276 "T" Breakout and TCM Reflashing Harness at the TCM 80-way connector. Do not reconnect vehicle harness 80-way harness.
  1. Connect J 42455 load box at J 47276 "T" Breakout and TCM Reflashing Harness 37-pin AMP connector.
  2. Supply 12V at J 42455 load box to power up the TCM.
  3. Connect Allison DOC™ For PC–Service tool interface device at J 42455 load box.
  4. This configuration should allow communication directly with the TCM, if no communication is available replace the TCM with a known good module. Test again. Refer to Section 5 for complete "T" harness hook-up information.
- Systematically disconnecting modules on the CAN data bus until communication is established with Allison DOC™ For PC–Service tool may be useful in determining that an individual module is causing a short on the CAN data bus.
  - A short between wires 108 and 128 within the CAN harness could allow this DTC to set.
  - A short between wires 128 and 149 within the CAN harness could allow this DTC to set.
  - A short to a vehicle ground and wire 128 could allow this DTC to set.
  - A short to vehicle power and wires 108 or 128 could allow this DTC to set.
- For proper data communications it is necessary to have two 120 Ohms resistors installed in parallel at the J 1939 CAN backbone harness ends, this can be done externally or internally at the control module or TCM, depending on the OEM's configuration. The only way to determine the proper CAN configuration is to refer to specific vehicle wiring schematics from OEM.

DIAGNOSTIC TROUBLE CODES (DTC)

- The CAN backbone harness can be configured in one of three different ways:
  1. Traditional Stub Interface, in this set-up the terminating resistors are located externally at the end stubs of the CAN backbone harness.
  2. Pass Through Interface, in this set-up the OEM can eliminate the TCM stub connection. This setup allows the CAN wiring to enter the TCM on one set of pins and continues out through a second set of pins, eliminating the TCM stub connector. Two terminating resistors are still located externally on the end stubs.
  3. Backbone termination, this set-up allows the elimination of one of the two external termination resistors. By the addition of a jumper wire between the TCM terminals 107 and 148 an internal TCM 120 Ohm resistor is wired in parallel between the CAN high and low wires.

Temporary Backbone

If available, to determine who “owns” the problem, and after receiving the proper authorization from the OEM. Connecting a temporary backbone between the engine and the transmission can be used to identify the source of the concern. This procedure is not covered under Allison warranty and must be authorized and covered by the vehicle or engine OEM.

- 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-to-ground or power, massage the wiring harness while watching the test equipment for a change. It may be necessary to check for shorts at individual wires within a harness to isolate an intermittent condition. Refer to Section 4, Wire Check Procedures.
- You may have to drive the vehicle on rough roads to determine if the problem occurs with vibration or under specific driving conditions, left or right hand turns, etc.
- 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.
- If this DTC is present in new vehicle, harsh shifting may occur due to adaptive (DNA) function inhibit.

Test Description

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

3. This step inspects the CAN backbone harness for shorts-to-ground or power.
5. This step checks TCM function.

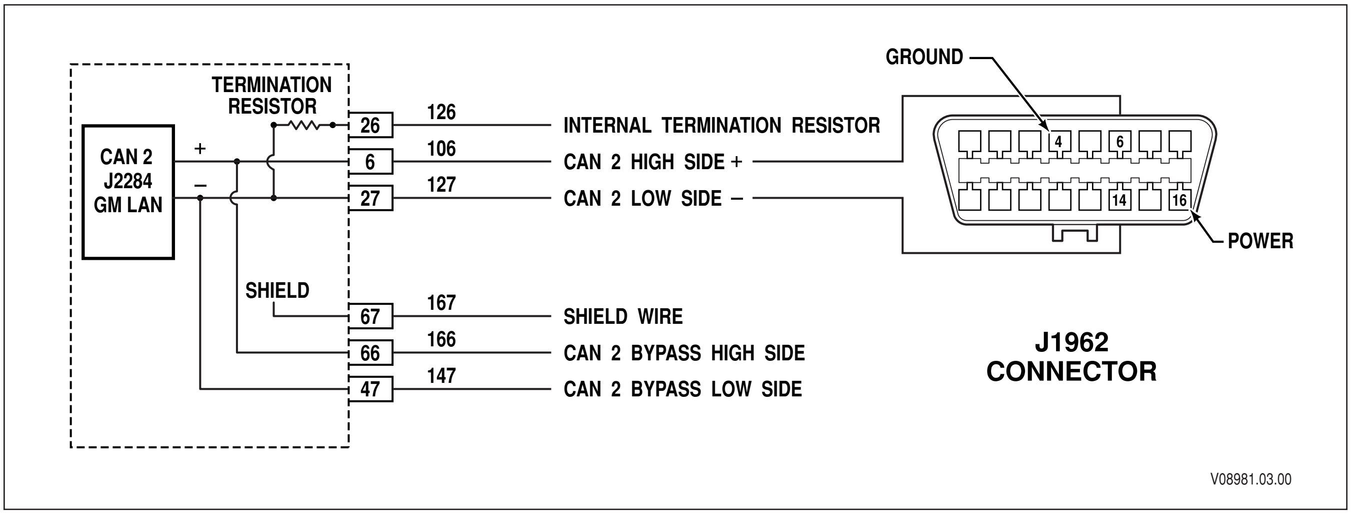
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0010 CAN 1 Bus Reset Counter Overrun

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ignition On with the engine Off. Is Allison DOC™ communication possible at the diagnostic connector?		*Go to Diagnostic Aids*	*Go to Step 3*
3	Inspect wires 128 (Positive), 108 (Negative), 149 (Shield) at engine and transmission connectors for a possible shorting condition or terminal damage. ***NOTE: No Allison DOC™ communication is possible when this DTC is active.*** This DTC indicates that a CAN bus hardware error has occurred. This may indicate a short to power or ground has occurred at the CAN bus wiring harness. Was a wiring problem found?		*Go to Step 4*	*Go to Step 5*
4	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 6*	
5	Substitute TCM with a known good unit. Check for proper communication. If this repairs the condition, reinstall the “defective” TCM to verify the TCM failure. Then install a new TCM. Is replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Establish TCM communication with Allison DOC™, clear DTC. 2. Check Allison DOC™ test passed section to make sure the diagnostic test was run. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0073 CAN 2 GMLAN Bus Reset Counter Overrun



Circuit Description

SAE J2284 or CAN 2 is an option that allows the integration of high speed (500K baud) communication and is currently only for GM LAN applications. If any of the CAN circuits are shorted-to-battery voltage, ground, or between them, no communication is possible on the CAN serial data bus, and a DTC U0073 is set.

For medium duty applications J2284 CAN 2 communication can be used to perform TCM recalibration via PCCS Load Station.

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 18V 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 U0073 is set when the TCM detects no communication on the Controller Area Network (CAN) backbone harness for 3 seconds or more. This indicates that the CAN communication has reset due to a short-to-ground or power on CAN 2 high or low wires.

Action Taken When the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC U0073 is stored in the TCM history.
- The TCM defaults to the last-used adaptive shift values and engine throttle percentage is calculated from torque converter slip speed.
- The TCM inhibits shift adapts (DNA).

Conditions for Clearing the DTC/CHECK TRANS Light

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 TROUBLE CODES (DTC)

Diagnostic Aids

When an U0073 is active no communication will be possible at the OBD II vehicle diagnostic connector. Install J 47276 “T” Breakout and TCM Reflashing Harness only at the TCM 80-way connector.

- Connect J 42455 load box at J 47276 “T” Breakout and TCM Reflashing Harness 37-pin AMP connector.
- Supply 12V at J 42455 load box to power up the TCM.
- Connect Allison DOC™ For PC–Service Tool interface device at the OBD II connector supplied on the J 47276 “T” Breakout and TCM Reflashing Harness.
- This setup allows communication directly to TCM, if no communication is available replace the TCM with a known good module. Test again. Refer to Section 5 for complete “T” harness hook-up information.
- By systematically disconnecting modules on the CAN data bus until communication is established with the Allison DOC™ For PC–Service Tool, may be useful in determining that an individual module is causing a short on the CAN data bus.
- A short between wires 106 and 127 within the CAN harness could allow this DTC to set.
- A short between wires 127 and 167 within the CAN harness could allow this DTC to set.
- A short to a vehicle ground and wire 106 or 127 could allow this DTC to set.
- A short to vehicle power and wires 106 or 127 could allow this DTC to set.
- For proper data communications it is necessary to have two 120 Ohms resistors installed in parallel at the J 2284 CAN 2 backbone harness ends, this can be done externally or internally at the control module or TCM depending on the OEM’s configuration. The only way to determine the proper CAN configuration is to refer to specific vehicle wiring schematics from OEM.

If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 “T” Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).

- Connect J 42455 load box at J 47276 “T” Breakout and TCM Reflashing Harness 37-pin AMP connector.
- Supply 12V at J 42455 load box to power up the TCM.
- Connect Allison DOC™ For PC–Service Tool interface device at J 47276 “T” Breakout and TCM Reflashing Harness 9-pin connector.

This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete “T” harness hook-up information).

The CAN2 backbone harness can be configured in one of three different ways:

1. Traditional Stub Interface, in this set-up the terminating resistors are located externally at the end stubs of the CAN backbone harness.
2. Pass Through Interface, in this set-up the OEM can eliminate the TCM stub connection. This setup allows the CAN wiring to enter the TCM on one set of pins and continues out through a second set of pins, eliminating the TCM stub connector. Two terminating resistors are still located externally on the end stubs.

DIAGNOSTIC TROUBLE CODES (DTC)

3. Backbone termination, this set-up allows the elimination of one of the two external termination resistors. With the addition of a jumper wire between the TCM terminals 106 and 126, an internal TCM 120 Ohm resistor is wired in parallel between the CAN high and low wires.

Refer to Appendix P, J1939 and J 2284 for detailed CAN backbone option drawings.

Temporary Backbone

If available, to determine who "owns" the problem, and after receiving the proper authorization from the OEM. Connecting a temporary backbone between the engine and the transmission can be used to identify the source of the concern.

NOTE: This procedure is not covered under Allison warranty and must be authorized and covered by the vehicle or engine OEM.

- 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-to-ground or power, massage the wiring harness while watching the test equipment for a change. It may be necessary to check for shorts at individual wires within a harness to isolate an intermittent condition. Refer to Section 4, Wire Check Procedures.
- You may have to drive the vehicle on rough roads to determine if the problem occurs with vibration or under specific driving conditions, left or right hand turns, etc.
- 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.
- If this DTC is present in new vehicle, harsh shifting may occur due to adaptive (DNA) function inhibit.

Test Description

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

3. This step inspects the CAN 2 backbone harness for shorts-to-ground or power.
5. This step checks TCM function.

DTC U0073 CAN 2 Bus Reset Counter Overrun

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn the ignition ON with the engine OFF. Is Allison DOC™ communication possible at the diagnostic connector?		*Go to Diagnostic Aids*	*Go to Step 3*

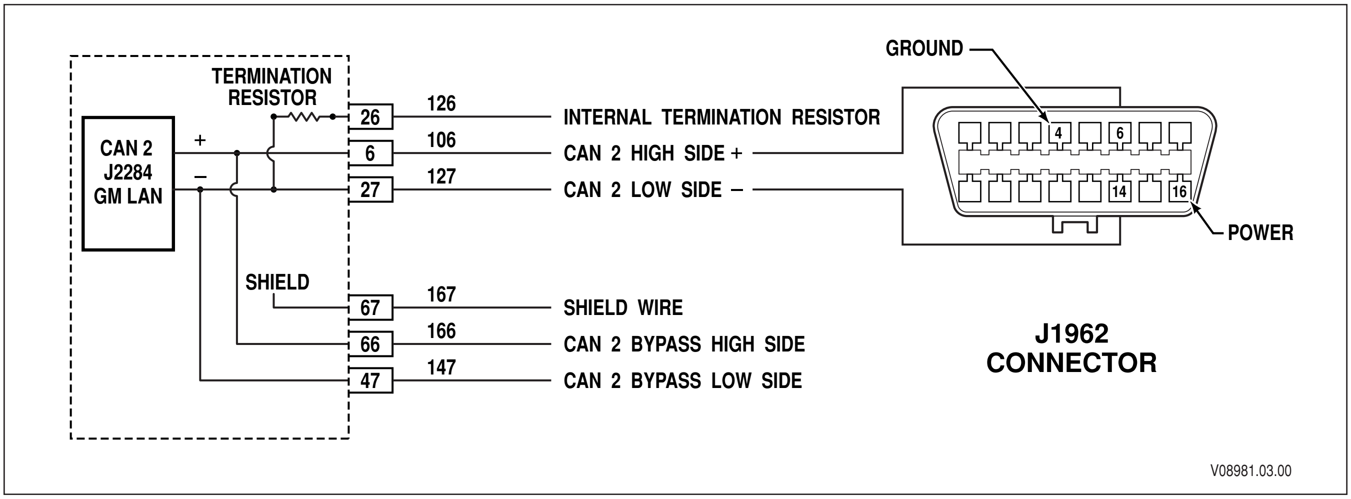
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0073 CAN 2 Bus Reset Counter Overrun *(cont'd)*

Step	Action	Value(s)	Yes	No
3	1. Inspect wires 106 (positive), 127 (negative), 167 (shield) at engine and transmission connectors for a possible shorting condition or terminal damage. ***NOTE: No Allison DOC™ communication is possible when this DTC is active.*** 2. This DTC indicates that a CAN bus hardware error has occurred. This may indicate a short-to-power or ground has occurred at the CAN 2 bus wiring harness. Was a wiring problem found?		*Go to Step 4*	*Go to Step 5*
4	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repair. Harness repairs performed by Allison Transmission distributors and dealers are not covered by Allison Transmission warranty.*** Is the repair complete?		*Go to Step 7*	*Go to Step 4*
5	Substitute TCM with a known good unit. Check for proper communication. If this repairs the condition, reinstall the "defective" TCM to verify the TCM failure and then install a new TCM. Is replacement complete?		*Go to Step 6*	—
6	In order to verify your repair: 1. Establish TCM communication with Allison DOC™, clear DTC. 2. Check Allison DOC™ test passed section, to make sure diagnostic test was run. 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 (CAN 2)



Circuit Description

SAE J2284 or CAN 2 is an option that allows the integration of high speed (500K baud) communication and is currently only for GM LAN applications. For medium duty applications J2284 CAN2 communication can be used to perform TCM recalibration via PCCS Load Station.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 U0100 is set when the TCM detects that no engine torque or throttle messages are being received on the Controller Area Network (CAN 2) backbone harness for 3 seconds or more.

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC U0100 is stored in the TCM history.
- TCM defaults to last used adaptive shift values and engine throttle percentage is calculated from torque converter slip speed.
- TCM inhibits shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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 missing terminating resistor may cause this DTC to set; this often, will only allow limited Allison DOC™ For PC–Service Tool communication with the TCM.

DIAGNOSTIC TROUBLE CODES (DTC)

- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 "T" Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 "T" Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC–Service Tool interface device at J 47276 "T" Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete "T" harness hook-up information).
- When Allison DOC™ For PC–Service Tool communication with the TCM can be established at the vehicle OBD II diagnostic connector and the U0100 is active, generally it points to an open connection at high or low wires at the ECM/PCM or terminal in the wrong location at the engine ECM connector.
- For proper data communications it is necessary to have two 120 Ohms resistors installed in parallel at the CAN 2 backbone harness ends, this can be done externally or internally at the control module or TCM depending on the OEM's configuration. The only way to determine the proper CAN configuration is to refer to specific vehicle wiring schematics from OEM.
- The CAN backbone harness can be configured in one of three different ways:
  1. Traditional Stub Interface, in this set-up the terminating resistors are located externally at the end stubs of the CAN backbone harness.
  2. Pass Through Interface, in this set-up the OEM can eliminate the TCM stub connection. This setup allows the CAN wiring to enter the TCM on one set of pins and continues out through a second set of pins, eliminating the TCM stub connector. Two terminating resistors are still located externally on the end stubs.
  3. Backbone termination, this set-up allows the elimination of one of the two external termination resistors. By the addition of a jumper wire between the TCM terminals 6 and 26 an internal TCM 120 Ohm resistor is wired in parallel between the CAN high and low wires.

Temporary Backbone

If available, to determine who "owns" the problem, and after receiving the proper authorization from the OEM. Connecting a temporary backbone between the engine and the transmission can be used to identify the source of the concern.

NOTE: This procedure is not covered under Allison warranty and must be authorized and covered by the vehicle or engine OEM.

- The Data bus viewer option in Allison DOC™ For PC–Service Tool can be used to view different modules that may be located between the ninepin diagnostic connector and the engine ECM/PCM. By comparing which modules are still communicating on the data link often times an open condition can be tracked to a specific portion of the CAN2 data link (refer to Appendix SAE J1939 Message and Parameter Received Overview to determine proper message and parameter received).

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.
- When diagnosing for an intermittent open, massage the wiring harness while watching the test equipment for a change. It may be necessary to check for opens at individual wires within a harness to isolate an intermittent condition. Refer to Section 4, Wire Check Procedures.
- You may have to drive the vehicle on rough roads to determine if the problem occurs with vibration or under specific driving conditions, left or right hand turns, etc.
- 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.
- If this DTC is present in new vehicle, harsh shifting may occur due to adaptive (DNA) function inhibit.

Test Description

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

2. This step tests for throttle communication over the CAN data link.
3. This step inspects the CAN backbone harness for open conditions or engine ECM/PCM concern.
4. This step tests the CAN backbone harness for the proper resistance value.

DTC U0100 Lost Communication With ECM/PCM (CAN 2)

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. With Allison DOC™ connected, start the engine. 2. Select the CAN viewer option first then click the data monitor screen, move the CAN viewer down so both screens are viewable on Allison DOC™. 3. On the CAN viewer click on message EEC2 and expand to view accelerator pedal position. 4. Depress the throttle petal watching both screens for a valid throttle percentage. DTC U0100 indicates that the TCM is not receiving engine throttle or torque information (if enabled in calibration). This may indicate an open condition has occurred at the CAN bus wiring harness between the engine and TCM. ***NOTE: If no engine communication exists the data monitor screen value will be defaulted to a maximum of 64.5 percent at full throttle.*** Does the CAN viewer throttle message correspond with the data monitor reading?		*Go to Diagnostic Aids*	*Go to Step 3*

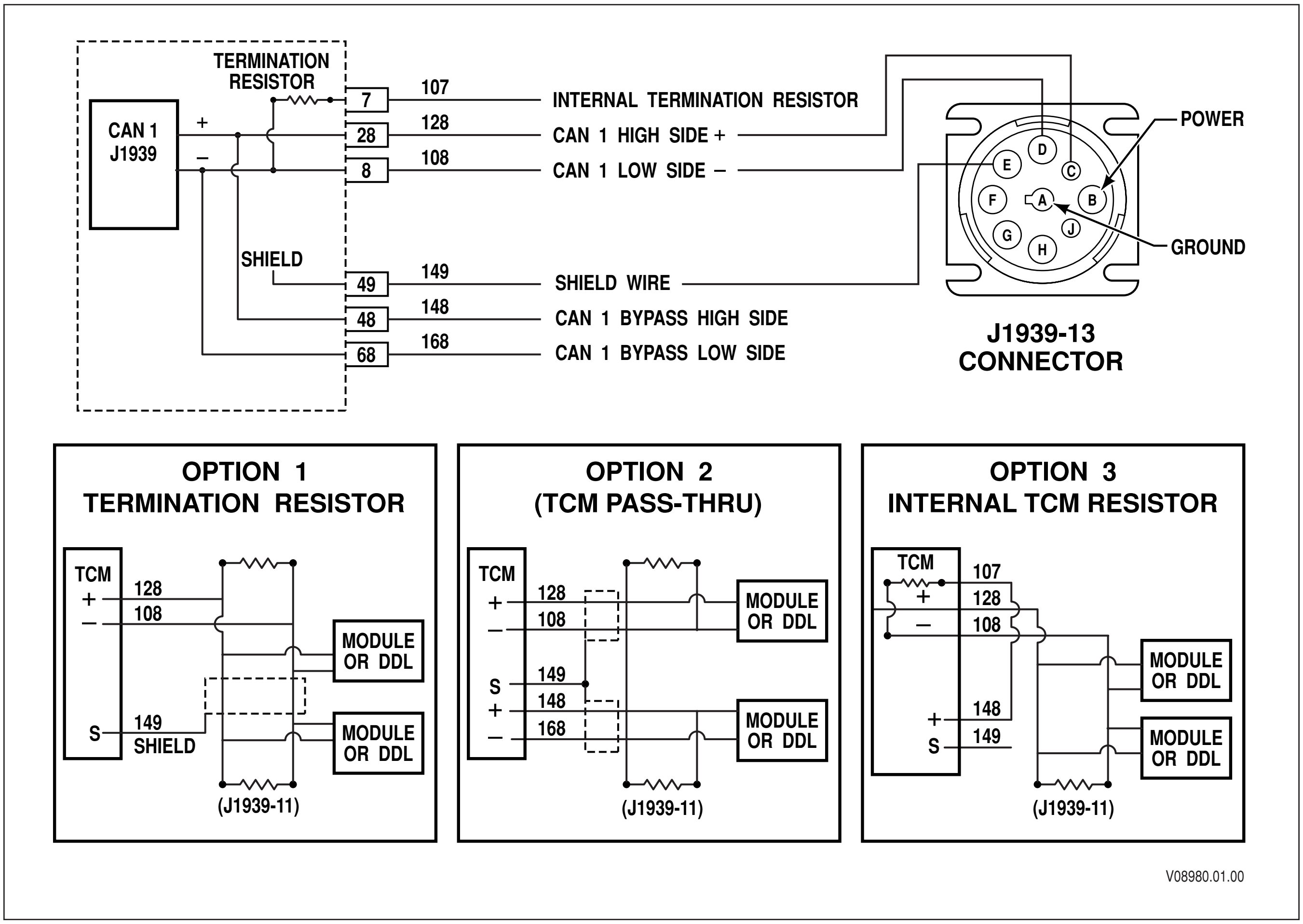
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0100 Lost Communication With ECM/PCM (CAN 2) *(cont'd)*

Step	Action	Value(s)	Yes	No
3	1. Inspect wires 106 (Positive), 127 (Negative), 167 (Shield) between the 9-pin diagnostic connector and the engine ECM/PCM. 2. Inspect for the following conditions: • Connector stubs not fully locked together at modules. • Terminals not fully locked in place in connector back shell. • chafing of insulation • Terminal damage • Signs of corrosion Was a wiring problem found?		*Go to Step 6*	*Go to Step 4*
4	Using a DMM measure resistance between pins 6 and 14 at the vehicle OBD II (J1962) diagnostic connector. Did the resistance match resistance match specified value?	60 Ohms	*Go to Step 7*	*Go to Step 5*
5	Return the vehicle to the OEM for repair. ***NOTE: A resistance reading other than 60 Ohms indicates that a terminating resistor is missing or a resistor with an improper value is installed. For proper communication there should be two 120 Ohm resistors wired in parallel in the CAN 2 backbone.*** Is the repair complete?		*Go to Step 9*	
6	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 9*	

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0115 Lost Communication With ECM/PCM (CAN 1)



Circuit Description

The Controller Area Network (CAN) defined by SAE J1939 allows the integration of various vehicle components into an overall vehicle system by providing a standard way of exchanging information between the various modules used in a vehicle. Use of a J1939 network, or data link, for on-vehicle communication reduces the amount of wiring in a vehicle, and allows the many different components and subsystems access to a wider range of information. Allison utilizes the J1939 communication link for vehicle operation controls, power train interaction, and conveying vehicle management information

There are two versions of J1939 currently in use on1000 and 2000 Product Families transmissions, version J1939-11, the most widely used, which incorporates a shield wire and J1939-15, which uses a two-wire connection without shielding.

For proper J1939 communication to occur there must be two terminating resistors included in the CAN backbone at the ends of the network, each of these resistors are 120 Ohms and placed in parallel between the high and low CAN wires. OEM’s have two options available for CAN wiring: (1) Two externally mounted 120 Ohm resistors. (2) One internal 120 Ohm resistor contained inside the TCM, to use this option a jump wire must be added between TCM pins 107 and 148 the other resistor can be either inside another module or externally mounted.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V (12V TCM) or greater than 18V or 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 U0115 is set when the TCM detects that no engine torque or throttle messages are being received on the Controller Area Network (CAN) backbone harness for 3 seconds or more.

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC U0115 is stored in the TCM history.
- TCM defaults to last used adaptive shift values and engine throttle percentage is calculated from torque converter slip speed.
- TCM inhibits shift adapts (DNA).

Conditions for clearing the DTC/CHECK TRANS Light

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 missing terminating resistor may cause this DTC to set; this often, will only allow limited Allison DOC™ For PC–Service Tool communication with the TCM.
- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 “T” Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 “T” Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC–Service Tool interface device at J 47276 “T” Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete “T” harness hook-up information).
- When Allison DOC™ For PC–Service Tool communication with the TCM can be established at the nine pin vehicle diagnostic connector and the U0115 is active, generally it points to an open connection at wires 108, 128, or 148 at the ECM/PCM or terminal in the wrong location at the engine ECM connector.
- Engine ECM/PCM parameters improperly set can cause this DTC to set.
- If DTC U0115 has recently become active shortly AFTER an engine update and the rest of the troubleshooting procedures for U0115 has been performed then see “Resetting of TCM Parameters to Support Engine Update” Section 3–7.
- Vehicles that use SEM/LRTP may set a DTC U0115 when engine performance complaints are present, this may include injector concerns that could allow an engine default to a “fail safe” mode. Some engine manufacturers may interrupt engine torque messaging, which will allow a DTC U0115 to set. Inspect the

DIAGNOSTIC TROUBLE CODES (DTC)

engine side for possible engine DTCs that may indicate this concern is present and correct before performing further troubleshooting on a DTC U0115.

- For proper data communications it is necessary to have two 120 Ohms resistors installed in parallel at the J 1939 CAN backbone harness ends, this can be done externally or internally at the control module or TCM depending on the OEM's configuration. The only way to determine the proper CAN configuration is to refer to specific vehicle wiring schematics from OEM.

  The CAN backbone harness can be configured in one of three different ways:

  1. Traditional Stub Interface, in this set-up the terminating resistors are located externally at the end stubs of the CAN backbone harness.
  2. Pass Through Interface, in this set-up the OEM can eliminate the TCM stub connection. This setup allows the CAN wiring to enter the TCM on one set of pins and continues out through a second set of pins, eliminating the TCM stub connector. Two terminating resistors are still located externally on the end stubs.
  3. Backbone termination, this set-up allows the elimination of one of the two external termination resistors. By the addition of a jumper wire between the TCM terminals 107 and 148 an internal TCM 120 Ohm resistor is wired in parallel between the CAN high and low wires.

Temporary Backbone

If available, to determine who "owns" the problem, and after receiving the proper authorization from the OEM. Connecting a temporary backbone between the engine and the transmission can be used to identify the source of the concern.

NOTE: This procedure is not covered under Allison warranty and must be authorized and covered by the vehicle or engine OEM.

- The Data bus viewer option in Allison DOC™ For PC–Service Tool can be used to view different modules that may be located between the ninepin diagnostic connector and the engine ECM/PCM. By comparing which modules are still communicating on the data link often times an open condition can be tracked to a specific portion of the CAN data link (refer to Appendix SAE J1939 Message and Parameter Received Overview to determine proper message and parameter received).
- 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 open, massage the wiring harness while watching the test equipment for a change. It may be necessary to check for opens at individual wires within a harness to isolate an intermittent condition (refer to Section 4, Wire Check Procedures).
- You may have to drive the vehicle on rough roads to determine if the problem occurs with vibration or under specific driving conditions, left or right hand turns, etc.
- 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.

DIAGNOSTIC TROUBLE CODES (DTC)

- Intermittent cycling of the TCC could indicate a J1939 wiring problem exists. It is possible to have an open condition at the CAN backbone harness allowing TCC to cycle without an U0115 setting. For an U0115 to set, an open condition needs to be present for 3 seconds.
- If this DTC is present in new vehicle, harsh shifting may occur due to adaptive (DNA) function inhibit.

Test Description

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

2. This step tests for throttle communication over the CAN data link.
3. This step inspects the CAN backbone harness for open conditions or engine ECM/PCM concern.
4. This step tests the CAN backbone harness for the proper resistance value.

DTC U0115 Lost Communication With ECM/PCM (CAN 1)

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. With Allison DOC™ connected, start the engine. 2. Select the CAN viewer option first then click the data monitor screen, move the CAN viewer down so both screens are viewable on Allison DOC™. 3. On the CAN viewer click on message EEC2 and expand to view accelerator pedal position. 4. Depress the throttle petal watching both screens for a valid throttle percentage. DTC U0115 indicates that the TCM is not receiving engine throttle or torque information. This may indicate an open condition has occurred at the CAN bus wiring harness between the engine and TCM. ***NOTE: If no engine communication exists the data monitor screen value will be defaulted to a maximum of 64.5 percent at full throttle.*** Does the CAN viewer throttle message correspond with the data monitor reading?		*Go to Diagnostic Aids*	*Go to Step 3*
3	1. Inspect wires 128 (Positive), 108 (Negative), 149 (Shield) between the nine pin diagnostic connector and the engine ECM/PCM. 2. Inspect for the following conditions: • Connector stubs not fully locked together at modules • Terminals not fully locked in place in connector back shell • Chafing of insulation • Terminal damage • Signs of corrosion Was a wiring problem found?		*Go to Step 6*	*Go to Step 4*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0115 Lost Communication With ECM/PCM (CAN 1) *(cont'd)*

Step	Action	Value(s)	Yes	No
4	Using a DMM 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 7*	*Go to Step 5*
5	Return the vehicle to the OEM for repair. ***NOTE: A resistance reading other than 60 Ohm indicates that a terminating resistor is missing or a resistor with an improper value is installed. For proper communication there should be two 120 Ohm resistors wired in parallel in the J1939 CAN.*** Is the repair complete?		*Go to Step 9*	
6	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 9*	
7	Return the vehicle to OEM for inspection of the following: 1. Confirm that the engine ECM is properly set to broadcast J1939 messages. 2. Improper pin location at the engine ECM. 3. Defective engine ECM. Is the repair complete?		*Go to Step 9*	
8	Replace the TCM with a known good module. Check for proper vehicle operation, if this repairs the condition; reinstall the original TCM to verify DTC returns. Install a new TCM if concern is eliminated. Is replacement complete?		*Go to Step 9*	
9	In order to verify your repair: 1. Establish communication with Allison DOC™, clear DTC. 2. Check Allison DOC™ test passed section to make sure the diagnostic test was run. Did the DTC return?		*Go to Step 8*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0400 Invalid J1939 Communications

Circuit Description

The Controller Area Network (CAN) defined by SAE J1939 allows the integration of various vehicle components into an overall vehicle system by providing a standard way of exchanging information between the various modules used in a vehicle. Use of a J1939 network, or data link, for on-vehicle communication reduces the amount of wiring in a vehicle, and allows the many different components and subsystems access to a wider range of information. Allison uses the J1939 communication link for vehicle operation controls, power train interaction, and conveying vehicle management information.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V for 12V TCM or greater than 18V or less than 32V for 24V TCM.
- Engine speed is greater than 200 rpm and less than 7500 rpm for 5 seconds.
- J1939 brake switch message is available.

Conditions for Setting the DTC

DTC U0400 is set when the TCM detects a defaulted J1939 brake switch status because of error, not available or time out.

Actions taken when the DTC Sets

- The **CHECK TRANS** light is illuminated
- DTC U0400 is stored in the TCM history.

Conditions for clearing the DTC/CHECK TRANS Light

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

- This code will set if the Controller Area Network (CAN) is not communicating with the TCM.
- In Emergency Vehicle Series applications, when J1939 brake switch reception indicates “Error” or “Not Available”, or is lost for any reason, the TCM will assume the brake pedal is depressed and will allow the transmission to go into range. The TCM response will be to set a U0400 and illuminate the **CHECK TRANS** light.

DTC U0400 Invalid J1939 Communications

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0400 Invalid J1939 Communications *(cont'd)*

Step	Action	Value(s)	Yes	No
2	1. With the Allison DOC™ connected, start the engine. 2. Select the Allison DOC™ CAN Bus Viewer option. 3. On the Allison DOC™ CAN Bus Viewer click on message EBC1 and/or CCVS and expand to view brake switch status. 4. Depress the brake petal while watching brake switch status. ***NOTE: DTC U0400 indicates that the TCM is not receiving a proper brake switch response via J1939 (if enabled in calibration). This may indicate a controller concern with the module sending this brake status message.*** Does the Allison DOC™ CAN Bus Viewer brake switch status indicate the proper ON and OFF status when the service brake is applied?		*Go to Diagnostic Aids*	*Go to Step 3*
3	Does the Allison DOC™ CAN Bus Viewer indicate the brake switch status as: **ERROR** or **NOT AVAILABLE**?		*Go to Step 4*	
4	Determine the source address of the module sending the brake switch status to the TCM. This address will be indicated on the Allison DOC™ CAN Data Bus Viewer next to the message/parameter showing the brake switch status. Example—for MY "08" message CCVS, the possible addresses are: • 00 Engine Controller • 17 Cruise Control • 23 Instrument Cluster • 33 Body Controller • 49 Cab Controller • 232 Forward Road Image Processor If message EBC1 is used: • 11 Brakes System Controller Was the source address of the controller determined?		*Go to Step 5*	
5	Return the vehicle to OEM dealer and inform the OEM dealer of the source address of the offending controller and the brake switch message received. Is the repair complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Clear the DTC. 2. Confirm with Allison DOC™ 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 U0442 Invalid Data Received from ECM/PCM B (CAN1/J1939)

Circuit Description

The Controller Area Network (CAN) defined by SAE J1939 allows the integration of various vehicle components into an overall vehicle system by providing a standard way of exchanging information between the various modules used in a vehicle. Use of a J1939 network, or data link, for on-vehicle communication reduces the amount of wiring in a vehicle, and allows the many different components and subsystems access to a wider range of information. Allison uses the J1939 communication link for vehicle operation controls, power train interaction, and conveying vehicle management information.

Conditions for Running the DTC

- Components are powered and the ignition voltage is greater than 9V and less than 18V for 12V TCM or greater than 18V or less than 32V for 24V TCM.
- J1939 EC1 engine controller message is available.

Conditions for Setting the DTC

DTC U0442 is set when engine temperature is above 60°C and the TCM has learned initial engine torque and power limits, then broadcasted max torque indicates a value under 135.6 lb ft (100 N·m) of previous learned max values or max peak power values are 38 Kw under previous learned max power values.

Actions taken when the DTC Sets

- The **CHECK TRANS** light is not illuminated
- DTC U0442 is stored in the TCM history.
- Substitute percent load for throttle pedal and/or adjust shift schedule.

Conditions for clearing the DTC/CHECK TRANS Light

Allison DOC™ 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

Since this DTC did not return, the engine conditions that were previously present have not been reproduced. To verify engine concern return vehicle to OEM to check for historic engine DTCs that may indicate if de-rate was due to overtemp condition or engine component failure.

Test Description

2. This step checks if the DTC is active.

DTC U0442 Invalid Data Received from ECM/PCM B (CAN1/J1939)

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*

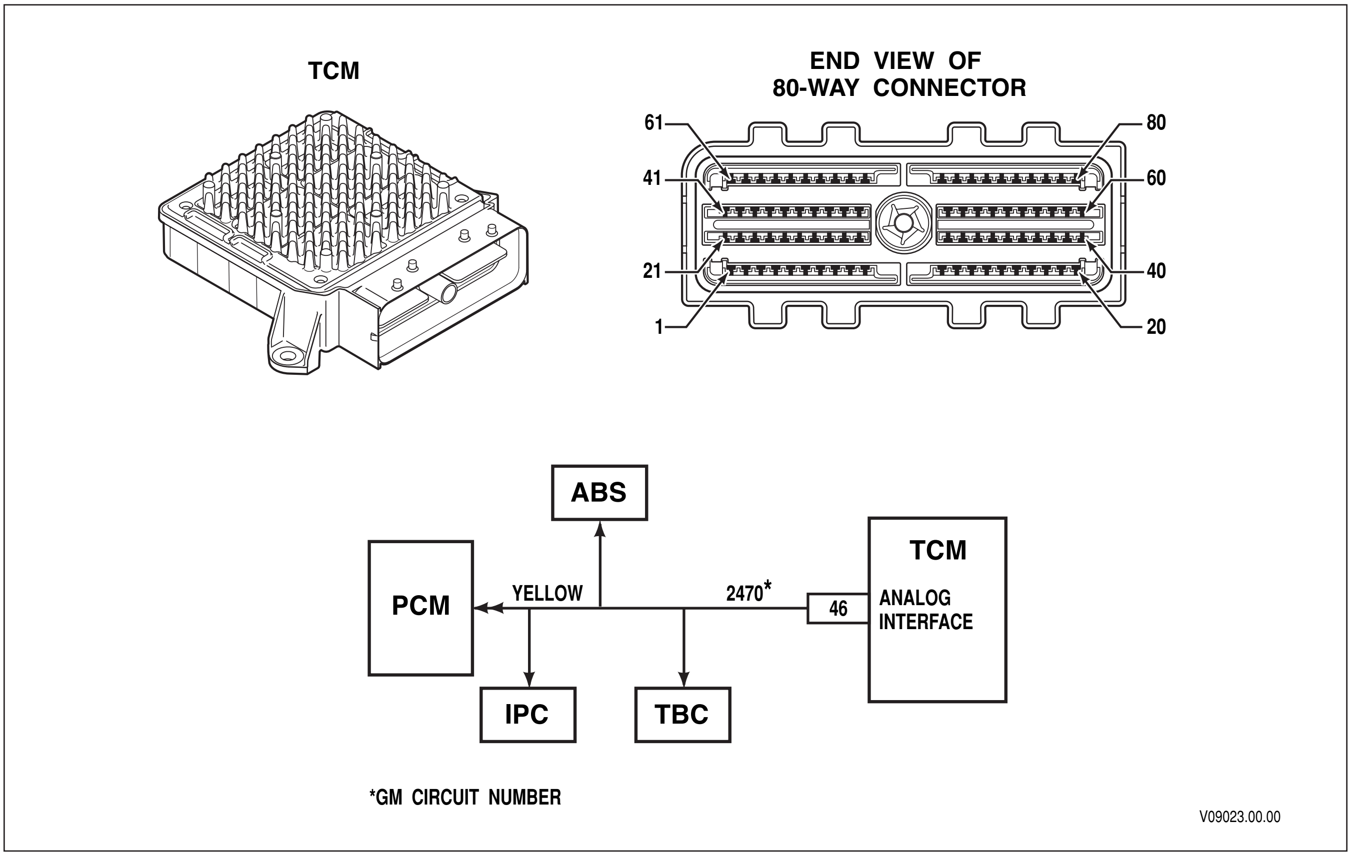
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U0442 Invalid Data Received from ECM/PCM B (CAN1/J1939)

Step	Action	Value(s)	Yes	No
2	1. With the Allison DOC™ connected, start the engine. 2. Clear the DTC and drive vehicle to see if DTC returns. ***NOTE: DTC U0442 indicates that the TCM is receiving a reduced engine torque curve when compared with previously broadcasted values (if enabled in calibration). This indicates an engine concern has de-rated engine torque and/or power to prevent engine damage.*** Did DTC U0442 return?		*Go to Step 3*	*Go to Diagnostic Aids*
3	DTC U0442 indicates that the engine controller has reduced engine torque and power output to prevent engine damage. When this DTC is active, this indicates that an engine concern is still present and the vehicle must be returned to the OEM for troubleshooting. Did the OEM repair the engine concern?		*Go to Step 4*	
4	In order to verify your repair: 1. Clear the DTC. 2. Confirm with Allison DOC™ 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 U1016 Class 2 Powertrain Controller State of Health Failure



Circuit Description

Applications that employ J1850 class 2 serial communication use wire 46 to send operational information and commands among the various control modules. Included modules would be Powertrain Control Module (PCM), Antilock Brake System Controller (ABS), and Truck Body Controller (TBC), and Instrument Panel Controller (IPC). Each controller sends out a state of health (SOH) message about once every second. The TCM uses these SOH messages to monitor the condition of the devices on the class 2 serial link.

Conditions for Running the DTC

Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.

Conditions for Setting the DTC

DTC is set when the TCM has not received a state of the health message from the device expected to communicate at start up, for a period over 2 seconds.

DIAGNOSTIC TROUBLE CODES (DTC)

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC is stored in the TCM history.
- TCM freezes shift adapts.

Conditions for clearing the DTC/CHECK TRANS Light

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

- An intermittent open between a module and the connector mode may cause this DTC to set.
- A poor connection at a module or the connector node may cause the DTC to set.
- An intermittent open in a connector node may cause this DTC to set.
- An open voltage or ground circuit to a module may cause the DTC to set.
- An internal module malfunction may cause this DTC to set.
- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 "T" Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 "T" Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC–Service Tool interface device at J 47276 "T" Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete "T" harness hook-up information).

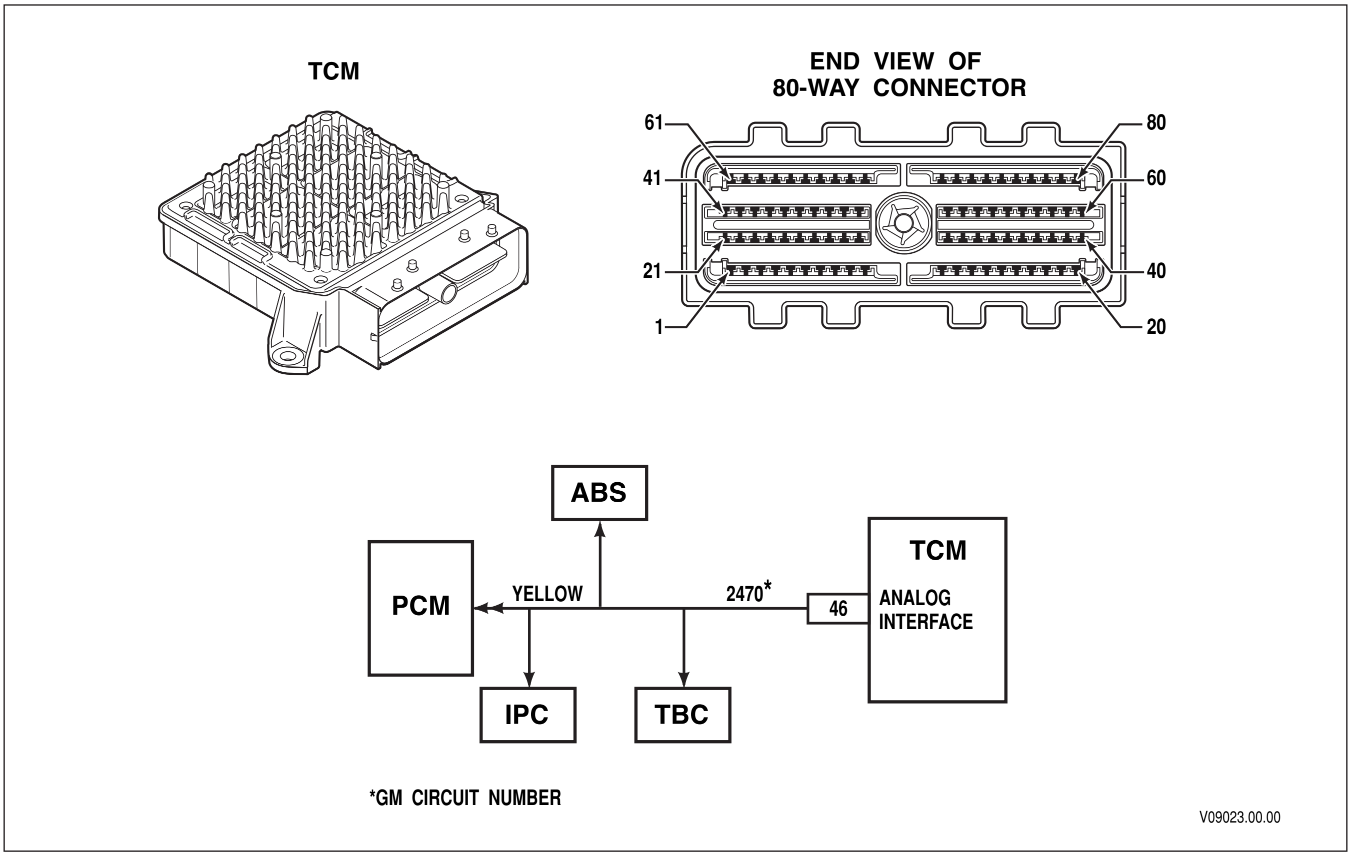
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U1016 Class 2 Powertrain Controller State of Health Failure

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Test the following circuits of the module for an open or a short-to-ground: 1. The battery positive (fuses) and ground connections at the module. 2. The ignition positive (fuses) and ground connections. ***NOTE: The DTC set indicates the module for which the state health message was not detected by the TCM for a period of time exceeding 2 seconds. This may indicate an open wire leading to module, or a defective module.*** Did you find and correct the condition?		*Go to Step 6*	*Go to Step 3*
3	Inspect for opens at the connector and the wire connecting the Module to the TCM (wire 146). Did you find a problem?		*Go to Step 4*	*Go to Step 5*
4	Repair the module class 2 wiring harness connection. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs.*** Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty. Is the repair complete?		*Go to Step 6*	
5	Refer to troubleshooting procedures specific to the Controller Module indicated. Replace if defective, is replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Clear the DTC. 2. Confirm with Allison DOC™ 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 U1041 Class 2 Anti-lock Brake Controller (ABS) State of Health



Circuit Description

Applications that employ J1850 class 2 serial communication use wire 46 to send operational information and commands among the various control modules. Included modules would be Powertrain Control Module (PCM), Antilock Brake System Controller (ABS), Truck Body Controller (TBC), and Instrument Panel Controller (IPC). Each controller sends out a state of health (SOH) message about once every second. The TCM uses these SOH messages to monitor the condition of the devices on the class 2 serial link.

Conditions for Running the DTC

Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.

Conditions for Setting the DTC

DTC is set when the TCM has not received a state of the health message from the device expected to communicate at start up, for a period over 2 seconds.

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC is stored in the TCM history.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for clearing the DTC/CHECK TRANS Light

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

- An intermittent open between a module and the connector mode may cause this DTC to set.
- A poor connection at a module or the connector node may cause the DTC to set.
- An intermittent open in a connector node may cause this DTC to set.
- An open voltage or ground circuit to a module may cause the DTC to set.
- An internal module malfunction may cause this DTC to set.
- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 “T” Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 “T” Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC–Service Tool interface device at J 47276 “T” Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete “T” harness hook-up information).

DTC U1041 Class 2 Anti-lock Brake Controller (ABS) State of Health

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Test the following circuits of the module for an open or a short-to-ground: 1. The battery positive (fuses) and ground connections at the module. 2. The ignition positive (fuses) and ground connections. ***NOTE: The DTC set indicates the module for which the state health message was not detected by the TCM for a period of time exceeding 2 seconds. This may indicate an open wire leading to module, or a defective module.*** Did you find and correct the condition?		*Go to Step 6*	*Go to Step 3*
3	Inspect for opens at the connector and the wire connecting the Module to the TCM (wire 146). Did you find a problem?		*Go to Step 4*	*Go to Step 5*

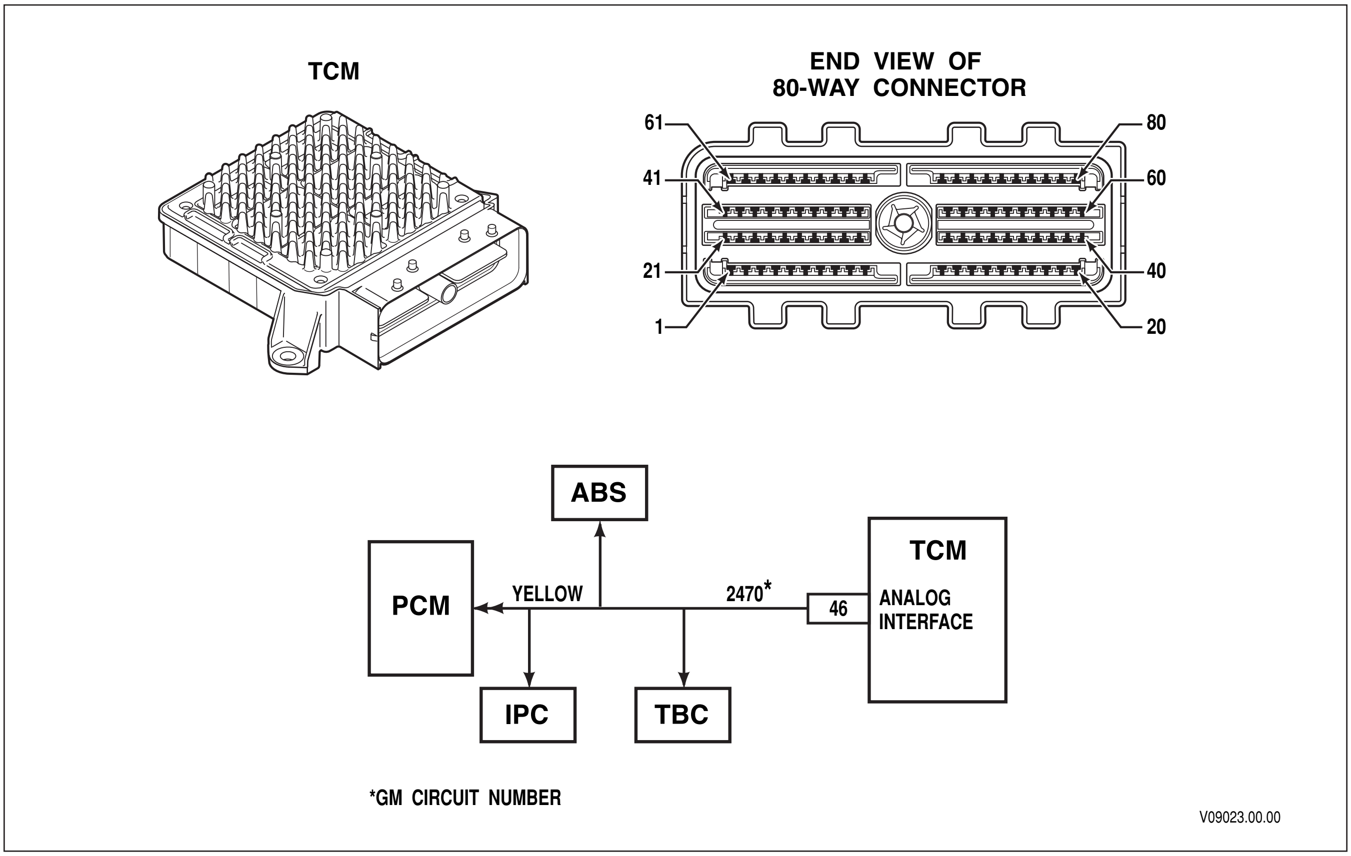
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U1041 Class 2 Anti-lock Brake Controller (ABS) State of Health *(cont'd)*

Step	Action	Value(s)	Yes	No
4	Repair the module class 2 wiring harness connection. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs.*** Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty. Is the repair complete?		*Go to Step 6*	
5	Refer to troubleshooting procedures specific to the Controller Module indicated. Replace if defective, is replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Clear the DTC. 2. Confirm with Allison DOC™ 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 U1064 Class 2 Truck Body Controller (TBC) State of Health



Circuit Description

Applications that employ J1850 class 2 serial communication use wire 46 to send operational information and commands among the various control modules. Included modules would be Powertrain Control Module (PCM), Antilock Brake System Controller (ABS), Truck Body Controller (TBC), and Instrument Panel Controller (IPC). Each controller sends out a state of health (SOH) message about once every second. The TCM uses these SOH messages to monitor the condition of the devices on the class 2 serial link.

Conditions for Running the DTC

Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.

Conditions for Setting the DTC

DTC is set when the TCM has not received a state of the health message from the device expected to communicate at start-up, for a period over 2 seconds.

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC is stored in the TCM history.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for clearing the DTC/CHECK TRANS Light

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

- An intermittent open between a module and the connector mode may cause this DTC to set.
- A poor connection at a module or the connector node may cause the DTC to set.
- An intermittent open in a connector node may cause this DTC to set.
- An open voltage or ground circuit to a module may cause the DTC to set.
- An internal module malfunction may cause this DTC to set.
- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 "T" Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 "T" Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC–Service Tool interface device at J 47276 "T" Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete "T" harness hook-up information).

DTC U1064 Class 2 Truck Body Controller (TBC) State of Health

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Test the following circuits of the module for an open or a short-to-ground: 1. The battery positive (fuses) and ground connections at the module. 2. The ignition positive (fuses) and ground connections. ***NOTE: The DTC set indicates the module for which the state health message was not detected by the TCM for a period of time exceeding 2 seconds. This may indicate an open wire leading to module, or a defective module.*** Did you find and correct the condition?		*Go to Step 6*	*Go to Step 3*
3	Inspect for opens at the connector and the wire connecting the Module to the TCM (wire 146). Did you find a problem?		*Go to Step 4*	*Go to Step 5*

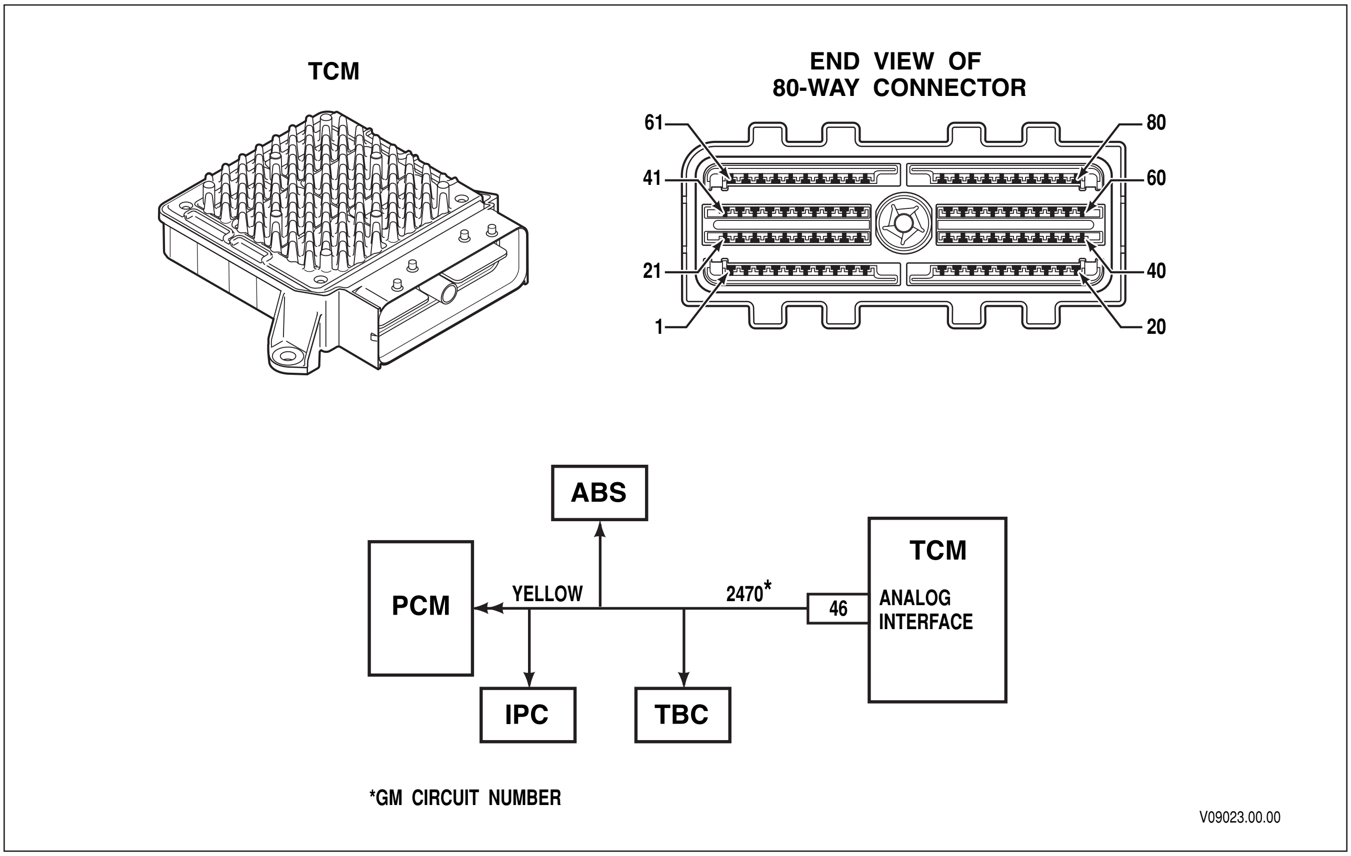
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U1064 Class 2 Truck Body Controller (TBC) State of Health *(cont'd)*

Step	Action	Value(s)	Yes	No
4	Repair the module class 2 wiring harness connection. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs.*** Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty. Is the repair complete?		*Go to Step 6*	
5	Refer to troubleshooting procedures specific to the Controller Module indicated. Replace if defective, is replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Clear the DTC. 2. Confirm with Allison DOC™ 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 U1096 Class 2 Instrument Panel Controller (IPC) State of Health



Circuit Description

Applications that employ J1850 class 2 serial communication use wire 46 to send operational information and commands among the various control modules. Included modules would be Powertrain Control Module (PCM), Antilock Brake System Controller (ABS), Truck Body Controller (TBC), and Instrument Panel Controller (IPC). Each controller sends out a state of health (SOH) message about once every second. The TCM uses these SOH messages to monitor the condition of the devices on the class 2 serial link.

Conditions for Running the DTC

Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.

Conditions for Setting the DTC

DTC is set when the TCM has not received a state of the health message from the device expected to communicate at start up, for a period over 2 seconds.

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC is stored in the TCM history.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for clearing the DTC/CHECK TRANS Light

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

- An intermittent open between a module and the connector mode may cause this DTC to set.
- A poor connection at a module or the connector node may cause the DTC to set.
- An intermittent open in a connector node may cause this DTC to set.
- An open voltage or ground circuit to a module may cause the DTC to set.
- An internal module malfunction may cause this DTC to set.
- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 "T" Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 "T" Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC–Service Tool interface device at J 47276 "T" Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete "T" harness hook-up information).

DTC U1096 Class 2 Instrument Panel Controller (IPC) State of Health

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	Test the following circuits of the module for an open or a short-to-ground: 1. The battery positive (fuses) and ground connections at the module. 2. The ignition positive (fuses) and ground connections. ***NOTE: The DTC set indicates the module for which the state health message was not detected by the TCM for a period of time exceeding 2 seconds. This may indicate an open wire leading to module, or a defective module.*** Did you find and correct the condition?		*Go to Step 6*	*Go to Step 3*
3	Inspect for opens at the connector and the wire connecting the Module to the TCM (wire 146). Did you find a problem?		*Go to Step 4*	*Go to Step 5*

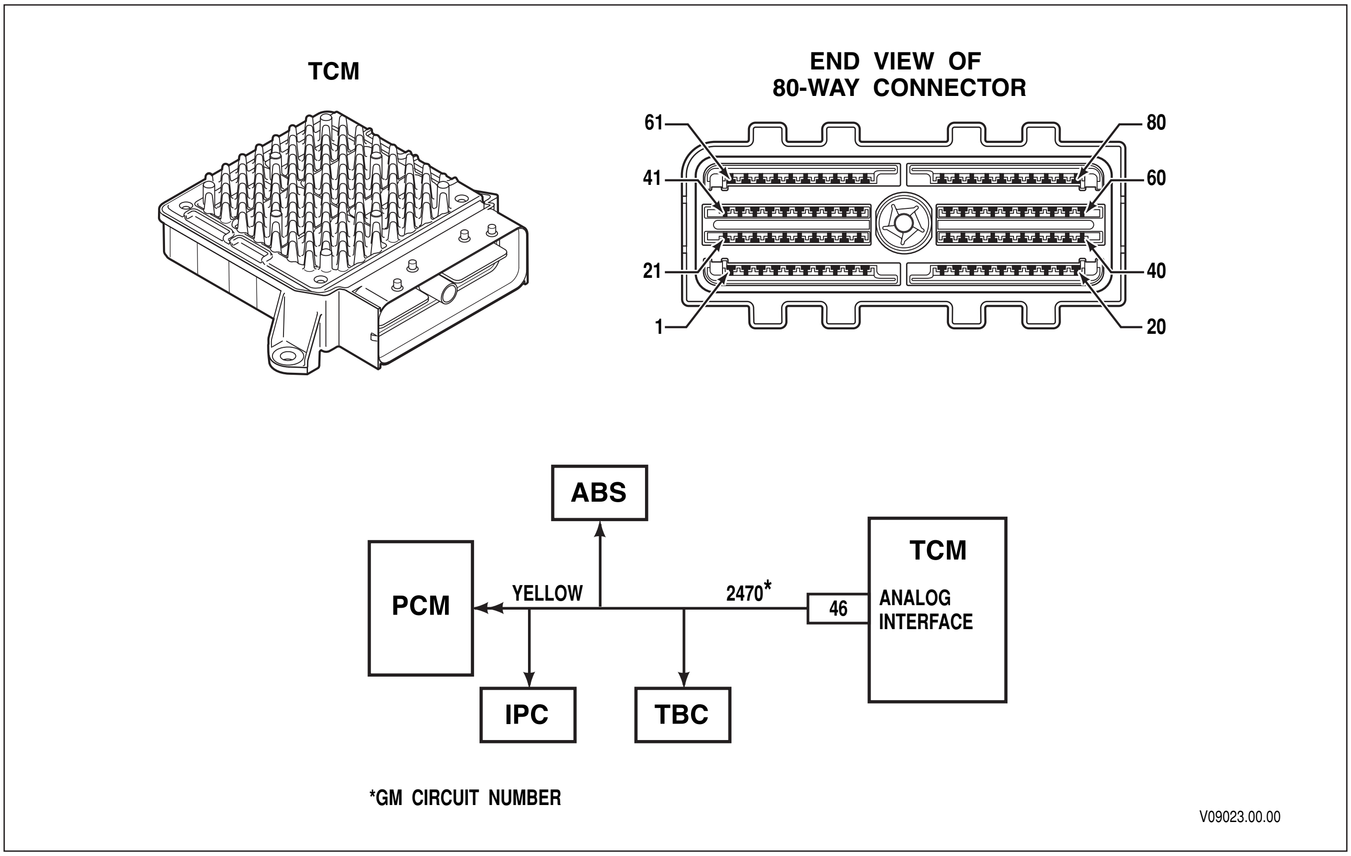
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U1096 Class 2 Instrument Panel Controller (IPC) State of Health *(cont'd)*

Step	Action	Value(s)	Yes	No
4	Repair the module class 2 wiring harness connection. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs.*** Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty. Is the repair complete?		*Go to Step 6*	
5	Refer to troubleshooting procedures specific to the Controller Module indicated. Replace if defective, is replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Clear the DTC. 2. Confirm with Allison DOC™ 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 U1300 Serial Data Communication Link Low (Class 2)



Circuit Description

Applications that employ J1850 class 2 serial communication use wire 146 (pin 46) to send operational information and commands among the various control modules.

Conditions for Running the DTC

Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.

Conditions for Setting the DTC

DTC U1300 is set when low voltage is detected on the class 2 data circuit for more than a period of 3 seconds. This would normally indicate a short-to-ground at wire 146.

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC U1300 is stored in the TCM history.
- TCM uses default values for missing/erroneous information.
- The TCM freezes shift adapts.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for clearing the DTC/CHECK TRANS Light

- 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 self clears this DTC when software detects a failure recovery has occurred.

Diagnostic Aids

- If communication can be established with Allison DOC™ For PC–Service Tool at the OBD II connector, then the U1300 should be shown in failure records only. This may indicate that an intermittent short-to-ground was present at one time (refer to Appendix A, Identification of Potential Circuit Problems).
- It is not possible to communicate with J1850 with this DTC active.
- Using the J 47276 "T" Breakout and TCM Reflashing Harness to communicate with the TCM will allow a technician to determine if the U1300 is still active.
- U1300 in failure records may be present along with an U1016-U1096 that is active. This would indicate that the malfunction occurred when the ignition was on.
- This DTC indicates that voltage is low at wire 146, normally this is an indication that a short-to-ground exists at wire 146. Inspect wire 146 for this condition.
- Inspect wire 146 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 this DTC is active an engine no-start condition may exist. Class 2 messages will not be sent to enable the fuel pump and starter.
- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 "T" Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 "T" Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC–Service Tool interface device at J 47276 "T" Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete "T" harness hook-up information).

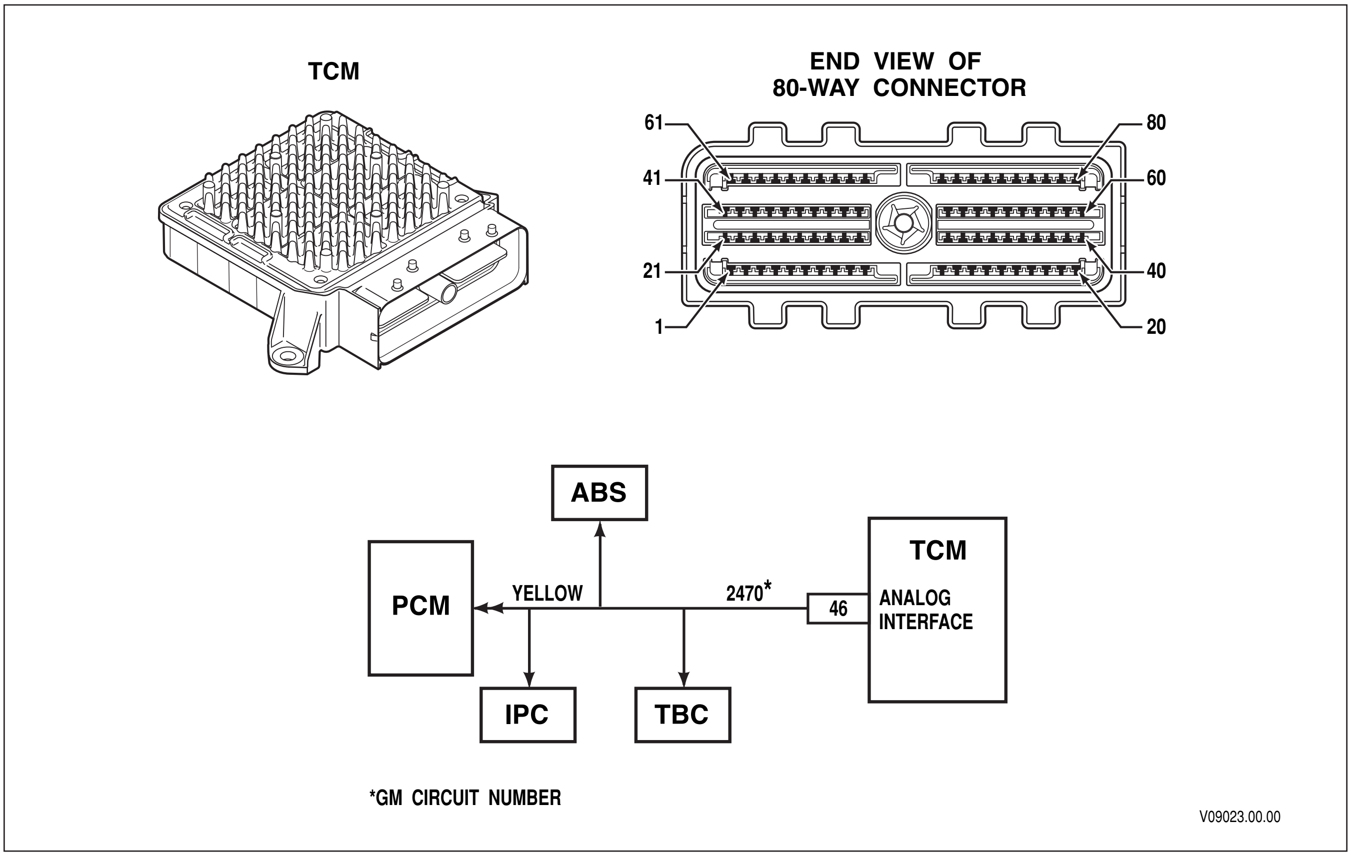
DIAGNOSTIC TROUBLE CODES (DTC)

DTC U1300 Serial Data Communication Link Low (Class 2)

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition with the engine OFF. 3. Verify data is being communicated to the TCM via J1850 using Allison DOC™. ***NOTE: U1300 is set when low voltage is detected on the J1850 serial communication link by the TCM for a period of time exceeding 3 seconds. This may indicate a short-to-ground exists at wire 146.*** Is engine data communicated to Allison DOC™?		*Go to Diagnostic Aids*	*Go to Step 3*
3	Inspect wire 146 for a possible short-to-ground. Did you find a problem?		*Go to Step 4*	*Go to Step 5*
4	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs. Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty.*** Is the repair complete?		*Go to Step 6*	
5	1. Substitute TCM with a known good unit. 2. Check for proper communication. If this repairs the condition, reinstall the “defective” TCM to verify the TCM failure. Then install a new TCM. Is replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Connect Allison DOC™. 2. Clear the DTC. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U1301 Serial Data Communication Link High (Class 2)



Circuit Description

Applications that employ J1850 class 2 serial communication use wire 146 (pin 46) to send operational information and commands among the various control modules.

Conditions for Running the DTC

Components are powered and the ignition voltage is greater than 9V and less than 18V or greater than 18V or less than 32V.

Conditions for Setting the DTC

DTC U1301 is set when high voltage is detected on the class 2 data circuit for more than a period of 3 seconds. (This would normally indicate a short-to-power at wire 146.)

Actions taken when the DTC Sets

- The TCM does not illuminate the **CHECK TRANS** light (Non-OBD II Strategy).
- The TCM does not illuminate the MIL (OBD II Strategy).
- DTC U1301 is stored in the TCM history.
- TCM uses default values for missing/erroneous information.
- The TCM freezes shift adapts.

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for clearing the DTC/CHECK TRANS Light

- 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 self clears this DTC when software detects a failure recovery has occurred.

Diagnostic Aids

If communication can be established with Allison DOC™ For PC–Service Tool at the OBD II connector, then the U1301 should be shown in failure records only. This may indicate that an intermittent short-to-power was present at one time (refer to Appendix A, Identification of Potential Circuit Problems).

- It is not possible to communicate with J1850 with this DTC active.
- Using the J 47276 “T” Breakout and TCM Reflashing Harness to communicate with the TCM will allow a technician to determine if the U1301 is still active.
- U1301 in failure records may be present along with an U1016–U1064 that is active. This would indicate that the malfunction occurred when the ignition was on.
- This DTC indicates that voltage is high at wire 146, normally this is an indication that a short-to-power exists at wire 146. Inspect wire 146 for this condition.
- Inspect wire 146 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 this DTC is active an engine no-start condition may exist. Class 2 messages will not be sent to enable the fuel pump and starter.
- If only intermittent communication is possible at the 9-pin vehicle diagnostic connector, install J 47276 “T” Breakout and TCM Reflashing Harness at the TCM 80-way connector (do not reconnect vehicle harness 80-way harness).
  - Connect J 42455 load box at J 47276 “T” Breakout and TCM Reflashing Harness 37-pin AMP connector.
  - Supply 12V at J 42455 load box to power up the TCM.
  - Connect Allison DOC™ For PC–Service Tool interface device at J 47276 “T” Breakout and TCM Reflashing Harness 9-pin connector.

  This setup allows communication directly to TCM. If no communication is available replace the TCM with a known good module. Test again (refer to Section 5 for complete “T” harness hook-up information).

DIAGNOSTIC TROUBLE CODES (DTC)

DTC U1301 Serial Data Communication Link High (Class 2)

Step	Action	Value(s)	Yes	No
1	Was the Beginning the Troubleshooting Process (refer to Section 5–4) performed?		*Go to Step 2*	*Go to Beginning The Troubleshooting Process (Section 5–4)*
2	1. Install Allison DOC™. 2. Turn ON the ignition with the engine OFF. 3. Verify data is being communicated to the TCM via J1850 using Allison DOC™. ***NOTE: U1301 is set when high voltage is detected on the J1850 serial communication link by the TCM for a period of time exceeding 3 seconds. This may indicate a short-to-power exists at wire 146.*** Is engine data communicated to Allison DOC™?		*Go to Diagnostic Aids*	*Go to Step 3*
3	Inspect wire 146 for a possible short-to-power. Did you find a problem?		*Go to Step 4*	*Go to Step 5*
4	Repair the vehicle wiring harness. ***NOTE: The vehicle OEM has responsibility for all external wiring harness repairs.*** Harness repairs performed by Allison Transmission distributors and dealers are not covered under Allison Transmission warranty. Is the repair complete?		*Go to Step 6*	
5	Substitute TCM with a known good unit. Check for proper communication. If this repairs the condition, reinstall the “defective” TCM to verify the TCM failure. Then install a new TCM. Is replacement complete?		*Go to Step 6*	
6	In order to verify your repair: 1. Connect Allison DOC™. 2. Clear the DTC. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

SECTION 6—INPUT AND OUTPUT FUNCTIONS

6–1. SPECIAL INPUT AND OUTPUT FUNCTIONS

Each transmission control system provides additional functional control of transmission and/or vehicle operations tailored to the expected duty of the vehicle. Specific vocational requirements can be satisfied using input and output functions. Although these features may be used independently to control the function of the TCM, they can be combined to provide more comprehensive vehicle control functions. An example of the combined use of input and output functions is the combination of control signals which automatically commands the transmission to neutral when a PTO is operated.

NOTE: Wiring diagrams for input and output functions are shown in Appendix N.

A. Input Functions

Input functions are control signals that send vehicle data to the TCM to designate the operating state of other vehicle systems. “Ground input” control wires activate the programmed function when the input wire is switched to an isolated circuit ground. “Power input” control wires activate the programmed function when the input wire is switched to 12V or 24V power, or a signal can be sent via the J1939 communication link. Typical input functions are:

- Secondary Shift Schedule
- PTO Enable
- Auxiliary Function Range Inhibit
- Engine Brake Enable and Preselect Request
- Automatic Neutral—Single Input
- Reverse Enable
- Anti-lock Brake Response
- Service Brake Status
- Kickdown
- Refuse Packer Step Switch
- Overdrive Disable
- 3rd Lockup Pump Mode
- Transfer Case Low
- Grade Braking Enable
- Crank Input

B. Output Functions

Output function signals send data from the TCM for use in controlling the operation of non-transmission components. As determined by programmed logic or attainment of preselected conditions, the TCM activates the appropriate output control wire (the circuit goes from OPEN to GROUND). This energizes a customer-supplied relay or switch to complete the external vehicle circuit. A J1939 message can be used as an alternative to actuate certain output functions.

The output functions may be turned on and off based on the state of the input function signals and the operating state of the transmission. Typical output functions are:

- Engine Brake Enable
- Sump/Retarder Temperature Indicator
- Range Indicator
- Output Speed Indicator A
- Output Speed Indicator B
- PTO Enable
- Lockup Indicator
- Trailering Mode Indicator
- Overdrive Disable Indicator

INPUT AND OUTPUT FUNCTIONS

Table 6–1. I/O Packages and Wire Numbers

			1000 and 2000 Product Families Transmissions (Vocation Package Number)					
		Normally Activated?	Highway Series/ Pupil Transport Series (350)	Bus Series/ Emergency Vehicle Series/ Motorhome Series (351)	European Trucks (352)	European Buses (353)	European Refuse Packer (357)	Emergency Vehicle Series/ Rugged Duty Series/ Specialty Series (360)
Input Functions								
A	Secondary Shift Schedule	Yes	142	142	142	142	142	142
C	PTO Enable	Yes		143	143		143	143
E	Aux. Function Range Inhibit (Std)	No	101	101	101	101		
H	Eng. Brake Enable and Preselect Request (Std)	Yes	102	102				102
I	Eng. Brake Enable and Preselect Request (Std)	No			102	102	102	
L	Automatic Neutral—Single Input	No	123	123	123	123	123	
V	Reverse Enable	No				143		
Y	Anti-lock Brake Response	Yes	121	121	121	121	121	121
AA	Service Brake Status (Not used)	Yes	162	162	162	162	162	162
AH	Kickdown	Yes			122	122	122	122
AM	Refuse Packer Step Switch	Yes					123	
AR	Overdrive Disable	Yes	161	161	161	161	161	161
BQ	3rd Lockup Pump Mode	No						122/123
BR	Transfer Case Low	Yes						
BS	Grade Braking Enable	Yes						
BT	Crank Input							
Output Functions								
A	Engine Brake Enable	Yes			102	102	102	
B	Sump/Retarder Temperature Indicator	Yes	164	164	164	164	164	164
C	Range Indicator	Yes	123	123	123	123	123	
D	Output Speed Indicator A	Yes	105	105	105	105	105	105
E	Output Speed Indicator B	Yes						
G	PTO Enable	Yes		143	143		143	143
K	Lockup Indicator	Yes						
N	Trailering Mode Indicator	Yes						
X	Overdrive Disable Indicator	Yes						

SECTION 7—GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

7–1. GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

IMPORTANT:

Make the following general checks before beginning specific troubleshooting, removing the transmission, or removing attached components.

- Are there active DTCs?
- Is the shift selector lever in **N** (Neutral), **P** (Park), or **PB** (Park Brake Apply) 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?

After making these general checks use the various sections of this manual to isolate the listed problems. The following charts address specific vehicle complaints. Some complaints involve DTCs, so all troubleshooting checks should involve checking the system for DTCs.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints

Problem	Possible Cause	Suggested Remedy
VEHICLE WILL NOT START—ENGINE WILL NOT CRANK	Lever shift selector not in **N** (Neutral) or **P** (Park) or **PB** (Park Brake Apply)*	Select **N** (Neutral) and restart
	Dead battery	Recharge battery
	Disconnected battery*	Reconnect battery
	Faulty starter circuit	Repair vehicle starter circuit
	Faulty Internal Mode Switch (IMS)*	Replace IMS (refer to Mechanic's Tips)
	Misadjusted switch linkage*	Adjust linkage properly (refer to Mechanic's Tips)
	Faulty wiring in vehicle neutral start circuit or relay (OEM-supplied)*	Repair wiring or relay
	Connectors not properly seated on IMS*	Properly install connector
CHECK TRANS LIGHT WILL NOT GO OUT AT START-UP	TCM has logged a DTC	Install Allison DOC™ to determine if DTC is present
A. Vehicle Drives Normally	Faulty **CHECK TRANS** light, relay, or circuit	Replace relay or repair circuit
B. Vehicle Does Not Drive Normally	Incorrect or no calibration in TCM	Calibrate TCM via PCCS
	Vehicle cannot establish communication with TCM	Repair J1939 backbone (upshifts may be affected due to throttle-percent default)
	Faulty wiring harness	Repair wiring harness (refer to Section 4 and Appendix E)
	Faulty TCM	Replace the TCM

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
CHECK TRANS LIGHT FLASHES INTERMITTENTLY	Intermittent power to TCM*	Check input power to the TCM and correct if necessary
	Faulty vehicle wiring	Repair vehicle wiring
	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 (refer to Appendix E)
	Faulty vehicle wiring including J1939 Backbone Harness, some vehicles use J1939 to illuminate the **CHECK TRANS**	Repair vehicle wiring
	Circuit 129 open	Repair Circuit 129
	Faulty TCM	Replace TCM

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
TRANSMISSION WILL NOT SHIFT TO FORWARD OR REVERSE—STAYS IN NEUTRAL	Engine rpm too high (engine fast idle enabled)*	Reduce engine rpm. It may be necessary to reselect **N** (Neutral) also, and then **D** (Drive) or **R** (Reverse)
	Low fluid level*	Add fluid to correct level (refer to Mechanic's Tips for proper dipstick calibration)
	Faulty throttle sensor or circuit*	See throttle sensor section for installation and operation information (Appendix F)
	Faulty throttle signal from engine	Correct engine throttle signal
	Faulty or misadjusted shift selector*	Repair or adjust shift selector
	Faulty speed sensor or circuit*	Repair circuit or replace speed sensor(s) (refer to speed sensor DTCs and Appendix E)
	Mechanical failure to C5 clutch	Repair transmission
	Mechanical failure in transmission torque converter, shafts, or planetaries	Repair transmission
	Low main pressure*	See Low Pressure Section (inspect for inhibit indicating condition)
	Faulty wiring in TCM Input/Output function circuits*	Correct circuit wiring (check input function status with Allison DOC™)
	Intermittent loss of TCM supply voltage (battery direct)	Repair wiring concern or return to OEM for repair
	Auxiliary function range inhibit active*	Correct circuit wiring (check input function status with Allison DOC™)
	Misadjusted shift linkage*	Adjust linkage properly (refer to Mechanic's Tips)
	Faulty reverse pressure switch and/or circuit	Repair circuit or replace PSM
	Stuck or sticking converter flow valve	Rebuild front support assembly

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
TRANSMISSION WILL NOT STAY IN FORWARD OR REVERSE	Faulty auto-neutral for PTO circuit (input function)*	Repair quick-to-neutral circuit (check input function status with Allison DOC™)
	Low fluid level*	Add fluid to correct level (refer to Mechanic's Tips for proper dipstick calibration)
	Incorrect sump filter installed — shallow sump filter in deep sump pan — pressure switch codes may be set	Install proper sump filter for oil pan used
	Low main pressure*	See Low Pressure Section
	Faulty solenoid—leaking*	Replace solenoid (refer to Mechanic's Tips)
	Plugged control main filter	Replace filter
TRANSMISSION WILL NOT MAKE A SPECIFIC SHIFT	Low engine power	Correct engine problem (refer to engine Service Manual)
	Extreme fluid temperature	Inspect cooling system and fluid level
	Faulty speed sensor or circuit*	Repair circuit or replace speed sensor(s) (refer to speed sensor DTCs and Appendix E)
	Faulty temperature sensor or circuit	Check for temperature reading which may inhibits shifts
	Incorrect calibration	Install proper calibration
	Faulty or misadjusted shift selector*	Repair or adjust shift selector
	3-position hold switch. This switch allows upshifts to be held to 4th, 5th, or 6th range when a 6-speed calibration is used.	Check the voltage displayed in Allison DOC™ (refer to Appendix J wiring schematics for proper voltages).

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
TRANSMISSION WILL NOT HOLD RANGE WHEN USING 3-POSITION SWITCH	Faulty 3-position switch or regulation circuit concern	Monitor switch voltage displayed on Allison DOC™ For PC–Service Tool. With a properly operating switch and regulation, circuit with the 3-position switch in 6th range position, the voltage reading in Allison DOC™ For PC–Service Tool should be 2.5V. In 5th hold position, the voltage reading should be 4V, and in 4th hold position, the voltage should be 1V. If the voltage readings are not correct, disconnect the TCM 80-way connector. Using a DVOM, set to read K Ohms, connect the leads between pin listed on the chart below to check switch and circuit.

Switch Position	Wire 112 and 156 Resistance Values	Wire 156 and 158 Resistance Values
4th Range Hold	10 Ohms	2.48 Ohms
5th Range Hold	2.48 Ohms	10 Ohms
6th Range Hold	10 Ohms	10 Ohms

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
TRANSMISSION DOES NOT SHIFT PROPERLY—ROUGH SHIFTS, SHIFTS OCCURRING AT TOO LOW OR TOO HIGH SPEED	Engine idle speed too high (neutral to range shift)*	Adjust engine idle speed (refer to vehicle Service Manual)
	Faulty throttle sensor or circuit*	See throttle sensor section for installation and operation information (Appendix F)
	Excessive clutch running clearance*	Rebuild transmission and adjust clearances
	Incorrect TCM calibration	Install correct calibration
	Instrument panel tachometer incorrect	Repair or replace tachometer
	Incorrectly calibrated electronic speedometer	Calibrate electronic speedometer
	Improper engine ECM governor/ transmission setting	Refer to Technical Document 161 Communication Requirements for Various Engine Controls on the Allison Extranet
	Faulty speed sensor or circuit*	Repair circuit or replace speed sensor(s) (refer to speed sensor DTCs and Appendix E)
	Degraded fluid	Change transmission fluid and filter (refer to Mechanic's Tips)
	Loose speed sensor	Tighten speed sensor retainer bolt
	Incorrect fluid level*	Correct fluid level (refer to Mechanic's Tips for proper dipstick calibration)
	Low main pressure*	See Low Pressure Section
	Intermittent wiring problems*	Check wiring harnesses and connectors (refer to Appendix E)
	Loose or damaged output tone wheel	Inspect for damage. Replace tone wheel
	Sticking valves in control valve assembly*	Overhaul control valve assembly
	Leaking pressure control solenoids*	Repair or replace pressure control solenoids (refer to Service Manual)
	Incorrect TCM calibration	Install correct calibration

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
ABNORMAL TRANSMISSION ACTIVITIES OR RESPONSES **A**. Excessive Creep in First and Reverse Gears **B**. Vehicle Moves Forward in Neutral **C**. Vehicle Moves Backward in Neutral	Engine idle speed too high*	Adjust engine idle speed (refer to vehicle Service Manual)
	C1 clutch failed or not released*	Rebuild C1 clutch assembly (refer to transmission Service Manual)
	C3 clutch failed or not released*	Rebuild C3 clutch assembly (refer to transmission Service Manual)
EXCESSIVE FLARE—ENGINE OVERSPEED ON FULL-THROTTLE UPSHIFTS	TPS Adjustment:	
	—Overstroke	— Adjust TPS linkage for proper stroke (refer to Appendix F)
	—Loose	— Tighten loose bolts or connections
	Incorrect TCM calibration	Install correct calibration
	Incorrect fluid level*	Correct fluid level (refer to Mechanic's Tips for proper dipstick calibration)
	Sticking valves in control valve assembly*	Rebuild control valve assembly
	Low main pressure*	See Low Pressure Section
	Leaking trim solenoids*	Repair or replace pressure control solenoids (refer to Service Manual)
	MAIN MOD solenoid mechanical failure	Repair or replace pressure control solenoids (refer to Service Manual)
	Erratic speed sensor signal	See speed sensor DTCs
	Leaking piston seals or slipping clutch plates in range involved*	Overhaul transmission (refer to transmission Service Manual)

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
SHUDDER WHEN SHIFTING INTO FORWARD OR REVERSE RANGE	Low main pressure*	See Low Pressure Section
	Faulty trim solenoid*	Replace solenoid (refer to Service Manual or Mechanic's Tips)
	Sticky trim valve*	Rebuild control valve assembly (refer to Service Manual or Mechanic's Tips)
	C1 or C3 clutch failure*	Repair transmission (refer to Service Manual)
ABNORMAL STALL SPEEDS (Stall In First Range—Fifth Range) **A.** High Stall Speeds **B.** Low Stall Speeds	Not in gear	Select **D** (Drive)
	Low fluid level, aerated fluid*	Add fluid to correct level (refer to Mechanic's Tips for proper dipstick calibration)
	Stuck or sticking converter flow valve	Rebuild front support assembly
	Faulty torque converter	Replace torque converter
	Incorrect torque converter	Replace torque converter (refer to transmission Service Manual)
	Clutch pressure low*	See Low Pressure Section and Appendix B
	C1 or C5 clutch slipping* ***Note: Use the Allison DOC™ to check turbine speed.***	Rebuild C1 or C5 clutch assembly (refer to transmission Service Manual)
	Engine too powerful	Confirm proper engine match
	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)	Repair engine (refer to engine Service Manual or vehicle Service Manual)
	Stall speeds 66 percent of normal implies freewheeling stator	Replace converter assembly (refer to transmission Service Manual)
	Engine smoke controls	Compare lugback vs. static stall speed
	Incorrect torque converter	Install correct torque converter (refer to transmission Service Manual)

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
OVERHEATING IN ALL RANGES	Aerated fluid—incorrect fluid level*	Correct fluid level, check for defective pump (refer to 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)
	Inaccurate temperature gauge or sending unit	Replace gauge and/or sending unit
	Inaccurate sump temperature sensor	Replace Pressure Switch Manifold (PSM) or internal harness (refer to transmission Service Manual)
	Inadequate cooler sizing	See vehicle OEM for specifications
	Excessive cooler circuit pressure drop	Check for plugged cooler, lines too small, collapsed hose, too many elbows in circuit
	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 transmission Service Manual) ***Note: Stuck stator will not allow cool down in neutral.***
	Cooler flow loss due to internal transmission leakage	Overhaul transmission (refer to transmission Service Manual)
INTERMITTENT NOISE—BUZZING	Low fluid level*	Add fluid to correct level (refer to Mechanic's Tips for proper dipstick calibration)
	Air leak in oil suction screen canister*	Replace suction filter (refer to Mechanic's Tips)

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
INTERMITTENT NOISE—BUZZING *(cont'd)*	Clogged filter*	Replace filter (refer to Mechanic's Tips)
	Incorrect sump filter installed — shallow sump filter in deep sump pan — pressure switch codes may be set	Install proper sump filter for oil pan used
	Aerated fluid causes noisy pump*	Correct fluid level (refer to Mechanic's Tips for proper dipstick calibration)
	Low main pressure causes main regulator valve to oscillate*	See transmission Service Manual
LEAKING FLUID—FILL TUBE AND/OR BREATHER	Dipstick loose	Tighten cap, replace if necessary
	Incorrect fluid level*	Correct fluid level (refer to Mechanic's Tips for proper dipstick calibration)
	Dipstick not properly vented	Provide proper ventilation per Sales Tech Data
	Breather stopped up—clogged	Clean or replace breather (refer to transmission Service Manual)
	Fluid contaminated with foreign liquid	Drain and replace fluid. Locate and fix source of additional fluid (refer to transmission Service Manual)
	Dipstick or fill tube seal worn	Replace seals or dipstick
	Incorrect dipstick marking	Calibrate dipstick (refer to Mechanic's Tips)
A. Cold start	Fluid leaking from fill tube and/or breather on "cold start"	Refer to SIL 06-1K2K-06
B. Normal operating temperature	Fluid leaking from fill tube and/or breather in neutral at normal operating temperature	Possible damaged C5 piston seal (refer to transmission Service Manual)
	Fluid leaking from fill tube and/or breather in specific gear at normal operating temperature	Possible damaged piston seals related to clutches applied. See transmission Service Manual

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
LEAKING FLUID—TRANSMISSON OUTPUT	Faulty or missing seal at output flange	Install new lip-type seal in rear of transmission housing (refer to Mechanic's Tips)
	Machine lead on output flange seal surface	Replace flange
	Rear cover porosity	Repair or replace cover
	Flange worn at seal surface	Replace flange
	Insufficient seal around seal OD	Replace seal (refer to Mechanic's Tips)
	Damaged, missing, or loose output flange bolt	Replace and/or torque output flange bolts
LEAKING FLUID—TRANSMISSION INPUT	Leaking front seal	Replace front seal (refer to Mechanic's Tips)
	Leaking manifold seal	Replace manifold seal (refer to Mechanic's Tips)
	Leaking front support bolt seals	Replace bolt seals
	Leaking converter	Check converter seals, cracked converter pump tangs, converter cover, or converter housing porosity; replace parts as required (refer to transmission Service Manual)
	Front pump casting porosity	Replace pump casting
	Leaking spin-on filter	Replace filter (refer to Mechanic's Tips)
	Leaking main pressure plug	Replace or torque main pressure plug
	Worn pump bushing	Rebuild and repair pump

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
DIRTY FLUID	Failure to change fluid and filters	Change fluid and install new filters (refer to Mechanic's Tips)
	Excessive heat	Check cooling system for restrictions and proper capacity
	Substandard fluid	Use recommended fluid (refer to Mechanic's Tips)
	Clutch/transmission failure*	Overhaul transmission (refer to transmission Service Manual)
RANGE CLUTCH TROUBLESHOOTING SECTION		
EXCESSIVE SLIPPAGE AND CLUTCH CHATTER	Incorrect TCM calibration	Install correct calibration
	Throttle Position Sensor (TPS) out of adjustment or failed*	Adjust or replace TPS (refer to Appendix F)
	Incorrect speed sensor readings*	See speed sensor DTCs
	Incorrect fluid level*	Correct fluid level (refer to Mechanic's Tips for proper dipstick calibration)
	Low main pressure*	See Low Pressure Section
	TCC clutch not applied	Inspect lockup clutch system wiring, pressure, and controls; repair as necessary (refer to transmission Service Manual and Appendix B)
A. Ranges 1, 2, 3, 4 Only	C1 clutch slipping, leaks at rotating clutch seals, leaks at piston seals, C1 clutch plates worn*	Inspect C1 clutch plates, piston seals, and rotating seals; replace/rebuild as necessary (refer to transmission Service Manual and Appendix B)
B. Ranges 4, 5 Only	C2 clutch slipping, leaks at rotating clutch seals, leaks at piston seals, C2 clutch plates worn*	Inspect C2 clutch plates, piston seals, and rotating seals; replace/rebuild as necessary (refer to transmission Service Manual and Appendix B)
C. Ranges 3, 5, R Only	C3 clutch slipping, leaks at piston seals, C3 clutch plates worn*	Inspect C3 clutch plates and piston seals; replace/rebuild as necessary (refer to transmission Service Manual and Appendix B)

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
D. Range 2 Only	C4 clutch slipping, leaks at piston seals, C4 clutch plates worn*	Inspect C4 clutch plates and piston seals; replace/rebuild as necessary (refer to transmission Service Manual and Appendix B)
E. Ranges 1, R Only	C5 clutch slipping, leaks at piston seals, C5 clutch plates worn*	Inspect C5 clutch plates and piston seals; replace/rebuild as necessary (refer to transmission Service Manual and Appendix B)
	LOW PRESSURE SECTION	
A. Low or No Main Pressure in All Ranges	Incorrect fluid level*	Correct fluid level (refer to Mechanic's Tips for proper dipstick calibration)
	Clogged or faulty oil filter element*	Replace oil filter (refer to Mechanic's Tips)
	Plugged or faulty suction filter*	Clean or replace oil suction filter element and refill the transmission (refer to Mechanic's Tips)
	Sticking main pressure regulator valve*	Overhaul front support assembly (refer to transmission Service Manual)
	Incorrect sump filter installed — shallow sump filter in deep sump pan — pressure switch codes may be set	Install proper sump filter for oil pan used
	Stuck or sticking lube regulator valve	Overhaul front pump assembly (refer to Service Manual)
	Leaking solenoids in control valve assembly*	Repair or replace solenoids (refer to Mechanic's Tips)
	MAIN MOD solenoid failure	Replace MAIN MOD solenoid. See transmission Service Manual.
	Weak, broken, or missing main pressure regulator valve spring*	Check spring and replace if necessary (refer to transmission Service Manual)

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Troubleshooting Performance Complaints *(cont'd)*

Problem	Possible Cause	Suggested Remedy
A. Low or No Main Pressure in All Ranges *(cont'd)*	Control valve body leakage* (loose control valve body bolts)	Replace or rebuild control valve assembly. Care should be taken when removing and labeling shift springs (refer to transmission Service Manual)
	Faulty or incorrect fluid pressure gauge*	Repair or replace gauge
	Worn or damaged oil pump*	Replace or rebuild oil pump (refer to transmission Service Manual)
	Leak in suction circuit*	Check suction circuit for leaking seal, gasket, or mating surface
B. Low Main Pressure in Specific Ranges, Normal Pressure in Other Ranges		See transmission Service Manual

* Refer to Range Inhibit Sections 2–2 and 2–4.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

NOTES

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APPENDICES

NOTES

APPENDIX A—DIAGNOSING INTERMITTENT DTCs

Intermittent Diagnostic Trouble Codes (DTC) are a result of faults that are detected, logged, and then disappear, only to recur later. If, when troubleshooting, a DTC 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 DTCs depending upon where the TCM was in the diagnostic process.

- Damaged terminals.
- Dirty or corroded terminals.
- Terminals not fully seated in the connector. Check 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. Check 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 DTC is an electronic part exposed to excessive vibration, heat, or moisture. Examples of this are:

- Exposed harness wires subjected to moisture.
- A defective connector seal allows moisture to enter the connector or part.
- An electronic part (TCM, 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 DTCs is good parts in an abnormal environment. The abnormal environment will usually include excessive heat, moisture, or voltage. For example, a TCM that receives excessive voltage will generate a diagnostic code as it senses high voltage in a circuit. The DTC may not be repeated consistently because different circuits may have this condition on each check. The last step in finding an intermittent DTC is to observe if the DTC is set during sudden changes in the operating environment.

Troubleshooting an intermittent DTC requires looking for common conditions that are present whenever the DTC is diagnosed. Use the failure record information from the scan tool to identify the conditions when the DTC was set.

APPENDIX A—DIAGNOSING INTERMITTENT DTCs

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 DTC, it is easier to find the cause. If the time between DTC occurrences is very short, troubleshooting is easier than if it is several weeks or more between DTC occurrences.

- Repair parts for the internal wiring harness 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 through the vehicle OEM and the OEM is responsible for warranty on these parts.

APPENDIX B—MAIN PRESSURE CHECK PROCEDURE

B–1. MAIN PRESSURE CHECK PROCEDURE

Checking main 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.

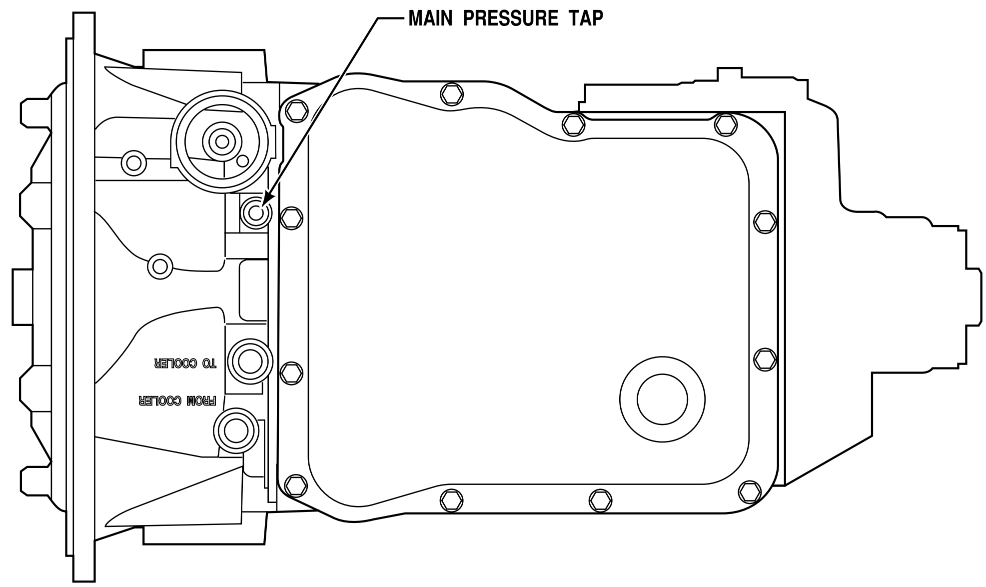

Figure B–1. Main Pressure Check Point

WARNING!	**Observe safety precautions during hydraulic pressure check procedures. All personnel must stand clear of the vehicle. Take precautions against movement of the vehicle. Be sure that gauges (vacuum, pressure, and tachometer) have extended lines so that they can be read from inside the vehicle.**

All transmission fluid level and pressure checks must be made at normal operating temperatures 71–93°C (160–200°F) sump; 82–104°C (180–220°F) converter-out. Check transmission fluid level.

1. Connect a 0–2070 kPa (0–300 psi) oil pressure gauge at the main pressure tap (refer to Figure B–1). Use Allison DOC™ to check engine rpm. See Table B–1 for main pressure levels.

2. Disconnect the driveshaft.

3. With brakes applied, check main pressure with the engine running at 2100 rpm and 600 rpm.

4. Continue the procedure for all ranges.

APPENDIX B—MAIN PRESSURE CHECK PROCEDURE

Table B–1. Main Pressure Test Conditions

Range	Main Pressure @ 600 rpm	Main Pressure @ 2100 rpm
Forward (Converter)	700–1280 kPa (101–186 psi)	1515–1795 kPa (220–260 psi)
Forward (Torque Converter Clutch Applied)	—	1000–1170 kPa (145–170 psi)
Reverse	700–1280 kPa (101–186 psi)	1515–1795 kPa (220–260 psi)
Neutral/Park	800–1655 kPa (130–240 psi)	1515–1795 kPa (220–260 psi)

Table B–2. Modulated Main Pressure Schedule

Range	Main Pressure @ 600 rpm	Main Pressure @ 2100 rpm
Forward/Reverse Converter with MAIN MOD Active	590–720 kPa (85–105 psi)	634–758 kPa (92–110 psi)
Forward Converter with MAIN MOD Inactive	700–1380 kPa (101–200 psi)	1515–1795 kPa (220–260 psi)
Forward Lockup with MAIN MOD Active*	—	510–627 kPa (74–91 psi)
Forward Lockup with MAIN MOD Inactive*	—	1000–1170 kPa (145–170 psi)
Neutral/Park with MAIN MOD Active	590–720 kPa (85–105 psi)	—
Neutral/Park with MAIN MOD Inactive	800–1655 kPa (130–240 psi)	1515–1795 kPa (220–260 psi)
* Medium duty gasoline engines only.		

APPENDIX C—SOLENOID AND CLUTCH TABLE

C–1. SOLENOID AND CLUTCH TABLE

Normal operation of the transmission requires application of two clutches to attain a forward or reverse range. A unique combination of solenoid and shift valve actuation produces clutch application in a given range. Table C–1 lists the transmission range shifts, the clutches that are applied in each range, and the electrical state (ON/OFF) of each solenoid for each range.

Table C–1. Solenoid and Clutch Table

Steady State	Upshifts	Clutch to Main	PCS1	PCS2	SS1	SS2	SS3	TCC	MAIN MOD
R Steady State with Throttle		—	OFF; C3 Applied	ON; C5 Applied	ON	ON	ON	OFF	OFF/ON Solenoid Status is Calibration Dependent on Engine, Turbine, Output, and other factors
*R Steady State at Closed Throttle	R	—	OFF; C5 Applied	ON; C3 Applied	OFF	ON	ON	OFF	ON
	R–N	—	ON; C3 Exhausting	ON; C5 Applied	OFF	ON	ON	OFF	—
	N–R	—	OFF; C3 Trimming on	ON; C5 Applied	ON	ON	ON	OFF	—
N			OFF; C5 Applied	OFF; — Exhausted	ON	ON	ON	OFF	ON at closed throttle
	N–1	—	OFF; C5 Applied	ON; C1 Trimming on	ON	ON	ON	OFF	—
	1–N	—	OFF; C5 Applied	OFF; — Exhausted	ON	ON	ON	OFF	—
1		C1	OFF; C5 Applied	OFF; C4 Exhausted	OFF	ON	OFF	OFF	ON at closed throttle
	1–2	C1	ON; C5 Exhausting	ON; C4 Trimming on	OFF	ON	OFF	OFF	—
	2–1	C1	OFF; C5 Trimming on	OFF; C4 Exhausting	OFF	ON	OFF	OFF	—
2		C1	ON; C3 Exhausted	ON; C4 Applied	OFF	OFF	OFF	ON; dependent on output speed	Vocation Dependent
	2–3	C1	OFF; C3 Trimming on	OFF; C4 Exhausting	OFF	OFF	OFF	ON	—
	3–2	C1	ON; C3 Exhausting	ON; C4 Trimming on	OFF	OFF	OFF	ON	—
3		C1	OFF; C3 Applied	OFF; C2 Exhausted	ON	OFF	OFF	ON	Vocation Dependent
	3–4	C1	ON; C3 Exhausting	ON; C2 Trimming on	ON	OFF	OFF	ON	—
	4–3	C1	OFF; C3 Trimming on	OFF; C2 Exhausting	ON	OFF	OFF	ON	—

APPENDIX C—SOLENOID AND CLUTCH TABLE

Table C–1. Solenoid and Clutch Table *(cont'd)*

Steady State	Upshifts	Clutch to Main	PCS1	PCS2	SS1	SS2	SS3	TCC	MAIN MOD
4		C2	ON; C3 Exhausted	ON; C1 Applied	ON	OFF	ON	ON	Vocation Dependent
	4–5	C2	OFF; C3 Trimming on	OFF; C1 Exhausting	ON	OFF	ON	ON	—
	5–4	C2	ON; C3 Exhausting	OFF; C1 Trimming on	ON	OFF	ON	ON	—
5		C2	OFF; C3 Applied	OFF; C4 Exhausted	OFF	OFF	ON	ON	Vocation Dependent
	5–6	C2	ON; C3 Exhausting	ON; Trimming on	OFF	OFF	ON	OB	—
	6–5	C2	OFF; Trimming on	OFF; Trimming off	OFF	OFF	ON	ON	—
6		C2	ON; C4 Applied	ON; C4 Applied	OFF	OFF	ON	ON	Vocation Dependent

* The following throttle dependent conditions occur in reverse range:
At closed throttle (Idle) SS1 is OFF, PCS1 controls C5 clutch, PCS2 controls C3 clutch.
Above 20 percent throttle, SS1 is ON, PCS1 controls C3, PCS1 controls C5 (valves are calibration dependent).
Under 10 percent throttle, TCM reverts back to the close throttle (Idle) schedule (valves are calibration dependent).

APPENDIX D—WIRE/CONNECTOR TABLES

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, and transmission connectors. Other kinds of connectors for optional or customer-furnished components are provided based on typical past practice for an Allison-designed system.

Contact your vehicle manufacturer for information on connectors not found in this appendix.

APPENDIX D—WIRE/CONNECTOR TABLES

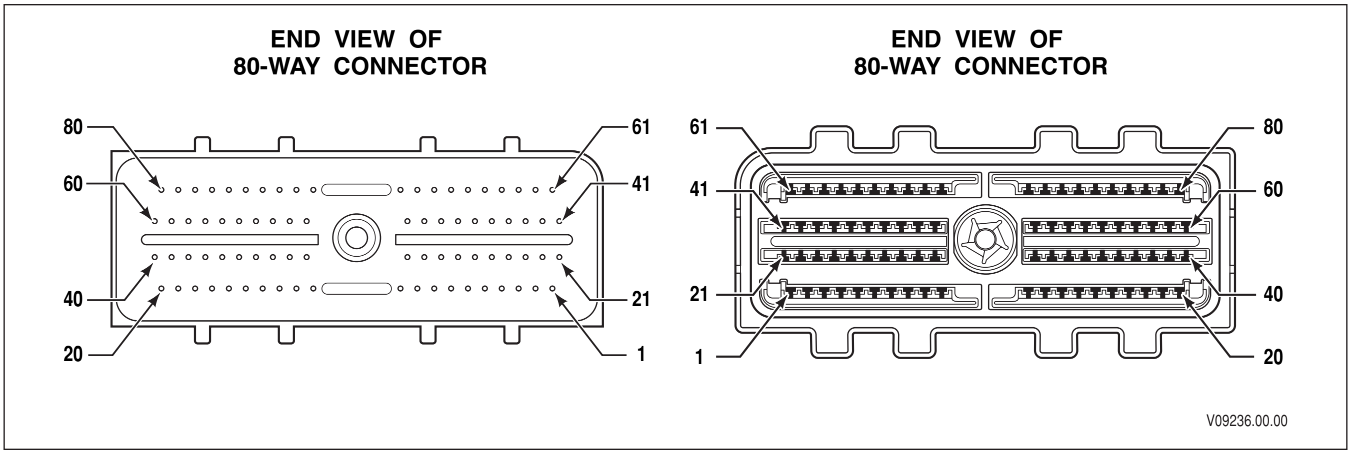

Figure D–1. AFL Automotive 80-Way TCM Connector

AFL AUTOMOTIVE 80-WAY TCM CONNECTOR

Terminal No.	Recommended Wire Colors	Wire No.	Description	Termination Point(s)
1	Blue	101	GPI 6	Vehicle System
2	Yellow	102	GPI 2	Vehicle System
3	Yellow	103	Signal Ground	Vehicle System
4	Yellow	104	GPO 2	Vehicle System
5	Orange	105	GPO 4	Vehicle System
6	Yellow	106	CAN 2 High (+)	J2284 High
7	Yellow	107	Internal Terminating Resistor CAN 1 (TCM)	Vehicle System
8	Green	108	CAN 1 Low (–)	J1939 B or L
9	Gray	109	Battery Ground	Vehicle System
10	Pink	110	Battery Power	Vehicle System
11	Orange	111	High Side Driver 1 (HSD1) Feed	Trans Connector (24-way—14) (20-way—L)
12	No Color	112	Signal Reference 5V	TPS Pin C
13	No Color	113	GPO 8	Vehicle System
14	Gray	114	IMS Switch C	Trans Connector (24-way—20) (20-way—T)
15			Not used with 1000 and 2000 Product Families	
16			Not used with 1000 and 2000 Product Families	
17	Blue	117	Pressure Switch 1 (PS1)	Trans Connector (24-way—4) (20-way—D)
18	No Color	118	Replicated Toss	GM L-18 PCM
19			Not used with 1000 and 2000 Product Families	
20	Blue	120	Turbine Speed Sensor—Low	NT-B
21	Green	121	GPI 8	Vehicle System
22	Yellow	122	GPI 4	Vehicle System
23	Green	123	GPI 1	Vehicle System
24	White	124	Range Inhibit	Vehicle System
25	Tan	125	Vehicle Speed Signal	Input for Vehicle Speedometer

APPENDIX D—WIRE/CONNECTOR TABLES

AFL AUTOMOTIVE 80-WAY TCM CONNECTOR *(cont'd)*

Terminal No.	Recommended Wire Colors	Wire No.	Description	Termination Point(s)
26	Yellow	126	Internal Terminating Resistor CAN 2 (TCM)	Vehicle System
27	Yellow	127	CAN 2 Low (–)	J2284 Low
28	Yellow	128	CAN 1 High (+)	J1939 A or H
29	Green	129	CHECK TRANS	Vehicle System
30			Not used with 1000 and 2000 Product Families	
31			Not used with 1000 and 2000 Product Families	
32			Not used with 1000 and 2000 Product Families	
33	Yellow	133	Shift Solenoid 2 (SS2)	Trans Connector (24-way—2) (20-way—B)
34	White	134	IMS Switch P	Trans Connector (24-way—23) (20-way—W)
35			Not used with 1000 and 2000 Product Families	
36	Orange	136	Pressure Control Solenoid 2 (PCS2)	Trans Connector (24-way—17) (20-way—P)
37			Not used with 1000 and 2000 Product Families	
38	Orange	138	IMS Switch Neutral Start Input to TCM/ECM	Trans Connector (24-way—18) (20-way—R) In GM Applications may run direct to ECM/PCM
39	Orange	139	Engine Speed Sensor—Low	NE-B
40	Green	140	Output Speed Sensor—Low	NO-B
41	Tan	141	Positive TCM Output for Neutral Start Relay	To OEM supplied starter relay
42	White	142	GPI 5	Vehicle System
43	Blue	143	GPI 3	Vehicle System
44	Blue	144	PWM Input and TPS	Vehicle System
45	Orange	145	GPO 3	Vehicle System
46	N/A	146	J1850/ISO9141	Vehicle System
47	Green	147	CAN 2 Low (–)	J2284 Low
48	Yellow	148	CAN 1 High	J1939 A or H
49	N/A	149	CAN 1 Shield	J1939 C or S
50	Pink	150	GPO 7	Vehicle System
51	White	151	Shift Solenoid 3 (SS3)	Trans Connector (24-way—3) (20-way—C)
52	Green	152	Shift Solenoid 1 (SS1)	Trans Connector (24-way—1) (20-way—A)
53	Yellow	153	IMS Switch B	Trans Connector (24-way—21) (20-way—U)
54	Tan	154	Sump Temp Sensor	Trans Connector (24-way—8) (20-way—G)

APPENDIX D—WIRE/CONNECTOR TABLES

AFL AUTOMOTIVE 80-WAY TCM CONNECTOR *(cont'd)*

Terminal No.	Recommended Wire Colors	Wire No.	Description	Termination Point(s)
55	White	155	Pressure Control Solenoid 1 (PCS1)	Trans Connector (24-way—15) (20-way—M)
56			Not used with 1000 and 2000 Product Families	
57	White	157	Pressure Switch (PS3)	Trans Connector (24-way—6) (20-way—E)
58	Green	158	TCM Internal Transmission Ground Return	Trans Connector (24-way—9) (20-way—H)
59	Tan	159	Engine Speed Sensor—High	NE-A
60	Yellow	160	Output Speed Sensor—High	NO-A
61	Orange	161	GPI 7	Vehicle System
62	Yellow	162	GPI 9	Vehicle System
63	Yellow	163	Ignition Power	Vehicle System
64	Blue	164	GPO 6	Vehicle System
65	Tan	165	Reverse Warning	Vehicle System
66	Yellow	166	CAN 2 High (+)	J2284 High
67	N/A	167	CAN 2 Shield	N/A
68	Green	168	CAN 1 Low (–)	J1939 B or L
69	Gray	169	Battery Ground	Vehicle System
70	Pink	170	Battery Power	Vehicle System
71	Yellow	171	High Side Driver 2 (HSD2) Feed	Trans Connector (24-way—16) (20-way—N)
72			Not used with 1000 and 2000 Product Families	
73	Blue	173	IMS Switch A	Trans Connector (24-way—22) (20-way—V)
74	Blue	174	Main Mod	Trans Connector (24-way—19) (20-way—S)
75			Not used with 1000 and 2000 Product Families	
76	Tan	176	Trans ID	Trans Connector (24-way—24) (20-way)
77	Green	177	Pressure Switch (PS4)	Trans Connector (24-way-24) (20-way-)
78	White	178	TCC Solenoid	Trans Connector (24-way—10) (20-way—J)
79	Pink	179	Pressure Switch (PS2)	Trans Connector (24-way—7) (20-way—F)
80	Orange	180	Turbine Speed Sensor—High	NT-A

APPENDIX D—WIRE/CONNECTOR TABLES

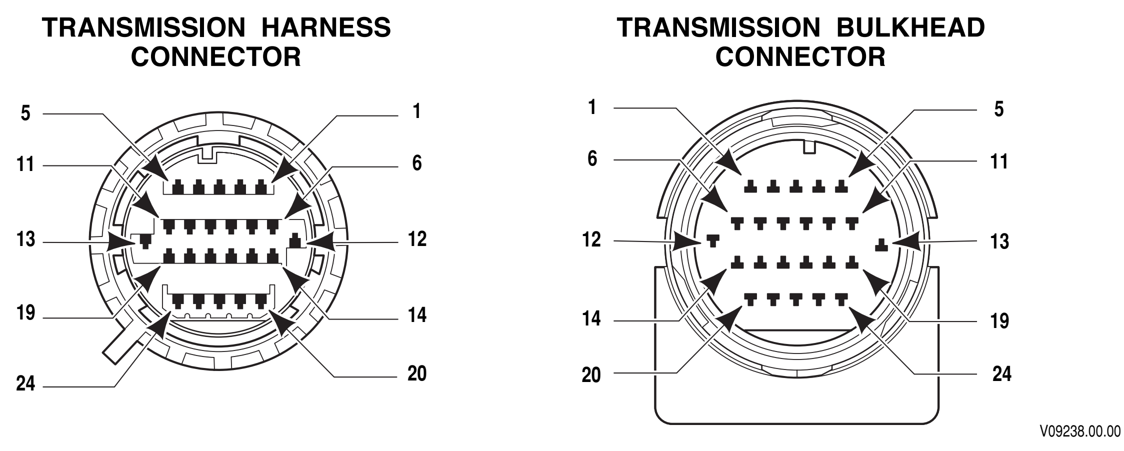

Figure D–2. AFL Automotive Main Transmission Connector (24-Way)

AFL AUTOMOTIVE MAIN TRANSMISSION CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
1		152	SS1 (ON/OFF) Lowside	52
2		133	SS2 (ON/OFF) Lowside	33
3		151	SS3 (ON/OFF) Lowside	51
4		117	PS1	17
5			—	—
6		157	PS3	57
7		179	PS2	79
8		154	Sump Temperature Input	54
9		158	Analog Ground	58
10		178	TCC Solenoid Low	78
11		177	PS4	77
12			—	15
13			—	31
14		111	High Side Driver 1 (HSD1)	11
15		155	PCS1 Low Variable Bleed Solenoid (VBS)	55
16		171	High Side Driver 2 (HSD2)	71
17		136	PCS2 Low Variable Bleed Solenoid (VBS)	36
18		138	IMS—Neutral Start	38
19		174	Main Mod Lowside	74
20		114	IMS—C	14
21		153	IMS—B	53
22		173	IMS—A	73
23		134	IMS—P	34
24		176	TRANSID	76

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulkhead connector are used.

APPENDIX D—WIRE/CONNECTOR TABLES

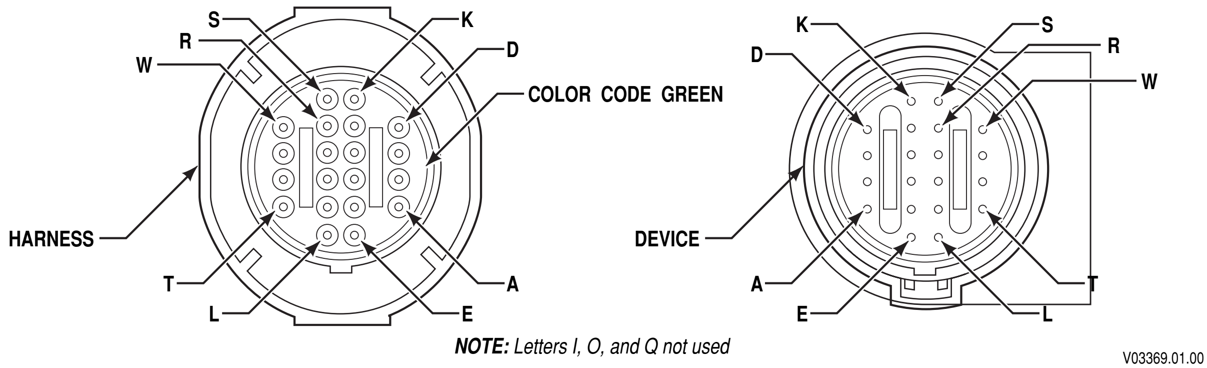

Figure D–3. Delphi-Packard Main Transmission Connector (20-way)

DELPHI-PACKARD MAIN TRANSMISSION CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Green	152	SS1 Low (ON/OFF)	52
B	Yellow	133	SS2 Low (ON/OFF)	33
C	White	151	SS3 Low (ON/OFF)	51
D	Blue	117	PSM PS1	17
E	White	157	PSM PS3	57
F	Pink	179	PSM PS2	79
G	Tan	154	Sump Temperature Input	54
H	Green	158	Analog Ground	58
J	White	178	TCC Solenoid Low	78
K	Green	177	PSM PS4	77
L	Orange	111	HSD1	11
M	White	155	PCS1 Low Variable Bleed Solenoid (VBS)	55
N	Yellow	171	HSD2	71
P	Orange	136	PCS2 Low Variable Bleed Solenoid (VBS)	36
R	Orange	138	IMS—Neutral Start	38
S	Blue	174	Lowside, Main Mod Solenoid	74
T	Gray	114	IMS—C	14
U	Yellow	153	IMS—B	53
V	Blue	173	IMS—A	73
W	White	134	IMS—P	34

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulkhead connector are used.

APPENDIX D—WIRE/CONNECTOR TABLES

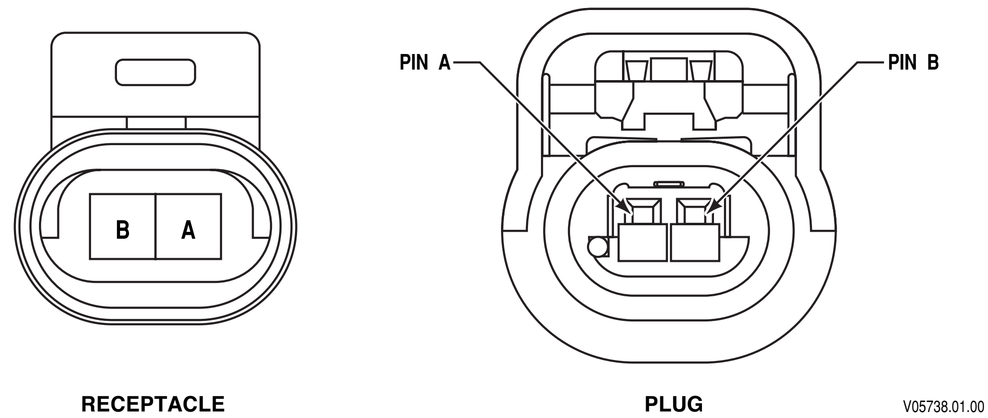

Figure D–4. Speed Sensor Connector

ENGINE SPEED SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Tan	159	Engine Speed Sensor Hi	59
B	Orange	139	Engine Speed Sensor Lo	39

TURBINE SPEED SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Orange	180	Turbine Speed Sensor Hi	80
B	Blue	120	Turbine Speed Sensor Lo	20

OUTPUT SPEED SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Yellow	160	Output Speed Sensor Hi	60
B	Green	140	Output Speed Sensor Lo	40

APPENDIX D—WIRE/CONNECTOR TABLES

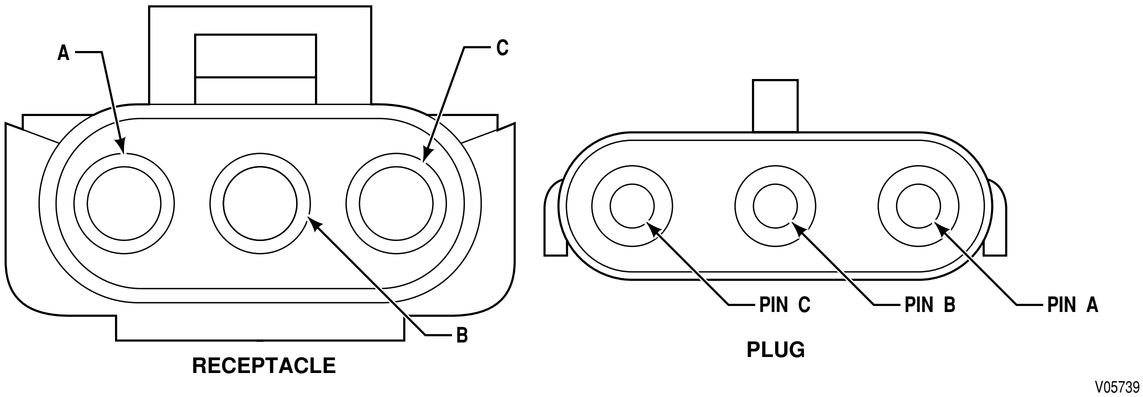

Figure D–5. TPS Connector

THROTTLE POSITION SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Green	158	Analog Ground	58
B	Blue	144	TPS Signal	44
C	Pink	112	TPS Hi	12

APPENDIX D—WIRE/CONNECTOR TABLES

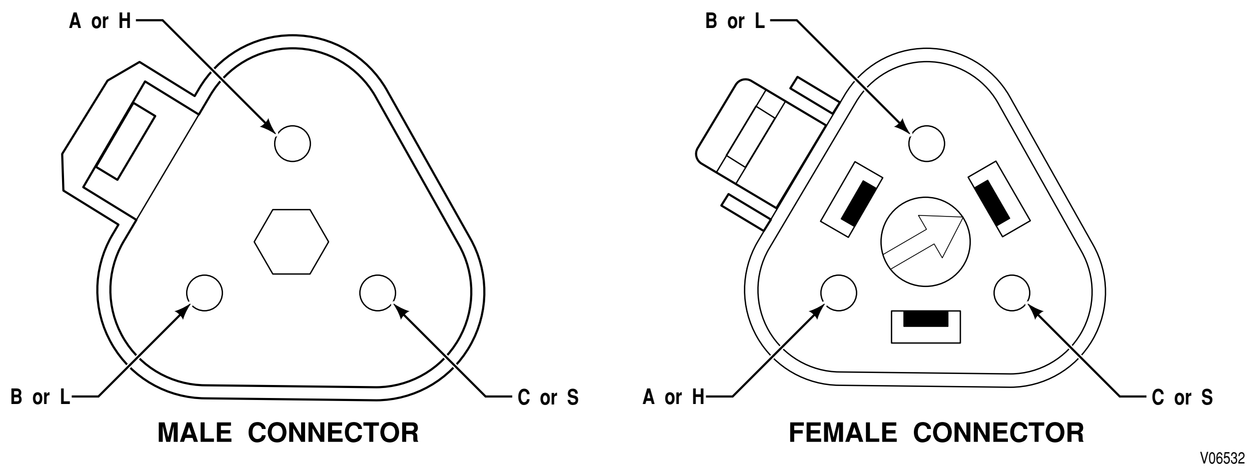

Figure D–6. J1939 Interface Connector

J1939 INTERFACE CONNECTOR

J1939 Connector Terminal No.	Color	Wire No.	Description	TCM Connector Terminal No.
A or H	Yellow	128 or 148	J1939 Controller, High	28 or 48
B or L	Green	108 or 169	J1939 Controller, Low	8 or 68
C or S	Uninsulated	144	J1939 Shield/Ground	44

APPENDIX D—WIRE/CONNECTOR TABLES

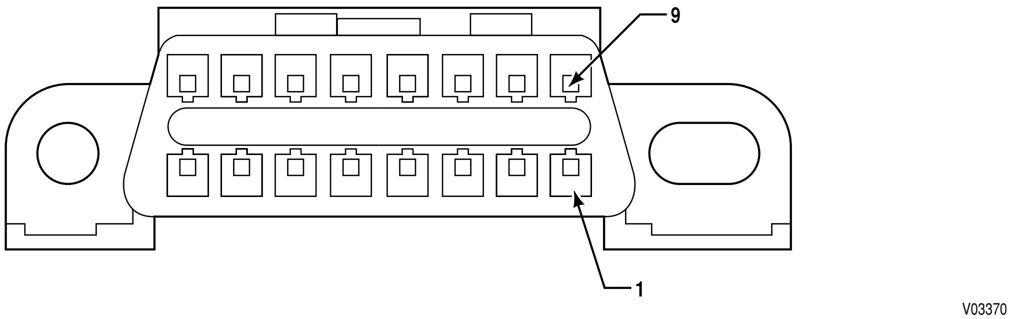

Figure D–7. GMC Connector for OBD-II Diagnostic Adapter

OBD-II Diagnostic Connector

Terminal No.	Wire	Description	Termination Points
1			
2	146	DLC Class 2 Serial Data	TCM–46
3			
4	N/A	Ground	
5	N/A	Ground	
6	106	CAN 2 High (+)	J2284 High
7			
8			
9			
10			
11			
12			
13			
14	127	CAN 2 Low (–)	J2284 Low
15			
16	N/A	Ignition Sense (+)	

APPENDIX D—WIRE/CONNECTOR TABLES

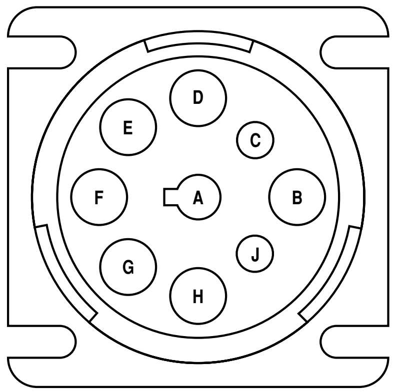

Figure D–8. Deutsch Diagnostic Tool Connector

SAE STD 9-PIN DIAGNOSTIC (J1939 DIAGNOSTIC LINK) CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Determined By OEM		Battery Ground (–)	Vehicle System
B	Determined By OEM		Ignition Power (+)	Vehicle System
B (Optional)	Determined By OEM		Battery Power (+)	Vehicle System
C	Yellow		J1939 High	J1939 Backbone A
D	Green		J1939 Low	J1939 Backbone B
E	Uninsulated		J1939 Shield/Ground	J1939 Backbone C
F				
G				

APPENDIX D—WIRE/CONNECTOR TABLES

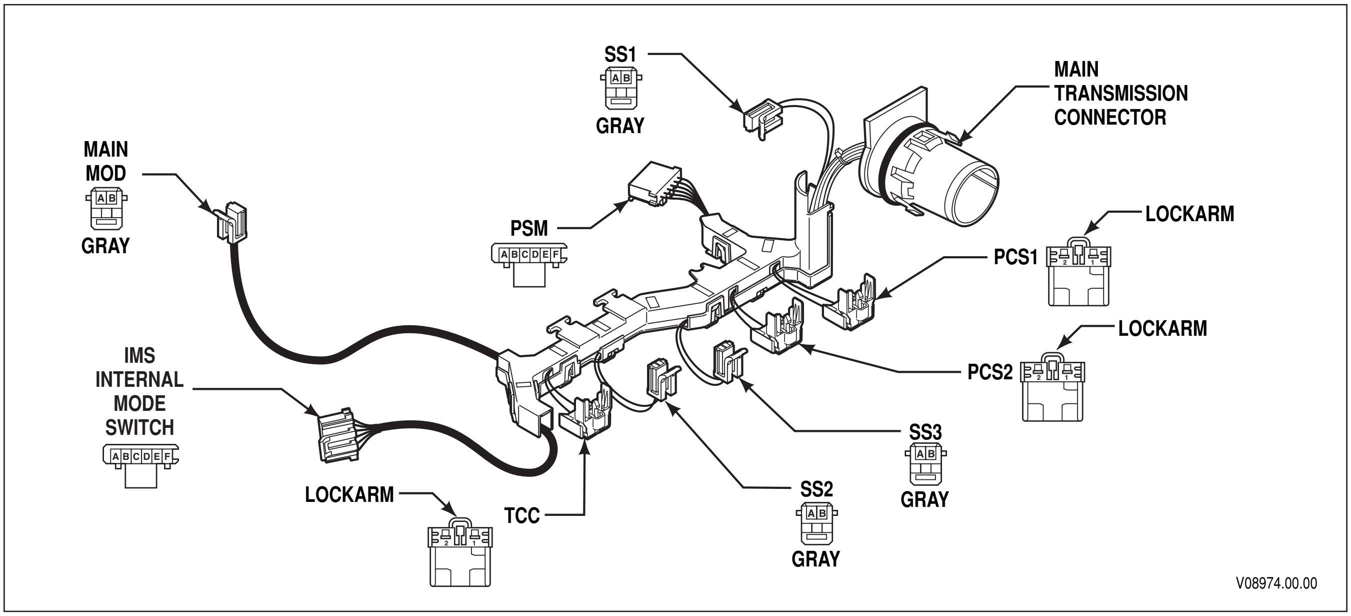

Figure D–9. Transmission Internal Harness (20-Way)

Transmission Internal Harness Connectors (20-Way)—GM Truck

Connector Name	Connector Pin No.	Main Connector Pin No.	Circuit Number	TCM Pin No.
Solenoid PCS1	B	M	1525	55
	A	L	150	11
Solenoid PCS2	A	N	250	71
	B	P	1526	36
Solenoid SS1	A	N	250	71
	B	A	1527	52
Solenoid SS2	A	N	250	71
	B	B	1528	33
Solenoid SS3	A	N	250	71
	B	C	1529	51
Solenoid TCC	A	L	150	11
	B	J	1531	78
Main Mod	A	L	150	11
	B	S	1532	74
Pressure Switch Manifold	A	D	1224	17
	B	F	1225	79
	C	E	1226	57
	D	K	1530	77
	E	G	1227	54
	F	H	407	58
Internal Mode Switch	A	R	1995	38
	B	W	776	34
	C	V	771	73
	D	U	772	53
	E	T	773	14
	F	H	407	58

APPENDIX D—WIRE/CONNECTOR TABLES

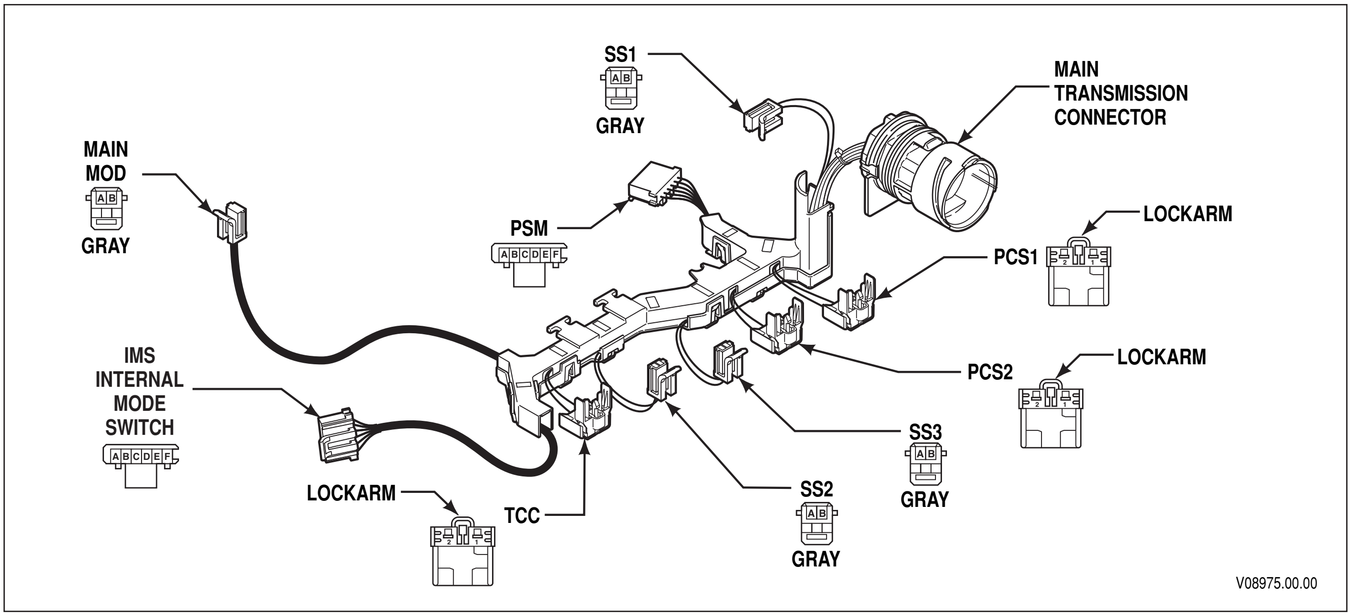

Figure D–10. Transmission Internal Harness (24-way)

Transmission Internal Harness Connectors (24-way)—Medium Duty

Connector Name	Connector Pin No.	Main Connector Pin No.	Wire Number	TCM Pin No.
Solenoid PCS1	B	15	155	55
	A	14	111	11
Solenoid PCS2	A	16	171	71
	B	17	136	36
Solenoid SS1	A	16	171	71
	B	1	152	52
Solenoid SS2	A	16	171	71
	B	2	133	33
Solenoid SS3	A	16	171	71
	B	3	151	51
Solenoid TCC	A	14	111	11
	B	10	178	78
Main Mod Solenoid	A	14	111	11
	B	19	174	74
Pressure Switch Manifold	A	4	117	17
	B	7	179	79
	C	6	157	57
	D	11	177	77
	E	8	154	54
	F	9	158	58
Internal Mode Switch	A	18	138	38
	B	23	134	34
	C	22	173	73
	D	21	153	53
	E	20	114	14
	F	9	158	58
TRANSID		24	176	76

APPENDIX D—WIRE/CONNECTOR TABLES

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APPENDIX E—CONNECTOR REPAIR INFORMATION

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

- ***Repair parts for the internal wiring harness 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 through the vehicle OEM and the OEM is responsible for warranty on these parts.***

APPENDIX E—CONNECTOR REPAIR INFORMATION

List Of Special Tools Required To Service 1000 and 2000 Product Families Wiring Harnesses

Tool Number	Tool Type	Paragraph Reference
15359996	Crimper	E–5C
23046604	Splice, Sealed (14–16 AWG)	E–10B
23046605	Splice, Sealed (18–22 AWG)	E–10B
J 25070	Heat Gun	E–10B
J 34182	Crimper 1	E–8C, E–9C
J 34513	Removal 1 Tool	E–8A
J 35606	Crimper (Alternate)	E–7D
J 35615	Wire Stripper 1	E–5C, E–10B
J 35689-A	Removal Tool	E–5A
J 38125-10	Removal Tool	E–7B
J 38125-6	Crimper	E–5C, E–7C
J 38125-7	Crimper	E–5C
J 38125-8	Crimper	E–10B
J 38125-12A	Crimper	E–1D, E–2C, E–3B, E–5B
J 47139	Crimper	E–1E, E–3C
J 38582-3	Removal Tool	E–8A
J 38852	Crimper (Alternate)	E–7D
J 39227	Removal Tool	E–1D, E–7D, E–3B
J 41194	Extractor/Inserter	E–8B
J 42215	Crimper	E–4C

APPENDIX E—CONNECTOR REPAIR INFORMATION

NOTES

APPENDIX E—CONNECTOR REPAIR INFORMATION

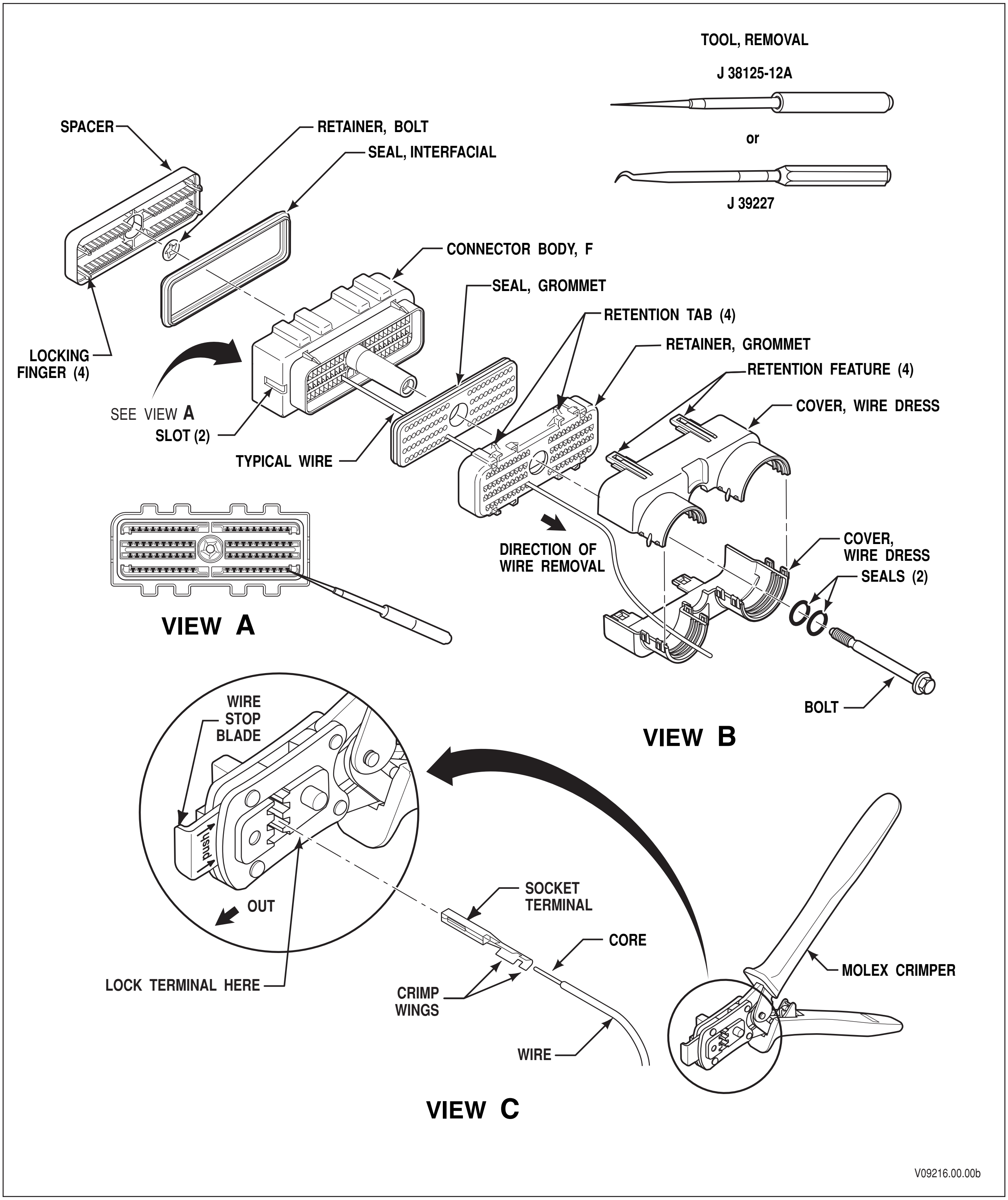

Figure E–1A. AFL 80F Bolt-Assist TCM Connector

APPENDIX E—CONNECTOR REPAIR INFORMATION

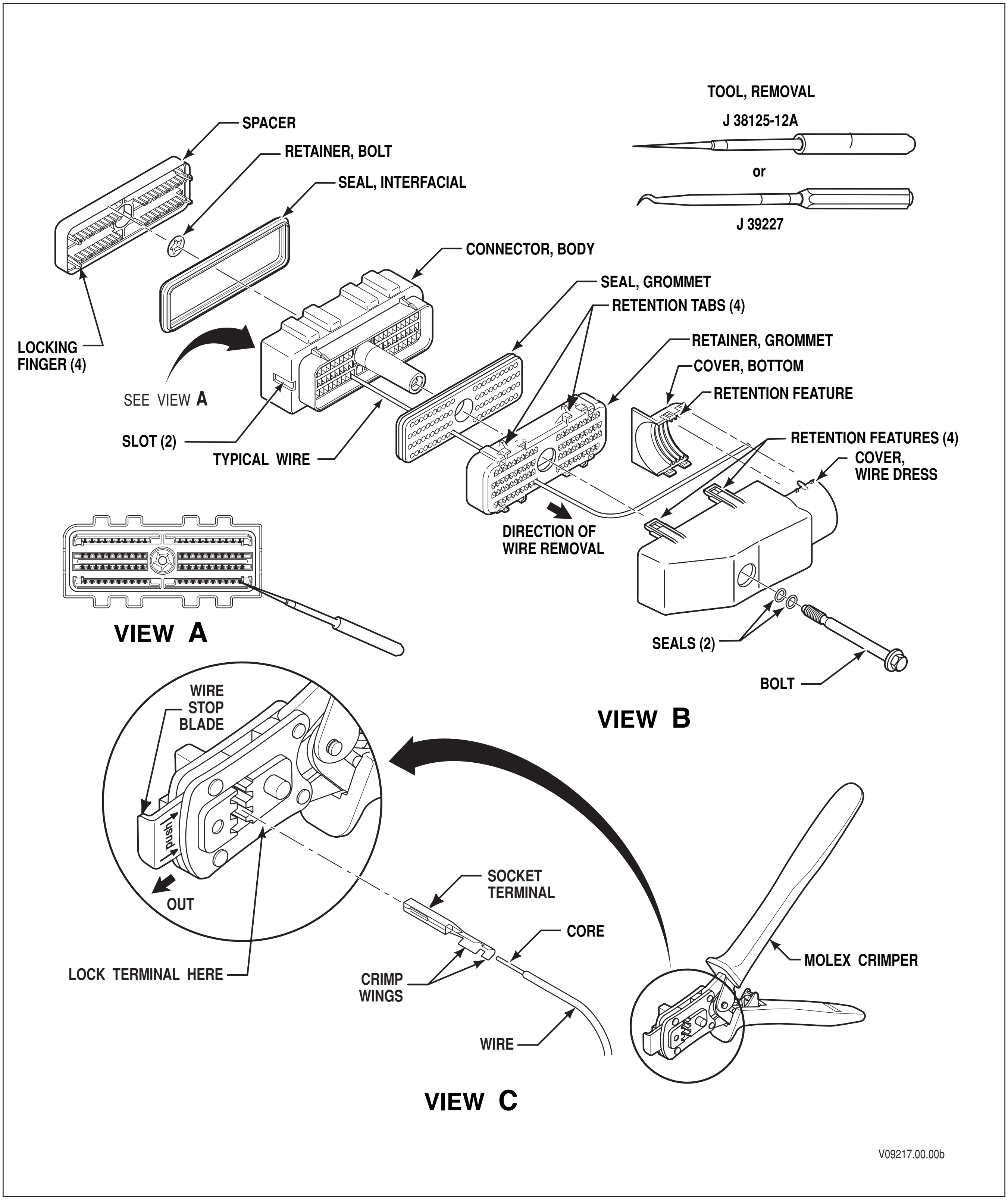

Figure E–1B. AFL 80F Bolt-Assist, Dir 'A' 90 Degree TCM Connector

APPENDIX E—CONNECTOR REPAIR INFORMATION

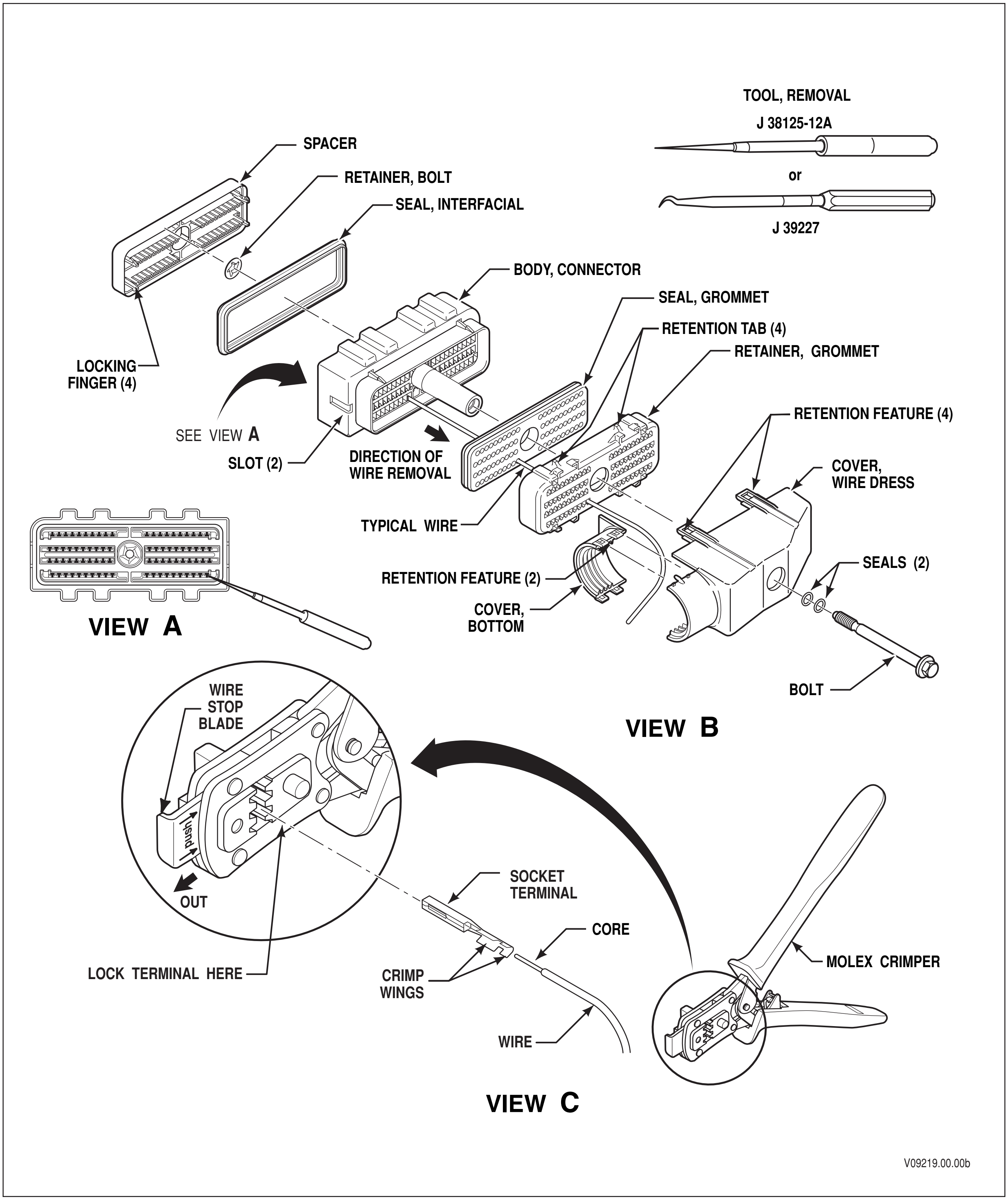

Figure E–1C. AFL 80F Bolt Assist, Dir 'B' 90 Degree TCM Connector

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–1. AFL AUTOMOTIVE 80F BOLT ASSIST CONNECTORS (TCM CONNECTOR)

A. TCM Connector, Assembly 80F Bolt Assist (refer to Figure E1–A)

Required Tools

Crimping Tool	J 47139
Removal Tool	J 38125-12A or J 39227

Use

TCM Connector

Description	Manufacturers P/N	St. Clair P/N
Component Kit	N/A	300276
Connector, Assembly	R-61991-001	300243
Spacer	E-4540	300284
Seal, Interfacial	E-4539	300285
Bolt Kit 80W		300234
Bolt	E-4543-001	
Seals	E-4544	
Retainer Bolt	E-4545	
Grommet		
Grommet, Retainer	E-4542	300244
Wire Cover Kit 80W Bolt	N/A	300235
Cover A, Wire Dress	E-4550	300245
Cover B, Wire Dress	E-4551	300246
Terminal	33001-1004	300247

B. TCM Connector, Assembly 80F Bolt Assist, Dir ‘A’ 90 Deg Wire Dress (refer to Figure E–1B)

Required Tools

Crimping Tool	J 47139
Removal Tool	J 38125-12A or J 39227

Use

TCM Connector

Description	Manufacturers P/N	St. Clair P/N
Component Kit	N/A	300290
Connector, Assembly	R-61991-001	300243
Spacer	E-4540	300284
Seal, Interfacial	E-4539	300285
Bolt Kit 80W		300234
Bolt	E-4543-001	
Seals	E-4544	
Retainer Bolt	E-4545	
Grommet		
Grommet, Retainer	E-4542	300244
Wire Cover Kit 80W Bolt (Dir ‘A’ 90 Deg Wire Dress)	N/A	300237
Backshell-80F Dir ‘A’ (25mm)	E-6206-002	
Cover, Wire Dress	E-4555	
Terminal	33001-1004	300247

APPENDIX E—CONNECTOR REPAIR INFORMATION

C. Connector, Assembly 80F Bolt Assist, Dir 'B' 90 Deg Wire Dress (refer to Figure E–1C)

Required Tools	
Crimping Tool	J 47139
Removal Tool	J 38125-12A or J 39227

Use

TCM Connector

Description	**Manufacturers P/N**	**St. Clair P/N**
Component Kit	N/A	300291
Connector, Assembly	R-61991-001	300243
Spacer	E-4540	300284
Seal, Interfacial	E-4539	300285
Connector Body, 80F Bolt		
Bolt Kit 80W	N/A	300234
Bolt	E-4543-001	
Seals	E-4544	
Retainer Bolt	E-4545	
Grommet		
Grommet, Retainer	E-4542	300244
Wire Cover Kit 80W (Dir 'B' 90 Deg Wire Dress)	N/A	300236
Backshell-80 F Dir 'B' (25mm)	E-6206-001	
Cover, Wire Dress	E-4555	
Terminal	33001-1004	300247

Read disassembly process/procedure thoroughly before beginning disassembly.

D. Terminal Removal

1. Loosen bolt that retains 80-way connector to the transmission control module TCM.
2. Separate the 80-way connector from the TCM.
3. Use a small-bladed screwdriver to gently unlatch the retention features on convolute capture (part of wire dress cover) on 80-way female. Slide the wire dress cover away from the 80-way connector body.
4. Separate each half of wire dress cover and set aside for later use.
5. Insert a small blade 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 the spacer lifts to the pre-stage location (approximately 1/8 inch). Carefully continue to evenly lift the red spacer out of the connector body until the four lock arms release. Remove the red spacer and set aside for later use. (The spacer must be replaced if any of the four lock arms is broken during removal.)
6. Insert metal blade of J 38125-12A or J 39227 removal tool into front of connector body at desired terminal/wire lead cavity location (See Figures E–1A through E–1C).
7. Apply pressure to the terminal locking finger (part of connector body) with removal tool.
8. Remove the selected terminal by lifting the locking finger 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.

9. Take note of what wire (number) goes to what terminal cavity in connector body for reassembly.

APPENDIX E—CONNECTOR REPAIR INFORMATION

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 exposed.
2. Raise the wire stop blades. Place the terminal into the appropriate wire size opening of the J 47139 Molex crimping tool, and squeeze the handle enough to keep the terminal in place.
3. Insert the bare end of the wire into the terminal, with the wire held against the wire stop blade. Use the crimper to maintain a light and constant pressure on the wire. Hold the wire and terminal in place until the terminal is fully crimped.
4. Squeeze the crimper handle until the ratchet releases.
5. Lift the wire stop blades.
6. 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.***

7. Repeat as necessary.
8. Snap grommet cover into place.
9. Complete terminal installation of the 80-way connector as follows:
   a. When all terminals have been inserted, install the red spacer into the connector body. Push until fully seated and flush with the connector body.

NOTE: ***If spacer does not seat flush with the connector body, make sure all terminals are fully seated.***

   b. 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).
   c. Install both halves of wire dress cover over convolute harness cover. Engage the clips to lock the two wire dress halves together.
   d. Push the wire dress cover onto the 80-way connector body until it snaps in place.

NOTES

APPENDIX E—CONNECTOR REPAIR INFORMATION

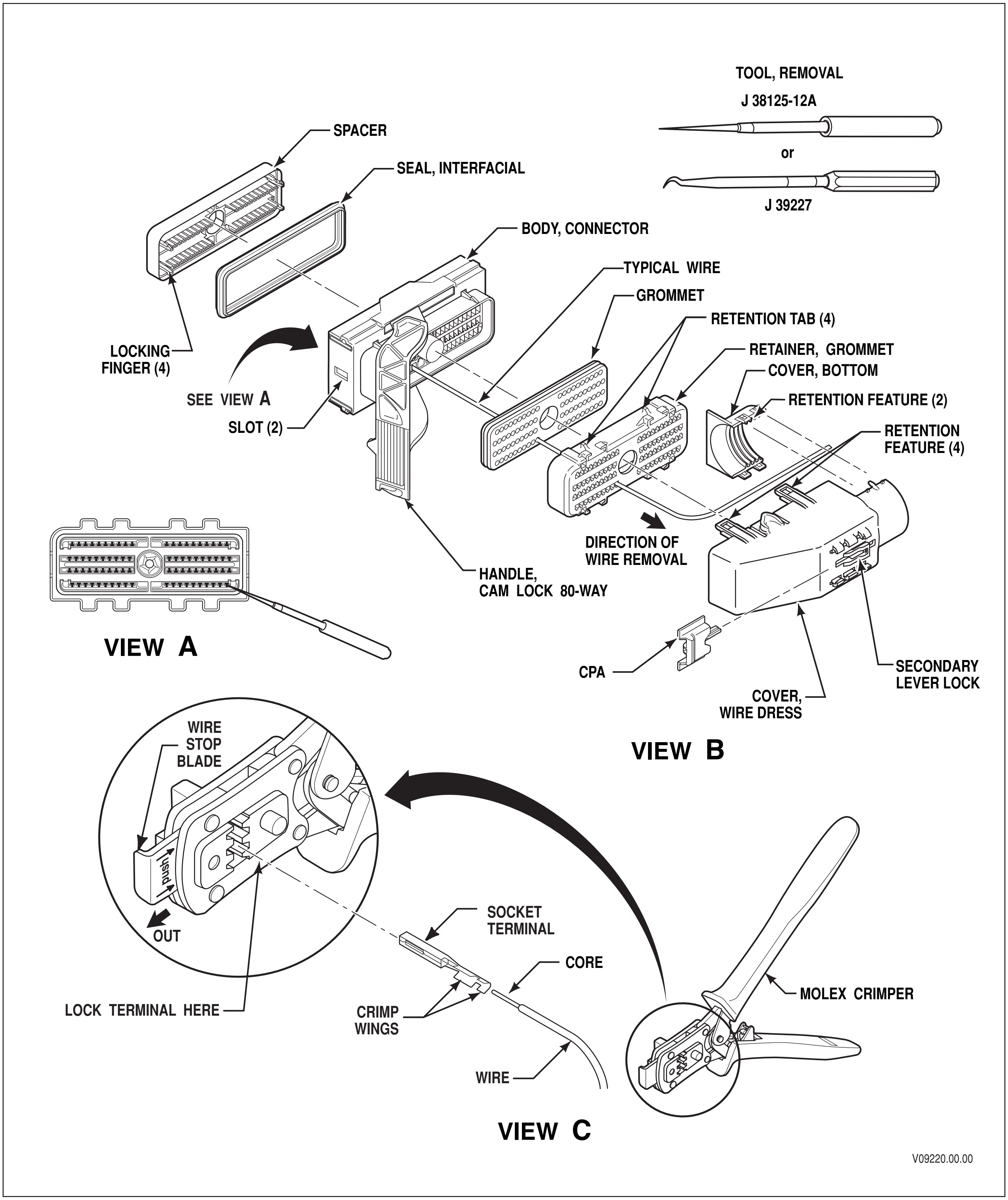

Figure E–2A. AFL 80F Cam-Assist, Dir 'A' Connector (TCM Connector)

APPENDIX E—CONNECTOR REPAIR INFORMATION

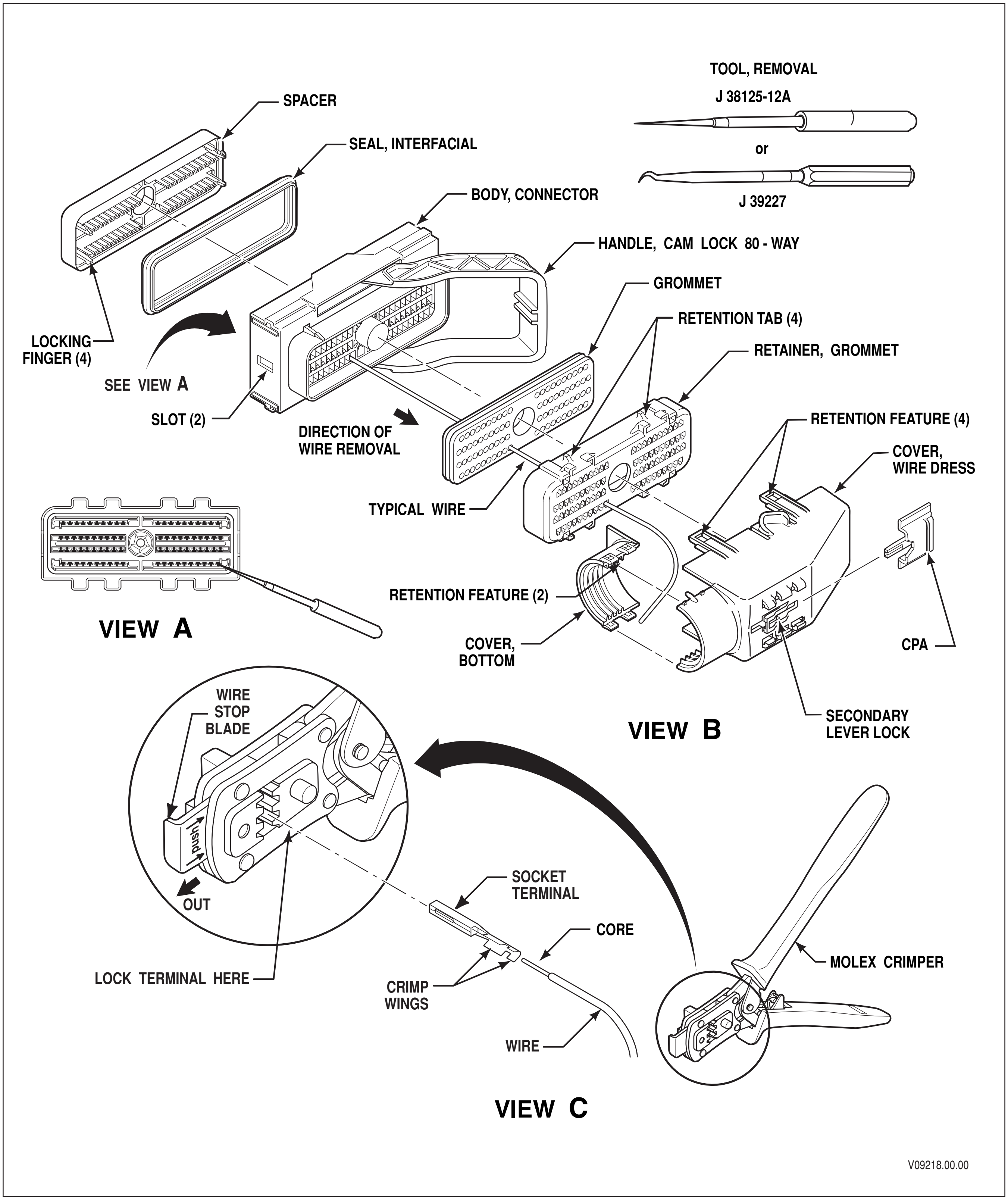

Figure E–2B. AFL 80F Cam-Assist, Dir 'B' Connector (TCM Connector)

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–2. AFL AUTOMOTIVE 80F CAM-ASSIST CONNECTORS (TCM CONNECTOR)

A. Connector, Assembly 80F Cam-Assist, 'A' Dir (refer to Figure E–2A)

Required Tools

Crimping Tool	J 47139
Removal Tool	J 38125-12A or J 39227

Use

TCM Connector

Description	Manufacturers P/N	St. Clair P/N
Component Kit (serviced with 90 degree bolt-assist)	N/A	300290
Connector, Assembly	R-62004-002	N/A
Spacer 80F	E-4540	300284
Seal, Interfacial	E-4539	300285
Connector Body, 80F Cam		
Cam, Left		
Cam, Right		
Handle, Cam		
Grommet, Wire Seal		
Grommet, Retainer	E-4542	
Wire Cover Kit 80W Cam 'A' Dir	N/A	300239
Backshell and CPA	E-4588	
Cover, Wire Dress	E-4555	
Terminal	33001-1004	300247

B. Connector, Assembly 80F Cam-Assist, 'B' Dir (refer to Figure E–2B)

Required Tools

Crimping Tool	J 47139
Removal Tool	J 38125-12A or J 39227

Use

TCM Connector

Description	Manufacturers P/N	St. Clair P/N
Component Kit (serviced with 90 degree bolt-assist)	N/A	300291
Connector, Assembly	R-62004-001	N/A
Spacer	E-4540	300284
Seal, Interfacial	E-4539	300285
Connector Body		
Cam, Left		
Cam, Right		
Handle, Cam		
Grommet		
Grommet, Retainer	E-4542	
Wire Cover Kit 80W Cam 'A' Dir	N/A	300238
Cover, Wire Dress	E-4589	
Cover, Bottom	E-4555	
Terminal	33001-1004	300247

APPENDIX E—CONNECTOR REPAIR INFORMATION

C. Connector Removal

1. Disengage the CPA by pushing it away from the locked handle.
2. Depress the two square pads on the secondary lever lock to unlatch the handle.
3. Push the cam lever handle to the unlocked position.
4. Separate the connector from the TCM.

NOTE: Do not attempt to move CAM lever after it is disengaged from the TCM, doing so can break the internal latching mechanism. Lever is designed to move only when connected to the TCM.

5. Insert a small blade 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 the spacer lifts to the pre-stage location (approximately 1/8 inch). Carefully continue to evenly lift the red spacer out of the connector body until the four lock arms release. Remove the red spacer and set aside for later use. (The spacer must be replaced if any of the four lock arms is broken during removal.)
6. Insert metal blade of J 38125-12A or J 39227 removal tool into front of connector body at desired terminal/wire lead cavity location (refer to Figures E–2A and E–2B).
7. Apply pressure to the terminal locking finger (part of connector body) with removal tool.
8. Remove the selected terminal by lifting the locking finger 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.

9. Take note of what wire (number) goes to what terminal cavity in connector body for reassembly.

D. Terminal Crimping

1. Lift the wire stop blades in the up position.
2. Insert the terminal fully into the correct die profile and the locator slot until the terminal is fully seated and stops.
3. Bring down the wire stop blades. Make sure the wire stop blades are fully seated on the terminal behind the conductor grip section.
4. Strip the wire to a strip length of 4.70–5.60 mm.
5. Slide the pre-stripped wire into the terminal; make sure to aim the wire brush towards the tip point on the wire stop blade. Align the wire so that it is parallel and sitting into the terminal. Maintain a light and constant pressure on the wire that is seated in the terminal at all times.
6. (Do not release the wire.) Be sure to hold the wire and terminal in place until the terminal is fully crimped.
7. Close the tool until the ratchet releases.
8. Lift the wire stop blades up.
9. Carefully remove the crimped terminal.

APPENDIX E—CONNECTOR REPAIR INFORMATION

D. Terminal Crimping *(cont'd)*

10. Insert the new terminal through the grommet at the back of the connector body. Push on the wire until the terminal is completely in the cavity. The locking finger in the connector body should engage the terminal, which should stay in place when the wire is lightly pulled.

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.***

11. Install wire dress cover on connector body.
12. Install convolute over wire leads while placing convolute into wire dress cover grooves and snap convolute capture into place.

Procedure for proper mating of the 80-way cam lever connector to the TCM

1. Bring the connector to the TCM "squared-up" (not at an angle).
2. Squarely press the connector onto the TCM until the cam handle moves of its own accord (about 3/4 inch travel). This is known as a "prestage."
3. Gently move the cam handle to the locked position.
4. Engage the connector position assurance slide.

APPENDIX E—CONNECTOR REPAIR INFORMATION

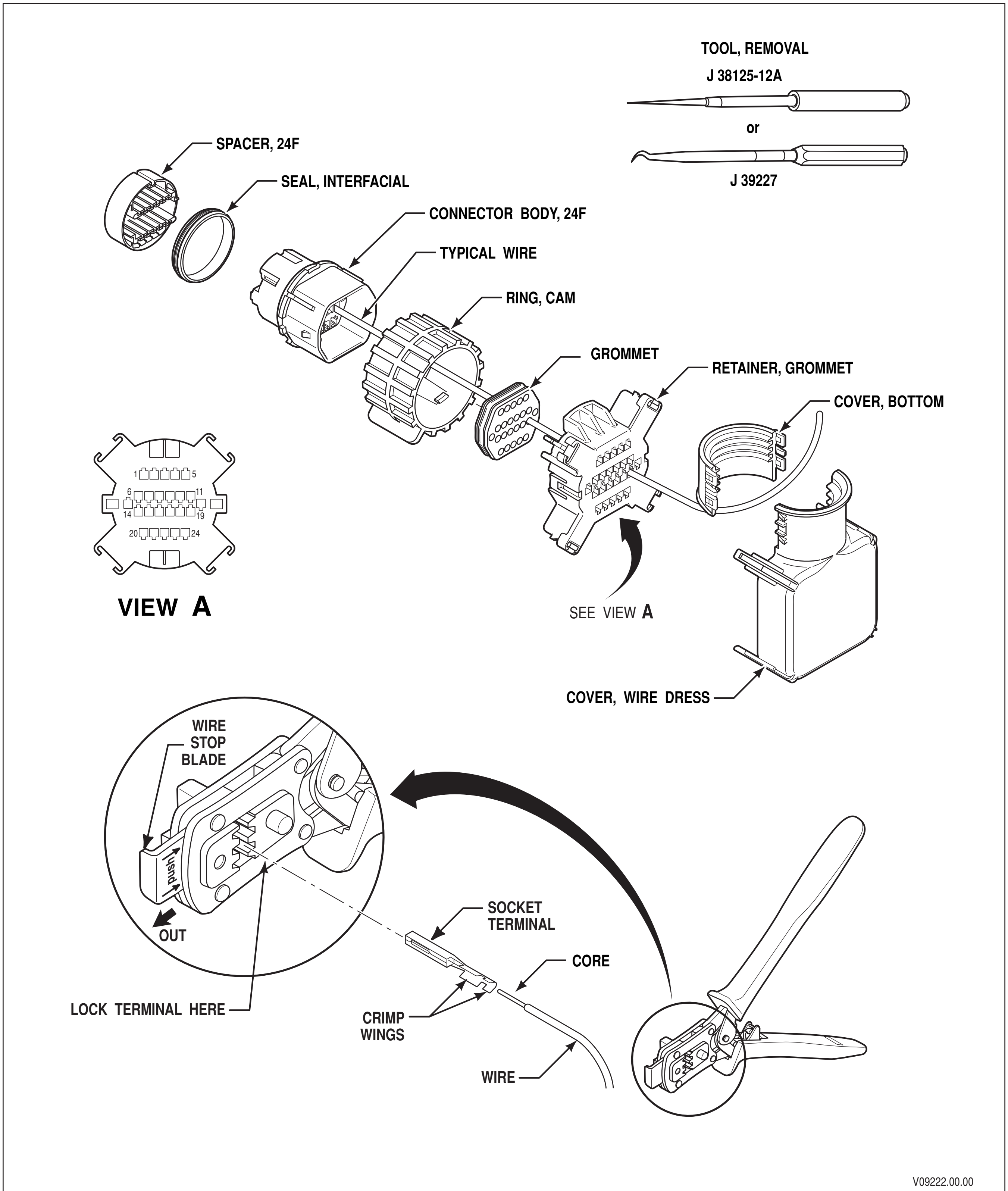

Figure E–3. AFL 24F Transmission Connector

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–3. AFL AUTOMOTIVE 24F TRANSMISSION CONNECTOR

A. Connector/Terminal Repair (refer to Figure E–3)

Required Tools

Crimping Tool	J 47139
Removal Tool	J 38125-12A or J 39227

Use

1000/2000 Main Transmission Connector (Med Duty)

Description	Manufacturers P/N	St. Clair P/N
Kit, Complete Assembly	N/A	300277
Connector Assembly	R-62001-001	300248
Grommet Retainer	E-4582	300249
Cover, Wire Dress	E-4586	300250
Cover, Bottom	E-4570	300251
Terminal, Receptacle	33001-1004	300247
Plug, Cavity Seal	12034413	300008
Spacer, Lock (service replacement)	E-4580	300286
Seal, Interfacial (service replacement)	E-4581	300287

Read disassembly process/procedure thoroughly before beginning disassembly.

B. Terminal Removal

1. Remove 24-way connectors by twisting lock ring counter-clockwise and pull apart.
2. Remove convolute capture and wire dress cover from connector body on 24-way female and set aside for later use.
3. Remove grommet cover by prying with a screwdriver at the retention points.
4. Remove lock ring by rotating connector body to align connector keyway. Slide ring over connector body and wire harness.
5. Insert a small blade 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 the spacer lifts to the pre-stage location (approximately 1/8 inch). Carefully continue to evenly lift the red spacer out of the connector body. Remove the red spacer and set aside for later use. (The spacer must be replaced if any of the lock arms is broken during removal).
6. Insert metal blade of J 38125-12A or J 39227 removal tool into front of connector body at desired terminal/wire lead cavity location (refer to Figure E–3).
7. Apply pressure to the terminal locking finger (part of connector body) with removal tool.
8. Remove the selected terminal by lifting the locking finger 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.***

9. Take note of what wire (number) goes to what terminal cavity in connector body for reassembly.

APPENDIX E—CONNECTOR REPAIR INFORMATION

C. Terminal Crimping

1. Insert a small blade screwdriver between connector body and grommet cover. Pry cover up to remove from connector body.
2. Carefully strip insulation to leave 5.0 mm +/- 0.5 mm (0.2 +/- 0.02 inch) of bare wire showing.
3. Place the core crimp portion of the terminal to be crimped in the J 47139 Molex crimping tool and squeeze the handle enough to keep the terminal from dropping.
4. Position the 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 indentation on the side of the terminal socket is aligned with the locking finger in the connector body.
5. Position insulation crimp portion of the terminal in the J 47139 Molex crimping tool. Squeeze the handle to complete the insulation crimp.
6. Insert the new terminal through the grommet at the back of the connector body. Push on the wire until the terminal is completely in the cavity. The locking finger in the connector body should engage the terminal, which should stay in place when the wire is lightly pulled.

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.

7. Repeat as necessary.
8. Install lock ring by rotating connector body to align connector keyway. Slide ring over connector body.
9. Snap grommet cover into place.
10. Complete terminal installation of the 24-way connector as follows:
11. When all terminals have been inserted, install the red spacer into the connector body. Push until fully seated and flush with the connector body.

NOTE: If spacer does not seat flush with the connector body, make sure all terminals are fully seated.

12. Install wire dress cover on connector body with wire routed through exit opening of wire dress cover.
13. Install convolute over wire leads while placing convolute into wire dress cover grooves and snap convolute capture into place.

NOTES

APPENDIX E—CONNECTOR REPAIR INFORMATION

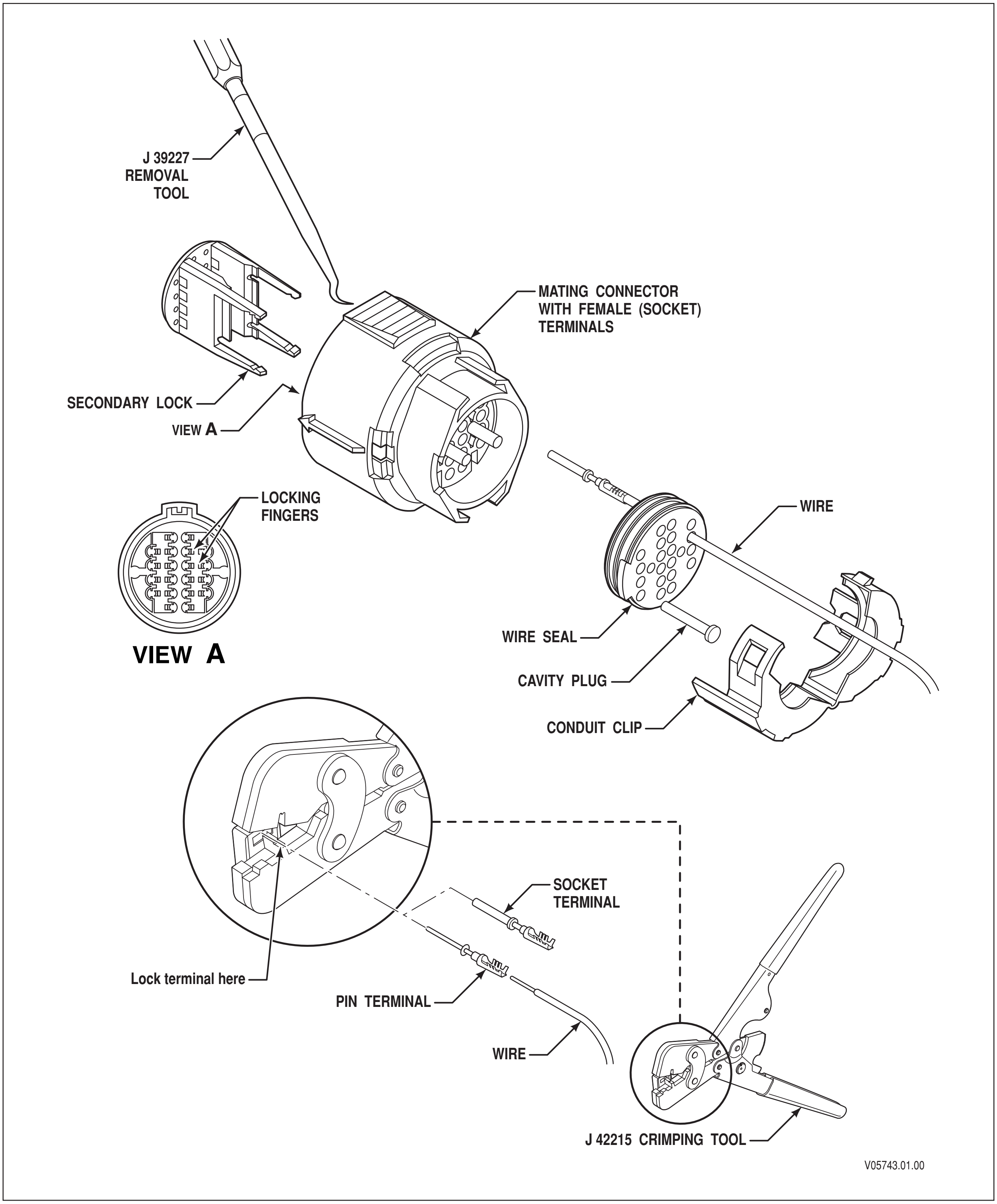

Figure E–4. Delphi-Packard Micro Pack 100W Connector (Main Transmission Connector)

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–4. DELPHI-PACKARD MICRO PACK 100W CONNECTOR (MAIN TRANSMISSION CONNECTOR)

A. Connector/Terminal Repairs (refer to Figure E–4)

Required Tools

Crimping Tool	J 42215
Removal Tool	J 39227

Use

Main Transmission Connector

Description	Manufacturers P/N	St. Clair P/N
Kit, Complete Assembly	N/A	300181
Connector, 20F MIC/P 100W Gray	12160280	
Lock, Secondary 20F Green	12160494	
Terminal, Socket 100W	12084912	
Cavity Plug, 100W	12129557	
Conduit Clip, 13 mm Black	12176394	
Wire Seal	12177159	

B. Terminal Removal—Main Transmission Connectors (refer to Figure E–4)

1. Use a small bladed screw driver to gently release the locktabs at the split line of the conduit clamp.
2. Remove conduit clamp.
3. Use a small-bladed screw driver to gently release the locktab remove the lock assembly.
4. 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.

C. Terminal Crimping

1. Carefully strip 5.0 mm ±0.5 mm (0.20 ±0.02 inch) of insulation from the end of the wire.
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.
4. Complete terminal installation for Main Transmission Connector as follows: (refer to Figure E–1B)
   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 connectors as follows: (refer to Figures E–1A through E–2B)
   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 gently 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 REPAIR INFORMATION

NOTES

APPENDIX E—CONNECTOR REPAIR INFORMATION

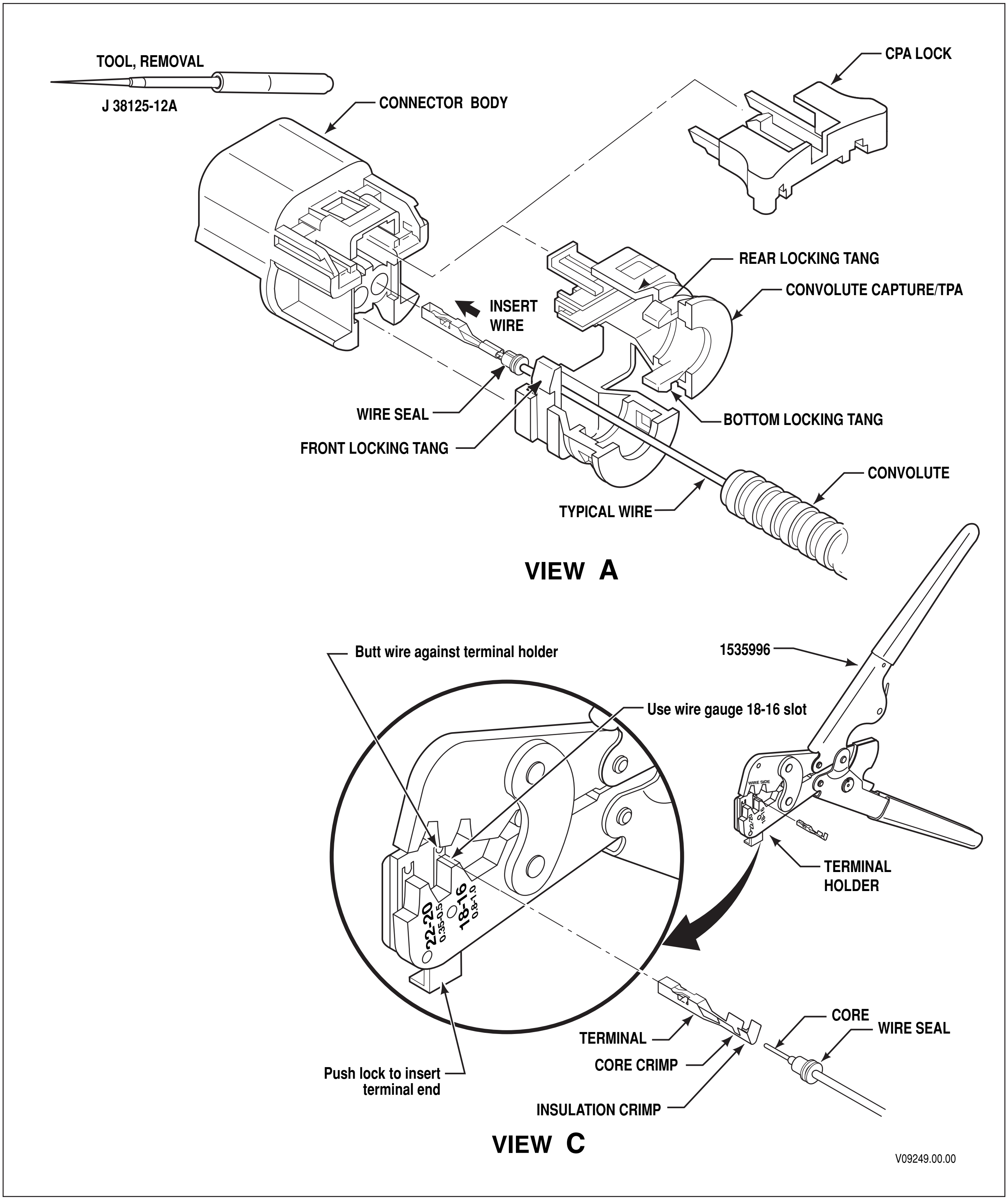

Figure E–5A. Delphi-Packard GT 150 Series Connectors—Push-to-Seat (Speed Sensors)

APPENDIX E—CONNECTOR REPAIR INFORMATION

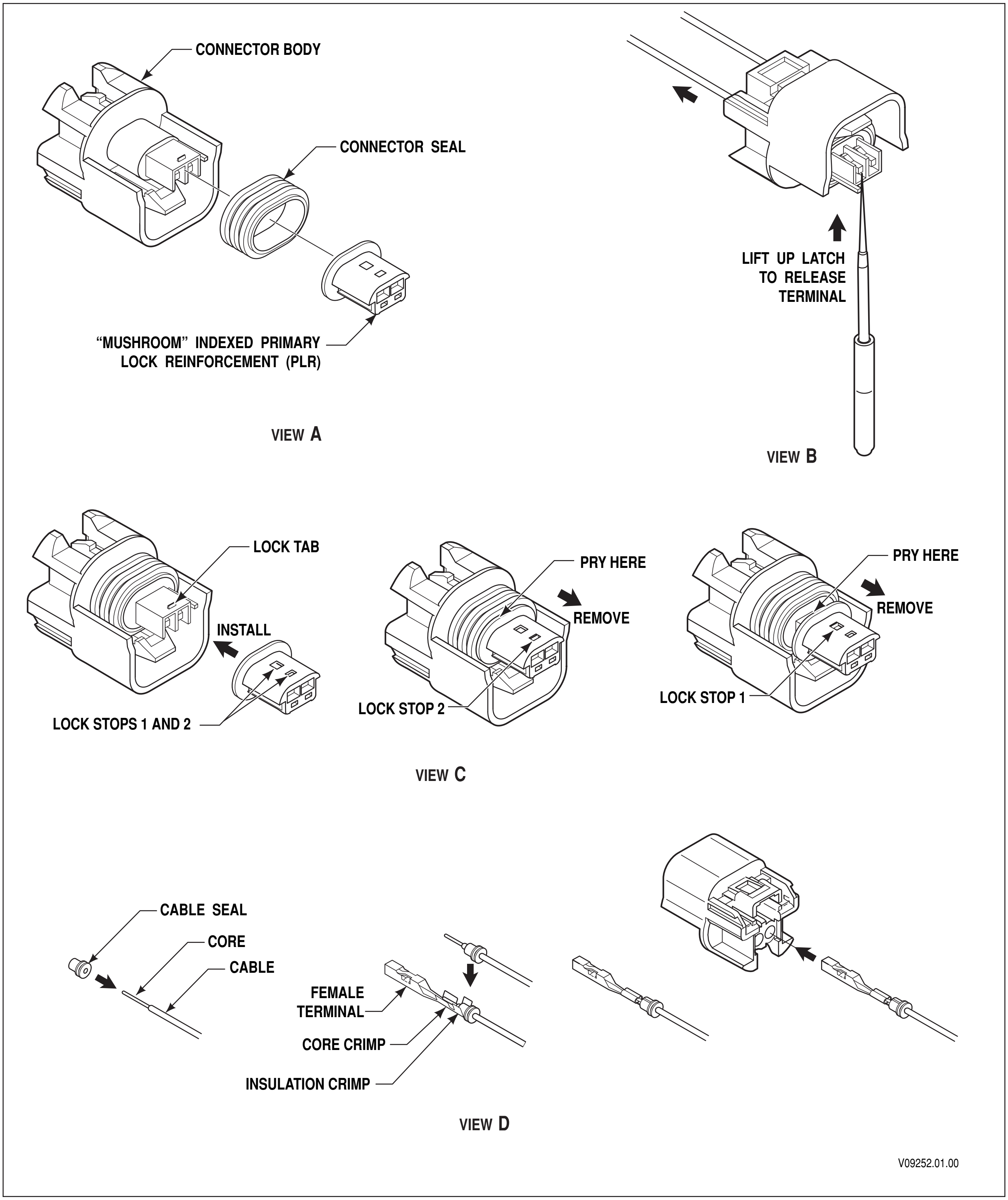

Figure E–5B. Delphi-Packard GT 150 Series Connectors—Push-to-Seat (Speed Sensors)

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–5. DELPHI-PACKARD GT 150 SERIES CONNECTORS—PUSH-TO-SEAT (SPEED SENSORS)

A. Connector /Terminal Repairs (refer to Figures E–5A and E–5B)

Required Tools		
Recommended Crimping Tool		Delphi 15359996
Alternate Insulation Crimp	Anvil “1”	J 38125-6
Alternate Wire Crimp	Anvil “E”	J 38125-7
Recommended Removal Tool		J 38125-12A
Alternate Removal Tool		J 35689-A
Automatic Wire Stripper		J 35615

Use

Engine/Output/Turbine Speed Sensor

Description	**Manufacturers P/N**	**St. Clair P/N**
Kit, Complete Assembly	N/A	300227
Connector Assembly	13520101	300260
Terminal	15326267	
CPA Lock (Tan)	15496486	300261
Seal Assembly (Yellow)	15305351	
Convoluted Capture/TPA	15358890	300263

B. Terminal Removal

1. Pull the CPA Lock (tan) straight back until it unlocks before removing the connector from the speed sensor.
2. The CPA Lock must be removed before opening the convoluted capture assembly. Using removal tool depress the lock tab that holds Convolute Capture Assembly to the convoluted tubing, open convolute capture so the convoluted tube is free. Using the removal tool lift the locks at the top and bottom of Convolute Capture Assembly and remove it from the connector body.
3. Insert a small screwdriver between the interfacial seal and the Primary Lock Reinforcement (PLR) (refer to Figure E–5B), gently pry up to remove the PLR. Insert the end of removal tool J 38125-12A under the terminal locking tab and lift to unlock the terminal. Pull on the wire from behind to remove wire and terminal.

C. Terminal Crimping

1. Before stripping the wire slide the Wire Seal (yellow) onto the wire insulation.
2. Carefully strip approximately 6.0 mm of insulation from the end of the wire. Automatic wire stripper J 35615 may be used for this operation.

(Recommended Crimping Tool Procedure)

a. Install the terminal assembly indexing it properly in the 15359996 crimping tool.

b. Squeeze the crimping tool enough to retain the terminal. Position the wire core into the terminal; slide the wire seal up to the outside tabs that will retain the wire seal.

c. With the wire core positioned and the wire seal both in the proper location crimp the wire to the terminal assembly.

APPENDIX E—CONNECTOR REPAIR INFORMATION

C. Terminal Crimping *(cont'd)*

(Alternate Crimping Tool Procedure)

a. Place the terminal onto the crimping tool J 38125-7, use Anvil E to crimp the wire to the terminal.

b. Slide the wire seal (yellow) onto the wire insulation until it is positioned between the crimping tabs. Place the terminal onto the crimping tool J 38125-6 at Anvil 1, crimp the tabs onto the wire seal.

c. Inspect both crimps, making sure the complete wire core was crimped properly, and also note that the tabs that surround the wire seal are properly crimped.

D. Terminal Installation

1. Insert the terminal into the connector body; push the wire and terminal into the connector body until the terminal locks in place.
2. Reinstall the PLR at the front of the connector body. Install the Convolute Capture Assembly over the wires and snap it into the connector body.
3. Reinstall the CPA Lock to the pre-staged location.

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–6. INTERNAL WIRING HARNESS

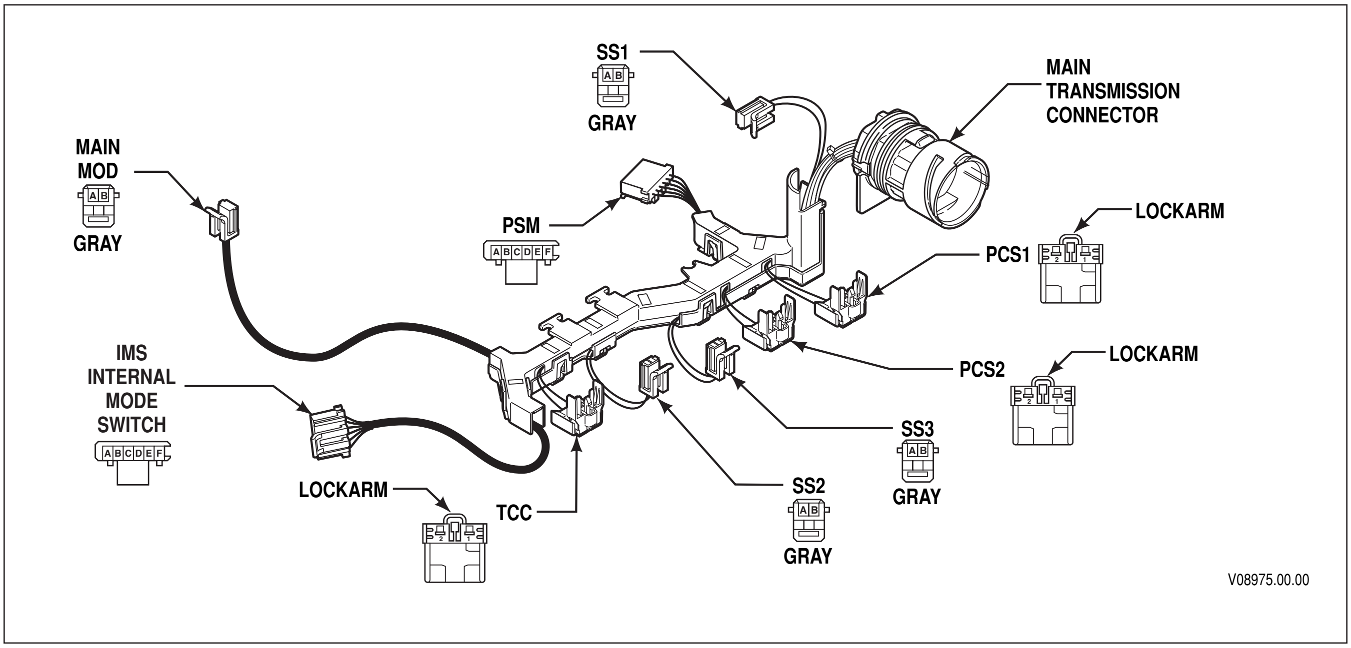

Figure E–6A. Internal Wiring Harness; 24-Way (Medium Duty)

Service with internal wiring harness assembly P/N 29543334 (refer to Figure E–6A).

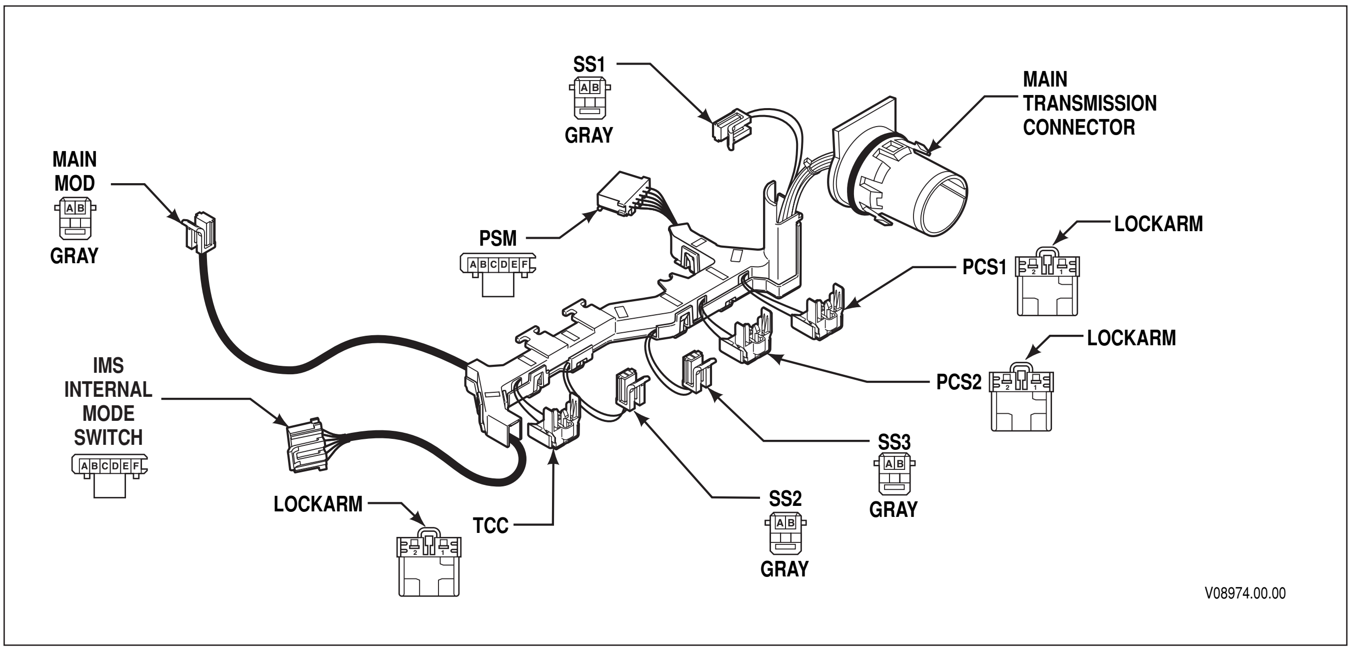

Figure E–6B. Internal Wiring Harness; 20-Way (GM Pickup Only)

Service with internal wiring harness assembly P/N 29543336 (refer to Figure E–6B).

APPENDIX E—CONNECTOR REPAIR INFORMATION

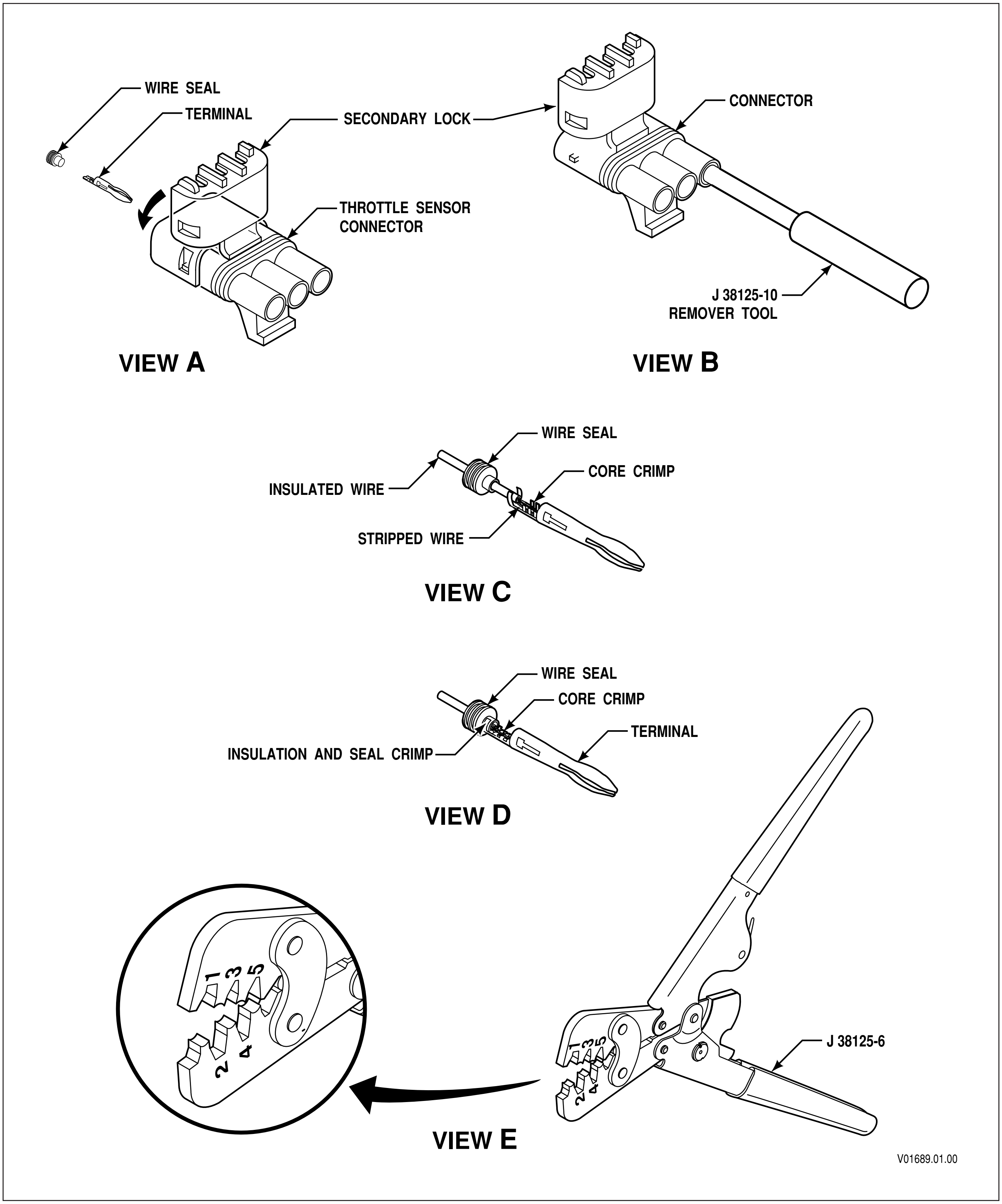

Figure E–7A. Delphi-Packard WeatherPack Connectors (TPS)

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–7. DELPHI-PACKARD WEATHERPACK CONNECTORS (TPS)

A. Connector/Terminal Repairs (refer to Figure E-7A)

Required Tools	
Crimping Tool	J 38125-6
Wire Crimp	Anvil “2”
Insulation Crimp	Anvil “5”
Alternate Crimping Tool	J 35606 or J 38852
Removal Tool	J 38125-10

Use

Throttle Position Sensor (TPS)

Description	**Manufacturers P/N**
Connector	12015793
Terminal	12089040
Wire Seal	12089444

B. Terminal Removal

1. Unlatch and open the secondary lock on the connector (refer to Figure E–7A, View A).
2. From the front of the connector, insert removal tool J 38125-10 over the terminal. Push the tool over the terminal and pull the terminal out the back of the connector (refer to Figure E–7A, View B).
3. If a terminal is to be replaced, cut the terminal between the core and the insulation crimp to minimize wire loss.

NOTE: Two special tools are available for this operation—tool J 38125-6 (Paragraph C) and tool J 35606 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 (refer to Figure E–7A, View C).
2. Strip 6.0 ±0.25 mm (0.24 ±0.01 inch) of insulation from the end of the wire.
3. Place the terminal onto crimping tool J 38125-6 (refer to Figure E–7A, View E), anvil “2.”
4. Slightly close the crimping tool to hold the terminal steady.
5. 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 (refer to Figure E–7A, View C).
6. Crimp the stripped section of the wire.
7. Remove the terminal from the crimping tool.
8. Push the wire seal onto the terminal (refer to Figure E–7A, View D). The second crimp will wrap around the wire seal. This will seal the insulated area of the wire.
9. Use a pair of needle nose pliers, if necessary, to squeeze the terminal wings together to fit in anvil “5.”
10. Crimp the wire seal in anvil “5.”
11. Tug on the terminal to be sure the crimp is tight.
12. Insert the terminal into the connector. The terminal will click into place and should not pull out.

APPENDIX E—CONNECTOR REPAIR INFORMATION

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 (refer to Figure E–7A, View C).
2. Strip 6.0 ±0.25 mm (0.24 ±0.01 inch) of insulation from the end of the wire.
3. Insert terminal into crimping tool J 35606 (refer to Figure E–7B, 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 (refer to Figure E–7B, View B).
7. Position the wire and seal and squeeze the crimping tool until it opens when released.
8. Tug on the terminal to be sure the crimp is tight.
9. Insert the terminal into the connector. The terminal will click into place and should not pull out.
10. Secure the secondary lock. Both sides of the connector must be latched.

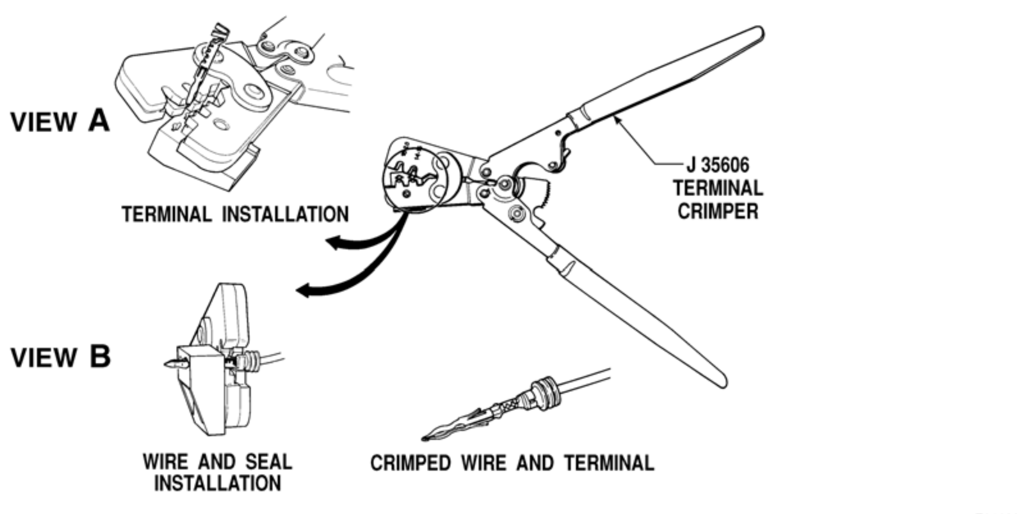

Figure E–7B. Terminal Crimping With Tool J 35606

APPENDIX E—CONNECTOR REPAIR INFORMATION

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APPENDIX E—CONNECTOR REPAIR INFORMATION

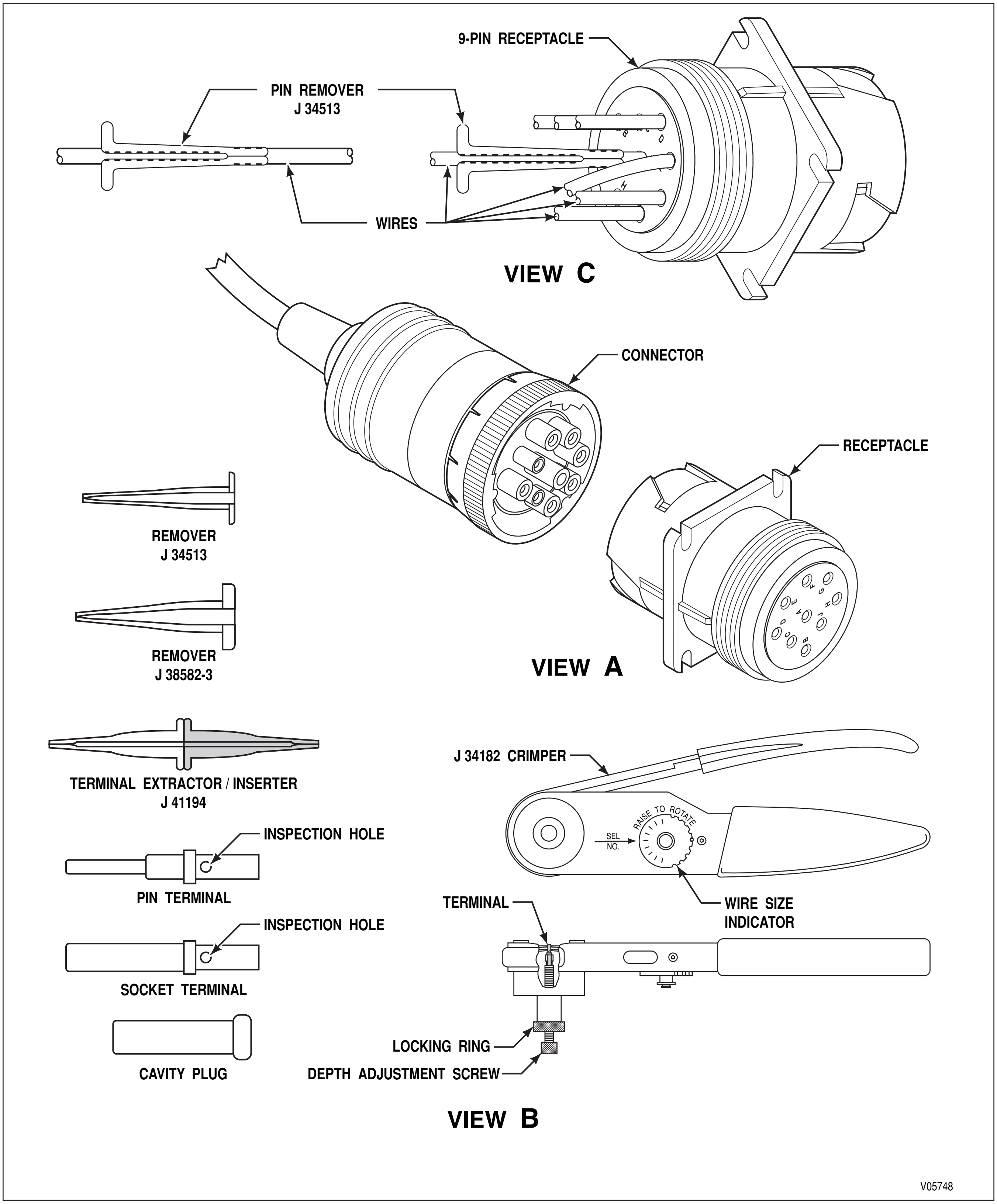

Figure E–8. Deutsch IPD/ECD Connectors (9-Way DDR)

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–8. DEUTSCH IPD/ECD CONNECTORS (J1939 DIAGNOSTIC LINK 9-WAY DDR)

A. Connector/Terminal Repairs (refer to Figure E–8)

Required Tools		
Crimping Tool	J 34182	
Extractor/Inserter Tool	J 41194 (18 GA ECD Bulkhead)	
Removal Tool Set	J 34513	
Removal Tool (DDR Connector)	J 38582-3 (12–14 GA)	
Use		
J1939 Diag Link (9-Way DDR)		
Description	**Manufacturers P/N**	**St. Clair P/N**
9-Way Receptacle	HD10-9-1939P	300267

NOTE: ***If difficulty is encountered in removing or installing the plug backshell, insert the plug into the receptacle, do not lock it into place, and loosen the backshell.***

B. Terminal Removal (refer to Figure E–8, View A)

NOTE: ***When using removal/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 removal/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 a terminal, cut the wire through the middle of the terminal crimp to minimize wire loss.

C. Terminal Crimping (refer to Figure E–8, View B)

1. Strip approximately 6–8 mm (0.236–0.315 inch) of insulation from the end of the wire.
2. Set the crimping tool wire size to number 12. To 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.
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 (0.02–0.04 inch)) of wire will be visible above the terminal barrel.

APPENDIX E—CONNECTOR REPAIR INFORMATION

C. Terminal Crimping (refer to Figure E–8, View B) *(cont'd)*

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 be sure 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 the tubing to the insulation.

D. Terminal Insertion (all connectors except 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 REPAIR INFORMATION

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APPENDIX E—CONNECTOR REPAIR INFORMATION

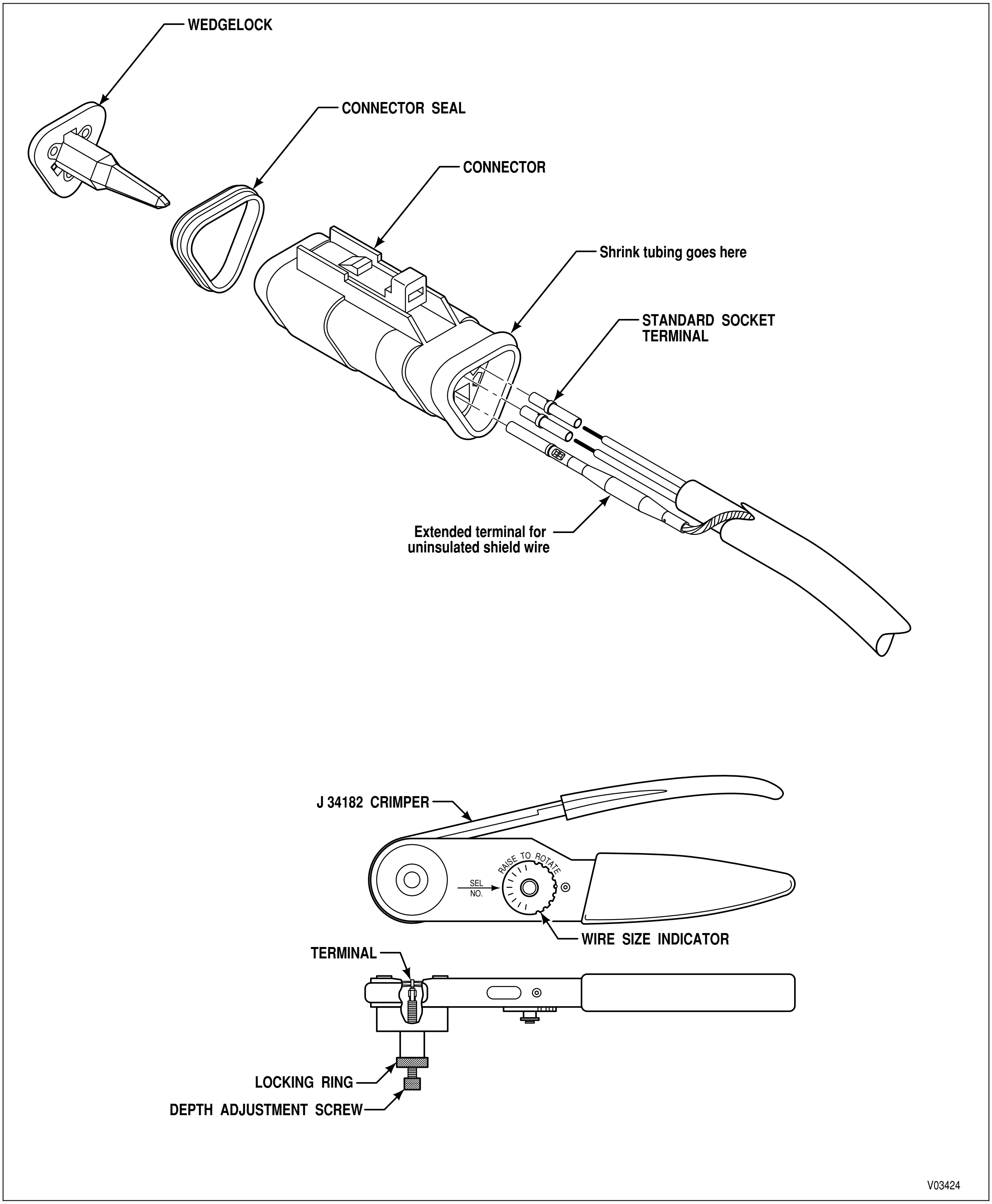

Figure E–9. Deutsch DT Series Connector (3-Way J1939 Interface)

APPENDIX E—CONNECTOR REPAIR INFORMATION

E–9. DEUTSCH DT SERIES CONNECTORS (3-WAY J1939 INTERFACE)

A. Connector/Terminal Repair (refer to Figure E–9)

Required Tools

Crimping Tool J 34182

Use

J1939 Interface

Description	Manufacturers P/N
Connector, Plug, 3-Way	DT06-3S-E008
Wedgelock, Plug	W3S-1939
Contact, Socket (Standard)	3662-204-1690
Contact, Socket (Extended)	0462-221-1631
Cable, J1939 Databus	23-000-13

B. Terminal Removal (refer to Figure E–9)

1. Use a small-bladed screwdriver to remove the wedgelock 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 for all of the terminals. Pull the wire and terminal out the rear of the connector.
4. Slide a new piece of shrink tubing over the removed terminals and onto the cable.
5. If replacing a terminal, cut the wire through the middle of the terminal crimp to minimize wire loss.

C. Terminal Crimping (refer to Figure E–9)

1. Strip approximately 6–8 mm (0.24–0.31 inch) of insulation from the end of 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 the number 18 is aligned with the SEL NO. arrow. Reinstall the retainer pin.
3. Insert the contact end of the terminal down 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 wire end of the terminal is just above flush with the top of the crimping hole. The depth adjustment screw will need to be backed out a large amount to accept the extended shield terminal. The crimp jaws will now 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 (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 be sure the crimp is tight.

D. Terminal Insertion

1. Insert the terminal and attached wire into the back of the connector.
2. Push on the terminal and wire until the terminal clicks into position. Check the front of the connector to see that the terminal is at the same height as other terminals. Pull gently on the wire to be sure that the terminal is fully seated.
3. Insert the wedge lock to hold the terminals 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 REPAIR INFORMATION

E–10. 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

   Make sure that terminals are secure in the connector. Clean, straighten, or replace parts as required.

2. Reconnect all previous unmated connectors. Make sure 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 the trouble recurs after starting the vehicle, follow the repair procedures for the trouble code or complaint.
4. If the trouble does not recur, or if the appropriate 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 (refer to Figure E–10)

NOTE: Use crimping anvils "F" and "G."

- Wire Strippers, 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 REPAIR INFORMATION

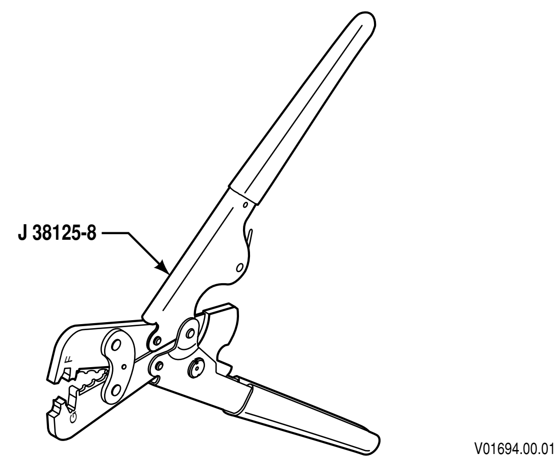

Figure E–10. Crimper J 38125-8

C. Straight Lead Repair Procedure

1. Locate the damaged wire.
2. Remove 8.0 mm (0.3 inch) of insulation from the end of each segment of the damaged wire.
3. Insert the stripped end of one wire into the crimp barrel of the splice, and crimp.
4. Insert the stripped end of the other wire into the other end of the crimp barrel, and crimp.
5. Pull on the connection to be sure of crimping integrity.
6. Heat the splice with a heat gun until the covering shrinks and adhesive flows from under the covering.
7. The splice is now sealed and insulated. Electrical tape is not necessary and should not be used.

CONNECTOR REPAIR INFORMATION

CONNECTOR	MFG P/N	ST. CLAIR P/N	PART NAME	MANUFACTURER	CONFIG	MATING P/N	MFG P/N	MATING PART
TCM 80-WAY BOLT-ASSIST STRAIGHT (ST. CLAIR P/N 300276)	R-61991-001	300243	SPACER, 80F	AFL AUTOMOTIVE	1-PC/TCM			TCM HEADER
			SEAL, INTERFACIAL					
			CONNECTOR BODY, 80F BOLT					
			BOLT					
			SEAL, BOLT					
			RETAINER, BOLT					
			GROMMET, WIRE SEAL					
	E-4542	300244	GROMMET, RETAINER					
	E-4550	300245	COVER A, WIRE DRESS					
	E-4551	300246	COVER, B WIRE DRESS					
	33001-1004	300247	TERMINAL	MOLEX				
	12034413	300008	PLUG, CAVITY SEAL	DELPHI				
TCM 80-WAY BOLT-ASSIST DIR “A” 90 DEGREE WIRE DRESS	R-61991-001	300243	SPACER, 80F	AFL AUTOMOTIVE	1-PC/TCM			TCM HEADER
			SEAL, INTERFACIAL					
			CONNECTOR BODY, 80F BOLT					
			BOLT					
			SEAL, BOLT					
			RETAINER, BOLT					
			GROMMET, WIRE SEAL					
	E-4542	300244	GROMMET, RETAINER					
	E-6206-002		COVER, WIRE DRESS, DIR A					
	E-4555		COVER, BOTTOM					
	33001-1004	300247	TERMINAL	MOLEX				
	12034413		PLUG, CAVITY SEAL	DELPHI				
TCM 80-WAY BOLT-ASSIST DIR “B” 90 DEGREE WIRE DRESS	R-61991-001	300243	SPACER, 80F	AFL AUTOMOTIVE	1-PC/TCM			TCM HEADER
			SEAL, INTERFACIAL					
			CONNECTOR BODY, 80F BOLT					
			BOLT					
			SEAL, BOLT					
			RETAINER, BOLT					
			GROMMET, WIRE SEAL					
	E-4542	300244	GROMMET, RETAINER					
	E-6206-001		COVER, WIRE DRESS, DIR B					
	E-4555		COVER, BOTTOM					
	33001-1004	300247	TERMINAL	MOLEX				
	12034413		PLUG, CAVITY SEAL	DELPHI				

CONNECTOR REPAIR INFORMATION

CONNECTOR	MFG P/N	ST. CLAIR P/N	PART NAME	MANUFACTURER	CONFIG	MATING P/N	MFG P/N	MATING PART
TCM 80-WAY CAM-ASSIST DIR "A"	R-62004-001		SPACER, 80F	AFL AUTOMOTIVE	1-PC/TCM			TCM HEADER
			SEAL, INTERFACIAL					
			CONNECTOR 80F CAM					
			CAM, LEFT					
			CAM, RIGHT					
			BOLT					
			HANDLE, CAM					
			RETAINER, BOLT					
			GROMMET, WIRE SEAL					
	E-4542	300244	GROMMET, RETAINER					
	E-4589		COVER, BOTTOM					
	E-4555		COVER, WIRE DRESS					
			CPA					
			TERMINAL					
			PLUG, CAVITY SEAL					
TCM 80-WAY CAM-ASSIST DIR "B"	R-61991-002		SPACER, 80F	AFL AUTOMOTIVE	1-PC/TCM			TCM HEADER
			SEAL, INTERFACIAL					
			CONNECTOR 80F CAM					
			CAM, LEFT					
			CAM, RIGHT					
			BOLT					
			HANDLE, CAM					
			RETAINER, BOLT					
			GROMMET, WIRE SEAL					
	E-4542	300244	GROMMET, RETAINER					
	E-4588		COVER, BOTTOM					
	E-4555		COVER, WIRE DRESS					
			CPA					
			TERMINAL					
			PLUG, CAVITY SEAL					
TRANS, 24F TWIST-LOCK (ST. CLAIR P/N 300277)	R-62001-001	300248	SPACER, 24F	AFL AUTOMOTIVE	1-PC/ TRANS	R-62002-001	R-62002-001	CONNECTOR ASSY, 24M, PASS-THRU
			SEAL, INTERFACIAL					
			CONNECTOR BODY, 24F					
			CAM RING					
			GROMMET,WIRE SEAL					
	E-4582	300249	GROMMET RETAINER					
	E-4586	300250	COVER, WIRE DRESS					
	33001-0004	300247	TERMINAL	MOLEX				
	12034413	300008	PLUG, CAVITY					
	E-4570	300251	COVER, BOTTOM	AFL AUTOMOTIVE				

CONNECTOR REPAIR INFORMATION

CONNECTOR	MFG P/N	ST. CLAIR P/N	PART NAME	MANUFACTURER	CONFIG	MATING P/N	MFG P/N	MATING PART
MICRO PACK 100W, 20-WAY CONNECTOR	12160280		CONNECTOR 20F 100W GRAY	DELPHI	1-PC/ TRANS	12160782		CONNECTOR 20M, INTERNAL HARNESS
	12177159		CABLE SEAL, 20F ORANGE				15317365	LOCK ASSIST 20M
	12160494		LOCK, SECONDARY 20F GREEN					
	12084912		TERMINAL, SOCKET FEMALE			12160551		TERMINAL, SOCKET MALE
	12129557		CAVITY PLUG					
	12176394		CONDUIT CLIP, 13 MM BLACK					
GT 150 CONNECTOR (ST. CLAIR P/N 300227)	13520101	300260	CONNECTOR ASSEMBLY	DELPHI				
	15326267		TERMINAL					
	15496486	300261	CPA LOCK					
	15305351		SEAL ASSEMBLY					
	15358890	300263	CONVOLUTED CAPTURE/TPA					
WEATHERPACK CONNECTOR (TPS)	12015793		CONNECTOR	DELPHI	1-PC/ COMP			TPS HEADER
	12089040		TERMINAL					
	12089444		WIRE SEAL					
J1939 DIAGNOSTIC LINK 9-WAY DDR (ST. CLAIR P/N 300217)	HD10-9-1939P	300267	CONNECTOR, REC., 9-WAY	DEUTSCH IPD	1-PC/ COMP			DIAGNOSTIC TOOL/ STD J1939
	0460-202-1631		CONTACT, PIN					
	0460-247-1631		CONTACT, PIN EXTENDED					
	114017	300000	SEALING PLUG					
	HD18	300269	STRAIN RELIEF					
	HDC16-6	300268	CAP, CONNECTOR					
J1939 INTERFACE (ST. CLAIR P/N 300282)	0462-201-1631		CONTACT, SOCKET #16	DEUTSCH IPD	1-PC/TCM	29511369	0460-202-1631	CONTACT, PIN #16
	0462-221-1631		CONTACT, EXTENDED SOCKET				0460-247-1631	CONTACT, PIN EXTENDED
	23-000-13		CABLE, J1939 DATA BUS					
	DT06-3S-P032	300272	CONNECTOR, PLUG, 3-WAY	DEUTSCH IPD			DT04-3P-EE01	CONNECTOR, REC., 3-WAY
	W3S-1939-P012	300271	WEDGELOCK, PLUG (GREEN)				W3P	WEDGELOCK, RECEPTACLE

APPENDIX F—THROTTLE POSITION SENSOR ADJUSTMENT

F–1. TPS ADJUSTMENT

A. Description of Operation

1. To properly communicate throttle position to the TCM, the throttle position sensor must convert 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 (refer to Figure F–1).

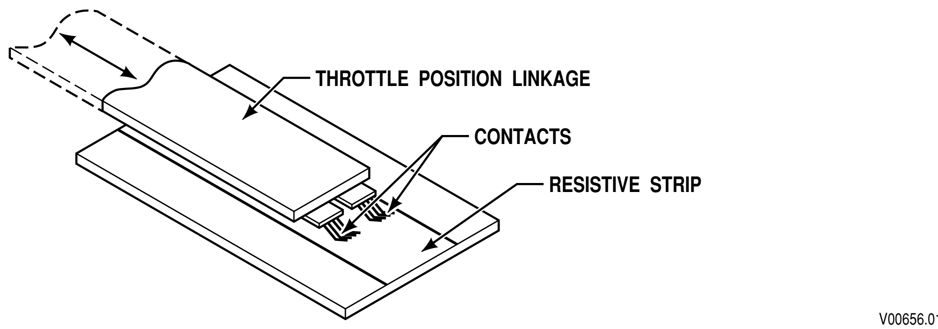

Figure F–1. Throttle Position-to-Voltage Conversion

2. Each position gives a different voltage. The TCM then converts this voltage into throttle percent. Each millimeter of travel converts to approximately 0.110 volts. Figure F–2 diagrams the voltage and throttle movement relationship.

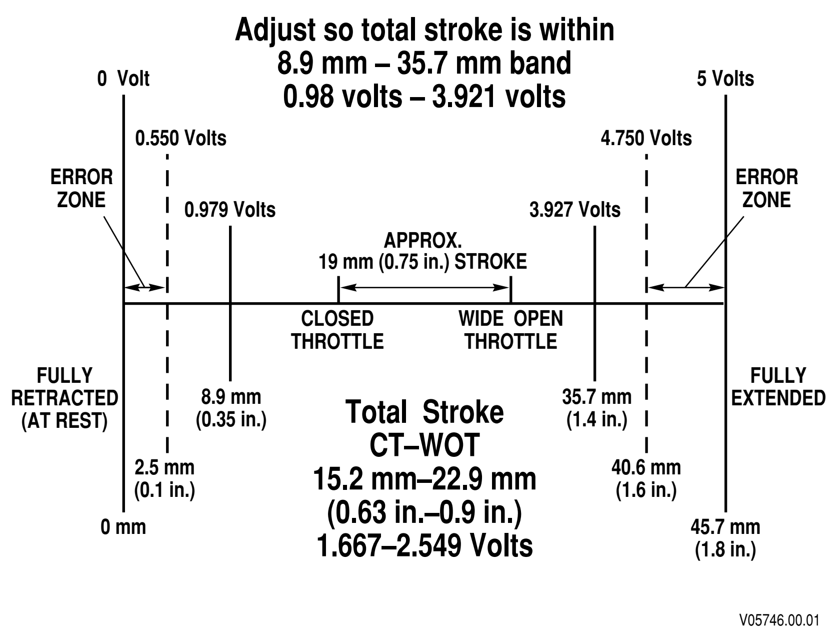

Figure F–2. Throttle Position Determination Diagram

APPENDIX F—THROTTLE POSITION SENSOR ADJUSTMENT

3. Throttle percent is proportional to the amount of travel of the throttle position sensor. Therefore a small amount of travel corresponds to a low throttle percentage, and a large amount of travel corresponds to a high throttle percentage (refer to Table F–1).

4. The throttle position sensor 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 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 Scan Tool to reset the TPS calibrations after a TPS adjustment.

B. Throttle Position Sensor (TPS) Adjustment

When properly installed by the equipment manufacturer (refer to 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 0.98 volts or higher, and the full throttle position should be approximately 35.7 mm or 3.921 volts or lower. The TPS is self-calibrating, meaning there is no optimum closed throttle 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 the full stroke. Make certain the idle and full throttle positions are not in the error zones (refer to 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 J 39700 Breakout Box and J 47275 TCM Breakout Harness Adapter for measuring voltages.

APPENDIX F—THROTTLE POSITION SENSOR ADJUSTMENT

Table F–1. Throttle Position Travel vs. Voltage

mm	Volts
0	0
1	0.110
2	0.220
3	0.329
4	0.439
5	0.549
6	0.659
7	0.768
8	0.878
9	0.988
10	1.098
11	1.207
12	1.317
13	1.427
14	1.537
15	1.646
16	1.756
17	1.866
18	1.976
19	2.085
20	2.195
21	2.305
22	2.415
23	2.524

mm	Volts
24	2.634
25	2.744
26	2.854
27	2.964
28	3.073
29	3.183
30	3.293
31	3.403
32	3.512
33	3.622
34	3.732
35	3.842
36	3.951
37	4.061
38	4.171
39	4.281
40	4.390
41	4.500
42	4.610
43	4.720
44	4.829
45	4.939
46	5.049

APPENDIX F—THROTTLE POSITION SENSOR ADJUSTMENT

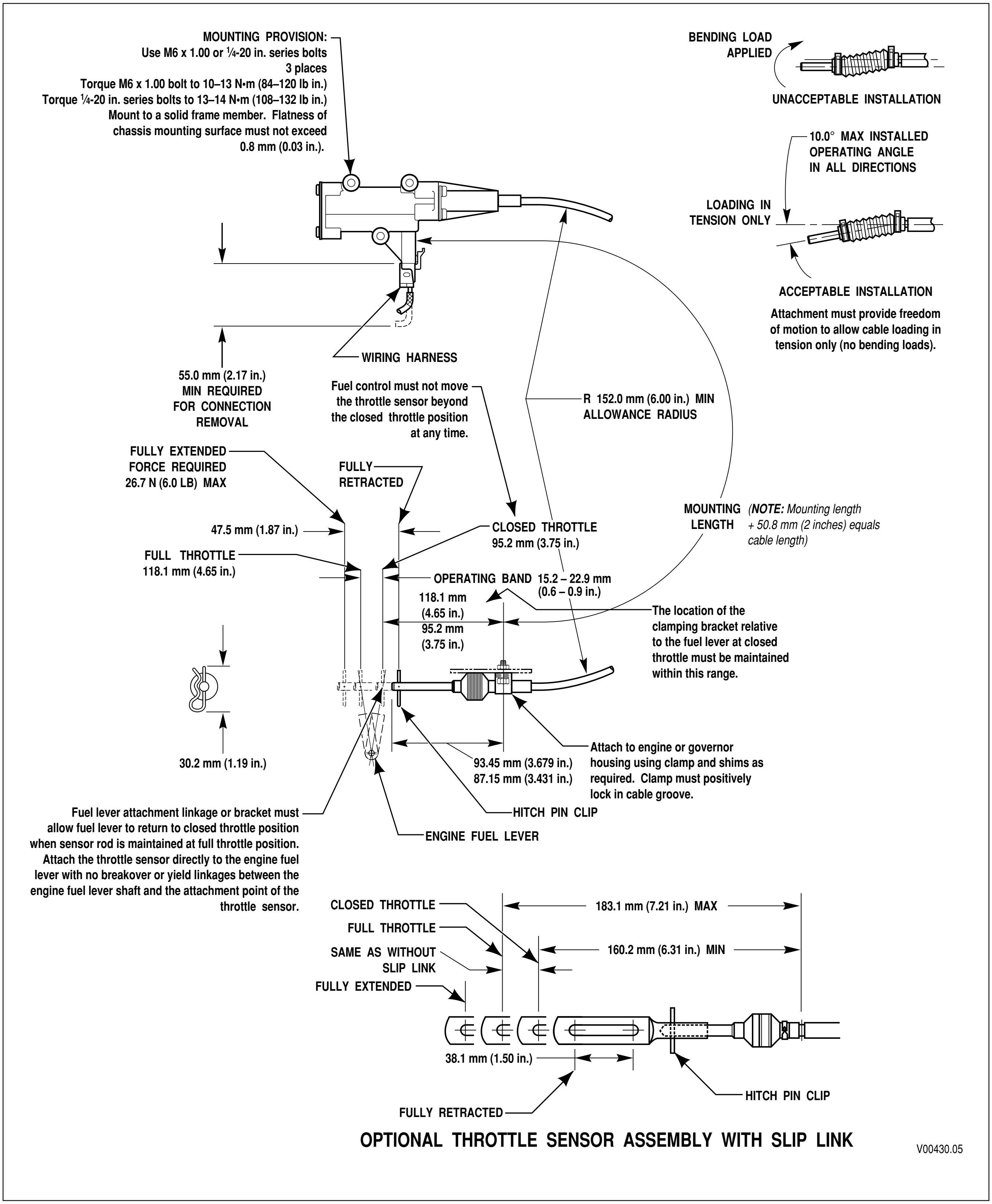

Figure F–3. Throttle Position Sensor Adjustment

APPENDIX G—WELDING ON VEHICLE/VEHICLE INTERFACE

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 control module (TCM).
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.**

APPENDIX G—WELDING ON VEHICLE/VEHICLE INTERFACE

NOTES

APPENDIX H—HYDRAULIC SCHEMATICS

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NOTES

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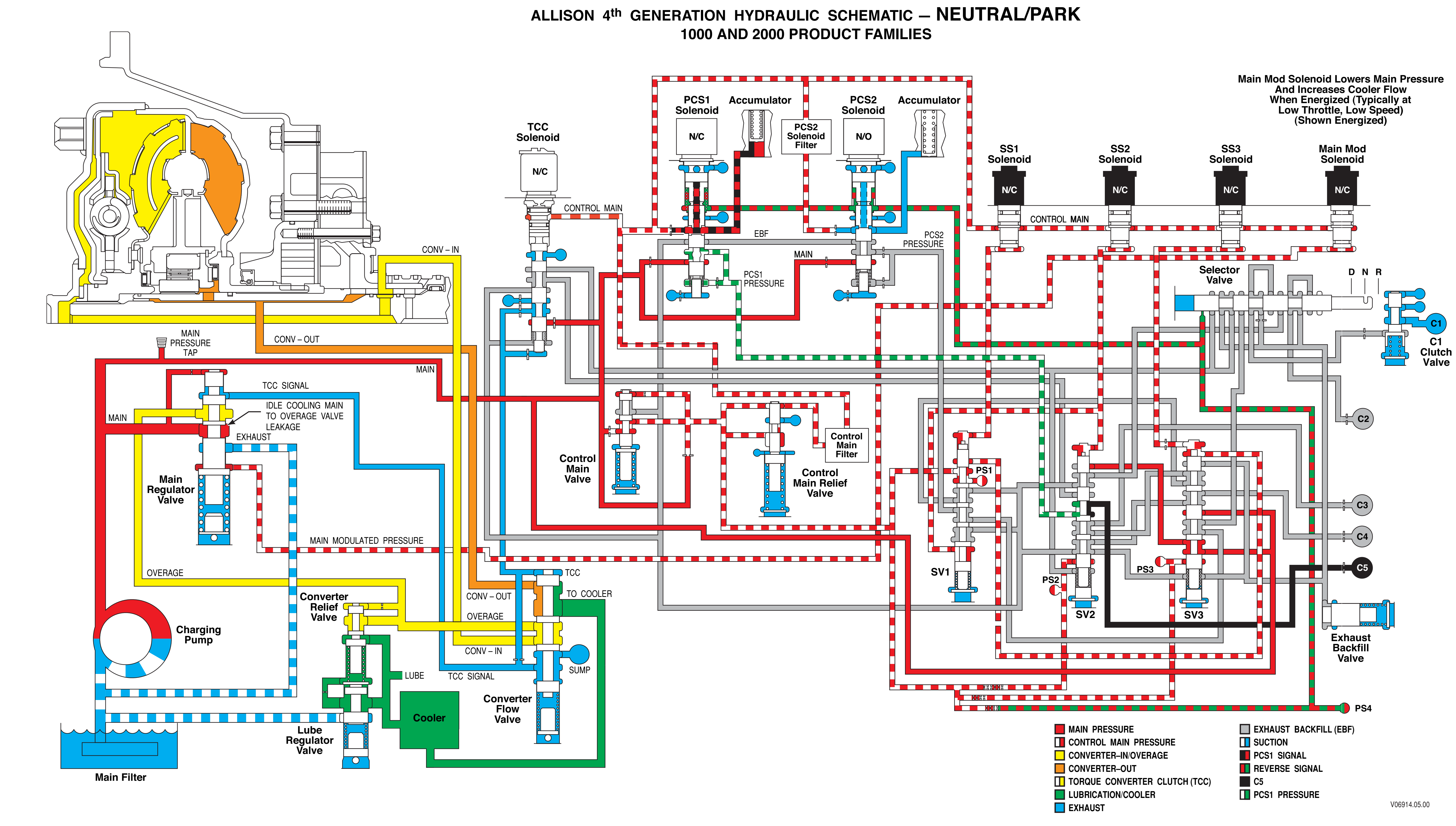


Figure H–1. 1000 and 2000 Product Families Hydraulic Schematic—Neutral/Park

APPENDIX H—HYDRAULIC SCHEMATICS

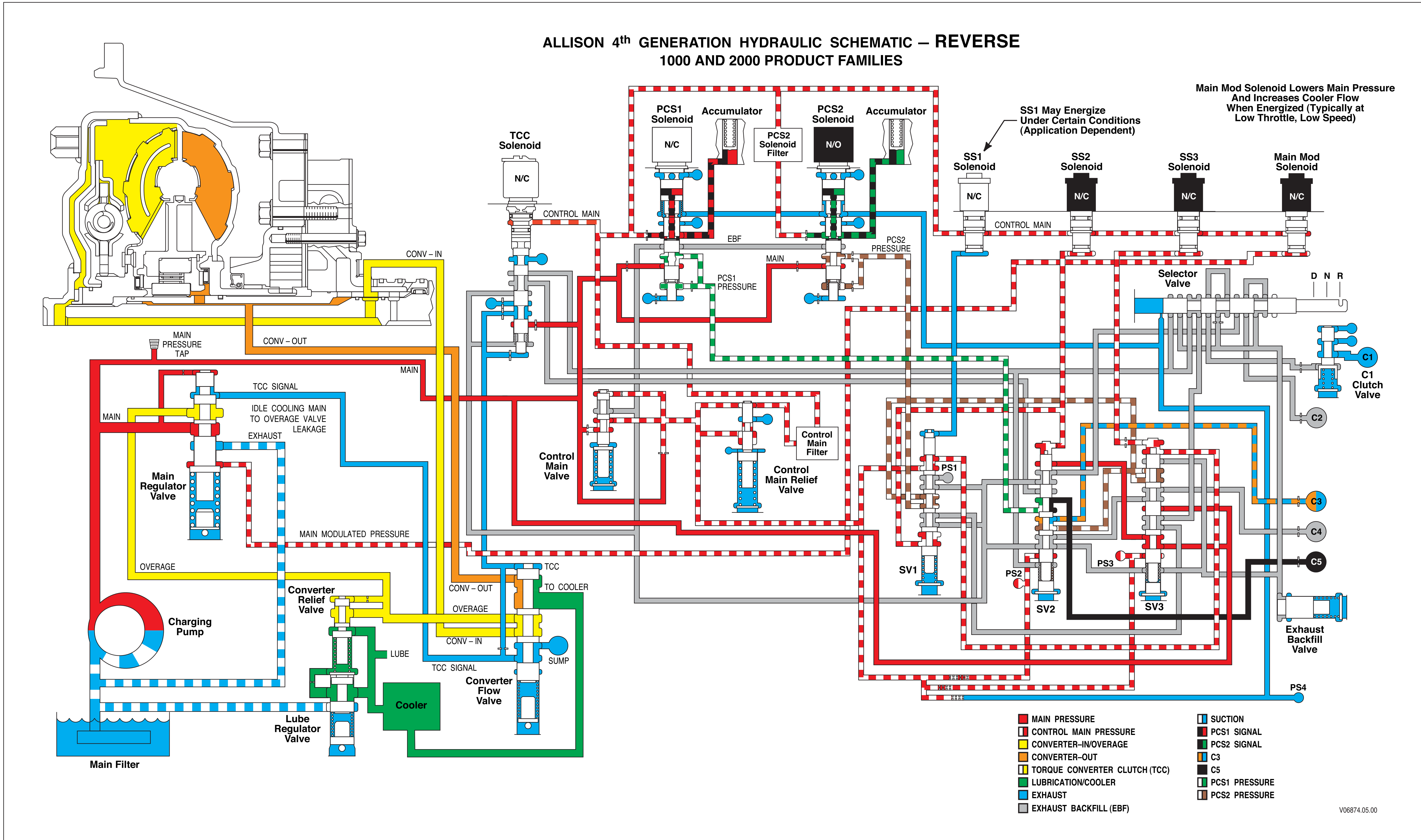


Figure H–2. 1000 and 2000 Product Families Hydraulic Schematic—Reverse

APPENDIX H—HYDRAULIC SCHEMATICS

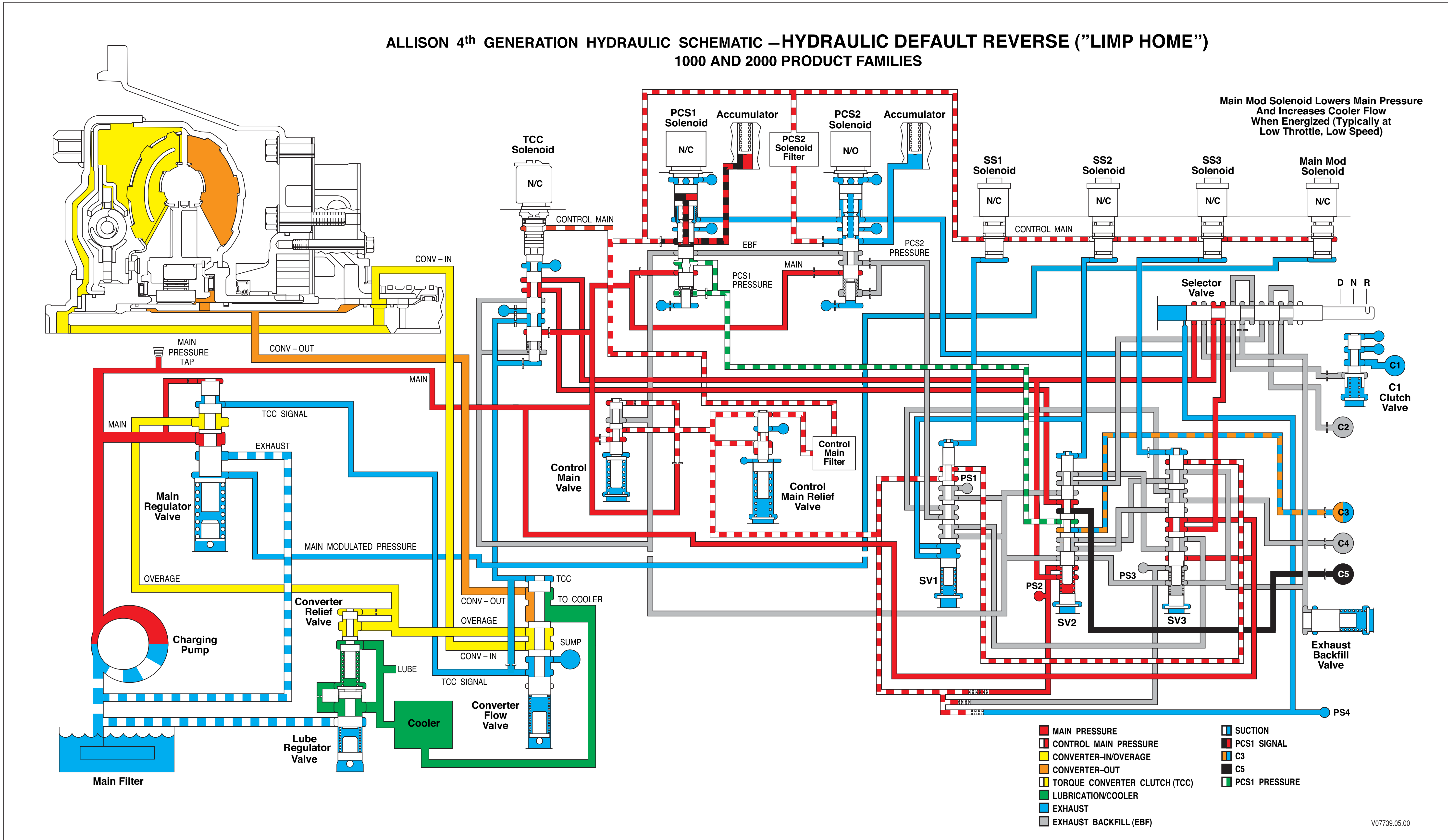


Figure H–3. 1000 and 2000 Product Families Hydraulic Schematic—Hydraulic Default Reverse ("Limp Home")

APPENDIX H—HYDRAULIC SCHEMATICS

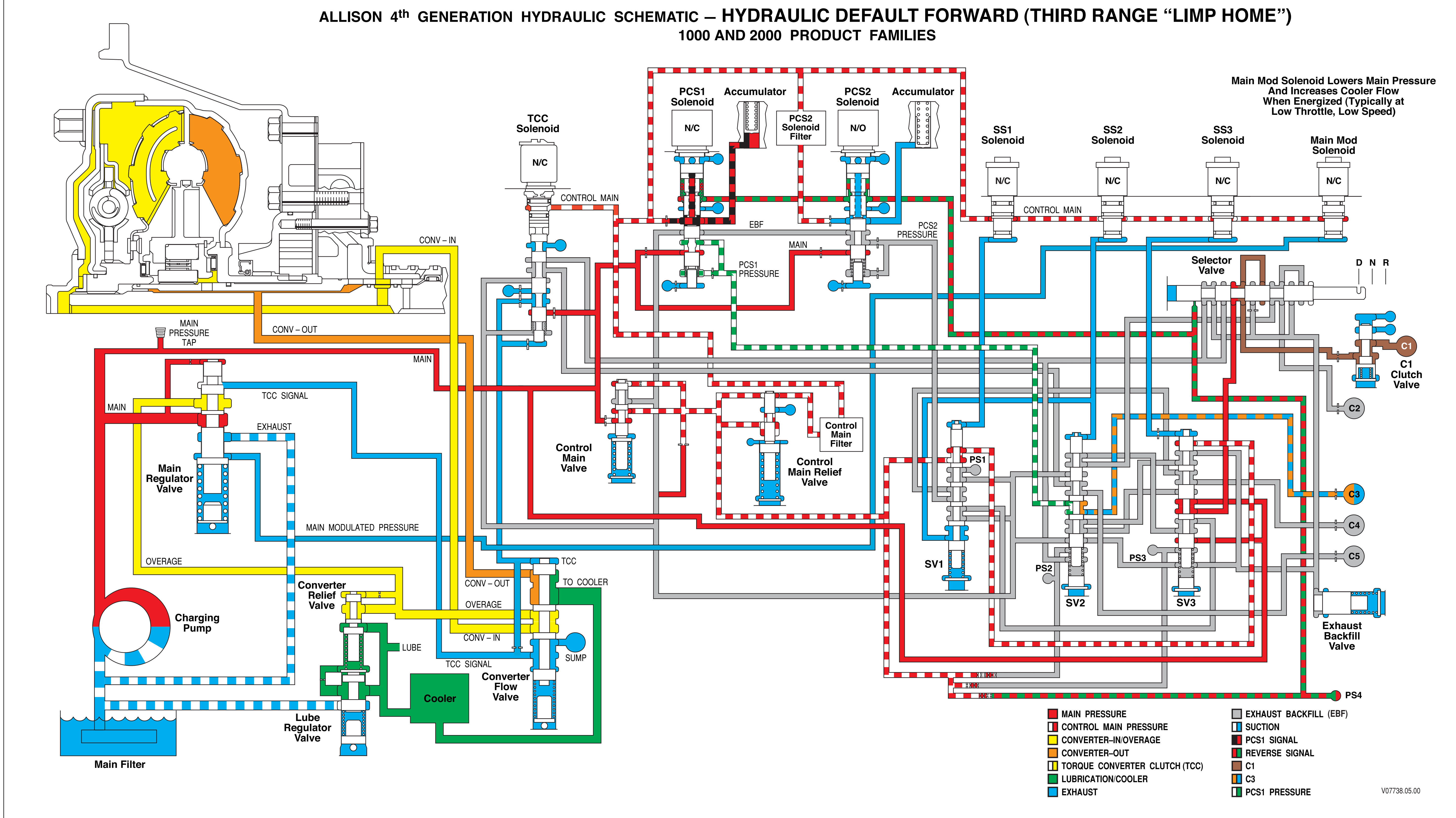


Figure H–4. 1000 and 2000 Product Families Hydraulic Schematic—Hydraulic Default Forward (Thid Range "Limp Home")

APPENDIX H—HYDRAULIC SCHEMATICS

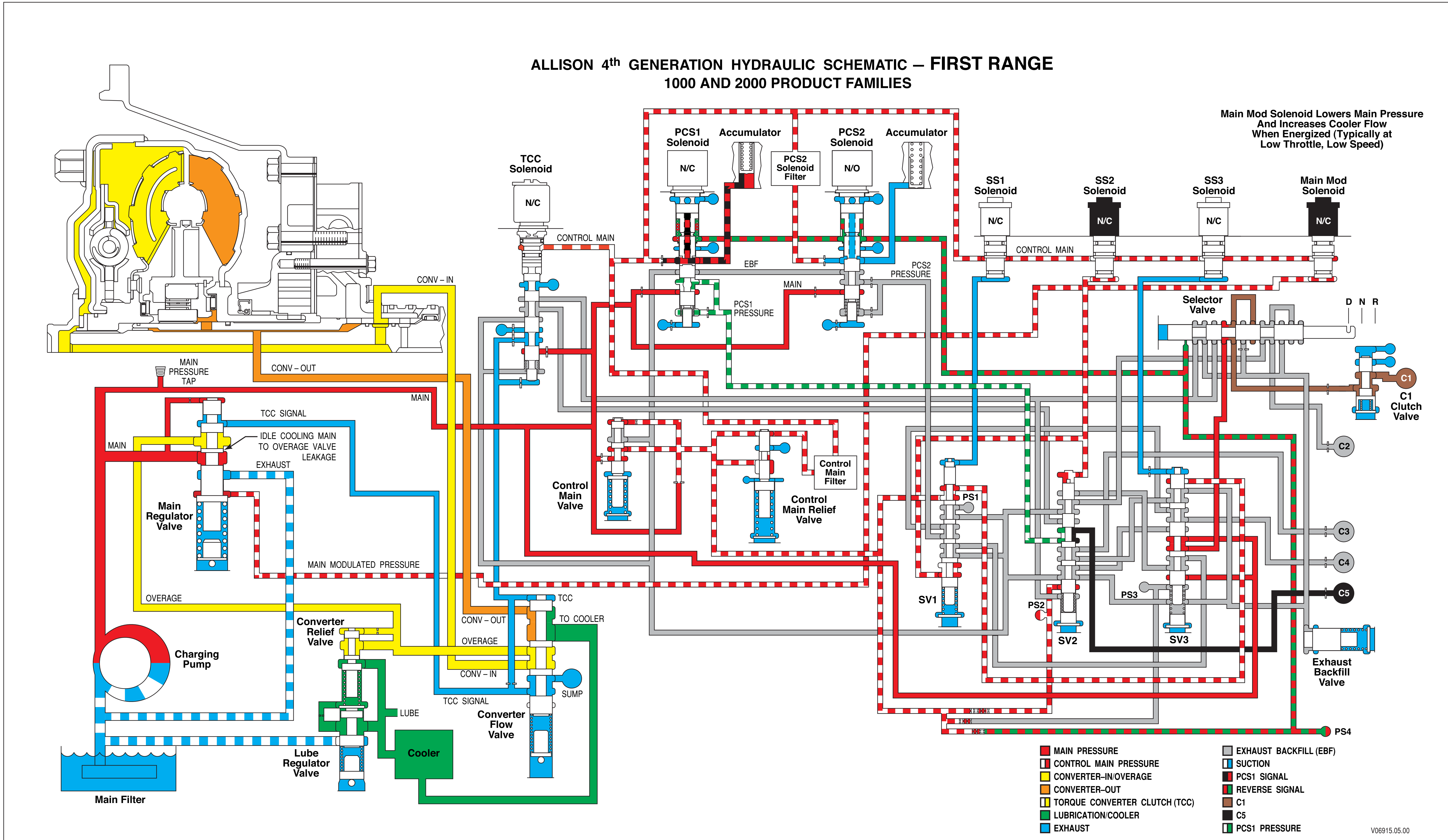


Figure H–5. 1000 and 2000 Product Families Hydraulic Schematic—First Range

APPENDIX H—HYDRAULIC SCHEMATICS

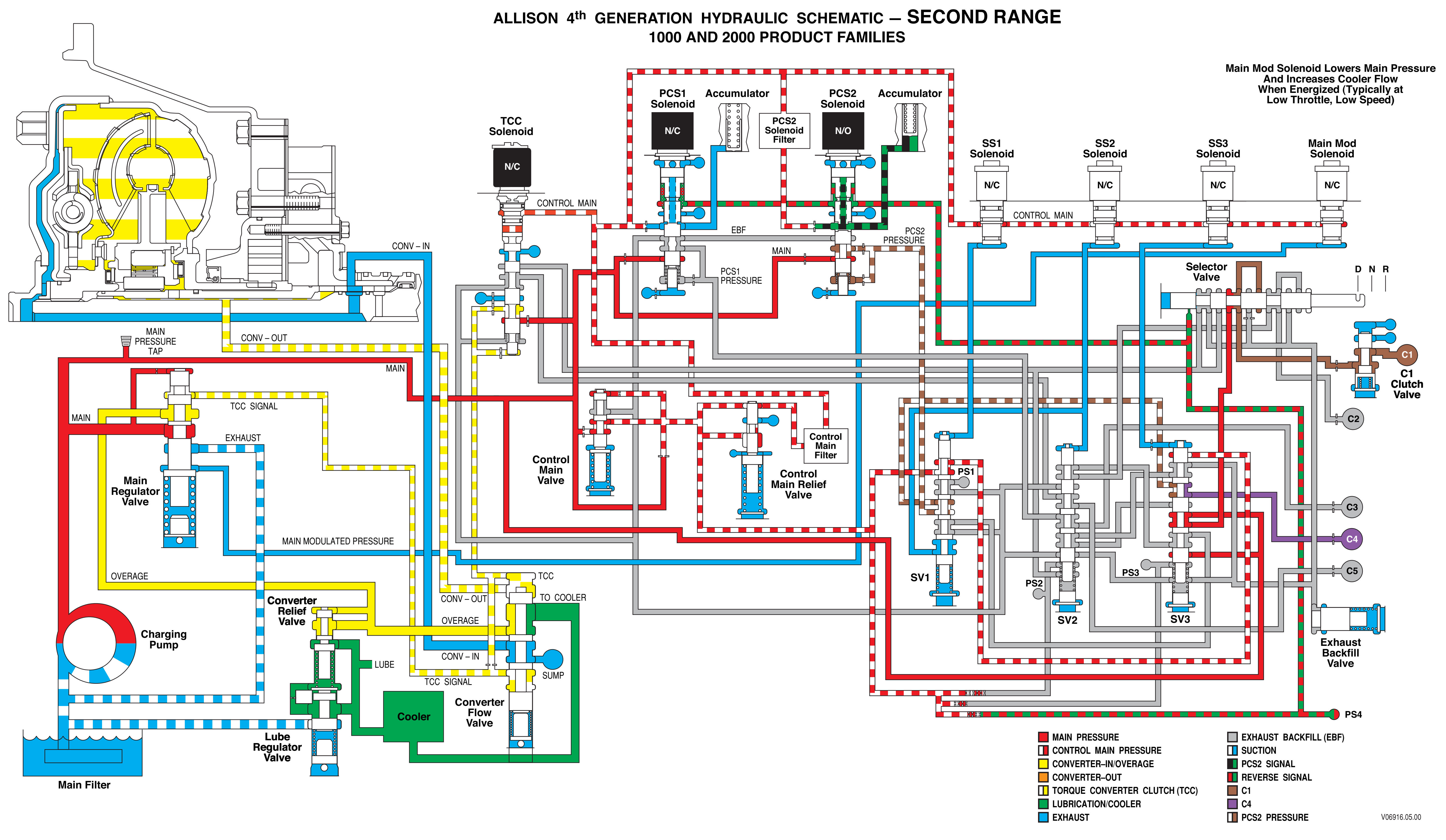


Figure H–6. 1000 and 2000 Product Families Hydraulic Schematic—Second Range

APPENDIX H—HYDRAULIC SCHEMATICS

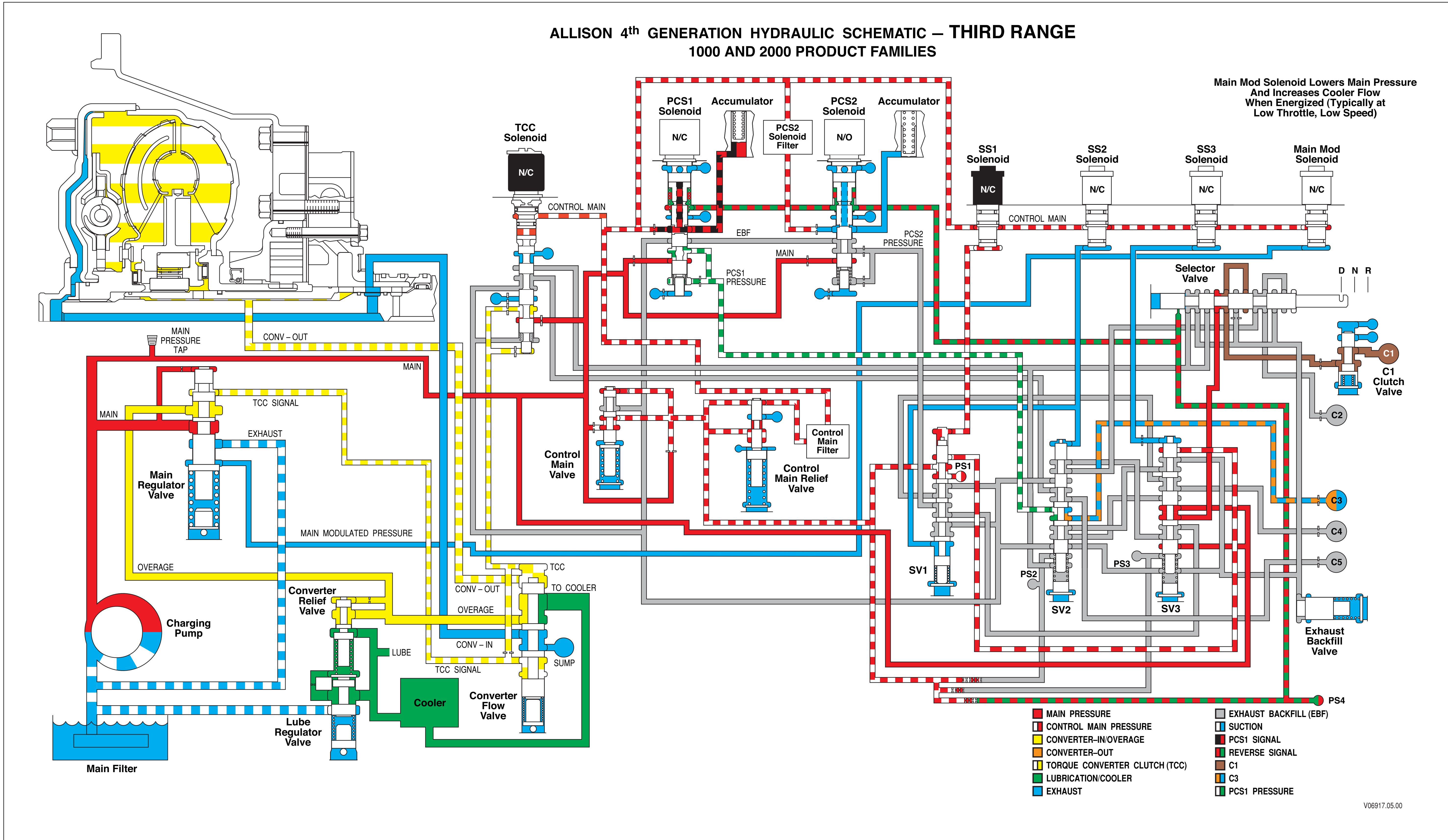


Figure H–7. 1000 and 2000 Product Families Hydraulic Schematic—Third Range

APPENDIX H—HYDRAULIC SCHEMATICS

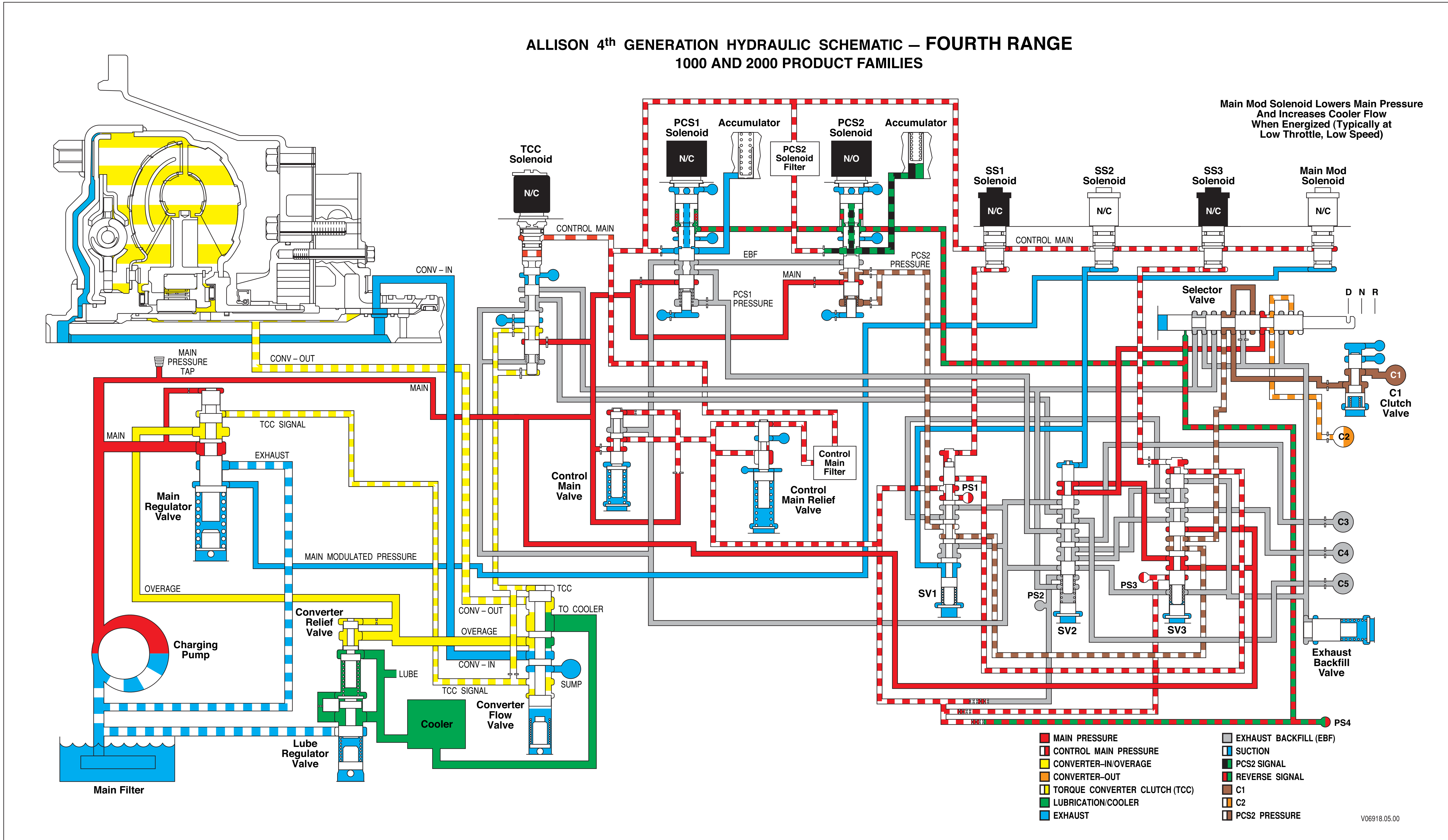


Figure H–8. 1000 and 2000 Product Families Hydraulic Schematic—Fourth Range

APPENDIX H—HYDRAULIC SCHEMATICS

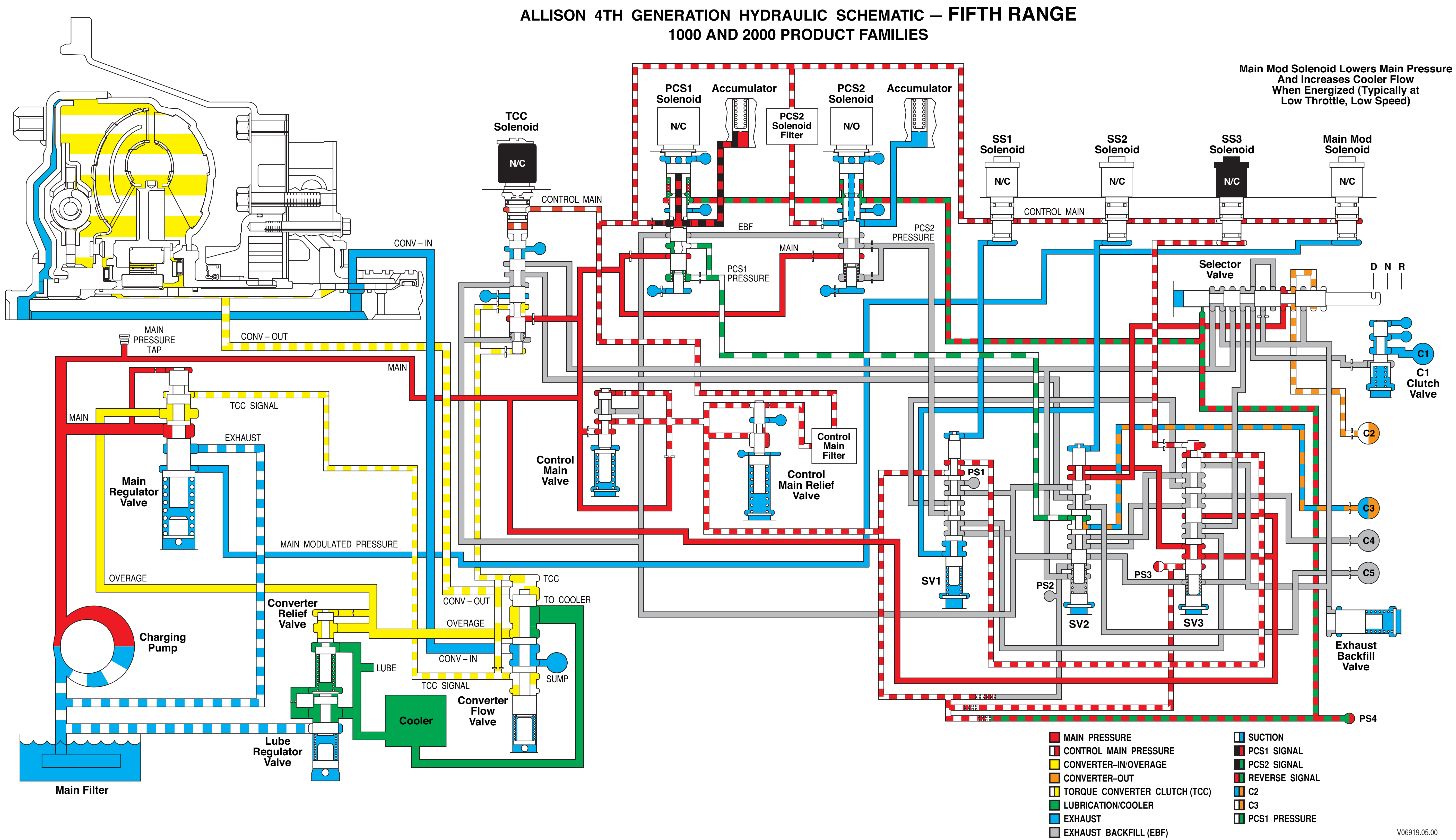


Figure H–9. 1000 and 2000 Product Families Hydraulic Schematic—Fifth Range

APPENDIX H—HYDRAULIC SCHEMATICS

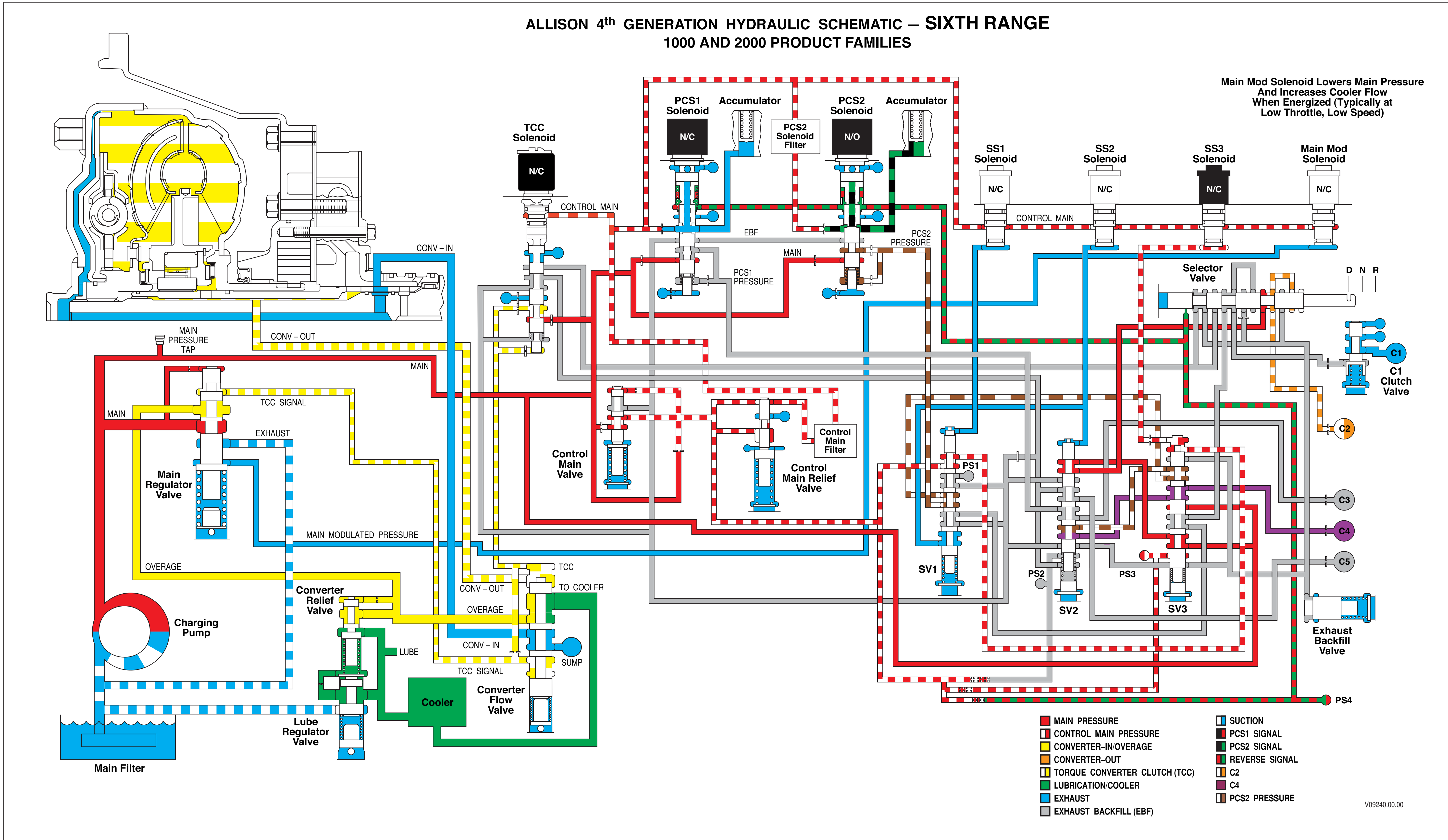


Figure H–10. 1000 and 2000 Product Families Hydraulic Schematic—Sixth Range

APPENDIX J—WIRING SCHEMATICS

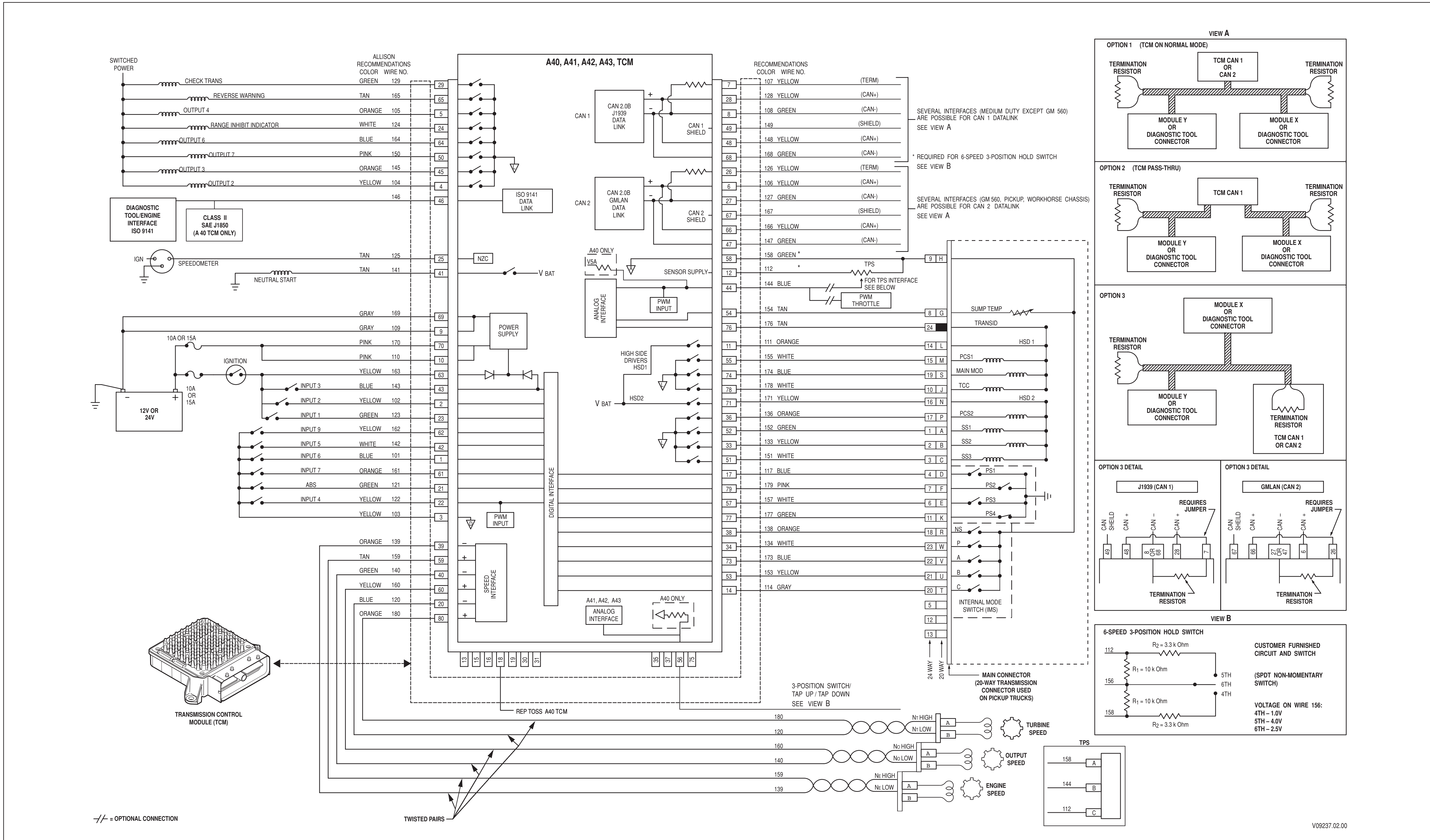


Figure J–1. 1000 and 2000 Product Families Wiring Schematic

APPENDIX K—RESISTANCE VS. TEMPERATURE

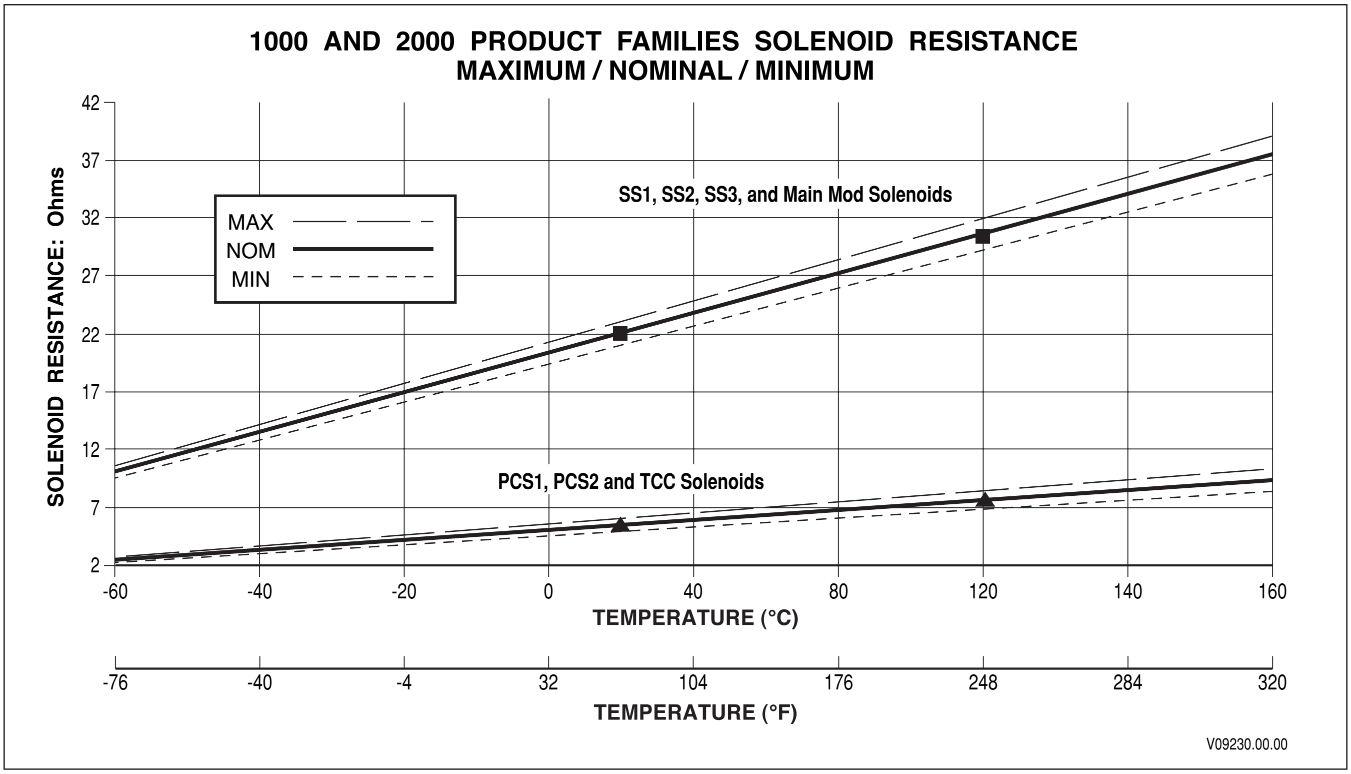


Figure K–1. Solenoid Resistance vs. Temperature Graph

Table K–1. Solenoid Resistance vs. Temperature

Sump Temperature		PCS1, PCS2, TCC Solenoid Resistance (Ω)			Main Mod, SS1, SS2, SS3 Solenoid Resistance (Ω)		
(°C)	(°F)	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
-65	-85	3.23	3.36	3.50	13.98	14.65	15.32
-40	-40	3.71	3.86	4.01	16.05	16.81	17.58
-30	-22	3.90	4.06	4.22	16.87	17.68	18.48
-20	-4	4.09	4.26	4.42	17.70	18.54	19.38
-10	14	4.28	4.45	4.63	18.52	19.41	20.29
0	32	4.47	4.65	4.84	19.35	20.27	21.19
10	50	4.66	4.85	5.04	20.17	21.14	22.10
20	68	4.85	5.05	5.25	21.00	22.00	23.00
30	86	5.04	5.25	5.46	21.83	22.86	23.90
40	104	5.23	5.45	5.66	22.65	23.73	24.81
50	122	5.42	5.65	5.87	23.48	24.59	25.71

APPENDIX K—RESISTANCE VS. TEMPERATURE

Table K–1. Solenoid Resistance vs. Temperature *(cont'd)*

Sump Temperature		PCS1, PCS2, TCC Solenoid Resistance (Ω)			Main Mod, SS1, SS2, SS3 Solenoid Resistance (Ω)		
(°C)	(°F)	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
60	140	5.61	5.84	6.08	24.30	25.46	26.62
70	158	5.80	6.04	6.28	25.13	26.32	27.52
80	176	5.99	6.24	6.49	25.95	27.19	28.42
90	194	6.18	6.44	6.69	26.78	28.05	29.33
100	212	6.37	6.64	6.90	27.60	28.92	30.23
110	230	6.57	6.84	7.11	28.43	29.78	31.14
120	248	6.76	7.03	7.31	29.25	30.65	32.04
130	266	6.95	7.23	7.52	30.08	31.51	32.94
140	284	7.14	7.43	7.73	30.90	32.38	33.85
150	302	7.33	7.63	7.93	31.73	33.24	34.75
160	320	7.52	7.83	8.14	32.55	34.10	35.65
165	329	7.61	7.93	8.24	32.97	34.54	36.11

APPENDIX K—RESISTANCE VS. TEMPERATURE

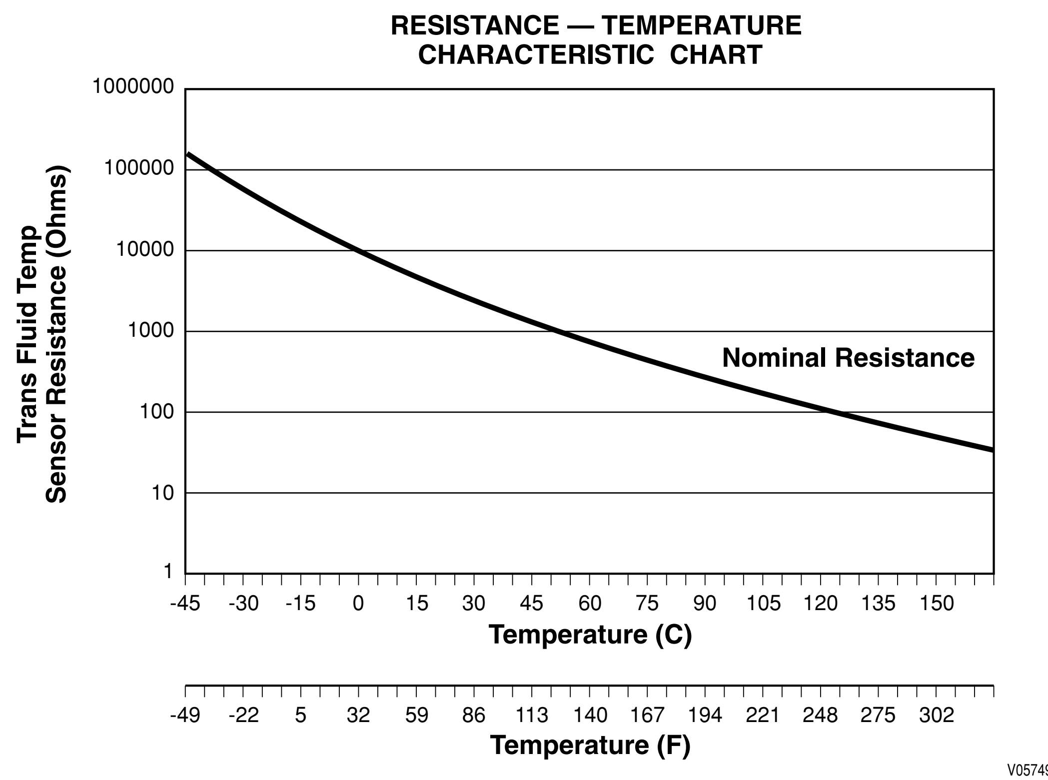


Figure K–2. Transmission Fluid Temperature Sensor Resistance vs. Sump Temperature Graph

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.

Table K–2. Transmission Fluid Temperature Sensor Resistance vs. Temperature

Temperature (°C)	Temperature (°F)	Minimum Resistance (Ω)	Nominal Resistance (Ω)	Maximum Resistance (Ω)
–45	–49	128 565	141 951	155 338
–40	–40	95 826	100 735	105 644
–35	–31	68 952	72 315	75 679
–30	–22	50 153	52 480	54 807
–25	–13	36 854	38 478	40 103
–20	–4	27 345	28 488	29 631
–15	5	20 476	21 286	22 097
–10	14	15 467	16 045	16 624
–5	23	11 781	12 197	12 612
0	32	9045	9345	9646

APPENDIX K—RESISTANCE VS. TEMPERATURE

Table K–2. Transmission Fluid Temperature Sensor Resistance vs. Temperature *(cont'd)*

Temperature (°C)	Temperature (°F)	Minimum Resistance (Ω)	Nominal Resistance (Ω)	Maximum Resistance (Ω)
5	41	6998	7219	7441
10	50	5458	5623	5787
15	59	4291	4413	4536
20	68	3398	3490	3582
25	77	2710	2779	2849
30	86	2173	2228	2282
35	95	1754	1797	1840
40	104	1424	1459	1493
45	113	1163	1191	1218
50	122	955.0	977.1	999.2
55	131	788.6	806.5	824.5
60	140	654.7	669.3	683.9
65	149	546.3	558.3	570.2
70	158	458.1	467.9	477.8
75	167	385.9	394.1	402.2
80	176	326.6	333.3	340.1
85	185	277.5	283.2	288.9
90	194	236.5	241.6	246.7
95	203	202.4	206.9	211.5
100	212	173.8	177.9	182.0
105	221	149.8	153.6	157.3
110	230	129.7	133.0	136.4
115	239	112.6	115.6	118.7
120	248	98.17	100.88	103.6
125	257	85.87	88.29	90.71
130	266	75.35	77.52	79.69
135	275	66.34	68.27	70.21
140	284	58.58	60.31	62.04
145	293	51.88	53.42	54.97
150	302	46.08	47.46	48.84
155	311	41.04	42.27	43.50
160	320	36.65	37.74	38.84

APPENDIX K—RESISTANCE VS. TEMPERATURE

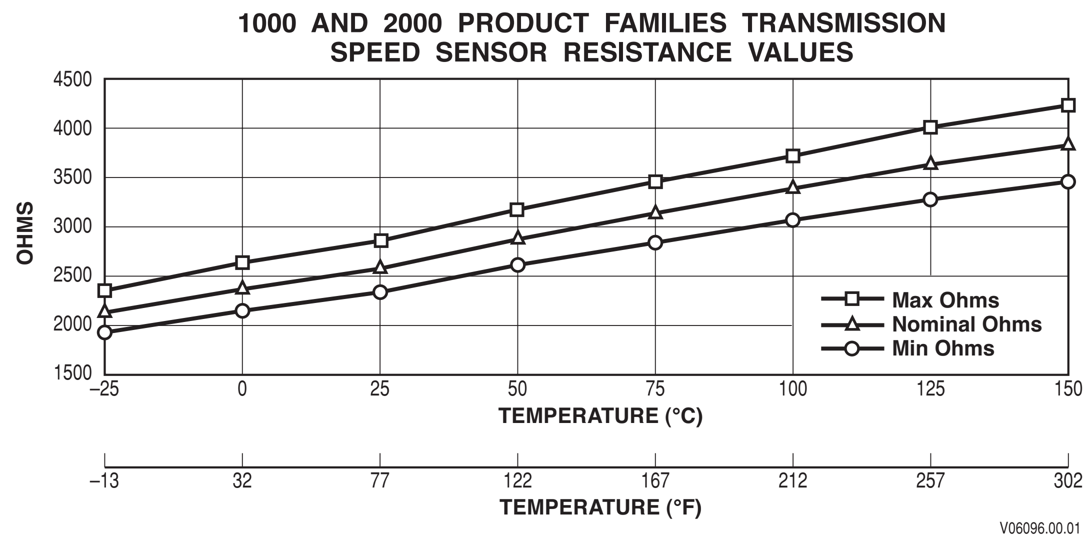


Figure K–3. Speed Sensor Resistance vs. Temperature Graph

Table K–3. Speed Sensor Resistance vs. Temperature

Temperature (°C)	Temperature (°F)	Minimum Resistance (Ω)	Nominal Resistance (Ω)	Maximum Resistance (Ω)
–25	–13	1929	2143	2358
0	32	2157	2397	2637
25	77	2340	2600	2860
50	122	2614	2904	3195
75	167	2842	3158	3474
100	212	3071	3412	3753
125	257	3299	3666	4032
150	302	3483	3870	4257

APPENDIX K—RESISTANCE VS. TEMPERATURE

NOTES

APPENDIX L—ELECTRONIC INTERFERENCE

L–1. ELECTROMAGNETIC INTERFERENCE (EMI)/RADIO FREQUENCY INTERFERENCE (RFI)

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 Electromagnetic Interference (EMI)/Radio Frequency Interference (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 making sure 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 reacts 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—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. Checking 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 the ignition ON.
2. Keep the engine OFF.
3. If the TCM is ON, connect Allison DOC™ For PC.

NOTE: ***If false speed signals were present at the previous shutdown, the TCM might still be "ON" even though the ignition is "OFF". Allison DOC™ For PC is powered by ignition power so the ignition must be "ON" to use Allison DOC™ For PC to read the speed signals.***

4. Read the 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. Check resistance of the sensor.
7. Check for shorts to other circuits within the harness or transmission connector.
8. Check to be sure there is no conductive material inside the connector.
9. Check to be sure the speed sensor circuit wires are a twisted pair.
10. Check for a properly grounded drain wire.
11. Check for the presence of a strong external AC signal.
12. Repair or replace parts as required.

APPENDIX M—ALLISON DOC™ FOR PC–SERVICE TOOL

NOTE: ***Refer to the Allison DOC™ For PC–Service Tool V5.0.0 (or later) User Guide, GN3433EN, for complete information.***

APPENDIX M—ALLISON DOC™ FOR PC–SERVICE TOOL

NOTES

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Use Appendix N, or Tech Data, and Datalink Communication on the Allison Transmission website to determine the wiring circuit schematic and/or J1939 messaging/parameters used for the function. Use the appropriate section in the Allison DOC™ For PC–Service Tool to verify the proper signal is received and/or is enabled by the TCM.

1. To access Input/Output wiring schematic from Allison DOC™ For PC–Service Tool, double-click on the function name displayed, this will link to the Troubleshooting Manual Appendix N.
2. Allison DOC™ For PC–Service Tool can be useful in troubleshooting input/output concerns. After connecting to the vehicle, go to the Diagnostic button (F3) and select TCM/Calibration Information or the Data Monitor sections.
3. In this section the Input/Output wire state and/or Data bus status is displayed and can be monitored for proper operation. With the input function switched ON, compare the wire state/data bus status to the actual function state. If they are not switching at the proper time there may be a switch, relay, circuit concern or possibly a CAN bus concern.

The CAN Data Bus Viewer included in Allison DOC™ For PC–Service Tool may be used to monitor and/or record a snapshot of the J1939 messaging and parameter status.

The TCM receives analog input as either a positive or a negative input, which is calibration dependant.
Allison DOC™ will display the active input or output function and the polarity of the input or output function.

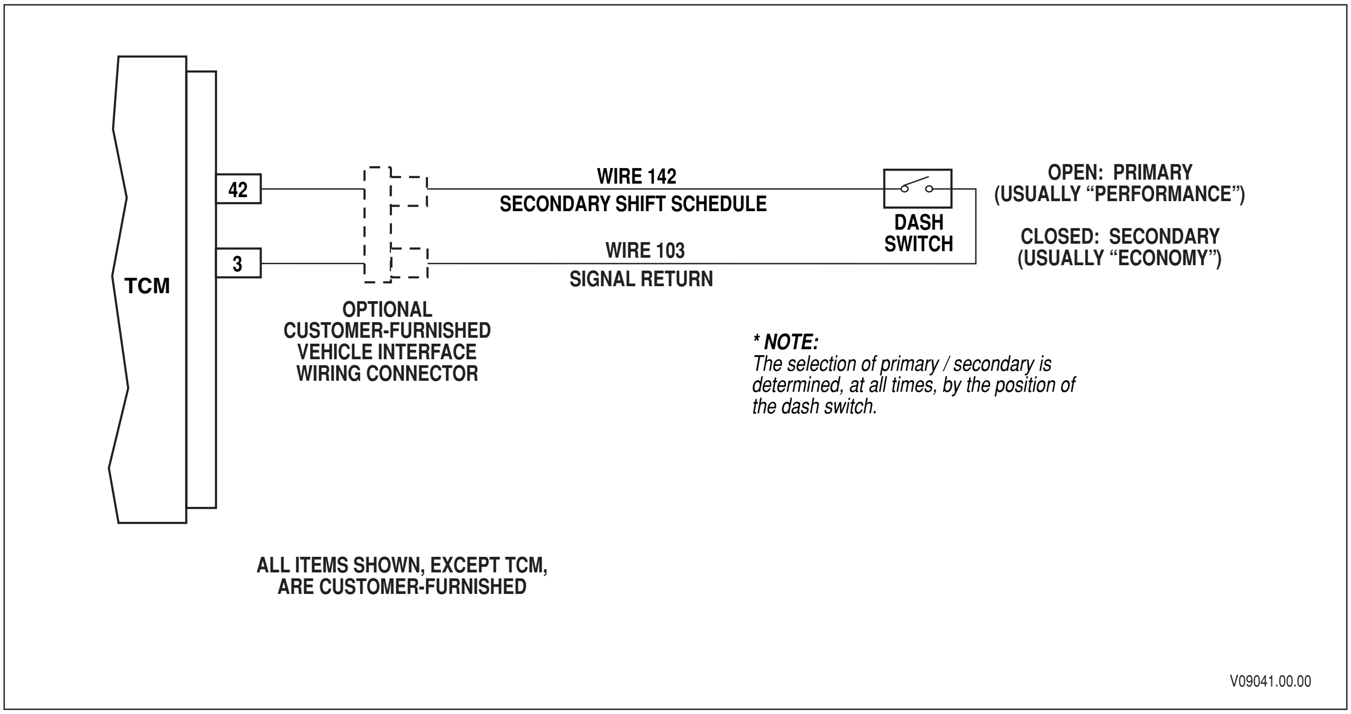
A Digital Volt/Ohmmeter (DVOM) may be used to check the output functions, but be aware that the output wire may only be operational during specific operating conditions that must be met within the TCM logic.

It may be necessary to isolate the output circuit and supply an alternate source of voltage or a ground to complete the circuit to determine if the circuit is operating properly.

Never use a test light to check input/output wiring—this could cause internal TCM damage.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION A. SECONDARY MODE INPUT (ENABLED BY WIRE 142)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This function is enabled when a switch is closed to complete the circuit between input wire 142 and wire 103, Signal Return. When the function is enabled, the TCM will command the transmission to shift according to the secondary shift calibration. Operation in primary mode resumes when the function is disabled. Unless specified differently, the mode calibrations typically include differences in shift schedules as follows:

- Primary Mode—Performance
- Secondary Mode—Economy

Primary and secondary modes may also be programmed with other differences such as the availability forward gear ranges (e.g. 1–5 vs. 1–6), or loaded vs. unloaded vehicle configuration.

Uses

- Facilitates operator selection of dual shift schedules
- Can be used for performance/economy, loaded/empty, or other shift schedule combinations.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Customer Modifiable Constants

None

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power-off—No change
- Power restored—No change

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Transmission Control 1 (TC1)	Transmission Mode 2	33, 05		

NOTE: ***This function cannot be used via J1939 if the mode button or an analog input for this function is enabled in the calibration.***

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of this parameter.

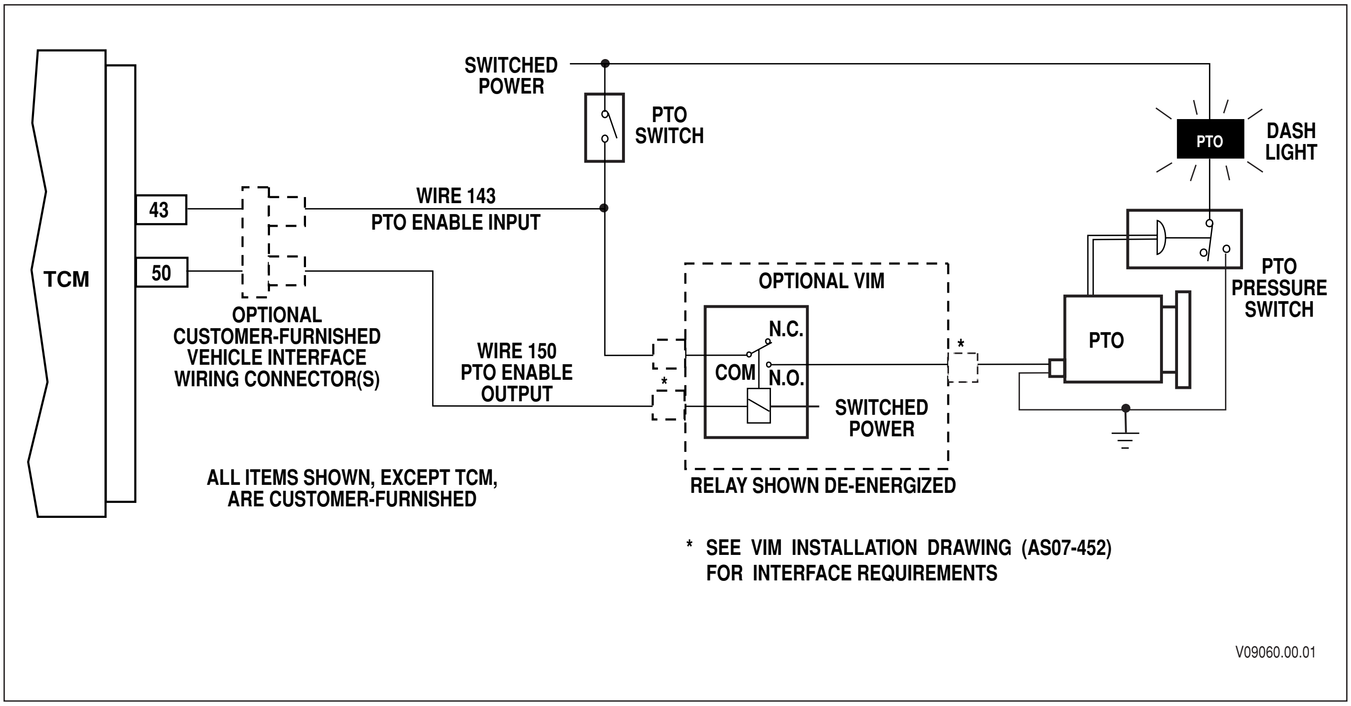
Normal Function Operation:

1. The TCM receives the following J1939 message:
   - TC1—Transmission Mode 2 = **Enable**
2. The TCM operates in **Secondary Mode**.
3. The TCM receives the following J1939 message:
   - TC1—Transmission Mode 2 = **Disable**
4. The TCM operates in **Primary Mode**.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION C. PTO REQUEST (ENABLED BY WIRE 143)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This function is enabled when wire 143 is switched to send power to the TCM. Enabling the function alerts the TCM that PTO operation has been requested by the operator. When the function is enabled and all of the following conditions exist, the TCM activates the output function by switching wire 150 to ground. When this function is enabled, the TCM disables the “modulated main pressure” feature in the transmission, resulting in transmission operation at full main pressure. Required operating conditions for enabling this function are:

- Throttle position is low
- Engine speed and output speed is within Customer Modifiable Constant limits

When turbine speed for lockup engagement (a Customer Modifiable Constant) is reached during PTO operation with the transmission in neutral or park, the TCM commands engagement of the transmission lockup clutch, thus providing direct drive from the engine to the PTO drive gear. The lockup clutch will automatically disengage at an engine/turbine speed which is 100 rpm lower than the engagement speed.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Uses

- Permits operator to control engagement and disengagement of the PTO with a switch
- Provides inhibits for PTO engagement based on engine speed or transmission output speed
- Provides for automatic disengagement of PTO based on engine speed or transmission output speed
- Provides a mechanism to disable the modulated main pressure feature in the transmission

WARNING! **If the PTO is used to drive high inertia equipment (e.g. alternator, blower, chain-driven mechanical devices), the "Max. Engine Speed for PTO Engagement" should be set as closely as possible to the engine idle speed. Engagement of the PTO at high speed, whether by activation of this function or automatic re-engagement of the function following a disengagement due to overspeed, may cause damage to the PTO system.**

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Maximum engine speed for PTO engagement	900	500–2000	rpm
Maximum engine speed for PTO operation	4000	375–5000	rpm
Maximum output speed for PTO engagement	250	60–6000	rpm
Maximum output speed for PTO operation	300	70–6000	rpm
Turbine speed for engaging lockup in neutral or park:			
4-cylinder engines	1200	1200–5000	rpm
All other engine types	900	900–5000	rpm

Vocations

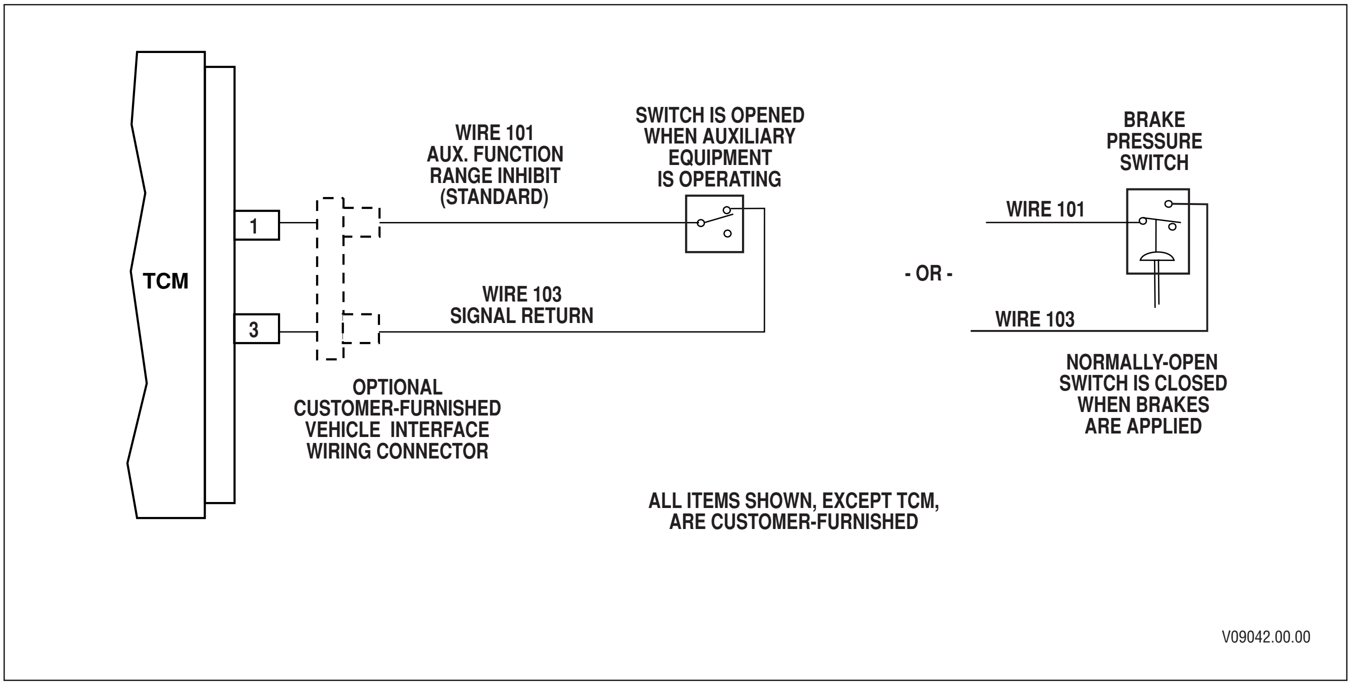
Refuse vehicles, utility vehicles, emergency vehicles

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power-off—Output (wire 150) is disabled
- Power restored—Output (wire 150) re-enabled if required operating conditions continue to be satisfied

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION E. AUX. FUNCTION RANGE INHIBIT, STANDARD (ENABLED BY WIRE 101)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This function is enabled when a switch is opened to break the circuit between input wire 101 and wire 103, Signal Return. When an interfaced auxiliary vehicle function is activated, as denoted by the open state of the enable switch, the TCM commands an inhibit on all neutral-to-range transmission shifts. The inhibit remains in effect until the auxiliary vehicle function is disabled (wire 101 switched from open to wire 103) or the output speed exceeds a preset value.

CAUTION:	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring.**

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

***NOTE:** Most functions are enabled when the control circuit is closed (switched from open-to-power or open-to-ground). This function is based on inverted logic; it is enabled when the circuit is open and subsequently disabled when the control circuit is switched closed. Design and installation of the control circuit for this function requires special attention in order that circuit actuation creates the desired result in vehicle operation.*

Uses

- Prevents inadvertent range selection when auxiliary equipment is operating
- Prevent engagement of the transmission unless brake pedal is depressed

Customer Modifiable Constants

None

Vocations

Auxiliary equipment input: Transit bus, school bus

Brake pedal input: Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power-off—No change
- Power restored—No change

J1939 Implementation

To accomplish this function over J1939, the TCM calibration must be set to "1939 Service Brake Status—Auxiliary Function Range Inhibit = YES." This information can be found in a calibration summary report.

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Cruise Control/Vehicle Speed (CCVS)	Brake Switch	00, 17, 33,49	00, 17, 33, 49, 232	00, 17, 23, 33, 49, 232
Electronic Brake Controller 1 (EBC1)	EBS Brake Switch	N/A	11	11

***NOTE:** The analog Auxiliary Function Range Inhibit (AFRI) input may or may not be used, depending on calibration.*

***NOTE:** If both messages/parameters are present in the datalink, the TCM will only react to EBC1-EBS Brake Switch.*

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Normal Function Operation:

1. The TCM is inhibiting range.
2. The operator steps on the service brakes (if calibration uses analog input this input will need to be satisfied along with brake controller message).

   The TCM receives any of the following J1939 messages:

   a. EBC1—EBS Brake Switch = Brake pedal is being pressed, or

   b. CCVS—Brake Switch = Brake pedal depressed
3. The TCM detects that braking condition and removes the inhibiting condition.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

GUIDELINES FOR SELECTING INPUT FUNCTION H, ENGINE BRAKE ENABLE AND PRESELECT REQUEST

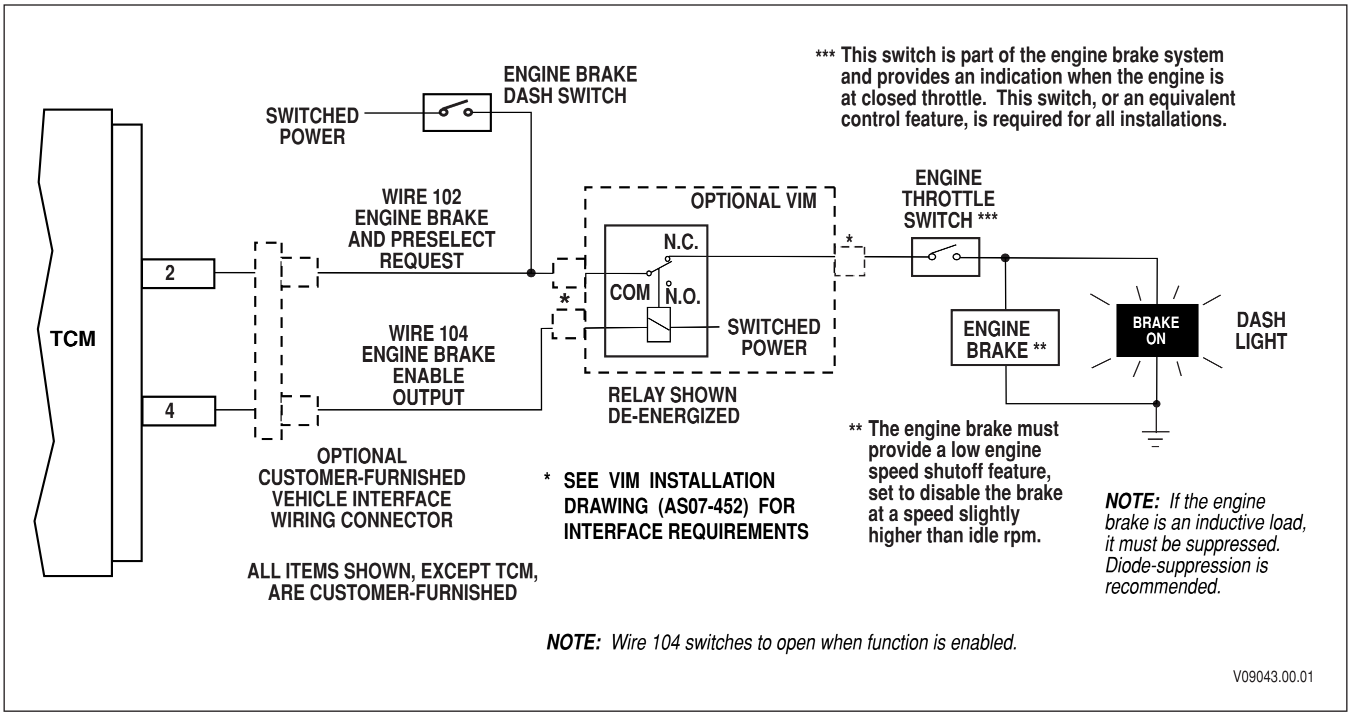
NOTE: All vehicle installations which utilize an exhaust- or compression-type engine brake must include a means to enable this auxiliary braking system.

The preferred method to enable the brake is via an SAE J1939 vehicle communications interface. For detailed information regarding this topic, refer to Datalink Communications Tech Data. If a J1939 interface is not used for control of the engine brake, one of the following hard-wire methods MUST be used for that purpose.

Performance of an engine brake is optimized when engine speed remains high during the brake operation cycle. Brake performance is also maximized by early downshifting of the transmission into lower ranges as permitted by the operating conditions. And, although the potential for transmission overheating exists during an engine braking cycle, this risk is minimized by permitting brake operation only when the transmission lockup clutch is engaged. The purpose of the Engine Brake Enable and Preselect function is to initiate the Preselect Downshift shift schedule for the transmission concurrently with the request for applying the engine brake. Simultaneously, the controls verify that other operating conditions, namely lockup clutch engagement and throttle position, are conducive to satisfactory engine brake operation. Due to the variety of vehicle interfaces which are possible, the following is offered as a guide to selecting the appropriate implementation of this function for your vehicle.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION H1. ENGINE BRAKE AND PRESELECT REQUEST, PLUS ENGINE BRAKE ENABLE OUTPUT—EXHAUST BRAKE (ENABLED BY INPUT WIRE 102, OUTPUT WIRE 104)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This variation of function H is enabled when wire 102 is switched to send power to the TCM. When the throttle is closed, the transmission lockup clutch is engaged and this function is enabled, the TCM activates the output function by switching wire 104 from ground to open. One of the following three user-specified preselect shift schedules will go into effect. Each provides downshifts at higher engine speeds, as compared to the standard shift schedule, resulting in improved engine braking performance.

- Standard Normal—Downshifts will occur at the same rpm as would occur by manually preselecting a lower range. Approximately 300 rpm over governed rpm after the shift.
- Standard Low—Downshifts will occur at the same rpm as would occur by manually preselecting a lower range. Approximately 150 rpm over governed rpm after the shift.
- Low—Downshifts will occur at approximately half way between 1000 rpm and the Standard Normal closed throttle shift points described above.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

An approved Allison Diagnostic Tool can be used to set or modify (1) the preselect forward drive range that is activated when the input is turned on, and (2) which of the three shift schedules is preselected when the function is activated.

NOTE: ***Output functions are normally off and become activated when its control circuit (switched input) is turned on and the TCM determines that specific operating conditions are met. The output associated with this function is based on inverted logic; the engine brake is actuated when the output function is turned off. Design and installation of the control circuit for this function therefore requires special attention in order that circuit actuation creates the desired result in vehicle operation.***

Uses

- Provides increased braking from exhaust brakes by signalling the TCM to preselect a lower forward drive range whenever the brake is active
- Prevents engagement of engine brake if throttle is applied
- Prevents engagement of engine brake if transmission lockup clutch is disengaged

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Preselected forward drive range	3	2–6	range

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power-off—No change
- Power restored—No change

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Electronic Retarder Controller #1 (ERC1)	Actual Retarder Percent Torque	41,15,00	41,15,00	41,15,00
Electronic Brake Controller #1 (EBC1)	Engine Retarder Selection	33,00	33,00	33,10
Electronic Retarder Controller #1 (ERC1)	Retarder Enable—Brake Assist Switch	41,15	41,15	41,15
Electronic Transmission Controller #1 (ETC1)	Torque Converter Lockup Engaged	03	03	03

NOTE: ***If the above messages are present in the datalink, the analog input signals for this function will be ignored by the TCM.***

NOTE: ***Mixing and matching analog and digital signals may cause improper responses, therefore it is not recommended.***

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

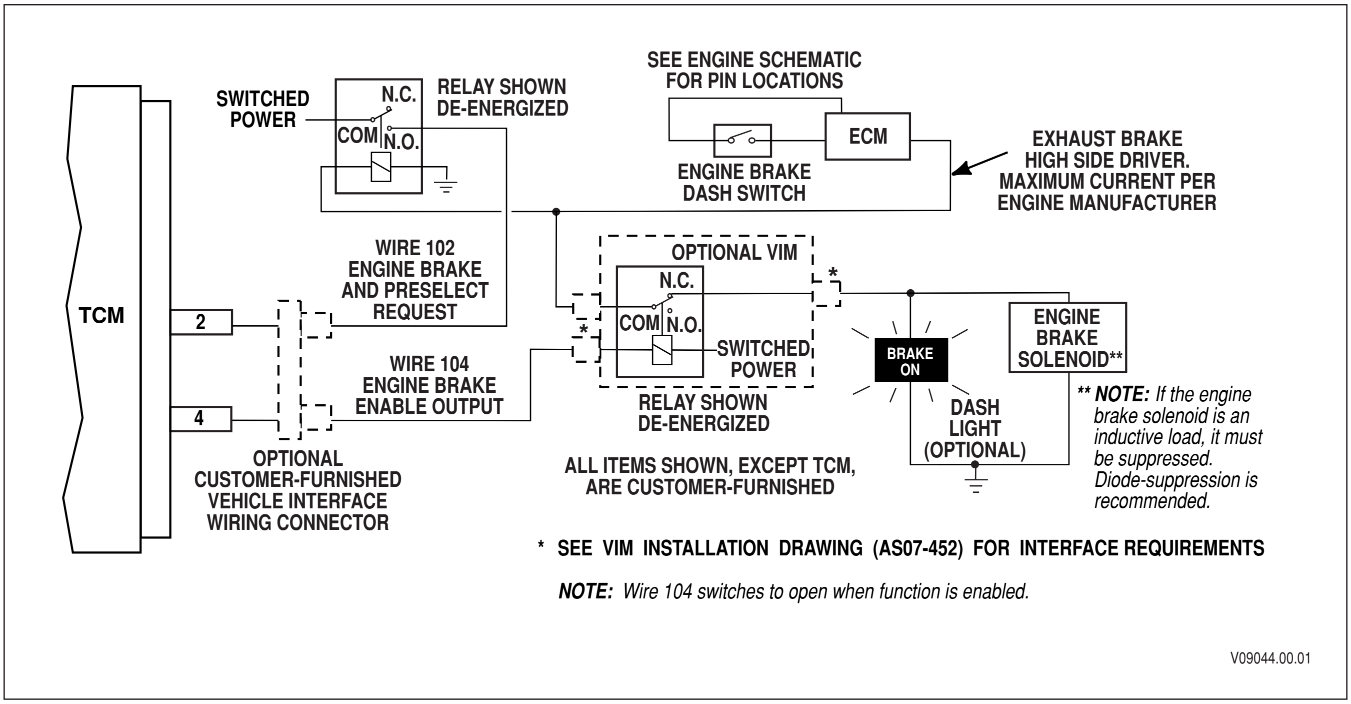
Normal Function Operation:

1. The operator turns on the exhaust brake switch, indicating a desire for braking to the exhaust brake controller (often the engine ECM).
2. The TCM receives any of the following J1939 messages:
   - EBC1—Engine Retarder Selection = a percentage value (0 to 100%), or
   - ERC1—Retarder Enable Brake Assist Switch = **Brake assist enabled**
3. The TCM attempts to engage TCC if a downshift is necessary.
4. Once TCC is verified as on, the TCM sends a message to the exhaust brake controller:
   - ETC1—Torque Converter Lockup Engaged Status = **Transmission Torque Converter Lockup Engaged**
5. The exhaust brake controller broadcasts back to the TCM:
   - ERC1—Actual Retarder Percent of Torque = a percentage value (–125 to 0%).
6. Once the TCM sees this message, it invokes preselect and uses engine brake adaptive controls.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION H2. ENGINE BRAKE ENABLE AND PRESELECT REQUEST, PLUS ENGINE BRAKE ENABLE OUTPUT—ECM-CONTROLLED EXHAUST BRAKE (ENABLED BY INPUT WIRE 102, OUTPUT WIRE 104)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This variation of function H is enabled when wire 102 is switched to send power to the TCM. When the throttle is closed, the transmission lockup clutch is engaged and this function is enabled, the TCM activates the output function by switching wire 104 from ground to open. One of the following three user-specified preselect shift schedules will go into effect. Each provides downshifts at higher engine speeds, as compared to the standard shift schedule, resulting in improved engine braking performance.

- Standard Normal—Downshifts will occur at the same rpm as would occur by manually preselecting a lower range. Approximately 300 rpm over governed rpm after the shift.
- Standard Low—Downshifts will occur at the same rpm as would occur by manually preselecting a lower range. Approximately 150 rpm over governed rpm after the shift.
- Low—Downshifts will occur at approximately half way between 1000 rpm and the Standard Normal closed throttle shift points described above.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

An approved Allison Diagnostic Tool can be used to set or modify (1) the preselect forward drive range that is activated when the input is turned on, and (2) which of the three shift schedules is preselected when the function is activated.

NOTE: ***Output functions are normally off and become activated when its control circuit (switched input) is turned on and the TCM determines that specific operating conditions are met. The output associated with this function is based on inverted logic; the engine brake is actuated when the output function is turned off. Design and installation of the control circuit for this function therefore requires special attention in order that circuit actuation creates the desired result in vehicle operation.***

Uses

- Provides increased braking from exhaust brakes by signalling the TCM to preselect a lower forward drive range whenever the brake is active
- Prevents engagement of engine brake if throttle is applied
- Prevents engagement of engine brake if transmission lockup clutch is disengaged

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Preselected forward drive range	3	2–6	range

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power-off—No change
- Power restored—No change

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Electronic Retarder Controller #1 (ERC1)	Actual Retarder Percent Torque	41,15,00	41,15,00	41,15,00
Electronic Brake Controller #1 (EBC1)	Engine Retarder Selection	33,00	33,00	33,10
Electronic Retarder Controller #1 (ERC1)	Retarder Enable—Brake Assist Switch	41,15	41,15	41,15
Electronic Transmission Controller #1 (ETC1)	Torque Converter Lockup Engaged	03	03	03

NOTE: ***If the above messages are present in the datalink, the analog input signals for this function will be ignored by the TCM.***

NOTE: ***Mixing and matching analog and digital signals may cause improper responses, therefore it is not recommended.***

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

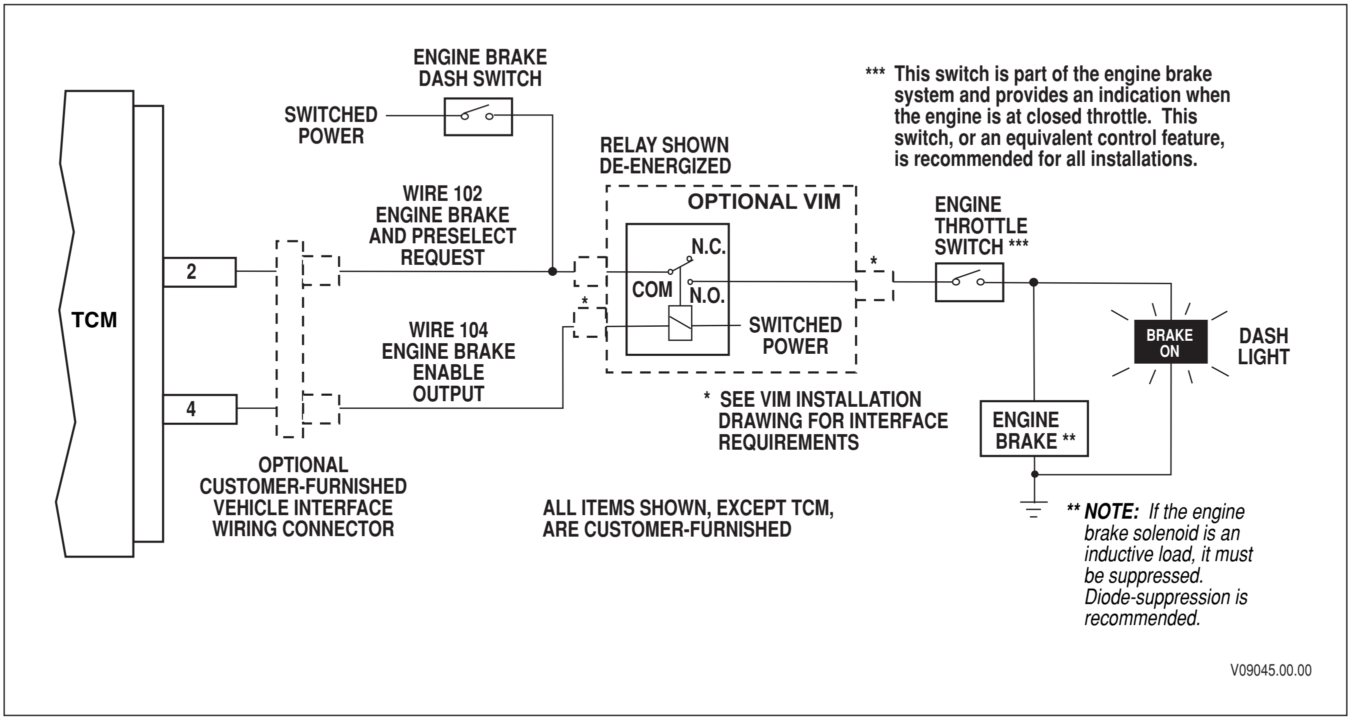
Normal Function Operation:

1. The operator turns on the exhaust brake switch, indicating a desire for braking to the exhaust brake controller (often the engine ECM).
2. The TCM receives any of the following J1939 messages:
   - EBC1—Engine Retarder Selection = a percentage value (0 to 100%), or
   - ERC1—Retarder Enable Brake Assist Switch = **Brake assist enabled**
3. The TCM attempts to engage TCC if a downshift is necessary.
4. Once TCC is verified as on the TCM sends a message to the exhaust brake controller:
   - ETC1—Torque Converter Lockup Engaged Status = **Transmission Torque Converter Lockup Engaged**
5. The exhaust brake controller broadcasts back to the TCM:
   - ERC1—Actual Retarder Percent of Torque = a percentage value (–125 to 0%).
6. Once the TCM sees this message, it invokes preselect and uses engine brake adaptive controls.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION I1. EUROPEAN ENGINE BRAKE ENABLE AND PRESELECT REQUEST, PLUS ENGINE BRAKE ENABLE OUTPUT—EXHAUST BRAKE (INPUT WIRE 102, OUTPUT WIRE 104)



NOTE: Wire 104 switches to ground when function is enabled.

WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This variation of function I is enabled when wire 102 is switched to send power to the TCM. When the throttle is closed, the transmission lockup clutch is engaged and this function is enabled, the TCM activates the output function by switching wire 104 to ground. One of the following three user-specified preselect shift schedules will go into effect. Each provides downshifts at higher engine speeds, as compared to the standard shift schedule, resulting in improved engine braking performance.

- Standard Normal—Downshifts will occur at the same rpm as would occur by manually preselecting a lower range. Approximately 300 rpm over governed rpm after the shift.
- Standard Low—Downshifts will occur at the same rpm as would occur by manually preselecting a lower range. Approximately 150 rpm over governed rpm after the shift.
- Low—Downshifts will occur at approximately half way between 1000 rpm and the Standard Normal closed throttle shift points described above.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

An approved Allison DOC™ For PC–Service Tool can be used to set or modify (1) the preselect forward drive range that is activated when the input is turned on, and (2) which of the three shift schedules is preselected when the function is activated.

Uses

- Provides increased braking from exhaust brakes by signalling the TCM to preselect a lower forward drive range whenever the brake is active.
- Prevents engagement of engine brake if throttle is applied.
- Prevents engagement of engine brake if transmission lockup clutch is disengaged.

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Preselected forward drive range	3	2–6	range

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—Brake off
- Power restored—Brake on if conditions continue to be satisfied.

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Electronic Retarder Controller #1 (ERC1)	Actual Retarder Percent Torque	41,15,00	41,15,00	41,15,00
Electronic Brake Controller #1 (EBC1)	Engine Retarder Selection	33,00	33,00	33,10
Electronic Retarder Controller #1 (ERC1)	Retarder Enable—Brake Assist Switch	41,15	41,15	41,15
Electronic Transmission Controller #1 (ETC1)	Torque Converter Lockup Engaged	03	03	03

NOTE: ***If the above messages are present in the datalink, the analog input signals for this function will be ignored by the TCM.***

NOTE: ***Mixing and matching analog and digital signals may cause improper responses, therefore it is not recommended.***

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

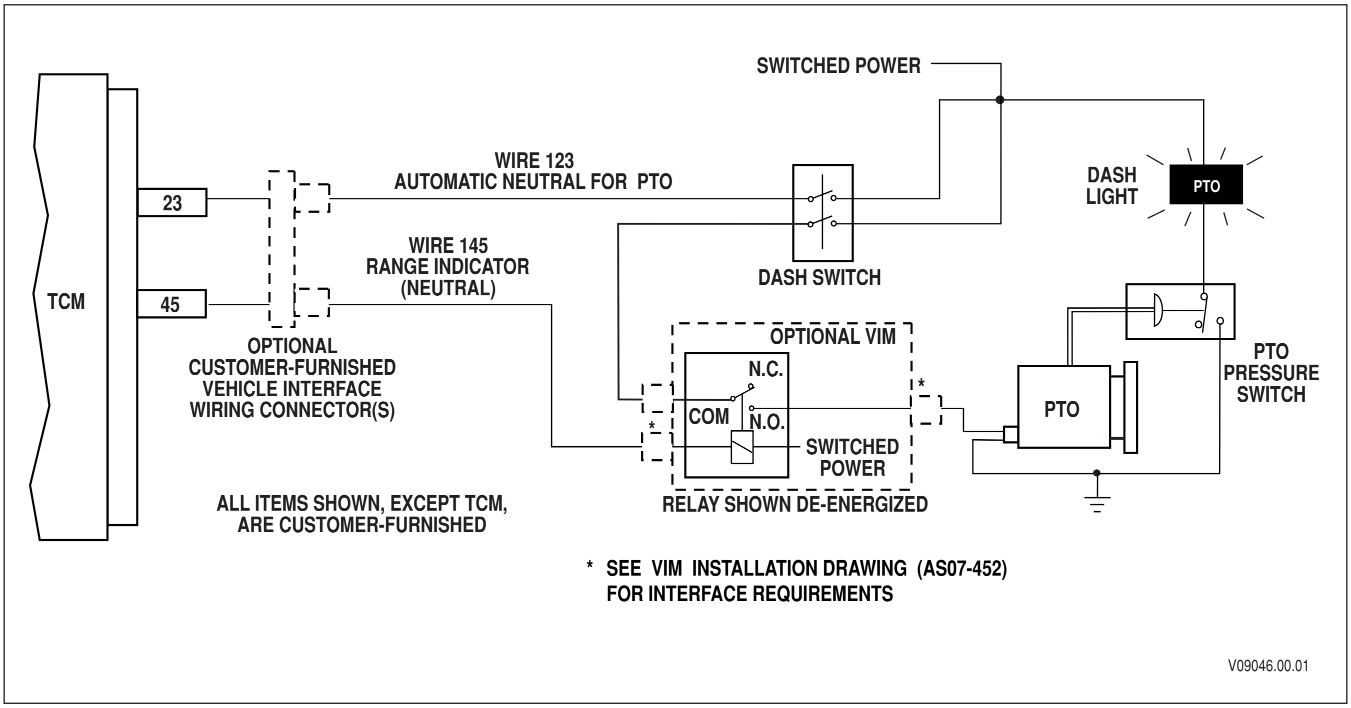
Normal Function Operation:

1. The operator turns on the exhaust brake switch, indicating a desire for braking to the exhaust brake controller (often the engine ECM).
2. The TCM receives any of the following J1939 messages:
   - EBC1—Engine Retarder Selection = a percentage value (0 to 100%), or
   - ERC1—Retarder Enable Brake Assist Switch = **Brake assist enabled**
3. The TCM attempts to engage TCC if a downshift is necessary.
4. Once TCC is verified as on the TCM sends a message to the exhaust brake controller:
   - ETC1—Torque Converter Lockup Engaged Status = **Transmission Torque Converter Lockup Engaged**
5. The exhaust brake controller broadcasts back to the TCM:
   - ERC1—Actual Retarder Percent of Torque = a percentage value (–125 to 0%).
6. Once the TCM sees this message, it invokes preselect and uses engine brake adaptive controls.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION L. AUTOMATIC NEUTRAL—SINGLE INPUT (ENABLED BY INPUT WIRE 123)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring.** **This function must not be used with Neutral Indicator for PTO (Output “S”).**

Description

This function is enabled when wire 123 is switched to send power to the TCM. When the function is enabled and both output speed and throttle position are near zero, the transmission will be commanded to neutral regardless of shift selector position. While in this mode, the shift selector display will flash the selected drive range. To resume operation in the selected drive range, the input must be disabled and the drive range must be re-selected on the shift selector. The neutral start relay does not change states while the function is activated—only when **N** (Neutral) has been re-selected on the shift selector.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Uses

- Commands the transmission to neutral when PTO is operated, regardless of drive range requested on the shift selector.
- Requires re-selecting drive range to shift out of neutral. Shown with range indicator output.
- This function must NOT be used with Neutral Indicator for PTO output function (output “S”).

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Maximum output speed for function activation	60	50–900	rpm
Range indicator	Neutral	Neutral	range

Vocations

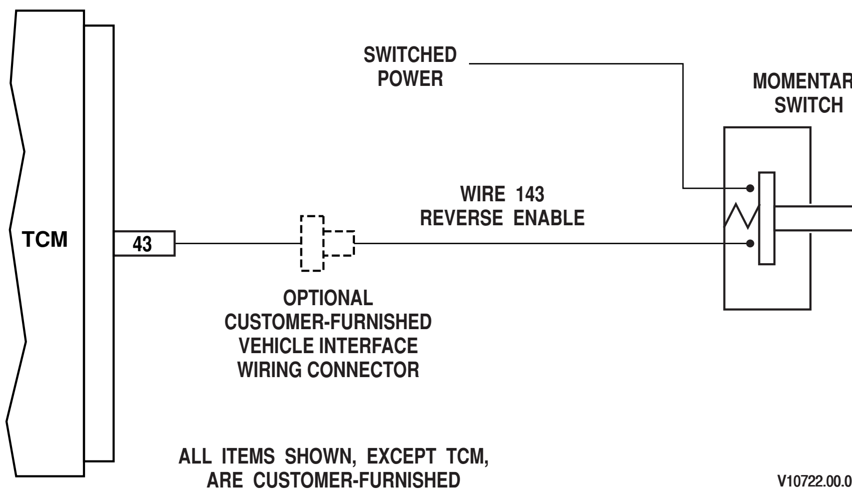
Various (With usage of PTO)

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION V. REVERSE ENABLE (ENABLED BY WIRE 143)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. Refer to Section E: Using Input/Output Functions, Packages, and Groups in the Allison 4th Generation Controls Installation Manual.**

Description

This function is enabled when wire 143 is switched to send power to the TCM. When the function is enabled, the TCM will recognize the request for neutral-to-reverse or from drive-to-reverse shifts and, if all other operating conditions are acceptable, will command the requested shift. If the function is not enabled, all shifts into reverse are inhibited.

The function is typically activated by a separate momentary instrument panel-mounted switch which must be pressed simultaneously with the **R** (Reverse) shift selector button to achieve reverse operation of the transmission and vehicle.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Uses

Prevention of inadvertent shifts into reverse.

Customer Modifiable Constants

None

Vocations

European transit buses and tour buses

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—Reverse not selectable
- Power restored—Reverse selectable

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

GUIDELINES FOR IMPLEMENTING INPUT FUNCTION Y, ABS RESPONSE

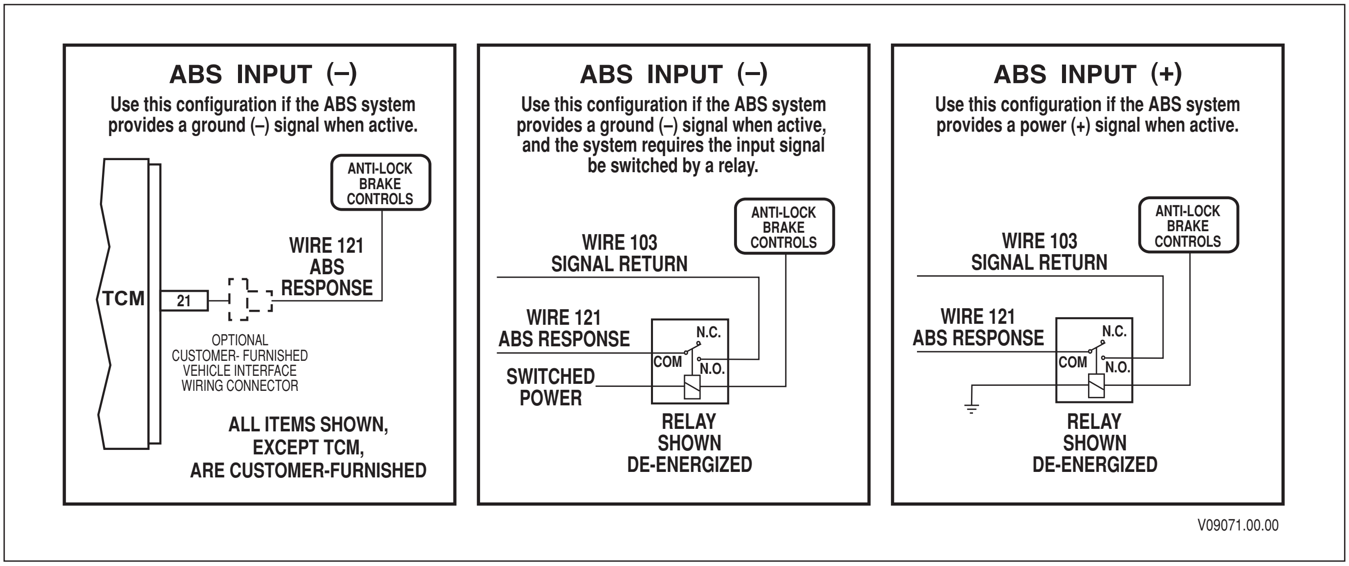
Operator control of the vehicle is enhanced if the transmission lockup clutch is not applied during severe braking of the vehicle. The purpose of Input Function Y, ABS Response, is to provide a means to quickly disengage these two transmission features (if applied) when a hard vehicle braking condition is detected. The implementation of this function is recommended for all vehicle installations. Due to the wide variety of vehicle interfaces which are possible, the following is offered as a guide to selecting the appropriate implementation of this function for your vehicle.

Table N–1. Implementing Input Function Y, ABS Response

Vehicle Interface	Controls Configuration	Function ID	Wire Assignment
Without ABS Controls	NO ABS on Vehicle. *ABS Response* is enabled by high pressure in the vehicle brake system, and is used only to disable the transmission lockup clutch during severe vehicle braking.	Y2	121
With ABS Controls (No interface with service brakes)	*ABS Response* is enabled by a signal from the ABS system when the system is activated. This input signal is used by the transmission controls to disable the transmission lockup clutch when an ABS event has occurred.	Y1	121
With ABS Controls (Interfaced with service brakes)	*ABS Response* is enabled either by a signal from the ABS system or by high pressure in the vehicle brake system. This input signal is used by the transmission controls to disable the transmission lockup clutch when an ABS event has occurred or during severe vehicle braking which does not activate ABS.	Y2	121
With ABS Controls J1939 (Interfaced with service brakes)	This version of the function is recommended if the vehicle utilizes a J1939 communication link. *ABS Response* is enabled either by an "ABS Active" signal from the SAE J1939 communication link or by high pressure in the vehicle brake system. This input signal is used by the transmission controls to disable the transmission lockup clutch when an ABS event has occurred or during severe vehicle braking which does not activate ABS.	Y3	121

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION Y1. ANTI-LOCK BRAKE RESPONSE (ENABLED BY INPUT WIRE 121)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This function provides the means to disengage the transmission lockup clutch during vehicle braking conditions which activate the vehicle's ABS system. The control configuration for this function is dependent upon the configuration of the ABS system control and output signal. One of the variations of this function (either Y1, Y2, or Y3) MUST be used if the vehicle is equipped with ABS.

This version (Y1) of the function relies upon the ABS system to provide an activation signal to the transmission controls when an ABS event has occurred. The function is enabled when the TCM senses a ground on wire 121. Wire 121 will enable the function directly if connected to an ABS system controller which switches to ground when an ABS event has occurred. For installations in which the ABS system controller provides a power output when an ABS event has occurred, this output must be used to control a relay which switches wire 121 to the transmission control system Signal Return, wire 103.

Uses

- Signals the TCM when an ABS event has occurred, so that lockup clutch will be disabled.
- This function is required for all vehicles which are equipped with ABS.

Customer Modifiable Constants

None

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Vocations

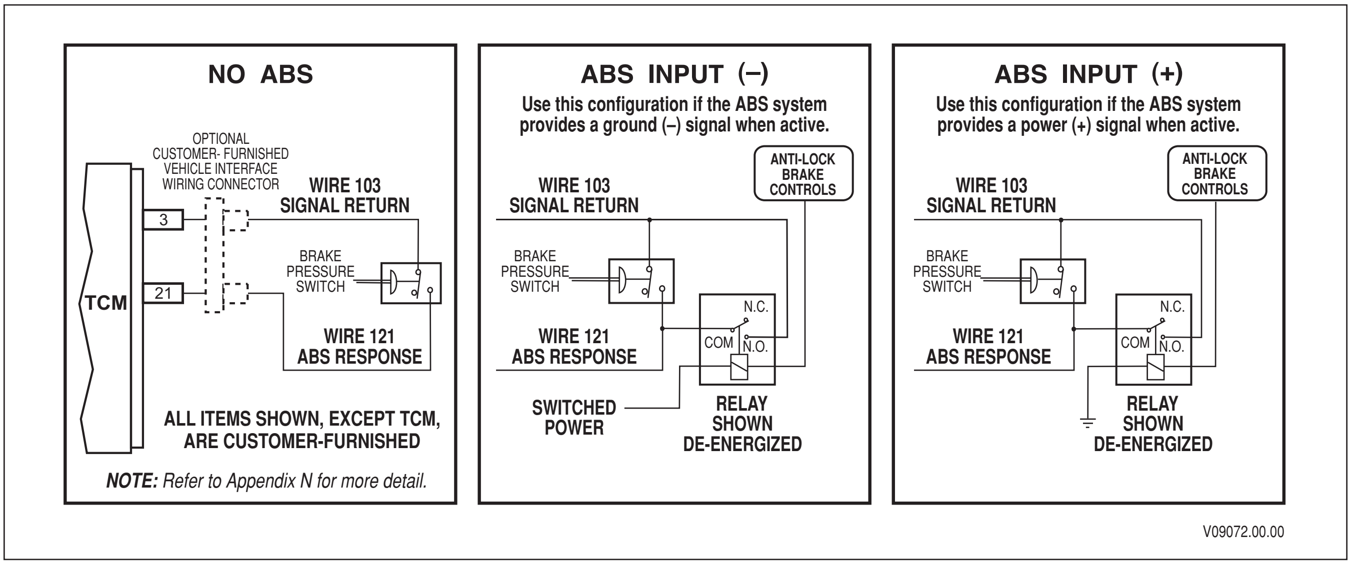
Various. This function (Y) is required for all vehicles which are equipped with ABS.

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION Y2. ANTI-LOCK BRAKE RESPONSE, WITH INPUT FROM BRAKE PRESSURE SWITCH (ENABLED BY INPUT WIRE 121)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This function provides the means to disengage the transmission lockup clutch during severe vehicle braking conditions. One of the variations of this function (either Y1, Y2, or Y3) MUST be used if the vehicle is equipped with ABS. The “No ABS” configuration noted below is recommended for all non-ABS vehicles.

This version (Y2) of the function is enabled when application of the vehicle brakes is detected and a brake pressure switch completes the circuit between input wire 121 and wire 103, Signal Return. For vehicles equipped with ABS, this brake pressure input may be used as a parallel input to the ABS controls, thus enabling the function during severe braking conditions which do not initiate an ABS event. Depending upon characteristics of the pressure switch and system design, the potential exists for this configuration to enable the function prior to broadcast of an “ABS-event” signal from the ABS controller. Three different installation schemes are illustrated below, representing the requirements for a vehicle without ABS, an ABS system controller which switches to ground when an ABS event has occurred, and an ABS system controller which provides a power output when an ABS event has occurred.

Uses

- Signals the TCM when ABS function is activated, so that lockup clutch will be disabled.
- Signals the TCM during hard vehicle braking, even if an ABS event has not occurred, so that lockup clutch will be disabled.
- This function is required for all vehicles which are equipped with ABS.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Customer Modifiable Constants

None

Vocations

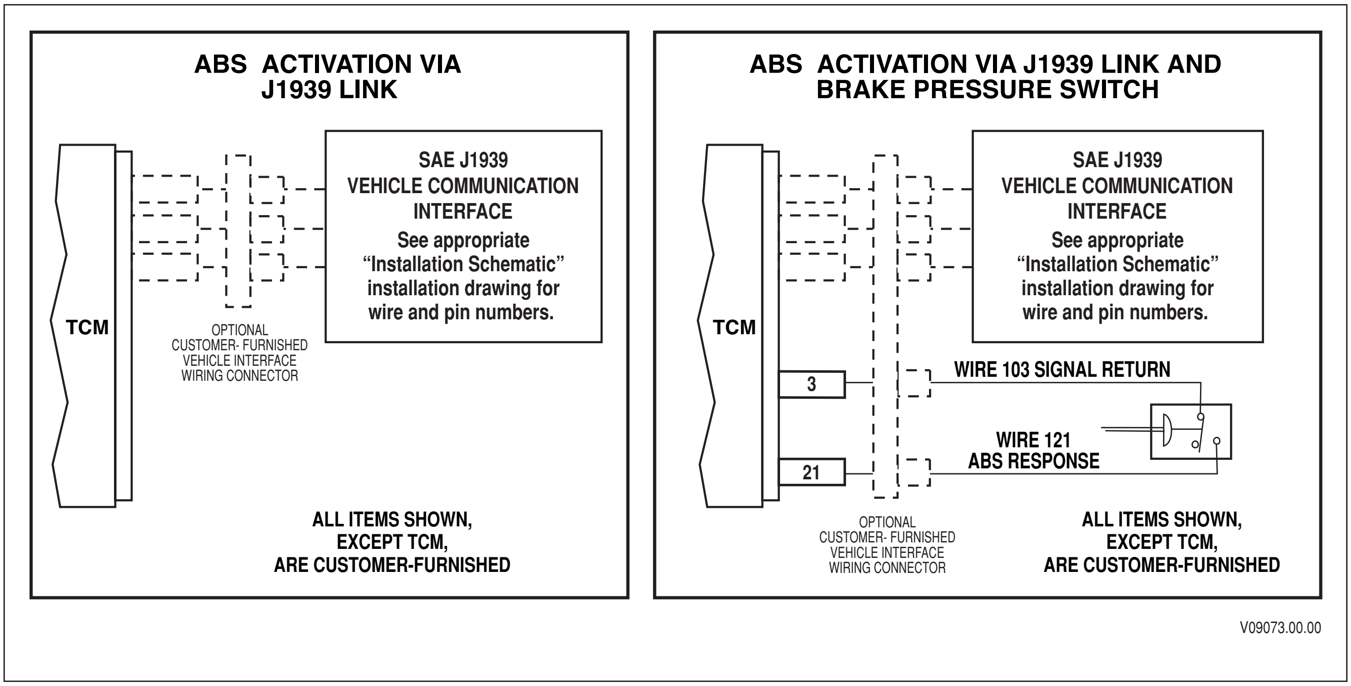
Various. This function (Y) is required for all vehicles which are equipped with ABS.

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION Y3. ANTI-LOCK BRAKE RESPONSE VIA J1939 COMMUNICATION LINK (ENABLED BY WIRE 121)



WARNING!	This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.

Description

This function provides the means to disengage the transmission lockup clutch during severe vehicle braking conditions and/or conditions which activate the vehicle's ABS system. One of the variations of this function (either Y1, Y2, or Y3) MUST be used if the vehicle is equipped with ABS. This version of the function (Y3) is recommended for vehicles utilizing an SAE J1939 vehicle communication link to indicate ABS status. Two possible installation designs are illustrated below.

This version (Y3) of the function is enabled by an indication on the J1939 communication link that the an ABS event has occurred. The response of some vehicle configurations may be enhanced by the additional input signal from the brake system which indicates that a severe braking has been detected. This input, which occurs when a brake pressure switch closes the circuit between input wire 121 and wire 103, Signal Return, enables the function in the event the severe braking does not initiate an ABS event. Depending upon characteristics of the pressure switch and system design, the potential exists for this configuration to enable the function prior to the broadcast of an "ABS-active" signal on the J1939 communication link.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Uses

- Signals the TCM when an ABS event has occurred, so that lockup clutch will be disabled.
- Signals the TCM during hard vehicle braking, even if an ABS event has not occurred, so that lockup clutch will be disabled.
- This function is required for all vehicles which are equipped with ABS.

Customer Modifiable Constants

None

Vocations

Various. This function (Y) is required for all vehicles which are equipped with ABS.

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Electronic Brake Controller #1 (EBC1)	Anti-Lock Braking	11	11	11
Electronic Engine Controller #1 (EEC1)	Engine Torque Mode	00	00	00

- Analog input may or may not be used, depending on calibration.

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

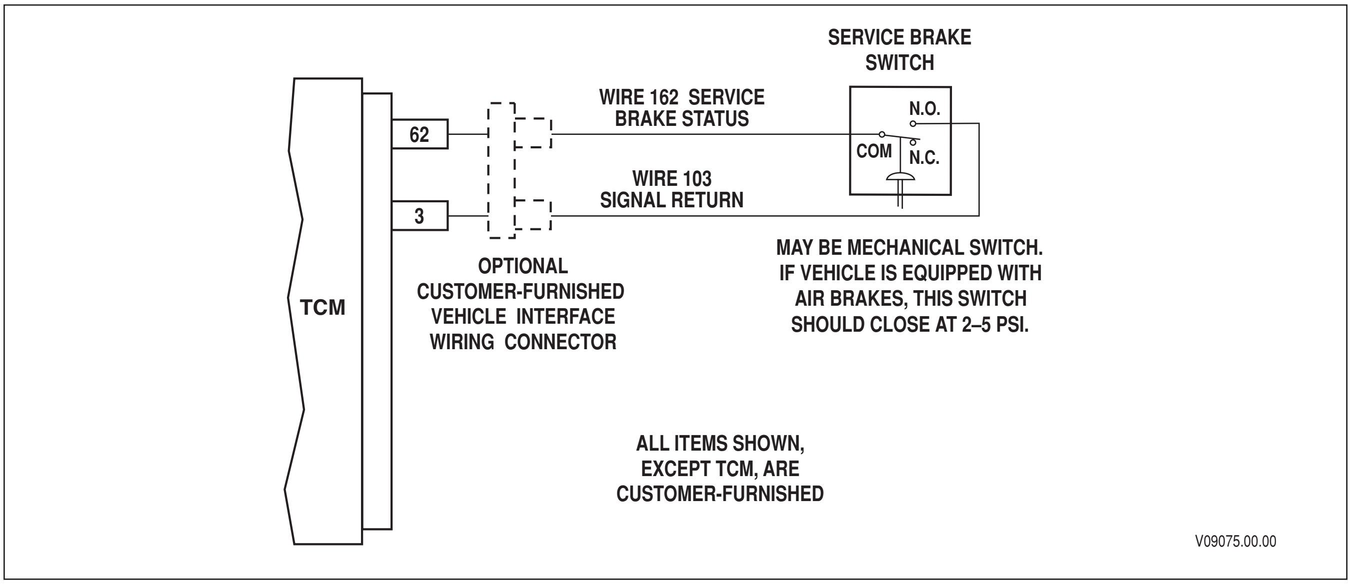
Normal Function Operation:

1. The TCM receives the following J1939 message:
   - EBC1—ABS Active = **ABS Active**
2. The TCM **activates** the ABS Active function, where the TCM:
   - Drops Torque Converter Lockup
   - Inhibit upshifts (except during “hold override” situations)
   - And, if EEC1—Engine Torque Mode = **ABS Control**, the TCM will avoid adapting shifts.
3. The TCM **deactivates** the ABS Active function, then receives the following J1939 message:
   - EBC1—ABS Active = **ABS Passive but installed**

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION AA. SERVICE BRAKE STATUS (ENABLED BY INPUT WIRE 162)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This function is enabled when a switch is closed to complete the circuit between wire 162 and wire 103, Signal Return. The enabled function indicates whether the current vehicle braking effect is being generated by the transmission retarder or by the vehicle brakes, so that certain shift control characteristics can be adapted accordingly by the TCM.

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.
- Required for all transmissions equipped with retarders.

Customer Modifiable Constants

None

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Cruise Control/Vehicle Speed (CCVS)	Brake Switch	00, 17, 33	00, 17, 33, 49, 232	00, 17, 23, 33, 49, 232
Electronic Brake Controller 1 (EBC1)	EBS Brake Switch	N/A	11	11

***NOTE:** If any one of the above messages/parameters is present in the datalink, the analog input for this function will be ignored by the TCM.*

***NOTE:** If both messages/parameters are present in the datalink, the TCM will only react to EBC1-EBS Brake Switch.*

Use the Data Bus Viewer, a feature included in Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

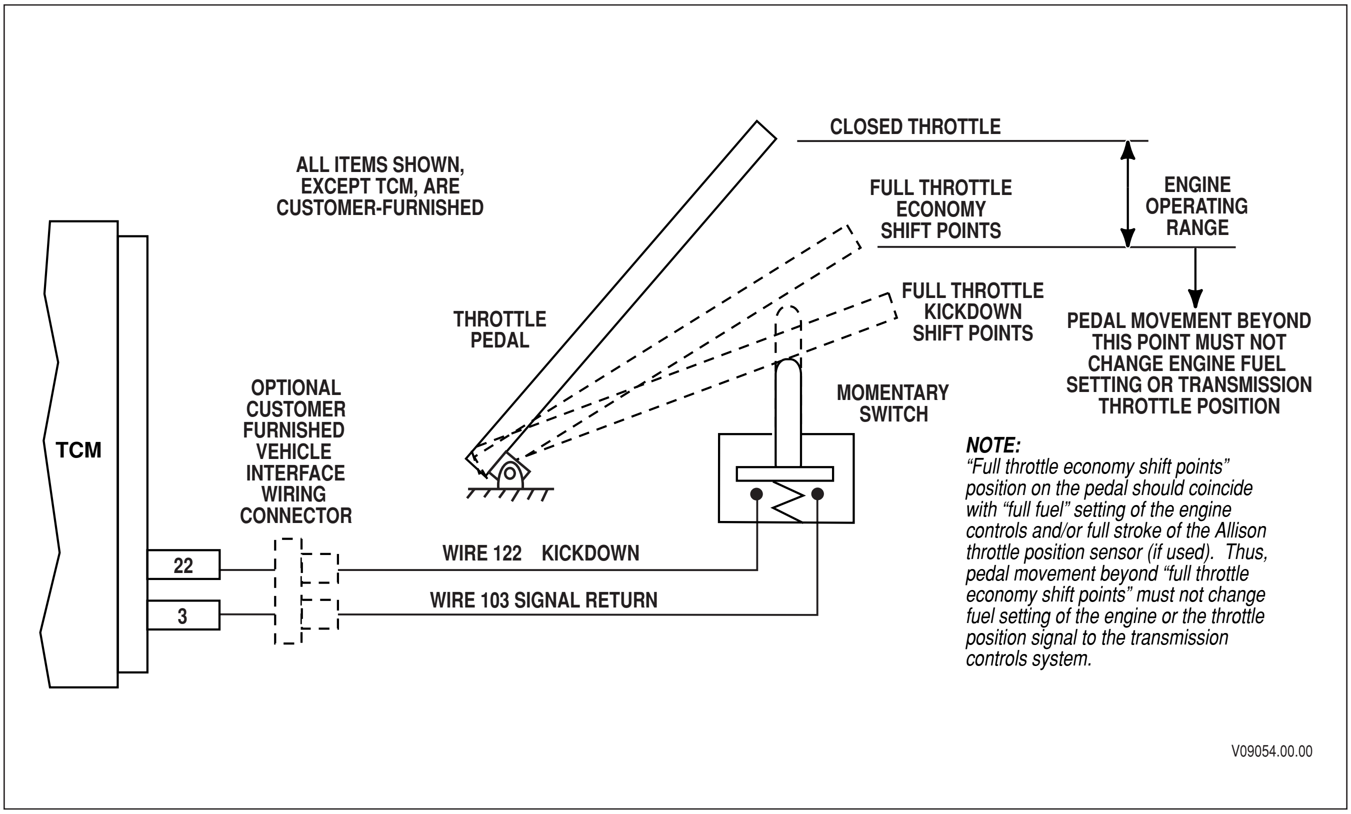
Normal Function Operation:

1. The TCM receives any of the following J1939 messages:
   a. EBC1—EBS Brake Switch = **Brake pedal is being pressed**, or
   b. CCVS—Brake Switch = **Brake pedal depressed**.
2. The Service Brake Status function becomes **Active**.
3. The TCM receives any of the following J1939 messages:
   a. EBC1—EBS Brake Switch = **Brake pedal is not being pressed**, or
   b. CCVS—Brake Switch = **Brake pedal released**.
4. The Service Brake Status function becomes **Inactive**.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION AH. KICKDOWN (ENABLED BY INPUT WIRE 122)



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Description

This function is enabled when a switch is closed to complete the circuit between wire 122 and Signal Return, wire 103. The enabled function permits the operator to choose between two different sets of shift points when operating at full-throttle in an Economy shift schedule. The throttle pedal must be equipped with a momentary normally-open switch which provides a detent feel that full-throttle is achieved. Throttle operation up to the detent utilizes Economy shift points. When the operator "steps through" the pedal detent, the Kickdown function is enabled and the control of shifts is converted to Performance shift points.

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.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Customer Modifiable Constants

None

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No shifts
- Power restored—Resume Performance shift schedule

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Electronic Engine Controller 2 (EEC2)	Accelerator Pedal Kickdown Switch	00, 33, 17	00, 33, 17	00, 33, 17

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

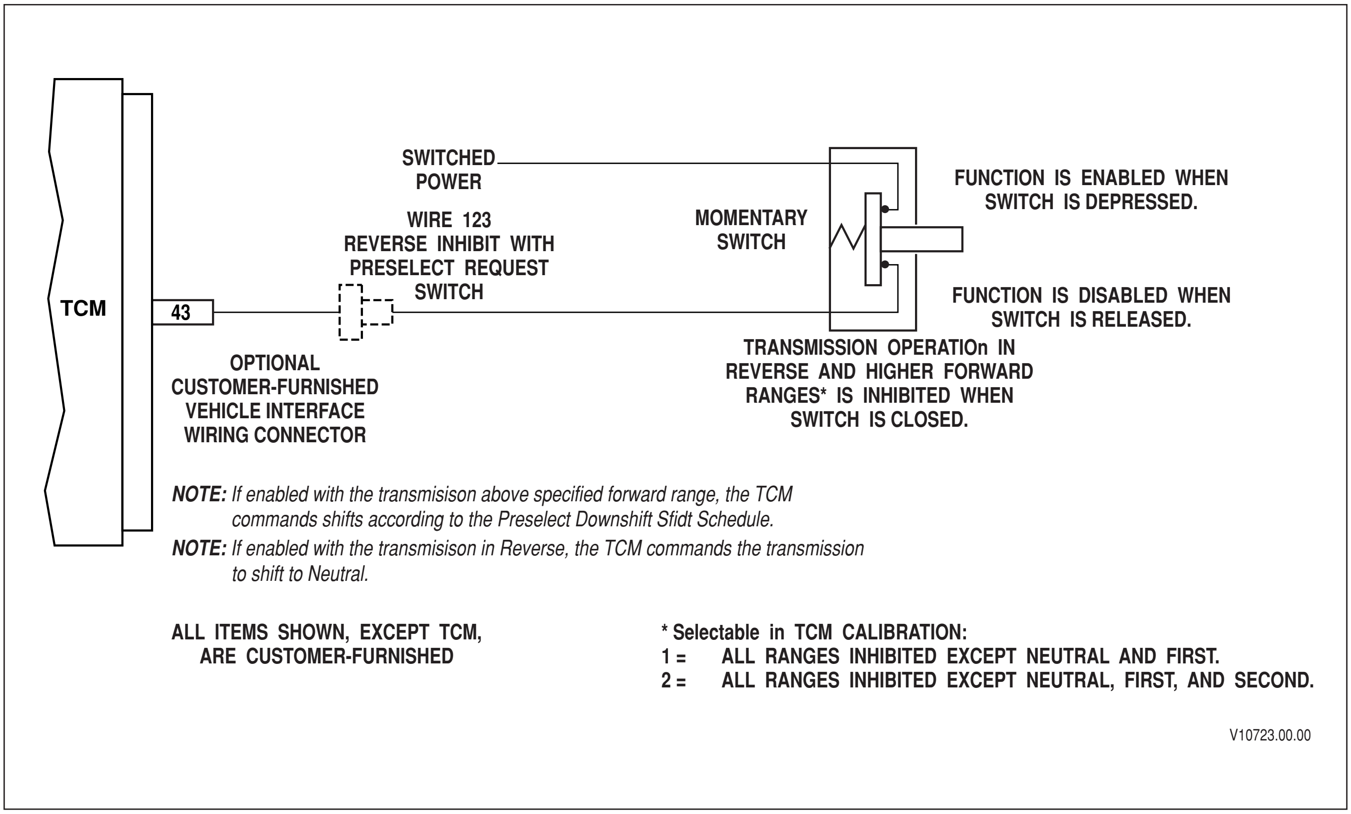
Normal Function Operation:

1. The TCM receives the following J1939 message:
   - EEC2—Accelerator Pedal Kickdown Switch = Kickdown active
2. The TCM activates the Accelerator Pedal Kickdown function, where the TCM uses performance shift points, while running in economy mode.
3. The TCM receives the following J1939 message:
   - EEC2—Accelerator Pedal Kickdown Switch = Kickdown passive
4. The TCM deactivates the Accelerator Pedal Kickdown function.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION AM. REVERSE INHIBIT WITH PRESELECT REQUEST (ENABLED BY WIRE 123)



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Description

This function is enabled when a normally-closed momentary switch is opened to interrupt power input to the TCM on wire 123. When this option is enabled, the transmission is limited to operation in only neutral and low forward range(s) (see "Customer Modifiable Constants" below). Operator requests to upshifts beyond specified gear range or to shift into reverse are ignored by the TCM. If the function is enabled with **R** (Reverse) selected on the shift selector, the transmission will shift to neutral. If the function is enabled in a forward drive range higher than the specified gear range, the TCM will invoke preselect downshifts until the specified gear range is attained.

The function is disabled when the momentary switch is released, changing the state of wire 123 to powered.

Functional control complies with European legislation for refuse vehicle operation.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

NOTE: ***Normally, an output function is activated when its control circuit (switched input) is enabled and the TCM determines that specific operating conditions are met. The output associated with this function is based on inverted logic; it is activated by the control circuit (switched input) but deactivated by the TCM when specific conditions exist. Design and installation of the control circuit for this function therefore requires special attention in order that circuit actuation creates the desired result in vehicle operation.***

Uses

- Used primarily in European refuse vehicles.
- Limit transmission operation to lower gear(s) and inhibit reverse when personnel ride at rear of vehicle.

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Preselect range	1	1–2	Range

NOTE: ***This selection is a calibration value in the TCM and cannot be modified with Allison DOC™ For PC–Service Tool.***

Vocations

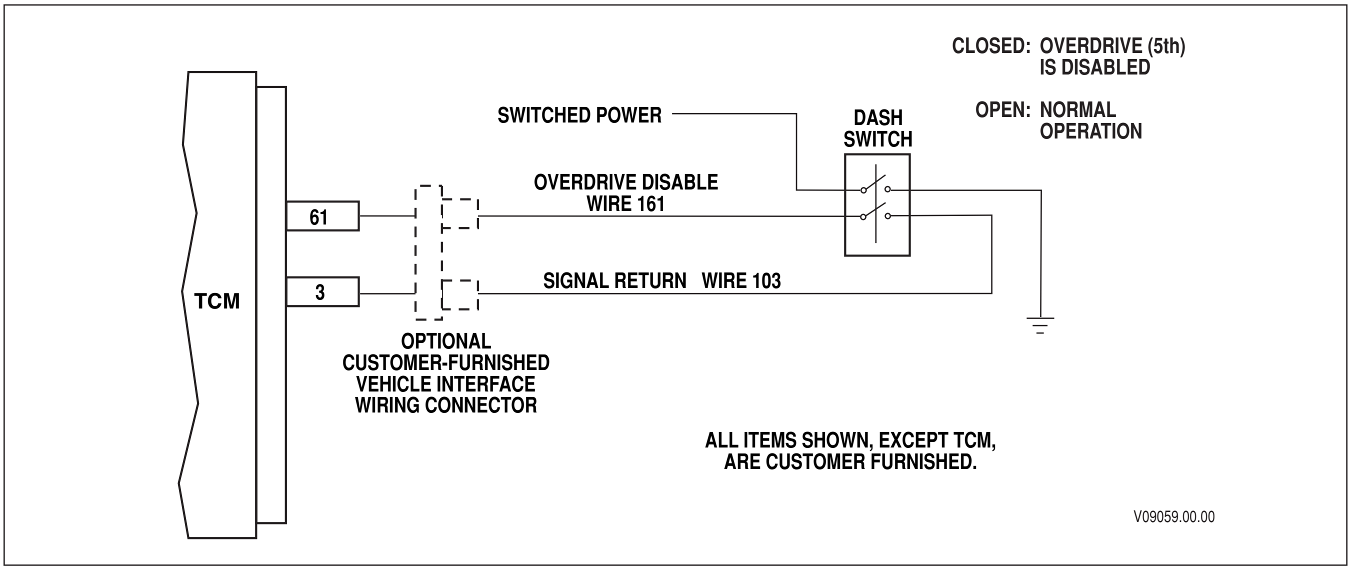
Refuse, off-highway

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION AR. OVERDRIVE DISABLE (ENABLED BY INPUT WIRE 161)



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Description

This function is enabled when a dash switch is closed to complete the circuit between wire 161 and Signal Return, wire 103. When the function is enabled, the transmission is prevented from operating in fifth (overdrive) range. The disable function is initiated electronically in the TCM, eliminating any required movement of the shift cable.

Uses

Provides the capability, through the enabling of this function, to prevent the transmission from upshifting into overdrive range(s).

When used with a six-speed transmission and the shift control is programmed with:

- The 6-4-2-1 shift mask, the enabled function creates the provision to hold the transmission in 5th range.
- The 6-4-3-1 shift mask, the enabled function creates the provision to hold the transmission in 5th range.
- The 6-4-3-2 shift mask, the enabled function creates the provision to hold the transmission in 5th range.
- The 6-3-2-1 shift mask, the enabled function creates the provision to hold the transmission in 4th range.

When used in conjunction with a five-speed transmission and the shift control is programmed with the 5–3–2–1 shift mask, enabling this function creates the provision for hold capability in 4th range—thus providing, for this combination, the capability to hold all forward ranges.

The feature has no effect when used with 4-speed transmission configurations.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Customer Modifiable Constants

Maximum range for transmission operation when the "overdrive disable" function is active:

For 5-speed transmission models:	4	No options
For 6-speed transmission models:	4 or 5	

Vocations

No vocational restrictions.

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No shifts
- Power restored—No change

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Transmission Controller 1	Transmission Requested Gear	N/A	33, 05,23	33, 05, 23

NOTE: Starting in MY08, this function will be superseded by Pre-Select Request.

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

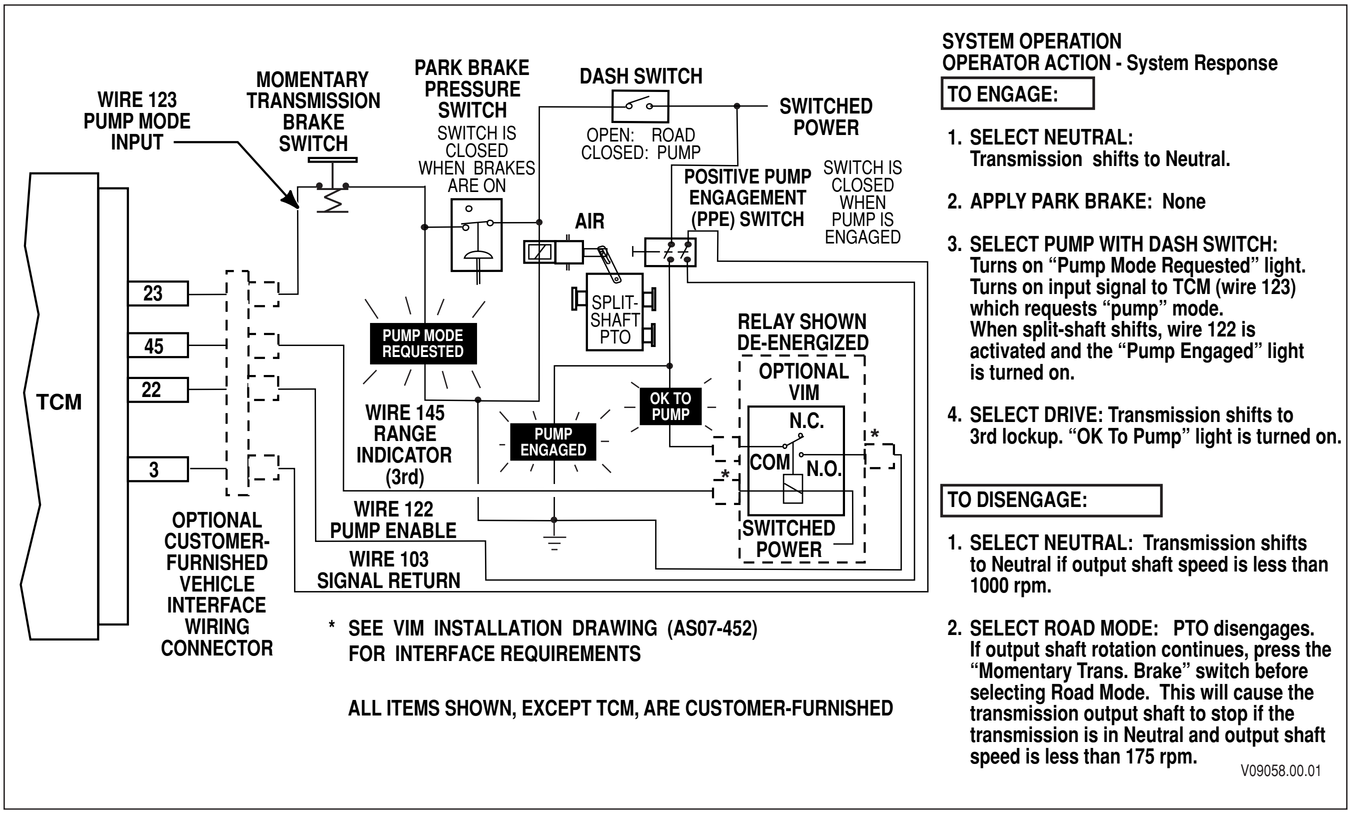
Normal Function Operation:

1. When the Overdrive Disable function is requested to be activated, the TCM receives the following J1939 message:
   - TC1—Transmission Requested Gear = D–1:1st forward selector position referenced from **D** (Drive).
2. The TCM activates the Overdrive Disable function.
3. When the Overdrive Disable function is requested to be deactivated, the TCM receives the following J1939 message:
   - TC1—Transmission Requested Gear = Position unknown and/or no buttons pressed.
4. The TCM deactivates the Overdrive Disable function.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION BQ. PUMP MODE (3RD LOCKUP), OPERATOR AND PUMP ACTIVATED (ENABLED BY INPUT WIRES 122 AND 123, OUTPUT WIRE 145)



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WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring.**

Description

This function is enabled when wire 123 is switched to send power to the TCM, and a switch is closed to complete the circuit between wire 122 and Signal Return, wire 103. When this function is enabled and a specific set of conditions exist (listed below), the TCM will command the transmission to operate in 3rd-gear-lockup. The switch on wire 123 reflects the selection of pump mode by the operator. It typically is also interlocked with the park brake to assure the brake has been engaged before pump mode can be requested. The separate switch on wire 122 denotes the completion of the split-shaft PTO shift (PTO is physically fully engaged). A second set of contacts on this same

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

switch is used to control illumination of the “OK To Pump” lamp. Required operating conditions for enabling the function are:

- Vehicle park brake is activated
- “Pump mode” is selected
- Auxiliary equipment is fully engaged
- **D** (Drive) is selected on the shift selector

Uses

Coordinates special transmission operation (third range lockup) with operator request for split shaft PTO operation (PTO mode switch), plus indication of pump engagement (PPE switch).

Customer Modifiable Constants

None

Vocations

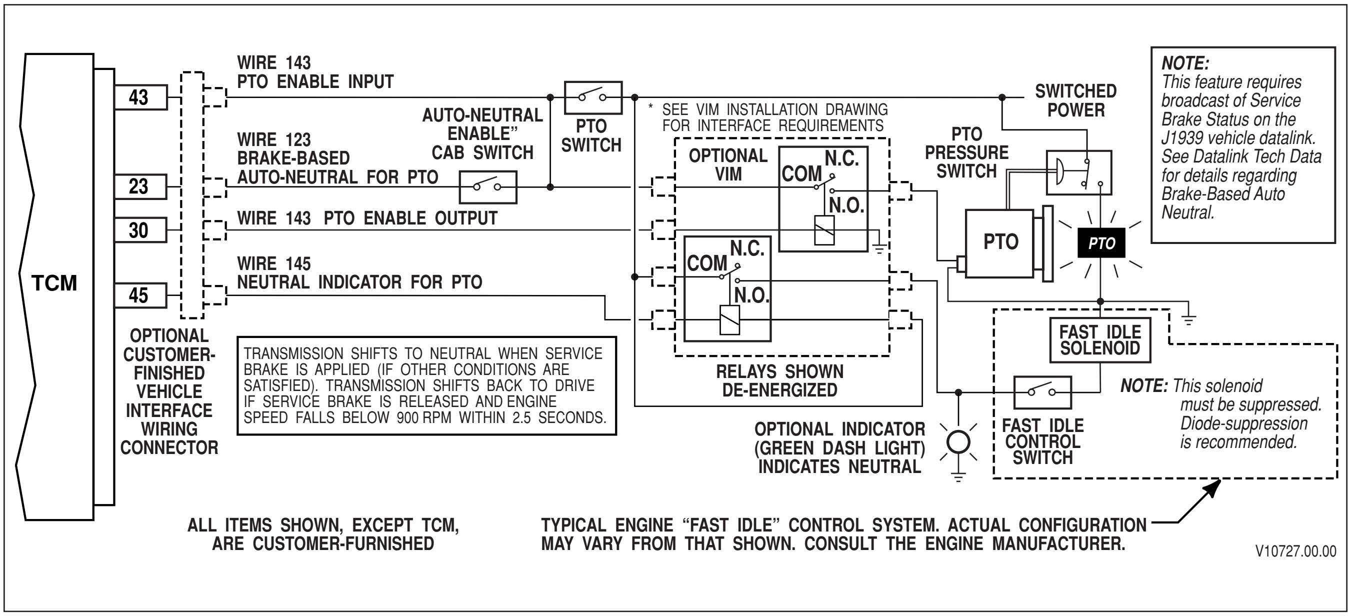
Fire truck pumper, sewer cleaner

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—Lockup clutch off. Transmission remains in 3rd range.
- Power restored—Lockup clutch on. Transmission remains in 3rd range.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION CA. BRAKE-BASED AUTOMATIC NEUTRAL FOR PTO (ENABLED BY INPUT WIRE 123 AND J1939 SERVICE BRAKE STATUS)



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NOTE:* *Allison Application Engineering must review all vehicle designs using this function.

Description

This feature facilitates automatic shifts to neutral and re-engagement of drive initiated by an SAE J1939 datalink Service Brake Status message. The function is enabled when 12V input power is switched to wire 123, a J1939 message is received to indicate that the service brakes are applied, and specified operating conditions exist. When the function is enabled, the transmission will be commanded to shift to neutral, regardless of the shift selector position. While in this state, the shift selector will flash the selected drive range. To enable this function, the throttle position must be low and output speed must be within Customer Modifiable Constant limits (see below). Additionally, when wire 123 is switched on but the transmission is not in the Auto Neutral state, the maximum allowable range of the transmission will be limited by a Customer Modifiable Constant (preselected forward range).

The implementation shown includes the Neutral Indicator for PTO (NIPTO) feature which deactivates fast idle operation upon release of the service brakes. NIPTO provides an inhibit to prevent re-engagement of drive for up to 2.5 seconds if engine speed remains above the Neutral-to-Drive shift inhibit speed (1000 rpm) or if throttle position remains high. If the throttle position and engine speed thresholds are not attained during this period, the transmission will remain in neutral. A gear range will only be commanded when a range is reselected on the shift selector.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

The function will be disabled, the transmission will be shifted back to the previously-selected (or newly-selected) drive range and normal transmission operation resumes when:

- A range is selected by the operator, or
- Output speed exceeds the Customer Modifiable Constant limit, or
- The Auto Neutral Enable cab switch is switched from closed to open, or
- The Service Brake message indicates that brakes have been released.

NOTE: ***Use of this feature requires installation of a rollback protection feature on the vehicle to prevent inadvertent rollback when the transmission is transitioning from Neutral to Drive. This feature must be configured to disengage when throttle position is raised above zero and a forward J1939 Transmission Current Gear message is received. Design and installation of this feature are the responsibility of the vehicle manufacturer.***

Uses

- Automatically commands neutral and activates fast idle when the service brake is applied.
- Automatically re-engages transmission in the selected drive range when service brake is released.

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Maximum output speed for engaging neutral	60	50–900	rpm
Maximum engine speed for PTO engagement	900	500–2000	rpm
Maximum engine speed for PTO operation	4000	375–5000	rpm
Maximum output speed for PTO engagement	250	60–6000	rpm
Maximum output speed for PTO operation	300	70–6000	rpm
Maximum engine speed for PTO engagement	900	500–2000	rpm
Maximum engine speed for PTO operation	4000	375–5000	rpm
Maximum output speed for PTO engagement	250	60–6000	rpm
Preselected forward drive range	3	1–6	range

Vocations

Refuse packer, recycling truck

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—Disable fast idle. Transmission remains in neutral.
- Power restored—Transmission remains in neutral. Fast idle stays off until pack cycle is deactivated/reactivated.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Cruise/Vehicle Speed (CCVS)	Brake Switch	N/A	00,17,33,49,232	00,17,33,49,232
Electronic Brake Controller #1 (EBC1)	EBS Brake Switch	N/A	11	11

NOTE: If both messages/parameters are present in the datalink, the TCM will only react to EBC1-EBS Brake Switch.

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

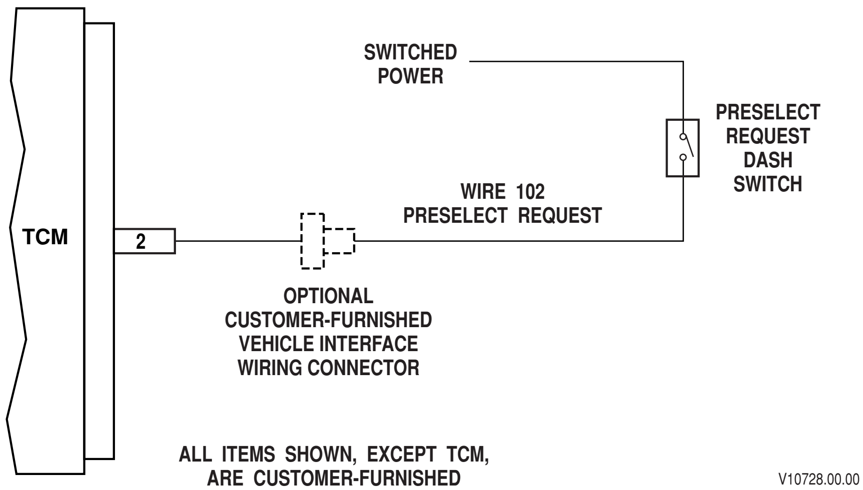
Normal Function Operation

1. The TCM **activates** the BBAN function after all the following operational conditions are met:
   - The vehicle operator activates the hard-wire (analog) BBAN input
   - The vehicle operator steps on the brakes and the TCM receives the following J1939 message:
     — EBC1—EBS Brake Switch = **Brake pedal is being pressed**, or
     — CCVS—Brake Switch = **Brake pedal depressed**
   - Throttle position and output speed are below calibrated values
   - A forward range has been selected, commanded, or attained
   - No ABS events are active or pending
   - A shift is not currently in process
   - The vehicle has moved within the last 10 activations of this function
2. The TCM **deactivates** the BBAN function when:
   - The vehicle operator deactivates the hard-wire (analog) BBAN input, OR
   - The vehicle operator releases the service brakes and the TCM receives the following J1939 message:
     — EBC1—EBS Brake Switch = **Brake pedal is not being pressed**, or
     — CCVS—Brake Switch = **Brake pedal released**; OR
   - The vehicle operator reselects a range on the shift selector, OR
   - The transmission output speed exceeds the customer modifiable constant (CMC) specified limit.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION CB. PRESELECT REQUEST (ENABLED BY INPUT WIRE 102)



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Description

This function is enabled when wire 102 is switched to send power to the TCM. Once the function is enabled, the TCM will activate the function by commanding one of two user-specified preselect shift schedules (standard or low) to go into effect. The resulting preselect shift schedule will be identical to the schedule achieved by manually preselecting with the shift selector.

An approved Allison Diagnostic Tool can be used to set or modify the preselect forward drive range that is activated when the input is turned on. With either preselect shift schedule, the TCM commands downshifts at higher engine speeds than with the standard shift schedule.

Uses

Signals the TCM to preselect a selectable forward drive range whenever the function switch is closed.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Preselected forward drive range:			
Primary Mode	3	2–6	range
Secondary Mode	3	2–6	range

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—Normal power loss response
- Power restored—Normal preselect response.

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Transmission Controller 1	Transmission Requested Gear	N/A	33, 05,23	33, 05, 23

NOTE: Starting in MY08, this function will be superseded by Pre-Select Request.

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

Normal Function Operation:

1. When the Pre-Select Request function is requested to be activated, the TCM receives the following J1939 message:
   - TC1—Transmission Requested Gear = any preselecting gear.
2. The TCM activates the Pre-Select Request function.
3. When the Pre-Select Request function is requested to be deactivated, the TCM receives the following J1939 message:
   - TC1—Transmission Requested Gear = Position unknown and/or no buttons pressed.
4. The TCM deactivates the Pre-Select Request function.

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

GUIDELINES FOR SELECTING INPUT FUNCTION CC: HIGH N/V

NOTE: ***N/V = ratio of transmission output shaft speed to road speed. Thus, "High n/v" relates to vehicles which are geared for relatively low road speed. For the purpose of this function, Allison Transmission defines a High n/v vehicle as having an n/v ratio in the range of 43–93 transmission output rpm per kilometers/hr (70–150 rpm/mph).***

Purpose of this function is to signal the TCM when the vehicle is being operated with a driveline configuration that produces an abnormally high n/v ratio. For proper operation, this vehicle configuration requires different transmission shifting characteristics as compared one with an n/v in the "normal" range. This condition is typically created by one of two situations:

1. The vehicle is equipped with a multi-speed transfer case and the "low road speed" ratio of the transfer case is currently selected for use.
2. The vehicle does not have a transfer case, but does use a very deep axle ratio in order for it to be geared very slowly due to its vocational use, e.g. an aircraft tow tractor.

Each of these two vehicle variations requires a different interface to enable this input function. Use the descriptions above and the guide below to select the proper version of this function for your vehicle.

CC1: High N/V resulting from multi-speed transfer case: Select this option if the high-reduction (low-gear speed) ratio of the vehicle's transfer case produces a calculated ratio of transmission output speed (n) to road speed (v) of 43.93 rpm per kilometers/hour (70.150 rpm per miles/hour). As a result of this installation, the TCM calculates different transmission shift characteristics for the low-speed and high-speed ratios of the transfer case.

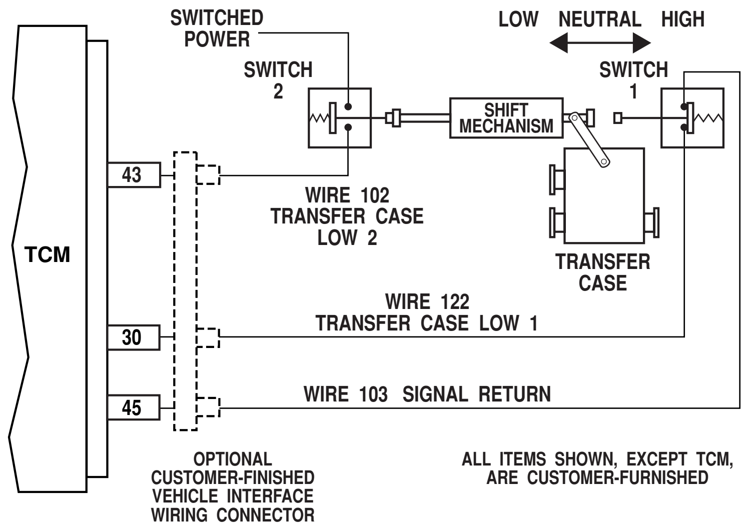
CC2: High N/V driveline: Select this option if the vehicle has a single-speed (or no) transfer-case, but an axle ratio which results in full-time operation in the n/v range of 43–93 rpm per kilometers/hour (70.150 rpm per mph).

Wiring schematics for the installation of both activations of the High N/V input function follow.

Vehicle Configuration	Function ID
Has multi-speed transfer case, one of which creates a "high n/v" driveline ratio	CC1
Full-time gearing ratio which meets CC2 definition of a "high n/v" driveline	CC2

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION CC1. HIGH N/V (ENABLED BY WIRES 102 AND 122)



TRANSFER CASE SELECTION	SWITCH 1 STATE	SWITCH 2 STATE
LOW	CLOSED	OPEN
NEUTRAL	OPEN	CLOSED
HIGH	OPEN	CLOSED

NOTE: *Transfer case and switches illustrated in "Low" position.*

V10729.00.00

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Description

This function is enabled when a switch is closed to complete the circuit between input wire 122 and Signal Return (wire 103), and switch between wire 102 and switched power is opened. This condition alerts the TCM that the transfer case shift mechanism has been shifted to the "Low" position which results in a high n/v ratio (see definition in note below). When this function is enabled, the TCM adjusts specific shift calibration values to accommodate changes in vehicle performance which result from use of the deeper gear ratio associated with the Low position of the transfer case. The function is disabled when the switch between wires 122 and 103 is opened and/or power is switched to wire 102, reflecting selection of the transfer case Neutral or High position.

NOTE: N/V = ratio of transmission output shaft speed to road speed. Thus, "High n/v" relates to vehicles which are geared for relatively low road speed. For the purpose of this function, Allison defines a high n/v vehicle as having an n/v ratio in the range of 43–93 transmission output rpm per kilometers/hr (70–150 rpm/mph).

Uses

Adjust transmission operating parameters to compensate for the gear ratio change and other factors associated with shifting between "High", "Neutral", or "Low" positions of a transfer case.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Customer Modifiable Constants

None

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

J1939 Implementation

The following table contains all J1939 parameters required to accomplish this function over J1939 communication.

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Transfer Case Information (TCI)	Transfer Case Status	N/A	04, 33	04, 33

NOTE: If analog input is used for this function, the J1939 information is ignored.

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

Normal Function Operation

1. The TCM receives any of the following J1939 messages:
   - TCI—Transfer Case Status = **2 wheel low (or "Off Highway" Range)**, or
   - TCI—Transfer Case Status = **4 wheel low (or "Off Highway" Range)**.
2. The High N/V function becomes Active. During this **Active** state, the TCM uses special shifting logic to optimize modulation and shift quality, and the transmission operates in converter mode.
3. When the TCM stops receiving the TCI message, or the Transfer Case Status parameter changes from the values described above, the High N/N becomes Inactive.

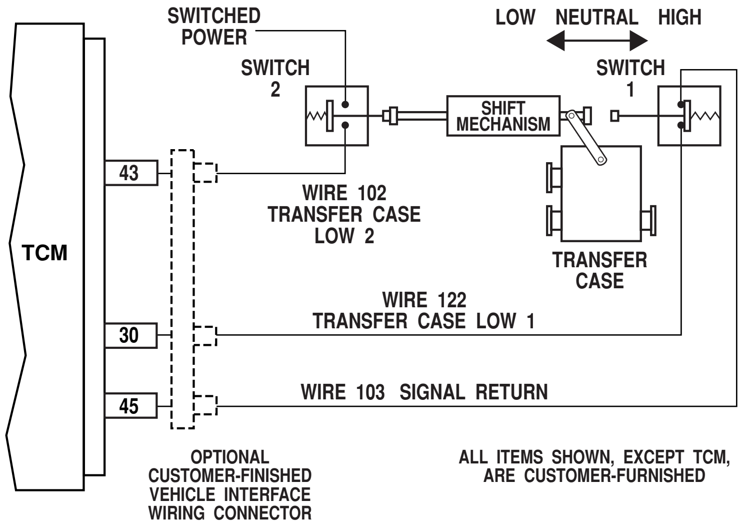
NOTE: Poor shift quality or engine stall in this type of application could occur when the TCM is not receiving a valid Transfer Case value:

- ***TCI—Transfer Case Status = Error***

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION CC2. HIGH N/V (ENABLED BY WIRE 122)



TRANSFER CASE SELECTION	SWITCH 1 STATE	SWITCH 2 STATE
LOW	CLOSED	OPEN
NEUTRAL	OPEN	CLOSED
HIGH	OPEN	CLOSED

NOTE: *Transfer case and switches illustrated in "Low" position.*

V10729.00.00

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Description

This function is enabled when a permanent connection is made between input wire 122 and Signal Return (wire 103). The signal which results from this connection alerts the TCM that the vehicle is geared for low road speed. When this function is enabled in this manner, the TCM adjusts specific shift calibration values to accommodate the relatively fast shifting characteristics which result from the use of an unusually deep driveline gearing ratio in a vehicle, or "n/v ratio".

NOTE: ***N/V = ratio of transmission output shaft speed to road speed. Thus, "High n/v" relates to vehicles which are geared for relatively low road speed.***

For the purpose of this function, Allison defines a high n/v vehicle as having an n/v ratio in the range of 43–93 transmission output rpm per kilometers/hr (70–150 rpm/mph).

Uses

Adjust transmission operating parameters to compensate for high n/v gearing.

Customer Modifiable Constants

None

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

J1939 Implementation

The following table contains all J1939 parameters required to accomplish this function over J1939 communication.

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
Transfer Case Information (TCI)	Transfer Case Status	N/A	04, 33	04, 33

NOTE: If analog input is used for this function, the J1939 information is ignored.

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of each of these parameters.

Normal Function Operation

1. The TCM receives any of the following J1939 messages:
   - TCI—Transfer Case Status = **2 wheel low (or “Off Highway” Range)**, or
   - TCI—Transfer Case Status = **4 wheel low (or “Off Highway” Range)**.
2. The High N/V function becomes Active. During this **Active** state, the TCM uses special shifting logic to optimize modulation and shift quality, and the transmission operates in converter mode.
3. When the TCM stops receiving the TCI message, or the Transfer Case Status parameter changes from the values described above, the High N/N becomes Inactive.

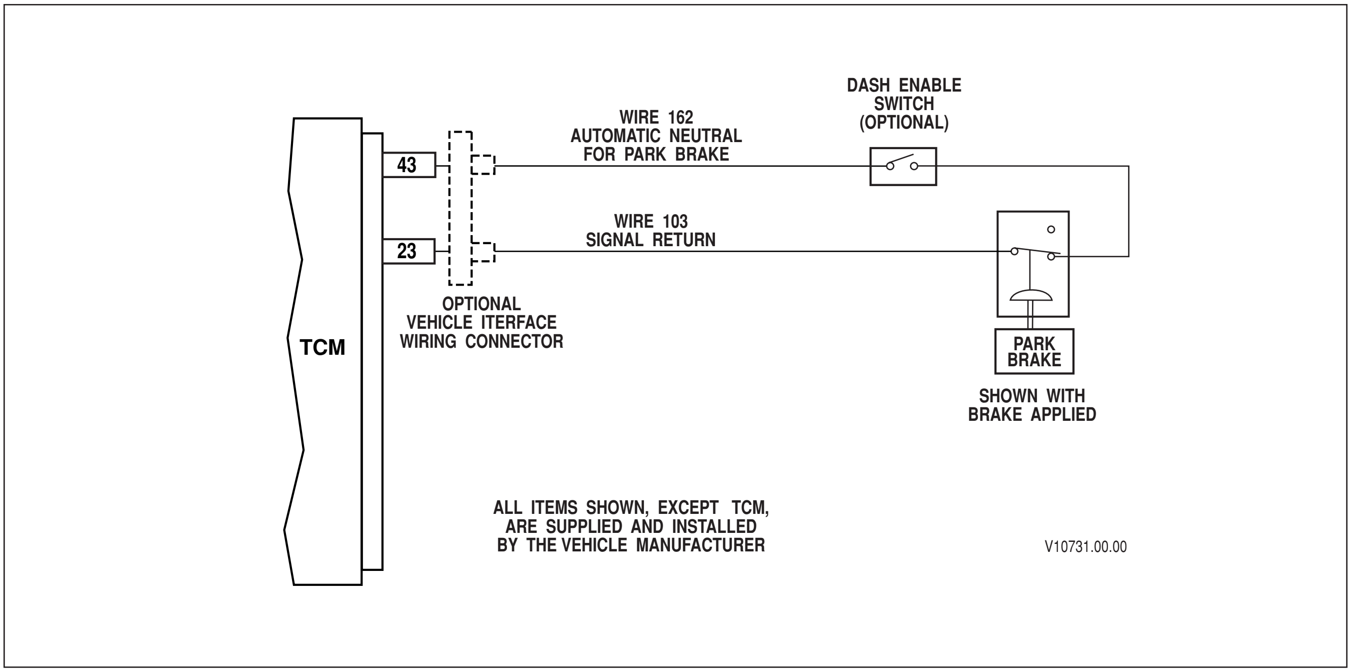
NOTE: Poor shift quality or engine stall in this type of application could occur when the TCM is not receiving a valid Transfer Case value:

- ***TCI—Transfer Case Status = Error***

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

INPUT FUNCTION CD. AUTOMATIC NEUTRAL (SINGLE INPUT), WITH SELECTOR OVERRIDE (ENABLED BY INPUT WIRE 162)



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WARNING!	**If this function is enabled in the shift calibration, the function MUST be integrated into the vehicle wiring. Refer to Section E: Using Input/Output Functions, Packages, and Groups in the Allison 4th Generation Controls Installation Manual. This function must not be used with Neutral Indicator for PTO (Output "S").**

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Description

This function is enabled when a switch is closed to complete the circuit between input wire 162 and wire 103, Signal Return. When the function is enabled and both output speed and throttle position are near zero, the transmission will be commanded to neutral regardless of shift selector position. While in this mode, the shift selector display will flash the selected drive range. To resume operation in the selected drive range, the drive range must be re-selected on the shift selector—which may be done after the enable switch is opened, or as an override with the input switch remaining closed. When the function is active, the shift selector display will flash the selected drive range. The neutral start relay does not change states when the function is activated with the transmission in drive or reverse—only when **N** (Neutral) has been re-selected on the shift selector. See Section C: Vehicle Electrical System Interface of the Allison 4th Generation Controls Manual for more information on the neutral start signal.

Uses

- Commands the transmission to neutral when the park brake is applied, regardless of drive range requested on the shift selector.
- Requires re-selecting drive range to shift out of neutral.
- This function must NOT be used with Neutral Indicator for PTO output function (output “S”).

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Maximum output speed for function activation	60	50–900	rpm
Range indicator	Neutral	Neutral	range

Vocations

Various (with usage of park brake)

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—No change
- Power restored—No change

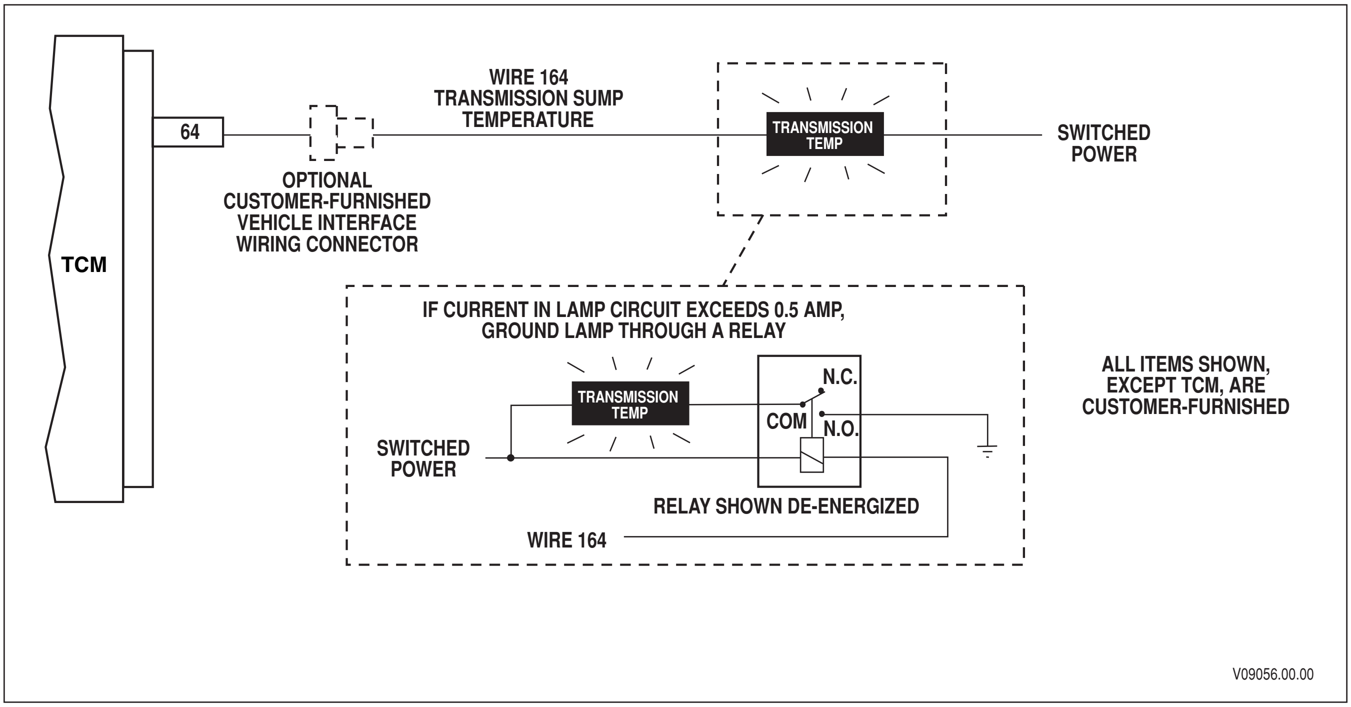
APPENDIX N—INPUT AND OUTPUT FUNCTIONS

OUPUT FUNCTION A. ENGINE BRAKE ENABLE (ACTIVATION WIRE 104)

Refer to Input Function H1, H2, or I1 for description.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

OUTPUT FUNCTION B. SUMP TEMPERATURE INDICATOR (ACTIVATION WIRE 164)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This output function is activated by the TCM switching wire 164 from open to ground, which occurs when instantaneous transmission sump temperature reaches 127˚C (260˚F). Upshifts beyond 4th range are inhibited if the temperature exceeds 128˚C (262˚F). The TCM automatically disengages the transmission lockup clutch if the temperature exceeds 160˚C (320˚F).

The function remains active until the sump temperature drops below 99˚C (210˚F). At this temperature the TCM deactivates the indicator by switching wire 164 from ground to open.

A DTC will be registered in memory each time the function is activated.

NOTE: A J1939 message is available as an alternative means to actuate this indicator.

Refer to the Allison Transmission Datalink Communications Manual for details.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Uses

Turn on dash indicator or alarm when transmission sump temperature has exceeded specified limit. Use of the function, either by wire 164 or by J1939 interface, is recommended for all transmission installations.

Customer Modifiable Constants

None

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—Indicator (wire 164) de-activated
- Power restored—Indicator (wire 164) re-activated if conditions warrant

J1939 Implementation

The following table contains all J1939 messages, parameters, and source addresses related to this function:

J1939 Message	J1939 Parameter	Source Address MY Support		
		MY06	MY07	MY08
DM1	Suspect Parameter Number	03		
	Amber Warning Lamp Status			
	Failure Mode Identifier			

Use the Data Bus Viewer, a feature included in the Allison DOC™ For PC–Service Tool, to monitor the status of these parameters.

Normal Function Operation

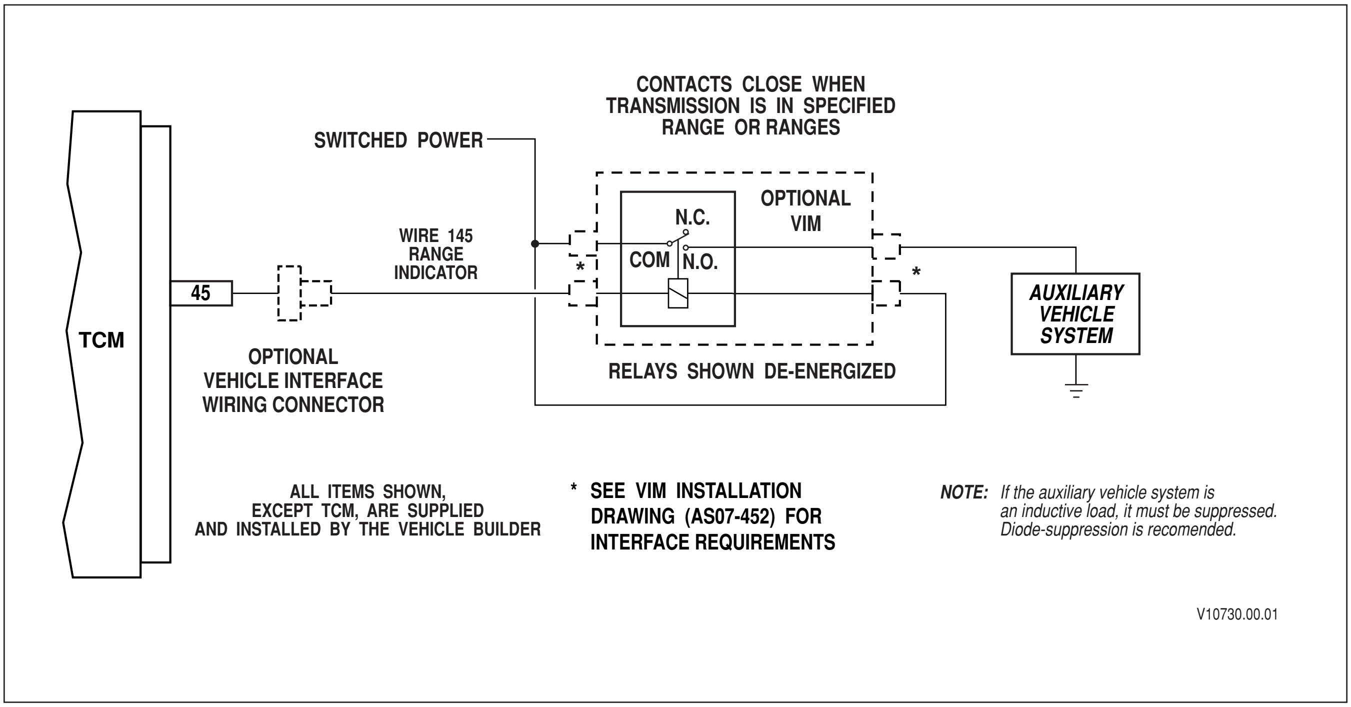
1. The TCM senses a Sump Temperature condition.
2. The TCM activates the analog output and broadcasts DM1 messages with the following information:
   - Suspect Parameter Number = **177**, and
   - Amber Warning Lamp Status = **On**, and
   - Failure Mode Identifier = **15**.
3. When the TCM detects the Sump Temperature condition is no longer present, the TCM stops broadcasting the above mentioned **parameter** values.

NOTE: The DM1 message could still be present (i.e. being broadcasted) due to other failures. However, a Sump Temp Condition is only indicated by the above mentioned parameter status (i.e. SPN=177, Amber Lamp=On, and FMI=15)

For more information concerning this function, please refer to the **Datalink Communications** available on the Allison Extranet under Tech Data.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

OUTPUT FUNCTION C. RANGE INDICATOR (ACTIVATION WIRE 145)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This output function is activated by the TCM switching wire 145 from open to ground, which occurs when the specified gear (or gears) is being commanded by the TCM.

NOTE: ***This signal must not be used to automatically apply the park brake or service brakes when the transmission is shifted to Neutral, since the indicator is activated only when the TCM is powered and the engine is running.***

This feature also must not be used to activate the vehicle reverse warning feature, since it is customer-programmable and may therefore be disabled by reprogramming. Activate reverse warning through use of wire 165 and the feature dedicated to this purpose.

Uses

- Used with auxiliary vehicle systems to permit operation only in specified transmission range(s).
- To activate a vehicle control or information display which may include a two speed governing system.
- To provide additional neutral or reverse indication.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
B210* and B220** models	P*, N**	P*,N**,R,N,5,4,3,2,1	range
1000, 2200, 2350, and 2550 models	P*, N	P*,R,N,6,5,4,3,2,1	range
2100, 2300, and 2500 models	P**, N	P**,R,N,6,5,4,3,2,1	range
Any 1000 or 2000 Product Families model with split-shaft PTO***	3	P*,N**,R,N,6,5,4,3,2,1	range

* **P** (PARK) can be an indicated range for models equipped with a park pawl.
** For models without a park pawl, the **P** (Park) position can be used to indicate a second neutral position.
*** If input function BQ is included in any I/O Package of the selected I/O Group.

Vocations

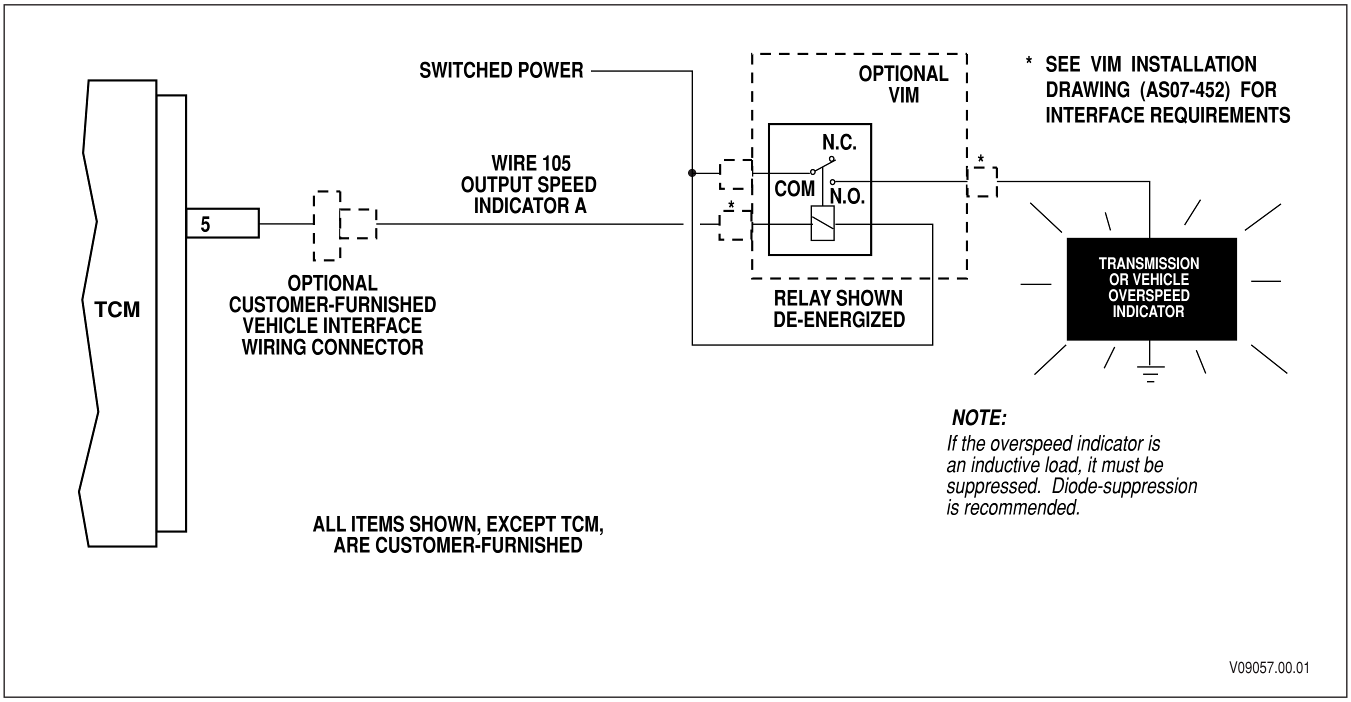
Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—Indicator (wire 145) deactivated
- Power restored—Indicator (wire 145) re-activated if conditions warrant

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

OUTPUT FUNCTION D. OUTPUT SPEED INDICATOR A (ACTIVATION WIRE 105)



WARNING!	**This schematic shows the intended use of the specified controls feature which has been validated in the configuration shown. Any miswiring or use of this feature 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.**

Description

This output function is activated by the TCM switching wire 105 from open to ground, which occurs when the TCM detects that a preset output speed has been exceeded in either the forward or reverse direction. The speed setting at which activation occurs is adjustable with diagnostic tools.

Uses

To signal that the transmission output shaft has exceeded a specified value. Examples:

- An overspeed condition is present.
- A predetermined low speed (greater than 1 mph) has been exceeded.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

Customer Modifiable Constants

Customer Modifiable Constants	Standard Value	Allowable Range	Units
Output rpm at which indicator is activated	70	70–5000	rpm
Output rpm at which indicator is deactivated	60	60–5000	rpm

NOTE: The speed for activation must be higher than the speed for deactivation.

Vocations

Various

Function Response to TCM Power Interruption (power-off, followed by power restored)

- Power off—Indicator (wire 105) deactivated
- Power restored—Indicator (wire 105) re-activated if conditions warrant

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

OUTPUT FUNCTION G. PTO ENABLE OUTPUT (ACTIVATION WIRE 150)

See Input Function C for description.

APPENDIX N—INPUT AND OUTPUT FUNCTIONS

OUTPUT FUNCTION S. NEUTRAL INDICATOR FOR PTO (ACTIVATION BY WIRE 145)

See Input Function CA for description.

APPENDIX P—J1939 AND J2284 HARDWARE AND TCM CONNECTIONS

P–1. J1939 HARDWARE AND TCM CONNECTIONS

A. TCM J1939 Interface

Allison 4th Generation TCMs can be interfaced to a vehicle's J1939 network in one of three ways:

- Traditional Stub
- Pass–Through
- Backbone Termination

The following sections detail each interface option, and their respective requirements.

B. Traditional Stub

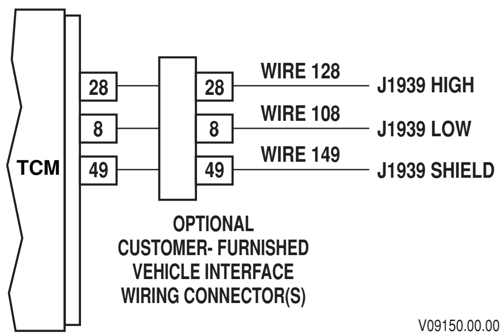


Figure P–1. Stub Interface

This option duplicates the TCM J1939 interfaces available on Allison products prior to the introduction of Allison 4th Generation Controls.

If an installation utilizes this TCM J1939 interface option, the following **are required**:

- Wires 108 and 128 are a "twisted pair," and must have a twist rate of 16±4 per 300 mm.
- Pins 7, 48, and 68 cannot be connected when this interface option is used; these pins are associated with other J1939 interface options.
- The TCM cannot be connected at either end of the backbone; the backbone must terminate with termination resistor(s) and/or other controllers equipped with an internal termination resistor configuration.

APPENDIX P—J1939 AND J2284 HARDWARE AND TCM CONNECTIONS

C. Pass-Through

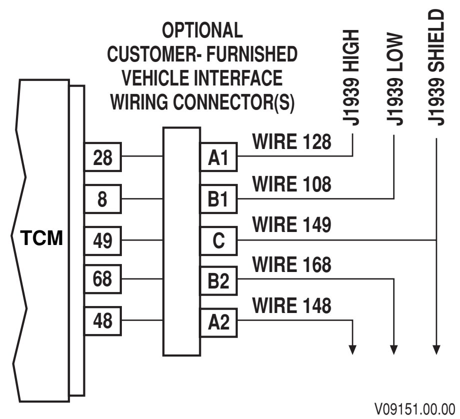


Figure P–2. Pass-Through Interface

This option allows a vehicle OEM to eliminate the stub-to-backbone splice required by the traditional stub connection. Here, the J1939 backbone enters the TCM on one set of pins and continues out through a second set of pins. The extremely short "stub" now actually resides inside the TCM.

If an installation utilizes this TCM J1939 interface option, the following **are required**:

- Wires 108/128 and 148/168 are "twisted pairs," and must have a twist rate of 16±4 per 300 mm.
- Internal termination resistor pin 7 cannot be connected when this interface option is used.
- The J1939 shield drain wire (where applicable) must be connected such that the shield remains continuous throughout the backbone.
- The TCM cannot be connected at either end of the backbone; the backbone must terminate with termination resistor(s) and/or other controllers equipped with an internal termination resistor configuration.

D. Backbone Termination

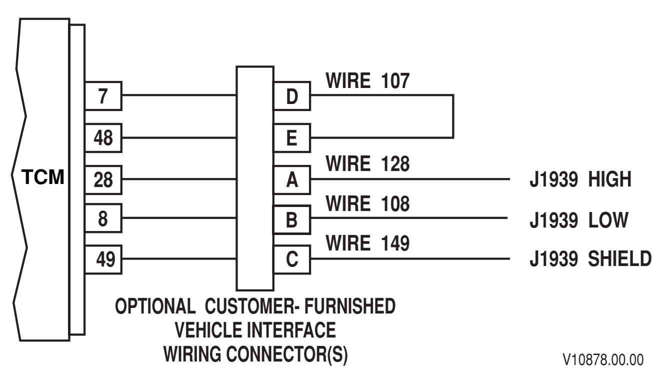


Figure P–3. Backbone Termination

This option allows the elimination of one of the two external termination resistors required in every J1939 network. Here, a jumper wire is used to connect an internal termination resistor across CAN high and low.

APPENDIX P—J1939 AND J2284 HARDWARE AND TCM CONNECTIONS

If an installation utilizes this TCM J1939 interface option, the following **are required**:

- Wires 108 and 128 are a "twisted pair," and must have a twist rate of 16±4 per 300 mm.
- Pass-through pin 68 cannot be connected when this interface option is used.
- Jumper wire 107 must be 120 Ohm impedance wire identical to that used throughout the rest of the vehicle's J1939 network.
- Jumper wire 107 should be kept as short as possible.
- TCM must be **clearly labelled** as utilizing the internal termination resistor. Otherwise, technicians may be mislead to believe a vehicle is missing a termination resistor, when in fact it is located where not visible to the naked eye.
- While exact labelling is left to the vehicle OEM's discretion, phrasing such as "Internal Termination Resistor In Use" is acceptable.
- The label must be connected at one of the two ends of the J1939 backbone.

E. J1939 Network Overview

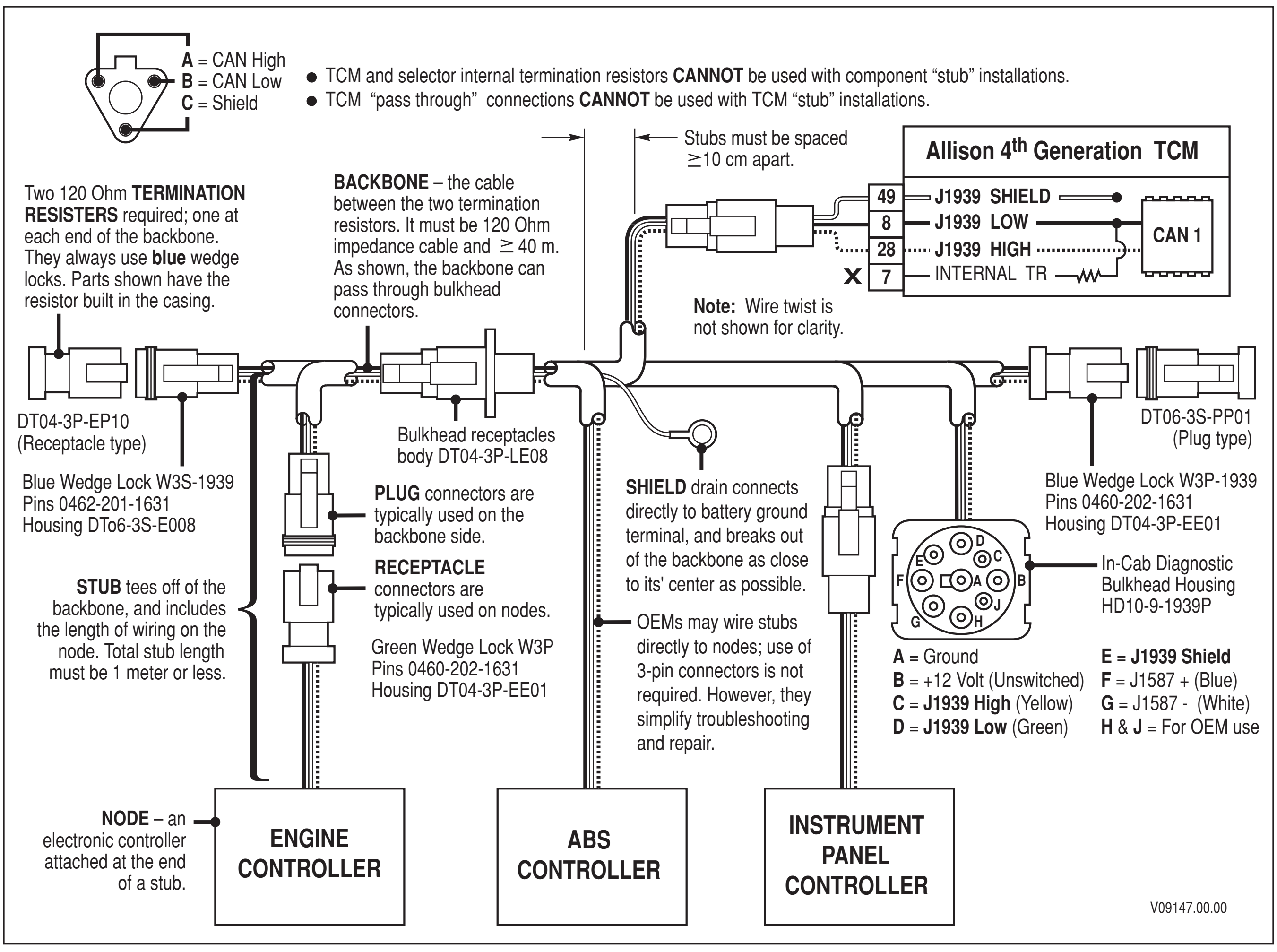


Figure P–4. TCM and Selector Stub Interfaces

APPENDIX P—J1939 AND J2284 HARDWARE AND TCM CONNECTIONS

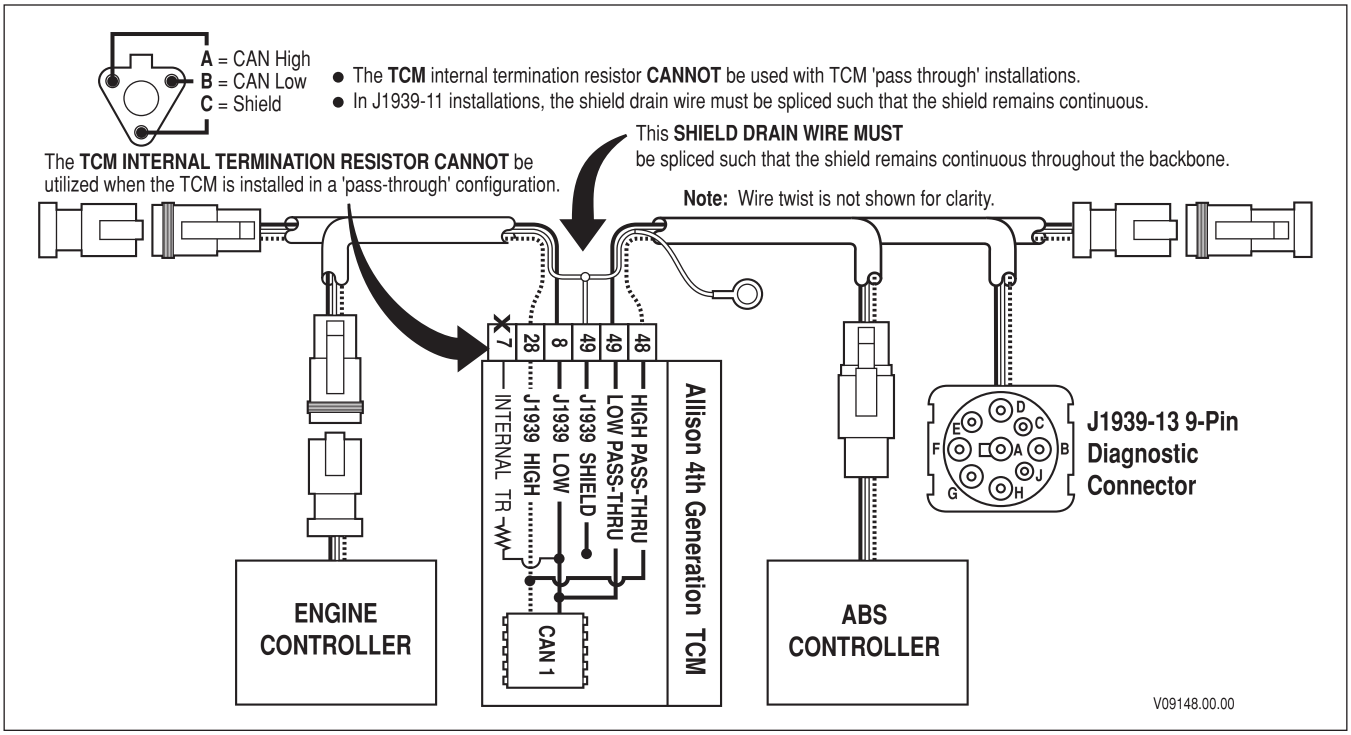


Figure P–5. Pass Through Interface

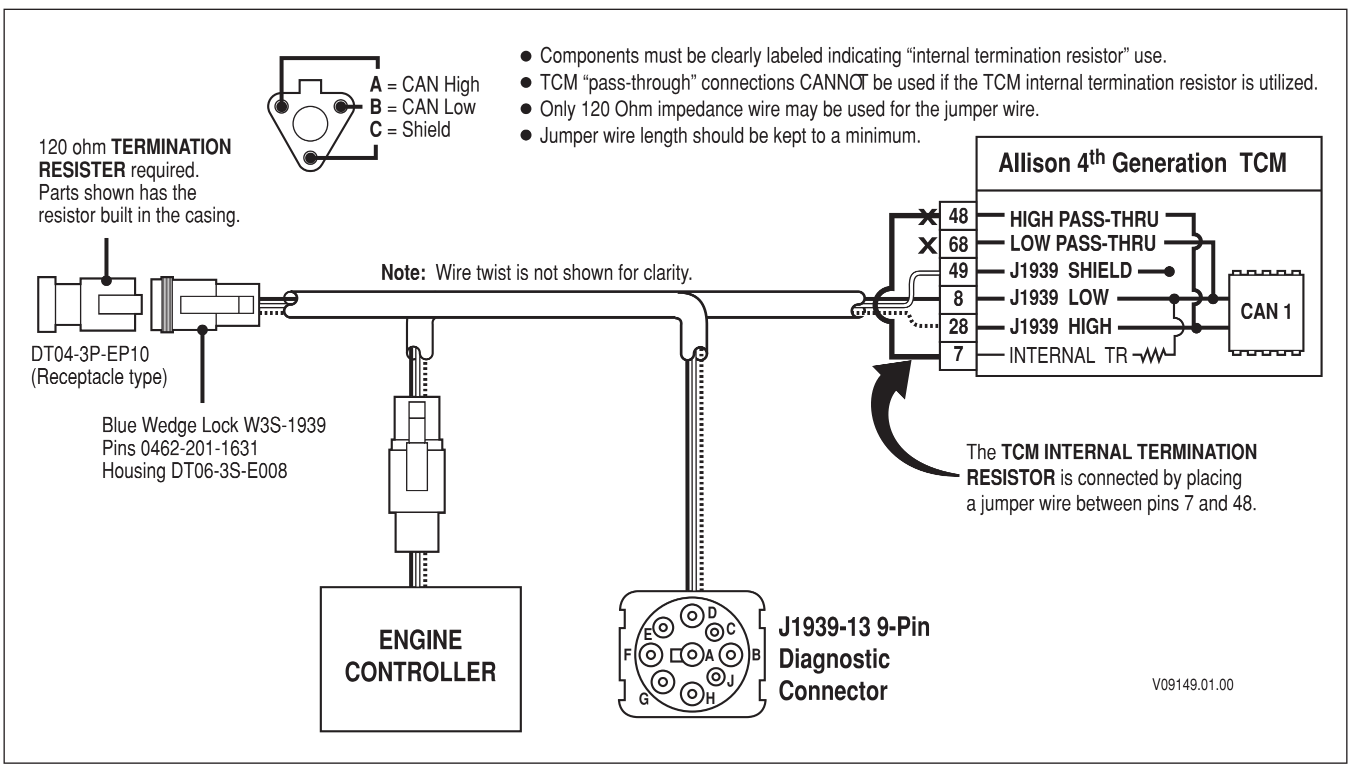


Figure P–6. Backbone Termination Interfaces

APPENDIX P—J1939 AND J2284 HARDWARE AND TCM CONNECTIONS

P–2. J2284 HARDWARE AND CONNECTIONS

SAE J2284-3 defines a high-speed 500 KBPS CAN communication link. This link is new to Allison 4th Generation Controls, and is referred to by Allison as 'CAN 2'. Communication is accomplished through a proprietary GM protocol known as GMLAN.

While its use may be expanded in the future, the only current use for CAN 2 to connect with Allison DOC™ and Allison engineering tools. No other J1939 components or tools may be connected.

Due to hardware setting and protocol differences, CAN 2 is not compatible with J1939, and CAN 2 cannot be tied to CAN 1 in any installation.

Advantages of the J2284 link include high speed (twice as fast as SAE J1939) and reduced wiring in TCM-only installations, as only one termination is required.

NOTE: ***Use of a single termination resistor in TCM-only installations is only acceptable with J2284 (CAN 2); it is not acceptable with J1939 (CAN 1).***

A. TCM J2284 INTERFACE

While 4th Generation TCMs can be interfaced to a J2284 network in a number of ways, only the 'TCM only with diagnostic connector' implementation is shown here, as it provides the simplest, lowest cost installation. Other installation methods are deemed less than optimum or not allowable for the following reasons:

- **Stub Connection**—Use of a TCM stub connection requires a traditional backbone with two termination resistors—one located at each end. The TCM would then attach to the backbone through one stub, and the diagnostic connector would attach through another.

  This interference is permissible but not recommended given the availability of the single component/single termination installation. Stub connections use more hardware, cost more, and have more failure points.
- **Pass Through Connection**—While the TCM has 'pass through' pins allocated for CAN 2, their use is currently not applicable for Allison 4th Generation Controls; the TCM will be the only onvehicle component connected to J2284. These pins should not be used in any installation.
- **Backbone Termination**—This option would use the TCM J2284 internal termination resistor to eliminate one of the two external termination resistors required in a traditional backbone arrangement.

B. TCM-ONLY INSTALLATION WITH SAE J1962 DIAGNOSTIC CONNECTOR

The SAE J2284 Recommended Practice allows for an installation to use only one termination resistor, providing the vehicle has only one J2284 component and one J2284 diagnostic connector on the J2284 network.

By definition, this installation does not have a backbone; it is simply a direct connection between the TCM and the diagnostic connection, with a single termination resistor used to dampen the network.

Use of the TCM J2284 internal termination resistor allows this installation to be simplified further. A jumper wire connects the internal termination resistor across CAN high and low to meet the single termination resistor requirement.

The figure below details TCM pin connections, while a larger diagram showing the entire installation is found under J2284 'TCM ONLY' INSTALLATION.

APPENDIX P—J1939 AND J2284 HARDWARE AND TCM CONNECTIONS

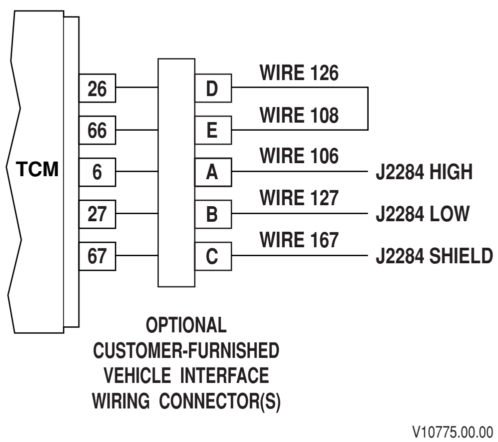


Figure P–7. TCM J2284 Interface with Internal Termination Jumper Connected

The following **ARE REQUIRED** for installations using this J2284 interface option:

- Wires 106 and 127 are a 'twisted pair', and must conform to the physical layer requirements of SAE J2284.
- Pass-through pin 47 cannot be connected.
- Jumper wire 126 must be 120 ohm impedance wire identical to that used throughout the rest of the J2284 network.
- Jumper wire 126 should be kept as short as possible.
- TCM must be CLEARLY LABELED as utilizing the internal termination resistor. Otherwise, technicians may be misled to believe a vehicle is missing a termination resistor, when in fact it is located where not visible to the naked eye.

  Exact labeling is left to the vehicle OEM's discretion, though phrasing such as 'INTERNAL TERMINATION RESISTOR IN USE' is acceptable.
- The label must not be painted over during the vehicle assembly process.

C. DIAGNOSTIC CONNECTOR

All installations **REQUIRE** at least one connection point for Allison DOC™, either on CAN 1 or CAN 2. If the vehicle OEM opts to meet this requirement via the CAN 2 J2284 datalink, use of the J1962 (ISO 15031-3) trapezoidal connector **IS REQUIRED**, with the following pin support:

- Pin 6 connected to J2284 High
- Pin 14 connected to J2284 Low
- Power and ground

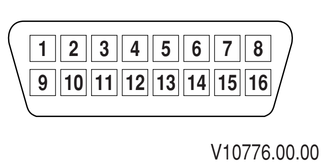


Figure P–8. SAE J1962 Pins—Vehicle Connector View

APPENDIX P—J1939 AND J2284 HARDWARE AND TCM CONNECTIONS

Pin	Allocation Per SAE J1962
1	Discretionary
2	Bus positive line of SAE J1850
3	Discretionary
4	Chassis ground
5	Signal ground
6	CAN_H line of ISO 15765-4
7	K line of ISO 9141-2 and ISO 14230-4
8	Discretionary
9	Discretionary
10	Bus negative line of SAE J1850
11	Discretionary
12	Discretionary
13	Discretionary
14	CAN_L line of ISO 15765-4
15	L line of ISO 9141-2 and ISO 14230-4
16	Permanent positive voltage

NOTE: ***Allison does not condone use of the 9-pin SAE J1939-13 connector with J2284; this is a violation of SAE Recommended Practice. J1939-13 pins are explicitly defined for SAE J1939 and J1587 use, with no pins available for 'discretionary' assignment.***

Redefining these pins in a given installation could cause confusion in the service channel when attempting to use service tools that adhere to the J1939-13 pin assignments.

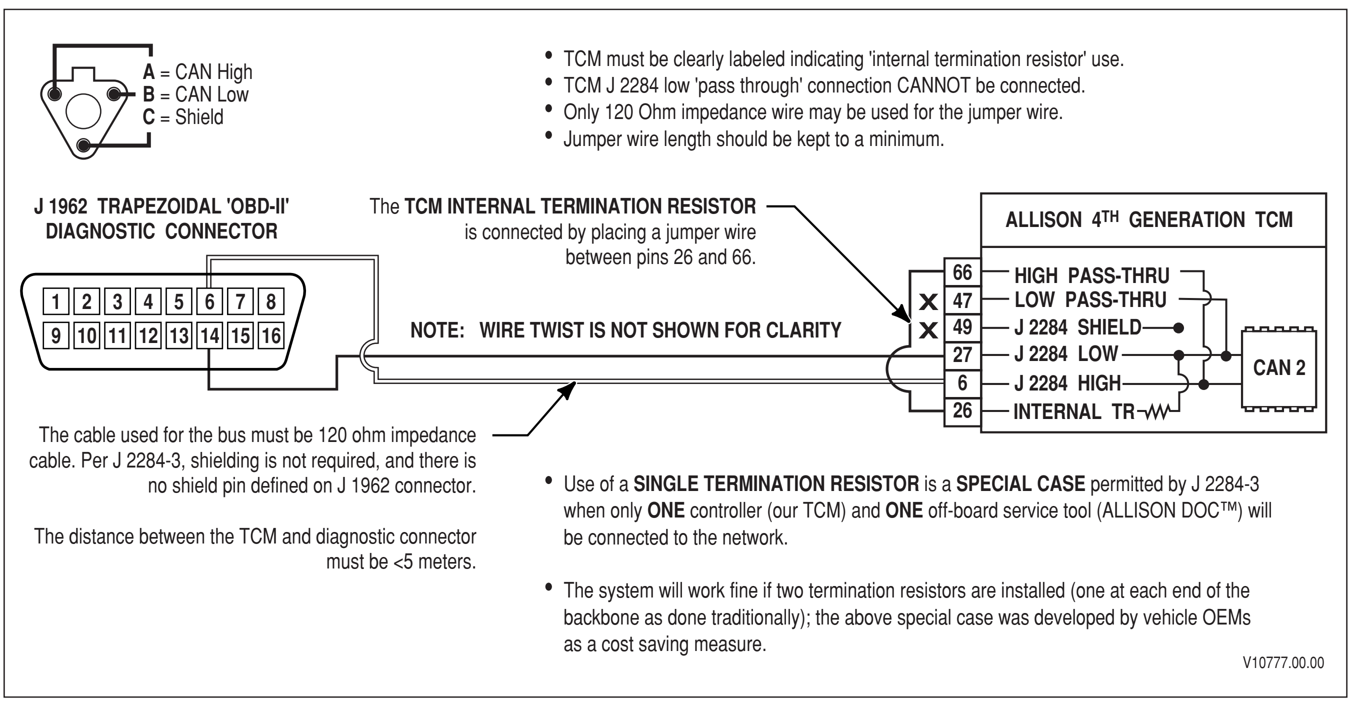


Figure P–9. J2284 "TCM Only" Installation

APPENDIX P—J1939 AND J2284 HARDWARE AND TCM CONNECTIONS

NOTES

APPENDIX R—FLUID CHECK PROCEDURE

WARNING!	**For vehicles containing 1000 Product Family and 2000 Product Family (2400 models), each time you park the vehicle or leave the operator's station with the engine running, do the following.** • **Bring the vehicle to a complete stop using the service brake.** • **Make sure that the engine is at low idle rpm.** • **Put the transmission in P (Park).** • **Engage the P (Park) range by slowly releasing the service brake.** • **Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.** • **If the operator's station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.** **If this procedure is not followed, the vehicle can move suddenly and you or others could be injured.**

WARNING!	**For vehicles containing 2000 Product Family transmissions without auto-apply parking brakes, each time you park the vehicle or leave the operator's station with the engine running, do the following.** • **Bring the vehicle to a complete stop using the service brake.** • **Make sure that the engine is at low idle rpm.** • **Put the transmission in N (Neutral).** • **Apply the emergency brake and/or parking brake and make sure they are properly engaged.** • **If the operator's station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.** **If this procedure is not followed, the vehicle can move suddenly and you or others could be injured.**

WARNING!	**For vehicles containing 2000 Product Family transmissions with auto-apply parking brakes, each time you park the vehicle or leave the operator's station with the engine running, do the following.** • **Bring the vehicle to a complete stop using the service brake.** • **Make sure that the engine is at low idle rpm.** • **Put the transmission in PB (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.** • **Apply the emergency brake, if present, and make sure it is properly engaged.** • **If the operator's station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.** **If this procedure is not followed, the vehicle can move suddenly and you or others could be injured.**

APPENDIX R—FLUID CHECK PROCEDURE

***NOTE:** For accurate fluid level checks, be sure that the fill tube and dipstick meet Allison Transmission specifications.*

When checking a short and medium dipstick calibration (refer to Figure R–1):

- ***Remove the oil pan.***
- ***Take measurements from the oil pan splitline.***

When checking a long dipstick calibration (refer to Figure R–2):

- ***Be sure the dipstick contacts the oil pan surface.***
- ***Take measurements from the end of the dipstick.***

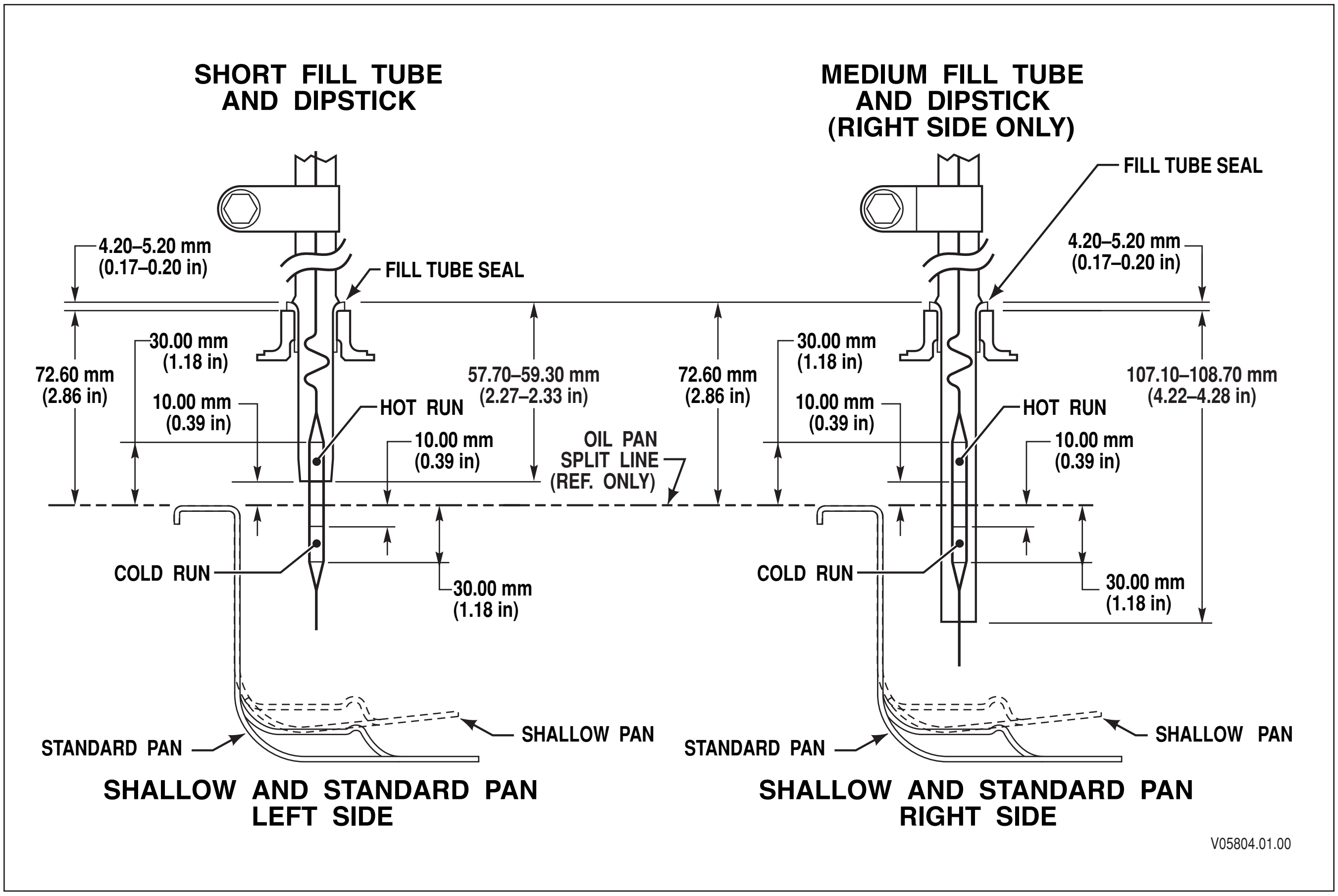


Figure R–1. Short and Medium Fill Tube And Dipstick Requirements

APPENDIX R—FLUID CHECK PROCEDURE

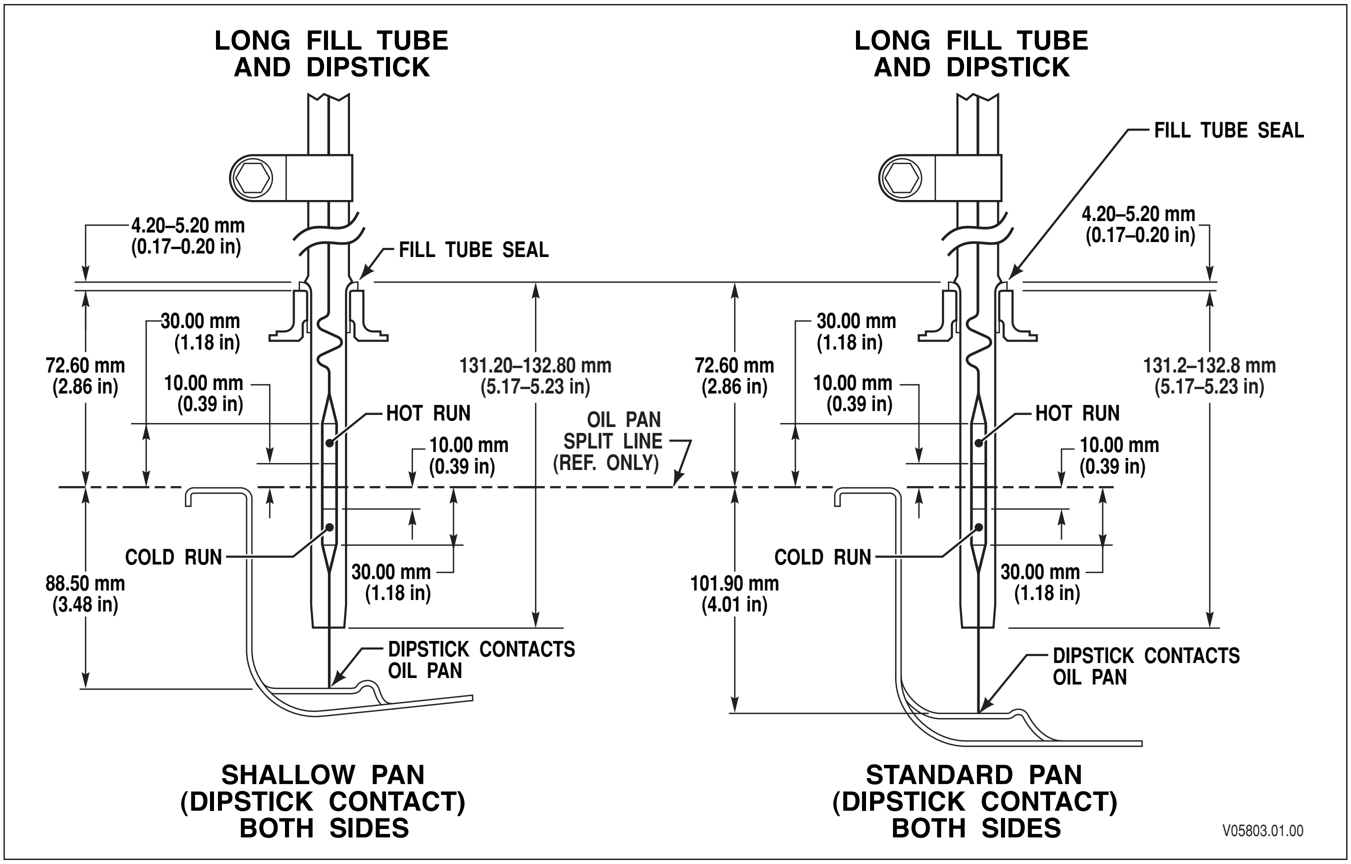


Figure R–2. Long Fill Tube And Dipstick Requirements

A. Manual Fluid Check Procedure

Clean all dirt from around the end of the fluid fill tube before removing the dipstick. Do not allow dirt or foreign matter to enter the transmission. Dirt or foreign matter in the hydraulic system may cause undue wear of transmission parts, make valves stick, and clog passages. Check the fluid level using the following procedure and report any abnormal fluid levels to your maintenance persons.

B. Cold Check Procedure

The purpose of the cold check is to determine if the transmission has enough fluid to be operated safely until a hot check can be made.

CAUTION:	**The fluid level rises as fluid temperature increases. DO NOT fill above the "COLD CHECK" band if the transmission fluid is below normal operating temperatures.**

- Park vehicles containing 1000 Product Family and 2000 Product Family (2400 models) as follows:
  - — Bring the vehicle to a complete stop on a level surface using the service brake.
  - — Make sure that the engine is at low idle rpm.
  - — Put the transmission in **P** (Park).
  - — Engage the **P** (Park) range by slowly releasing the service brake.
  - — Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.

APPENDIX R—FLUID CHECK PROCEDURE

- Park vehicles containing 2000 Product Family transmissions with auto-apply parking brakes as follows:
  - — Bring the vehicle to a complete stop on a level surface using the service brake.
  - — Make sure that the engine is at low idle rpm.
  - — Put the transmission in **PB** (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.
  - — Apply the emergency brake, if present, and make sure it is properly engaged.
- Park vehicles containing 2000 Product Family transmissions without auto-apply parking brakes as follows:
  - — Bring the vehicle to a complete stop on a level surface using the service brake.
  - — Make sure that the engine is at low idle rpm.
  - — Put the transmission in **N** (Neutral).
  - — Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- Chock the wheels and take any other steps necessary to keep the vehicle from moving.
- Run the engine for at least one minute. Apply the service brakes and shift to **D** (Drive), then to **N** (Neutral), and then shift to **R** (Reverse) to fill the hydraulic system. Finally, shift to **P** (Park) or **PB** (Auto-Apply Parking Brake), if available, or **N** (Neutral) and allow the engine to idle (500–800 rpm). Slowly release the service brakes.
- With the engine running, remove the dipstick from the tube and wipe the dipstick clean.
- Insert the dipstick into the tube and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.
- If the fluid level is within the “COLD CHECK” band, the transmission may be operated until the fluid is hot enough to perform a “HOT RUN” check. If the fluid level is not within the “COLD CHECK” band, add or drain as necessary to bring it to the middle of the “COLD CHECK” band.
- Perform a hot check at the first opportunity after the normal operating sump temperature of 71ºC–93ºC (160ºF–200ºF) is reached.

C. Hot Check Procedure

CAUTION:	**The fluid must be hot for an accurate check. The fluid level rises as temperature increases.**

- Operate the transmission in **D** (Drive) range until normal operating temperature is reached:
  - — sump temperature 71ºC–93ºC (160ºF–200ºF)
  - — converter-out temperature 82ºC–104ºC (180ºF–220ºF)
  - — If a transmission temperature gauge is not present, check fluid level when the engine water temperature gauge has stabilized and the transmission has been operated under load for at least one hour.
- Park vehicles containing 1000 Product Family and 2000 Product Family (2400 models) as follows:
  - — Bring the vehicle to a complete stop on a level surface using the service brake.
  - — Make sure that the engine is at low idle rpm.
  - — Put the transmission in **P** (Park).
  - — Engage the **P** (Park) range by slowly releasing the service brake.
  - — Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.

APPENDIX R—FLUID CHECK PROCEDURE

- Park vehicles containing 2000 Product Family transmissions with auto-apply parking brakes as follows:
  - Bring the vehicle to a complete stop on a level surface using the service brake.
  - Make sure that the engine is at low idle rpm.
  - Put the transmission in **PB** (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.
  - Apply the emergency brake, if present, and make sure it is properly engaged.
- Park vehicles containing 2000 Product Family transmissions without auto-apply parking brakes as follows:
  - Bring the vehicle to a complete stop on a level surface using the service brake.
  - Make sure that the engine is at low idle rpm.
  - Put the transmission in **N** (Neutral).
  - Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- Chock the wheels and take any other steps necessary to keep the vehicle from moving.
- With the engine running, remove the dipstick from the tube and wipe the dipstick clean.
- Insert the dipstick into the tube and remove. Check fluid level reading. Repeat the check procedure to verify the reading.

NOTE: Safe operating level is within the "HOT RUN" band on the dipstick. See Figures R–1 and R–2. The width of the "HOT RUN" band represents approximately 1.0 liter (1.06 quart) of fluid at normal operating sump temperature.

- If the fluid level is not within the "HOT RUN" band, add or drain as necessary to bring the fluid level to within the "HOT RUN" band.

D. Consistency of Readings

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

FLUID CHECK PROCEDURE

NOTES

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