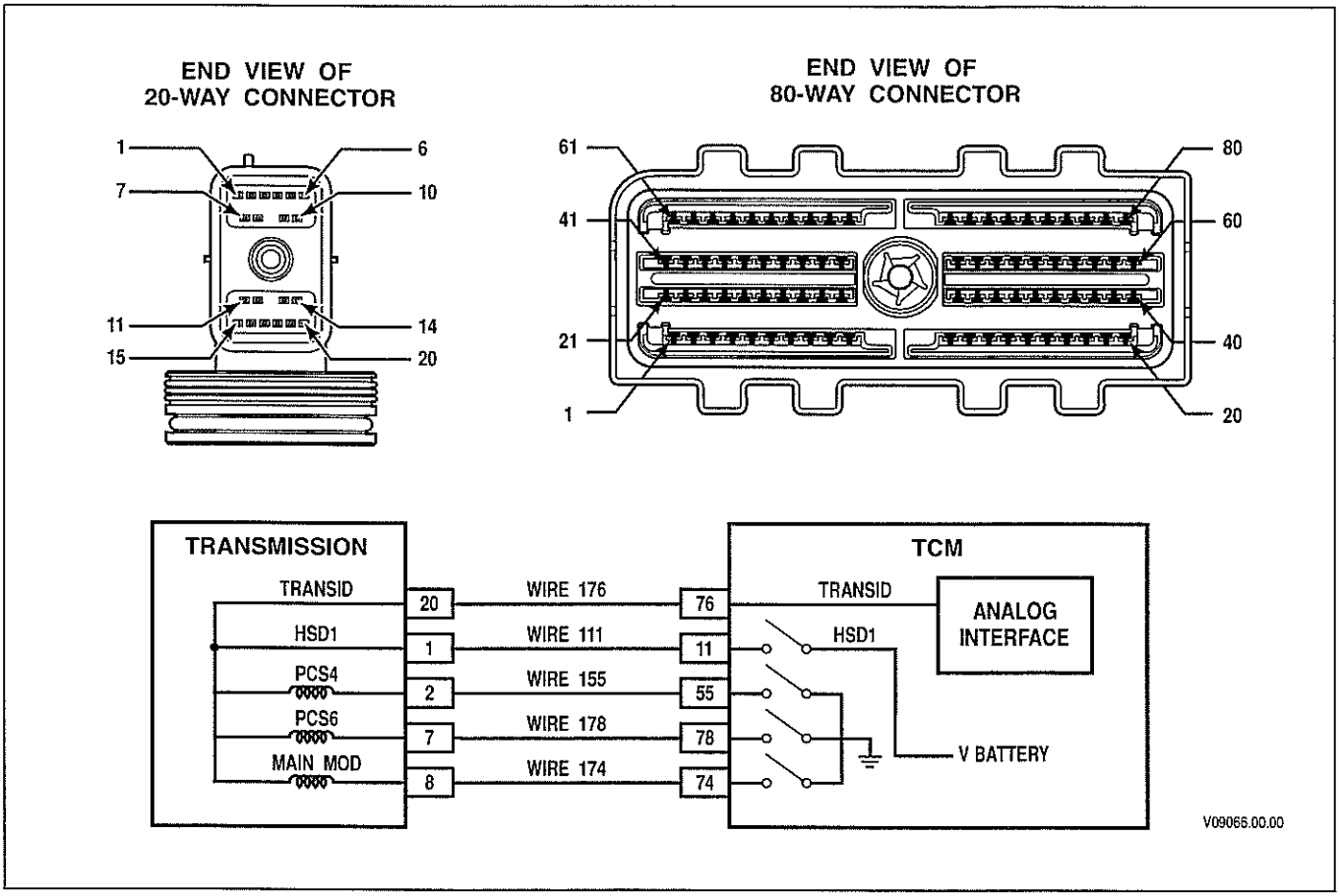
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0658 Actuator Supply Voltage 1 (HSD1) Low



Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

DIAGNOSTIC TROUBLE CODES (DTC)

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

Test Description

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

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

DTC P0658 Actuator Supply Voltage 1 (HSD1) Low

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

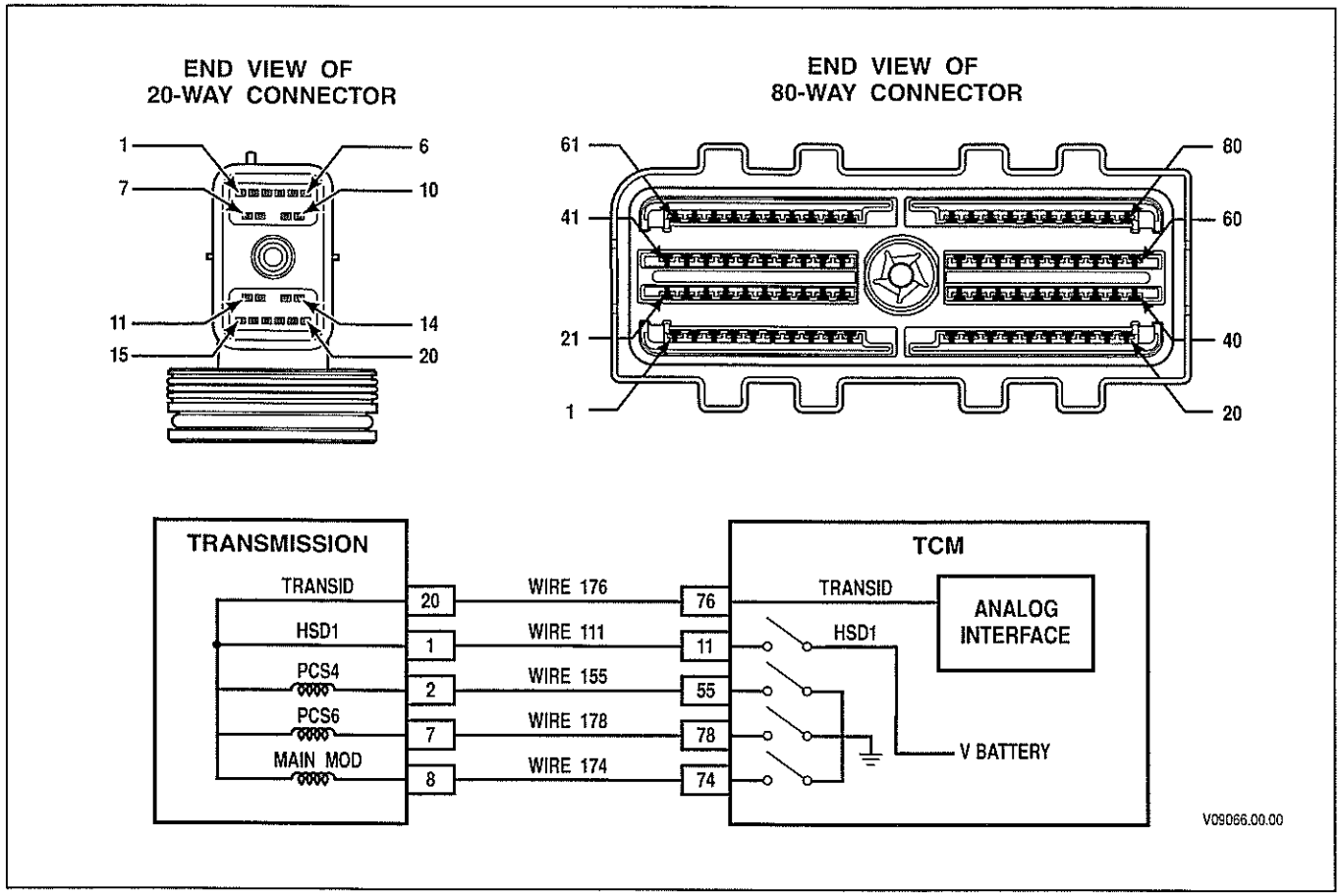
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0659 Actuator Supply Voltage 1 (HSD1) High



Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0659 Actuator Supply Voltage 1 (HSD1) High

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

Test Description

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0659 Actuator Supply Voltage 1 (HSD1) High

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

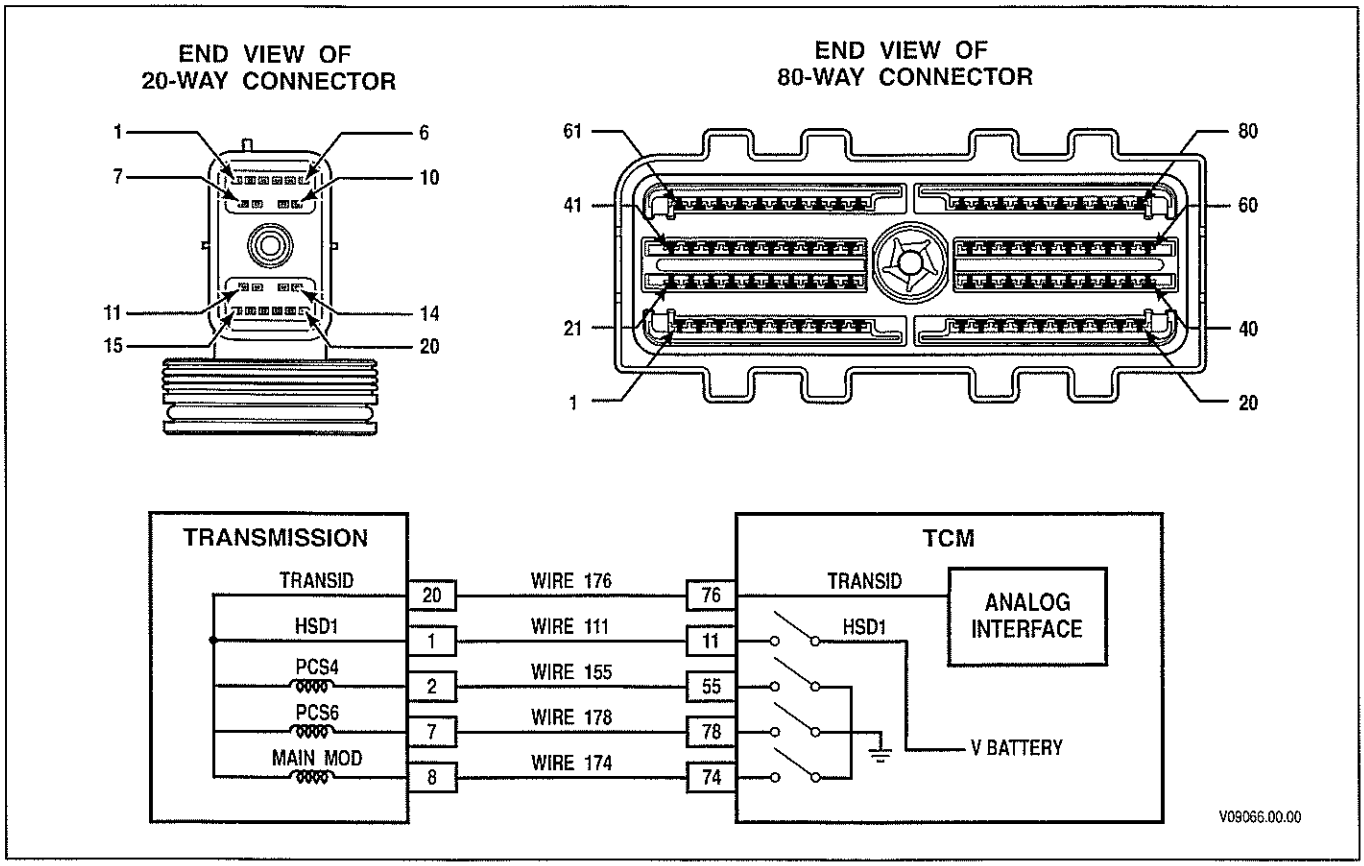
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0702 Transmission Control System Electrical (TransID)



Circuit Description

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

Conditions for Running the DTC

The test is enabled by the TCM calibration.

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Aids

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

Test Description

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

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

DTC P0702 Transmission Control System Electrical (TransID)

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

Table 6–7.

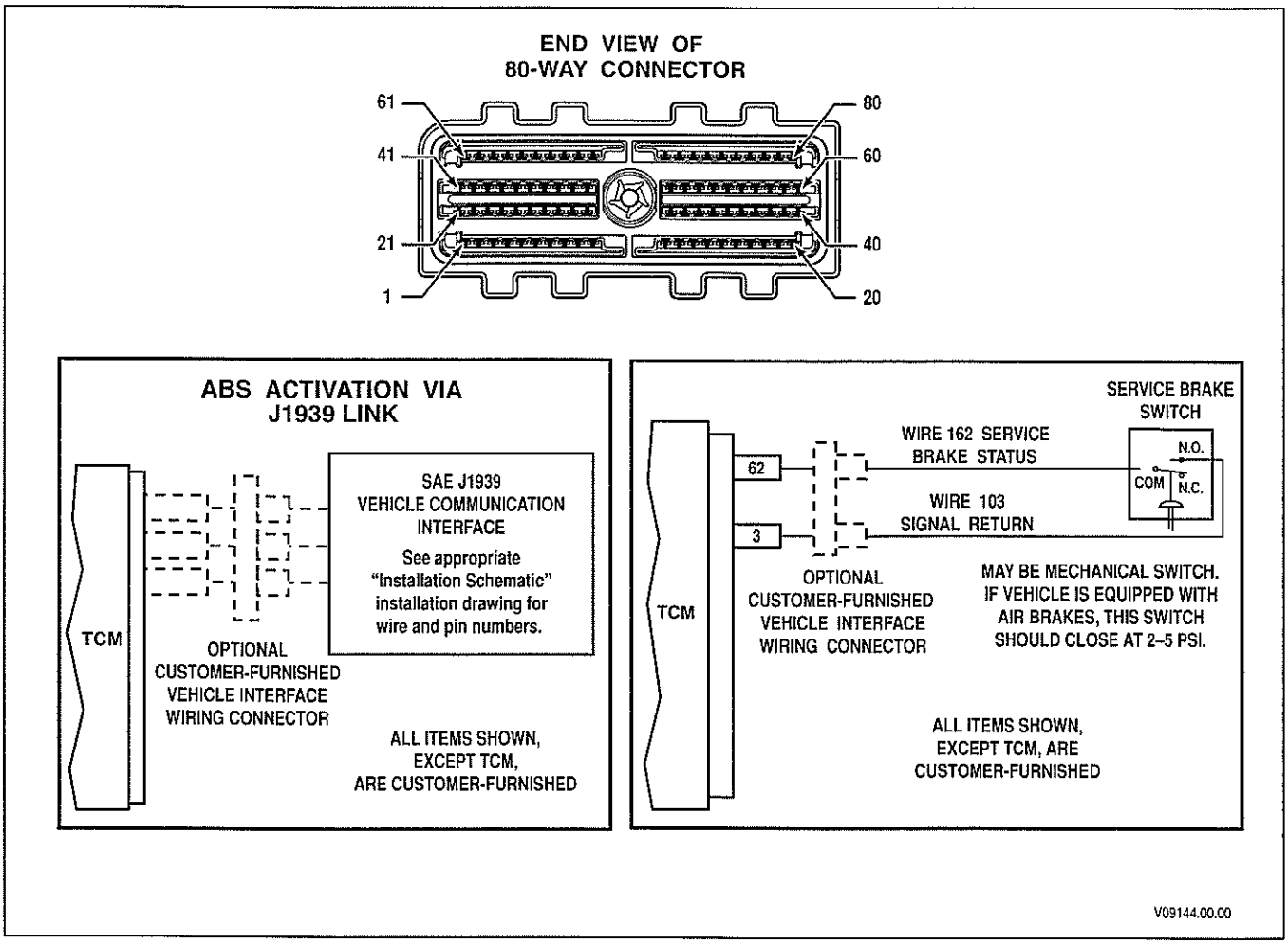
Wire 176 will be connected to the following wire in the transmission internal harness:	
TID	**Pin 20 connected to ...**
A	Pin 1 (wire 111)
B	TBD
C	TBD

Table 6–8.

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit Malfunction



Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit Malfunction

Actions Taken When the DTC Sets

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

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

Conditions for Clearing DTC/CHECK TRANS Light

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

Diagnostic Aids

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

Test Description

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0703 Brake Switch Circuit Malfunction

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

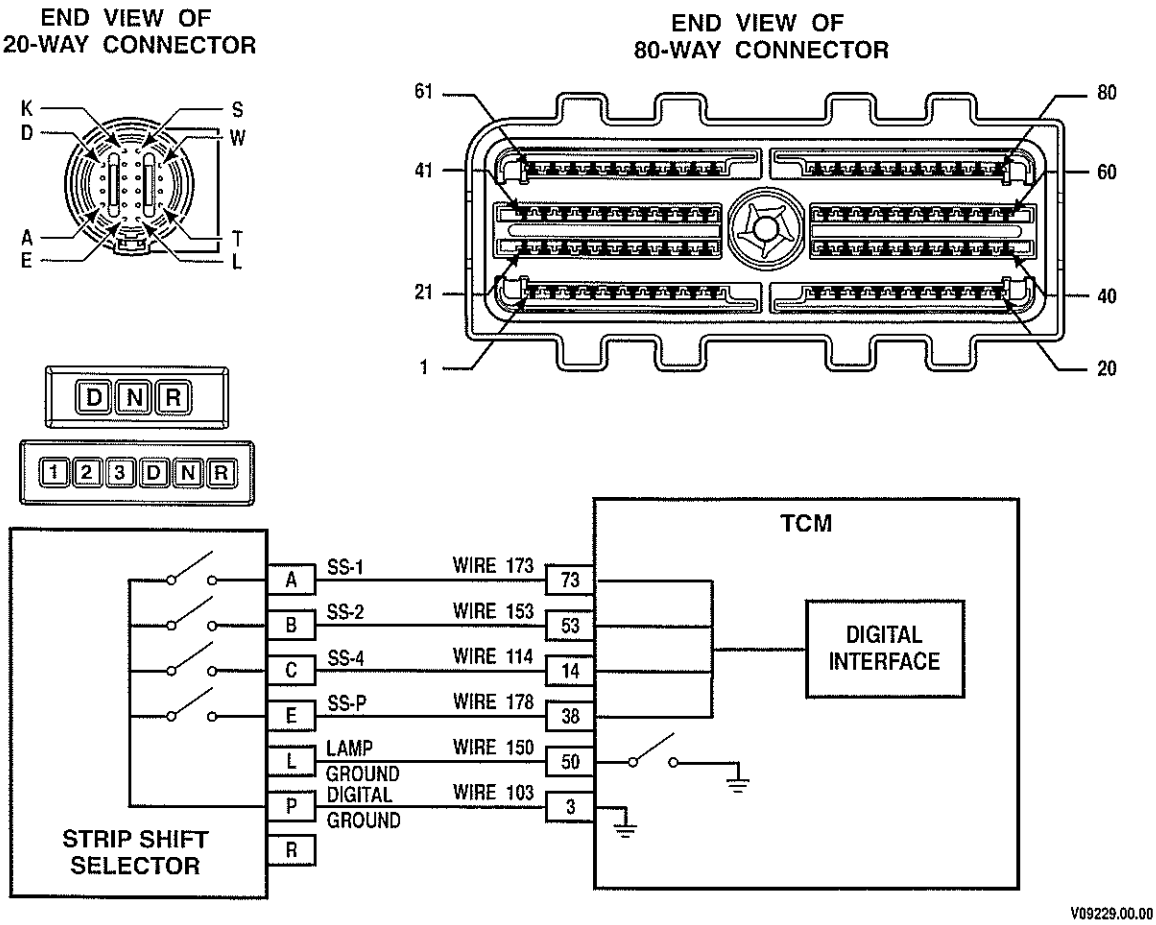
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

P0708 Transmission Range Sensor Circuit High Input



Circuit Description

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

Conditions for Running the DTC

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

DIAGNOSTIC TROUBLE CODES (DTC)

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

Test Description

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0708 Transmission Range Sensor Circuit High Input

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

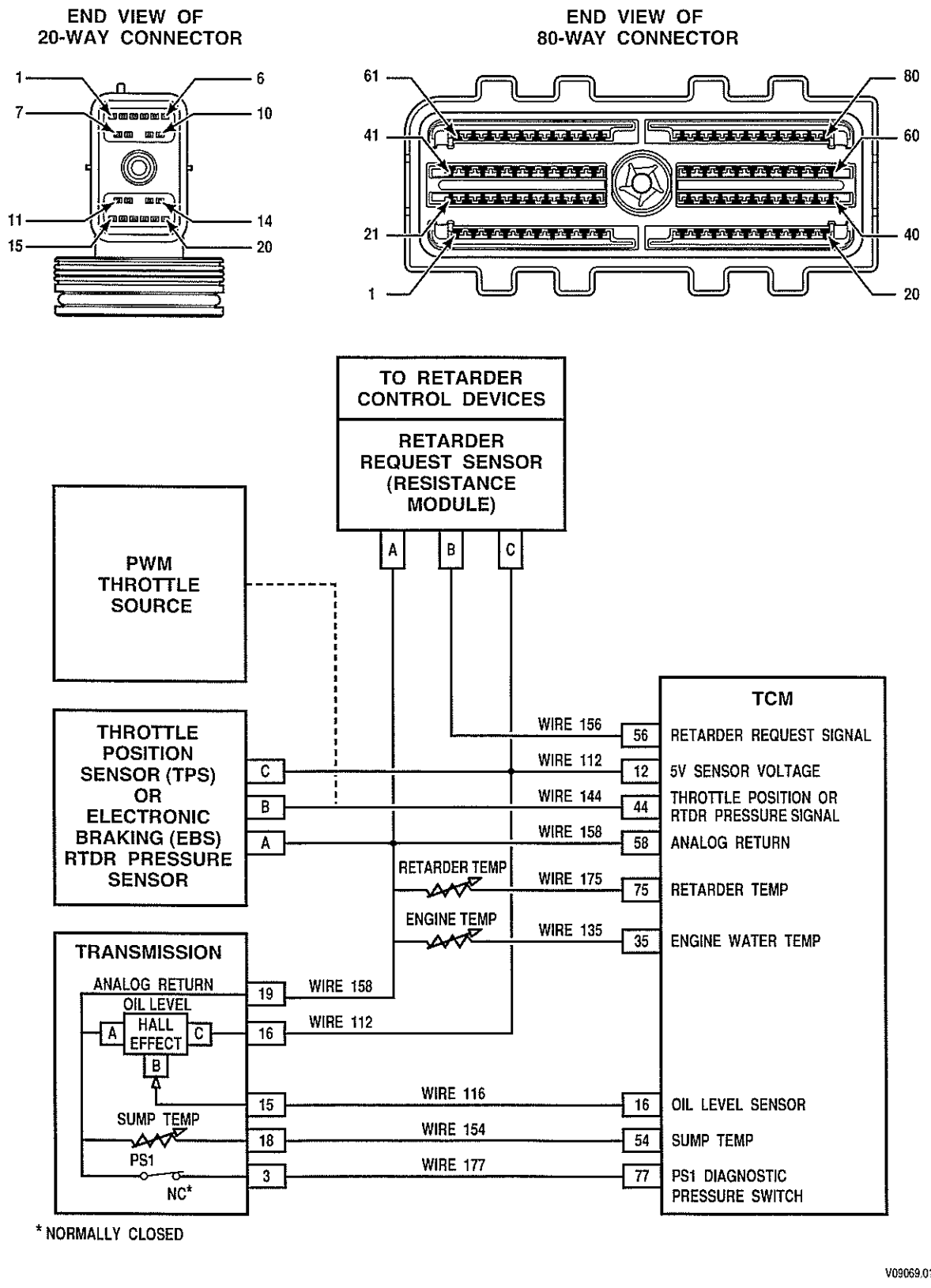
Table 6–9.

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070C Transmission Fluid Level Sensor Circuit—Low Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070C Transmission Fluid Level Sensor Circuit—Low Input

Circuit Description

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

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

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

Conditions for Running the DTC

Engine speed is greater than 1500 rpm.

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

Test Description

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

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

DTC P070C Transmission Fluid Level Sensor Circuit—Low Input

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

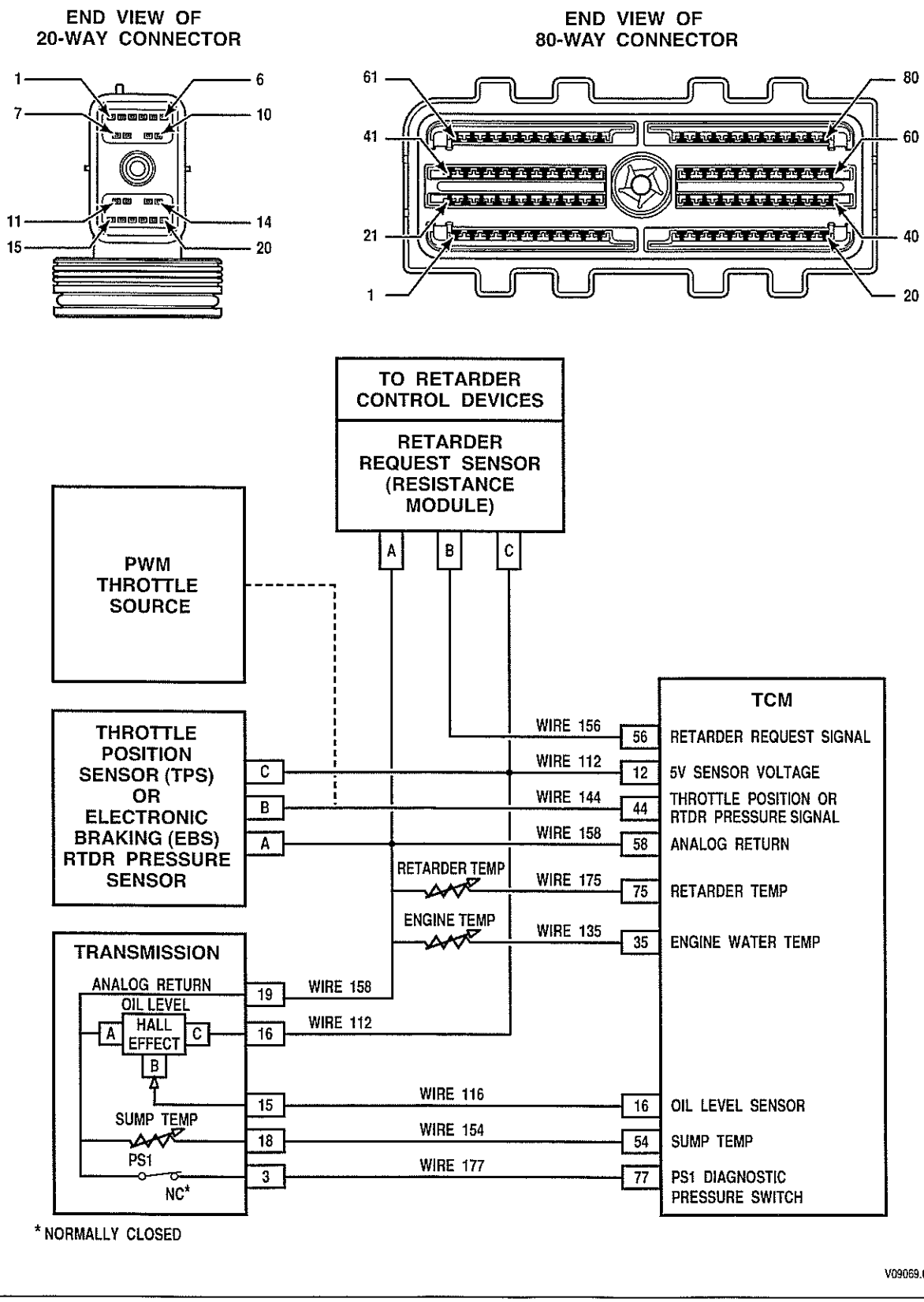
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070D Transmission Fluid Level Sensor Circuit—High Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P070D Transmission Fluid Level Sensor Circuit—High Input

Circuit Description

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

Conditions for Running the DTC

Engine speed is greater than 1500 rpm.

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

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

DTC P070D Transmission Fluid Level Sensor Circuit—High Input

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

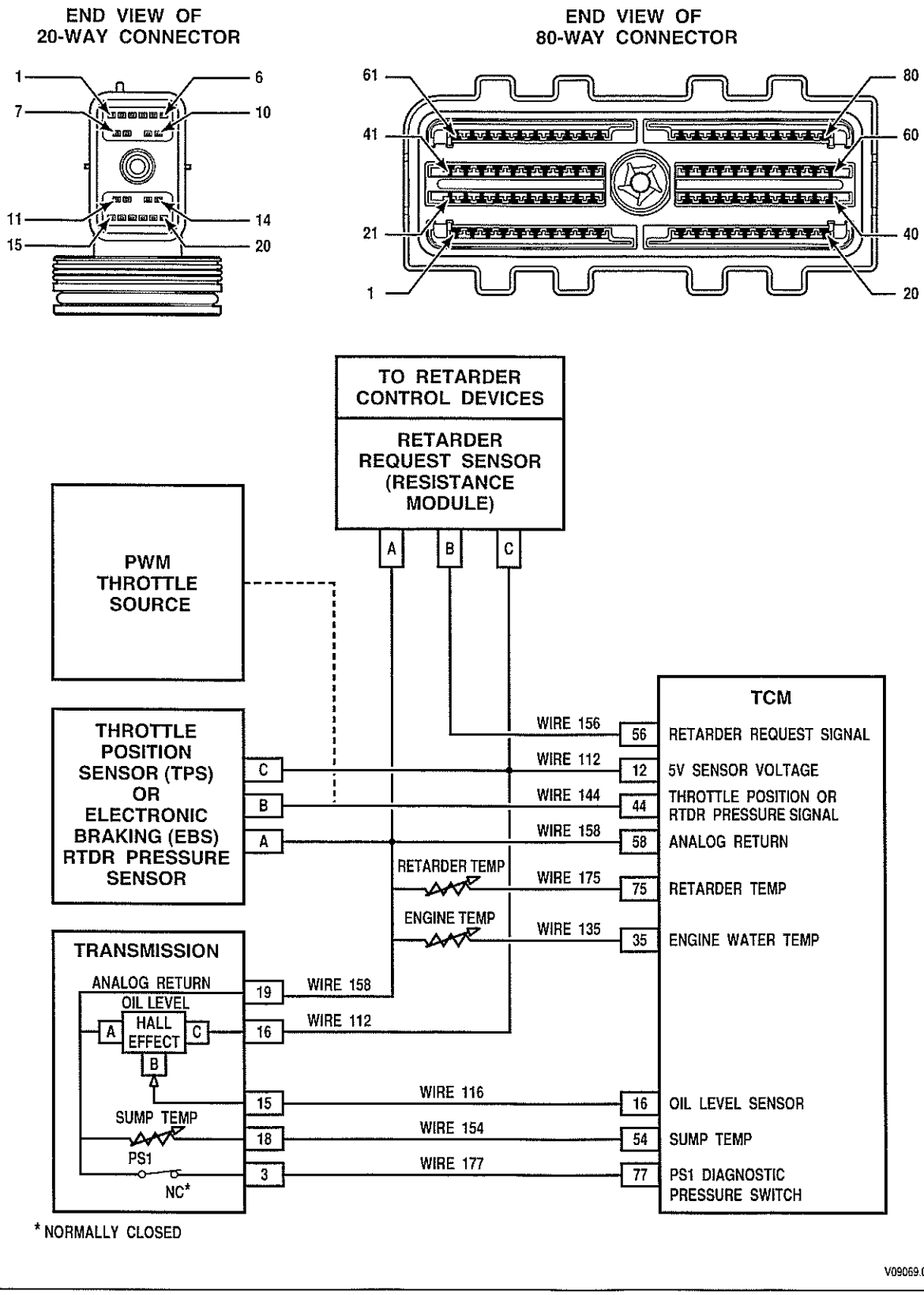
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0711 Transmission Fluid Temperature Sensor Circuit Performance



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0711 Transmission Fluid Temperature Sensor Circuit Performance

Circuit Description

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

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

One of the following conditions occur:

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

Test Description

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

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

DTC P0711 Transmission Fluid Temperature Sensor Circuit Performance

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

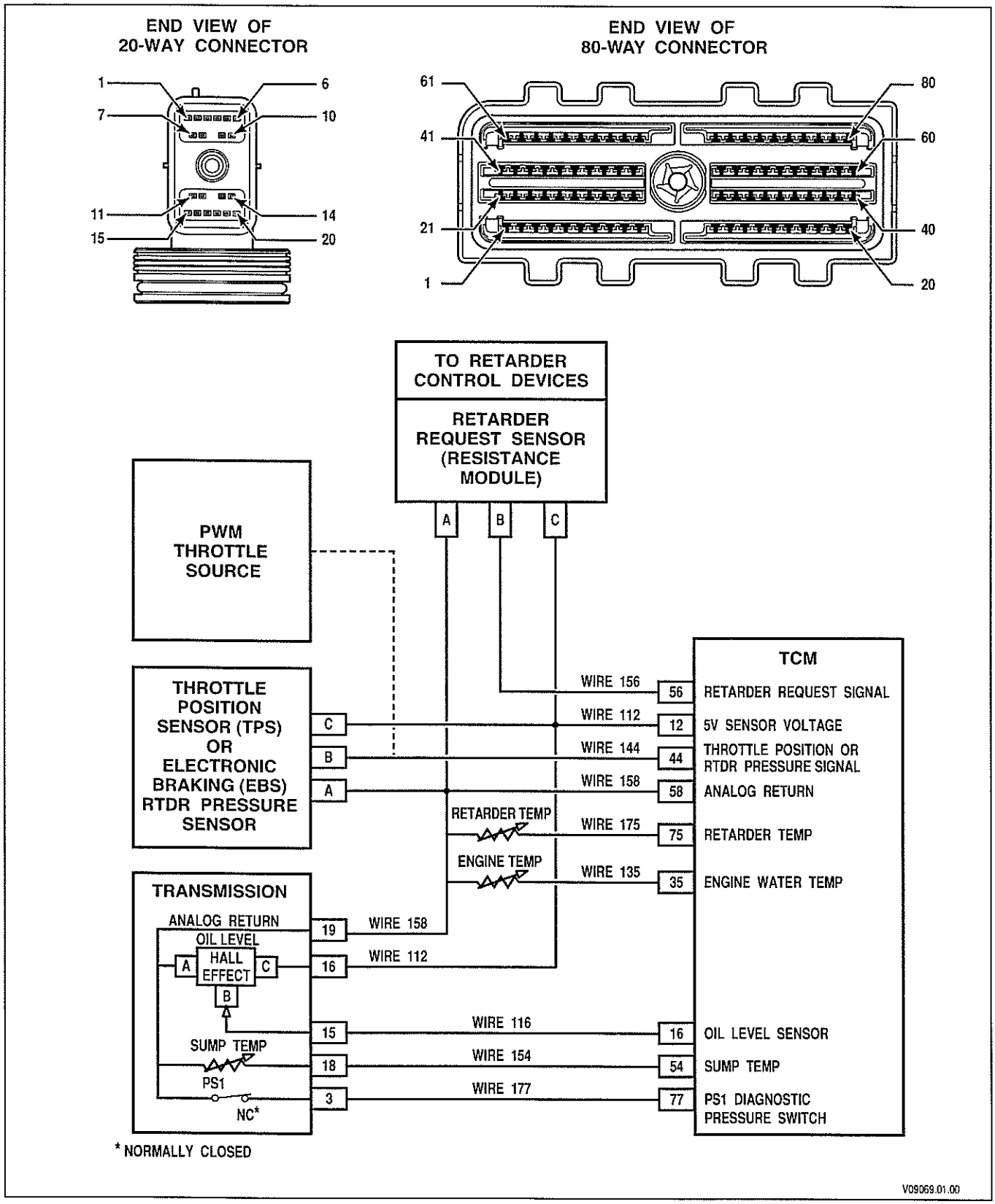
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0712 Transmission Fluid Temperature Sensor Circuit Low Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0712 Transmission Fluid Temperature Sensor Circuit Low Input

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

Test Description

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

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

DTC P0712 Transmission Fluid Temperature Sensor Circuit Low Input

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

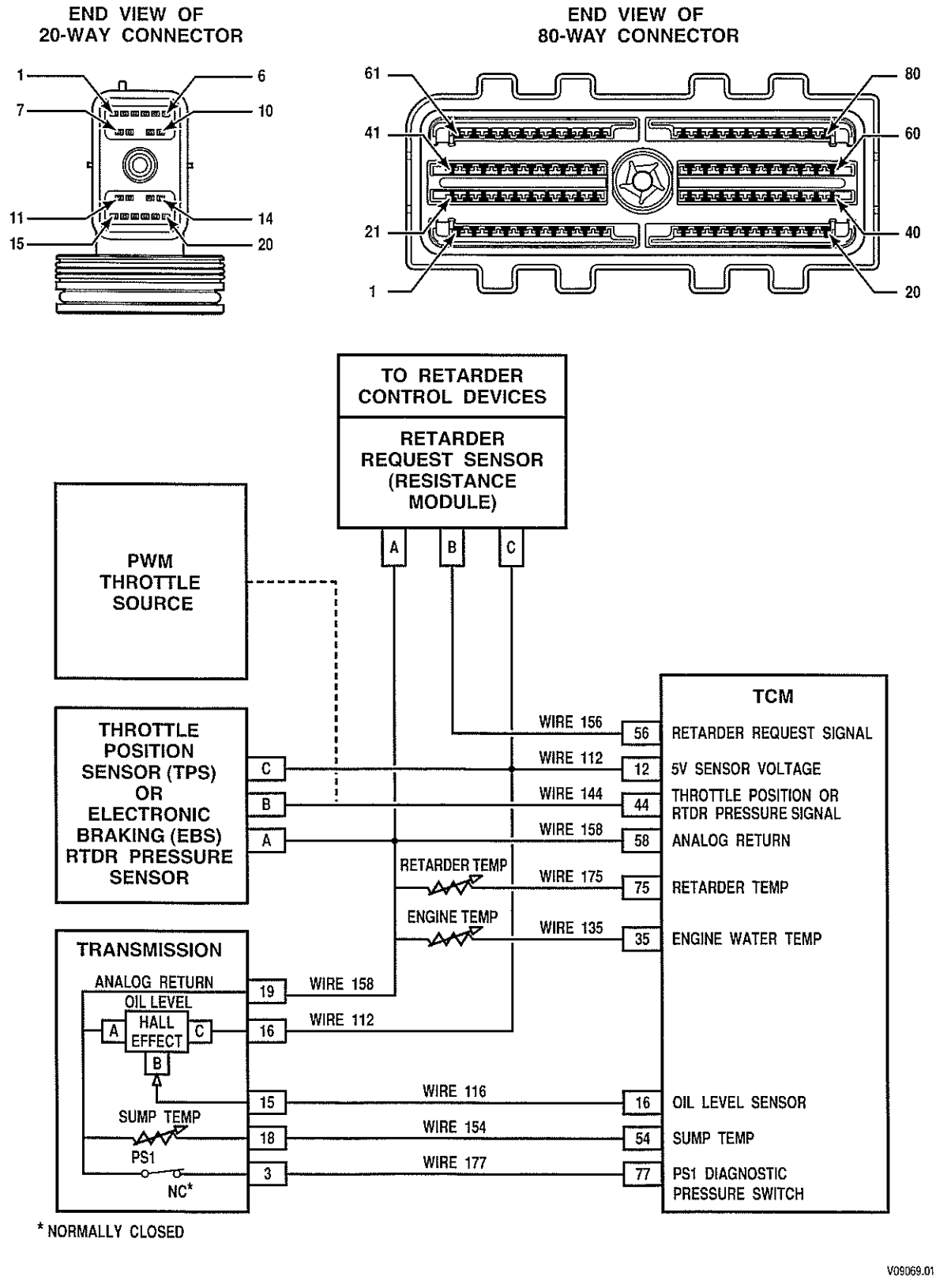
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input



DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

Test Description

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

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

DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

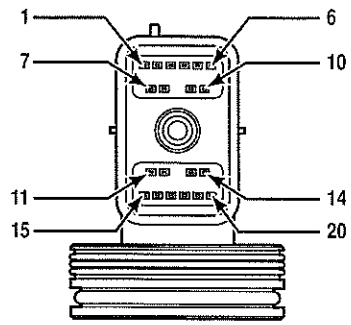
DTC P0713 Transmission Fluid Temperature Sensor Circuit High Input *(cont'd)*

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

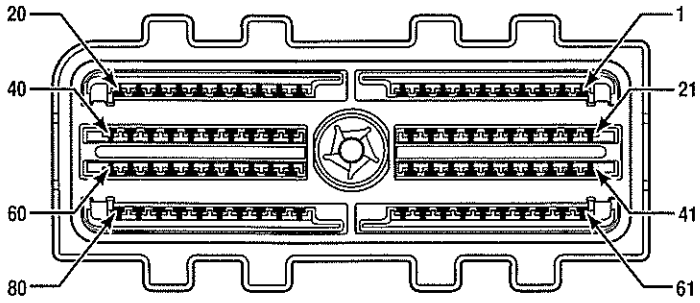
DIAGNOSTIC TROUBLE CODES (DTC)

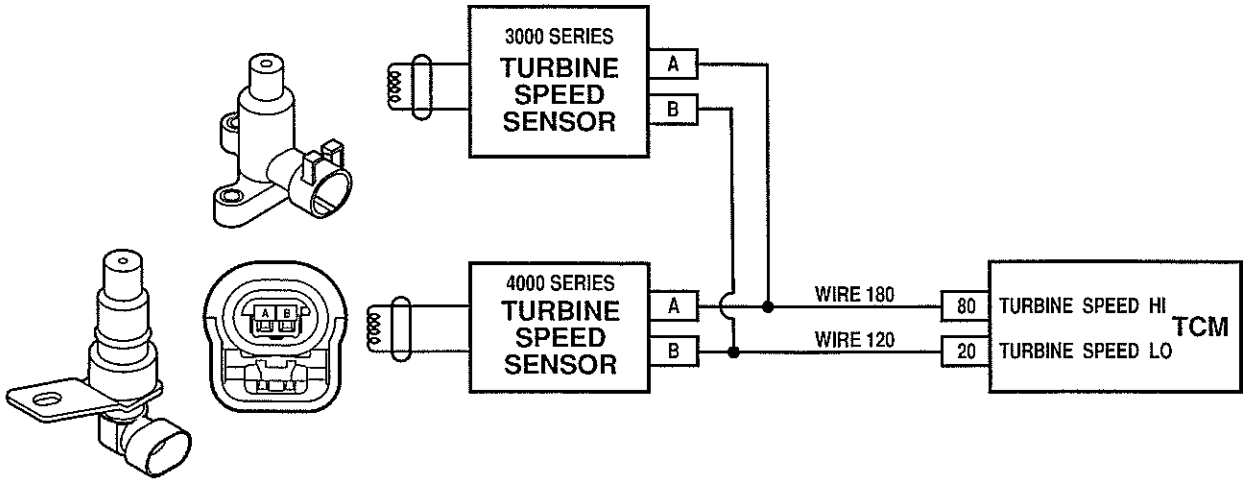
DTC P0716 Turbine Speed Sensor Circuit Performance

END VIEW OF
20-WAY CONNECTOR



END VIEW OF
80-WAY CONNECTOR





SPEED SENSOR CIRCUITS
Use twisted pairs of wires

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

V09137.00.01

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0716 Turbine Speed Sensor Circuit Performance

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Aids

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

Test Description

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

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

DTC P0716 Turbine Speed Sensor Circuit Performance

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

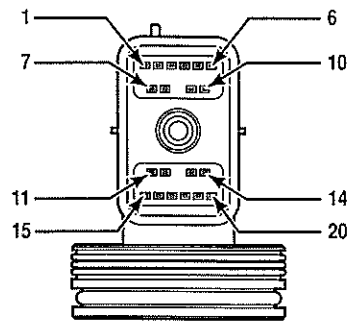
Table 6–10. Speed Sensor Temperature Resistance

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

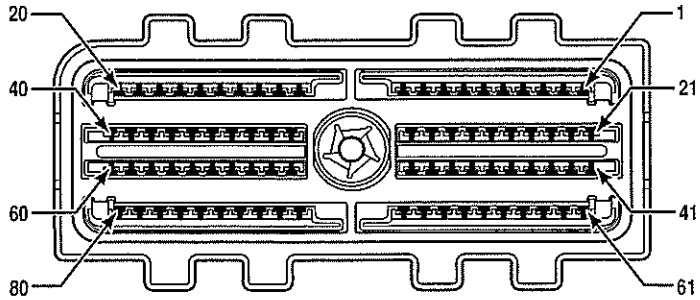
DIAGNOSTIC TROUBLE CODES (DTC)

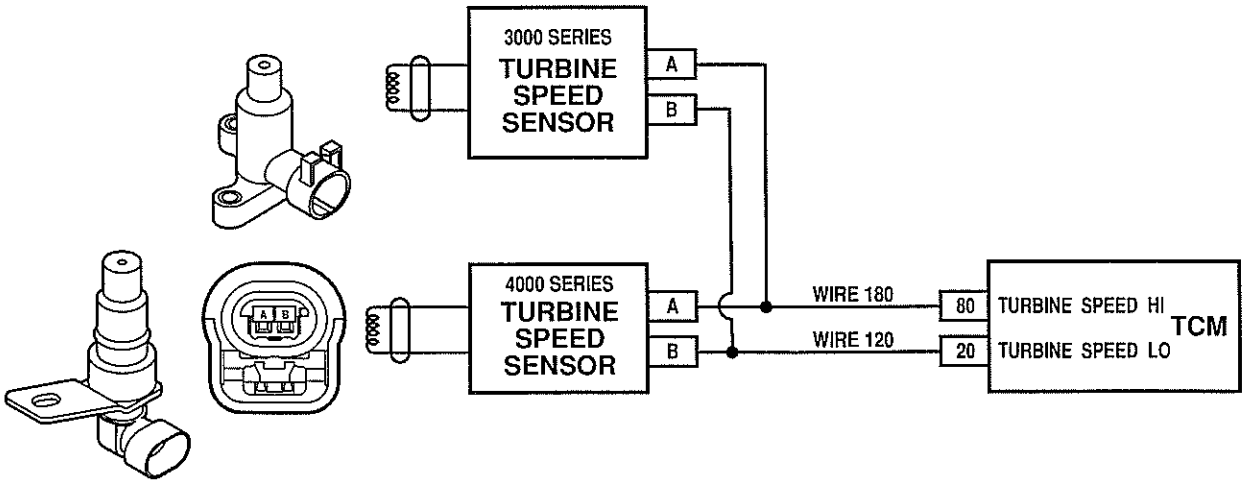
DTC P0717 Turbine Speed Sensor Circuit No Signal

END VIEW OF
20-WAY CONNECTOR



END VIEW OF
80-WAY CONNECTOR





SPEED SENSOR CIRCUITS
Use twisted pairs of wires

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

V09137.00.01

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0717 Turbine Speed Sensor Circuit No Signal

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

Test Description

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

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

DTC P0717 Turbine Speed Sensor Circuit No Signal

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

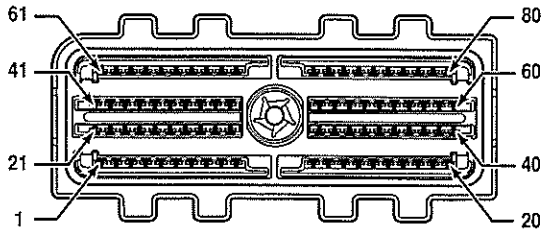
Table 6–11. Speed Sensor Temperature Resistance

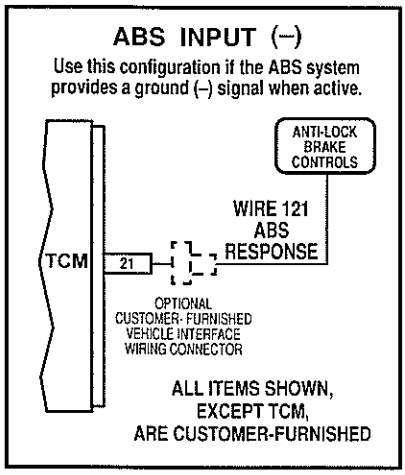
Current Resistance (Ohms) January, 2006	Former Resistance (Ohms) Before January, 2006	Temp °F	Temp °C
250	200	–40	–40
340	300	68	20
450	400	230	110

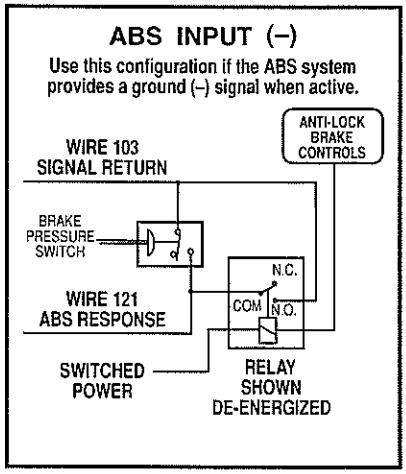
DIAGNOSTIC TROUBLE CODES (DTC)

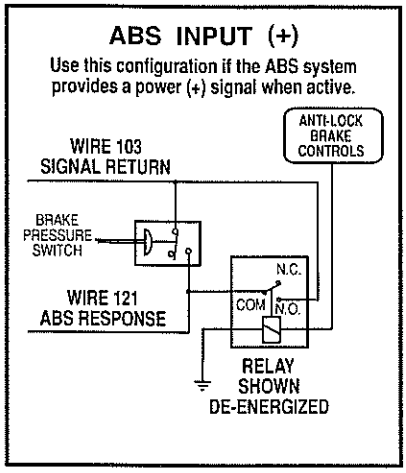
DTC P0719 Brake Switch ABS Input Low

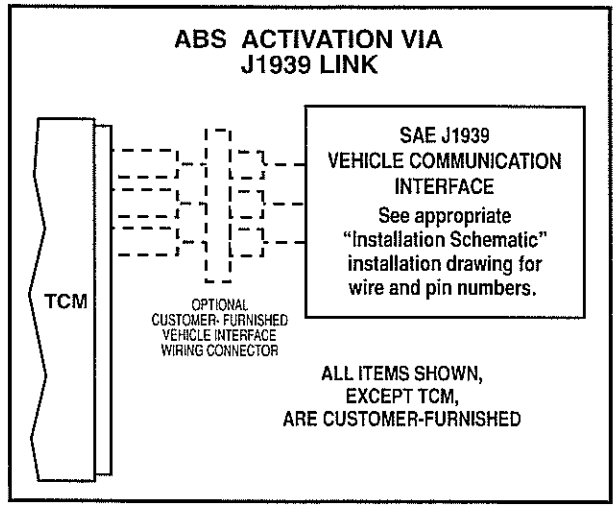
END VIEW OF
80-WAY CONNECTOR











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DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0719 Brake Switch ABS Input Low

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

Test Description

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

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

DTC P0719 Brake Switch ABS Input Low

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

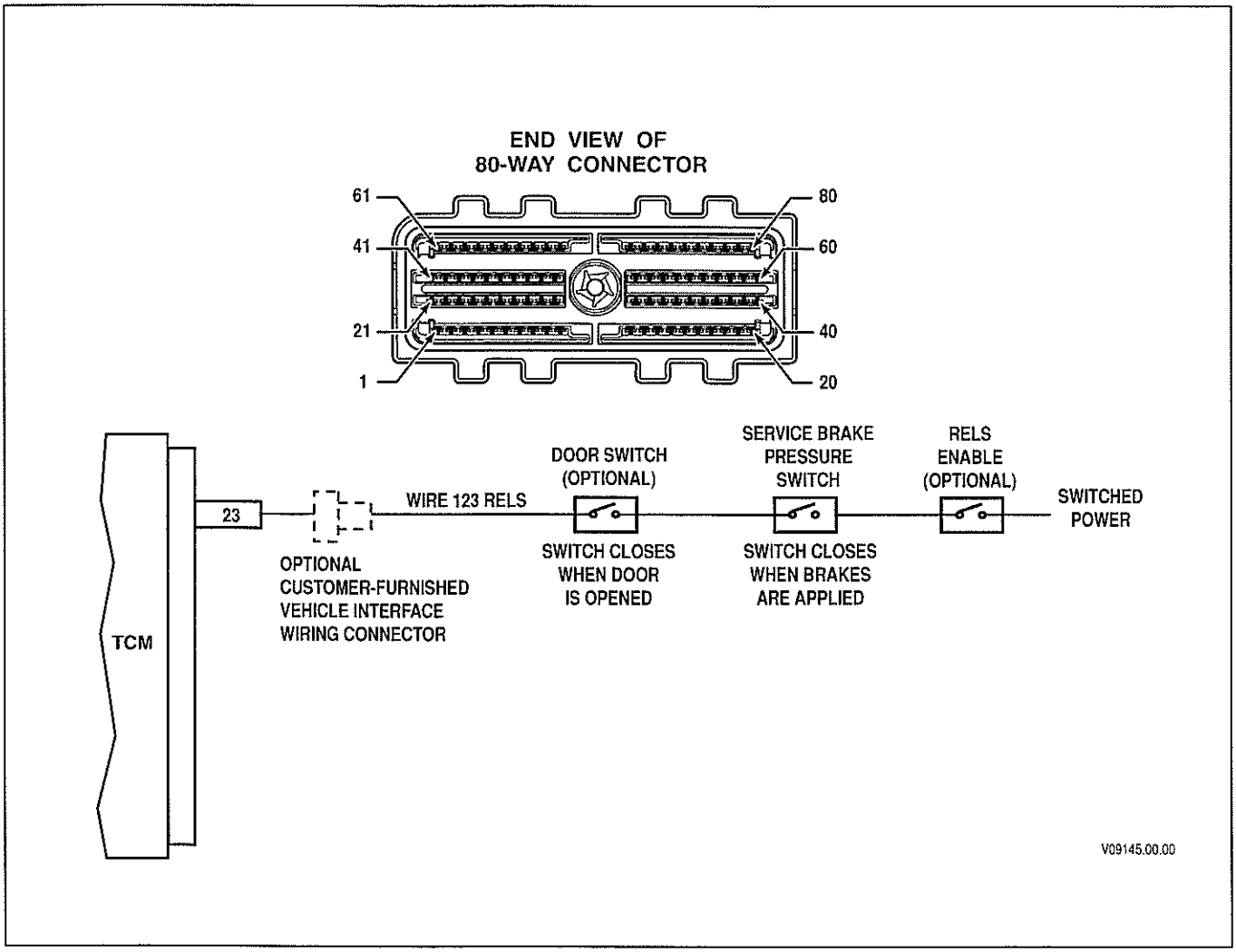
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071A RELS Input Failed On



Circuit Description

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

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

Conditions for Running the DTC

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071A RELS Input Failed On

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

Test Description

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071A RELS Input Failed On

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

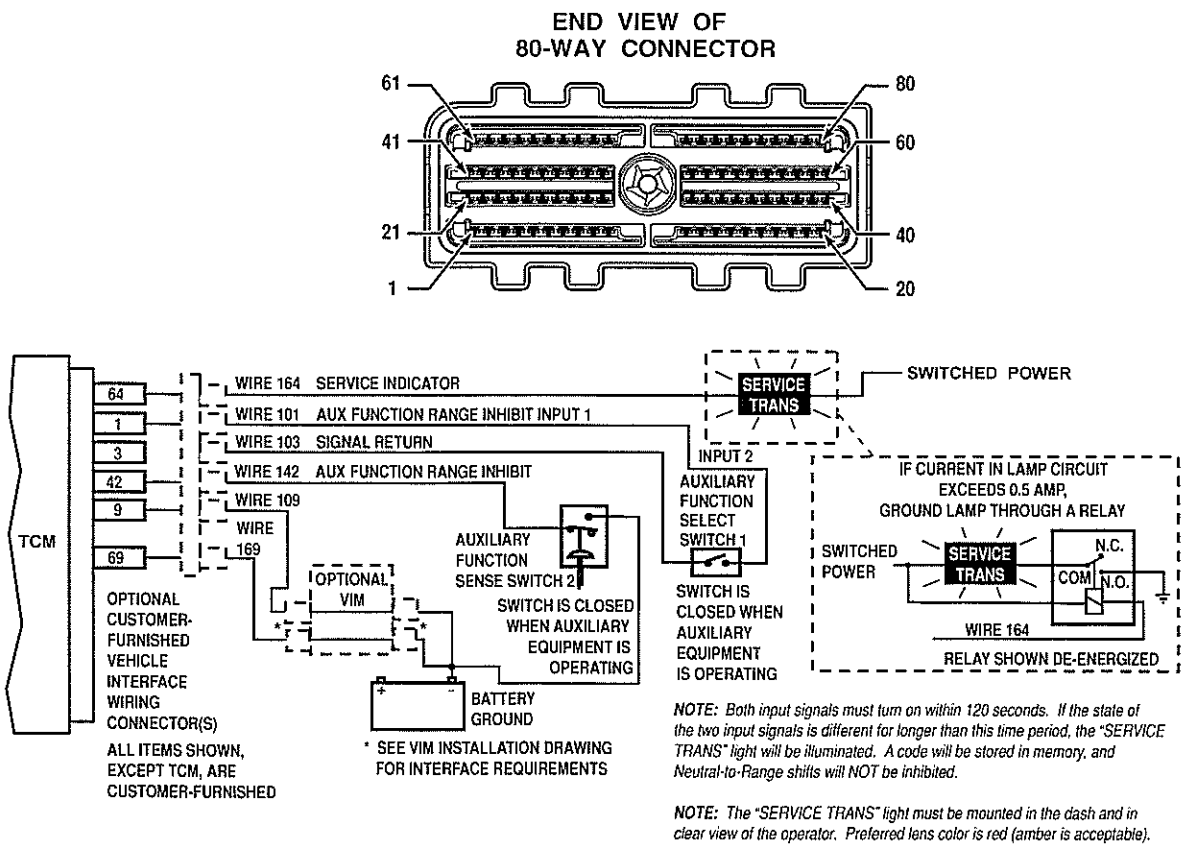
DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071D General Purpose Input Fault



Circuit Description

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

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071D General Purpose Input Fault

Conditions for Running the DTC

The test is enabled by calibration.

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

Test Description

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

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

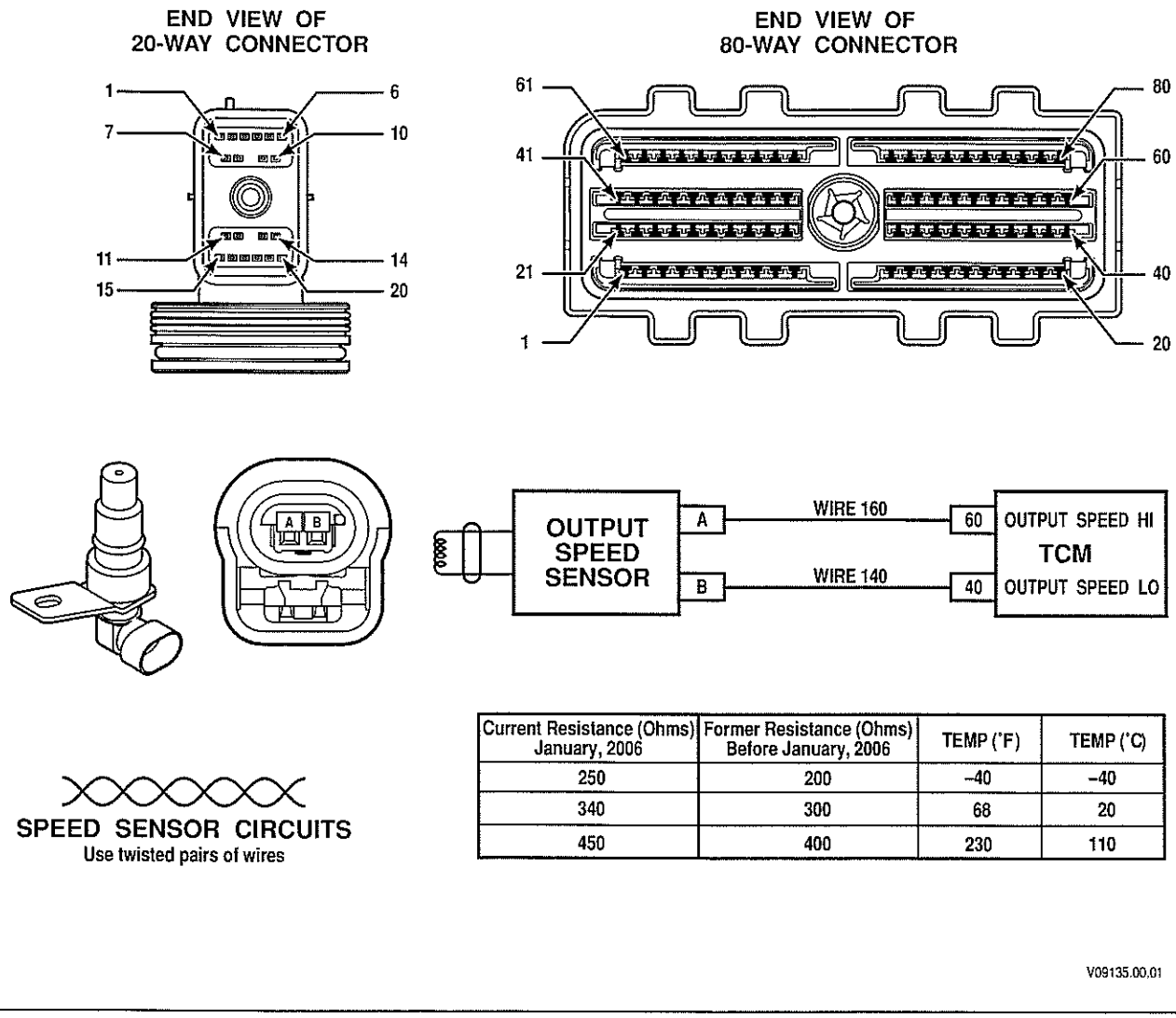
DIAGNOSTIC TROUBLE CODES (DTC)

DTC P071D General Purpose Input Fault

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0721 Output Speed Sensor Circuit Performance



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

Circuit Description

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0721 Output Speed Sensor Circuit Performance

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

Test Description

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

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

DTC P0721 Output Speed Sensor Circuit Performance

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

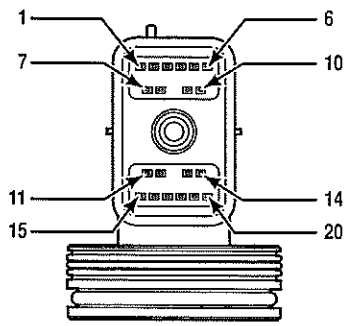
Table 6–12. Speed Sensor Temperature Resistance

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

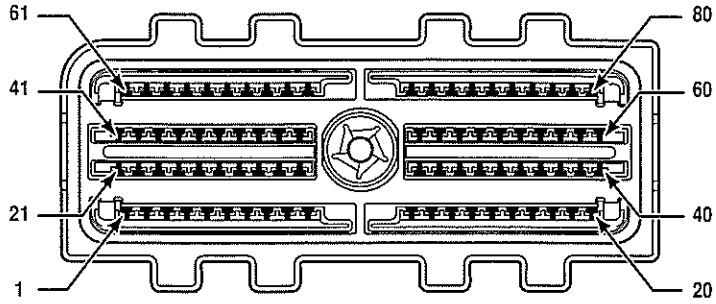
DIAGNOSTIC TROUBLE CODES (DTC)

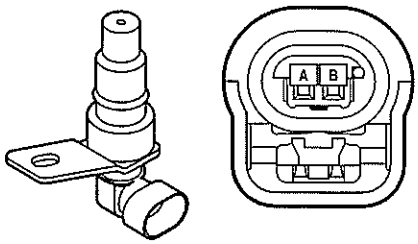
DTC P0722 Output Speed Sensor Circuit No Signal

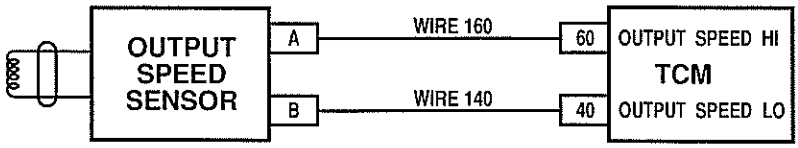
END VIEW OF
20-WAY CONNECTOR

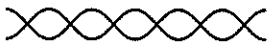


END VIEW OF
80-WAY CONNECTOR









SPEED SENSOR CIRCUITS
Use twisted pairs of wires

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

V09135.00.01

Circuit Description

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0722 Output Speed Sensor Circuit No Signal

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

DIAGNOSTIC TROUBLE CODES (DTC)

Diagnostic Aids

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

Test Description

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

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

DTC P0722 Output Speed Sensor Circuit No Signal

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

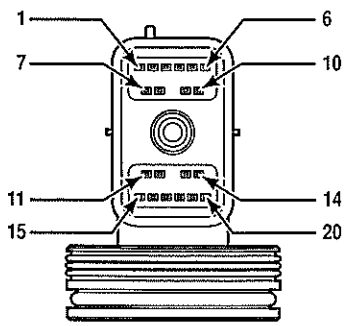
Table 6–13. Speed Sensor Temperature Resistance

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

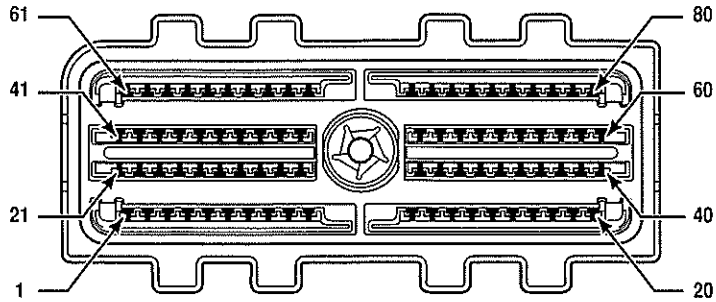
DIAGNOSTIC TROUBLE CODES (DTC)

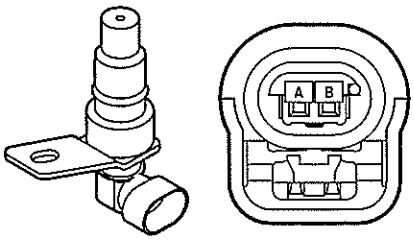
DTC P0726 Engine Speed Sensor Circuit Performance

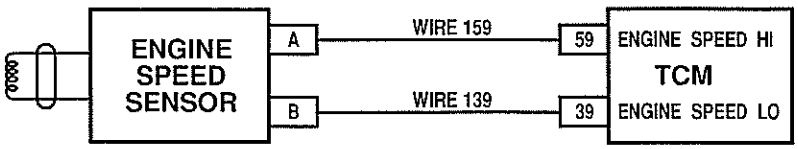
END VIEW OF
20-WAY CONNECTOR



END VIEW OF
80-WAY CONNECTOR







SPEED SENSOR CIRCUITS
Use twisted pairs of wires

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

V09136.00.01

Circuit Description

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0726 Engine Speed Sensor Circuit Performance

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

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

DTC P0726 Engine Speed Sensor Circuit Performance

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

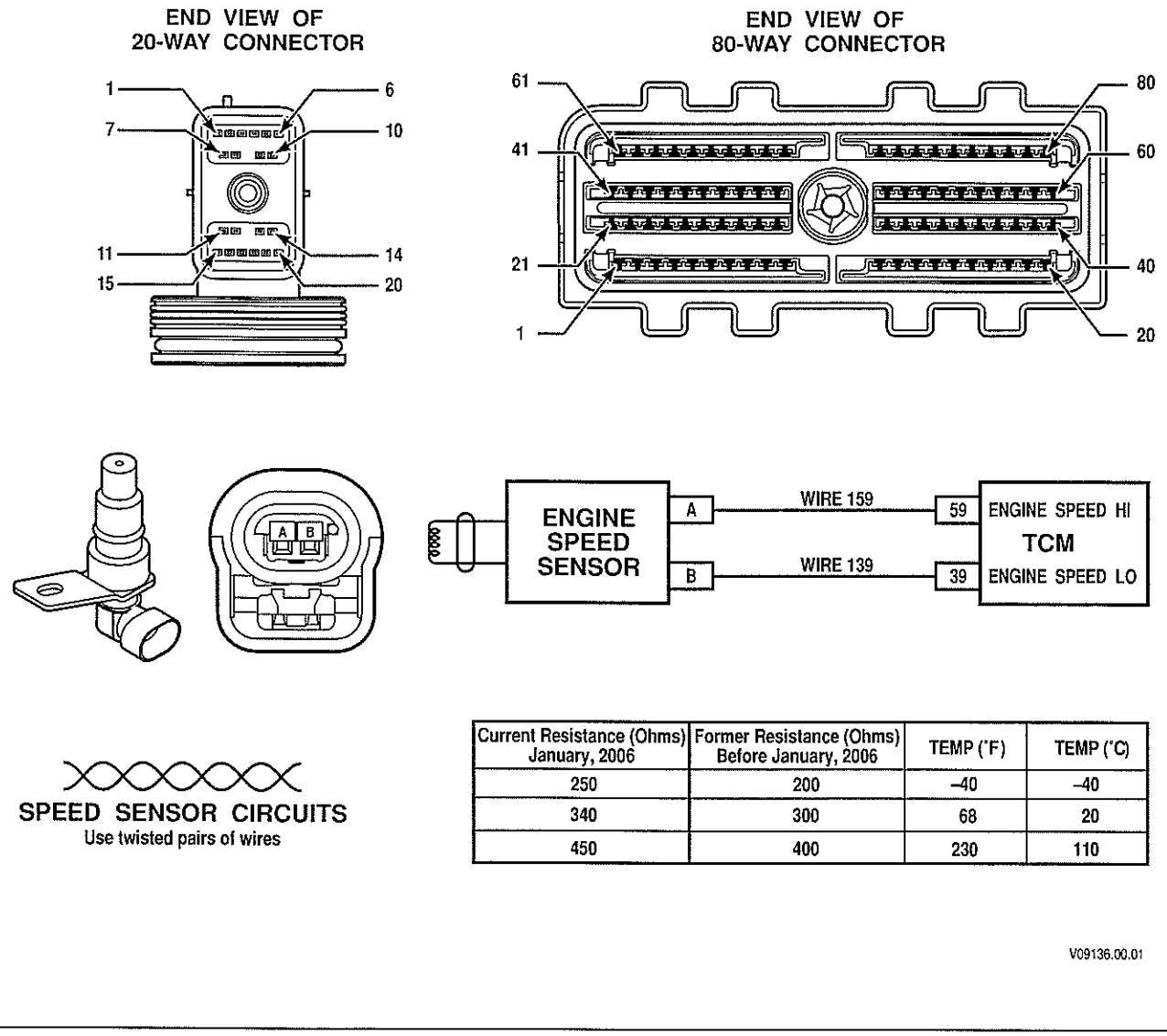
Step	Action	Value(s)	Yes	No
7	In order to verify your repair: 1. Clear the DTC. 2. Drive the vehicle under normal operating conditions. 3. Using Allison DOC™ For PC–Service Tool, monitor engine speed sensor operation. Did the DTC return?		*Begin the diagnosis again. Go to Step 1*	*System OK*

Table 6–14. Speed Sensor Temperature Resistance

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0727 Engine Speed Sensor Circuit No Signal



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

Circuit Description

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0727 Engine Speed Sensor Circuit No Signal

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

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

DTC P0727 Engine Speed Sensor Circuit No Signal

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

Table 6–15. Speed Sensor Temperature Resistance

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0729 Incorrect 6th Gear Ratio

Refer to Sixth Range Hydraulic Schematic

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

Test Description

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

DTC P0729 Incorrect 6th Gear Ratio

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0731 Incorrect 1st Gear Ratio

Refer to First Range Hydraulic Schematic

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

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

DTC P0731 Incorrect 1st Gear Ratio

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0732 Incorrect 2nd Gear Ratio

Refer to Second Range Hydraulic Schematic

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

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

DTC P0732 Incorrect 2nd Gear Ratio

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0733 Incorrect 3rd Gear Ratio

Refer to Third Range Hydraulic Schematic

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

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

DTC P0733 Incorrect 3rd Gear Ratio

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0734 Incorrect 4th Gear Ratio

Refer to Fourth Range Hydraulic Schematic

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

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

DTC P0734 Incorrect 4th Gear Ratio

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

DTC P0735 Incorrect 5th Gear Ratio

Refer to Fifth Range Hydraulic Schematic

Circuit Description

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

Conditions for Running the DTC

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

Conditions for Setting the DTC

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

Actions Taken When the DTC Sets

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

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

Conditions for Clearing the DTC/CHECK TRANS Light

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

Diagnostic Aids

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

DIAGNOSTIC TROUBLE CODES (DTC)

Test Description

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

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

DTC P0735 Incorrect 5th Gear Ratio

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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

DIAGNOSTIC TROUBLE CODES (DTC)

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

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