United States Army
Ordnance Mechanical Maintenance School

# 4L80E Transmission Troubleshooting Guide


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# TROUBLESHOOTING THE 4L80E AUTOMATIC TRANSMISSION

**INTRODUCTION**

The Hydra-matic 4L80E is a 4-speed automatic transmission which uses electronic control for smooth shifting. It offers a fourth gear overdrive to increase fuel efficiency. A torque converter clutch automatically engages at cruising speeds to improve fuel efficiency. Unlike hydraulically controlled automatic transmissions, the 4L80-E transmission uses electrical signals to specific gear shift solenoids which produce smooth shifts and quiet operation.

A neutral safety switch prevents the vehicle from being started if the transmission shift lever is in a position other than P (park) or N (neutral). A transmission warning light on the floor panel next to the shifter will illuminate if there is a problem with the transmission.

For increased power, depressing the accelerator to the floor will activate the throttle position sensor kick-down feature and will shift the transmission into one gear range lower than is selected on the gear range lever. The throttle position sensor is located on the fuel Injection pump.

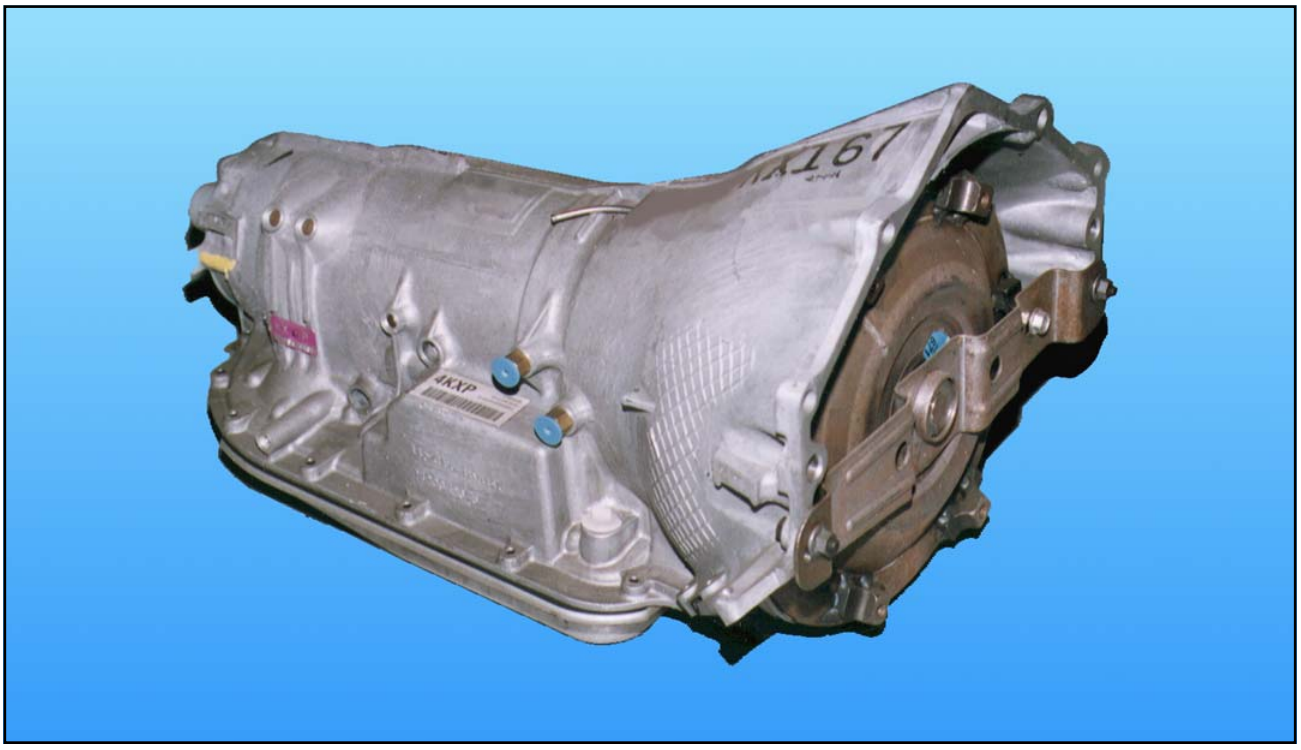


Figure 1. 4L80E Transmission.

**MAJOR COMPONENT GROUPS**

The major components of the transmission are (Figure 2):

- Two Band Assemblies
  Front band
  Rear band
- Five Multiple Clutch Assemblies
  Forward clutch
  Intermediate clutch
  Direct clutch
  Fourth clutch
  Overrun clutch
- Three Overrunning Clutches
  Lo Roller clutch
  Intermediate sprag
  Overdrive Roller clutch
- Three Planetary Gear Sets
- Control Valve Assembly with Two Electronic Shift Solenoids
- Input and output Speed Sensors
- Lock-up Torque Converter

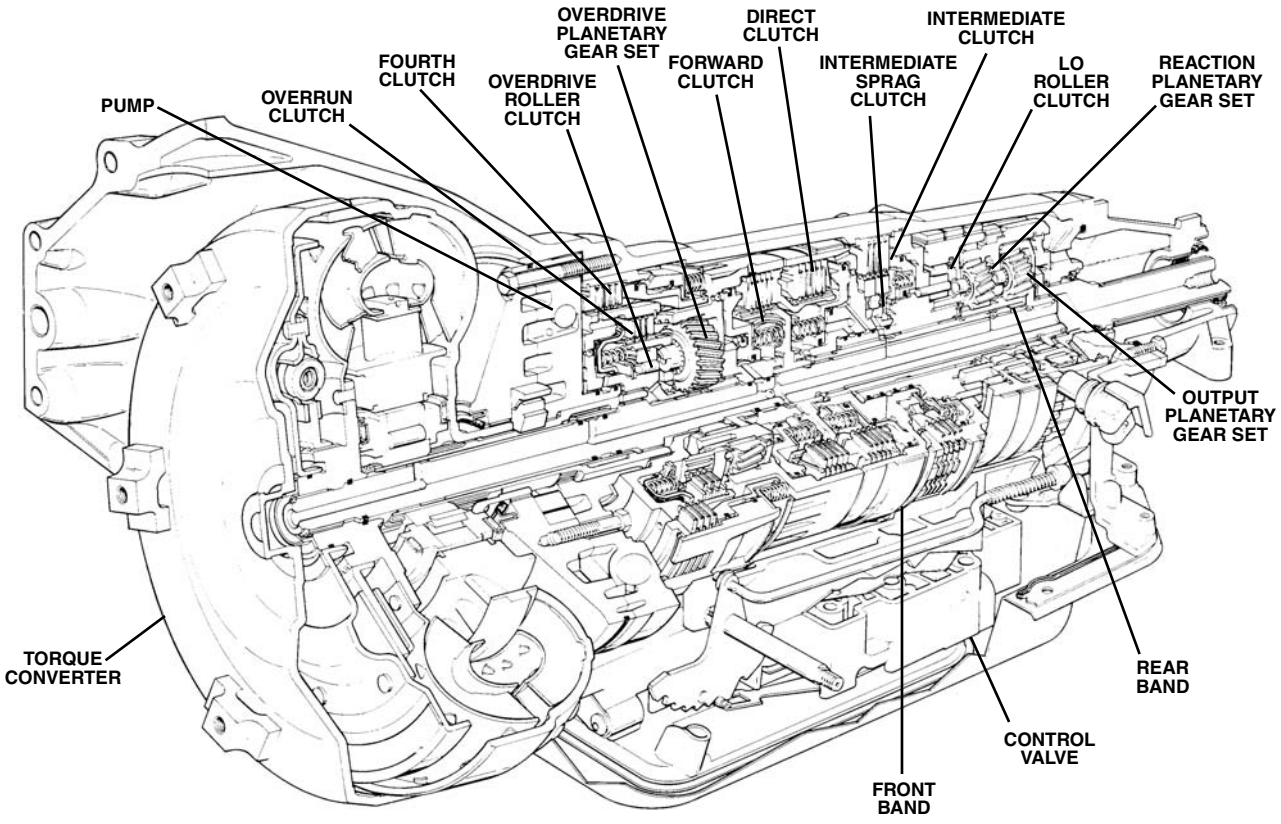



Figure 2. Major Component Groups

**DESCRIPTION**

Oil pressure is supplied by a gear-type oil pump. Oil pressure is regulated by a pressure control solenoid, and shift points are controlled by shift solenoids via the transmission control module (TCM) operation. The torque converter clutch apply and release is controlled by a pulse width modulated (PWM) solenoid.

**TRANSMISSION IDENTIFICATION**

The 4L80-E automatic transmission has a metal identification nameplate attached to the case exterior. This information will assist in the servicing and determination of replacement parts.

4 =Four Speed
L =Longitudinal Mount
80 =Manufacturers Product Series
E =Electronic Controlled

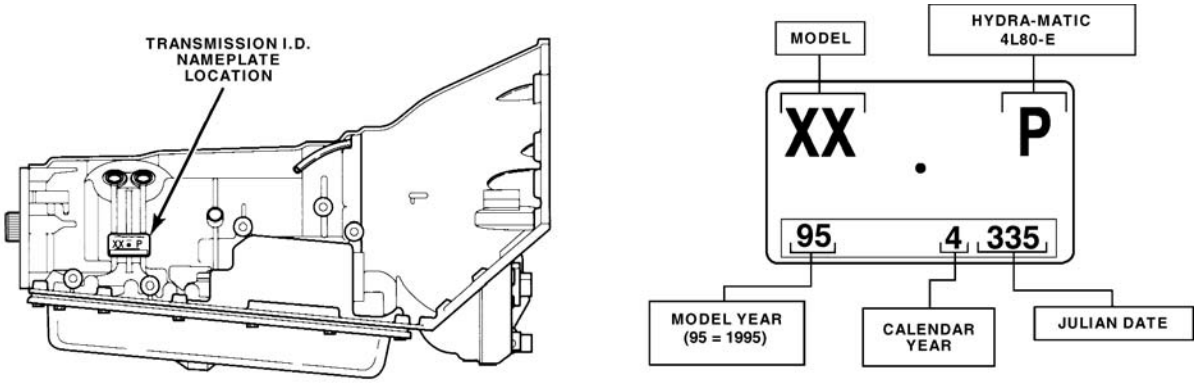



Figure 3. Transmission Identification

## CAUTION

**When fasteners are removed, reinstall in same location. Replace if necessary with a fastener of equal size and equal or better quality. Fasteners which will not be reused or which require locking compound are noted in the procedures. Torque fasteners as required in text, or equipment malfunction or damage could result.**

## CAUTION

**Use of air powered tools is not recommended to disassemble or assemble transmissions. Improper bolt torques can contribute to transmission repair conditions, and this information, vital to diagnosis, can only be detected when using hand tools.**

**TRANSMISSION CONTROL MODULE (TCM)**

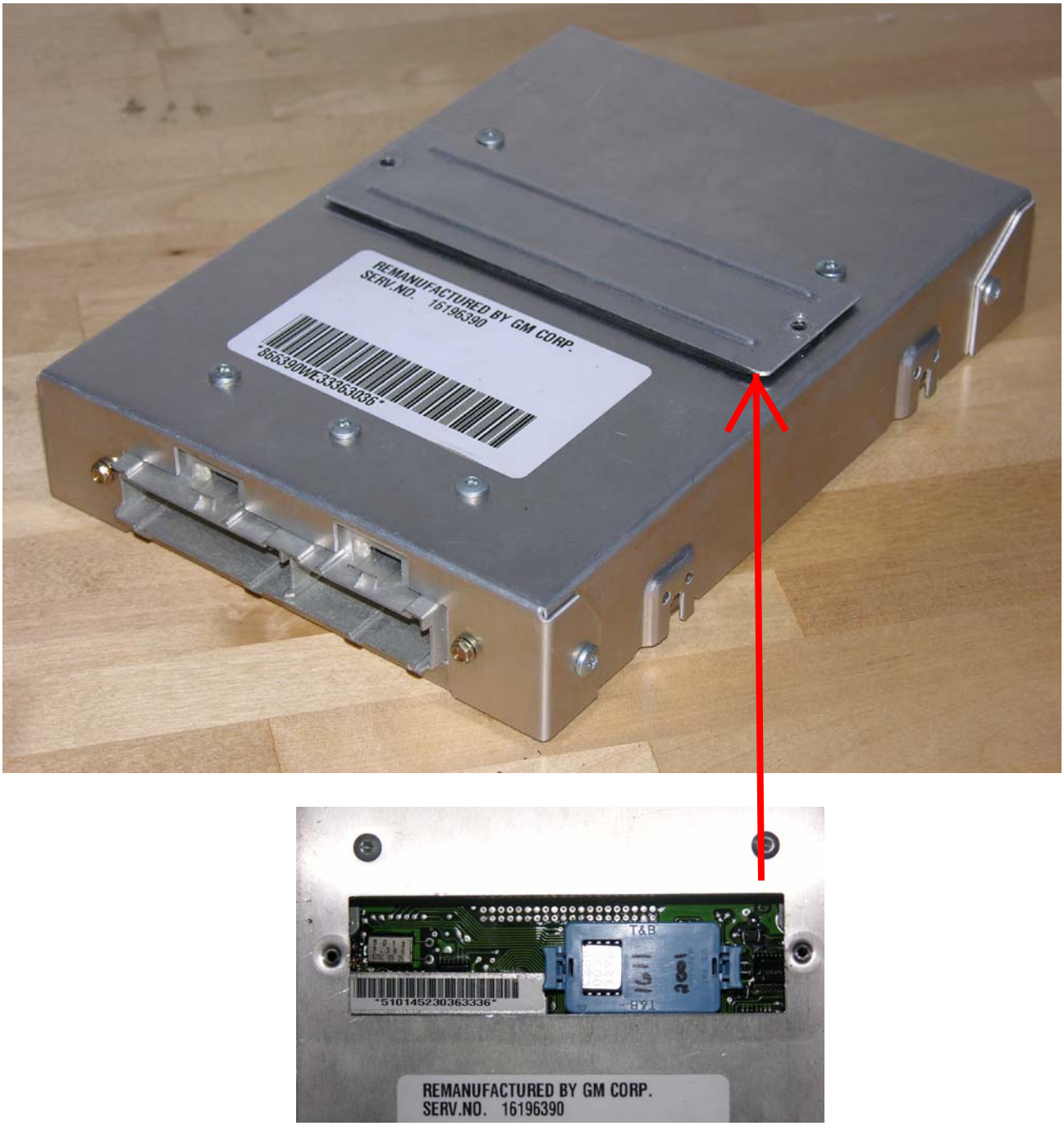
The 4L80E Transmission system is equipped with a computer called the Transmission Control Module (TCM), located in the left/rear passenger seat compartment which interprets, analyzes and records electronic signals from sensors and switches located on the engine, brake pedal, and transmission. The recorded codes stored in the TCM are known as **trouble codes**. The TCM will continually perform a self diagnosis check.

The TCM can protect the transmission from damage by locking it in second gear, with maximum fluid pressure, until a problem has been corrected. The procedures outlined in the troubleshooting booklet will detail diagnostic testing, troubleshooting and corrective action for existing faults. These transmission system tests may be run any time you think there is a transmission problem. The most common problems are loose or corroded wiring connections.

Figure 4. TCM Location

**Transmission Control Module (TCM).** The Transmission Control Module (TCM), an onboard computer, receives and processes input signals from various sensors on the vehicle and delivers output signals to the solenoids located in the control valve assembly. The solenoids control the transmission operating pressures, upshift and downshift patterns and torque converter clutch (TCC) operations.

A removable computer chip called a programmable read only memory (PROM) is used. The PROM programs the TCM for vehicle characteristics including weight, axle ratio, engine size, etc. The PROM differs within each TCM for transmission model year and HMMWV application.



**J2 Data Link Connector (DLC).** This connector is located on the TCM waterproof box under the left/rear seat. Trouble codes may be accessed by connecting the Diagnostic Switch Cable to the TCM J-2 connector and turning the ignition switch to the “RUN” position. If a Diagnostic Switch Cable is not available, use a jumper wire to jump across terminals “**A**” and “**E**” of the DLC J2 connector.

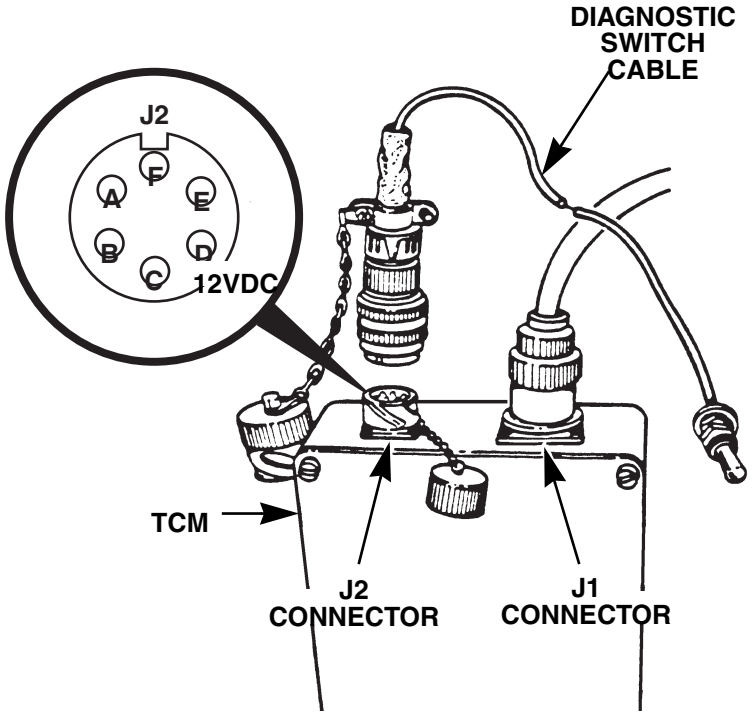



Figure 6. Data Link J2 Connector (DLC).

**SYSTEM/COMPONENT OPERATION**

In order to troubleshoot and service this transmission, it is important to understand how the TCM and transmission interact with their sensors and control elements.

The TCM receives data from various sensors, computes the optimum gear ratio based on the inputs, and causes the transmission to shift into the correct ratio at the best time.

- Throttle position (TP)
- Output Speed Sensor (TOSS)
- Input Speed Sensor (TISS)
- Transmission Range (TR) Pressure Switch Assembly
- Brake Switch
- Transmission Fluid Temperature (TFT)

**Throttle Position (TP) Sensor.** The Throttle Position (TP) sensor is a potentiometer, a device for measuring an unknown voltage or potential difference by comparison to a standard voltage. The TP sensor sends a voltage to the TCM, varying from approximately **0.5** volts to approximately **4.5** volts. This voltage signal to the TCM represents throttle shaft angle. At closed throttle, the signal voltage to the TCM is approximately **0.5** volts. As the throttle shaft angle increases, the signal voltage increases to greater than **4.5** volts at wide open throttle. The TP sensor is attached to the injector pump assembly (Figure 7).

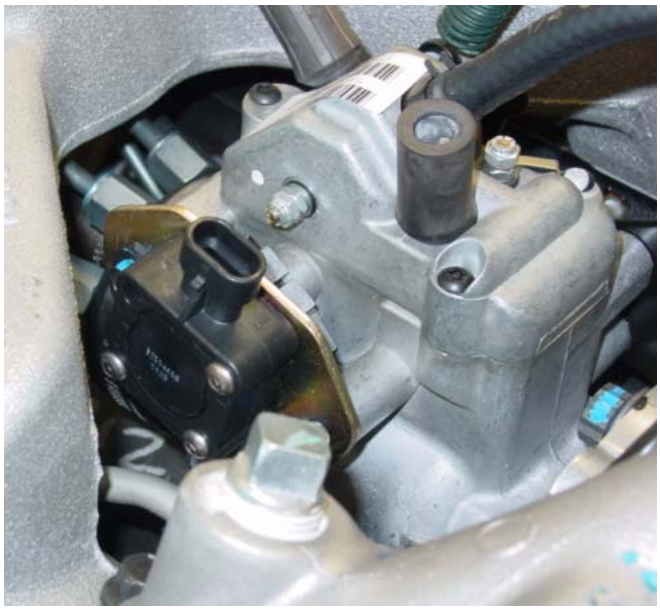


Figure 7. Throttle Position (TP) Sensor.

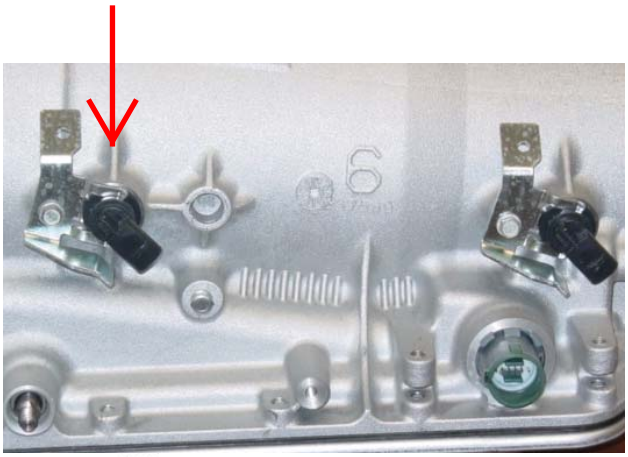
**Transmission Output Speed Sensor (TOSS).** This device (Figure 8) contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth on the output shaft. As the rotor interrupts the magnetic field, an AC voltage is generated in the circuit. This device is used to provide an output shaft speed signal to the control module. The control module uses the vehicle speed sensor signal input to:

- Calculate vehicle speed, trans output speed, and TCC slip speed.
- Control shift quality.

The TOSS is attached to the transmission output shaft housing (Figure 10).

Figure 8. Transmission Output Speed Sensor.

**Transmission Input Speed Sensor (TISS).** This device (Figure 9) contains a permanent magnet surrounded by a coil of wire producing a magnetic field which is interrupted by rotor teeth cut into the outside diameter of the forward clutch housing (Figure 10). As the serrations interrupt the magnetic field, an AC voltage is generated in the circuit. This device is used to provide an input speed signal to the control module. The control module uses the input speed sensor signal input to:



- Calculate TCC slip speed.
- Calculate gear ration.

Figure 9. Input Speed Sensor (TISS)

**Location of TISS & TOSS.** The Input Speed Sensor(TISS) is attached to the transmission case over the forward clutch housing. The Output Speed Sensor (TOSS) is attached to the transmission housing over the output shaft.

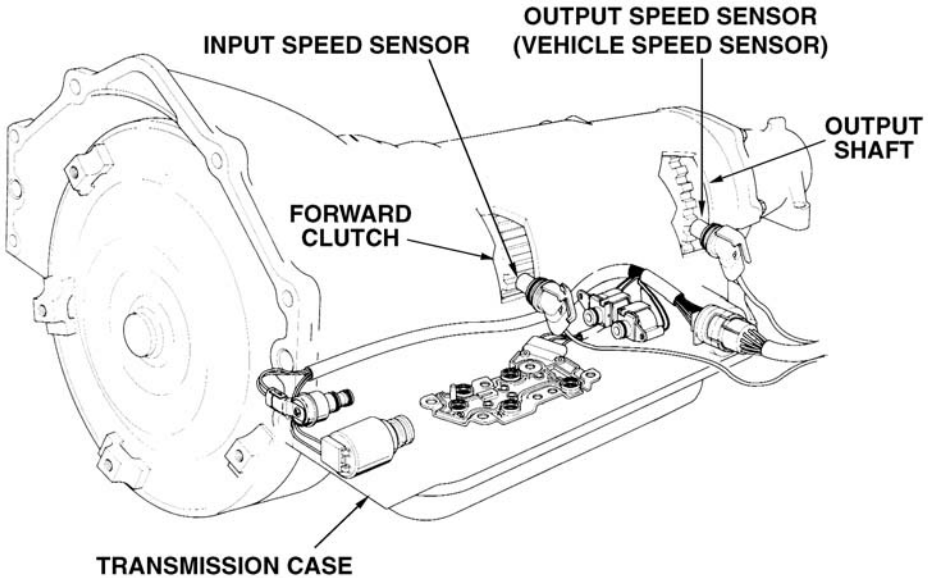



Figure 10. Location of TISS & TOSS.

**Transmission Range (TR) Pressure Switch Assembly.** This device is a set of five, normally open, pressure switches that detect fluid pressure within the valve body passages (Figure 11). The five pressure switches are connected to three signal circuits referred to as range signals **A, B** and **C**

The combination of pressure switch states determine the voltage signal (B+ or 0) on each range signal to the control module. These range signals are then interpreted by the control module to indicate the **transmission range selected** (Figure 51). The transmission range fluid pressure switch assembly is attached to the control valve body within the transmission.

Figure 11.

Table 2: Valid Combination Chart

| RANGE SIGNAL | A | B | C |
|---|---|---|---|
| Park | OFF | ON | OFF |
| Rev | ON | ON | OFF |
| Neutral | OFF | ON | OFF |
| D4 | OFF | ON | ON |
| D3 | OFF | OFF | ON |
| D2 | OFF | OFF | OFF |
| D1 | ON | OFF | OFF |
| Illegal | ON | OFF | ON |
| Illegal | ON | ON | ON |
| | | | |

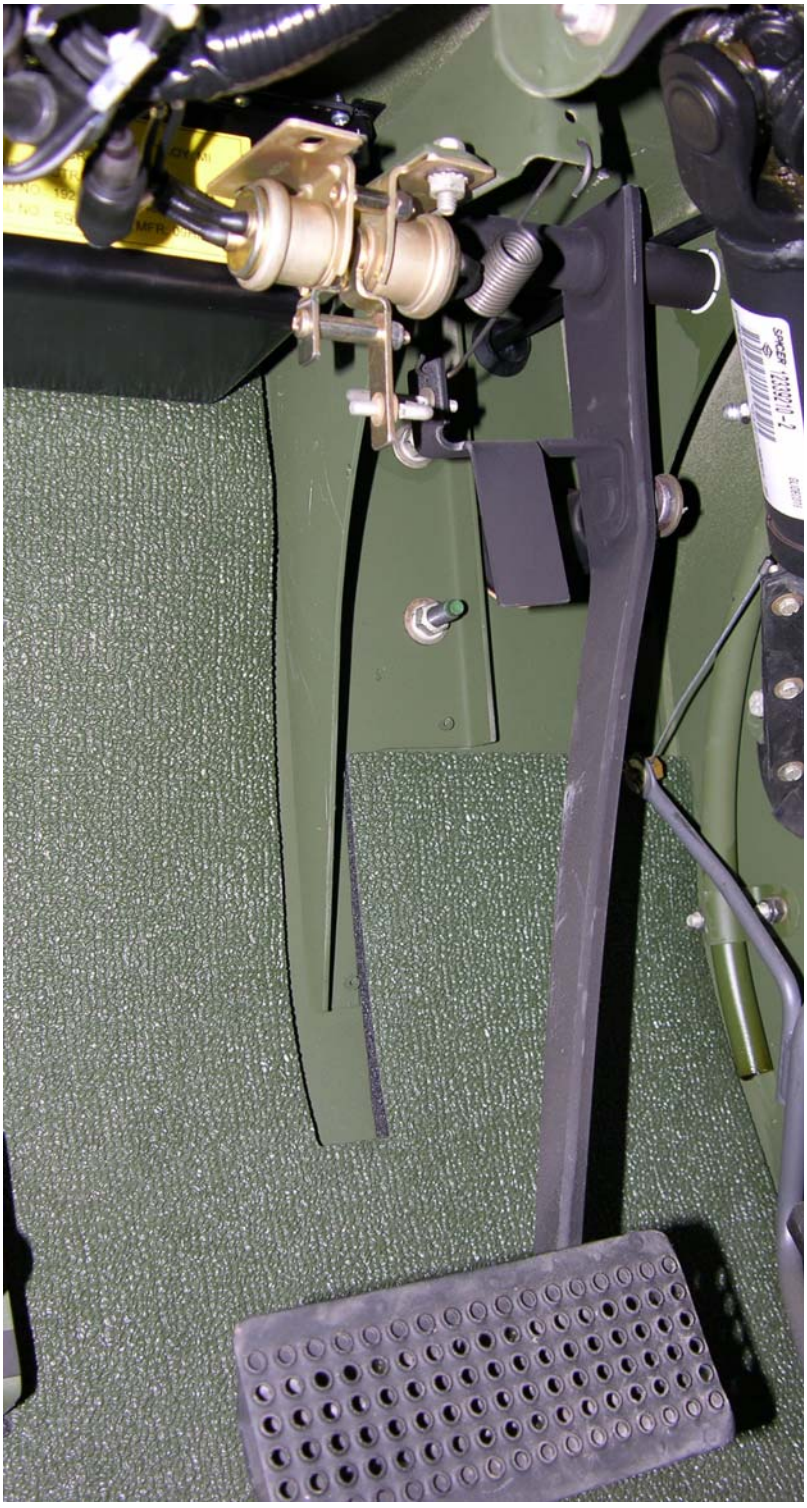
**Expected Voltage Readings**

**ON = 0 vdc at TCM** **OFF = B+ at the TCM**

**Actual Switch State**

**OFF = Open** **ON = Closed**

**Brake Switch.** This electrical switch is used to indicate brake pedal status. This switch is normally closed when the brake pedal is not applied. When the brake pedal is applied, the switch will open, changing the signal to the control module. The TCM uses this signal to de-energize the TCC solenoid when the brake pedal is applied. The brake switch is located on the brake pedal mounting bracket.



**Transmission Fluid Temperature (TFT) Sensor.** The TFT sensor is a thermistor (a device that changes resistance according to changes in temperature) used to indicate transmission fluid temperature. High sensor resistance produces high signal input voltage which corresponds to low fluid temperature. Low sensor resistance produces low signal input voltage which corresponds to high fluid temperature. The control module uses the TFT sensor signal input to determine the following:

- TCC apply and release schedules.
- Hot mode determination.
- Shift quality.

The TFT sensor is part of the internal wiring harness within the transmission (Figure 10).

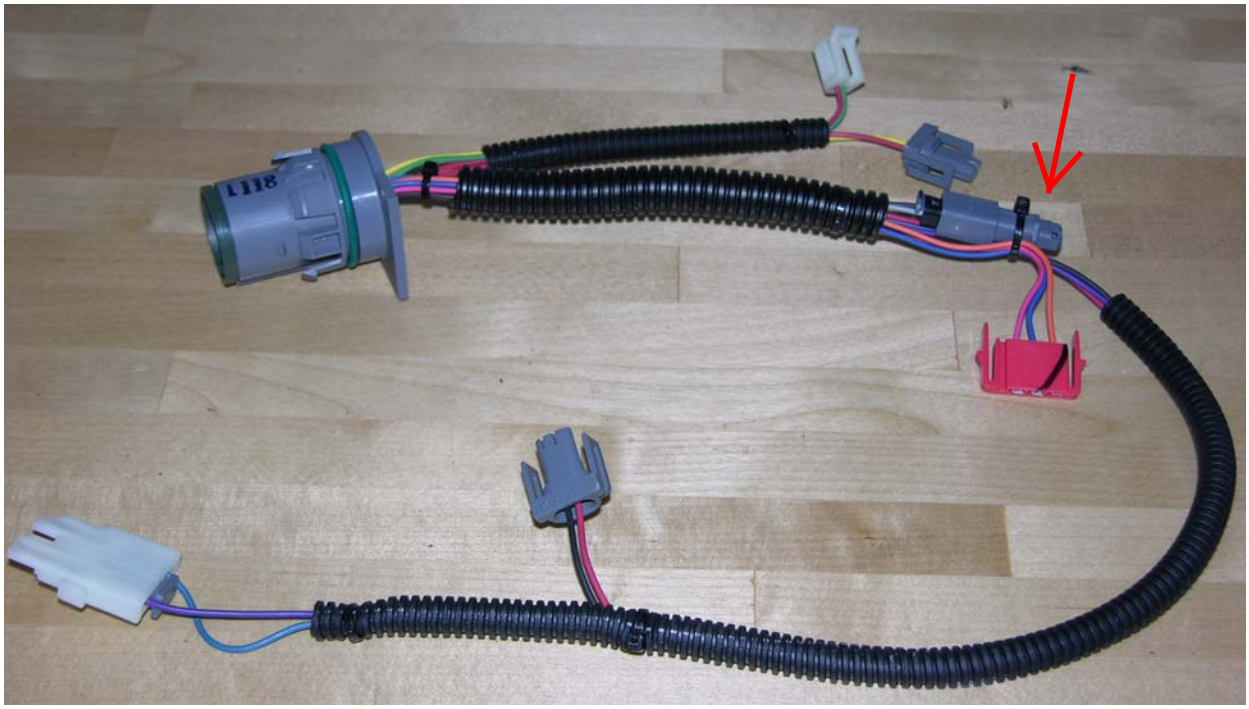


Figure 13. Transmission Fluid Temperature (TFT) Sensor

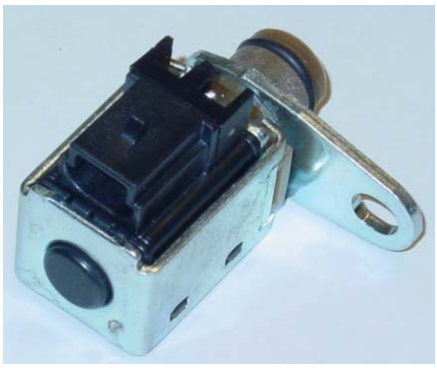
**OUTPUT CONTROLS OF THE TCM**

The TCM determines the optimum gear ratio and TCC engagement. Signals are transmitted through a transmission wiring harness to control elements in the transmission, these are:

- 1-2 Shift Solenoid.
- 2-3 Shift Solenoid.
- TCC PWM Solenoid
- Pressure Control Solenoid (PCS).

**1–2 / 2–3 Shift Solenoid.** These electrical devices are used to control fluid flow acting on the 1-2 and 3-4 shift valves. The solenoids are normally open exhaust valves that are used with the 2-3 shift solenoid to allow four different shifting combinations. The solenoid is attached to the control valve body within the transmission.

1-2 Shift Solenoid



2-3 Shift Solenoid

Figure 14. Shift Solenoids.

**Torque Converter Clutch (TCC) PWM Solenoid.**

This electrical device is used to control fluid acting on the TCC converter clutch valve, which then controls TCC apply and release (Figure 15). This solenoid is attached to the control valve body within the transmission. The TCC PWM solenoid is used to provide smooth engagement of the torque converter clutch by operating on a negative duty cycle percent of "ON" time.

Figure 15. Torque Converter Clutch (TCC)PWM Solenoid.

# TRANSMISSION DIAGNOSIS AND TROUBLESHOOTING

**INITIAL ACTION**

Obtain as much information as possible from the user. The technician may have to ask questions concerning the problem.

- When does it occur? Speed shifting up or down, loaded vehicle, full throttle, etc.
- Temperature? Transmission, engine, ambient, etc.
- Noise? Type, when, constant, intermittent, all gears, one gear, etc.
- Recent service? What and why?
- Refer to definitions to add more information.

**TRANSMISSION DEFINITIONS**

The following definitions are being provided to establish a common language and assist the user in describing transmission related conditions.

**Throttle Positions**

**Minimum Throttle.** The least amount of throttle opening required for an upshift.

**Light Throttle.** Approximately 25% of accelerator pedal travel.

**Medium Throttle.** Approximately 50% of the accelerator pedal travel.

**Heavy Throttle.** Approximately 75% of the accelerator pedal travel.

**Wide Open Throttle (WOT).** 100% travel of the accelerator pedal.

**Full Throttle Detent Downshift.** A quick application of the accelerator pedal to its full travel, forcing a downshift.

**Zero Throttle Coastdown.** A full release of the accelerator pedal while the vehicle is in motion and in drive range.

**Engine Braking.** A condition where the engine is used to slow the vehicle by manually downshifting during a zero throttle coast down.

**Shift Condition Definitions**

**Bump.** A sudden and forceful application of a clutch or band.

**Chuggle.** A bucking or jerking condition that may be engine related. This condition may be most noticeable when the converter clutch is engaged. It is similar to the feel of towing a trailer.

**Delayed (Late or Extended).** A condition in which a shift does not occur when expected. For example, a clutch or band engagement that hesitates during a part or wide open throttle acceleration or when manually downshifting.

**Double Bump (Double Feel).** Two sudden and forceful applications of a clutch or band.

**Early.** A condition in which the shift occurs before the vehicle has reached a proper speed and tends to labor the engine after the upshift.

**End Bump (End Feel or Slip Bump).** A firmer feel at the end of a shift than the feel at the start of the shift.

**Firm.** A noticeable quick application of a clutch or band that is considered normal with a medium to heavy throttle shift. It should not be confused with “harsh” or “rough.”

**Flare (Slipping).** A quick increase in engine rpm accompanied by a momentary loss of torque. This most generally occurs during a shift.

**Harsh (Rough).** A clutch or band application which is more noticeable than “firm”. This condition is considered undesirable at any throttle position.

**Hunting.** A repeating quick series of upshifts and downshifts that cause a noticeable change in engine rpm. An example could be described as a 4-3-4 shift pattern.

**Initial Feel.** A distinctly firmer feel at the start of a shift than at the end of a shift.

**Late.** A shift that occurs when the engine is at a higher than normal rpm for the current throttle.

**Shudder.** A repetitious jerking sensation similar to “chuggle” but more severe and rapid. This condition may be most noticeable during certain speeds. The term shudder may also be used to define the condition experienced after converter clutch engagement.

**Slipping.** A noticeable increase in engine rpm without an increase in vehicle speed. A slip usually occurs during or after initial clutch or band engagement.

**Soft.** A slow, almost unnoticeable clutch application with very little shift feel.

**Surge.** A repeating engine-related feeling of acceleration and deceleration that is less intense than “chuggle.”

**Tie-up.** A condition where two opposing clutches are attempting to apply at the same time causing the engine to labor with a noticeable loss of engine rpm.

**Noise Conditions**

**Gear Noise.** This noise is a whine which is related to vehicle speed and is most noticeable in first gear and reverse. A gear noise condition may become less noticeable or go away after an upshift.

**Pump Noise.** This noise is a high-pitched whine that increases in intensity with engine rpm. This condition may also be noticeable in PARK and NEUTRAL with the vehicle stationary.

**ANALYSIS PLAN**

Based on initial information and knowledge of transmission operation, a tentative plan of analysis should be made.

1. Is the problem of a mechanical nature? If so, is it internal or external?
2. Is the problem of an electrical nature? If so, is it internal or external?
3. Is the problem of an overheating nature? If so, is it internal or external?
4. Is a road test necessary?
5. If there was recent service, could the service have caused the problem?

### Preliminary Checking Procedure

An automatic transmission which is not operating properly may be affected by one or more of the following conditions:

- Improper fluid level
- Improper manual linkage adjustment
- Internal and external fluid leaks
- Electrical system failure
- Mechanical component failure

#### TRANSMISSION SHIFT LINKAGE

### Vehicle Starts In Shift Position Other Than N (Neutral) or P (Park)

1. Check operation of neutral safety switch. Disconnect harness leads 14A and 14B from neutral safety switch. Using ohmmeter, check for continuity in switch leads while moving shift lever through operating ranges. If continuity is indicated in any position other than N or P, Replace neutral safety switch.
2. Check transmission shift linkage. Adjust transmission shift linkage so vehicle starts only in N or P. Adjustment is as follows:
   a. Position shift lever arm into N position.
   b. Remove cotter pin and washer securing shift rod trunnion to shift lever arm.
   c. Disconnect shift rod from shift lever arm. Ensure shift lever arm is in the N position. Turn shift rod trunnion forward or backward on shift rod so that it slips easily into hole in the shift lever arm.
   d. Connect shift rod to shift lever arm with washer and cotter pin.

### Transmission Does Not Operate Properly According To Shift Lever Position

1. Check transmission shift linkage. Adjust shift linkage, if necessary.
2. Repair or replace transmission as required.

### Transmission Slips In Any Gear

1. Check fluid level and condition. Service as indicated.
2. Test transmission oil pressures.
3. Repair or replace transmission as required.

#### ERRATIC SHIFT POINTS OR NO DETENT DOWNSHIFTS

1. Check transmission fluid level. Add fluid if necessary.
2. Check adjustment of throttle position sensor. Adjust as necessary.
3. Replace transmission oil filter.
4. Test transmission oil pressure.
5. Repair or replace transmission.

#### INTERNAL AND EXTEMAL FLUID LEAKS

Internal fluid leaks usually cause low pressure problems, improper control valve operation, slipping or failure of clutch packs (loss of a gear ratio).

External leaks cause poor performance due to loss of fluid, lowering pressure.

**ELECTRICAL SYSTEM FAILURE**

This type failure can cause poor or erratic shifting, skipped gears, total transmission failure depending on which component failed.

**MECHANICAL FAILURE**

This type of failure can cause skipped gears, low pressure failure, total transmission failure.

**TRANSMISSION FLUID INFORMATION**

Check fluid level, color, and condition (refer to chart page 17) to diagnose transmission problems. Minor problems can result in major transmission repairs. Always check fluid level after it has reached a normal operating temperature of 180-200°F (82-93°C). Normal operating temperature is reached after approximately 15 miles (24 km) of driving. Use Dexron®III transmission fluid. Refer to Maintenance Intervals (Section I) for maintenance information and servicing intervals.

**CAUTION**

**Do not overfill. Overfilling will cause foaming, loss of fluid, and possible damage to the transmission.**

Transmission fluid is red when it is new. The red dye is added so technicians can distinguish it from engine oil or antifreeze. The red dye is not an indicator of the fluid quality and is not permanent. As the vehicle is driven, the transmission fluid will begin to look darker in color. The color may eventually appear light brown.

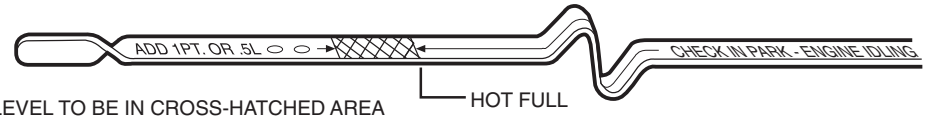
If the fluid is checked immediately after the vehicle has been operated under certain conditions, fluid level readings may be inaccurate. Driving in the following conditions may cause inaccurate readings:

- Ambient temperature above 90°F (32°C)
- Sustained high speed
- Heavy city traffic during hot weather
- Towing

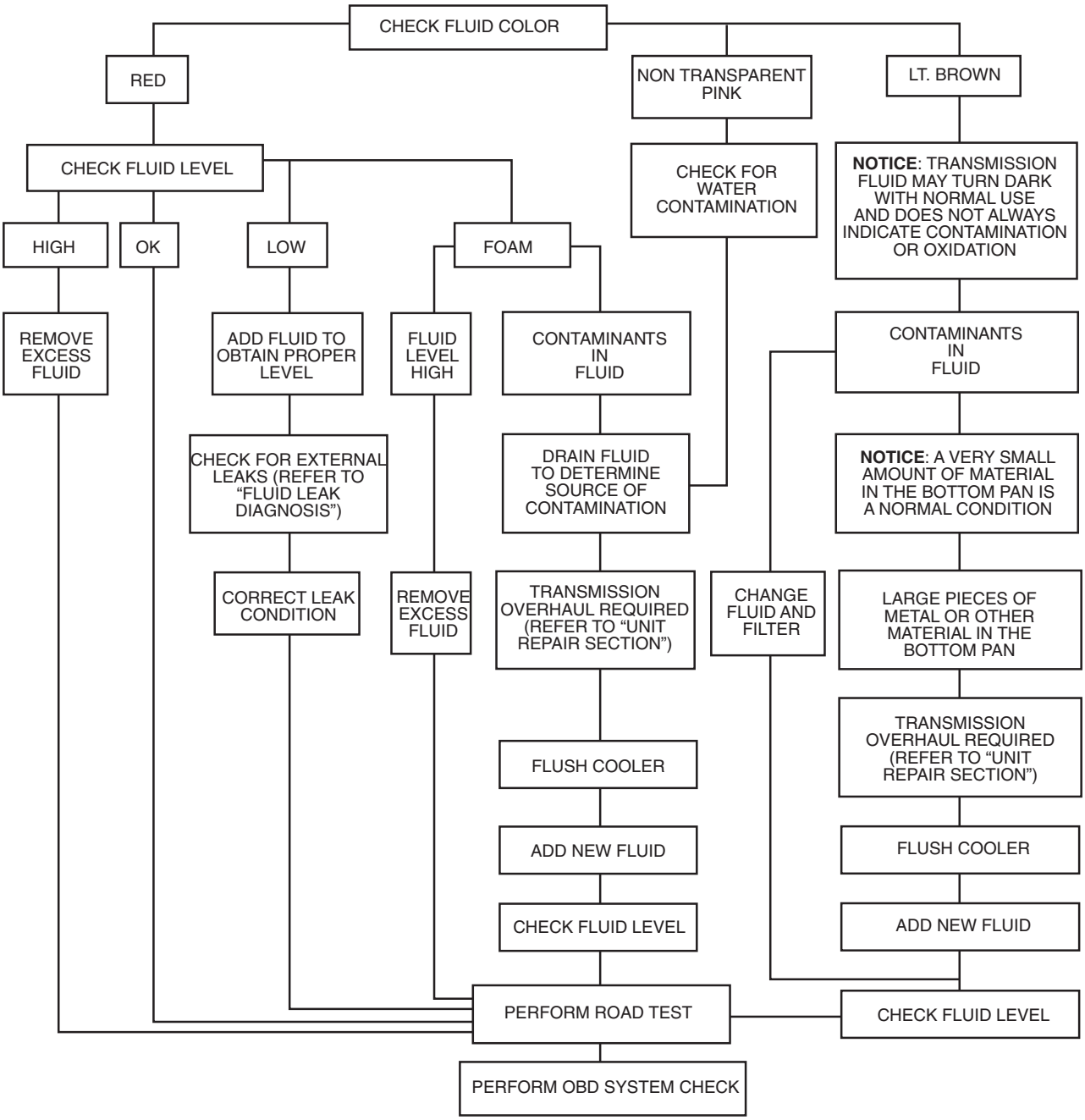
**TRANSMISSION FLUID CHECKING PROCEDURE**

NOTE: The automatic transmission fluid level must be checked with the vehicle at normal operating temperature 180-200°F (82-93°C). Temperature will greatly affect transmission fluid level. If the vehicle is not at normal operating temperature and the proper checking procedures are not followed, the result could be a false reading of the fluid level.

1. Start the engine and drive the vehicle for a minimum of 15 miles (24 km), or until normal operating temperature is reached.
2. Park the vehicle on level ground.
3. Move the gear selector to PARK.
4. Apply the parking brake.
5. Let the vehicle idle for 3 minutes with accessories off.
6. Check fluid level, color, and condition. (Refer to chart on page 17)




NOTE: FLUID LEVEL TO BE IN CROSS-HATCHED AREA ON FLUID LEVEL INDICATOR BLADE. CHECK AT OPERATING TEMPERATURE, 180°–200°F (82°–93°C).



**NOISE AND VIBRATION ANALYSIS**

A noise or vibration that is noticeable when the vehicle is in motion may not be from the transmission. (Refer to table 3)

If noise or vibration is noticeable in PARK and NEUTRAL with engine at idle, but it is less noticeable as rpm increases, the cause may be poor engine performance.

**NOTE**

**Check engine accessory drive components: water pump, power steering pump, and alternator for the source of noise before checking transmission.**

1. If noise is heard in neutral and all driving ranges:
   a. Check torque converter for loose mounting capscrews and damage. Tighten capscrews or replace torque converter if damaged.
   b. Check flywheel for damage. Replace flywheel if damaged.
2. If noise is heard during acceleration in any gear check engine and transmission mounts for looseness or damage. Secure or replace mounts.

Table 3: Possible Causes of Noise and Vibration

| COMPONENT TO INSPECT | CONDITIONS TO CHECK |
|---|---|
| Tires | • Uneven wear<br>• Imbalance<br>• Mixed sizes<br>• Mixed radial and bias ply |
| Suspension components | • Alignment and wear<br>• Loose fasteners |
| Engine/transmission mounts | • Damage<br>• Loose bolts |
| Transmission case mounting holes | • Missing bolts, nuts, studs<br>• Stripped threads<br>• Cracks |
| Flywheel Missing or loose bolts | • Missing or loose bolts<br>• Cracks<br>• Imbalance |
| Torque converter | • Missing or loose bolts or lugs<br>• Missing or loose balance weights |

**TRANSMISSION SERVICEABLILTY**

The Hydra-matic transmission used in HMMWV vehicles is serviced at two levels, Organizational and Direct Support. All external parts are serviced during and after the warranty period. A transmission internal component failure will require transmission replacement. Service replacement transmissions are available through the Army supply system. External repairs include replacement of the following:

- oil pan, gasket, and filter
- converter housing access covers
- shift solenoids
- rear servo
- speed sensors
- pressure control solenoid
- converter clutch solenoid
- accumulator
- park lock detent, actuator, pawl, pin, spring shift, plug, and bracket
- oil pump seals
- torque converter
- fill tube, O-ring, and dipstick
- adapter used it
- rear mount insulator and bracket
- transmission wiring harness
- vent lines and cooler lines
- TCM/PCM

**TRANSMISSION DIAGNOSIS**

Transmission diagnosis is a three step procedure. The first step involves two preliminary inspection procedures to check external parts. The second step involves road testing to confirm and identify a problem. The third step involves shop testing to locate the problem system or part. Shop testing includes pressure testing, scan tool diagnosis, and visual inspection.

**Preliminary Inspection - Vehicle Is Driveable**

1. If problem involves vibration or noise, check the following.
   a. Check tires and wheels for wear or damage.
   b. Check drive belt and accessories for wear, or looseness.
   c. Check propeller shaft U-joints for wear or damage.
   d. Check exhaust pipes, muffler and converter for touching body or frame.
   e. Check engine and transmission mounts for wear or damage.
2. Check transmission fluid condition as follows.
   a. Remove dipstick from filler tube and note fluid color.
   b. If fluid is dark red to light pink, condition is OK. Proceed to next step.
   c. If fluid is dark orange or brown, fluid has been overheated and should be changed. Cooler should also be flushed out. However, if fluid is black,

smells burned and contains clutch material, transmission and converter should be replaced and the cooler flushed.

3. Check transmission fluid level as follows.
   a. Transmission fluid should be at normal operating temperature for accurate check. Drive vehicle if necessary.
   b. Start engine, apply brakes, shift through all gear ranges and back to Park. Run engine at curb idle speed.
   c. Remove dipstick and check fluid level. Fluid should be in crosshatch area of dipstick.
   d. If level is low, add fluid in 1/4 pint/liter increments if necessary. If fluid level is high, draw-off excess with suction gun and plastic tubing inserted in filler tube.

**CAUTION**

**Do not overfill the transmission. Excess fluid will be churned into foam aerating the fluid. The result will be fluid overheat, shift problems and clutch wear.**

4. If fluid level was low, check for leaks at the oil pump seal, cooler and lines, filler tube and oil pan.
5. Check shift linkage adjustment. If vehicle starts only in Park and Neutral, linkage is OK. Linkage needs adjustment when engine won't start in one of the ranges, or if shift indicator in bezel is seriously misaligned.
6. Inspect transmission harness and case connector. Repair loose connections or damaged wiring as needed and proceed to next step.
7. If leaks, linkage, or fluid problems are not encountered, proceed to road test.

**Preliminary Inspection - Vehicle Is Disabled**

1. Check fluid level and condition as described in procedure for driveable vehicles.
2. Check for fluid leaks or broken shift linkage.
3. Check driveline as follows. Raise vehicle so wheels are free to rotate. Then start engine, shift transmission and transfer case into gear, and note the following.
   a. If one or both propeller shafts turn but wheels do not, problem is with differential or axle shafts.
   b. If propeller shafts turn but transmission or transfer case is noisy, stop engine immediately. Then repair transmission or transfer case as needed.
   c. If propeller shafts do not rotate and transmission is not noisy, test transmission line pressure as described in this section.

**Road Test**

1. If engine and transmission have cooled down, drive vehicle 10-12 miles to return to normal operating temperature.

**NOTE**

**The engine coolant and transmission fluid temperatures must be at normal operating levels for a proper road test. The engine and transmission temperature sensors will inhibit upshifts otherwise.**

2. Check torque converter operation as follows.
   a. Operate vehicle at 50-55 mph (80-88 km/h).
   b. Lightly apply brakes and check for converter clutch release. Engine rpm will increase slightly when release occurs.
   c. Release brakes, accelerate again, and check for converter clutch apply. Engine rpm will fall off slightly when apply takes place.
   d. If shudder occurs during converter clutch apply, or clutch won't release, problem is with one of the converter control valves, solenoid, or fluid level is low. If shudder occurs after clutch apply, problem is with engine, mounts, or other driveline component.
   e. If more than normal throttle opening is required to accelerate and maintain cruise speed, stator roller clutch may have failed.
3. Check shifting in both D ranges. Verify 1-2 and 2-3 upshifts and 3-4 upshift in overdrive D range. Then manually shift into 2 position at 25 mph. Transmission should immediately shift into second gear but do not upshift to third. Stop vehicle and shift into 1 range. Accelerate to 25-30 mph and note operation. Transmission should remain in first gear, provide overrun braking effect at decel, and not upshift. Stop vehicle, shift into reverse and backup. Vehicle should move smoothly in reverse. Check kick-down operation in both D ranges. Transmission should downshift promptly when accelerator pedal is moved to wide open position.
4. Drive vehicle in all gear ranges. The following indicates transmission mechanical or electrical fault:
   - loss of one or more gear ranges
   - engine flare during shifts (indicates clutch slip)
   - rough-harsh shifts
   - noise in one or more gear ranges
   - delayed or harsh engagement in D or R
   - shudder or surge during shifts
   - engine starts in range other than P or N
   - engine stalls after shift to D
   - loss of drive or reverse

## Road Test Analysis

Shift problems such as harsh or late shifts indicate a problem with the wiring, a sensor, low fluid level, or a TCM fault. Complete loss of a gear range when the fluid is cold or hot indicates failure of a drive element.

An important diagnostic tool is the Transmission Elements In Use chart (Table 16 on page 43). The chart indicates what elements are applied, holding, or overrunning in each gear range. The chart also indicates shift solenoid status in each gear range as well. By comparing elements in use to a problem gear range, the number of parts to be checked can be narrowed considerably.

In cases where loss of drive, slow engagement, or engine flare are experienced, a line pressure test is needed. (Refer to page 123). This test checks oil pump and force motor output and condition.

A torque converter fault will require scan tool testing to determine the problem part. A fault in one of the sensors or solenoids will also require scan tool testing. Incorrect shift points, no 3-4 upshift, converter shudder or slip, and harsh engagement are some of the problems caused by sensor, solenoid, wiring, or TCM fault.

Potential causes for common shift problems are described in the diagnosis guides. Corrective action is also provided. Problem causes are listed in order of probability (most-least).

## ELECTRICAL COMPONENT DIAGNOSIS INFORMATION

The following information describes the effect an electrical component fault can have on transmission operation and shifting. The information should be used to supplement shop testing and analysis.

**TPS or Electronic Accelerator Pedal.** A failure of either component will cause erratic shifts, high or low line pressures, rough idle, or low power.

**Engine Speed Sensor.** A sensor fault will result in loss of converter clutch engagement, or the clutch will apply at the wrong time. The electronic fuel injection pump will also be affected causing rough idle, hesitation, or low power.

**Input and Output Speed Sensors.** A failure of either sensor will affect shifting and converter clutch apply. Shifts will be erratic and the converter clutch applies at the wrong time.

**Pressure Control Solenoid.** A solenoid failure will result in harsh shifts and high line pressures if it fails closed. A failure in an open position will result in soft shifts, possible slip, and decreased pressure at high throttle opening.

**Converter Clutch Solenoid.** A solenoid failure can result in harsh converter clutch apply, incorrect apply sequence, or no apply.

**Pressure Switch Assembly.** A switch failure can result in loss of fourth gear, no converter clutch apply, harsh shifts, and high line pressure.

**Transmission Fluid and Engine Coolant Temperature Sensors.** A failure of either sensor can result in loss of fourth gear and converter clutch apply.

**Shift Solenoids.** A failure of either solenoid will result in loss of one or more gears, wrong gear range, or a no-shift condition.

**Brake Switch.** A brake switch fault will affect converter clutch apply. The converter could remain engaged, or fail to engage.

**Transmission Harness and Case Connector.** Loose, bent pins, loose connections, or damaged connector harness wires, can affect almost every phase of operation. Erratic shifts, no converter apply, overheating, and loss of one or more gear ranges can all occur. A check of the connector and harness, (Internal Wiring Harness Check, page 126), should be performed during initial inspection.

**Transmission Diagnosis Guides.** The diagnosis guides outline probable causes of various transmission malfunctions. The problem causes are listed in order of potential (most to least probable). The guides do not cover every possible condition or possibility. They do however, provide a means of reducing the number of components requiring further diagnosis and inspection.

**ELECTRICAL SHIFT TEST**

1. Move gear selector to PARK and set the parking brake.
2. Connect the scan tool to the DLC terminal.
3. Start the engine.
4. Verify that the following signals are present:
   - Input speed
   - Output speed
   - Engine speed
   - Transmission range
   - Current gear
   - Desired pressure control solenoid
   - Actual pressure control solenoid
   - Transmission temperature
   - Throttle angle
   - TCC duty cycle
   - System voltage
   - Brake switch
5. Monitor the brake switch signal while tapping the brake pedal with your foot. The brake switch should be open when the brake pedal is depressed, and be closed when the brake pedal is released
6. Monitor the transmission range switch signal and move the gear selector through all ranges. Verify that the transmission range switch value matches the gear range indicated on the instrument panel or console. Gear selections should be immediate and not harsh.
7. Move gear selector to NEUTRAL and monitor the throttle angle signal while increasing and decreasing engine rpm with the accelerator pedal. The throttle angle should increase with the engine rpm.

The road test should only be performed when traffic and road conditions permit. Observe all traffic regulations.

**Upshifts and Torque Converter Clutch (TCC) Applications.** The vehicle transmission control module calculates upshift points based on two inputs: percent throttle angle and transmission output speed. When throttle angle says a shift should occur, an electrical signal is sent to the shift solenoids which in turn move the valves to perform the upshift.

The shift speed chart, (Throttle Angle vs. Speed, page 42), references throttle angle instead of minimum throttle or wide open throttle (WOT) to make shift speed measurement more uniform and accurate. A scan tool is necessary to monitor throttle angle.

Scan tools like the TECH 2 have been programmed to measure and record shift point information. Check your scan tool instruction manual to see if this test is available with the scan tool you are using.

With the gear selector in D (overdrive):

1. Look at the shift speed charts and choose a 10 to 25 percent throttle angle.
2. Set up the scan tool to monitor throttle angle.
3. Accelerate to the chosen throttle angle and hold the throttle steady
4. As the transmission upshifts, note the shift speed for:

   2nd gear

   3rd gear

   4th gear

**NOTE**

**Shift speeds may vary due to slight hydraulic delays responding to electronic controls. A change from the original equipment tire size also affects shin speeds.**

**Be alert to determine when the TCC applies. This should occur in third or fourth gear. If TCC application is not noticed by an rpm drop, refer to Torque Converter Clutch Diagnosis.**

**The TCC will not apply unless the transmission fluid has reached a minimum operating temperature.**

5. Repeat steps 1-4 using several different throttle angles.

**Manual Downshifts.** The shift solenoids do not control the initial downshift during manual downshifts. All manual downshifts are hydraulic. The solenoid states will change either during manual downshift selection or slightly afterward.

Use a scan tool to see if any transmission malfunction codes hove been set After repairing the vehicle, perform the road test and verify that the code has not been set again.

If the transmission is not performing well and no trouble codes have been set, there may be an intermittent condition. Check all electrical connections for damage or a loose fit. Some scan tools have a snapshot test which can help catch an intermittent condition that does not occur long enough to set a code.

**TORQUE CONVERTER CLUTCH (TCC) DIAGNOSIS**

The torque converter clutch is applied by fluid pressure which is controlled by a pulse width modulated (TCC) solenoid located inside the automatic transmission assembly. The solenoid is energized by completing an electrical circuit through a combination of switches and sensors.

**TCC Functional Check Procedure**

1. Install a tachometer or scan tool.
2. Drive the vehicle until proper transmission operating temperature is reached.
3. Drive the vehicle at 50 to 55 mph (80 to 88 km/h) with light throttle.
4. Maintaining throttle, lightly touch the brake pedal and check for release of the TCC and slight increase in engine RPM.
5. Release the brake slowly, accelerate and check for a reapply of the TCC and a slight decrease in engine rpm.

To properly diagnose the torque converter clutch (TCC) system, perform all electrical testing first and then test the hydraulic system.

Additional TCC diagnosis information is available in the wiring diagram Diagnostic Trouble Codes (DTC) Table 4. and the Malfunction Code and Defaults Table 5.

**CAUTION**

**Use only high impedance-type ohmmeters for electrical testing on the TCC circuit. If another type of meter is used, false readings and damage to the circuits may occur.**

**NOTE**

**The pulse width modulated (TCC) solenoid is different than other TCC solenoids; it runs on 32 hertz and is not an ON/OFF switch.**

**TORQUE CONVERTER EVALUATION**

The torque converter should be replaced if any of the following conditions exist:

- External leaks in the hub area.
- Converter hub is scored or damaged.
- Converter pilot is broken, damaged, or fits poorly into crankshaft.
- Steel particles are found after flushing the cooler and cooler lines.
- Pump is damaged, or steel particles are found in the converter.
- Vehicle has TCC shudder and/or no TCC apply. Replace only after all hydraulics electrical diagnosis has been made. (Converter clutch material may be glazed.) Refer to TCC shudder diagnosis.
- Converter has an imbalance which cannot be corrected.
- Converter is contaminated with engine coolant containing antifreeze
- Internal failure of stator roller clutch.
- Excess end play.
- Heavy clutch debris due to overheating (blue converter).
- Steel particles or clutch lining material are found in fluid filter or on magnet when no internal parts in unit are worn or damaged (indicates that lining material came from converter).

The torque converter should not be replaced if:

- The oil has an odor, is discolored, and there is no evidence of metal or clutch facing particles.
- The threads in one or more of the converter bolt holes are damaged. Correct with thread insert.
- Transmission failure did not display evidence of damage or worn internal parts, steel particles or clutch plate lining material in unit and inside the fluid filter.

**Noise.** Torque converter whine is usually noticed when the vehicle is stopped and the transmission is in DRIVE or REVERSE. The noise will increase when engine rpm is increased. The noise will stop when the vehicle is moving or when the torque converter clutch is applied because both halves of the converter are turning at the some speed.

Perform a stall test to make sure the noise is actually coming from the converter.

1. Place foot on brake.
2. Put gear selector in DRIVE.
3. Depress accelerator to approximately 1200 rpm for no more than six seconds.

**CAUTION**

**If the accelerator is depressed for more than six seconds, damage to the transmission may occur.**

**IMPORTANT.** This noise should not be confused with pump whine noise which is usually noticeable in PARK, NEUTRAL, and all other gear ranges. Pump whine will vary with pressure ranges.

**Torque Converter Stator.** The torque converter stator roller clutch can malfunction in two different ways. It can either remain locked up at all times, or freewheel in both directions.

If the starter is freewheeling at all times, the vehicle tends to have poor acceleration from the standstill. The vehicle may act normal at speeds above 30 to 35 mph (48 to 56 km/ h). If poor acceleration is noted, it should first be determined that the exhaust system is not blocked, the engine timing is correct, and the transmission is in FIRST gear when starting out.

If the engine accelerated freely to high rpm in NEUTRAL, it can be assumed that the engine and exhaust are normal. Checking for poor performance in DRIVE and REVERSE will help determine if the stator is freewheeling at all times.

If the stator is locked up at all times performance from a standstill appears normal. However, engine rpm and acceleration is restricted or limited at high speeds. The engine may overheat with this condition. Visual examination of the converter may reveal a blue color from overheating.

It the torque converter has been removed from the vehicle the sector roller clutch can be checked by inserting a finger into the splined inner race of the roller clutch and trying to turn the race in both direc1ions The inner race should turn freely clockwise but not turn or be very difficult to turn counterclockwise

**TCC Shudder Diagnosis.** The key to diagnosing TCC shudder is to note when it happens and under what conditions.

TCC shudder should only occur during the applying and/or releasing of the converter clutch - never after the TCC plate is fully applied.While TCC is Applying or Releasing

If the shudder occurs while the TCC is applying, the problem is within the transmission or torque converter. Something is not allowing the clutch to become fully engaged, not allowing clutch to release, or is trying to release and apply the clutch at the some time. This could be caused by leaking turbine shaft sects, a restricted release orifice, a distorted clutch, or a damaged torque converter housing surface due to long converter bolts.

**After TCC Has Applied.** If shudder occurs after the TCC has applied (often with engine under load such as climbing a hill), most off the time there is nothing wrong with the transmission. As mentioned before, once the TCC has been applied, it is very unlikely that it will slip. Engine problems that may go unnoticed under light throttle and load become noticeable when going up a hill, or when accelerating, due to the mechanical lockup between engine and transmission.

**REMEMBER:** Once TCC is applied, there is no torque converter (fluid coupling) assistance. Engine or driveline vibrations could be unnoticeable before TCC engagement

## DIAGNOSTIC CODE INFORMATION

Additional information useful for diagnosing trouble with the 4L80-E transmission.

Malfunction Code (DTC) and Defaults. This table, arranged in DTC numerical order, provides information relative to causes of a component failure and the resulting default action by TCM. This would be useful in may cases for running down an intermittent fault.

Table 4: Diagnostic Trouble Codes

| DTC | MALFUNCTION |
|---|---|
| 21 | Throttle Position (TP) sensor circuit high |
| 22 | Throttle Position (TP) sensor circuit low |
| 24 | Vehicle Speed Sensor (VSS)/(TOSS) circuit low |
| 28 | Transmission Range (TR) pressure switch circuit |
| 37 | Torque Converter Clutch (TCC) brake switch stuck ON |
| 38 | Torque Converter Clutch (TCC) brake switch stuck OFF |
| 39 | Torque Converter Clutch (TCC) Solenoid stuck OFF |
| 51 | Programmable read only memory (PROM) error |
| 52 | System voltage (BATT) high long (length of time) |
| 53 | System voltage (BATT) high |
| 58 | Transmission Fluid Temp (TFT) circuit low |
| 59 | Transmission Fluid Temp (TFT) circuit high |
| 68 | Transmission component slipping |
| 69 | Torque Converter Clutch (TCC) stuck ON |
| 71 | Engine Speed Sensor (ESS) |
| 72 | Vehicle Speed Sensor (VSS)/(TOSS) circuit open |
| 73 | Pressure Control Solenoid (PCS) circuit |
| 74 | Transmission Input Speed Sensor (TISS) circuit |
| 75 | System voltage (BATT) low |
| 79 | Transmission fluid overtemp |
| 81 | 2-3 shift solenoid circuit fault |
| 82 | 1-2 shift solenoid circuit fault |
| 83 | Torque Converter Clutch (TCC PWM) solenoid circuit fault |
| 85 | Undefined ratio error |
| 86 | Low ratio error |
| 87 | High ratio error |

Table 5: Malfunction Code and Defaults

| DTC | SETTING PARAMETER(S) | DEFAULT |
|---|---|---|
| 21<br>TP High | Engine operating<br>TP Signal > 4.9 V for one second | Maximum line pressure<br>Use 35% TP as default<br>Inhibit 4th gear in HOT Mode |
| 22<br>TP Low | Engine operating<br>TP Signal < 0.2 volt | Same as DTC 21 |
| 24<br>VSS/TOSS LOW | No DTC 21,22,28,33,or 34 and not in P or N<br>Circuit 497 vdc is constant | Maximum line pressure<br>2nd gear<br>Calculate output speed |
| 28<br>TR FAULT | Range A & C are both 0 vdc for 2 seconds. | D4 shift pattern continued, No TCC, no 4th gear in HOT mode |
| 37<br>Brake Switch ON | Circuit 810 (TCM pin B4) open<br>VSS <5 mph (8 km/h) > 6 seconds<br>Then VSS/TOSS between 5–20 mph (8–32 km/h) > 6 seconds<br>Then VSS/TOSS > 20 mph (32 km/h) > 6 seconds<br>Total of seven times | No 4th gear in HOT mode |
| 38<br>Brake Switch OFF | Circuit 810 (TCM pin B4) constant voltage (B+)<br>VSS/TOSS > 20 mph (32 km/h) > 6 seconds<br>Then VSS/TOSS between 5–20 mph (8–32 km/h) > 6 seconds<br>Total of seven times | No 4th gear in HOT mode<br>No TCC |
| 39<br>TCC Stuck OFF | No DTC(s) 28, 71, 74<br>TCC Commanded on position<br>TCC slip speed > 65 rpm<br>TR D3 or D4 position<br>2nd or 3rd gear, all condition for 2 seconds | No 4th gear in HOT mode |
| 51<br>PROM ERROR | Prom internal fault | None<br>System inoperative |
| 52<br>System Voltage HIGH LONG | Ignition on, voltage >16 V for 109 minutes | Maximum line pressure<br>2nd gear<br>No TCC |

Table 5: Malfunction Code and Defaults

| | SETTING PARAMETER(S) | DEFAULT |
|---|---|---|
| 53<br>System Voltage<br>High | Ignition on, voltage > 19.5 vdc for 2 minutes | Same as DTC 52 |
| 58<br>TFT Circuit<br>Low | Signal voltage indicates trans fluid temp. 304°F (151°C) for 1 second | Use warm fluid values |
| 59<br>TFT Circuit<br>HIGH | Signal voltage indicates transmission fluid temp < –40°F (–40°C) for 1 second | Same as DTC 58 |
| 68<br>Transmission<br>Components<br>Slipping | No DTC(s) 28, 71, 74 present<br>TCC slip speed > 200 rpm<br>Fourth Gear Indicated:<br>–TCC locked<br>–Not in PARK or NEUTRAL<br>–Lasts longer than 2 seconds | No TCC<br>No manual mode operation |
| 69<br>TCC Stuck<br>ON | No DTC(s) 21, 22, 71 or 74 present<br>TCC slip rpm between –5 and + 10 rpm<br>TCC off<br>TP Signal > 25%<br>D3 or D4 on range SW<br>Commanded gear indicated 2nd or 3rd gear<br>Lasts longer than 2 seconds | None |
| 71<br>ESS<br>Circuit Low | No DTC 28 set.<br>Engine is less than 50 RPM<br>Trans range indicates R, D4, D3, or D1<br>Conditions are met for 2 seconds | No TCC |
| 72<br>TOSS<br>Circuit Loss | Not in Park or Neutral<br>Transmission output speed change > 1000 RPM<br>Engine Speed > 300 RPM and lasts longer than<br>2 minutes<br>No DTC 28<br>In Park/Neutral<br>Output speed change >2050 rpm | 2nd Gear<br>Maximum line pressure |

Table 5: Malfunction Code and Defaults

| DTC | SETTING PARAMETER(S) | DEFAULT |
|---|---|---|
| 73<br>PCS Circuit | No DTC 75<br>Return current >0.16A from commanded amp<br>Lasts longer than 1 second | Maximum line pressure |
| 74<br>TISS Circuit | No DTC(s) 24, 28 or 71<br>Not in PARK or NEUTRAL<br>Engine speed > 300 rpm<br>TISS < 50 rpm<br>TOSS > 200 rpm<br>Lasts longer than 2 seconds | No TCC |
| 75<br>System Voltage LOW | Ignition ON<br>Ignition feed is less than<br>–at 40°C = 7.3V<br>–at 90°C = 10.3V<br>–at 159°C = 11.7V<br>Engine speed > 1000 rpm<br>All conditions are met for 4 seconds | Maximum line pressure<br>2nd gear<br>No TCC<br>Inhibit 4th gear |
| 79<br>Trans Fluid Overtemp | No DTC 58<br>Trans Fluid Temp > 295°F (146°C)<br>Conditions are met for 30 minutes | HOT MODE<br>TCC in 2nd, 3rd or 4th |
| 81<br>2–3 Shift Solenoid Circuit | TCM command:<br>Solenoid ON and voltage stays HIGH<br>TCM command:<br>Solenoid OFF and voltage stays LOW<br>Lasts longer than 2 seconds | Maximum line pressure<br>No TCC<br>2nd or 3rd gear only |
| 82<br>1–2 Shift Solenoid Circuit | TCM command:<br>Solenoid ON and voltage stays HIGH<br>TCM command:<br>Solenoid OFF and voltage stays LOW<br>Lasts longer than 2 seconds | Maximum line pressure<br>2nd or 3rd gear only or 1st or 2nd gear only |
| 83<br>TCC PWM Circuit | TCM command:<br>Solenoid ON and voltage stays HIGH<br>TCM command:<br>Solenoid OFF and voltage stays LOW<br>Lasts longer than 2 seconds | No TCC<br>Inhibit 4th gear in HOT MODE |

Table 5: Malfunction Code and Defaults

| DTC | SETTING PARAMETER(S) | DEFAULT |
|---|---|---|
| 85<br>Undefined Ratio<br>Error | No DTC(s) 11, 22, 24, 28, 71, 72 or 87<br>TP >25%<br>Not in PARK, NEUTRAL or 4th gear<br>Engine speed > 7 mph (11 km/h)<br>Trans Ratio < 1.06 in. (2.7 cm) 1st or 2nd<br>Lasts longer than 2 seconds | 2nd gear<br>Maximum line pressure<br>No TCC |
| 86<br>Low Ratio<br>Error | No DTC(s) 21, 22, 24, 28, 72 or 74<br>Not in PARK, NEUTRAL or REVERSE<br>Engine > 300 rpm<br>TP > 25%<br>Vehicle speed > 7 mph (11 km/h)<br>Trans ratio < 1.06 in. (2.7 cm) 1st or 2nd<br>Lasts longer than 2 seconds | 2nd gear<br>Maximum line pressure<br>No TCC |
| 87<br>High Ratio<br>Error | No DTC 21, 22, 24, 28, 71, 72 or 74<br>TP > 25%<br>Not in PARK, NEUTRAL or REVERSE<br>Engine speed > 300 rpm<br>Vehicle speed 7 mph (2.7 cm) 1st or 2nd<br>Transmission temp > 68°F (20°C)<br>Trans gear ratio > 1.42 in 3rd or 4th<br>Lasts longer than 2 seconds | 2nd gear<br>Maximum line pressure<br>No TCC |

Table 6: Transmission Mechanical Diagnosis Guide

| PROBLEM | POTENTIAL CAUSE | CORRECTION |
|---|---|---|
| Fluid Leaking Out of Vent and/or Foaming | 1. Transmission overfilled. | 1. Drain excess fluid off through fill tube. Use suction gun and small diameter plastic or Teflon® tubing. |
| | 2. Wrong or contaminated fluid. | 2. Drain and change fluid and filter. May also be necessary to remove and drain converter. |
| | 3. Air entering fluid due to cross leakage at improperly seated pump cover or filter. | 3. Reseat filter. Remove transmission and reseat pump if necessary. |
| | 4. Transmission overheat caused by:<br>• low fluid level<br>• blocked fluid cooler<br>• high load-high ambient temperature operating<br>• converter clutch valve or spring failure<br>• converter stator locked (seized) and will not free wheel at coupling speed | 4. Correct low fluid level and check for leaks. Reduce engine/transmission load. Replace transmission if clutch valve or spring condition exists. replace plugged, damaged cooler. |
| Transmission Overheat | 1. Low fluid level. | 1. Add fluid and check for leaks. |
| | 2. Fluid cooler problem:<br>• Fins blocked with dirt, debris<br>• Cooler partially plugged<br>• Cooler (or lines) leaking | 2. Clean dirt/debris with water spray. Replace leaking or plugged cooler. Replace leaking cooler lines or fittings. |
| | 3. Converter clutch stuck in applied position. | 3. Replace converter. |
| | 4. Converter clutch valve, limit valve, enable valve or spring failure. | 4. Replace transmission. |
| | 5. Oil pump or body seal not seated causing cross leakage. May be accompanied by fluid foaming and leakage out vent. | 5. Remove pump and replace seal. Be sure pump body is properly seated. |
| | 6. Pressure regulator valve sticks in high demand position. | 6. Remove oil pump and free up valve. |
| | 7. Converter stator clutch seized (locked). Engine overheat may also occur. | 7. replace converter. |

Table 6: Transmission Mechanical Diagnosis Guide

| PROBLEM | POTENTIAL CAUSE | CORRECTION |
|---|---|---|
| Line Pressure Too High or Too Low | 1. Oil pump problem:<br>• Loose PCM connection<br>• Seals failed<br>• Gears damaged<br>• Bushing worn, scored<br>• Pressure regulator valve or spring fault<br>• Reverse/boost valve fault<br>• Pressure relief spring collapsed, broken<br>• Loose pump bolts<br>2. Pressure control solenoid failed OFF or ON.<br>3. TCM fault. | 1. Repair loose connection. Replace transmission if pump is damaged.<br>2. Replace solenoid.<br>3. Replace TCM. |
| Vehicle Creeps in Neutral | 1. Manual valve mispositioned or stuck.<br>2. Forward Clutch fault. | 1. Remove valve body and repair as needed.<br>2. Replace transmission. |
| Vehicle Moves in Park | 1. Manual linkage loose, damaged, misadjusted or disconnected.<br>2. Park pawl, spring or gear damaged. | 1. Repair or adjust linkage as required.<br>2. Inspect and replace pawl, spring or gear. |

Table 6: Transmission Mechanical Diagnosis Guide

| PROBLEM | POTENTIAL CAUSE | CORRECTION |
|---|---|---|
| Vehicle Will Not Move in Drive Range | 1. Low fluid level. | 1. Top off fluid level. If transmission now operates properly, locate and correct leaks. |
| | 2. Shift linkage misadjusted, disconnected or loose. | 2. Correct as required. |
| | 3. Pressure switch assembly fault. | 3. Replace switch assembly. |
| | 4. Low fluid pressure caused by oil pump fault:<br>• worn bushing<br>• failed seal<br>• broken gears<br>• loose bolts | 4. Remove pump and replace seal. Replace transmission of pump is damaged. |
| | 5. Transmission case seal or gasket failure. | 5. Locate and replace leaking gasket or seal. |
| | 6. Input or turbine shaft damage. (splines warn, shaft broken) | 6. Replace transmission if either shaft is damaged. |
| | 7. Roller clutch failure. | 7. Replace transmission |
| | 8. Torque converter hub damage. | 8. Replace converter. |
| | 9. Forward clutch problem:<br>• piston seal failure<br>• clutch plates burned, damaged or missing<br>• burned reaction plate<br>• worn teeth<br>• failed check ball | 9. Replace transmission. |
| | 10. Rear planetary gear set damage:<br>• broken pinions<br>• sun gear damage | 10. Replace transmission. |
| | 11. Park pawl spring broken. | 11. Replace spring. |
| | 12. Turbine shaft ball not seating. | 12. Replace transmission. |
| | 13. Main shaft splines damaged. | 13. Replace transmission. |

Table 6: Transmission Mechanical Diagnosis Guide

| PROBLEM | POTENTIAL CAUSE | CORRECTION |
|---|---|---|
| Vehicle Will Not Back Up (No Reverse) | 1. Low fluid level. | 1. Top off fluid. If vehicle now backs up. check and correct fluid leaks. |
| | 2. Shift linkage loose, misadjusted or damaged. | 2. repair linkage. |
| | 3. Reverse servo fault:<br>• misassembled<br>• Piston or seal damage | 3. Overhaul servo. |
| | 4. Rear band fault:<br>• wrong band apply pin<br>• Band worn | 4. Check and replace apply pin. |
| | 5. Direct clutch fault:<br>• worn, damaged clutch plates<br>• check ball leaking or missing | 5. Replace transmission. |
| | 6. Overdrive roller clutch failure. | 6. Replace transmission |
| | 7. Valve body fault:<br>• manual valve stuck, damaged<br>• Pressure switch failure | 7. Remove and free-up binding valves. Replace switch assembly if failed. Replace transmission if valve body bores are damaged. |
| Engine Stalls When Transmission is Shifted Into Gear | 1. Idle speed incorrect (too Low). | 1. Adjust idle speed on non-turbo diesel and gas engine models. Check PCM operation with scan tool on turbo diesel. |
| | 2. Torque converter clutch stuck in applied position or clutch is dragging. | 2. Check converter clutch valve and solenoid operation. If OK, replace converter. |
| | 3. Forward clutch seized. | 3. Replace transmission. |
| | 4. Fourth clutch seized or dragging. | 4. Replace transmission. |
| Slips in Drive/ Reverse | 1. Low fluid level. | 1. Top off fluid level and check for leaks. |
| | 2. Low fluid pressure. | 2. Check line pressure and overhaul pump if low. |
| | 3. Reverse servo seal failure (reverse range only). | 3. Overhaul servo. |
| No First Gear in Either D Range | 1. Low roller clutch failure (not attached or broken). | 1. Replace transmission. |
| | 2. Center support race, splines, or snap ring failure. | 2. Replace transmission. |
| | 3. Forward clutch problem. | 3. Replace transmission. |
| | 4. Overdrive roller clutch problem. | 4. Replace transmission. |
| | 5. shift solenoid fault (either solenoid). | 5. Check with scan tool and replace as needed |

Table 6: Transmission Mechanical Diagnosis Guide

| PROBLEM | POTENTIAL CAUSE | CORRECTION |
|---|---|---|
| No First gear in 1 range (Manual Low) | 1. Low roller clutch failure. | 1. Replace transmission. |
| | 2. Center support fault:<br>• race broken<br>• splines damaged<br>• snap ring not seated<br>• case damaged | 2. Replace transmission. |
| | 3. Forward clutch fault. | 3. Replace transmission. |
| | 4. Overdrive roller clutch failure. | 4. Replace transmission. |
| | 5. Rear band fault:<br>• band worn<br>• servo failure<br>• incorrect apply pin | 5. Replace transmission. |
| | 6. Shift solenoid fault. | 6. Check A and B solenoids with scan tool and repair as needed. |
| No Second Gear | 1. Overdrive roller or intermediate sprag clutch | 1. Replace transmission. |
| | 2. Center support problem:<br>• snap ring not seated<br>• splines or race damaged<br>• support bolt missing, damaged | 2. Replace transmission. |
| | 3. Intermediate clutch air bleed cup plug leaking or missing. | 3. Replace transmission. |
| | 4. Overrun clutch fault. | 4. Replace transmission. |
| | 5. Forward clutch fault. | 5. Replace transmission. |
| | 6. Intermediate clutch fault. | 6. Replace transmission. |
| | 7. Shift solenoid fault. | 7. Check with scan tool (both solenoids should be OFF). |

Table 6: Transmission Mechanical Diagnosis Guide

| PROBLEM | POTENTIAL CAUSE | CORRECTION |
|---|---|---|
| No Third Gear | 1. TCM/PCM ground wire fault. | 1. Repair bad connections. |
| | 2. No voltage to shift solenoid B (2–3). | 2. Locate and repair open in wire harness. |
| | 3. Shift solenoid fault. | 3. Test with scan tool (B should be ON and A should be OFF). Replace failed solenoid. |
| | 4. Direct clutch check ball stuck closed (partial apply and drag). | 4. Replace transmission. |
| | 5. Intermediate sprag clutch fault. | 5. Replace transmission. |
| | 6. Center support fault.<br>• snap ring not seated<br>• bolt missing or broken<br>• support worn or damaged | 6. Replace transmission. |
| | 7. Forward or direct clutch pack problem. | 7. Replace transmission. |
| No Overdrive Fourth Gear | 1. Shift solenoid A or B problem:<br>• loss of supply voltage<br>• shorted/open solenoid<br>• bad ground<br>• leaking O-ring | 1. Check and repair solenoid feed wiring. Replace either solenoid if open or shorted. Use a scan tool to check (both solenoids should be ON). |
| | 2. Pressure switch fault. | 2. Replace switch. |
| | 3. TCM ground fault. | 3. Repair bad ground connection. |
| | 4. Fourth clutch or overrun clutch failure. | 4. Replace transmission. |
| | 5. Forward and clutch or direct clutch failure. | 5. Replace transmission. |
| 1st and 4th Gear Only or Manual 2nd and 3rd | 1. Shift solenoid A stuck in OFF position. | 1. Replace solenoid. |
| | 2. Voltage supply wire to solenoid A is loose, shorted or open. | 2. Locate and repair wire problem. |
| | 3. Fault in TC< ground | 3. Locate and repair bad connection. |
| | 4. Filter plugged. | 4. Change fluid and replace filter. Replace transmission if filter is full of clutch material. |
| | 5. 2–3 shift valve stuck. | 5. Replace valve, spring or valve body if valve bore is damaged. |
| 1st and 2nd Gear Only | 1. Shift solenoid B stuck in OFF position or not connected to TCM. | 1. replace solenoid if seized. Repair wire connection to TCM if necessary. |
| | 2. Feed wire to shift solenoid B open or shorted. | 2. Repair wire or replace harness as required. |

Table 6: Transmission Mechanical Diagnosis Guide

| PROBLEM | POTENTIAL CAUSE | CORRECTION |
|---|---|---|
| No Torque (Drive) in 2md | 1. Worn or damaged intermediate sprag clutch. | 1. Replace transmission. |
| No Overrun Braking in 1st or 2nd | 1st:<br>1. Rear band or servo fault.<br>2. Main or output shaft damage.<br>3. Lo roller or sprag clutch fault.<br>2nd:<br>1. Front band worn, wrong apply pin or servo problem.<br>2. Direct clutch housing fault.<br>3. Overrun clutch fault.<br>4. Rear gear set problem. | 1st:<br>1. Replace transmission.<br>2. Replace transmission.<br>3. Replace transmission.<br>2nd:<br>1. Replace transmission.<br>2. Replace transmission.<br>3. Replace transmission.<br>4. Replace transmission. |
| 2nd and 3rd Gear Only in D Range | 1. Shift solenoid A in OFF position:<br>• Open voltage feed wire<br>• Bad TCM ground<br>• Solenoid seized<br>2. 1–2 shift valve fault. | 1. Repair solenoid feed or TCM ground wire as needed. replace solenoid if stuck closed.<br>2. Replace valve body if 1–2 valve is scored or spring has collapsed. |
| Coverter Clutch Will Not Release or Will Not Apply | 1. TCM or pulse width solenoid wiring fault (short, open, ground).<br>2. Fluid contamination.<br>3. Converter clutch solenoid fault.<br>4. Fault with converter clutch, enable, or limit valves.<br>5. TCM fault.<br>6. Converter clutch failure.<br>7. Brake switch inoperative.<br>8. Turbine shaft seal leak. | 1. Locate and repair wiring problem as needed.<br>2. Drain and change fluid and filter. Flush cooler and lines. replace converter.<br>3. Test with scan tool and replace if inoperative.<br>4. Remove oil pump and inspect valves (or pump body) if damaged. Smooth minor burrs, nicks with crocus cloth.<br>5 Test with scan tool and replace if fault is discovered.<br>6. Replace converter.<br>7. Replace switch if open or shorted<br>8. Replace transmission. |

Table 6: Transmission Mechanical Diagnosis Guide

| PROBLEM | POTENTIAL CAUSE | CORRECTION |
|---|---|---|
| Converter Clutch Slips or Soft Apply | 1. Low fluid level.<br>2. Fluid contaminated or wrong fluid.<br>3. Turbine shaft seal leak.<br>4. Oil pump bushing worn.<br>5. Low fluid pressure.<br>6. Converter clutch (pulse width) solenoid fault. | 1. Top off and check for leaks.<br>2. Drain and change fluid and filter. Flush cooler and lines.<br>3. Replace seals.<br>4. Replace bushing.<br>5. Test pressure and replace transmission of necessary.<br>6. Check solenoid wiring. If OK, replace solenoid. |
| Converter Clutch Apply Timing Incorrect | 1. Incorrect sensor input signal to TCM caused by inoperative sensor.<br>2. TCM problem. | 1. Test operation of all sensors with scan tool. Replace failed sensors as needed.<br>2. Test with scan tool. Repair wires or module as required. |
| Harsh shifts (All Drive Ranges) | 1. Pressure control solenoid stuck in off (de-energized) position.<br>2. Accumulator fault:<br>• Piston spring broken<br>• Piston seal damage<br>• Piston spring missing<br>• Cover bolts loose<br>• Gasket damaged<br>3. Valve body check ball missing or mispositioned.<br>4. Incorrect TCM calibration. | 1. Replace solenoid.<br>2. Overhaul accumulator.<br>3. Reposition check balls. Replace transmission if any check balls are missing.<br>4. Replace TCM. |
| Harsh engagement in Drive and Reverse | 1. High Idle speed.<br>2. Line pressure too high:<br>• Pressure control solenoid failed<br>• reverse/boost, or pressure regulator valve stuck<br>• accumulator spring or seal failure<br>•shift sensor failure<br>• missing valve body check ball | 1. Adjust idle or check TCM with scan tool on turbo diesel.<br>2. Test pressure control solenoid and sensors with scan tool and replace as needed. Repair accumulator spring, or pressure regulator valves as needed. |

### Coasting Downshifts

Table 7: Check Torque Converter Clutch Release

| VEHICLE SPEED | GEAR | ACTION | CONDITIONS TO OBSERVE |
|---|---|---|---|
| Coasting | 4th | Accelerate to 4th gear with TCC applied.<br>Release accelerator pedal and lightly apply brakes. | TCC releases.<br>Downshifts occur at speeds shown on the shift speed chart. |

### Manual Gear Range Selection

Upshifts in the manual gear range are controlled by the shift solenoids. Perform the following tests by accelerating at 10-15 percent TP Sensor.

Table 8: Manual Drive (D-Drive)

| VEHICLE SPEED | GEAR | ACTION | CONDITIONS TO OBSERVE |
|---|---|---|---|
| Vehicle Stopped | 3rd | Accelerate. | 1–2 shift.<br>2–3 shift.<br>TCC does not apply. |

Table 9: Manual Second (2)

| VEHICLE SPEED | GEAR | ACTION | CONDITIONS TO OBSERVE |
|---|---|---|---|
| Vehicle stopped | 2nd | Accelerate. | 1–2 shift. |
| 35 mph (56 km/h) | 2nd | Accelerate to 35 mph. (56 km/h) | 2–3 shift does not occur.<br>TCC does not apply. |

Table 10: Manual First (1)

| VEHICLE SPEED | GEAR | ACTION | CONDITIONS TO OBSERVE |
|---|---|---|---|
| Vehicle Stopped | 1st | Accelerate to 20 mph. (32 km/h) | No upshifts occur.<br>TCC does not engage. |

## TRANSMISSION SHIFT DIAGNOSIS

Table 11: Reverse (R)

| VEHICLE SPEED | GEAR | ACTION | CONDITIONS TO OBSERVE |
|---|---|---|---|
| Vehicle Stopped | Reverse | Accelerate slowly. | 1–2 solenoid in ON. |

Table 12: Throttle Angle vs. Speed (ESS or TOSS)

| GEAR CHANGE TPS% | 10% | 25% | 50% | 100% | 5–10% |
|---|---|---|---|---|---|
| Upshift 1–2 ±150 rpm | 455 | 600 | 1020 | 1260 | — |
| Upshift 2–3 ±200 rpm | 800 | 1210 | 1810 | — | — |
| Upshift 3–4 ±250 rpm | 1280 | 1400 | 2370 | — | — |
| Downshift 3–2 ±100 rpm | — | — | — | — | 650 |
| Downshift 2–1 ±100 rpm | — | — | — | — | 325 |

Table 13: 4–3 Downshift

| VEHICLE SPEED | GEAR | ACTION | CONDITION TO OBSERVE |
|---|---|---|---|
| 40–45 mph (64–72 km/h) | 4th | Release accelerator pedal while moving gear selector to D3. | TCC releases.<br>Transmission downshifts to 3rd gear immediately.<br>Engine slows vehicle down. |

Table 14: 4–2 Downshift

| VEHICLE SPEED | GEAR | ACTION | CONDITION TO OBSERVE |
|---|---|---|---|
| 40–45 mph (64–72 km/h) | 4th | Release accelerator pedal while moving gear selector to D2. | TCC releases.<br>Transmission downshifts to 2rd gear immediately.<br>Engine slows vehicle down. |

## TRANSMISSION SHIFT DIAGNOSIS

Table 15: 4-1 Downshift

| VEHICLE SPEED | GEAR | ACTION | CONDITION TO OBSERVE |
|---|---|---|---|
| 30 mph (48 km/h) | 4th | Release accelerator pedal while moving gear selector to D1. | TCC releases.<br>Transmission downshifts to 1rd gear immediately.<br>Engine slows vehicle down. |

### Elements In Use

Table 16: Clutch Application Chart

| | GEAR | 1-2 SHIFT SOLENOID A | 2-3 SHIFT SOLENOID B | FOURTH CLUTCH | OVERRUN CLUTCH | OVER DRIVE ROLLER CLUTCH | FORWARD CLUTCH | DIRECT BAND | FRONT BAND | INTERME-DIATE SPRAG CLUTCH | INTERME-DIATE CLUTCH | LO ROLLER CLUTCH | REAR BAND |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P-N | | ON | OFF | | | Holding | | | | | | | |
| R | Rev. | ON | OFF | | | Holding | | Applied | | | | | Applied |
| D | 1st | ON | OFF | | | Holding | Applied | | | * | | Holding | |
| | 2nd | OFF | OFF | | | Holding | Applied | | | Holding | Applied | Overrunning | |
| | 3rd | Off ON | | | | Holding | Applied | Applied | | Overrunning | Applied | Overrunning | |
| | 4th | ON | ON | Applied | | Overrunning | Applied | Applied | | Overrunning | Applied | Overrunning | |
| D | 1st | ON | OFF | | Applied | Holding | Applied | | | * | Applied | Overrunning | |
| | 2nd | OFF | OFF | | Applied | Holding | Applied | | | Holding | Applied | Overrunning | |
| | 3rd | OFF | ON | | Applied | Holding | Applied | Applied | | Overrunning | Applied | Overrunning | |
| 2 | 1st | ON | OFF | | Applied | Holding | Applied | | | * | | Holding | |
| | 2nd | OFF | OFF | | Applied | Holding | Applied | | Applied | Holding | Applied | Overrunning | |
| 1 | 1st | ON | OFF | | Applied | Holding | Applied | | | * | | Holding | Applied |

* Holding, but not effective – Solenoid operation follows a shift pattern dependent on vehicle speed and throttle position and not gear range.

ON= Solenoid energized

OFF=Solenoid de-energized

### ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK/TCM

## CAUTION

**Do not disconnect battery before running any test on the transmission.**

**Circuit Description:** The "On-Board Diagnostic (OBD) System Check" is an organized approach to identifying a problem created by a TCM system malfunction. It must be the starting point for any driveability complaint diagnosis. This will direct the service technician to the next logical step in diagnosing the problem. Understanding the chart and using it properly will reduce diagnostic time and prevent the unnecessary replacement of good parts.

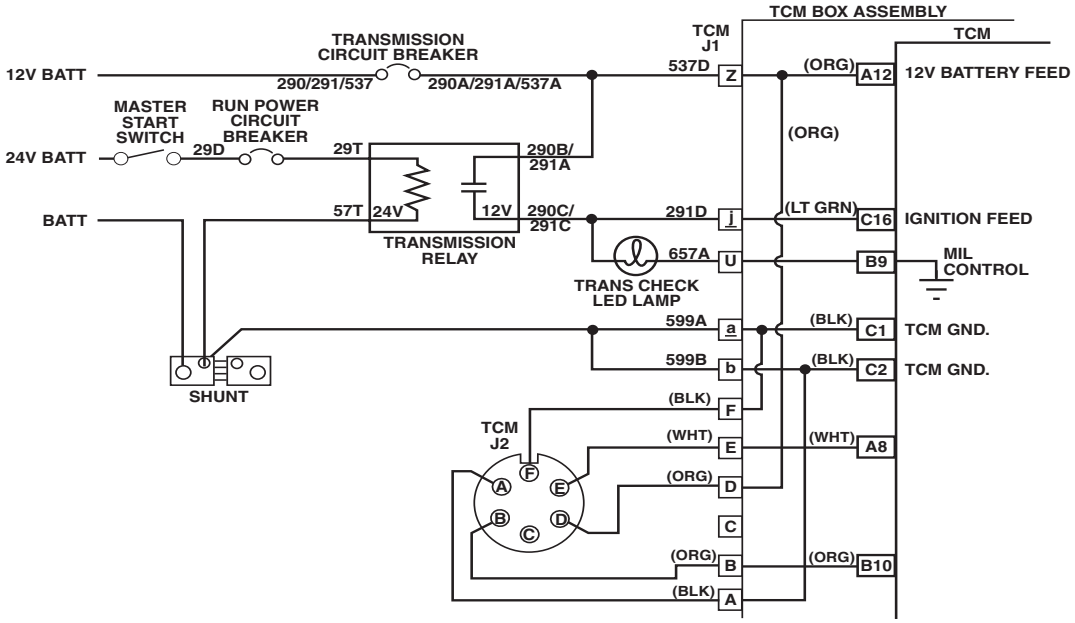
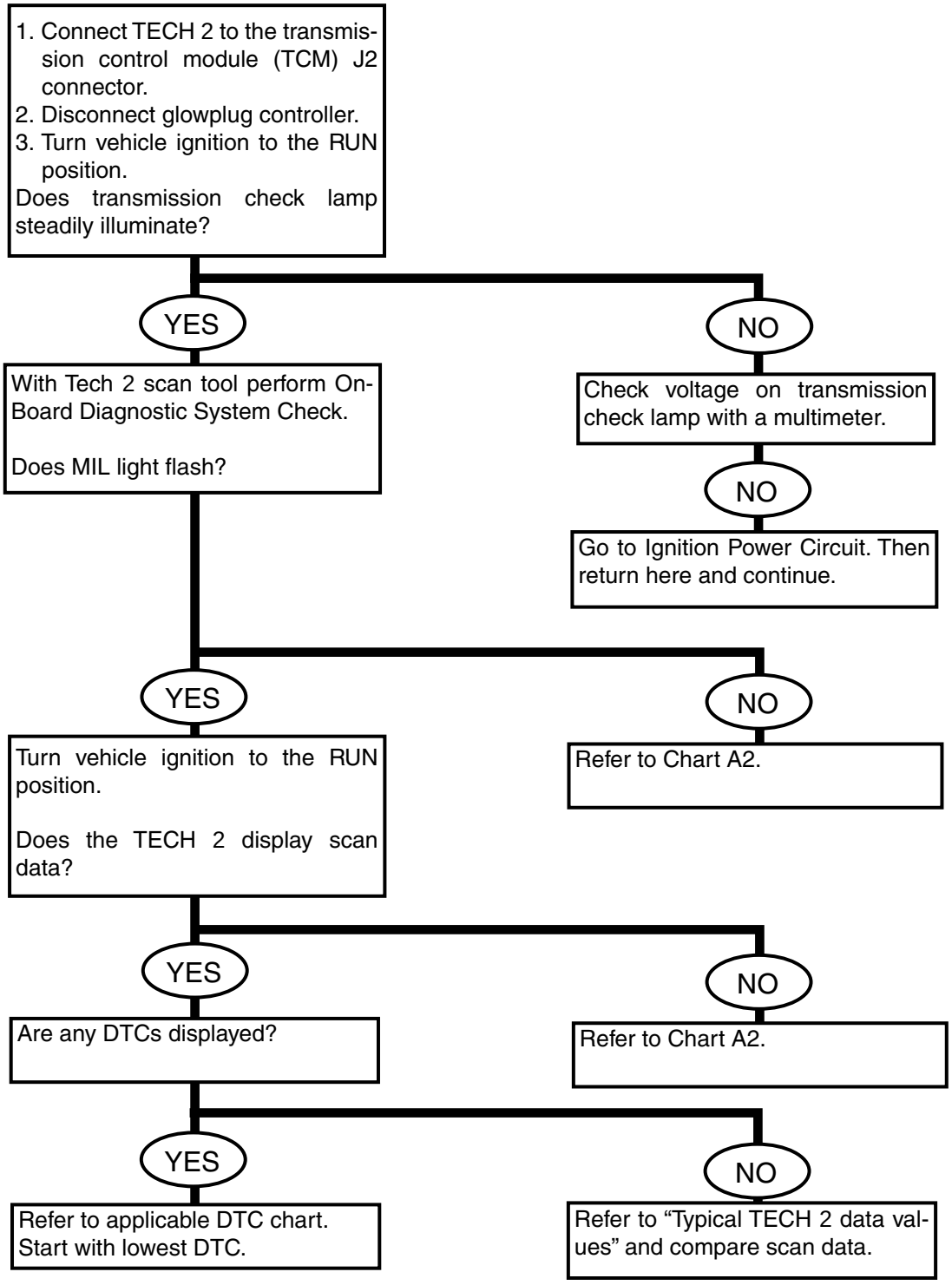



**Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. When the ignition switch is cycled to "ON," the MIL should turn "ON" and remain "ON." (steady) This sequence will determine that the vehicle diagnostics are operational.
2. This step will isolate if the complaint is a MIL or transmission problem.
3. Although the TCM is powered up, a symptom could exist because of a system fault.
4. Use of a Tech 2 or Diagnostic Switch Cable to diagnosis serial data must be available. If a PROM error is present, the TCM may have been able to flash DTC 12/51, but not enable serial data.
5. This step will isolate if the customer complaint is a MIL or transmission problem with no MIL. Refer to "Diagnostic Trouble Code Identification" on page 55 for a list of valid DTCs. An invalid DTC may be the result of a faulty scan tool, diagnostic switch cable, PROM or TCM.
6. Comparison of actual control system data with the typical Tech1 data values is a quick check to determine if any parameter is not within limits.

## ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK/TCM (USING A TECH 2 SCAN TOOL)



**ON-BOARD DIAGNOSTIC (OBD) SYSTEM CHECK/TCM (WITH A DIAGNOSTIC SWITCH CABLE)**

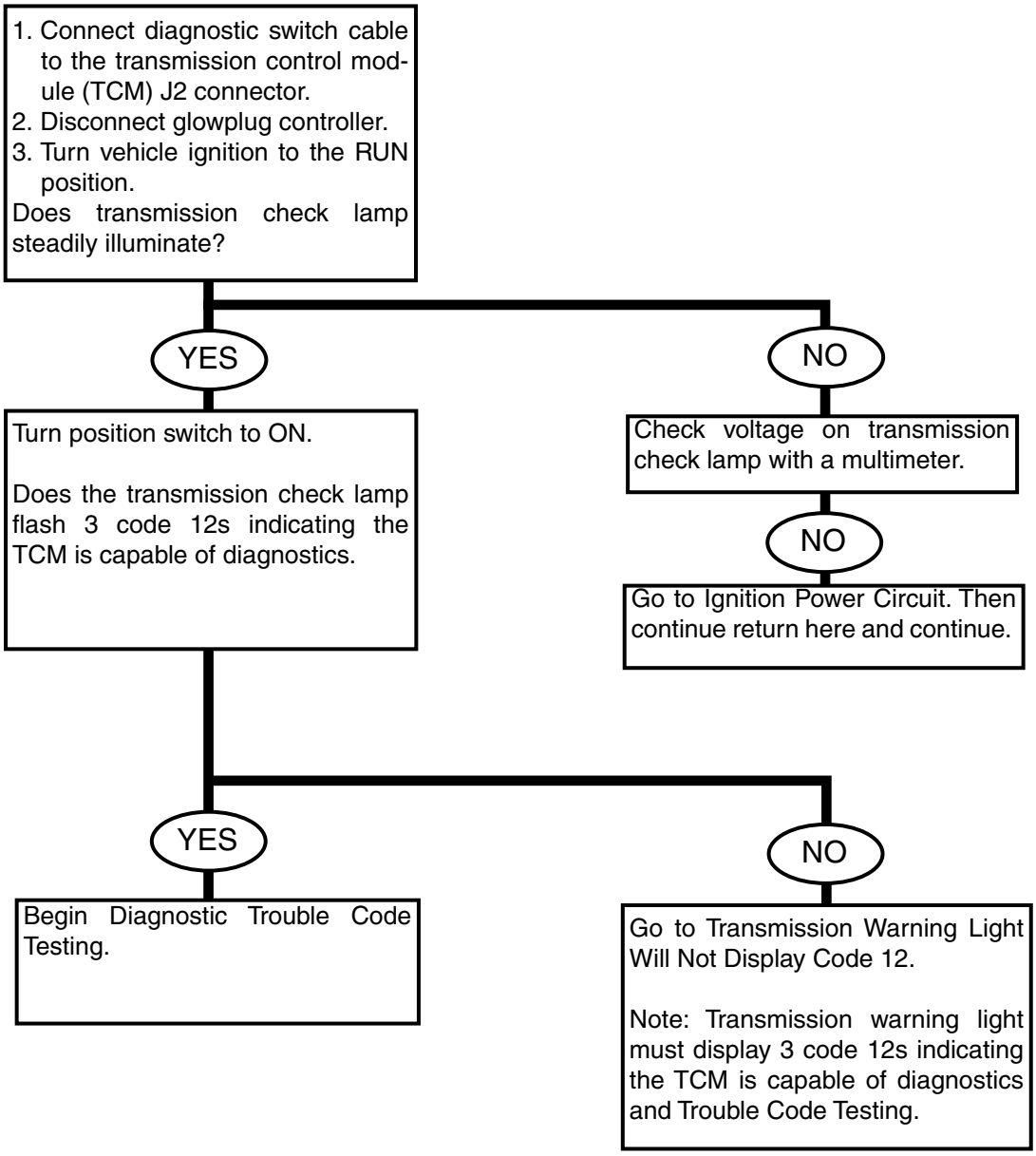
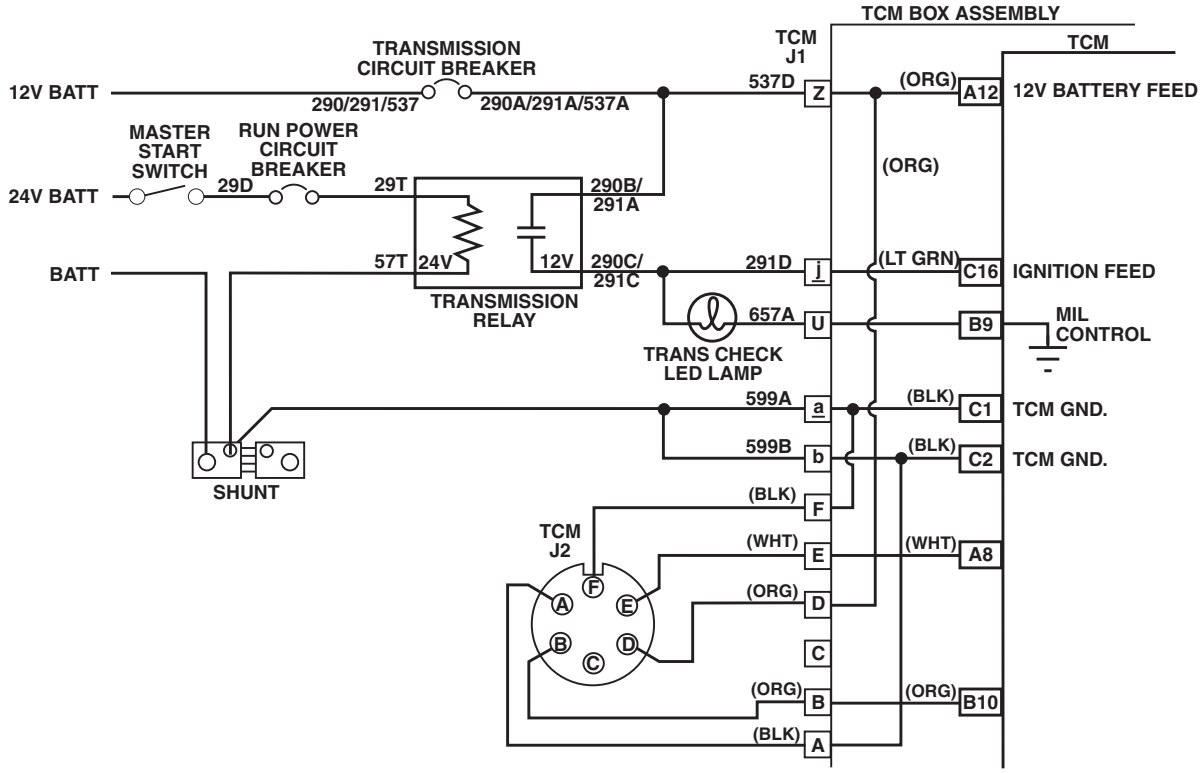


**CHART A-1 NO MALFUNCTION INDICATOR LAMP (MIL)**

**CIRCUIT DESCRIPTION:** There should always be a steady Malfunction Indicator Lamp (MIL) with the run switch "ON" and engine "OFF." Switched battery voltage is supplied to the lamp. The TCM will control the lamp and turn it "ON" by providing a ground path through CKT 657.




1. If there is a circuit open, refer to "TCM Wiring Diagram" for complete circuit.
2. Using a test light connected to 12 volts, probe each of the system ground circuits and check that a good ground is present. Refer to "Terminal End View" in this section for TCM pin locations of ground circuits.

**DIAGNOSTIC AIDS:**

Check for:

- Faulty light bulb.
- Wire 657 open.
- Transmission Circuit Breaker open.
- Battery 537B to TCM open.
- Battery 290C to Transmission Circuit Breaker open.

**CHART A-1 NO MALFUNCTION INDICATOR LAMP (MIL)**

**NOTE**

**The transmission check lamp is next to the shift lever marked TRANS-ONLY.**

Ignition ON, engine OFF and glow plug controller disconnected.

Remove diagnostic switch cable or TECH 2. Install jumper cable between pins A and E of J2 on TCM assembly.

Is transmission check lamp flashing DTC 12?

NO

- Turn ignition OFF.
- Remove jumper wire.
- Disconnect TCM connector.
- Turn Run Switch to ON.

Is transmission Check Lamp On?

NO

- Ignition OFF.
- TCM J2 pin (E) is not grounded.
- Reconnect TCM J1 connector.
- Turn ignition ON and engine OFF.
- Probe pin E on J2 to ground with jumper wire.

Is transmission check lamp flashing?

NO

Open circuit pin A J2.
Replace TCM.

YES

System OK
End of Test.

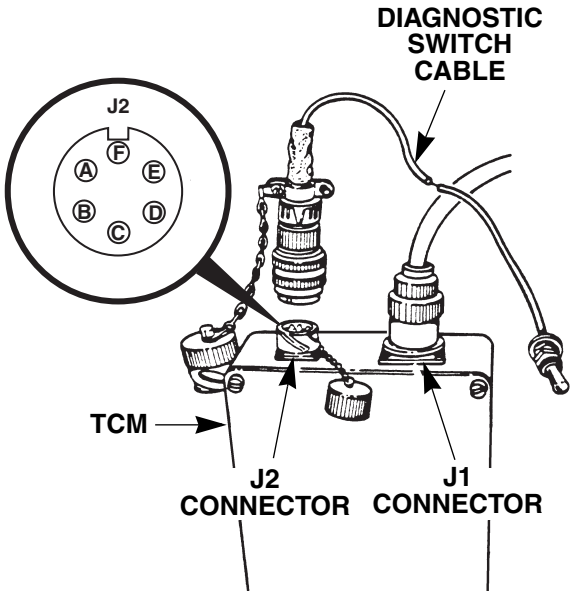
YES

Check diagnostics cable for open and repair.

Read code and remove jumper.

YES

Repair short to ground in circuit 657A.

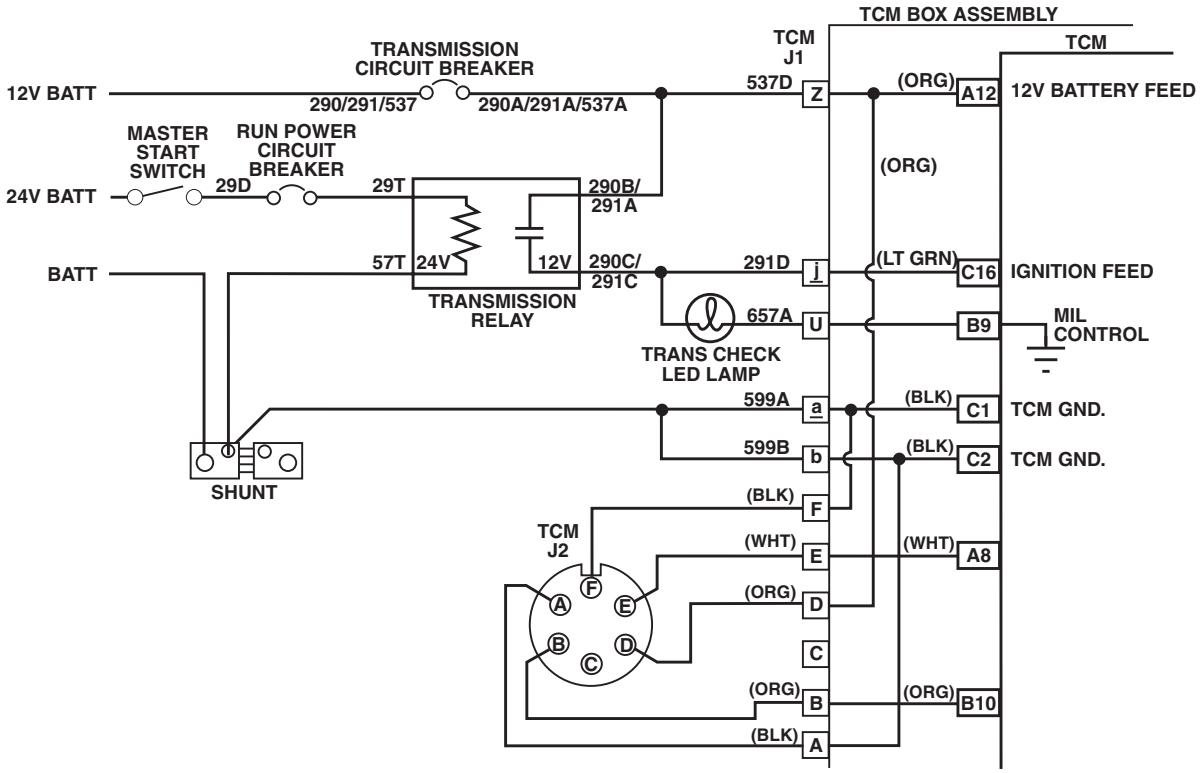



## NOTE

**After troubleshooting, reconnect glowplug controller. vehicle will have to be operated in order for TCM to receive trouble codes. After repairs, check trans lamp operation.**

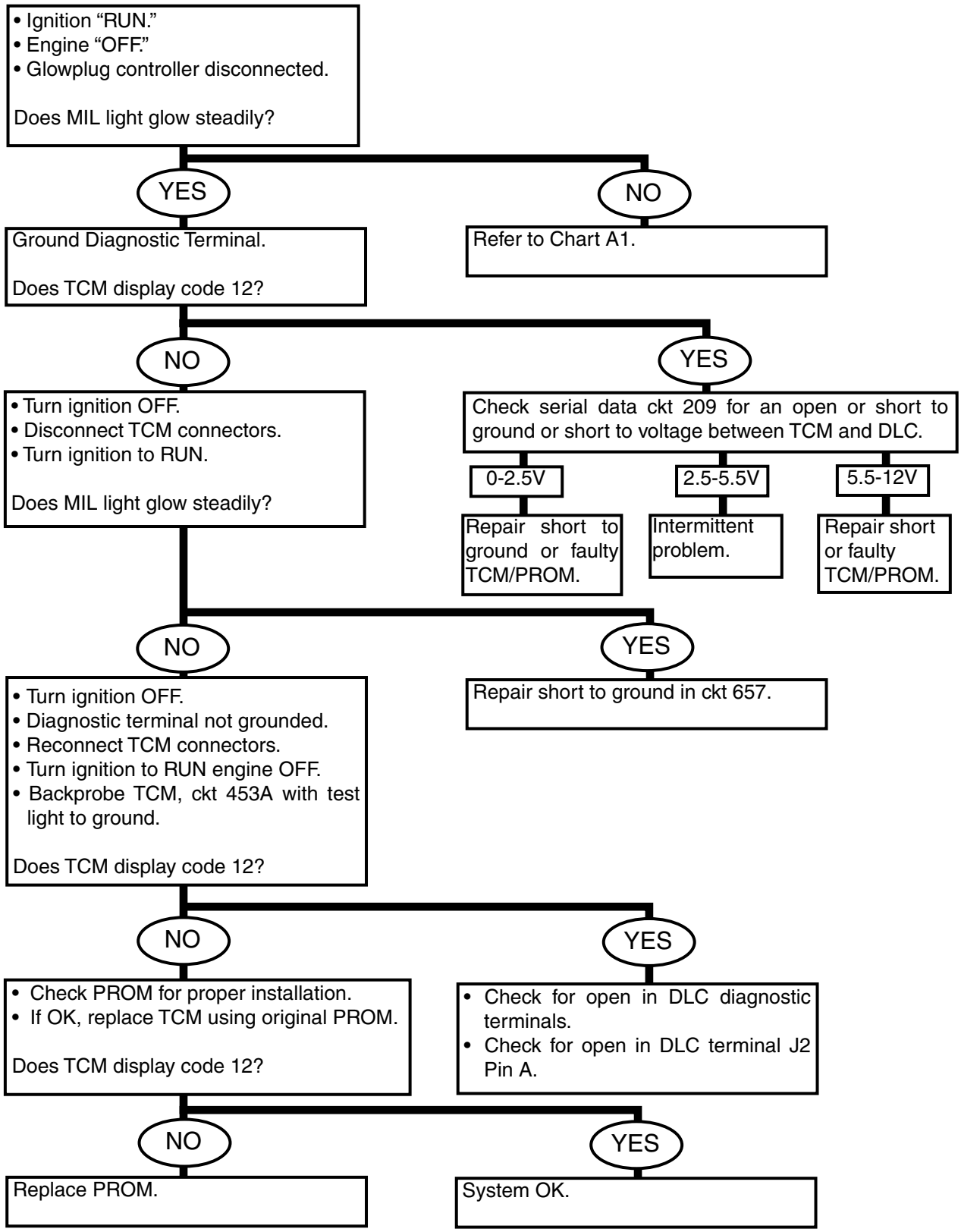
**CHART A-2 NO DATA LINK CONNECTOR (DLC) DATA WILL NOT DISPLAY DIAGNOSTIC TROUBLE CODE (DTC) 12, OR MALFUNCTION INDICATOR LAMP (MIL) "ON" STEADY**

**CIRCUIT DESCRIPTION:** There should always be a steady Malfunction Indicator Lamp (MIL) with the run switch "ON" and engine "OFF." Switched battery voltage is supplied to the lamp. The TCM will control the lamp and turn it "ON" by providing a ground path through CKT 657A. With the "Diagnostic" terminal grounded, the lamp should display a DTC 12, followed by any Diagnostic Trouble Code (DTC) stored in memory. A steady lamp indicates a short to ground in the lamp control 657B or an open in diagnostic test wire in the TCM.




1. If there is a problem with the TCM that causes a scan tool not to read serial data, then the TCM should not display a DTC 12. If DTC 12 does display, check that the scan tool is functioning properly on another vehicle. If the scan tool is functioning properly, and CKT 209 is OK, the PROM or TCM may be at fault for the NO DLC symptom.
2. If the lamp turns "OFF" when the TCM connector is disconnected, then CKT 657 is not shorted to ground.
3. This step will check for an open diagnostic CKT 453.
4. At this point, the MIL wiring is OK. The problem is a faulty PROM. If DTC 12 does not display, the TCM should be replaced using the original PROM. Replace the PROM only after trying a TCM. A defective PROM usually is an unlikely cause of the fault.

**CHART A-2 NO DATA LINK CONNECTOR (DLC) DATA WILL NOT DISPLAY DIAGNOSTIC TROUBLE CODE (DTC) 12, OR MALFUNCTION INDICATOR LAMP (MIL) "ON" STEADY**



Once the On-Board Diagnostic (OBD) system check is completed and the TECH 2 diagnostics function properly with DTC(s) displayed, the “Transmission Tech 2 Values” may be used for comparison with values obtained on the vehicle being diagnosed. The “Transmission Tech 2 Values” are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would display.

## NOTE

**A SCAN TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY SCAN TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.**

Only the parameters listed below are used in this manual for diagnosing. If a scan tool displays other parameters, the values are not recommended by AM General for use in diagnosing. For further description on parameters, the values and use of the Tech 2 to diagnose TCM inputs, refer to “Data Definitions”.

Table 17: **Transmission TECH 2 Values**

Idle / Lower Radiator Hose Hot / Closed Throttle / Park or Neutral / Accessories Off

| SCAN POSITION | UNITS DISPLAYED | TYPICAL DATA VALUE |
|---|---|---|
| Trans Input Speed | RPM | ±50-75 RPM of Engine Speed |
| Trans Output Speed | RPM | 0 RPM |
| Engine Speed | RPM | 700±25 RPM |
| A/B/C Range | OFF/ON | On/Off/On |
| Trans Range Sw | Invalid, Rev,Park/Neut<br>Drive 4,3,2, Low, Park/Neut | |
| Current Gear | 1-4 | 1 |
| 1-2 Sol 2-3 Sol | Off-On | Off–On |
| Trans Gear Ratio | Ratio | 0.00 to 1 |
| Desired PCS | Amps. | 1.01 Amps |
| Actual PCS | Amps. | 1.01 Amps |
| PCS Duty Cycle | Percentage | 0% |
| TCC Brake Switch | Open/Closed | Closed |
| Eng Cool Temp | Not Avail | |
| Trans Fluid temp | C°/F° | 82°–94°C (180°–200°F) |
| Throttle Angle | Percentage | 0% |
| Throttle Position | Volts | 0.3–0.9V |
| TCC PWM Solenoid | Percentage | 0% |
| TCC Slip Speed | RPM | ±50 RPM of Engine Speed |
| 1-2 Shift Time | Seconds | 0 |
| 2-3 Shift Time | Seconds | 0 |
| Turbine Speed | RPM | ±50 RPM of Engine Speed |
| Trans Calib ID | 0-65535 | Internal ID (7359) Typical |
| System Voltage | Volts | 12.0–14.5V |

**TRANS INPUT SPEED.** Scan tool displays 0 RPM to 8,191 RPM. This parameter indicates the rotational speed of the transmission input shaft expressed as revolutions per minute.

**TRANS OUTPUT SPEED.** Scan tool displays 0 RPM to 8,191 RPM. This parameter indicates the rotational speed of the transmission output shaft expressed as revolutions per minute.

**ENGINE SPEED.** Scan tool displays 0 RPM to 8,191 RPM. This parameter indicates the rotational speed of the engine expressed as revolutions per minute.

**A/B/C RANGE (RNG).** Scan tool displays "ON"/"OFF," "ON"/"OFF," "ON"/"OFF." These parameters are the three inputs from the transmission range pressure switch assembly. "OFF" represents a 0 voltage signal.

**TRANS RANGE SWITCH (SW).** Scan tool displays a range of invalid, Park/Neutral, Reverse, Drive 4, Drive 3, Drive 2, and Low. This parameter is the decoded status of the three A/B/C range inputs from the transmission range pressure switch assembly and represents the position of the transmission manual valve.

**CURRENT GEAR.** Scan tool displays a range of 1, 2, 3 or 4. This parameter is the decoded commanded state of the 1-2 and 2-3 shift solenoids.

**1-2 SOLENOID (SOL) / 2-3 SOLENOID (SOL).** Scan tool displays "ON"/"OFF." These parameters are the commanded status of the 1-2 and 2-3 shift solenoids. "ON" represents a commanded energized state (current flowing through solenoid). "OFF" represents a commanded non-energized state (current not flowing through solenoid).

**TRANS GEAR RATIO.** Scan tool displays a range of 0.00 to 5.00. This parameter is the difference between input speed and output speed.

**DESIRED PRESSURE CONTROL SOLENOID (PCS).** Scan tool displays a range of 0.00 amp to 1.10 amps. This parameter is the commanded current of the pressure control solenoid circuit. A measurement of 0.00 amps (no current flow) indicates commanded higher line pressure. A measurememt of 1.10 amps (high current flow) indicates commanded lower line pressure.

**ACTUAL PRESSURE CONTROL SOLENOID (PSC).** Scan tool displays a range of 0.00 amp to 1.10 amps. This parameter is the actual current of the pressure control solenoid circuit at the TCM. A measurement of 0.00 amps (no current flow) indicates actual higher line pressure. A measurement of 1.10 amps (high current flow) indicates actual lower line pressure.

**PRESSURE CONTROL SOLENOID (PCS) DUTY CYCLE.** Scan tool displays a range of 0% to 100%. This parameter is the commanded state of the pressure control solenoid expressed as a percent of energized on-time. A measurement of 0% indicates zero on-time (non-energized) or no current flow. A meausrement of100% indicates maximum on-time (energized) or high current flow.

**TCC BRAKE SWITCH.** Scan tool displays OPEN/CLOSED. This parameter indicates the state of the TCC brake switch circuit input. Applied indicates a 0 voltage input (brake switch open, brake pedal applied). Released indicates a B+ voltage input (brake switch closed, brake pedal released).

**TRANS FLUID TEMP.** Scan tool displays a range of –40°C to 151°C, –40°F to 304°F. This parameter is the input signal of the transmission fluid temperature sensor. Transmission fluid temperature is high (151°C) when signal voltage is low (0 volt), and transmission fluid temperature is low (-40°C) when signal voltage is high (5 volts).

**THROTTLE ANGLE.** Scan tool displays a range of 0% to 100%. This parameter indicates the signal input of the throttle position sensor circuit. 0% throttle angle (low voltage) indicates closed throttle, 100% throttle angle (high voltage) indicates wide open throttle.

**THROTTLE (THROT) POSITION.** Scan tool displays a range of 0.00 volt to 5.10 volts. This parameter indicates the signal input of the throttle position sensor circuit. Low voltage (approximately .3V to 1.3V) indicates closed throttle, high voltage (approximately greater than 4.5V) indicates wide open throttle.

**TCC PWM SOLENOID.** Scan tool displays a range of 0% to 100%. This parameter is the commanded percentage of “ON˜” time of the TCC solenoid. 100% represents an “ON” (energized) command state. 0% represents (non-energized) command state.

**TCC SLIP SPEED.** Scan tool displays a range of -4096 RPM to +4095 RPM. This parameter is the difference between transmission input speed and engine speed. A negative value indicates engine speed is less than input speed (deceleration). A positive value indicates engine speed is greater than input speed (acceleration). A value of zero indicates input speed is equal to engine speed (TCC applied).

**1-2 SHIFT TIME.** Scan tool displays a range of 0.00 seconds to 6.38 seconds. This parameter is the actual time of the last 1-2 shift.

**2-3 SHIFT TIME.** Scan tool displays a range of 0.00 seconds to 6.38 seconds. This parameter is the actual time of the last 2-3 shift.

**TURBINE SPEED.** Scan tool displays a range of 0 RPM to 8191 RPM. This parameter indicates rotational speed of the turbine shaft.

**TRANS CALIBRATION (CALIB) ID.** Scan tool displays a four digit identification of the software calibration.

**SYSTEM VOLTAGE.** Scan tool displays 0.00 volt to 25.5 volts. This parameter is the battery ignition voltage input to the TCM.

# 4L80-E TCM Diagnostic Code Retrieval

**(using a Diagnostic Switch Cable)**

1. **Connect the Diagnostic Switch Cable to the J-2 connector on the Transmission Control Module protective Box.**

2. **Disconnect the Glow Plug Controller.**

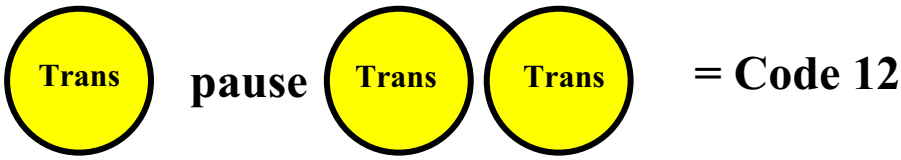
**Note: The Diagnostic Switch Cable switch has three positions:**
- **a. Center: Diagnostic Mode OFF.**
- **b. Left or Right: Diagnostic Mode ON.**

3. **Turn the Diagnostic Switch Cable switch to the ON position.**

4. **Turn the vehicle ignition switch to the Run position.**

5. **Observe the Check transmission Light located next to the shifter.**

6. **The light should flash a code 12 three times in the beginning. this indicates that the TCM is in Diagnostic Mode. (see below)**




7. **Any code that flashes after the Code 12 is a Diagnostic Trouble Code. Refer to page 28 or 55 of Supplement 7 for a DTC listing. NOTE: All codes will flash three times.**

8. **Once all of the codes have flashed, the Code 12 will flash again, indicating the end of code list.**

# 4L80-E TCM Diagnostic Code Retrieval

**(using a jumper wire)**

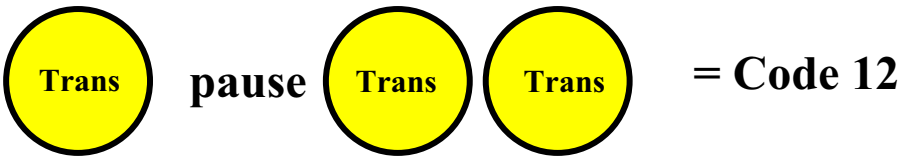
1. **Place a jumper wire across pins A & E of the J-2 connector on the Transmission Control Module protective Box.**

2. **Disconnect the Glow Plug Controller.**

3. **Turn the vehicle ignition switch to the Run position.**

4. **Observe the Check transmission Light located next to the shifter.**

6. **The light should flash a code 12 three times in the beginning. This indicates that the TCM is in Diagnostic Mode. (see below)**




7. **Any code that flashes after the Code 12 is a Diagnostic Trouble Code. Refer to page 28 or 55 of Supplement 7 for a DTC listing. NOTE: All codes will flash three times.**

8. **Once all of the codes have flashed, the Code 12 will flash again, indicating the end of code list.**

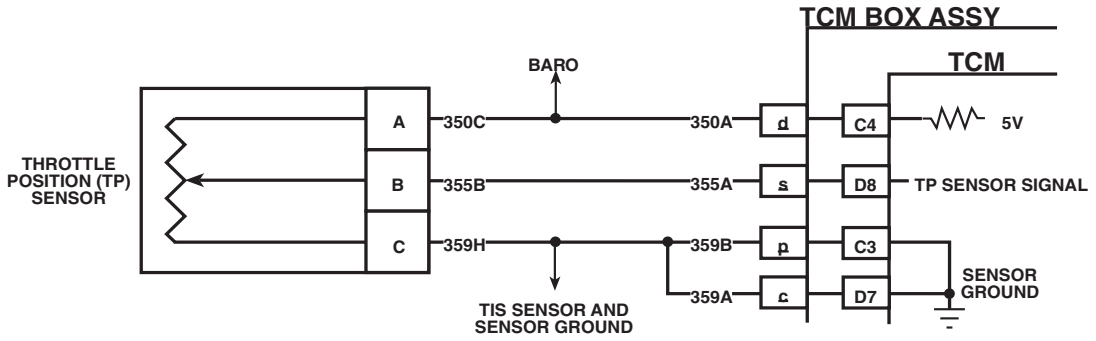
## TROUBLESHOOTING WITH A TECH 2 AND DVOM

Table 18: Diagnostic Trouble Codes

| DTC | MALFUNCTION | |
|---|---|---|
| 21 | Throttle Position (TP) sensor circuit high | Page 62 |
| 22 | Throttle Position (TP) sensor circuit low | Page 62 |
| 24 | Vehicle Speed Sensor (VSS)/(TOSS) circuit low | Page 67 |
| 28 | Transmission Range (TR) pressure switch circuit | Page 70 |
| 37 | Torque Converter Clutch (TCC) brake switch stuck ON | Page 73 |
| 38 | Torque Converter Clutch (TCC) brake switch stuck OFF | Page 73 |
| 39 | Torque Converter Clutch (TCC) Solenoid stuck OFF | Page 76 |
| 51 | Programmable read only memory (PROM) error | Page 79 |
| 52 | System voltage (BATT) high long (length of time) | Page 80 |
| 53 | System voltage (BATT) high | Page 80 |
| 58 | Transmission Fluid Temp (TFT) circuit low | Page 82 |
| 59 | Transmission fluid temp (TFT) circuit high | Page 86 |
| 68 | Transmission component slipping | Page 89 |
| 69 | Torque converter clutch (TCC) stuck ON | Page 91 |
| 71 | Engine Speed Sensor (ESS) | Page 93 |
| 72 | Vehicle speed sensor (VSS)/(TOSS) circuit open | Page 96 |
| 73 | Pressure control solenoid (PCS) circuit | Page 99 |
| 74 | Transmission input speed sensor (TISS) circuit | Page 102 |
| 75 | System voltage (BATT) low | Page 105 |
| 79 | Transmission fluid overtemp | Page 109 |
| 81 | 2-3 shift solenoid circuit fault | Page 113 |
| 82 | 1-2 shift solenoid circuit fault | Page 116 |
| 83 | Torque converter clutch (TCC PWM) solenoid circuit fault | Page 119 |
| 85 | Undefined ratio error | Page 122 |
| 86 | Low ratio error | Page 124 |
| 87 | High ratio error | Page 126 |

## DTC 21/22 THROTTLE POSITION (TP) SENSOR CIRCUIT LOW/ THROTTLE POSITION SENSOR CIRCUIT HIGH

**Circuit Description:** The TP sensor contains a resistor strip with one end connected to a 5 volt supply and the other to ground. The signal circuit is connected to a movable contact within the TP sensor. As the accelerator pedal is applied, the voltage signal will increase from approximately **.5 volt to 4.5 volts.**




**DTC 22 Will Set When:**

- Engine operating.
- TP sensor signal voltage less than .2 volt.
- Conditions met for one second.

**Action Taken (TCM will default to):**

- Maximum line pressure.
- Use 35% throttle as default.
- Inhibit 4th gear if in hot mode.

**DTC 21 Will Set When:**

- Engine operating.
- TP sensor signal voltage greater than 4.9 volts.
- Conditions met for one second.

**DTC 21/22 Will Clear When:** Fault condition(s) are removed, and the ignition is cycled "OFF" then "ON."

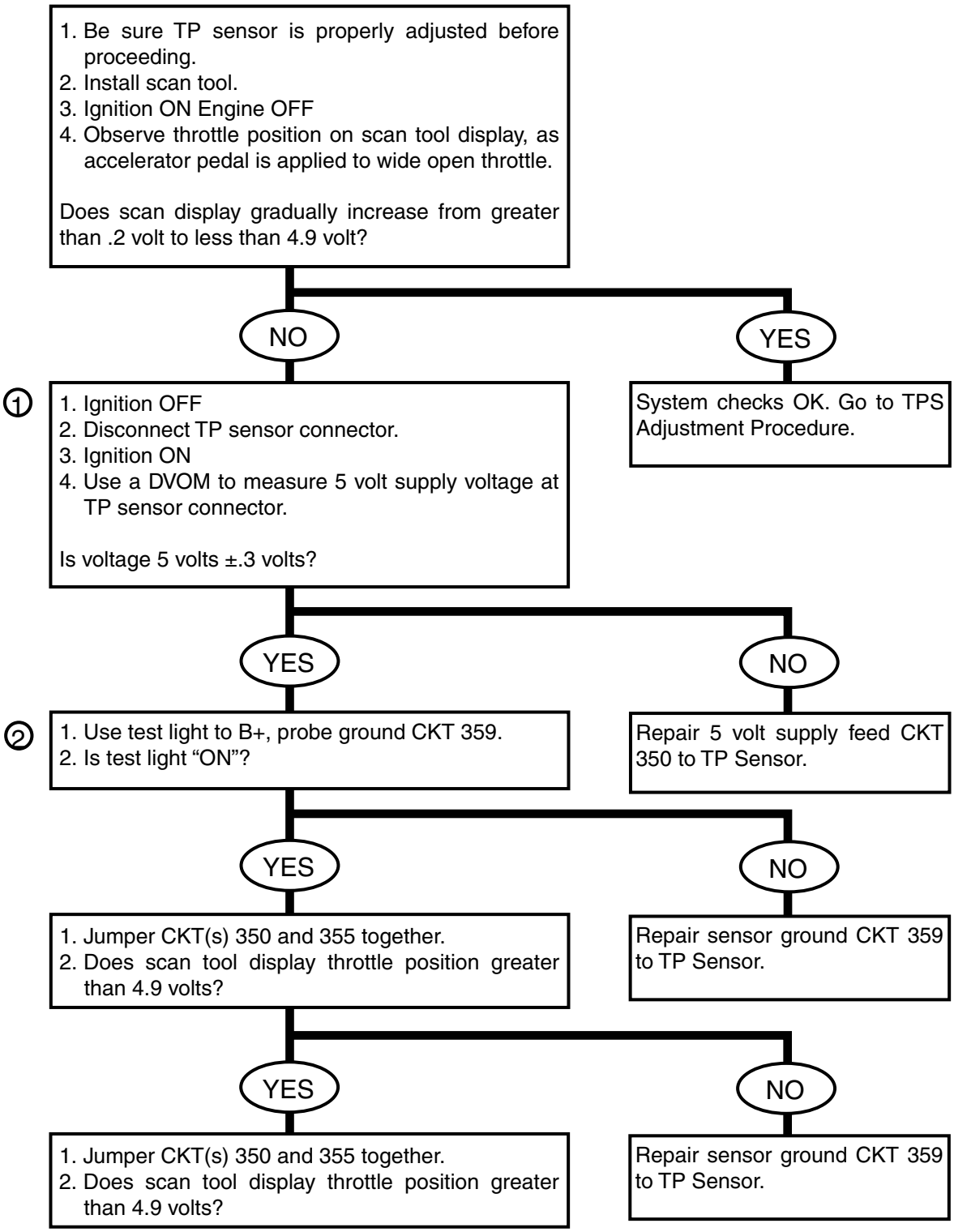
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for the presence of 5 volts at the TP sensor.
2. Scan tool should display the 5 volts reference to the TCM.

**Diagnostic Aids:**

- The TP sensor voltage should increase smoothly as the accelerator pedal is applied.
- If an intermittent is suspected check terminal tension at TP sensor and TCM. Also, use snapshot mode on scan tool to trigger on this DTC.

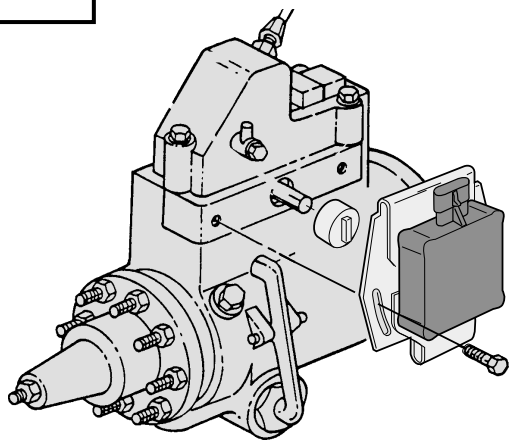
## DTC 21/22 THROTTLE POSITION (TP) SENSOR CIRCUIT LOW/ THROTTLE POSITION SENSOR CIRCUIT HIGH (USING A TECH 2 SCAN TOOL)




When all diagnosis and repairs are completed, clear DTC(s) and verify proper operation.

## DTC 21/22 THROTTLE POSITION (TP) SENSOR CIRCUIT DIAGNOSTICS (USING A DVOM)

Check for continuity from pin s wire 255A of TCM J1 to pin B wire 355B wire at TPS harness connector.



YES

Check for continuity from pin c wire 359A of TCM J1 to pin C wire 359H of TPS harness connector at TPS.

NO

Repair wire 355A.

YES

Check for continuity from pin d wire 350A of TCM J1 to pin A wire 350C of TPS harness connector at TPS.

NO

Repair wire 359A/359G.

YES

Vehicle wiring is OK. Go to the TPS adjustment procedure to determine whether the TPS or the adjustment is faulty.

NO

Repair wire 350A/350C.

## Throttle Position Sensor Adjustment

1. Disconnect the throttle position sensor wiring harness connector at the throttle position sensor.
2. Disconnect the three pin body harness connector containing wires numbered (350C, 355B and 359C) near the rear of the left cylinder head.
3. Install the **throttle position sensor test cable** between the two points disconnected in 1 and 2 below. (View A).

**NOTE**

**Disconnect glow plug controller.**

4. Turn the ignition switch to the RUN position.
5. Connect a multimeter to test leads **A** and **C** (View A) of the test cable and measure the voltage.

**NOTE**

**If voltage is below 4.90 or above 5.2 volts replace TCM.**

Multiply the voltage by 0.33 to obtain the desired throttle position sensor voltage. Retain calculated voltage to use in step 8a.
**Example: 5.05 volts times 0.33 equals 1.66 (plus or minus 0.01 volt) or 1.64 - 1.66.**

6. Install a gauge block **0.646 in. thickness** (16.5mm) between the fuel injection pump throttle lever stop screw and the casing boss on the pump housing. (View B).

**VIEW A**

**VIEW B**

7. Rotate the fuel injection pump throttle lever so that the maximum speed stop screw holds the guage block against the housing boss.

**NOTE**

**Keep the throttle lever in this position during the remainder of the adjustment steps.**

8. Measure the voltage between test leads B and C of the test cable.

   a. If the measured voltage is within the calculated specification, as indicated in step 5, reconnect the throttle position sensor. No adjustment is necessary.

   b. If the voltage is not within the calculated specification, go to step 9.

9. Loosen the TP sensor mounting screws and rotate it toward the rear of the vehicle (counter-clockwise direction).

10. With the voltmeter connected to leads **B** and **C** of the test cable, rotate the sensor slowly toward the front of the vehicle (clockwise direction) until the voltmeter indicates the correct voltage determined in step 5 above (1.64 to 1.66 volts, for example).

11. Tighten the two TP sensor mounting screws and confirm that the adjustment did not change.

12. Remove gauge block and push throttle to wide open position. Confirm that voltage is **4.5 to 4.6 volts**. If not, check to see if throttle is fully opening. If not repair.

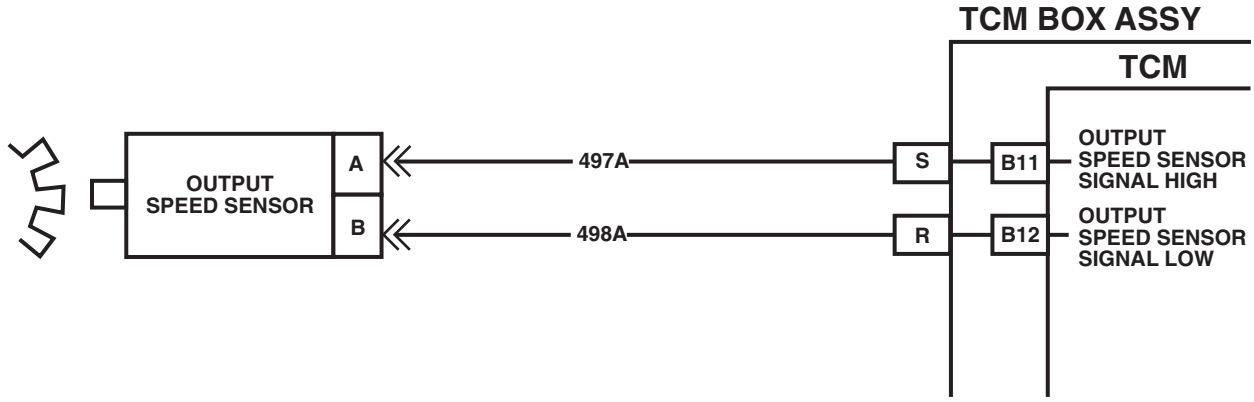
13. Remove the test jumper cable.

14. Remove the guage block set.

15. Reconnect the throttle position sensor wiring harness.

### DTC 24 TRANSMISSION OUTPUT SPEED SENSOR (TOSS) CIRCUIT LOW

**Circuit Description:** The output speed sensor circuit consists of a magnetic induction type sensor, and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the TCM which compares the signal to TP sensor volts for shift timing.




**DTC 24 Will Set When:**

- No DTC(s) 21, 22, 28, 33, or 34.
- Not in P/N.
- CKT 497 voltage is constant.
- Engine speed is greater than 3000 RPM.

**Action Taken (TCM will default to):**

- Second gear only.
- Maximum line pressure.
- Output speed is less than 200 RPM.
- TP is between 10% and 100%.
- All conditions are met for 3 seconds.

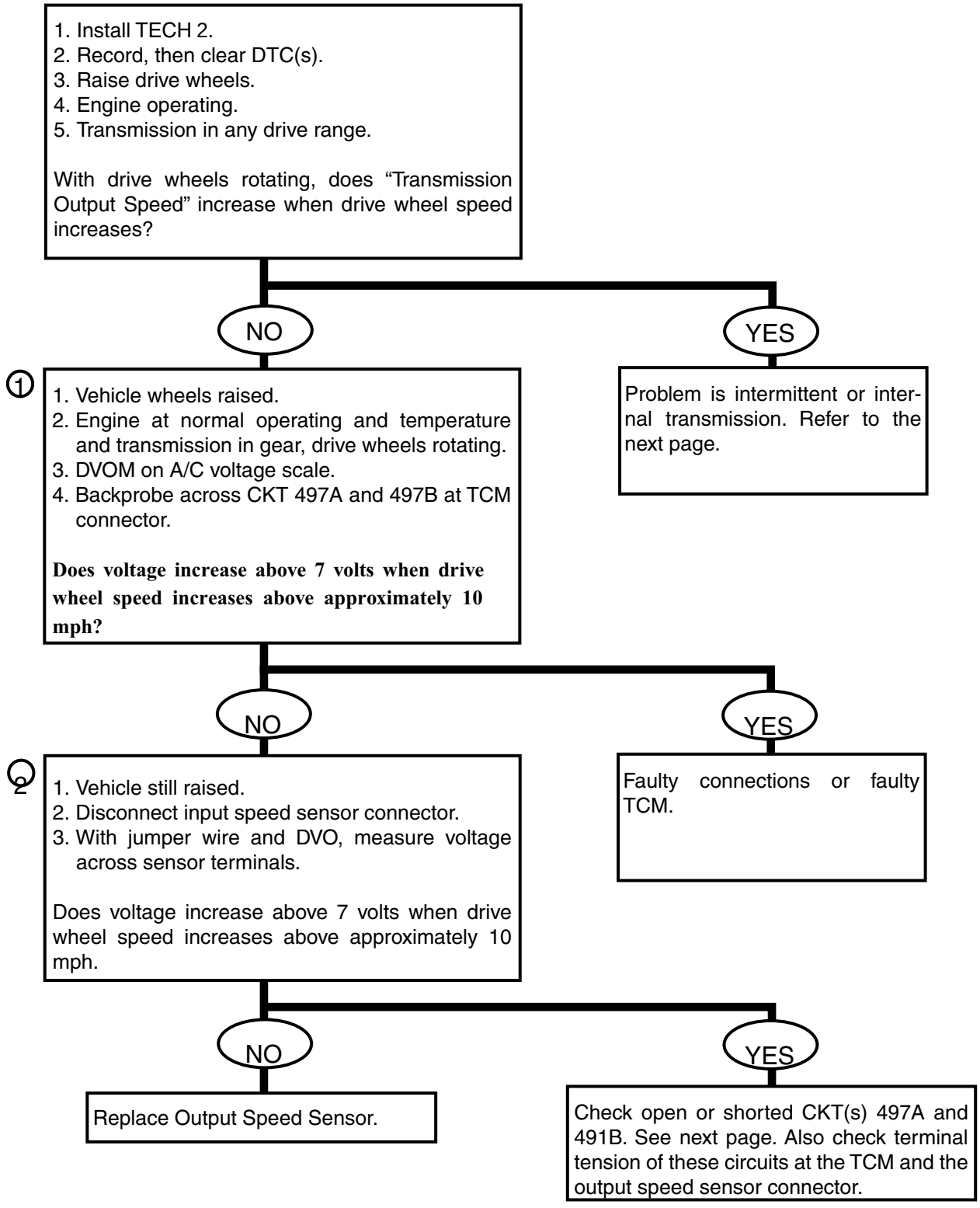
**DTC Chart Description:** Numbers below refer to circled numbers on the diagnostic chart.

1. This checks the entire circuit for continuity
2. This checks for proper voltage output of the output speed sensor.

**Diagnostic Aids:**

- DTC 24 will set when no vehicle speed is detected at start off.

## DTC 24 TRANSMISSION OUTPUT SPEED SENSOR (TOSS) CIRCUIT LOW (USING A TECH 2 SCAN TOOL)

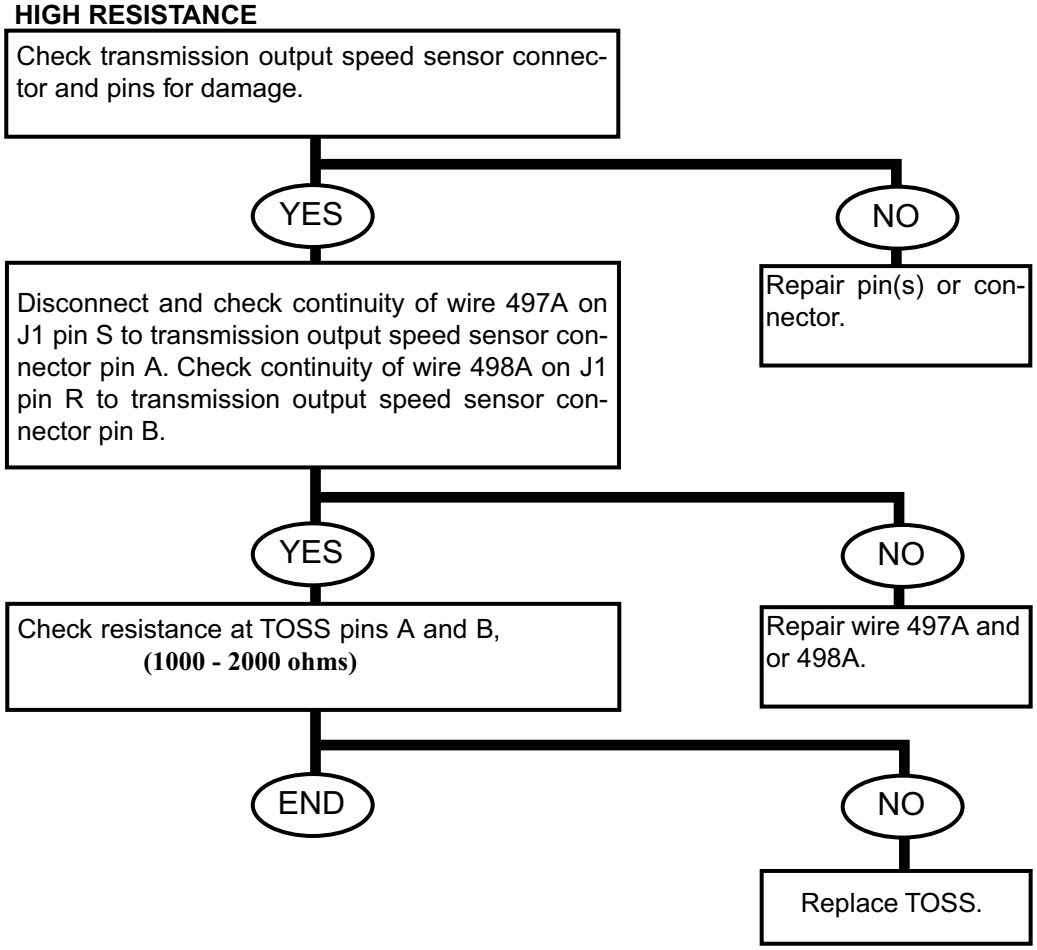


**TRANSMISSION OUTPUT SPEED SENSOR (TOSS) CIRCUIT LOW (USING A DVOM)**

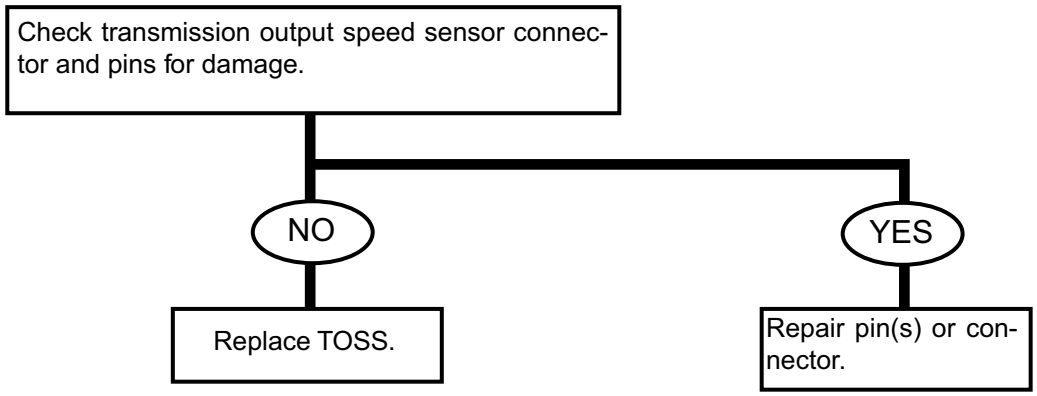
## NOTE

**When reading from TCM J1 diagnostics chart, and reading is greater than 2, perform high resistance. If less than 1, perform low resistance.**

**HIGH RESISTANCE**

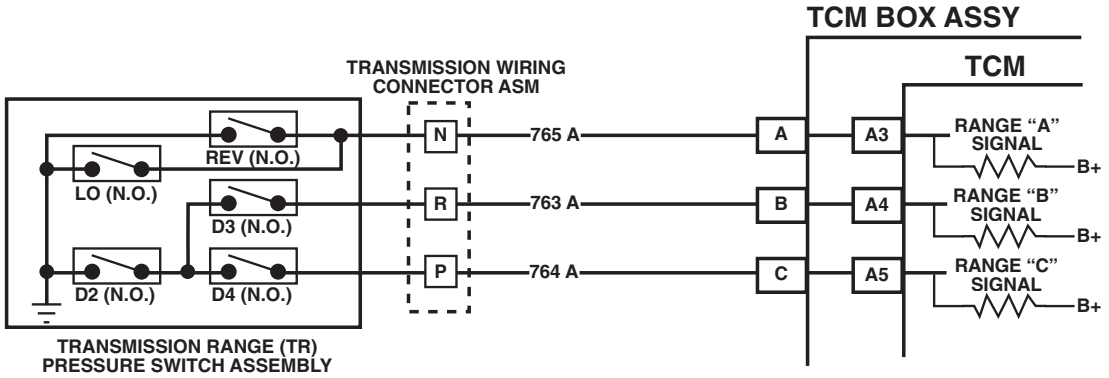



**LOW RESISTANCE**



## DTC 28 TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT

**Circuit Description:** The Transmission Range (TR) switch assembly consists of five normally open pressure switches mounted on the valve body. The TCM supplies battery voltage to each range signal. By grounding one or more of these circuits through various combinations of the pressure switches, the TCM detects what transmission range has been selected by the vehicle operator. When the transmission electrical connector is disconnected, the ground potential for the three range signals to the TCM will be removed, and D2 will be indicated.




**DTC 28 Will Set When:**

- Range signals "A" and "C" are both zero volt.
- All conditions are met for 2 seconds.

**Action Taken (TCM will default to):**

- Drive four shift pattern control.
- No fourth gear in hot mode.
- No TCC.

**DTC 28 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled from "OFF" then "ON ."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks the indicated range signal to the manual valve position actually selected.
2. This test checks for correct voltage form the TCM to the transmission external connector.
3. This test checks for a short to ground or an open in any one of the three circuits.

**Diagnostic Aids:** DTC 28 will set if the TCM detects one of two "Illegal" combinations. Refer to accompanying chart for various A/B/C range combinations.

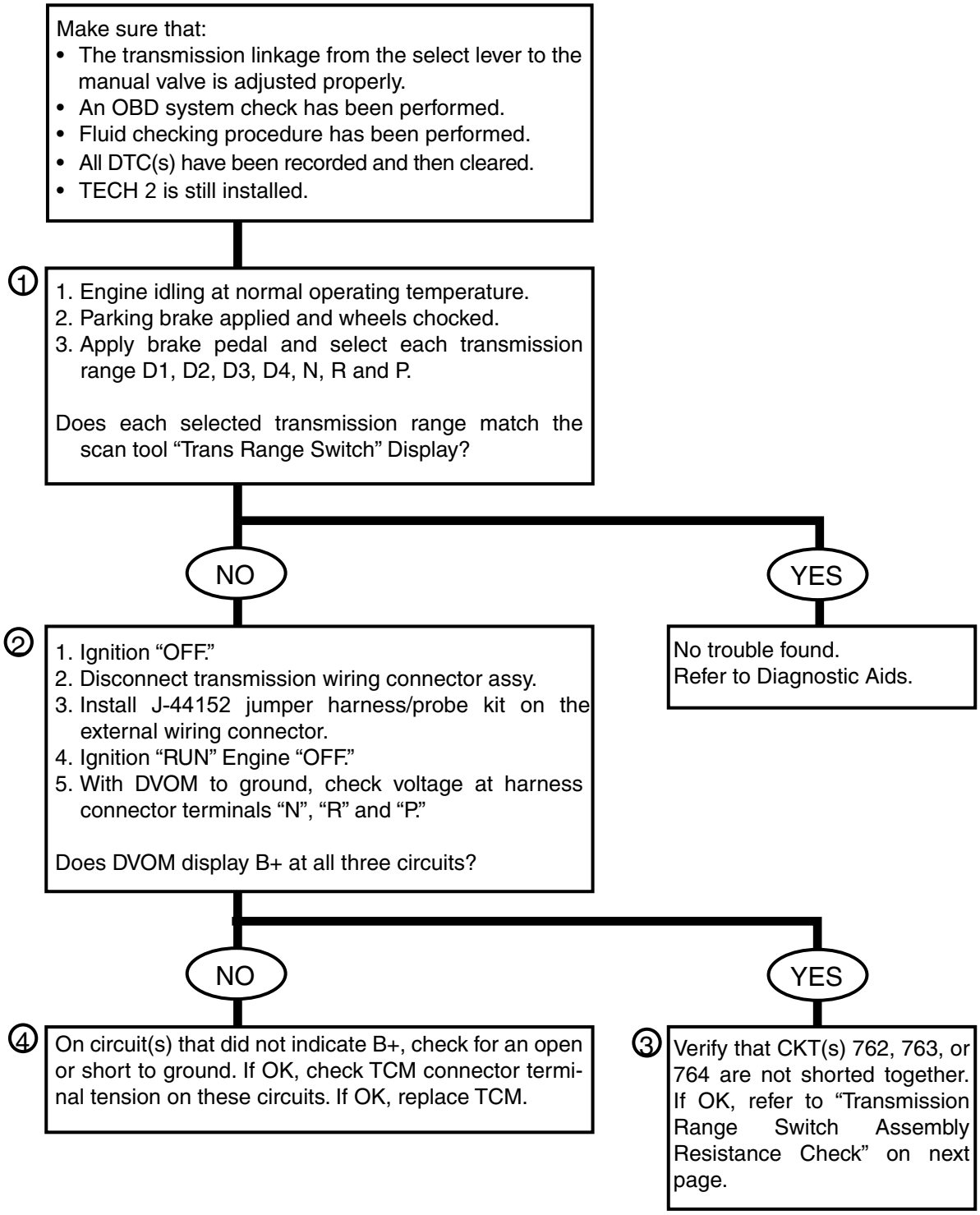
Check all wiring connectors for proper terminal tension.

Refer to "TR Pressure Switch Assembly Resistance Check" or "Functional Test Procedure" in the appropriate service manual for further information.

ON = 0 vdc at the TCM
OFF = 12 vdc at the TCM

| RANGE SIGNAL | A | B | C |
|---|---|---|---|
| PARK | OFF | ON | OFF |
| REV | ON | ON | OFF |
| NEUTRAL | OFF | ON | OFF |
| D4 | OFF | ON | ON |
| D3 | OFF | OFF | ON |
| D2 | OFF | OFF | OFF |
| D1 | ON | OFF | OFF |
| ILLEGAL | ON | OFF | ON |
| ILLEGAL | ON | ON | ON |

## DTC 28 TRANSMISSION RANGE (TR) PRESSURE SWITCH ASSEMBLY FAULT (USING A TECH 2 SCAN TOOL)



## TRANSMISSION RANGE PRESSURE SWITCH ASSEMBLY RESISTANCE CHECKS (USING A DVOM)

Install test cable J-44152 at the transmission pass-thru connector.
Make sure that:
- Engine is idling at normal operating temperature.
- Parking brake is applied and wheels chocked.

Select each transmission range D1, D2, D3, D4, N, R, and P.

Measure resistance between each terminal N,R and P to ground with DVOM.

Does each selected transmission range match the chart at right?

| TRANSMISSION RANGE | TEST CABLE PIN | | |
|---|---|---|---|
| | A | B | C |
| PARK | No | Yes | No |
| REV | Yes | Yes | No |
| NEUTRAL | No | Yes | No |
| D4 | No | Yes | Yes |
| D3 | No | No | Yes |
| D2 | No | No | No |
| D1 | Yes | No | No |
| ILLEGAL | OFF | ON | OFF |

*Yes = continuity to ground (switches are closed)
*No = no continuity to ground (switches are open)

YES → System OK

NO

Resistance measures LOW when chart indicates HIGH.

Remove oil pan and filter. Disconnect the wiring harness from the transmission range switch assembly. Measure the resistance of the transmission wiring harness from pass-thru terminals N, R and P to ground.

- High Resistance Over 2000 Ω or ∞. → Replace internal transmission wiring harness.
- Low Resistance Under 100 Ω. → High Resistance Over 2000 Ω or ∞.

NO

Resistance measures HIGH when chart indicates LOW.

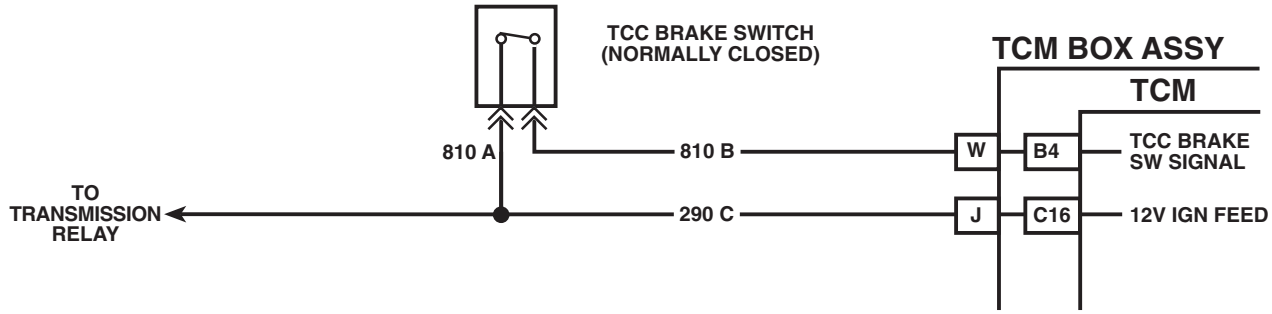
Remove oil pan and filter. Disconnect the wiring harness from the transmission range switch assembly. Measure the resistance of the transmission wiring harness from:

| Pass-thru Terminal | | Wiring Harness TR Connector Terminal |
|---|---|---|
| N | to | A |
| R | to | B |
| P | to | C |

- Low Resistance Under 100 Ω. → High Resistance Over 2000 Ω or ∞.
- High Resistance Over 2000 Ω or ∞. → High Resistance Over 2000 Ω or ∞.

**DTC 37/38 TCC BRAKE SWITCH STUCK "ON"**
**TCC BRAKE SWITCH STUCK "OFF"**

**Circuit Description:** The normally closed brake switch supplies a B+ signal on CKT 810 to the TCM. The signal voltage drops to 0 volts when the TCC brake switch is opened (brake pedal applied).




**DTC 37 Will Set When:**

- CKT 810 is open.
  - Vehicle speed si less than 5 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - Then vehicle speed is greater than 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

**DTC 38 will Set When:**

- CKT 810 has constant voltage.
  - Vehicle speed is greater than 20 mph for greater than 6 seconds.
  - Then vehicle speed is between 5 mph and 20 mph for greater than 6 seconds.
  - For a complete total of seven times.

**Action taken (TCM Will Default to):**

**DTC 37**

- No 4th gear in hot mode.

**DTC 38**

- No 4th gear in hot mode.
- No TCC.

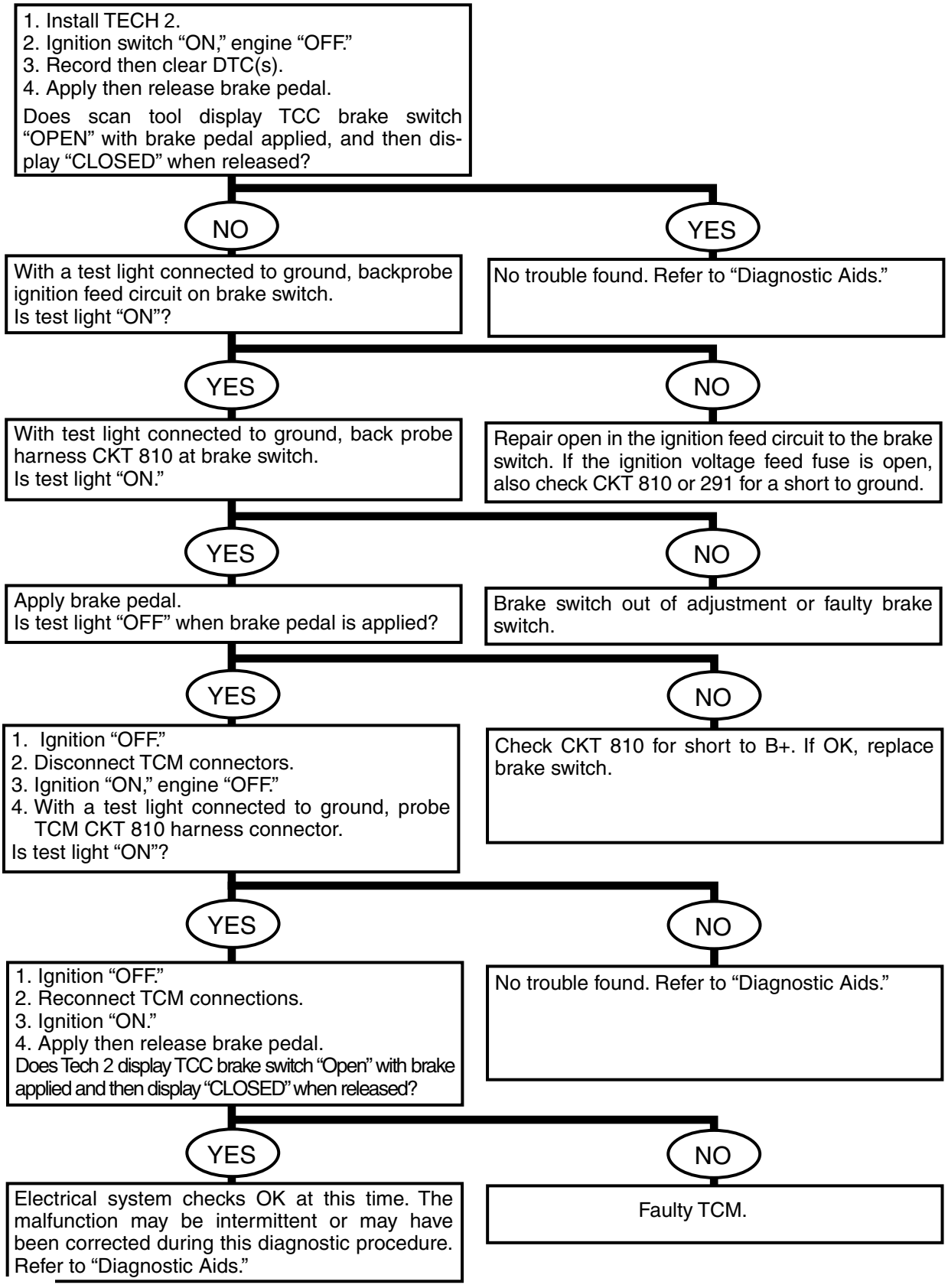
**DTC Chart Test Description:** Numbers(s) below refer to circled number(s) on the diagnostic charts.

1. This test checks for voltage at the brake switch.
2. This test checks the brake switch.
3. This test checks CKT 810 at the TCM.

**Diagnostic Aids:**

- Refer to "TCM Intermittent Diagnostic Trouble Code or Performance."
- Check operator driving habits and/or unusual traffic condition (i.e. stop and go expressway traffic).
- Check brake switch adjustment.

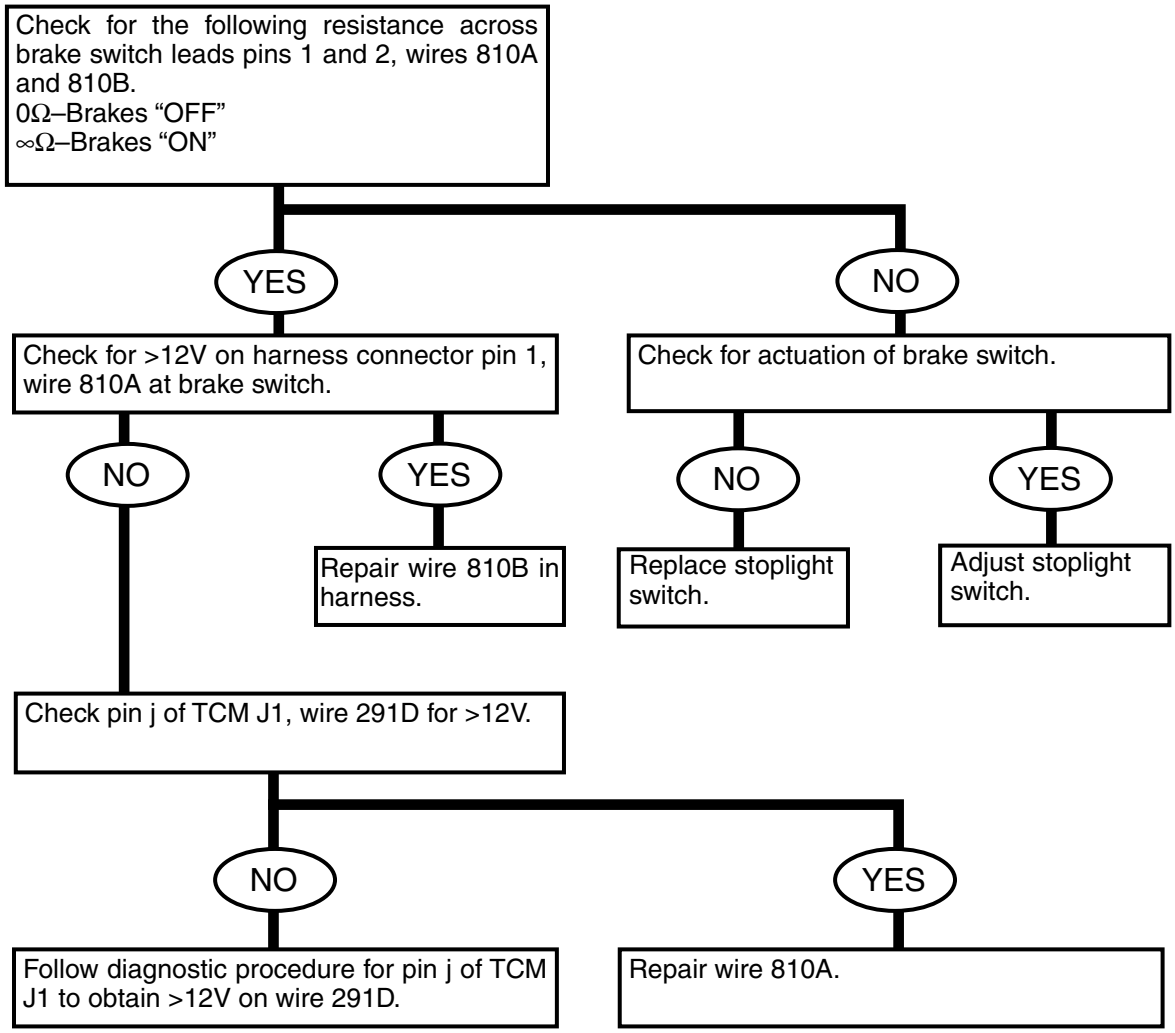
## DTC 37/38 TCC BRAKE SWITCH STUCK "ON" TCC BRAKE SWITCH STUCK "OFF" (USING A TECH 2 SCAN TOOL)



**DTC 37/38 BRAKE SWITCH TROUBLESHOOTING (USING A DVOM)**

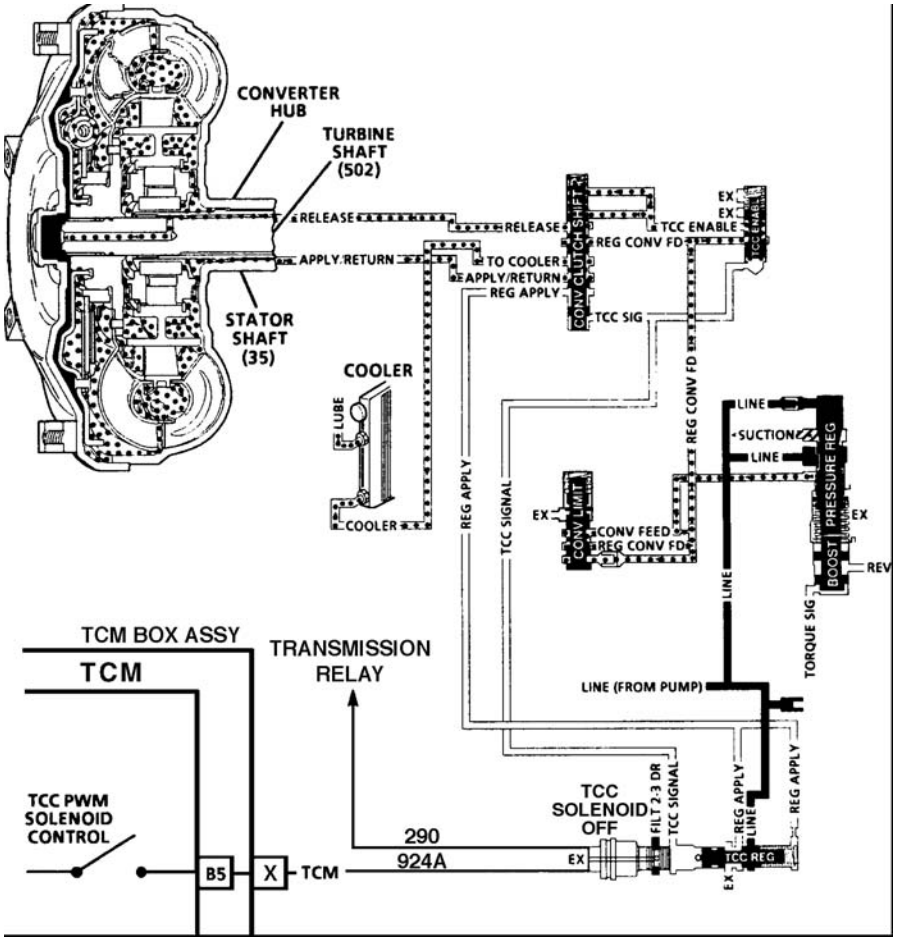
## NOTE

**All checks are done with start switch in the "RUN" position.**



**DTC 39 TCC STUCK "OFF"**

**Circuit Description:** The TCM commands the TCC PWM solenoid "ON" which then modulates TCC signal fluid acting on the converter clutch shift valve. Then TCC apply fluid applies the torque converter clutch.




**DTC 39 Will Set When:**

- No DTC(s) 28, 71, or 74.
- TCC is commanded "ON."
- TCC slip speed greater than 65 RPM.
- Trans range in D3 or D4
- 2nd or 3rd gear.
- All conditions are met for two seconds.

**.Action Taken (TCM will default to):** No 4th gear in hot mode.

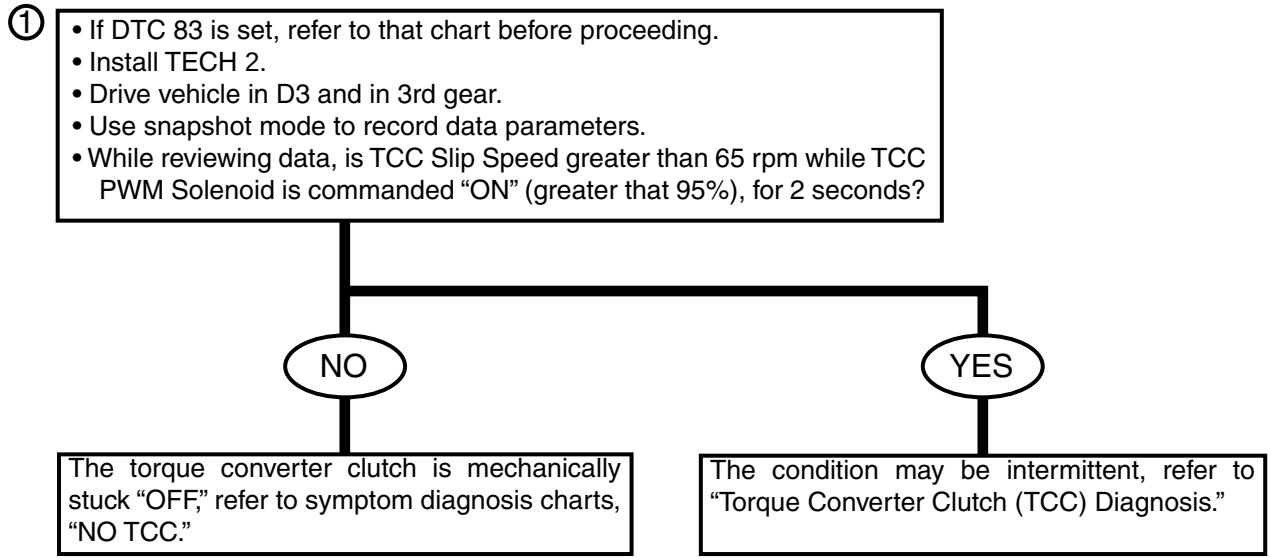
**DTC 39 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This checks the mechanical and hydraulic operation of the TCC, while commanded "ON" by the TCM.

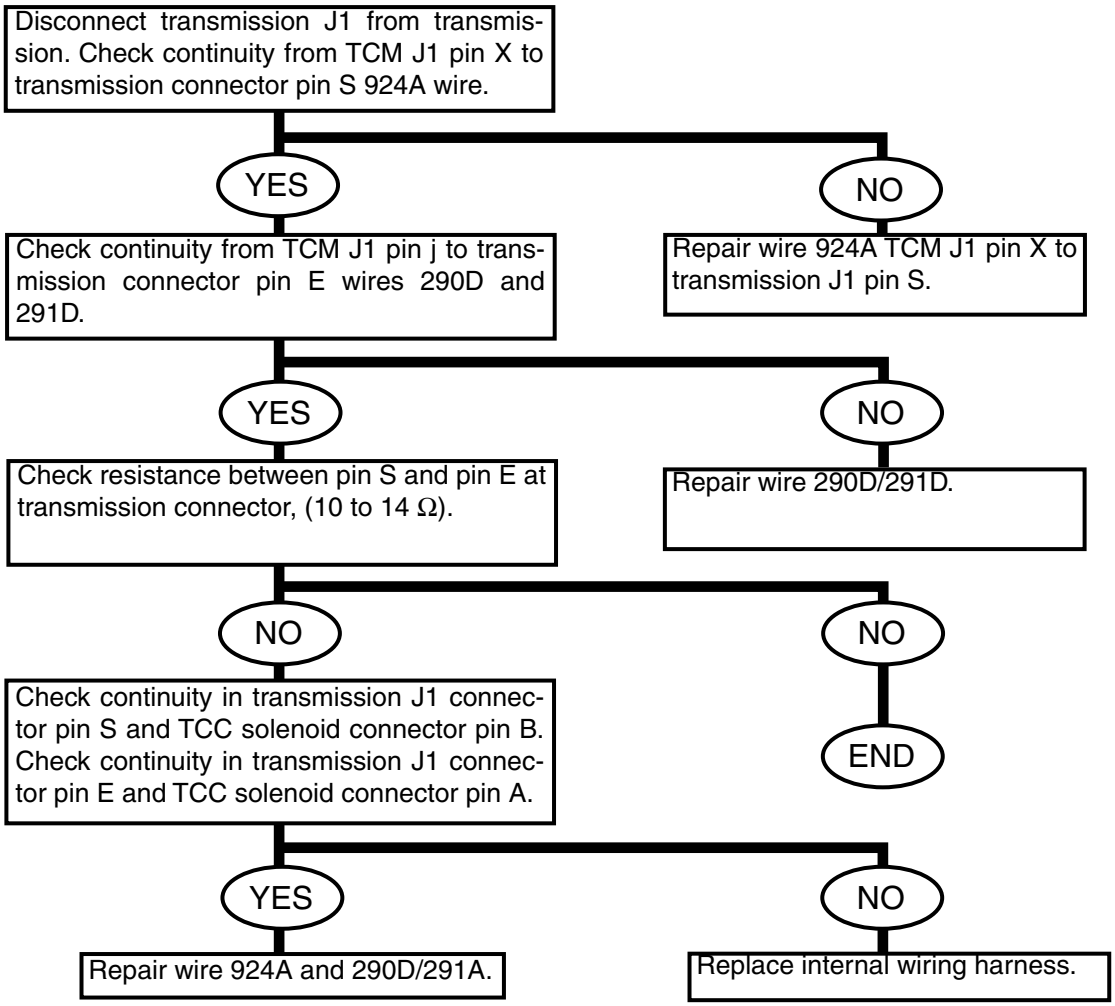
**Diagnostic Aids:** Snapshot mode will record 5 data parameters per second.

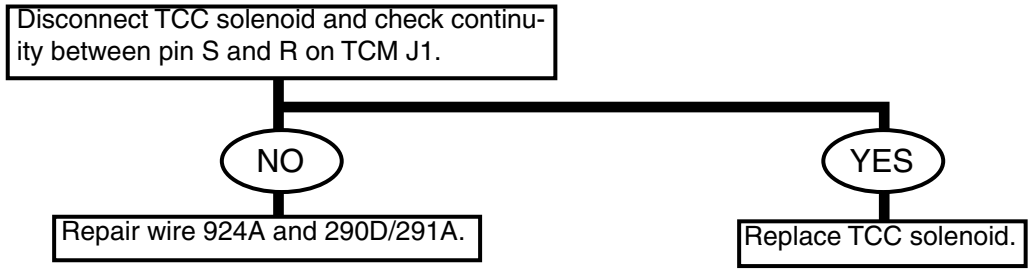
**DTC 39 TCC STUCK "OFF"**
**(USING A TECH 2 SCAN TOOL)**




**WHEN ALL DIAGNOSSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(S) AND VERIFY PROPER OPERATION.**

## TCC STUCK "OFF" (USING A DVOM)



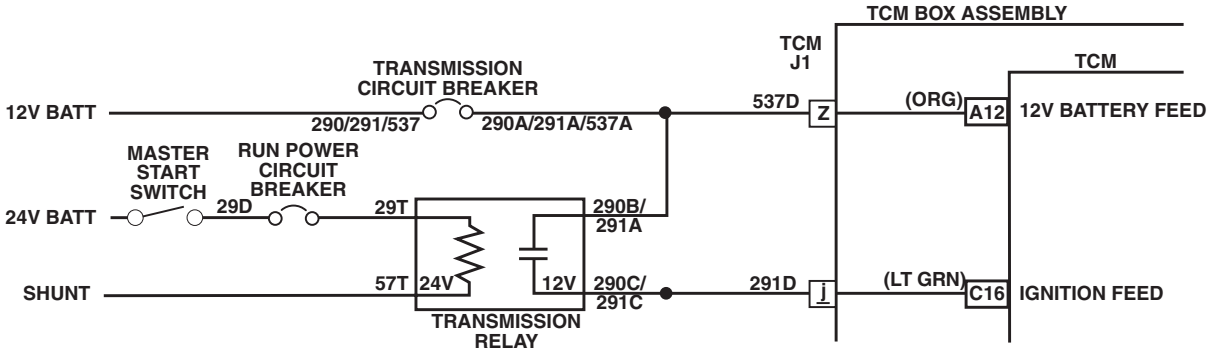



## DTC 51 PROM ERROR (FAULTY OR INCORRECT PROM)

Check that all pins are fully inserted in the socket. If OK, replace PROM, clear memory and recheck. If DTC 51 reappears, replace TCM.

**DTC 52/53 SYSTEM VOLTAGE HIGH LONG/SYSTEM VOLTAGE HIGH**

**Circuit Description:** Ignition voltage is supplied to the TCM to indicate the ignition status of the ignition switch. Battery voltage is supplied to the TCM to, in part, maintain memory of learned functions and parameters.




**DTC 52 Will Set When:**

- The ignition is “ON” and the system voltage is greater than 16 volts.
- All conditions are met for 109 minutes.

**DTC 53 Will Set When:**

- The ignition is “ON” and the system voltage is greater than 19.5 volts.
- All conditions are met for 2 minutes.

**Action Taken (TCM will default to):**

- Maximum line pressure.
- 2nd gear.
- Inhibit TCC.

**DTC 52/53 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled “OFF” then “ON.”

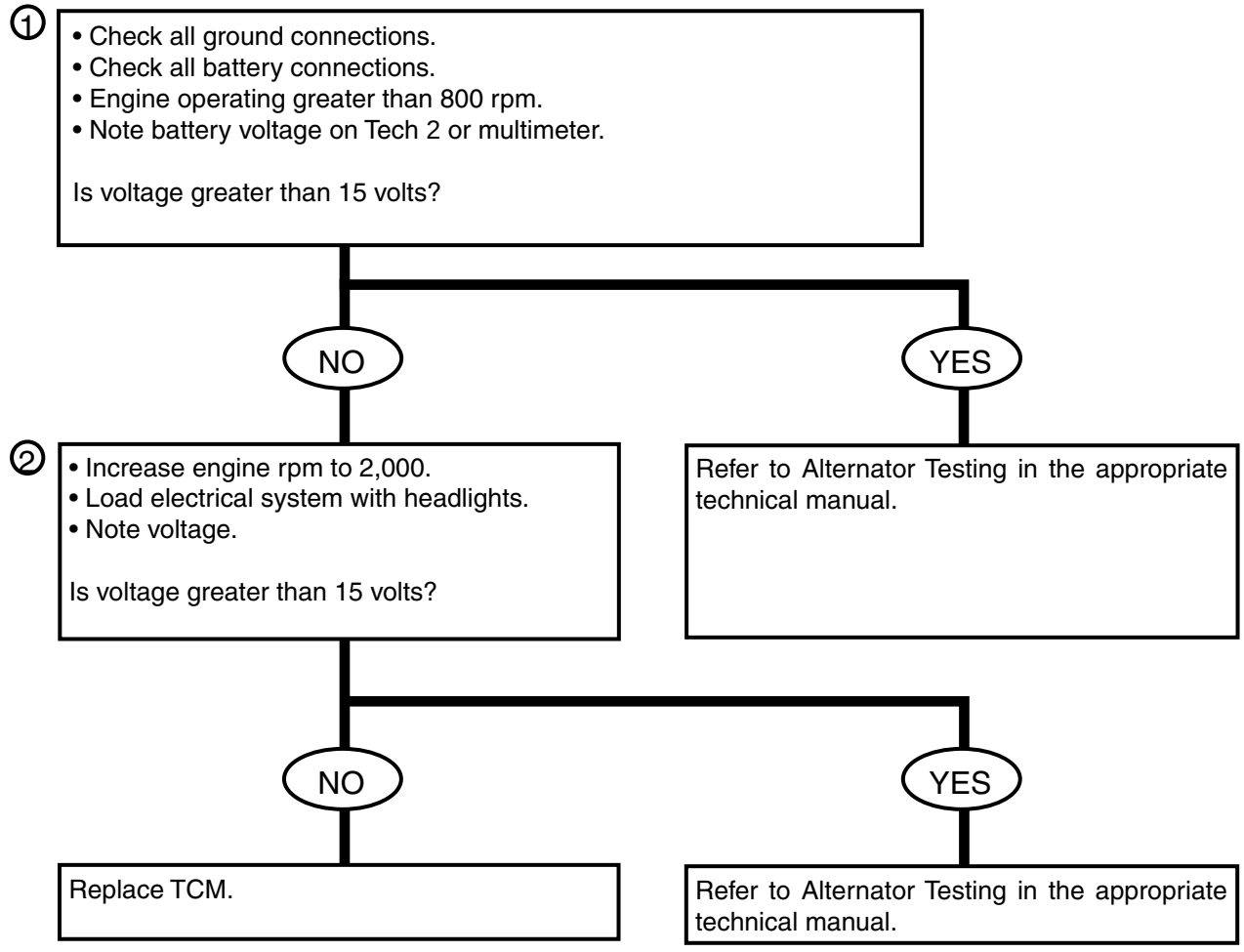
**TC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to General and Electrical Repair in Technical manual.

**Diagnostic Aids:**

- Charging the battery and jump-starting the engine may set DTC 52/DTC 53. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw
- Check for faulty connections at the starter solenoid or fusible link.

## DTC 52/53 SYSTEM VOLTAGE HIGH LONG/SYSTEM VOLTAGE HIGH (USING A TECH 2 SCAN TOOL OR DVOM)

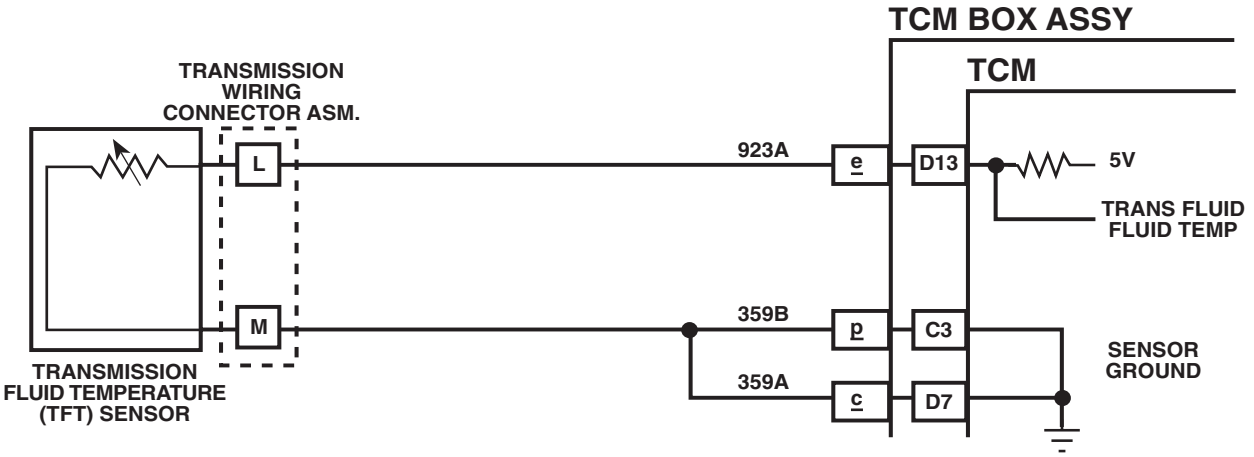



**WHEN ALL DIAGNOSSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(S) AND VERIFY PROPER OPERATION.**

## DTC 58 TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT LOW (HIGH TEMPERATURE INDICATED)

**Circuit Description:** The TFT sensor is a thermistor that controls the signal voltage to the TCM. The TCM supplies a 5 volt reference signal to the sensor on CKT 923. When the transmission fluid is cold, the sensor resistance is high and the TCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 100°C (212°F), the sensor resistance becomes less and the voltage decreases to approximately 1.5 to 2.0 volts. With a DTC 79 also set, check the transmission cooling system.




**DTC 58 Will Set When:**

- Signal voltage indicates TFT greater than 151°C (306°F).
- All conditions are met for 1 second.

**Action Taken (TCM will default to):**

- The TCM will use a warm default trans fluid temperature value.

**DTC 58 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for a short to ground or a "skewed" sensor.
2. This test checks for an internal fault within the transmission by creating an open.

**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 923.

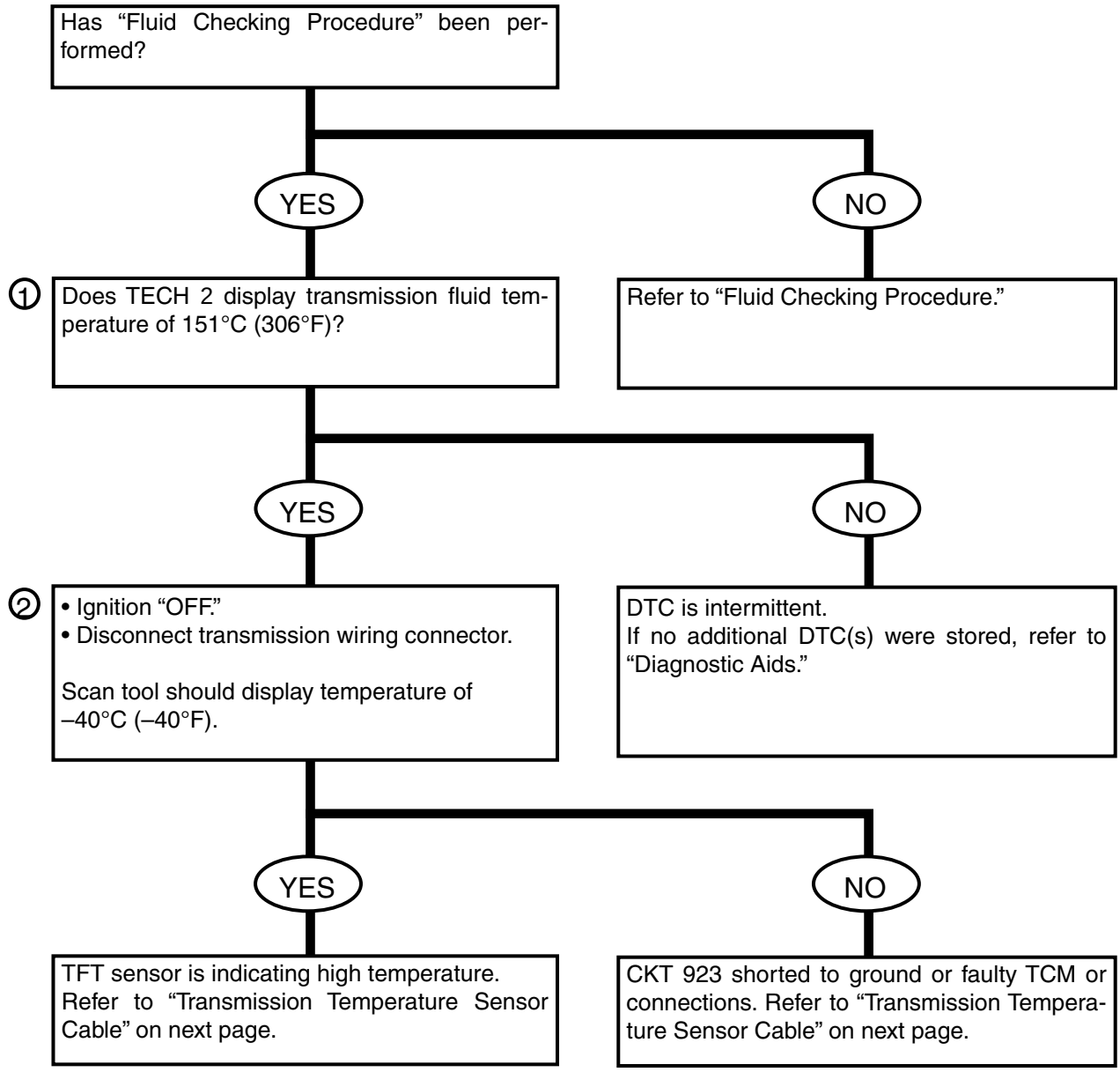
Scan tool TFT displays should rise steadily to about 66°C (150°F) then stabilize.

The temperature to resistance value scale may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" (mis-scaled) sensor could result in delayed garage shifts or TCC complaints.

Table 20: Temperature to Resistance Values (Approximate)

| OHMS | °C | °F |
|---|---|---|
| 185 | 100 | 210 |
| 450 | 70 | 160 |
| 1,800 | 38 | 100 |
| 3,400 | 20 | 70 |
| 7,500 | 4 | 40 |
| 13,500 | –7 | 20 |
| 25,000 | –18 | 0 |
| 100,700 | –40 | –40 |

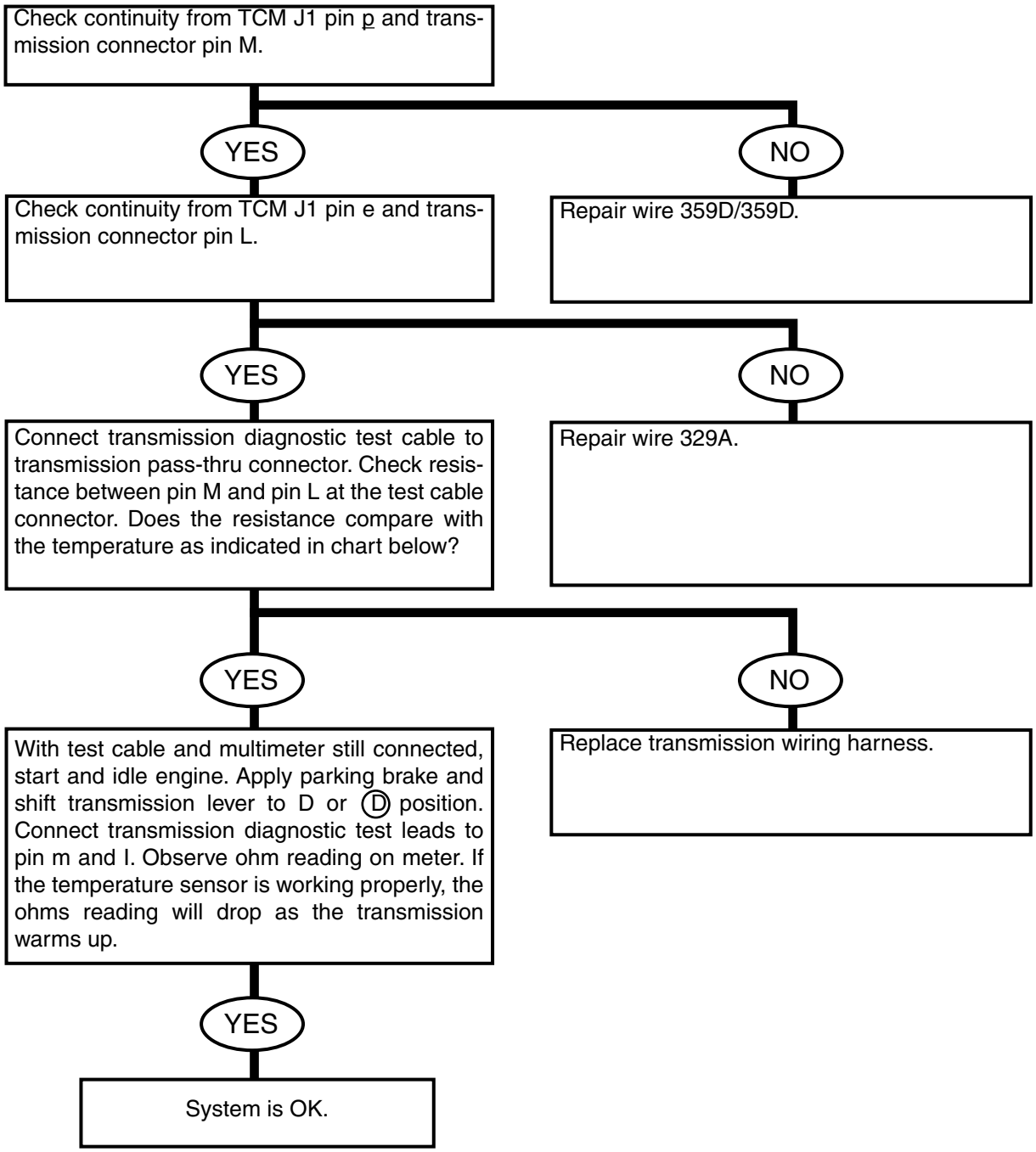
## DTC 58 TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT LOW (HIGH TEMPERATURE INDICATED) (USING A TECH 2 SCAN TOOL)




**WHEN ALL DIAGNOSSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(S) AND VERIFY PROPER OPERATION.**

**TRANSMISSION TEMPERATURE SENSOR CABLE**

The transmission temperature sensor is a thermistor. Resistance decreases as temperature increases. See chart on following page.



## TRANSMISSION FLUID SENSOR TEMPERATURE

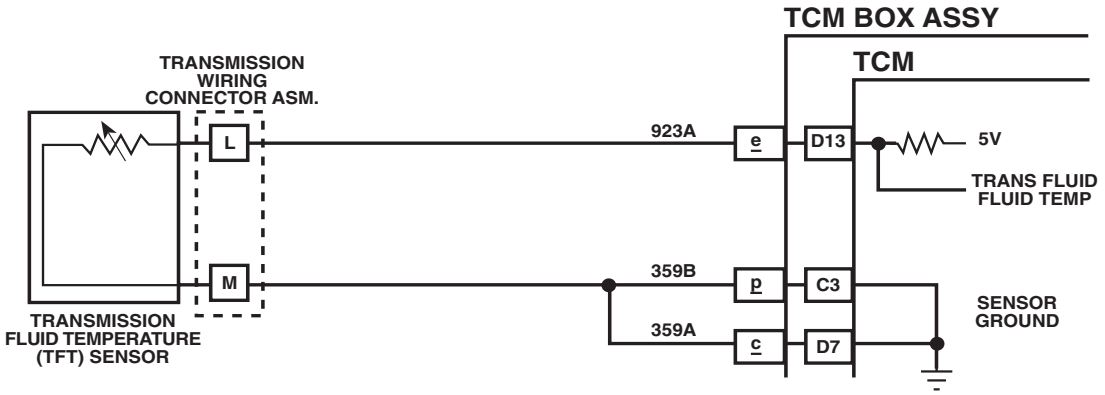
Table 21: Transmission Fluid Sensor Temperature to Resistance Chart

| °C | °F | MINIMUM RESISTANCE | NOMINAL RESISTANCE | MAXIMUM RESISTANCE |
|---|---|---|---|---|
| –40°C | -40°F | 80965 | 100544 | 120123 |
| –30°C | –20°F | 42701 | 52426 | 62151 |
| –20°C | _4°F | 23458 | 28491 | 33524 |
| –10°C | 14°F | 13366 | 16068 | 18770 |
| 0°C | 32°F | 7871 | 9370 | 10869 |
| 10°C | 50°F | 4771 | 5640 | 6508 |
| 20°C | 69°F | 2981 | 3500 | 4018 |
| 30°C | 86°F | 1915 | 2232 | 2550 |
| 40°C | 104°F | 1260 | 1460 | 1660 |
| 50°C | 122°F | 848.8 | 977.1 | 1105 |
| 60°C | 140°F | 584.1 | 668.7 | 753.4 |
| 70°C | 158°F | 419.3 | 467.2 | 524.2 |
| 80°C | 176°F | 293.7 | 332.7 | 371.7 |
| 90°C | 194°F | 213.9 | 241.0 | 268.2 |
| 100°C | 212°F | 158.1 | 177.4 | 196.8 |
| 110°C | 239°F | 118.8 | 132.6 | 146.5 |
| 120°C | 248°F | 90.40 | 100.6 | 110.8 |
| 130°C | 266°F | 69.48 | 77.29 | 85.11 |
| 140°C | 284°F | 53.96 | 60.13 | 66.29 |
| 150°C | 304°F‘ | 47.43 | 47.31 | 52.20 |

## DTC 59 TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)

**Circuit Description:** The TFT sensor is a thermistor that controls the signal voltage to the TCM. The TCM supplies a 5 volt reference signal to the sensor on CKT 923. When the transmission fluid is cold, the sensor resistance is high and the TCM will sense high signal voltage.

As the transmission fluid temperature warms to normal transmission operating temperature 66°C (150°F), the sensor resistance becomes less and the voltage decreases.




**DTC 59 Will Set When:**

- Signal voltage indicates TFT less than -40°C (-40°F).
- All conditions are met for 1 second.

**Action Taken (TCM will default to):** The TCM will use a warm default trans fluid temperature value.

**DTC 59 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This checks for entire circuit and indicates whether the malfunction is present.
2. This test simulates a DTC 58. If the TCM recognizes the low signal voltage (high temperature), and the scan displays 151°C (305°F) or greater, the TCM and wiring are OK.
3. This test checks if CKT 923 is open. There should be 5 volts present at the sensor connector if measured with a DVOM.

**Diagnostic Aids:** Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 66°C (150°F) then stabilize.

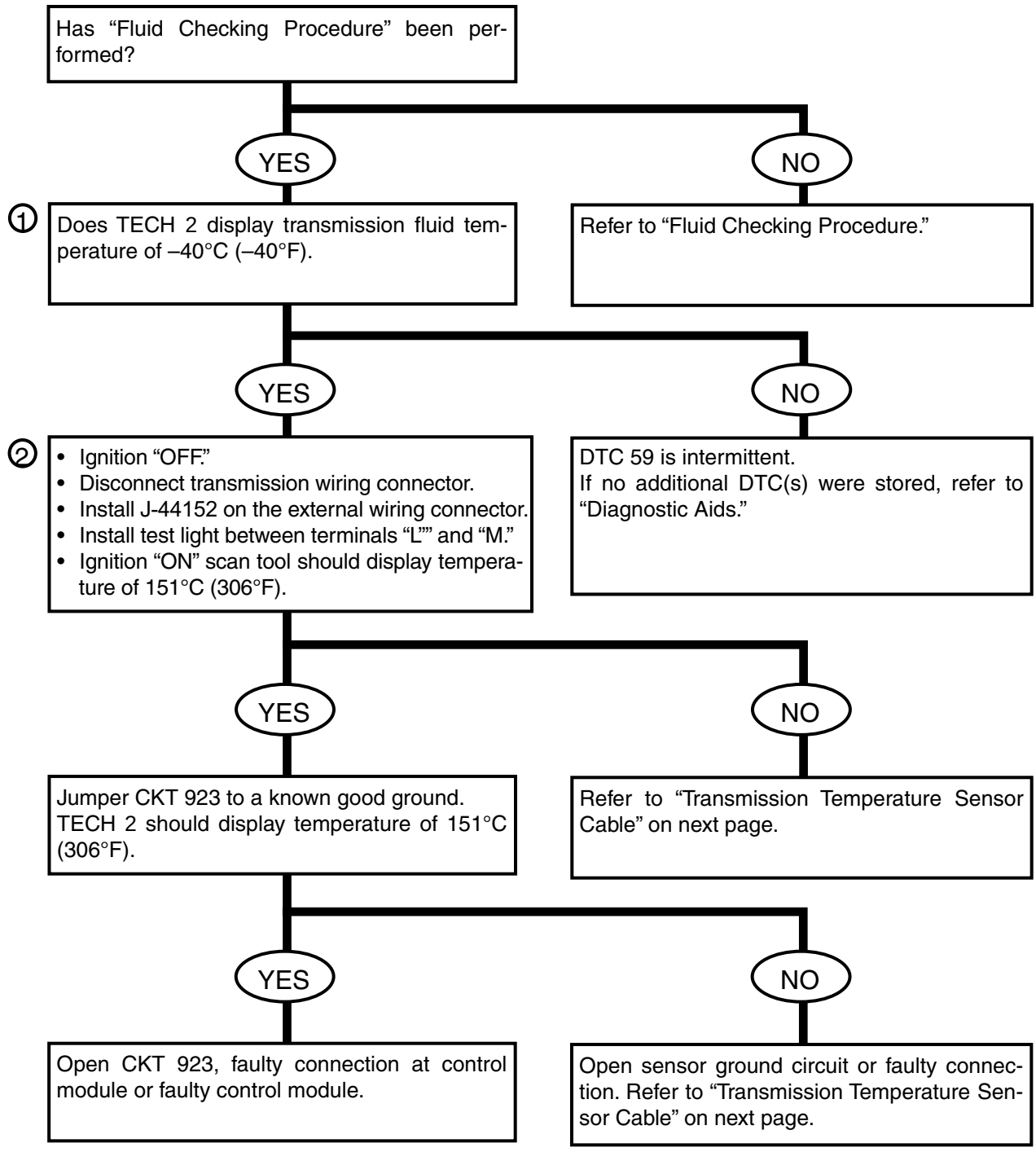
A faulty connection or an open in CKT 359 or CKT 923 can result in a DTC 59.

The "Temperature to Resistance Value" scale may be used to check the TFT sensor at various temperature levels to evaluate the possibility of a "skewed" (mis-scaled) sensor. A "skewed" sensor can result in firm shifts, or TCC complaints.

Table 22: Temperature to Resistance Values (Approximate)

| OHMS | °C | °F |
|---|---|---|
| 185 | 100 | 210 |
| 450 | 70 | 160 |
| 1,800 | 38 | 100 |
| 3,400 | 20 | 70 |
| 7,500 | 4 | 40 |
| 13,500 | –7 | 20 |
| 25,000 | –18 | 0 |
| 100,700 | –40 | –40 |

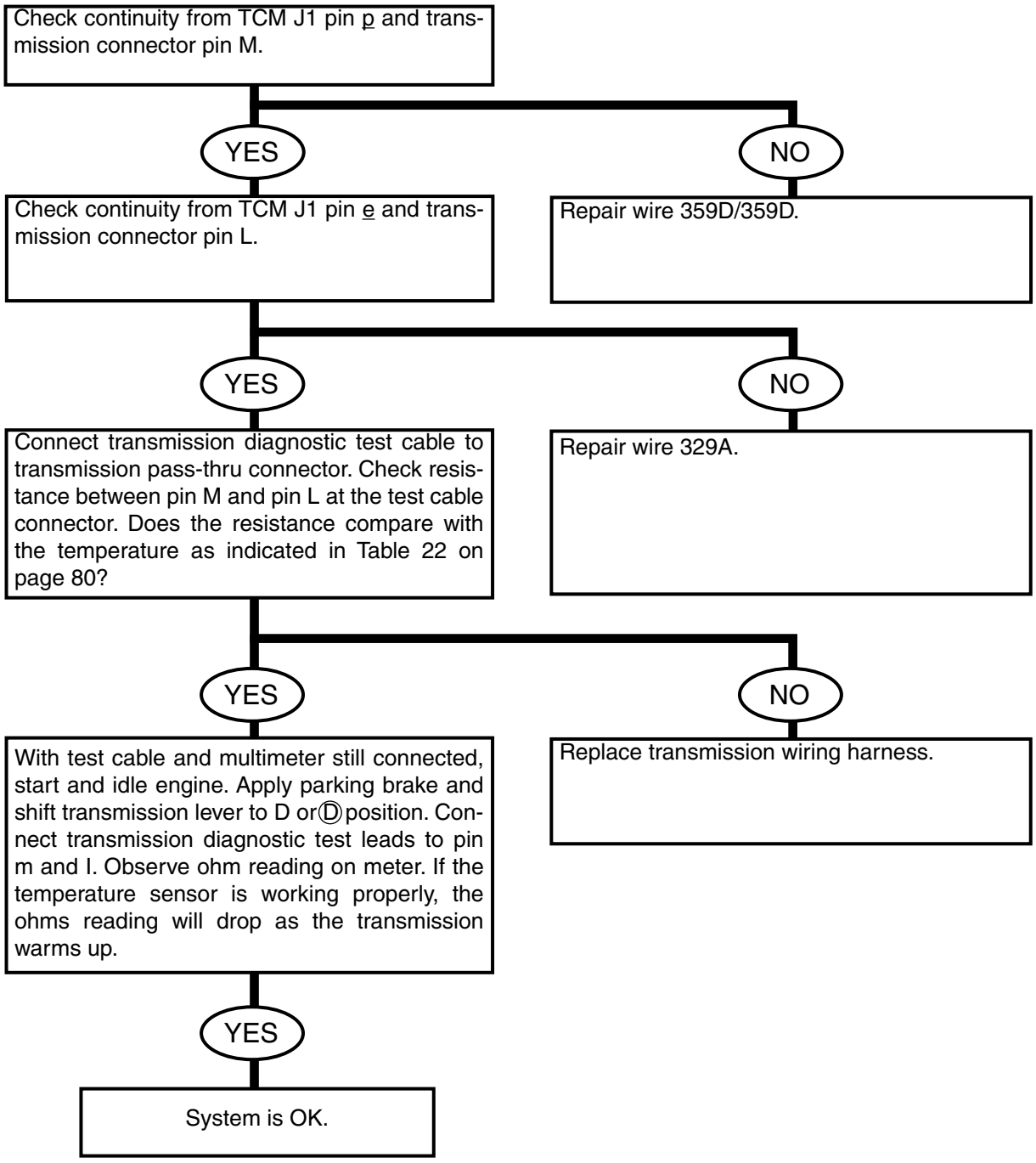
## DTC 59 TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CIRCUIT HIGH (LOW TEMPERATURE INDICATED)(USING A TECH 2 SCAN TOOL)




**WHEN ALL DIAGNOSSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(S) AND VERIFY PROPER OPERATION.**

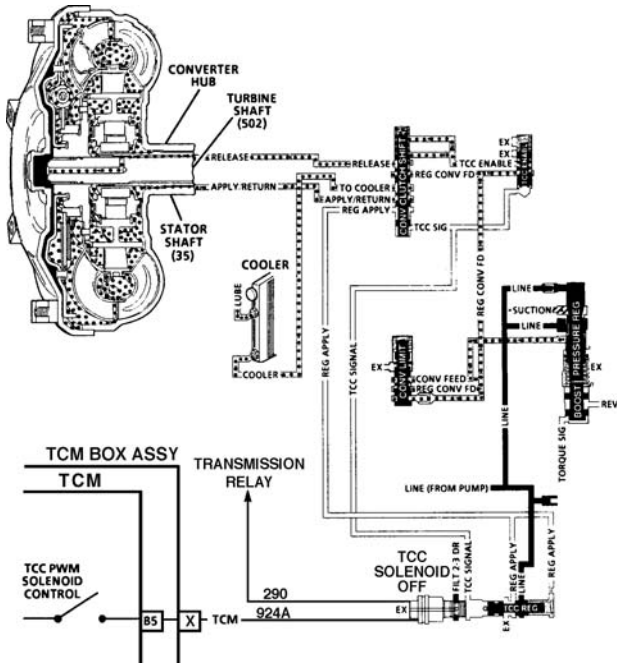
**TRANSMISSION TEMPERATURE SENSOR CABLE (USING A DVOM)**

The transmission temperature sensor is a thermistor. Resistance decreases as temperature increases. See chart on page 79.



**DTC 68 TRANSMISSION COMPONENT SLIPPING**

**Circuit Description:** The TCM monitors the difference in engine speed and input speed. With transmission in "Drive" and TCC locked, the scan tool should display engine speed closely matching input speed.




**DTC 68 Will Set When:**

- No DTC(s) 28, 71, 74.
- TCC slip speed greater than 200 RPM.
- Fourth gear is indicated.
- TCC is locked.
- Not in park/neutral
- All conditions are met for 2 seconds.

**Action Taken (TCM will default to):**

- Inhibit TCC operation.
- Inhibit manual mode operation.

**DTC 68 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

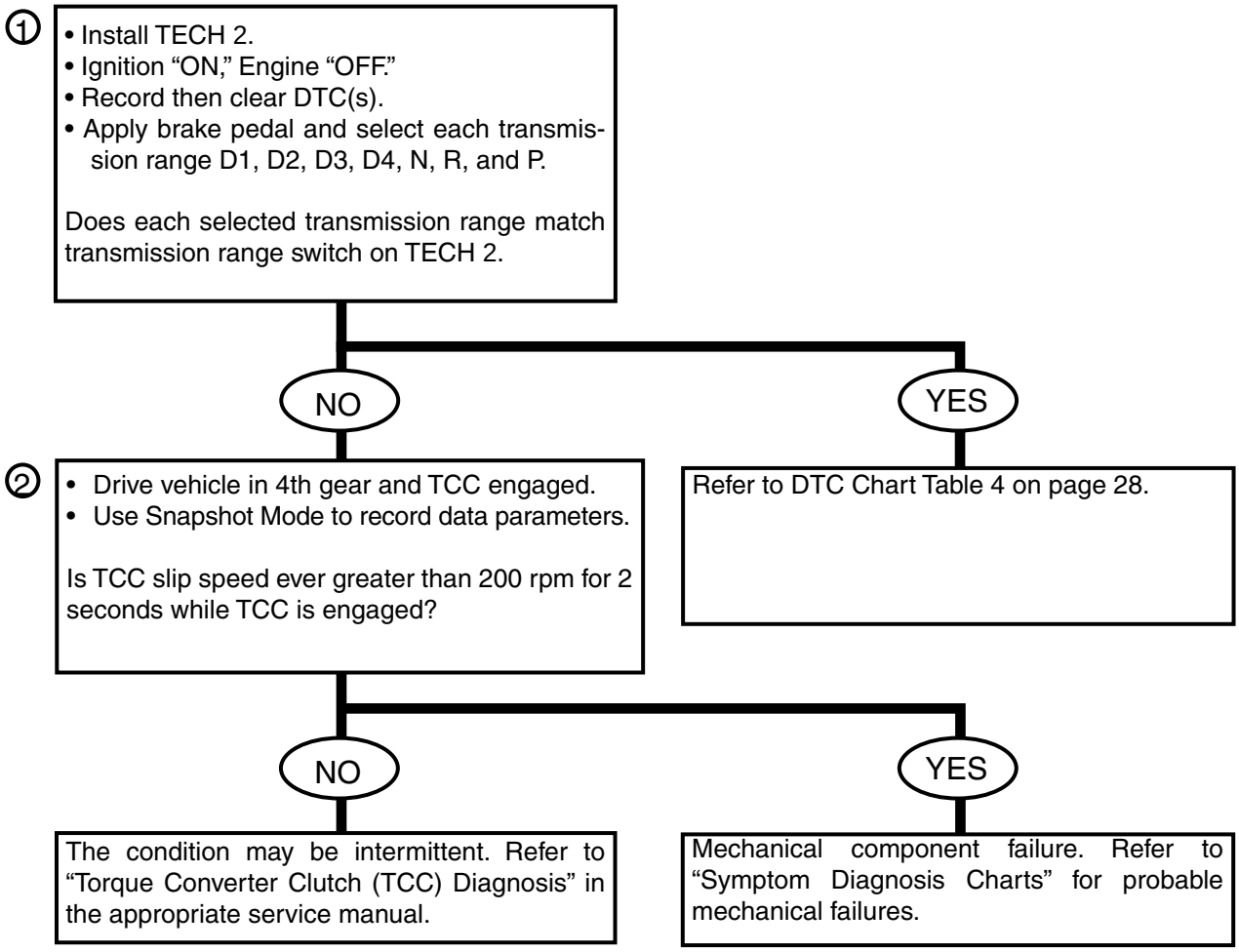
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the indicated range signal to the actual selected range. A faulty switch could set DTC 68.
2. This test checks the torque convertor for slippage while in a commanded lock-up state.

**Diagnostic Aids:**

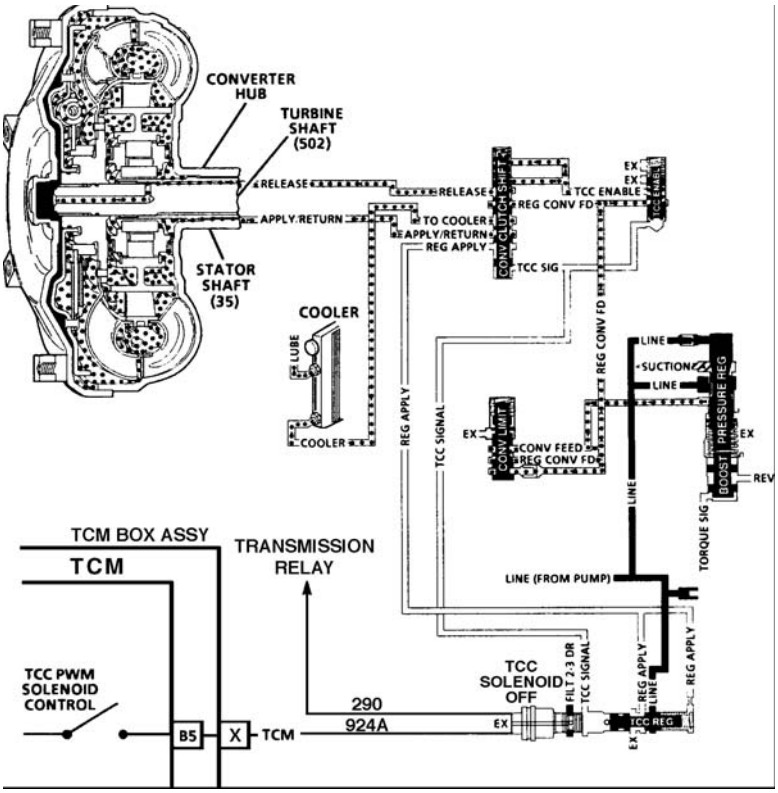
- Check for deformed connectors at pass-thru connector.
- DTC 68 will set when going to default (2nd gear).
- Refer to "TCM Intermittent DTC(s) or Performance."
- Refer to information on "Internal Transmission Faults."
- An intermittent incorrect engine speed signal will set a DTC 68 if the incorrect signal lasts for greater than 2 seconds.
- A mechanical failure in the 1-2 shift solenoid (stuck "OFF") or 2-3 shift solenoid (stuck "ON"), could set DTC 68.

## DTC 68 TRANSMISSION COMPONENT SLIPPING (USING A TECH 2 SCAN TOOL)



**DTC 69 TORQUE CONVERTER CLUTCH (TCC) STUCK "ON"**

**Circuit Description:** The TCM commands the TCC PWM solenoid "ON" which then modulates TCC signal fluid acting on the converter clutch shift valve. Then TCC apply fluid applies the torque converter clutch.




**DTC 69 Will Set When:**

- No DTC(s) 21, 22, 28, 71, 74 are set.
- TCC slip speed RPM indicates between -5 and + 10.
- TCC solenoid is commanded "OFF."
- TP sensor signal is greater than 25%.
- Trans range switch indicates D3 or D4.
- Commanded gear indicates 2nd or 3rd gear.

All conditions are met for 2 seconds.

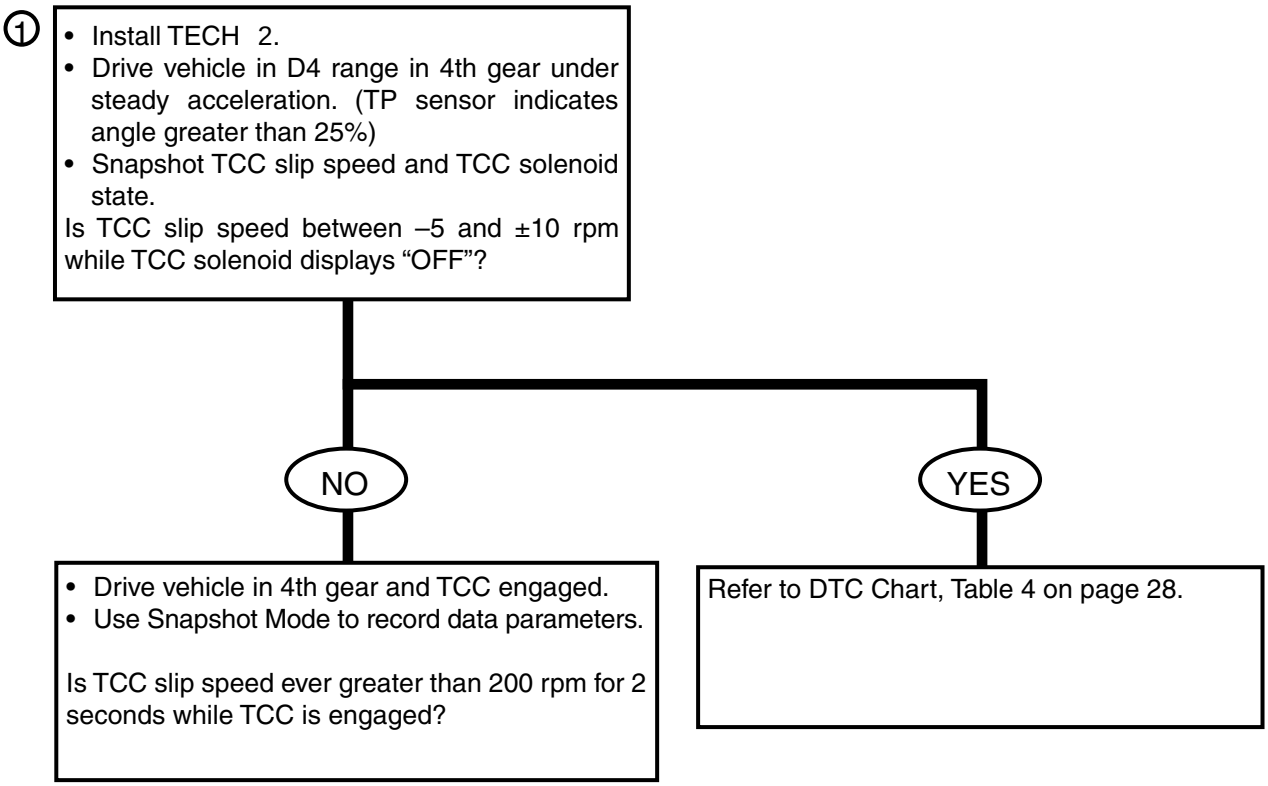
**DTC 69 Will Clear When:** Fault condition no longer exists and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks the mechanical state of the TCC. When the TCM commands the TCC solenoid "OFF." TCC slip speed should increase.

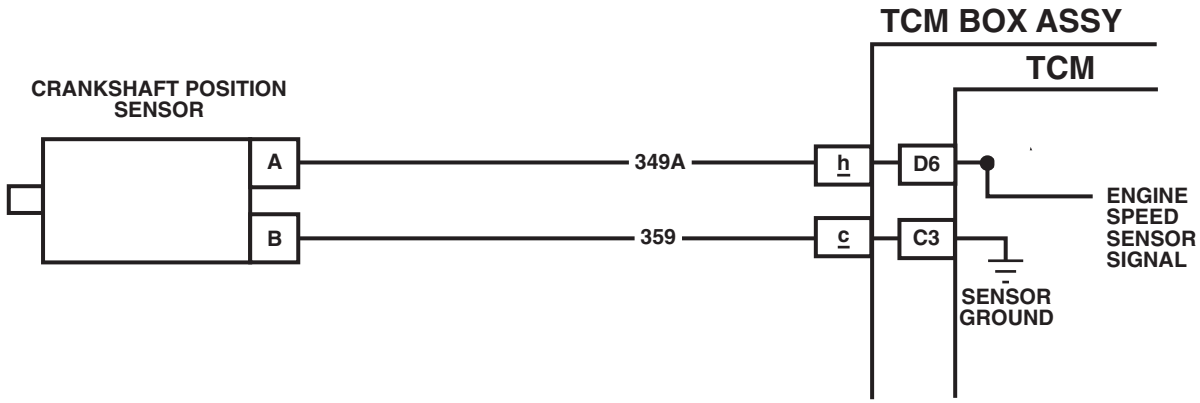
**Diagnostic Aids:** If the TCC is mechanically stuck "ON," vehicle speed is zero, brakes are applied, and is selected, the TCC fluid will mechanically apply the TCC causing an engine stall.

## DTC 69 TORQUE CONVERTER CLUTCH (TCC) STUCK "ON" (USING A TECH 2 SCAN TOOL)



### DTC 71 CRANKSHAFT POSITION SENSOR CIRCUIT LOW (ENGINE SPEED)

**Circuit Description:** The crankshaft position sensor detects the rotational speed of the crankshaft. As the crankshaft rotates, an AC signal is generated in the circuit. This signal provides the input to determine engine speed, for use in various calculations including TCC slip speed and overdrive ratio.




**DTC 71 Will Set When:**

- No DTC 28 set.
- Engine speed less than 50 RPM.
- Trans range indicates R, D4, D3, or D1.
- Conditions are met for 2 seconds.

**Action Taken (TCM will default to):** Inhibit TCC.

**DTC 71 Will Clear When:** Fault condition(s) on longer exist.

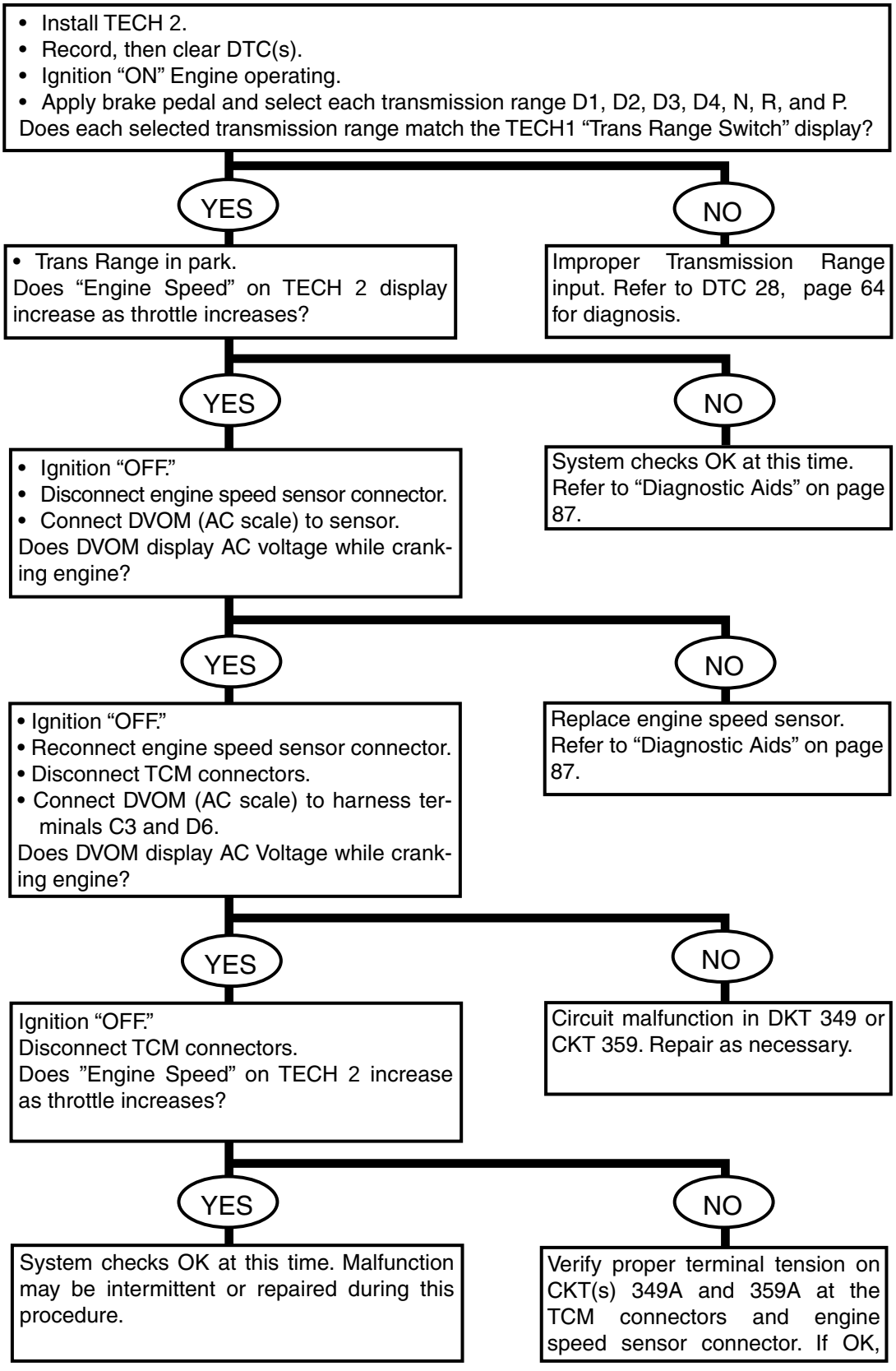
**DTC Chart Test Description:** Numbers(s) below refer to circled number(s) on the diagnostic chart.

1. An out of range transmission range pressure switch could falsely indicate the actual transmission range.
2. This checks the entire engine speed sensor circuit for proper signal.
3. A signal at this point indicates that the sensor is capable of inducing an AC voltage in the circuit.

**Diagnostic Aids:**

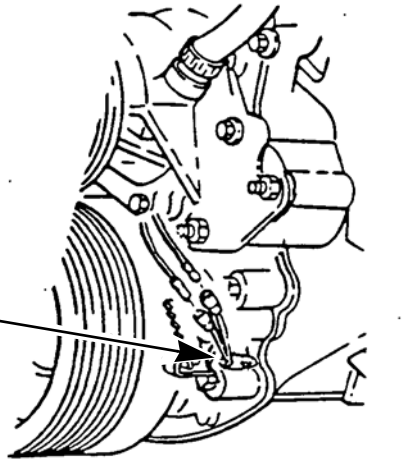
A mechanical problem with the crankshaft may set this code. With engine speed sensor removed, check crankshaft for damage.

## DTC 71 ENGINE SPEED SENSOR (ESS) CIRCUIT LOW (USING A TECH 2 SCAN TOOL)



## DTC 71 ENGINE SPEED SENSOR (ESS) CIRCUIT LOW (USING A DVOM)

Check resistance across pins 1 and 2 of engine rpm sensor leads located on engine front cover for 100 to 200 Ω.




YES

Check for continuity from pin h wire 349A of TCM J1 to pin 1 wire 349B at engine sensor and check for continuity from p wire 359B of TCM J1 to 2 wire 359J on engine harness connector to rpm sensor.

NO

Replace engine rpm sensor.

YES

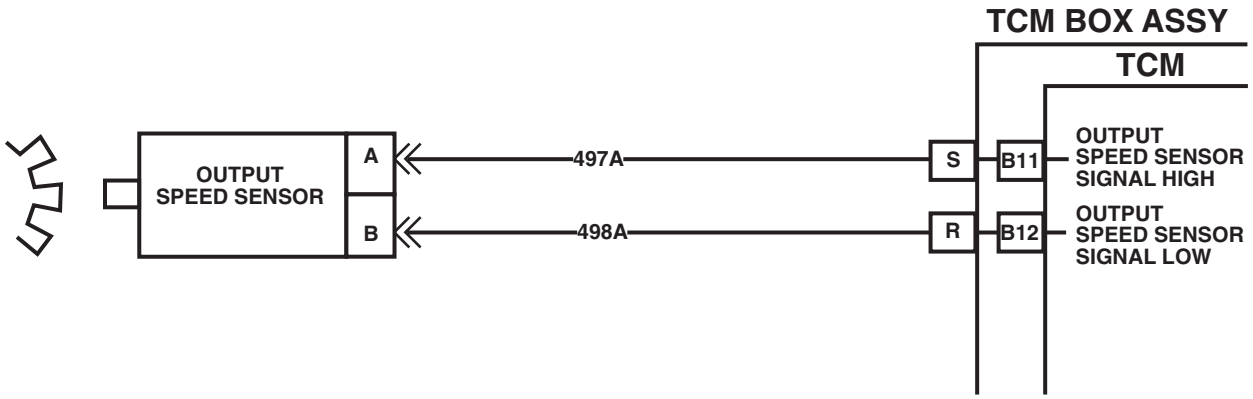
Replace engine rpm sensor.

NO

Repair wire 349A/349B, and/or wire 359B/359J.

**DTC72 TRANSMISSION OUTPUT SPEED SENSOR (TOSS) CIRCUIT LOSS**

**Circuit Description:** The output speed sensor circuit consists of a magnetic induction type sensor and wiring. Gear teeth pressed onto the output shaft induces an alternating voltage into the sensor. This signal is transmitted to the TCM which compares the signal to TP sensor volts for shift timing




**DTC 72 WILL SET WHEN:**

- Not in P/N
  –Transmission output speed change is greater than 1000 rpm.
  –Engine speed is greater than 300 rpm
  –Conditions met for 2 seconds.
  –No DTC 28 set.

- In P/N
  –Transmission output speed change is greater than 2050 rpm.
  –Engine speed si greater than 300 rpm.
  –Conditions met for 2 seconds.
  –No DTC 28 set.

**Action Taken (TCM will default to):**

- A (soft) delayed landing to second gear.
- Maximum line pressure.

**DTC 72 Will Clear When:** Fault conditions no longer exist and the ignition is cycled “OFF” then “ON”.

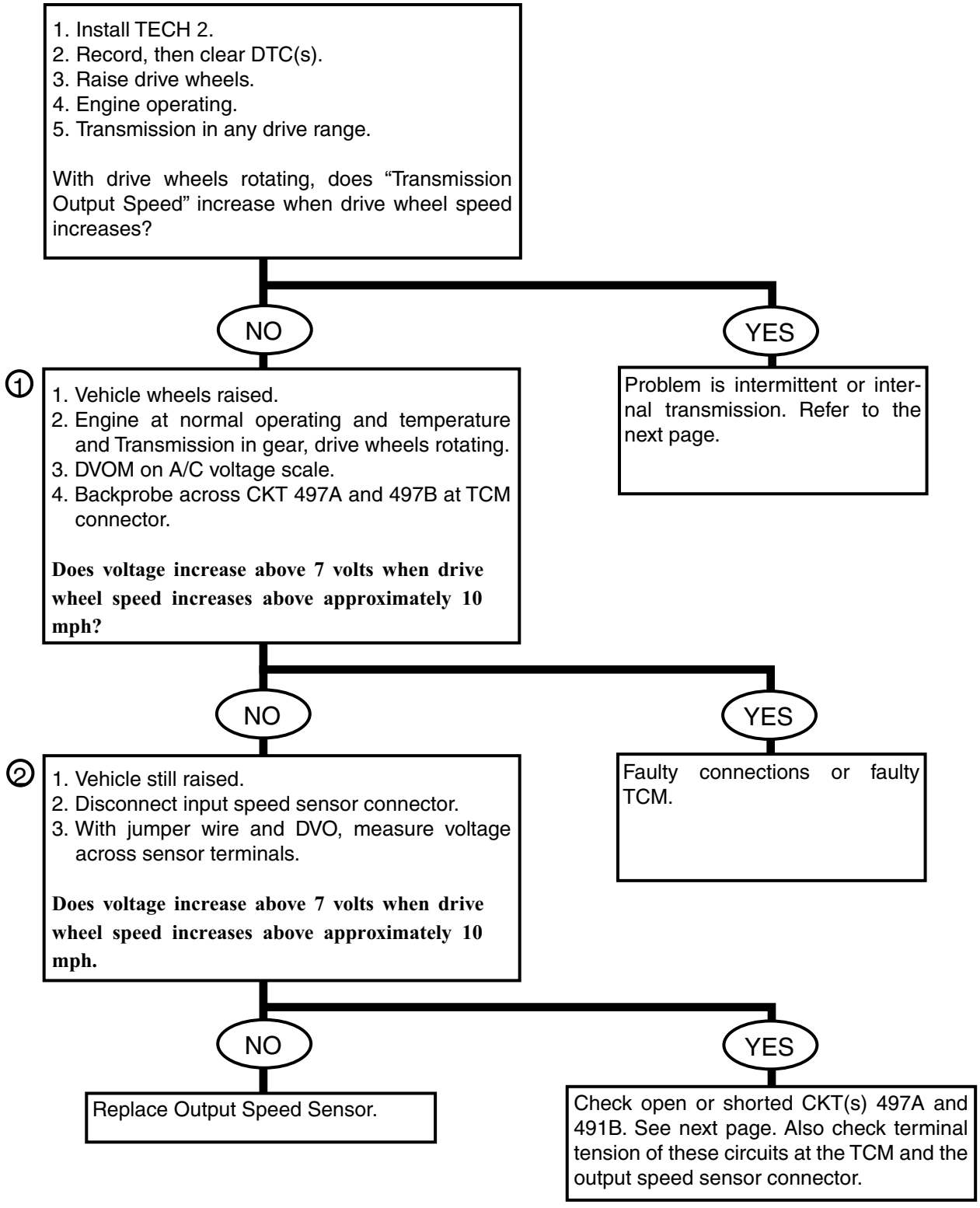
**DTC Chart Test Description:** Numbers(s) below refer to circled number(s) on the diagnostic chart.

1. This checks the entire circuit for continuity.
2. This checks for proper voltage output of the output sped sensor.

**Diagnostic Aids:**

- DTC 24 will set when no vehicle speed is detected at start off.
- DTC 72 will set when vehicle speed has been detected and is lost.

## DTC72 TRANSMISSION OUTPUT SPEED SENSOR (TOSS) CIRCUIT LOSS (USING A TECH 2 SCAN TOOL)

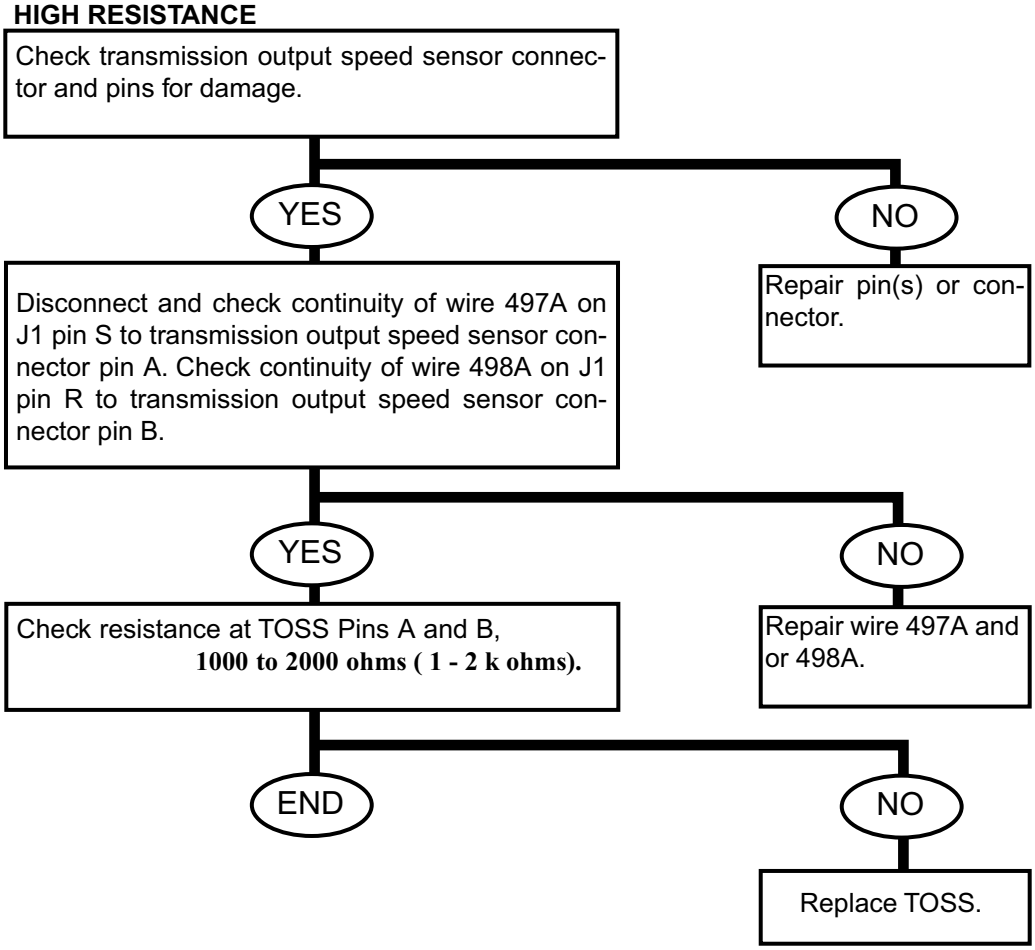


**TRANSMISSION OUTPUT SPEED SENSOR (TOSS) CIRCUIT LOSS (USING A DVOM)**

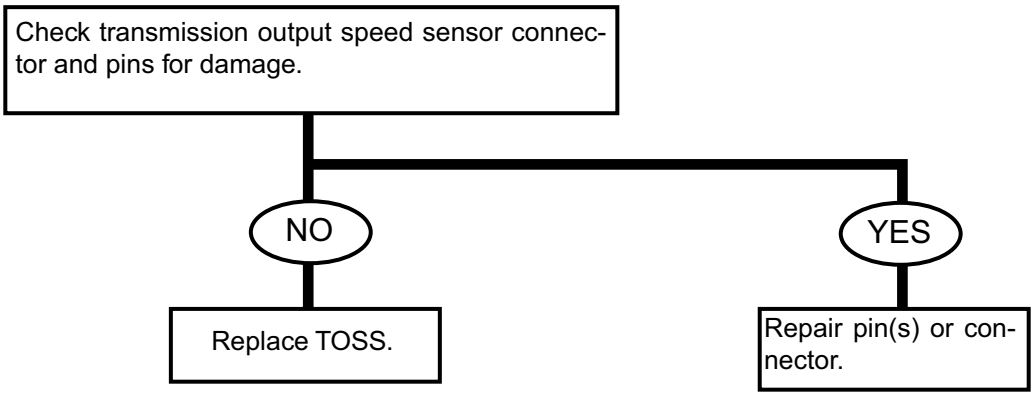
## NOTE

**When reading from TCM J1 diagnostics chart, and reading is greater than 2, perform high resistance. If less than 1, perform low resistance.**

**HIGH RESISTANCE**

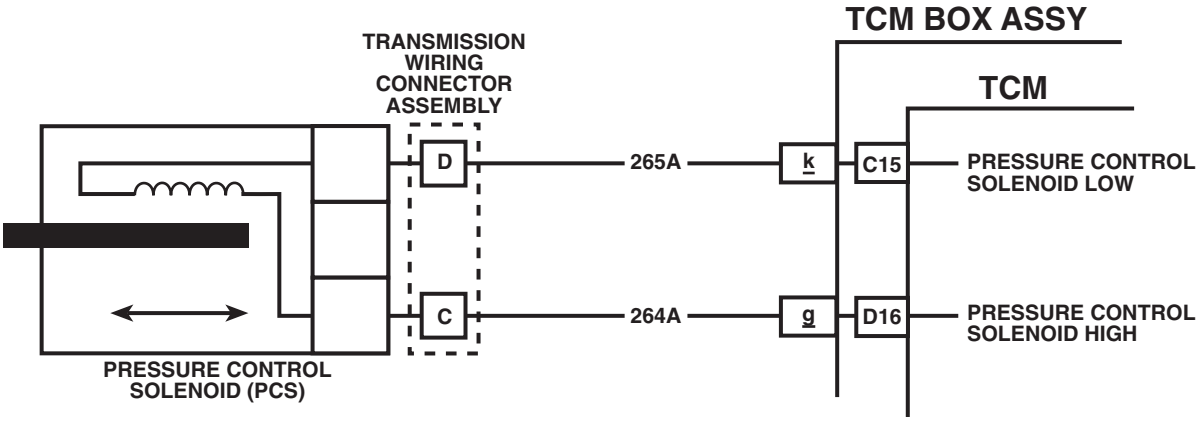



**LOW RESISTANCE**



**DTC 73 PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR)**

**Circuit Description:** The pressure control solenoid is a TCM controlled device used to regulate transmission line pressure. The TCM compares TP voltage, engine RPM and other inputs to determine the appropriate line pressure for a given load. The TCM will regulate the pressure by applying a varying amperage to the pressure control solenoid. The applied amperage can vary from 0.1 to 1.1 amp. The TCM then monitors the amperage at the return line.




**DTC 73 Will Set When:**

- No DTC 75.
- The return amperage varies greater than 0.16 amp from the commanded amperage.
- All conditions are met for 1 second.

**Action Taken (TCM will default to):** Maximum line pressure.

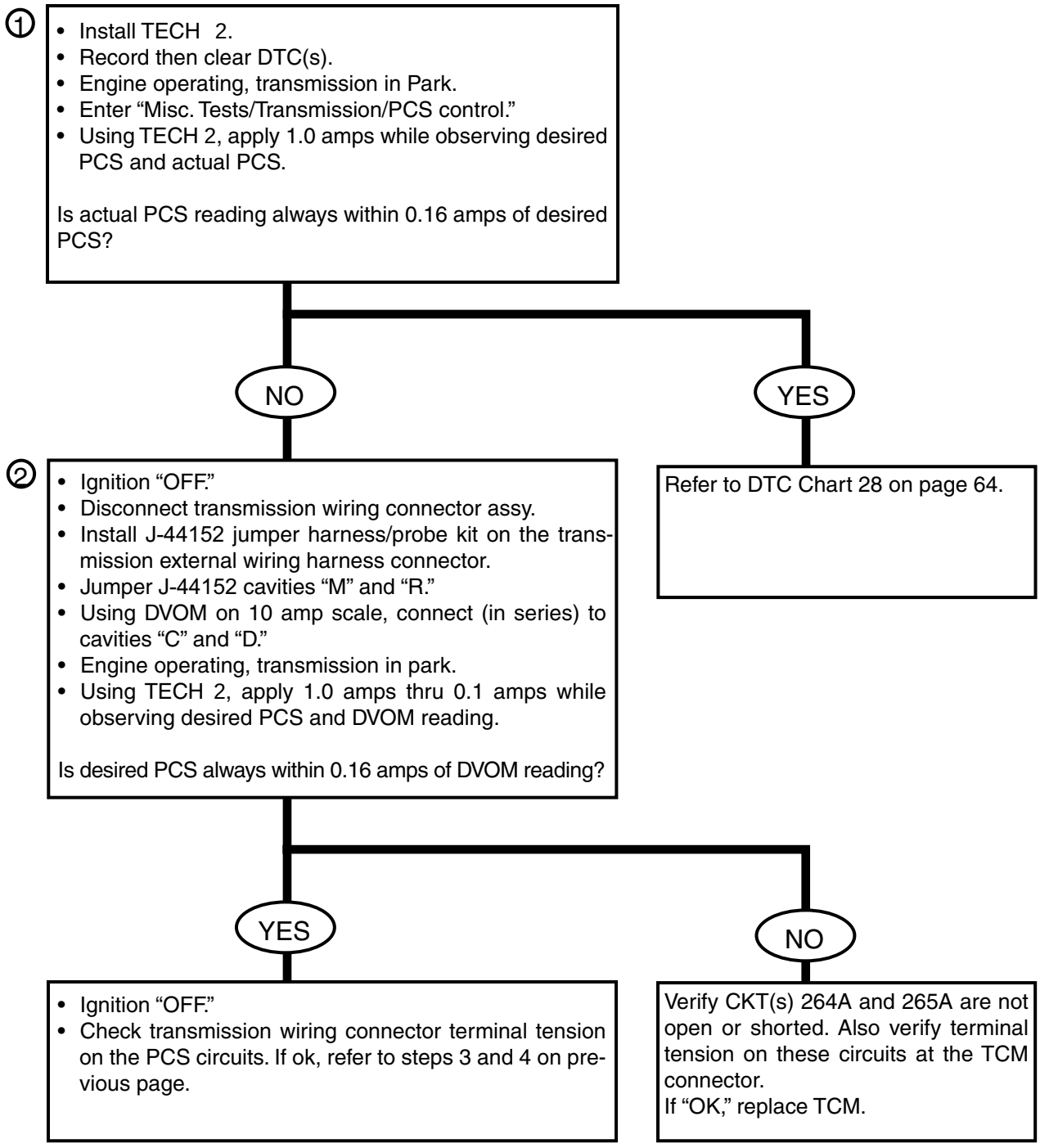
**DTC 73 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled “OFF” then “ON.”

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

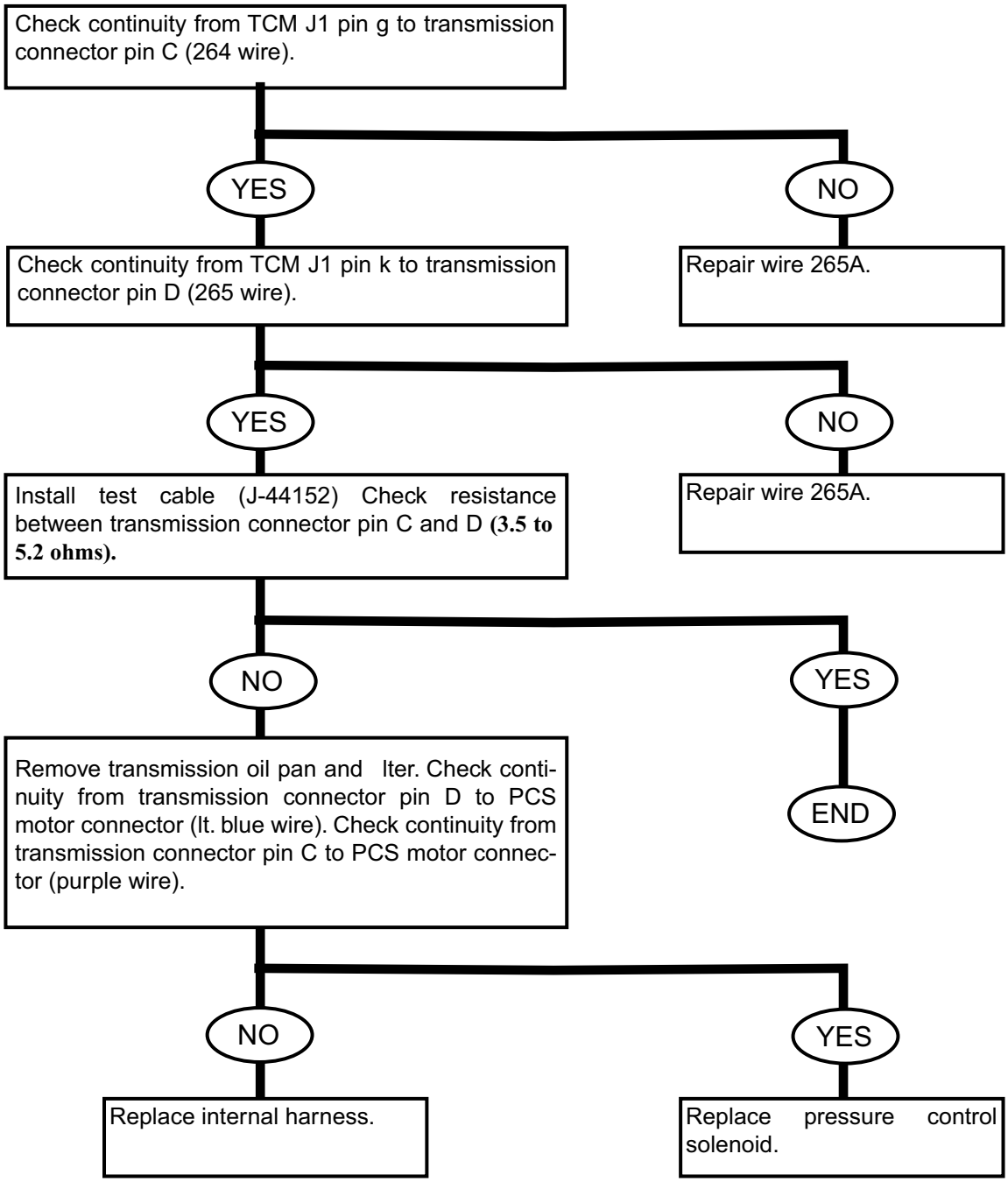
1. This test checks the ability of the TCM to command the pressure control solenoid.
2. This test checks internal transmission harness and the pressure control solenoid for high resistance.

**Diagnostic Aids:** Check for poor connections at TCM and at transmission connector.

## DTC 73 PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR) (USING A TECH 2 SCAN TOOL)



## DTC 73 PRESSURE CONTROL SOLENOID (PCS) CIRCUIT (CURRENT ERROR) (USING A DVOM)



**DTC 74 TRANSMISSION INPUT SPEED SENSOR (TISS) CIRCUIT**

**Circuit Description:** The TIS sensor consists of a permanent magnet surrounded by a coil of wire. As the forward clutch housing rotates, an AC voltage is induced in the circuit. The signal voltage and frequency vary directly with the forward clutch rotational speed.


**DTC 74 Will Set When:**

- No DTC(s) 24, 28, or 71.
- Trans range not in park or neutral.
- Engine speed greater than 300 RPM.
- Trans output speed greater than 200 RPM.
- Trans input speed less than 50 RPM.
- All conditions met for 2 seconds.

**Action Taken (TCM will default to):** No TCC operation.

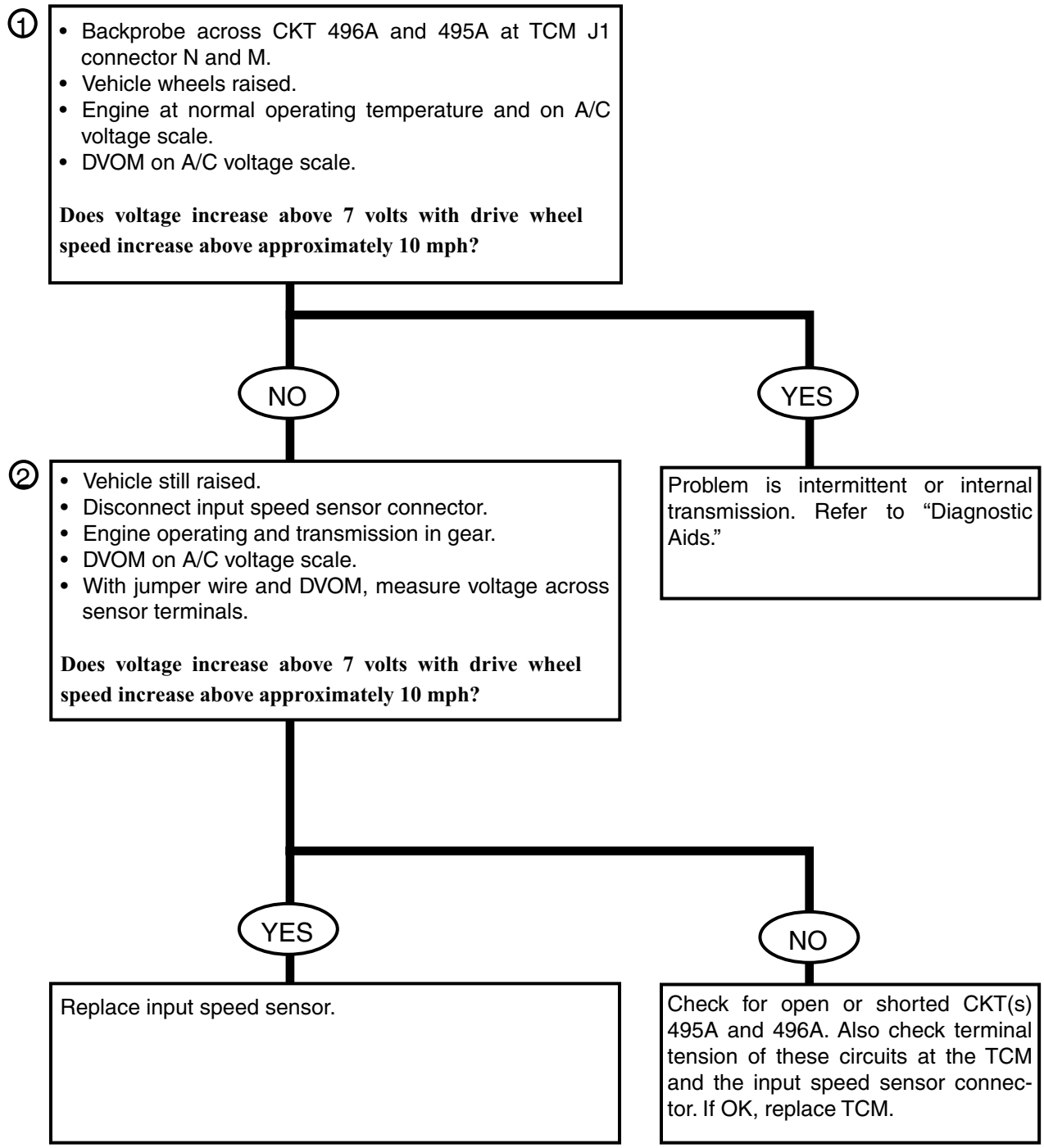
**DTC 74 Will Clear When:** The fault condition(s) no longer exist.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

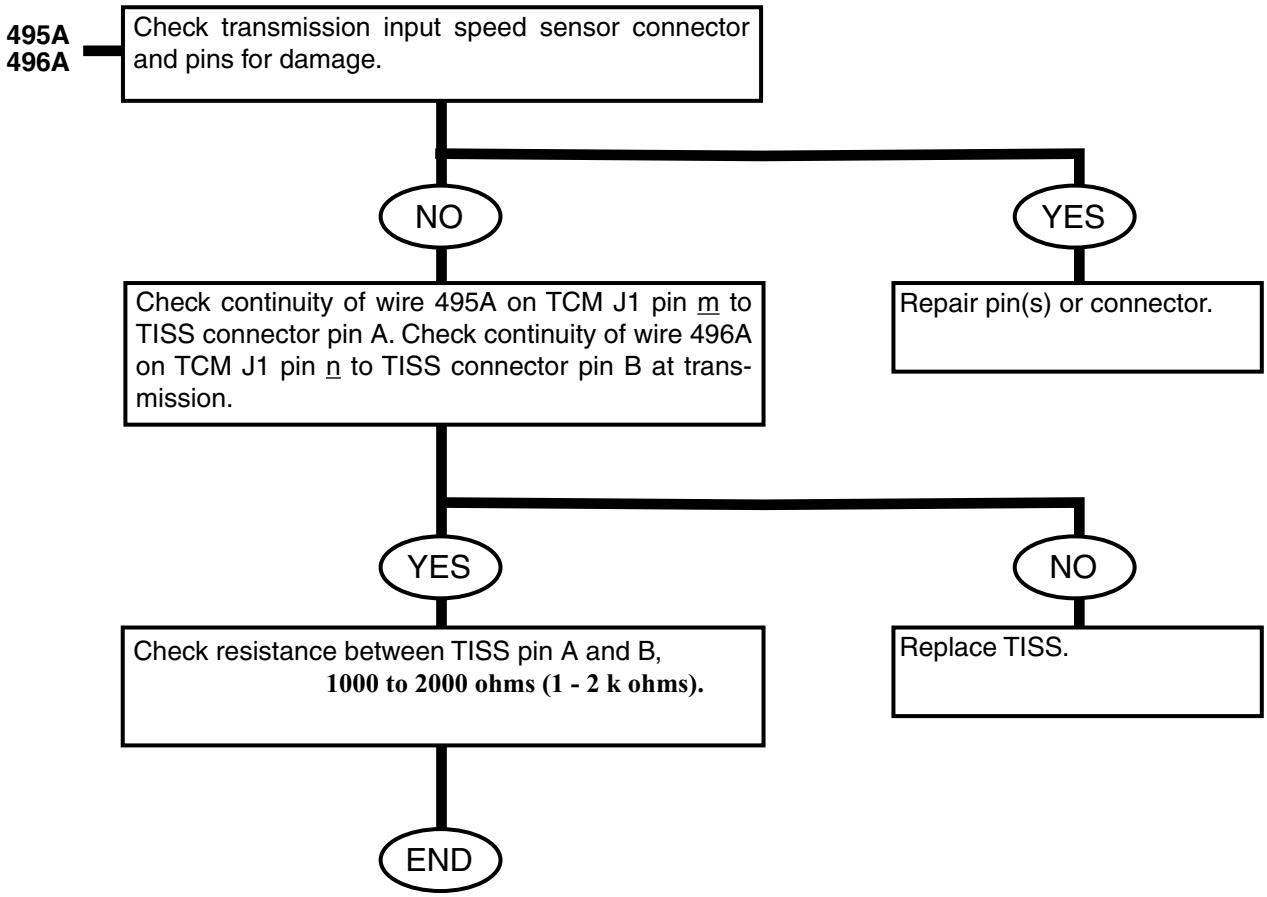
1. This checks the entire circuit for continuity.
2. This checks the output of the input speed sensor.

**Diagnostic Aids:** Refer to TCM intermittent DTC(s) or performance.

## DTC 74 TRANSMISSION INPUT SPEED SENSOR (TISS) CIRCUIT (TECH 2 ONLY)



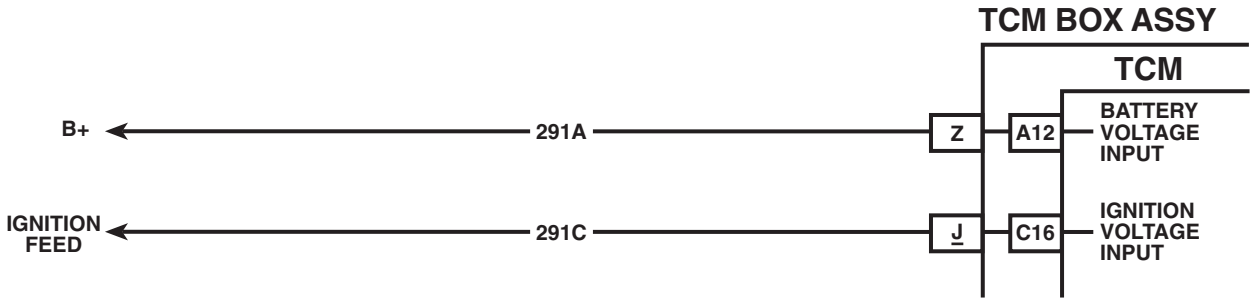
## DTC74 TRANSMISSION INPUT SPEED SENSOR (TISS) CIRCUIT (WITH A DVOM)



**DTC 75 SYSTEM VOLTAGE LOW**

**Circuit Description:** Ignition voltage is supplied to the TCM to indicate the status of the ignition switch.

Battery voltage is supplied to the TCM to, in part, maintain memory of learned functions and parameters.




**DTC 75 Will Set When:**

- The ignition is "ON."
- Ignition feed voltage to the TCM is less than the graduated scale of:
  –40°C (–40°F) = 7.3 volts.
  90°C (194°F) = 10.3 volts.
  150°C (304°F) = 11.7 volts.
- Engine speed greater than 1000 RPM.
- All conditions met for 4 seconds.

**Action Taken (TCM will default to):**

- Maximum line pressure.
- 2nd gear.
- Inhibit TCC.
- Inhibit 4th gear.

**DTC 75 Will Clear When:** Fault condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

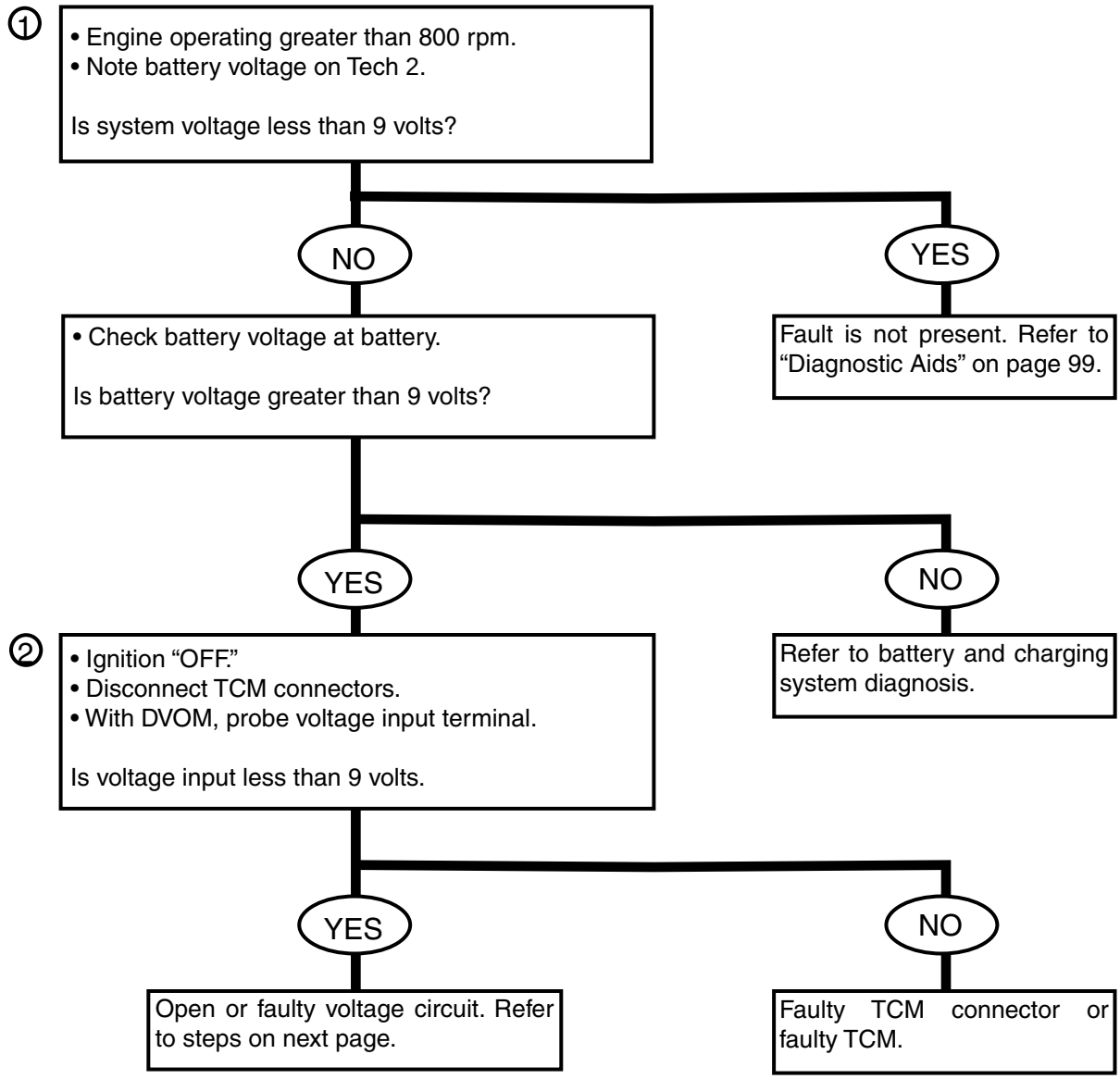
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic charts.

1. Normal battery voltage is between 9-15 volts.
2. This test checks if the generator is faulty under load conditions. If the voltage is greater than 15 volts, refer to Charging System Tests.

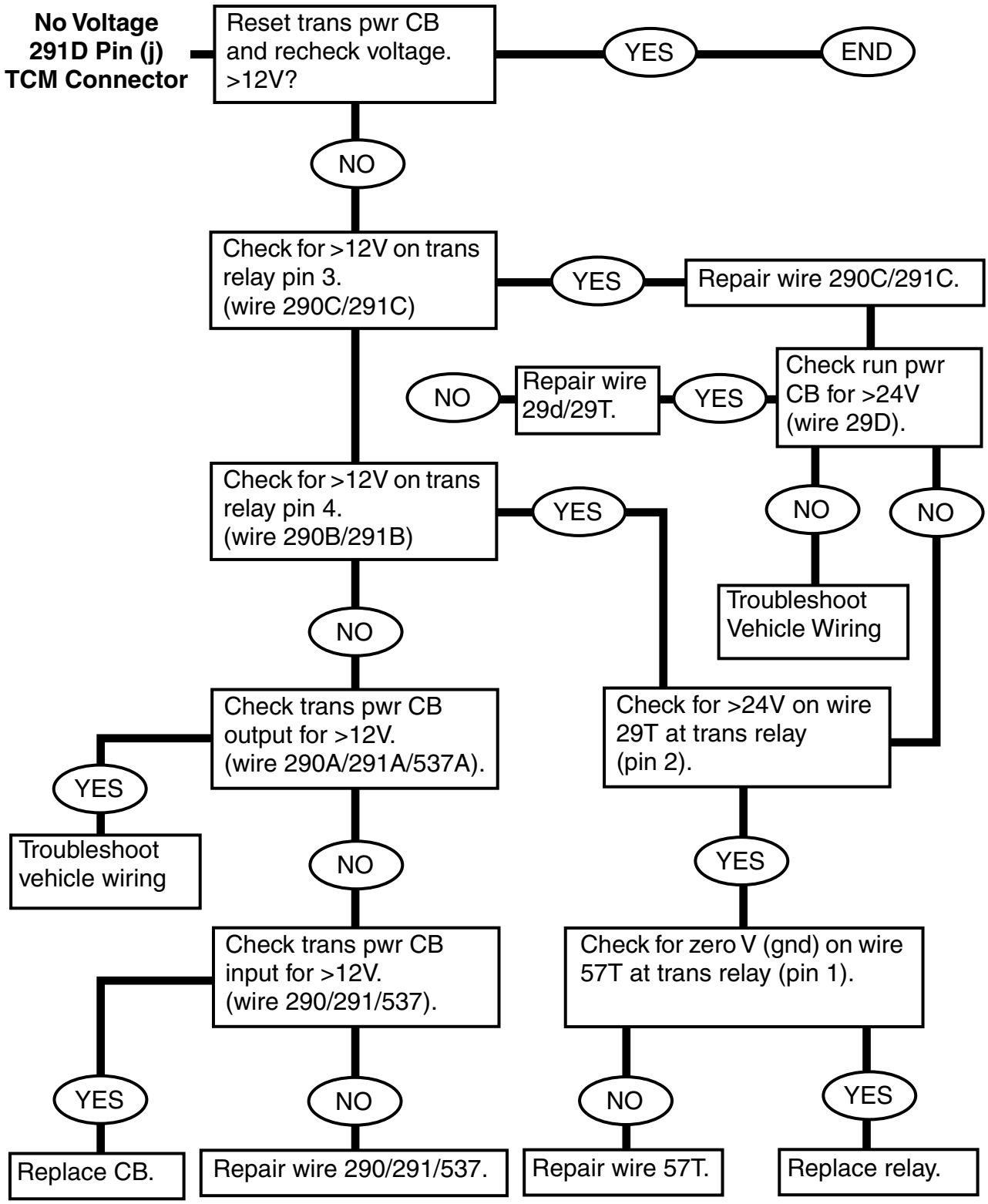
**Diagnostic Aids:** Charging the battery and jump-starting an engine may set DTC 52/ DTC 53. If DTC(s) set when an accessory is operated, check for faulty connections or excessive current draw. Refer to the appropriate service manual for circuit details.

Check for faulty connections at the starter solenoid or fusible link.

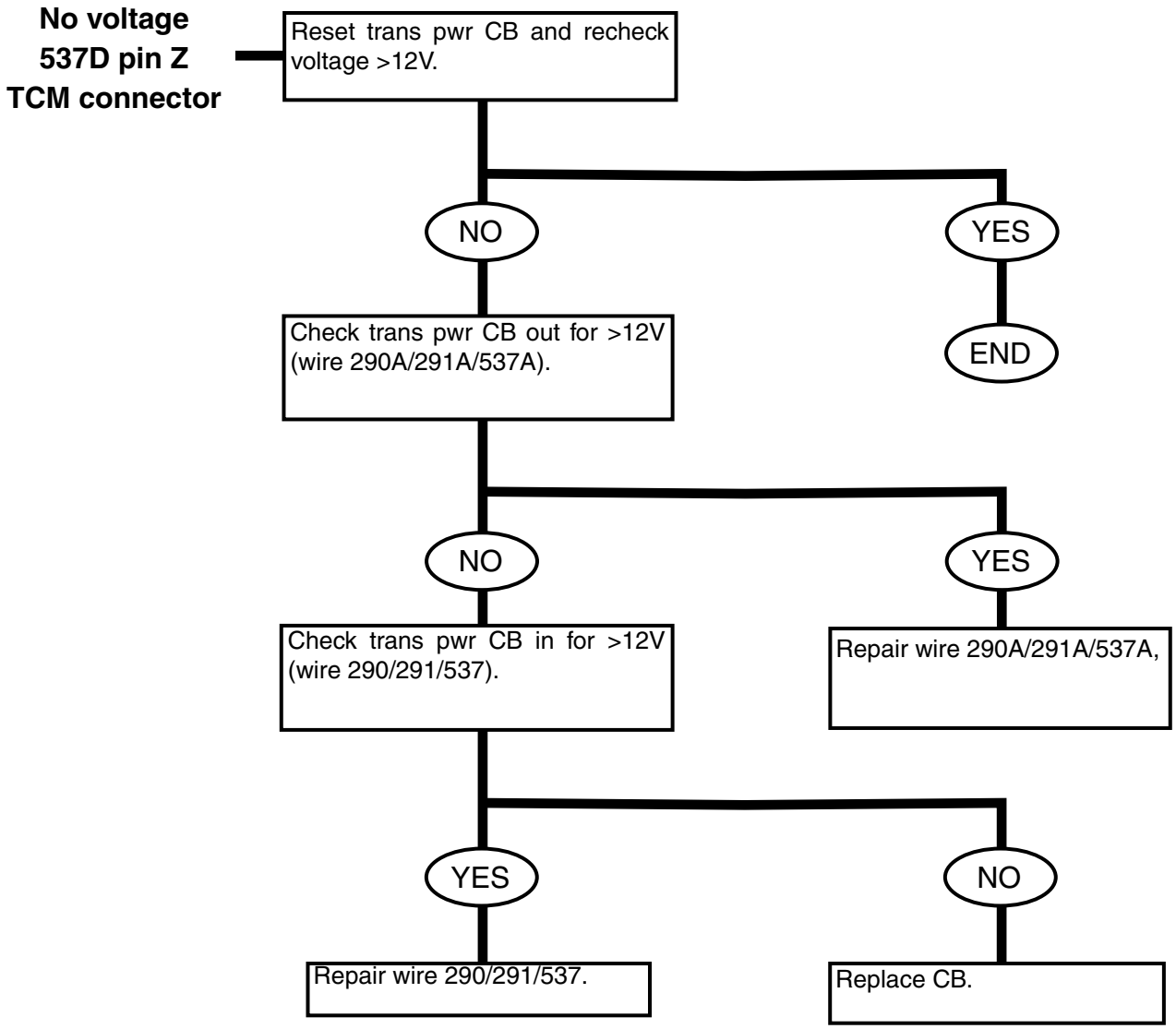
## DTC 75 SYSTEM VOLTAGE LOW (USING A TECH 2 SCAN TOOL)



**IGNITION POWER CIRCUIT**
**(USING A DVOM)**

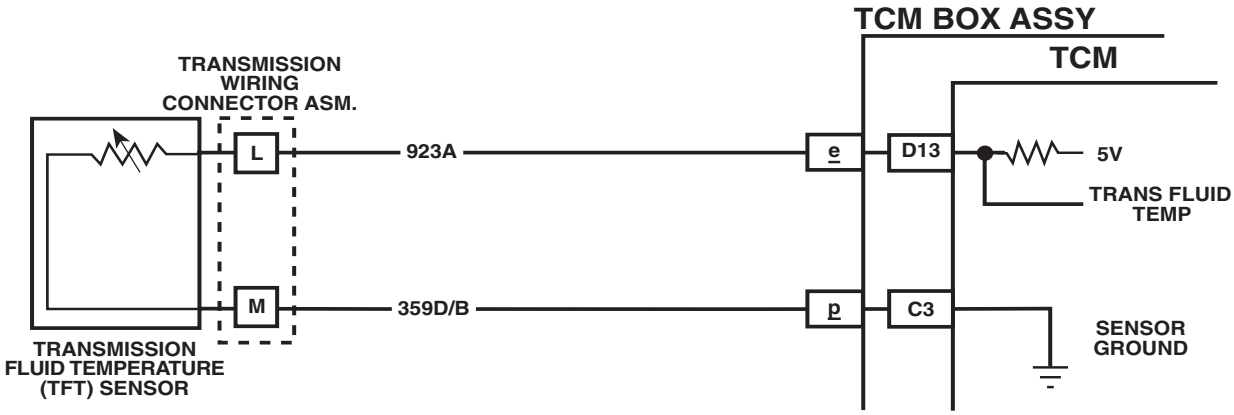


**BATTERY CIRCUIT MEMORY FEED**
**(USING A DVOM)**



### DTC 79 TRANSMISSION FLUID OVERTEMP

**Circuit Description:** The Transmission Fluid Temperature (TFT) sensor is a thermistor that controls the signal voltage to the TCM. The TCM supplies a 5 volt reference signal to the sensor on CKT 923A. When the transmission fluid is cold, the sensor resistance is high and the TCM will sense high signal voltage. As the transmission fluid temperature warms to normal transmission operating temperature 66°C (150°F), the sensor resistance becomes less and the voltage decreases.




**DTC 79 Will Set When:**

- No DTC 58.
- Trans fluid temp greater than 146°C (295°F).
- All conditions met for 30 minutes.

**DTC 79 Will Clear When:** The fault condition no longer exists.

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks for a "skewed" or shorted circuit.
2. This test simulates a DTC 59s.

Table 23: Temperature to Resistance Values (Approximate)

| OHMS | °C | °F |
|---|---|---|
| 185 | 100 | 210 |
| 450 | 70 | 160 |
| 1,800 | 38 | 100 |
| 3,400 | 20 | 70 |
| 7,500 | 4 | 40 |
| 13,500 | –7 | 20 |
| 25,000 | –18 | 0 |
| 100,700 | –40 | –40 |

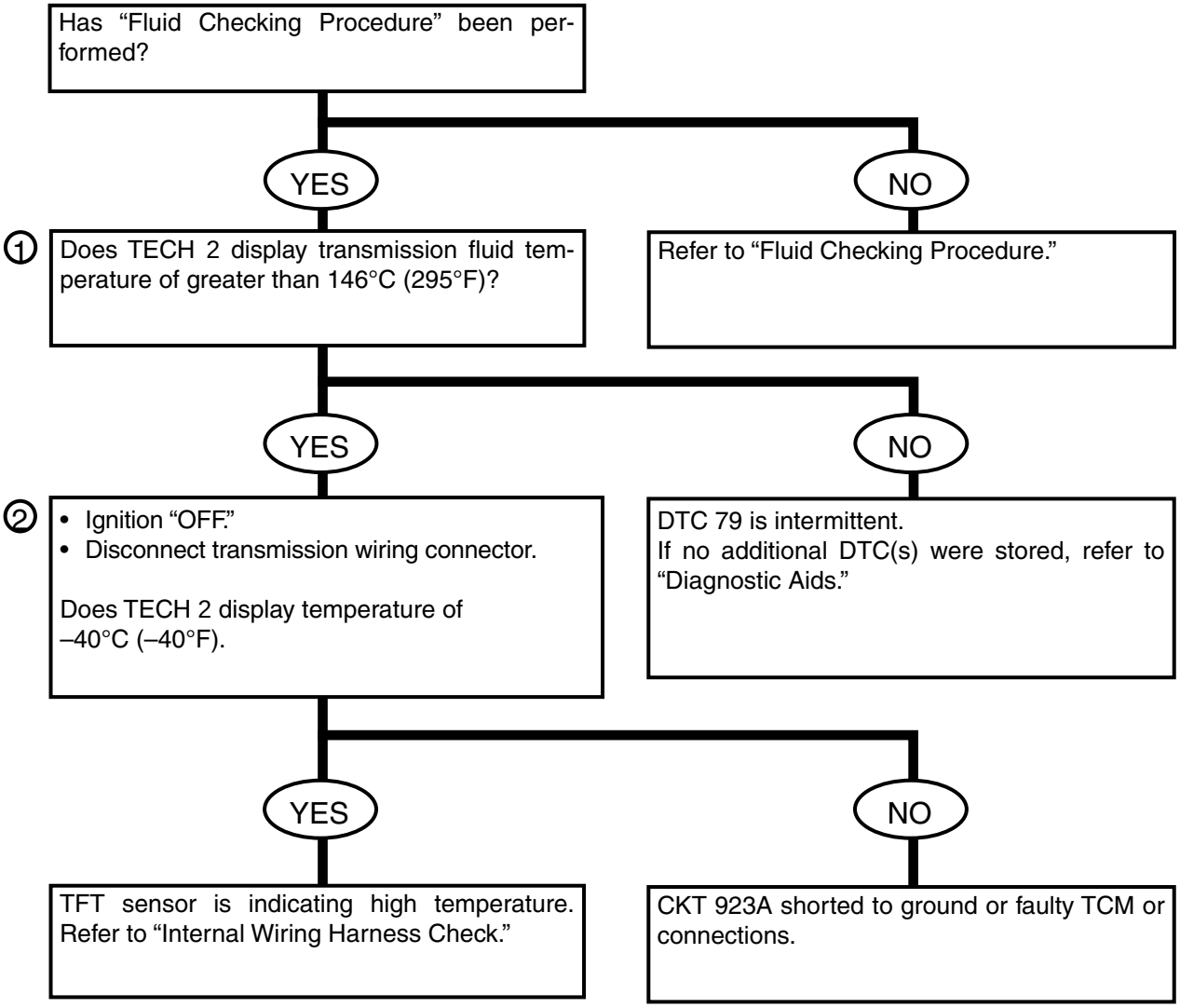
**Diagnostic Aids:** Check harness routing for a potential short to ground in CKT 923A.

Scan tool TFT displays should rise steadily to about 66°C then stabilize.

Refer to "TCM Intermittent Diagnostic Trouble Codes or Performance."

The temperature to resistance value scale may be used to test the transmission sensor at the various temperature levels to evaluate the possibility of a "skewed" sensor. A "skewed" sensor could result in delayed garage shifts or TCC complaints.

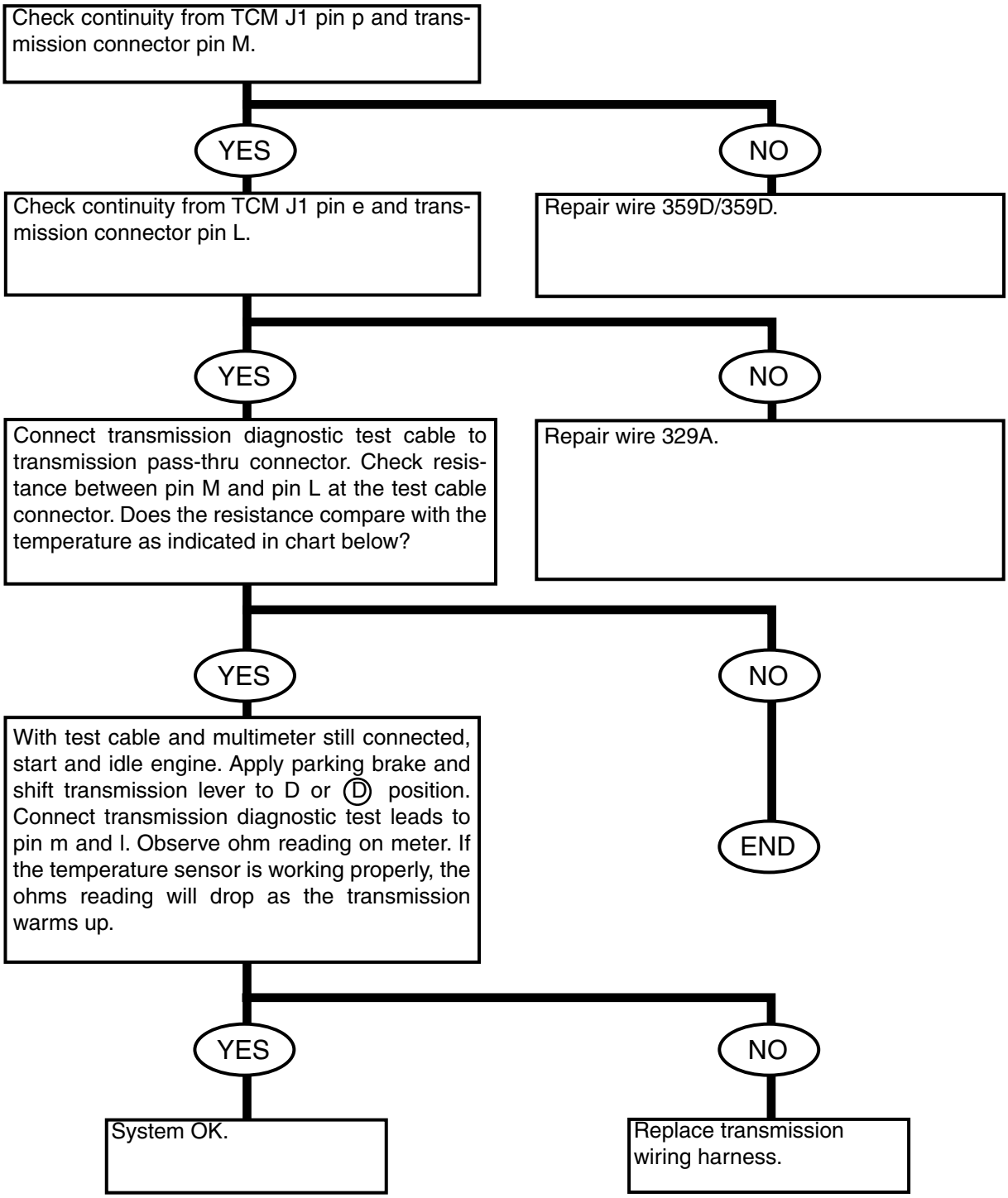
## DTC 79 TRANSMISSION FLUID OVERTEMP (USING A TECH 2 SCAN TOOL)




**WHEN ALL DIAGNOSSIS AND REPAIRS ARE COMPLETED, CLEAR DTC(S) AND VERIFY PROPER OPERATION.**

**TRANSMISSION TEMPERATURE SENSOR CABLE (USING A DVOM)**

The transmission temperature sensor is a thermistor. The resistance decreases as temperature increases.



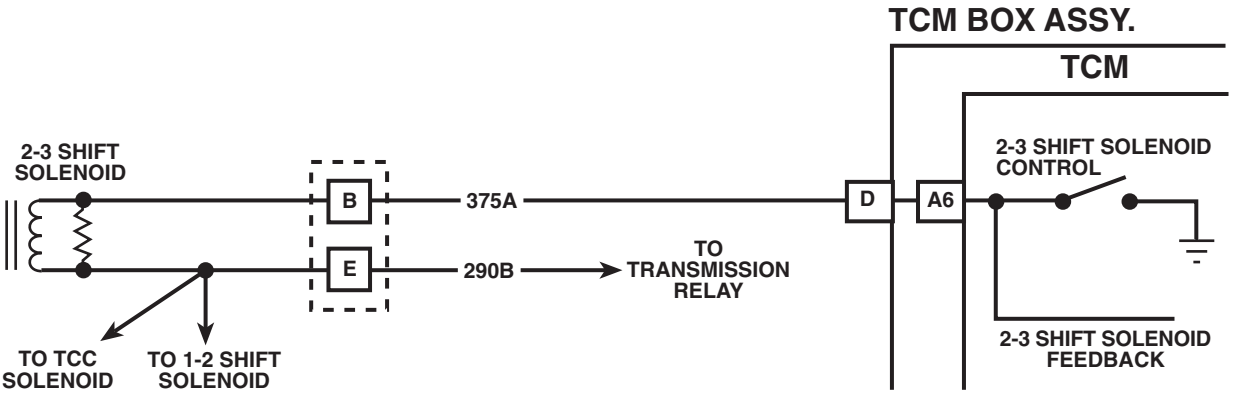
## TRANSMISSION FLUID SENSOR TEMPERATURE

Table 24: Transmission Fluid Sensor
Temperature to Resistance Chart

| °C | °F | MINIMUM RESISTANCE | NOMINAL RESISTANCE | MAXIMUM RESISTANCE |
|---|---|---|---|---|
| –40°C | -40°F | 80965 | 100544 | 120123 |
| –30°C | –20°F | 42701 | 52426 | 62151 |
| –20°C | _4°F | 23458 | 28491 | 33524 |
| –10°C | 14°F | 13366 | 16068 | 18770 |
| 0°C | 32°F | 7871 | 9370 | 10869 |
| 10°C | 50°F | 4771 | 5640 | 6508 |
| 20°C | 69°F | 2981 | 3500 | 4018 |
| 30°C | 86°F | 1915 | 2232 | 2550 |
| 40°C | 104°F | 1260 | 1460 | 1660 |
| 50°C | 122°F | 848.8 | 977.1 | 1105 |
| 60°C | 140°F | 584.1 | 668.7 | 753.4 |
| 70°C | 158°F | 419.3 | 467.2 | 524.2 |
| 80°C | 176°F | 293.7 | 332.7 | 371.7 |
| 90°C | 194°F | 213.9 | 241.0 | 268.2 |
| 100°C | 212°F | 158.1 | 177.4 | 196.8 |
| 110°C | 239°F | 118.8 | 132.6 | 146.5 |
| 120°C | 248°F | 90.40 | 100.6 | 110.8 |
| 130°C | 266°F | 69.48 | 77.29 | 85.11 |
| 140°C | 284°F | 53.96 | 60.13 | 66.29 |
| 150°C | 304°F‘ | 47.43 | 47.31 | 52.20 |

### DTC 81 2-3 SHIFT SOLENOID CIRCUIT FAULT

**Circuit Description:** Ignition voltage is supplied directly to the 2-3 shift solenoid. The Transmission Control Module (TCM) controls the solenoid by providing the ground path through CKT 315A.




**DTC 81 Will Set When:**

- The TCM commands the solenoid "ON" and voltage remains high.
- The TCM commands the solenoid "OFF" and voltage remains low.
- All conditions are met for 2 seconds.

**Action Taken (TCM will default to):**

- Maximum line pressure.
- No TCC.
- 2nd or 3rd gear only.

**DTC 81 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks 2-3 shift solenoid and the internal transmission wiring for shorts.
2. This test checks for power to 2-3 shift solenoid from the ignition through the fuse.

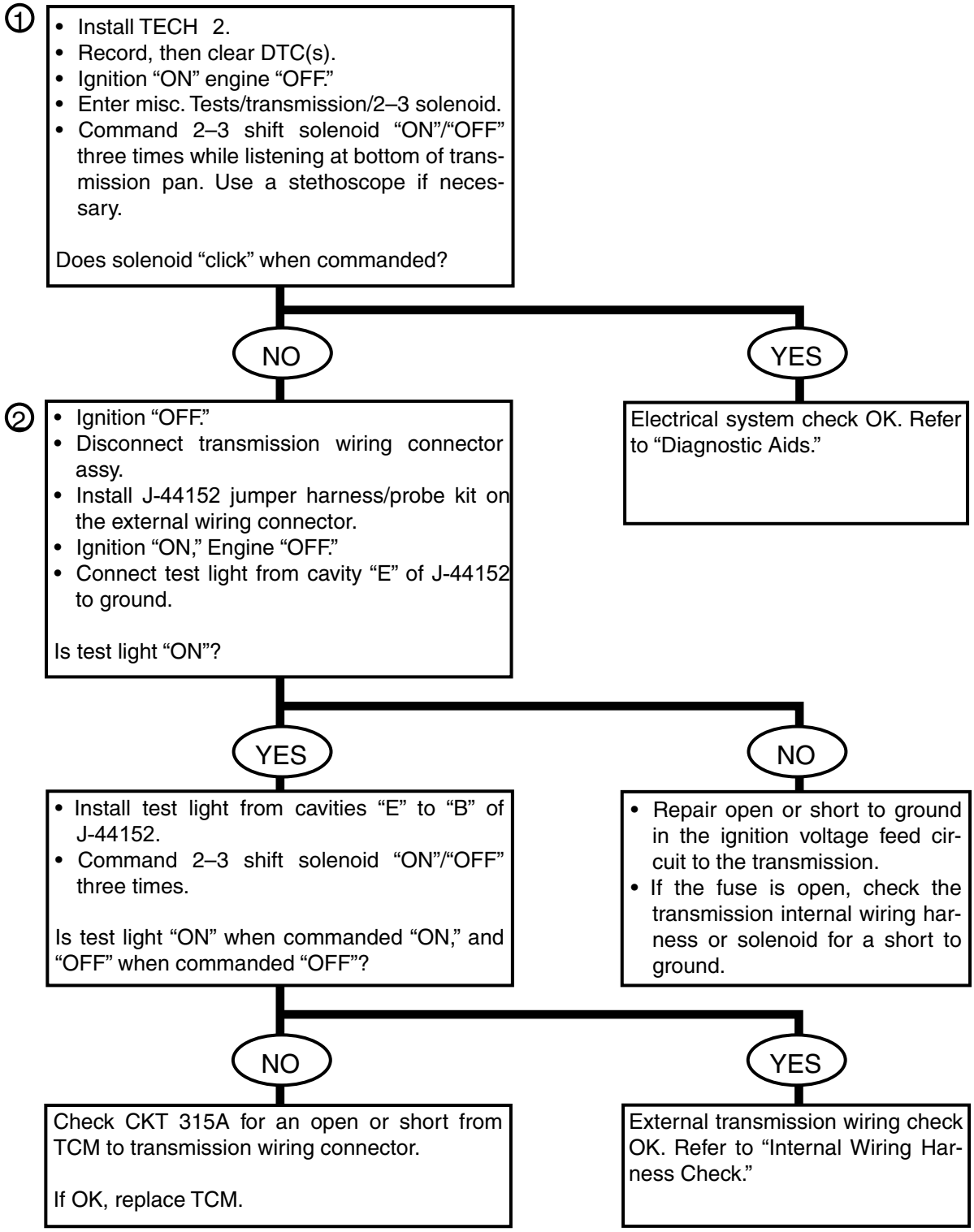
**Diagnostic Aids:** Check all connections at the transmission. Refer to "TCM Intermittent Diagnostic Trouble Codes or Performance."

An open in the ignition feed circuit can cause multiple DTC(s) to set.

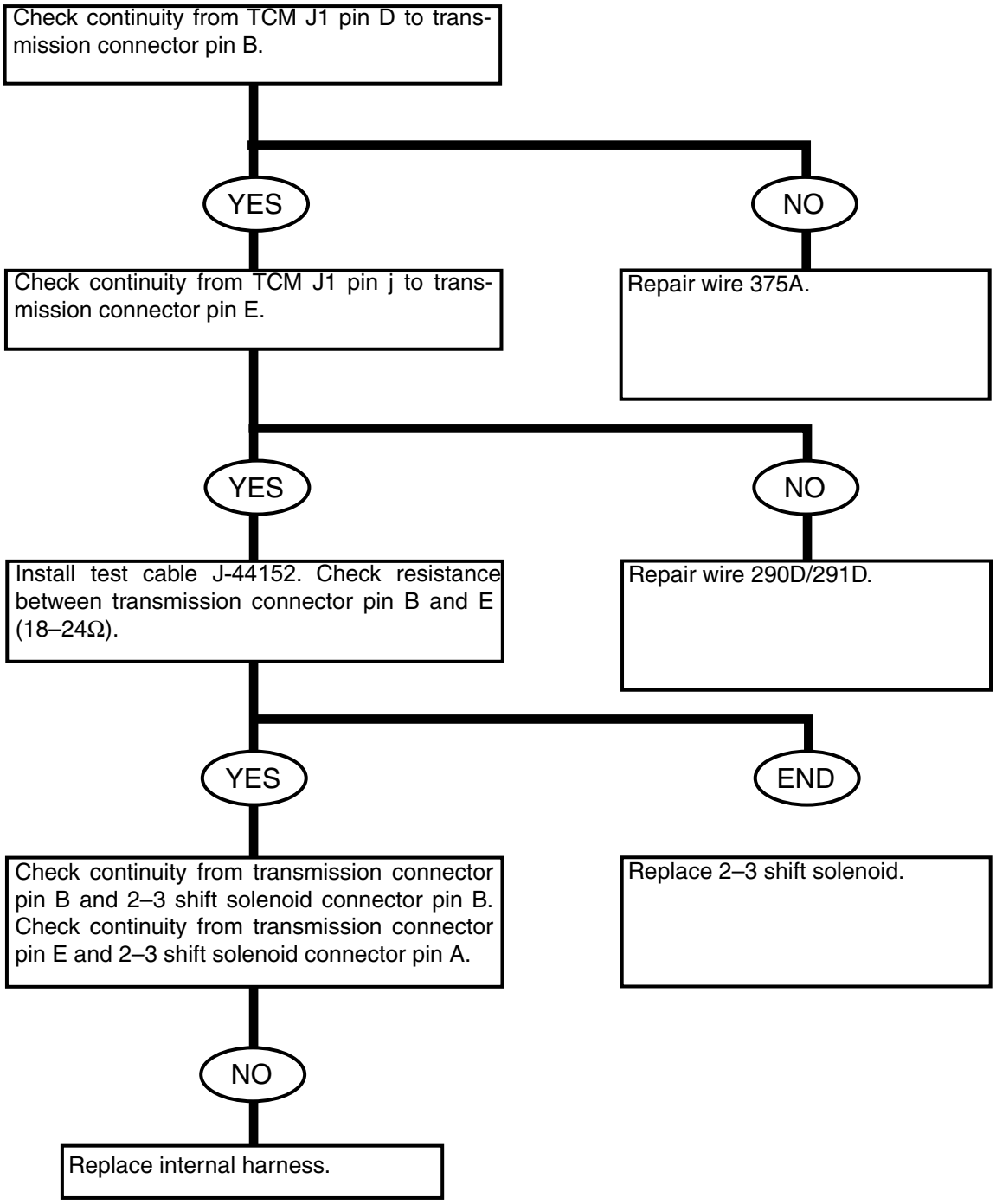
Table 25: Shift Solenoid Chart

| GEAR | 1-2 SHIFT SOLENOID | 2-3 SHIFT SOLENOID |
|---|---|---|
| 1 | ON | OFF |
| 2 | OFF | OFF |
| 3 | OFF | ON |
| 4 | ON | ON |

## DTC 81 2-3 SHIFT SOLENOID CIRCUIT FAULT (TECH 2 ONLY)

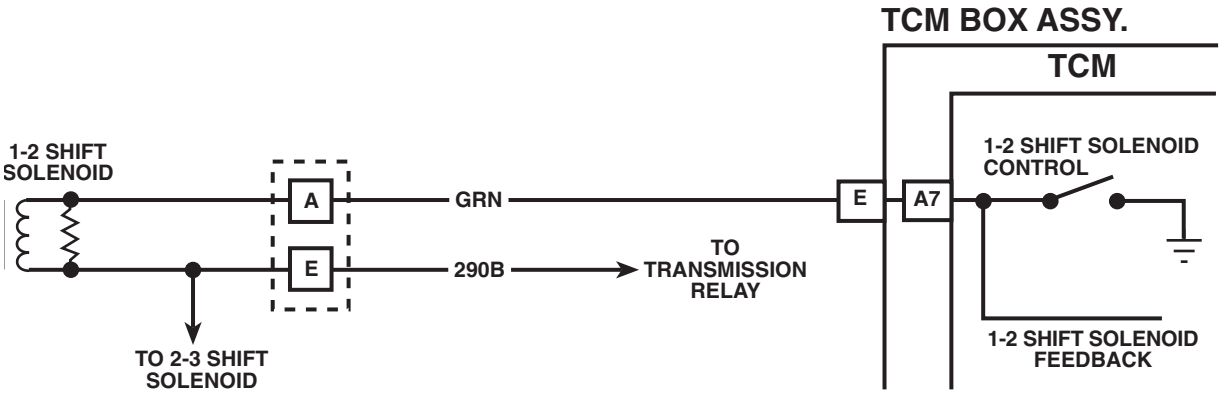


## 2–3 SHIFT SOLENOID CIRCUIT (USING A DVOM)



**DTC 82 1-2 SHIFT SOLENOID CIRCUIT FAULT**

**Circuit Description:** Ignition voltage is supplied directly to the 1-2 shift solenoid. The Transmission Control Module (TCM) controls the solenoid by providing the ground path through CKT 237A.




**DTC 82 Will Set When:**

- The TCM commands the solenoid “ON” and voltage remains high.
- The TCM commands the solenoid “OFF” and voltage remains low.
- All conditions are met for 2 seconds.

**Action Taken (TCM will default to):**

- Maximum line pressure.
- 2nd or 3rd gear only or 1st or 4th gear only.

**DTC 82 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled “OFF” then “ON.”

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test checks 1-2 shift solenoid and the internal transmission wiring for shorts.
2. This test checks for power to 1-2 shift solenoid from the ignition through the fuse.

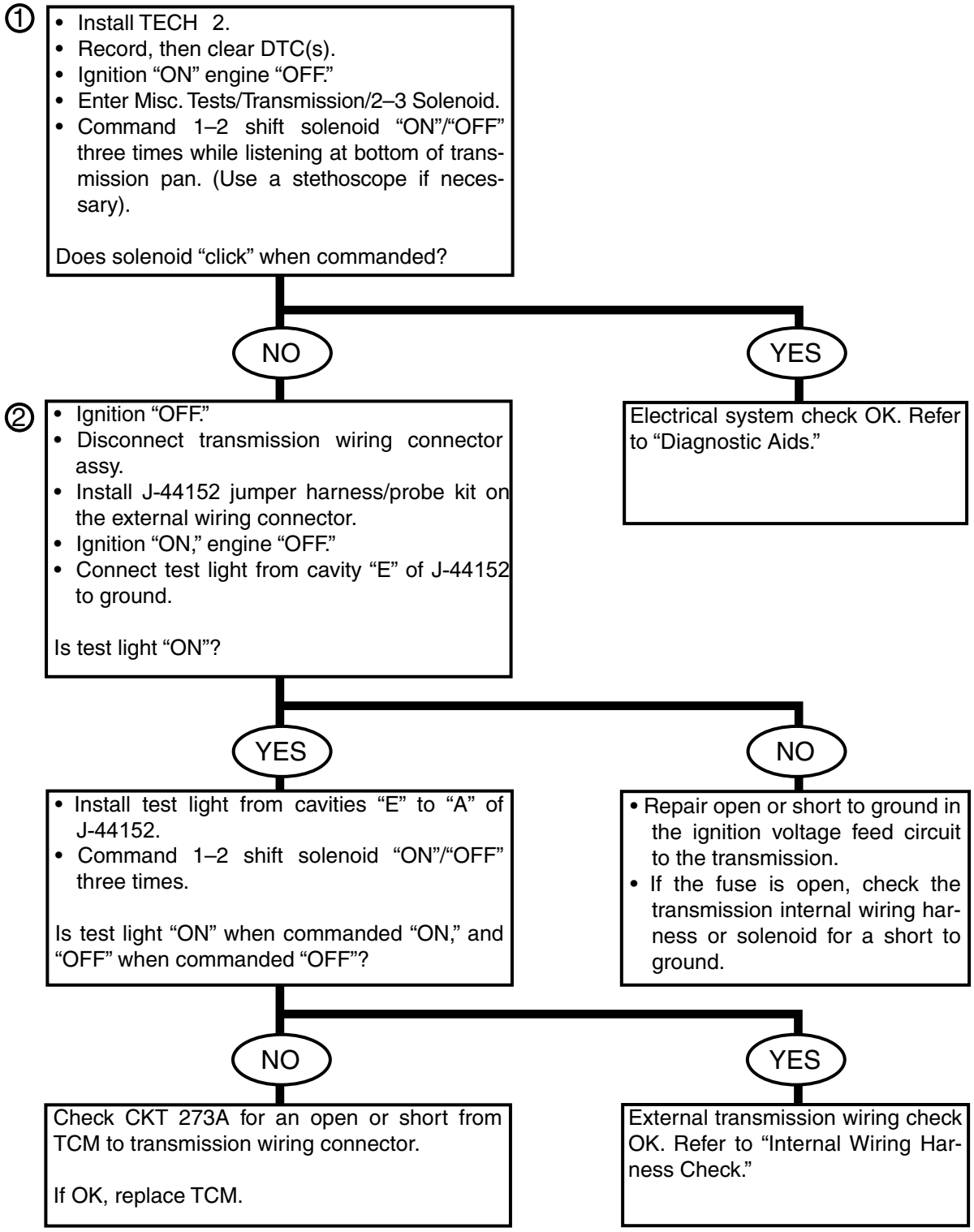
**Diagnostic Aids:** Check all connections at the transmission. Refer to “TCM Intermittent Diagnostic Trouble Codes or Performance.”

An open in the ignition feed circuit can cause multiple DTC(s) to set.

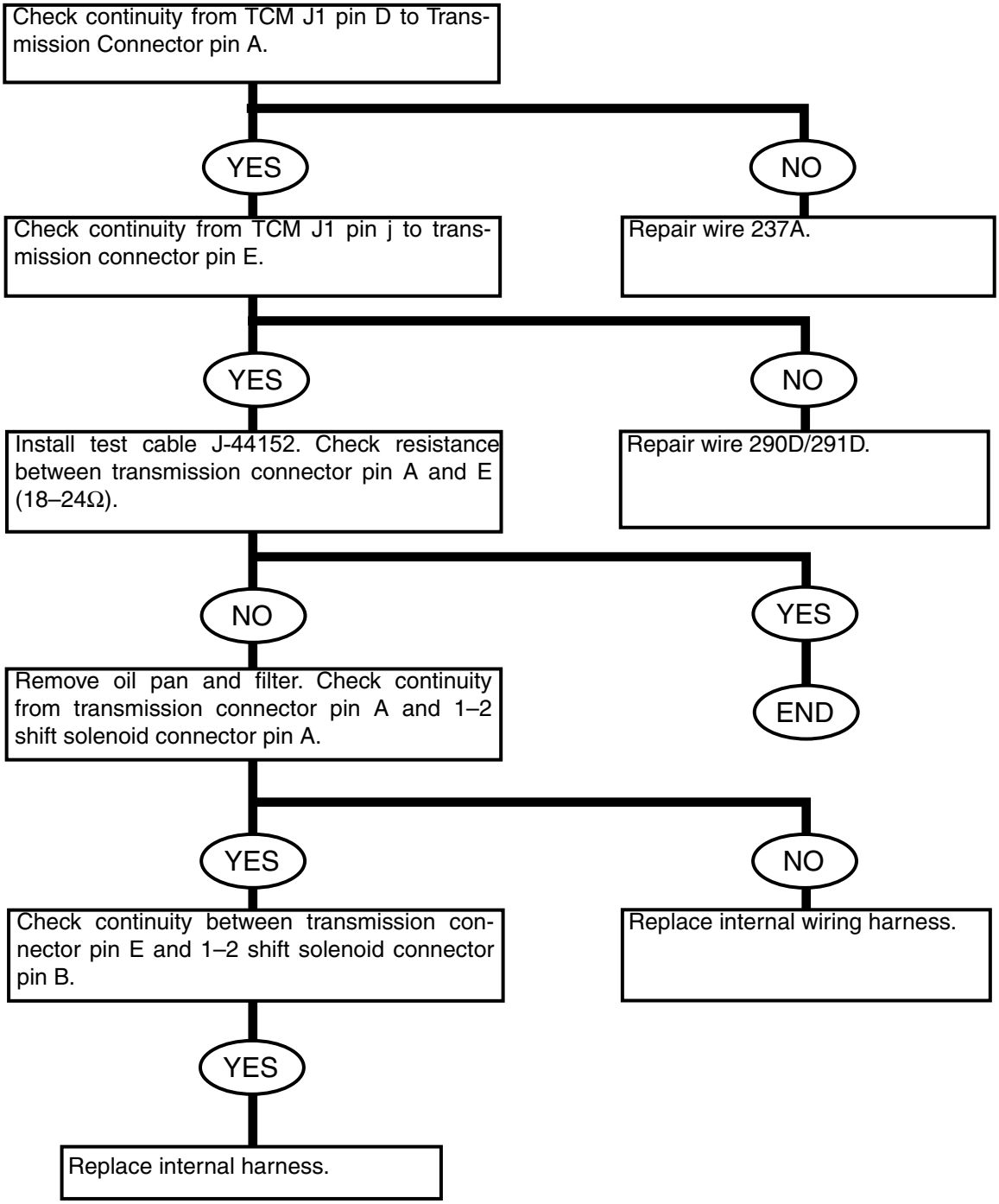
Table 26: Shift Solenoid Chart

| GEAR | 1-2 SHIFT SOLENOID | 2-3 SHIFT SOLENOID |
|---|---|---|
| 1 | ON | OFF |
| 2 | OFF | OFF |
| 3 | OFF | ON |
| 4 | ON | ON |

## 1–2 SHIFT SOLENOID CIRCUIT FAULT (TECH 2 ONLY)

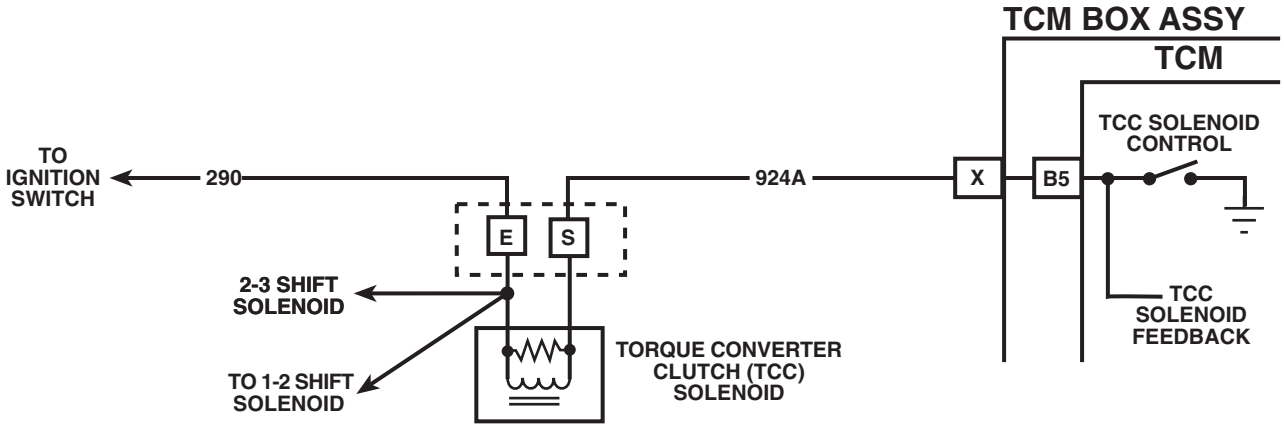


## 1–2 SHIFT SOLENOID CIRCUIT FAULT (USING A DVOM)



### DTC 83 TCC PWM SOLENOID CIRCUIT FAULT

**Circuit Description:** The TCM supplies a ground through an internal Quad-Driver Module (QDM) allowing current to flow through the solenoid coil according to the duty cycle (percentage of "ON" and "OFF" time). This current flow through the solenoid coil creates a magnetic field that magnetizes the solenoid core. The magnetized core attracts the check ball to seat against spring pressure. This blocks the exhaust for the TCC signal fluid and allows 2-3 drive fluid to feed the TCC signal circuit. The TCC signal fluid pressure acts on the TCC regulator valve to regulate line pressure and to apply fluid pressure to the torque converter clutch shift valve. When the TCC shift valve is in the apply position, regulated apply fluid pressure is directed through the TCC valve to apply the torque converter clutch.




**DTC 83 Will Set When:**

- The TCM commands the solenoid "ON" and voltage remains high.
- The TCM commands the solenoid "OFF" and voltage remains low.
- All conditions are met for 2 seconds.

**Action Taken (TCM will default to):**

- Inhibit TCC operation.
- Inhibit 4th gear operation if in hot mode.

**DTC 83 Will Clear When:** The fault condition(s) no longer exist, and the ignition switch is cycled "OFF" then "ON."

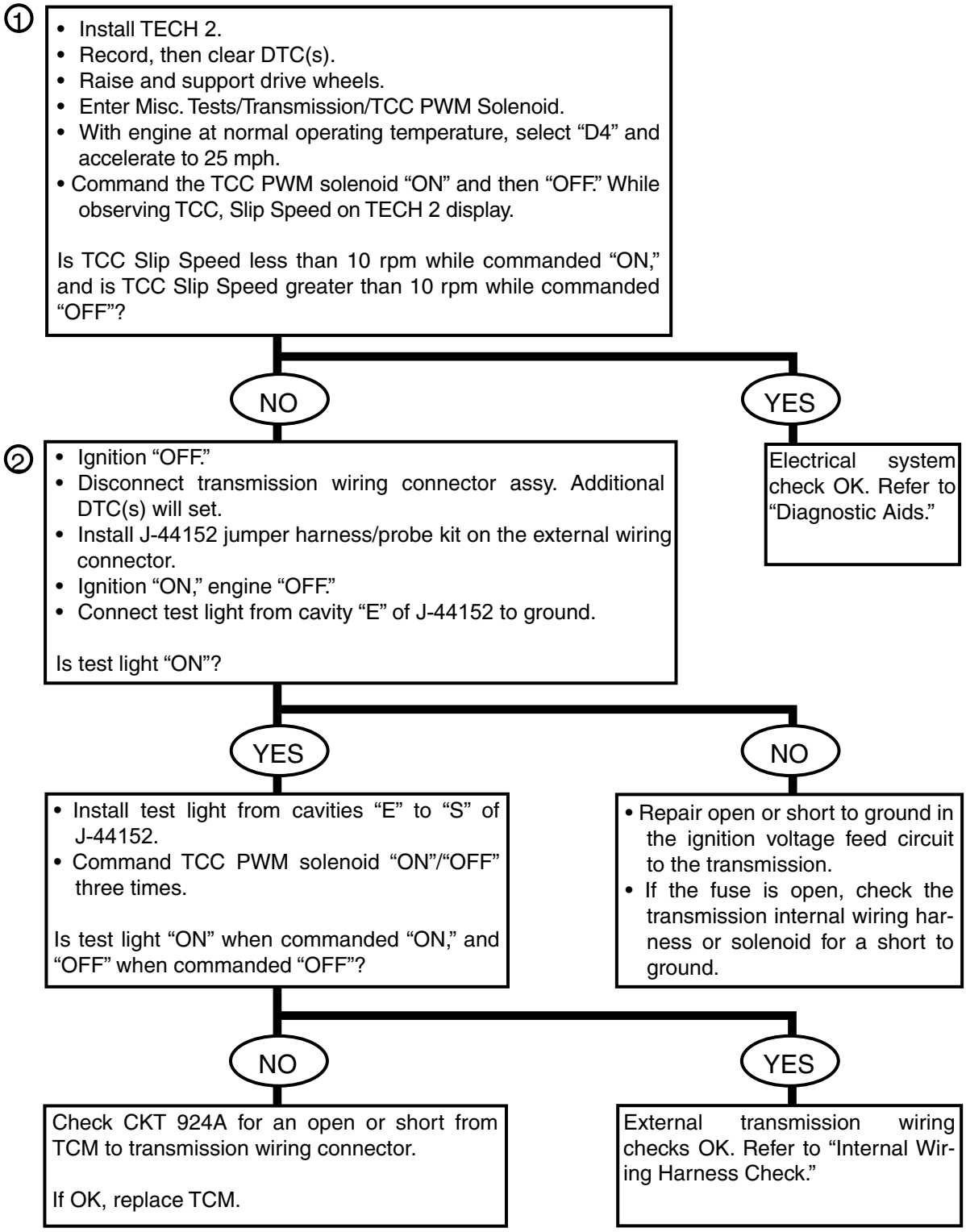
**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. This test will check if the TCM is commanding the TCC solenoid "ON."
2. This test will check for voltage to the solenoid.

**Diagnostic Aids:** Check all connections at the transmission pass-thru connector.

If they are OK, refer to "TCM Intermittent DTC(s) or Performance."

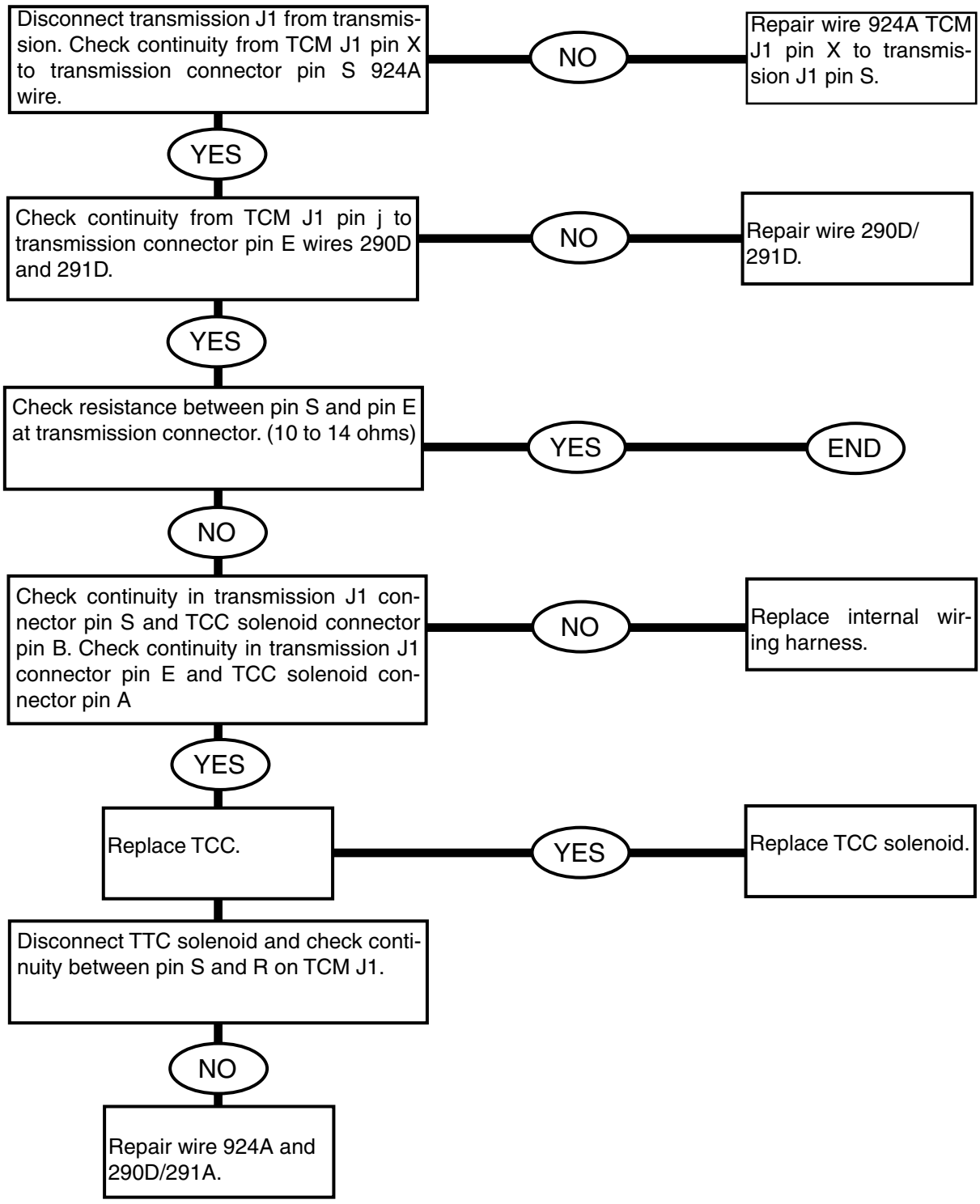
## DTC 83 TCC PWM SOLENOID CIRCUIT FAULT (TECH 2 ONLY)



## DTC 83 TCC PWM SOLENOID CIRCUIT FAULT (USING A DVOM)

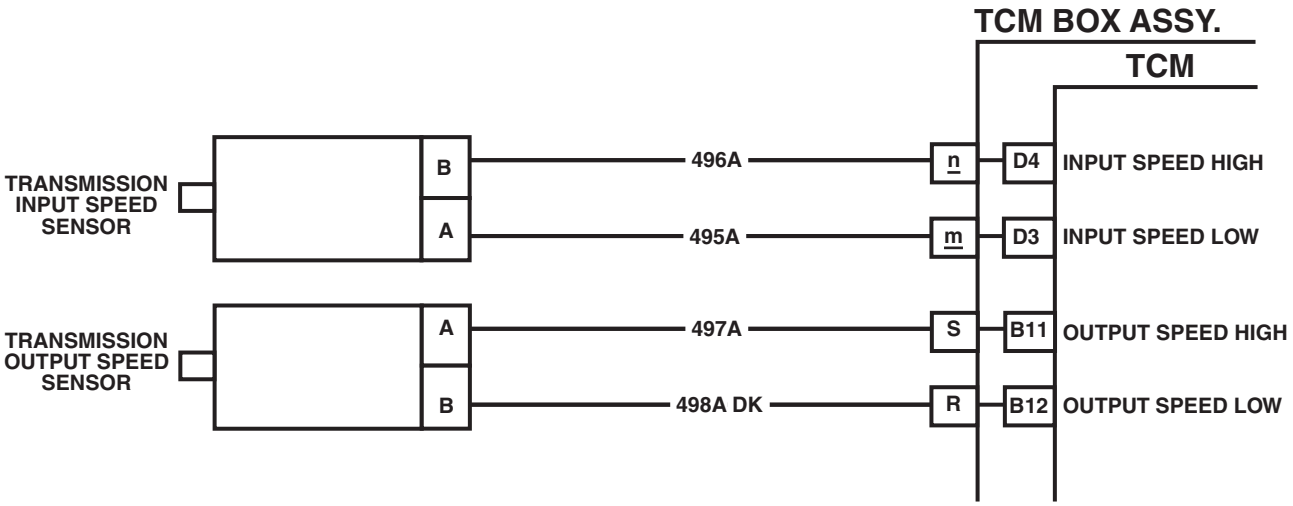
### NOTE

**All checks are done with start switch in the "Run Position"**



**DTC 85 UNDEFINED RATIO ERROR**

**Circuit Description:** The TCM calculates ratio based on the input speed and output speed sensor readings. The TCM compares the known transmission ratio to the calculated ratio, for the particular gear range selected.




**DTC 85 Will Set When:**

- No DTC(s) 21, 22, 24, 28, 71, 72 and 87.
- TP is greater than 25%.
- Not in P/N or 4th gear.
- Engine speed is greater than 300 RPM. Vehicle speed is greater than 7 mph.
- All conditions are met for 2 seconds.

**Action Taken (TCM will default to):**

- Line pressure set to maximum.
- Inhibits TCC operation.

**DTC 85 Will Clear When:** The condition no longer exists, and the ignition switch is cycled "OFF" then "ON."

**DTC Chart Test Description:** Number(s) below an refer to circled number(s) on the diagnostic chart.

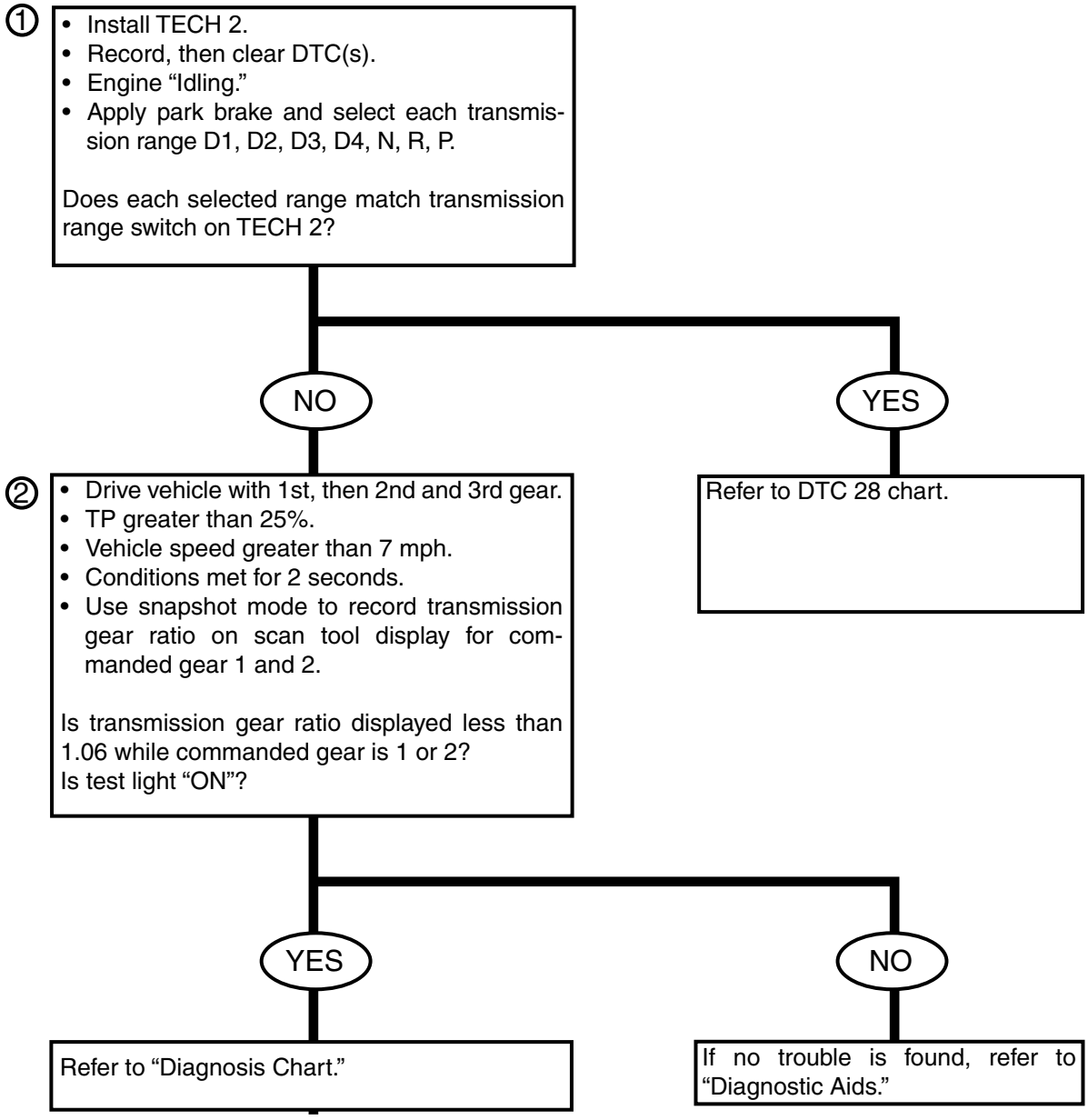
1. An out of range trans range pressure switch could falsely indicate the actual transmission range.
2. This test checks the calculated ratio to determine if the ratio is within the parameters.

Table 27: Ratio Error Chart

| CURRENT GEAR | IF CALCULATED RATIO IS | |
|---|---|---|
| | LESS THAN | MORE THAN |
| 1st | 2.38 | 2.65 |
| 2nd | 1.43 | 1.58 |
| 3rd | .95 | 1.05 |
| Rev | 1.97 | 2.17 |

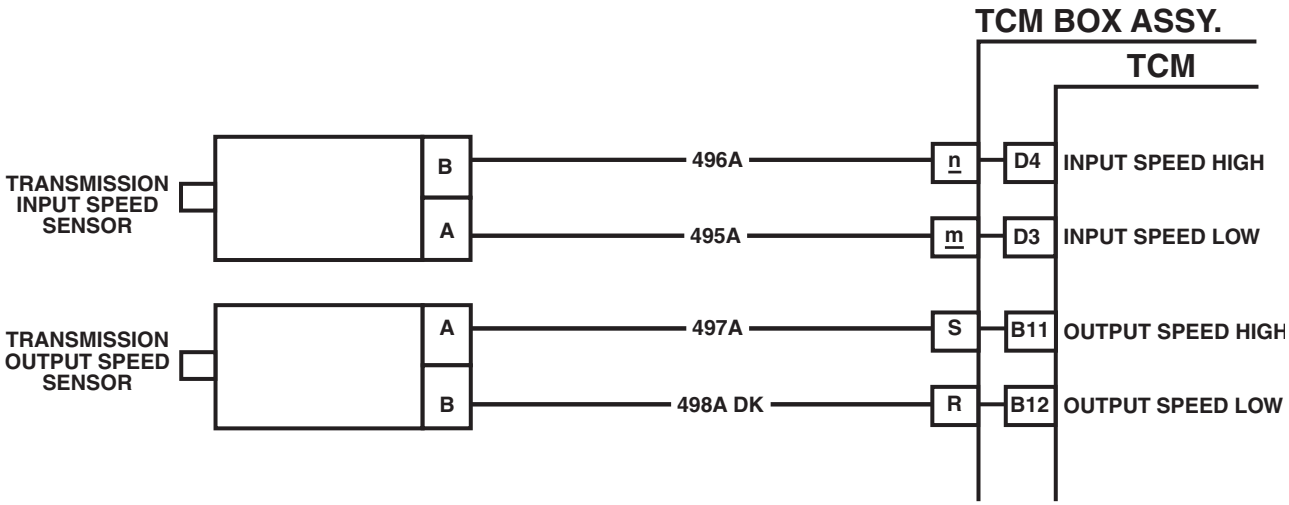
**Diagnostic Aids:** DTC 85 will set when unknown gear ratio is detected for any gear but 4th. Note commanded gear and incorrect ratio. Refer to Symptom diagnosis charts.

## DTC 85 UNDEFINED RATIO ERROR(TECH 2 ONLY)



**DTC 86 LOW RATIO ERROR**

**Circuit Description:** The TCM calculates ratio based on the input speed and output speed sensor readings. The TCM compares the known transmission ratio to the calculated ratio, for the particular gear range selected.




**DTC 86 Will Set When:**

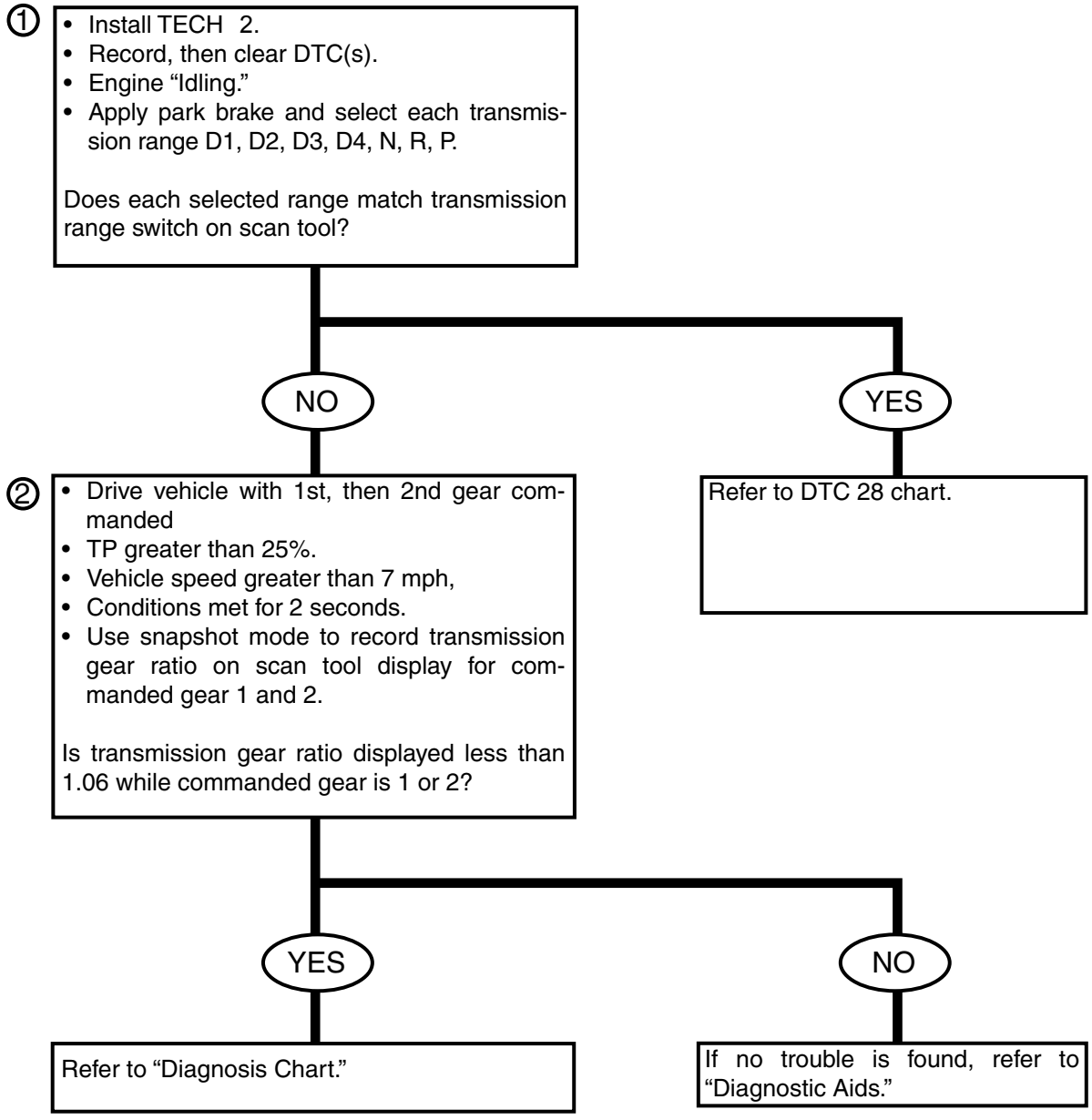
- No DTC(s) 21, 22, 24, 28, 71, 72 and 74.
- Not in P/R/N.
- Engine speed greater than 300 RPM.
- TP greater than 25%.
- Vehicle speed greater than 7 mph.
- Trans gear ratio is less than 1.06 in 1st or 2nd gear.

**DTC Chart Test Description:** Number(s) belowrefer to circled number(s) on the diagnostic chart.

1. An out of range trans range pressure switch could falsely indicate the actual transmission range.
2. This test compares the known ratio for a commanded gear to the calculated ratio displayed on the scan tool.

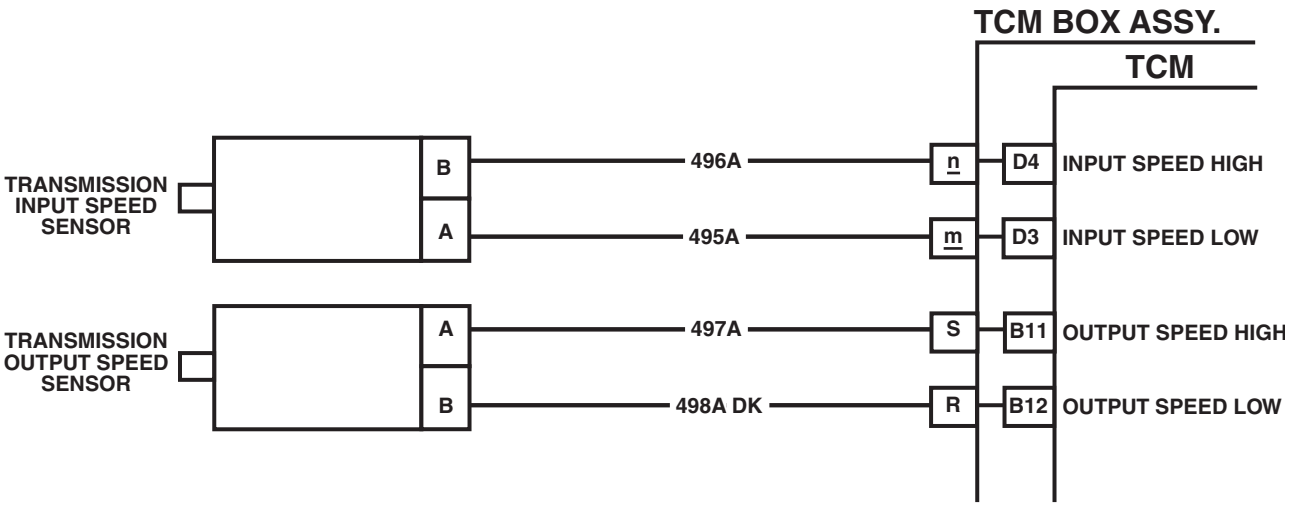
**Diagnostic Aids:** This DTC will set when trans commanded gear is 1 or 2 and trans is mechanically in 3rd or 4th gear. DTC 81 is used to detect a 2-3 shift 3rd or 4th gear. DTC 81 is used to detect a 2-3 shift solenoid circuit malfunction.

## DTC 86 LOW RATIO ERROR (TECH 2 ONLY)



**DTC 87 HIGH RATIO ERROR**

**Circuit Description:** The TCM calculates ratio based on the input speed and output speed sensor readings. The TCM compares the known transmission ratio to the calculated ratio, for the particular gear range selected.




**DTC 87 Will Set When:**

- No DTC(s) 21, 22, 24, 28, 71, 72 and 74.
- TP is greater than 25%.
- Not in P/R/N.
- Engine speed is greater than 300 RPM.
- Vehicle speed is greater than 7 mph.
- Transmission temperature is greater than 20°C.
- Trans gear ratio is greater than 1.42 in 3rd or 4th gear.
- All conditions met for 2 seconds.

**Action Taken (TCM will default to):**

- 2nd gear.
- Line pressure set to maximum.
- Inhibit TCC operation.

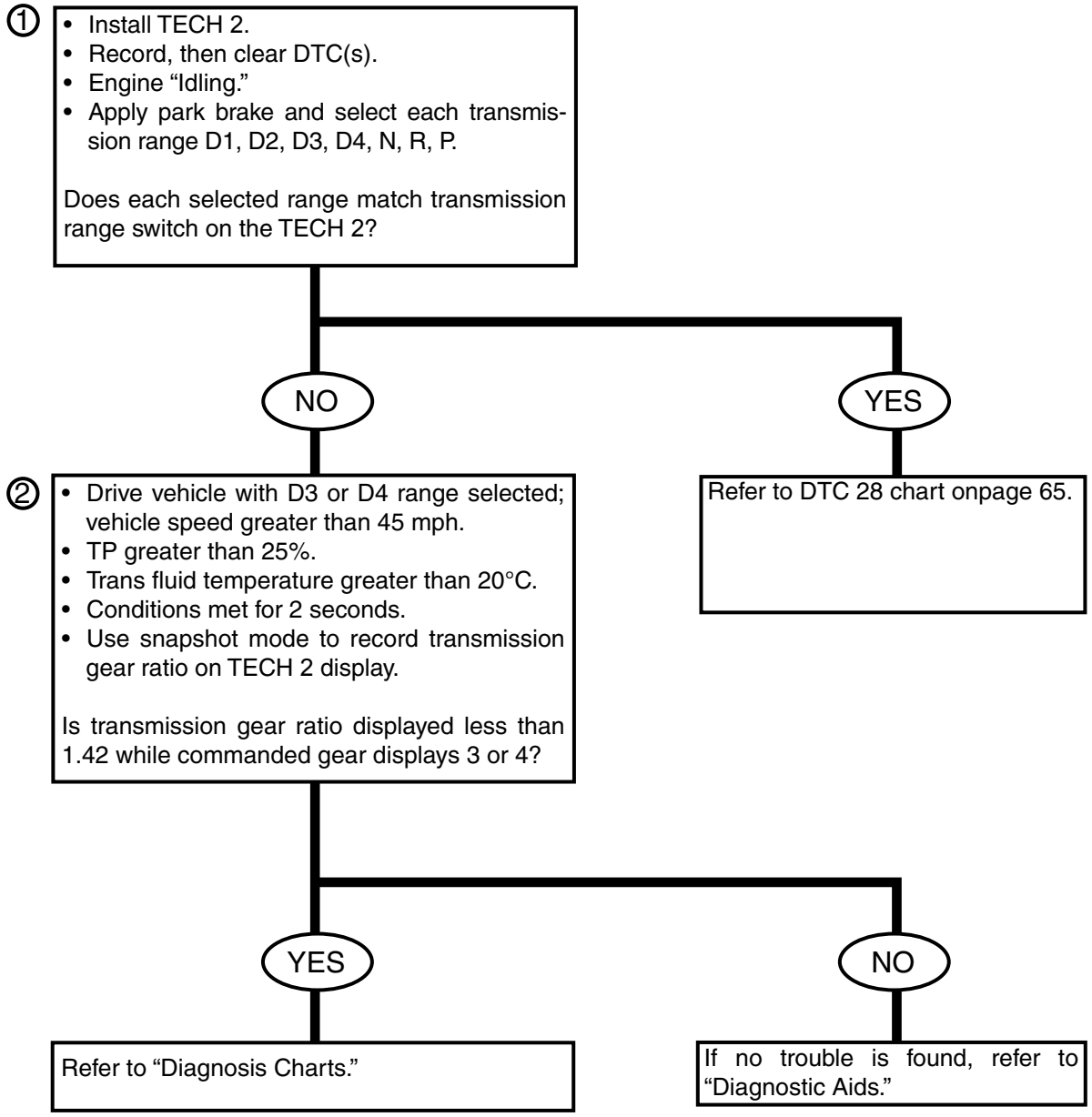
**DTC 87 Will Clear When:** The fault condition no longer exists, and the ignition switch is cycled “OFF” then “ON.”

**DTC Chart Test Description:** Number(s) below refer to circled number(s) on the diagnostic chart.

1. An out of range trans. range pressure switch could falsely indicate the actual transmission range.
2. This test compares the known ratio for a commanded gear to the calculated ratio displayed on the scan tool.

**Diagnostic Aids:** This DTC will set when trans. commanded gear is 3 or 4 and trans is mechanically in 1st or 2nd gear. DTC 81 is used to detect a 2-3 shift solenoid circuit malfunction.

## DTC 87 HIGH RATIO ERROR (TECH 2 ONLY)



# TRANSMISSION DATA AND CHECKING PROCEDURES

**LINE PRESSURE TEST**

1. Check and adjust fluid level if necessary.
2. Raise vehicle on hoist.
3. Connect pressure gauge to transmission test port (Figure 16). Gauge must have 325-350 psi (2240-2413 kPa) capacity.
4. Start engine and check pressures in Park, Neutral and both Drive ranges. Pressure should be a minimum of **35 psi** (241 kPa) at idle and increase to a maximum of **171 psi (**1179 kPa) at greater throttle openings.
5. Shift transmission into reverse and note pressure. At idle, pressure should be a minimum of **67 psi** (462 kPa) and increase to a maximum of **324 psi** (2234 kPa) as throttle opening increases.
6. Stop engine, remove gauge, and lower vehicle.
7. If pressures were low in all ranges, pump may need repair or replacement. Problem may be worn, damaged gears, blown out cup plug, cross leakage, or worn bushing. If pressure is high, fault may be with pressure control solenoid, reverse/boost or pressure regulator valves, bad TCM ground or solenoid connection.

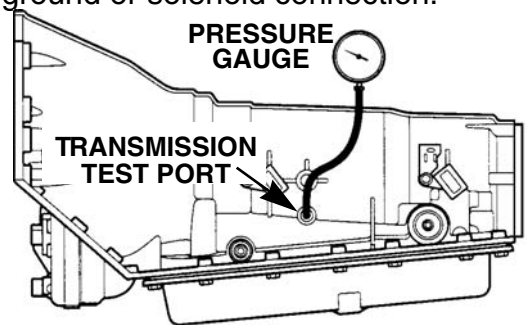



Figure 16. Pressure Gauge

**PRESSURE CONTROL SOLENOID TEST**

1. Connect scan tool to diagnostic/data link connector.
2. Connect pressure test gauge to transmission. Check fluid level and top off if necessary.
4. Shift into Park and apply parking brakes.
5. Start and operate engine at idle speed.
6. Access “override pressure control solenoid” test on scan tool.
7. Increase current to pressure control solenoid in the amperage increments shown in chart (Figure 5-17), and record pressure gauge readings. Allow gauge readings to stabilize for 3-5 seconds after each current change.
8. Stop engine and remove test tools.
9. Compare test pressure readings with charge readings. Pressures should decrease as current to solenoid is increased.
   - Consistently high pressures indicate a fault in the TCM, related wiring, or solenoid.
   - Low pressures indicate an oil pump fault, or hydraulic circuit fault.

Table 28: Pressure Control Solenoid Test Specifications

| AMP FEED TO PRESSURE CONTROL SOLENOID FROM TCM | LINE PRESSURE PSI (kPa) |
|---|---|
| 0.0–0.02 | 157–177 (1083–1220) |
| 0.10 | 151–176 (1041–1214) |
| 0.20 | 140–172 (965–1186) |
| 0.30 | 137–162 (945–1117) |
| 0.40 | 121–147 (834–1014) |
| 0.50 | 102–131 (703–903) |
| 0.60 | 88–113 (607–779) |
| 0.70 | 63–93 (434-641) |
| 0.80 | 43–73 (296–503) |
| 0.90 | 37–61 (255–421) |
| 0.98–1.1 | 35–55 (241–379) |

**RECOMMENDED FLUID**

The recommended and preferred fluid for 4L80-E transmissions is Dexron III.

In cases where Dexron lll is not readily available, Dexron IIE can be used to top off the fluid level. It is not, however, recommended for use as the primary fluid for a fluid change.

**Fluid Capacity**

Fluid capacity of the 4L80-E used in HMMWV vehicles is:

- Transmission refill capacity (after filter change) is approximately 5 qt. (4.7 L)
- Dry fill capacity (after overhaul) is approximately 11.5 qt. (10.9 L)
- Cooler and line capacity is approximately 1-2 qt. (.95 –1.9L)

## INTERNAL WIRING HARNESS CHECK

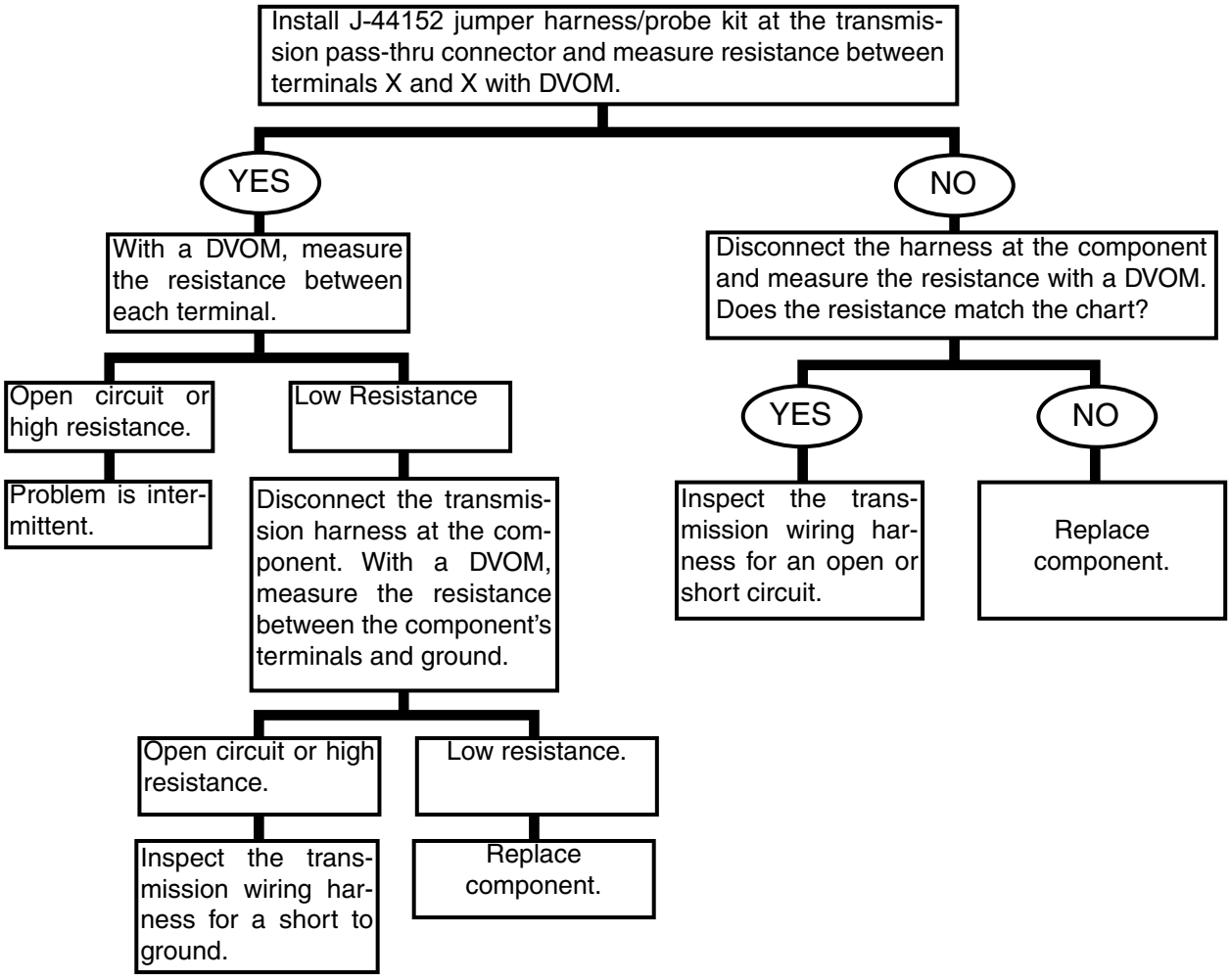
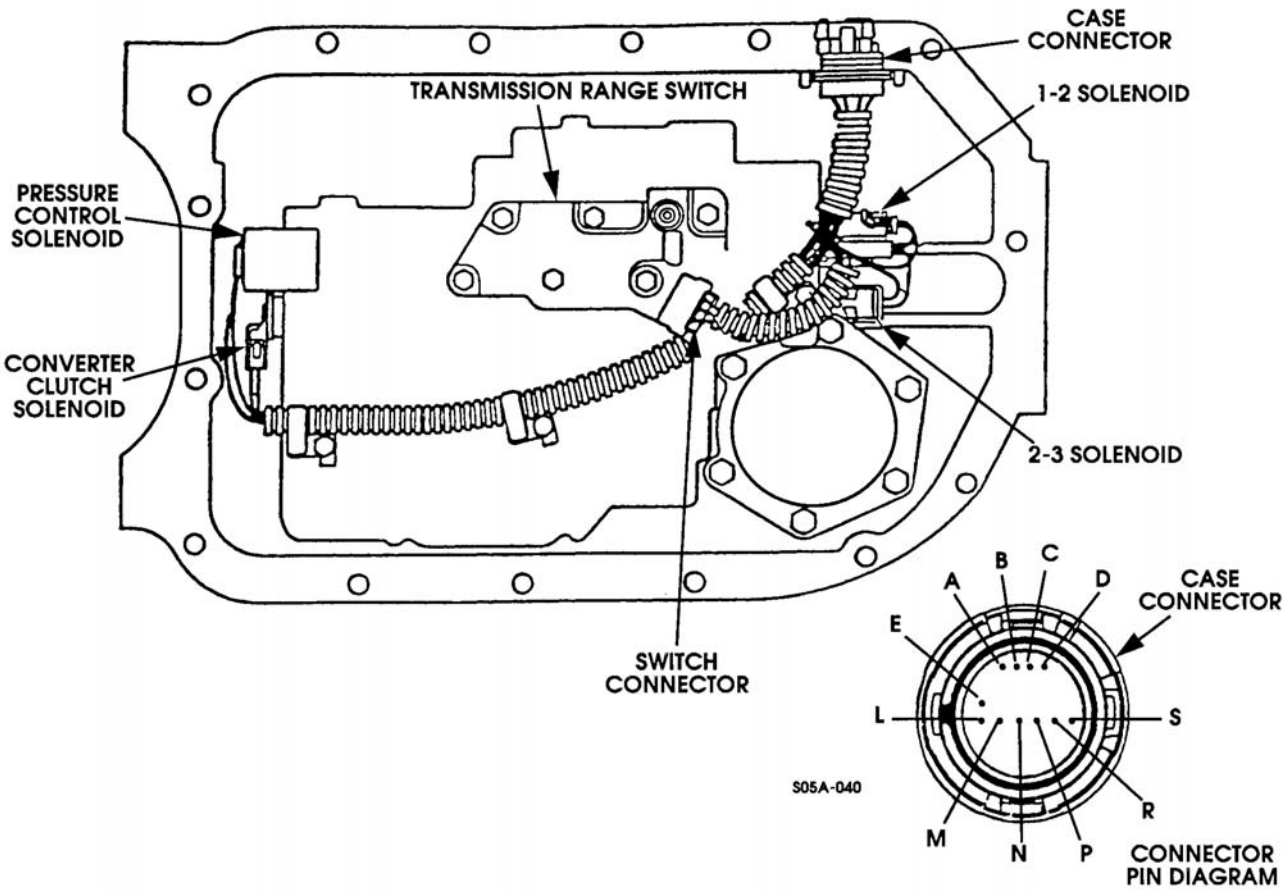
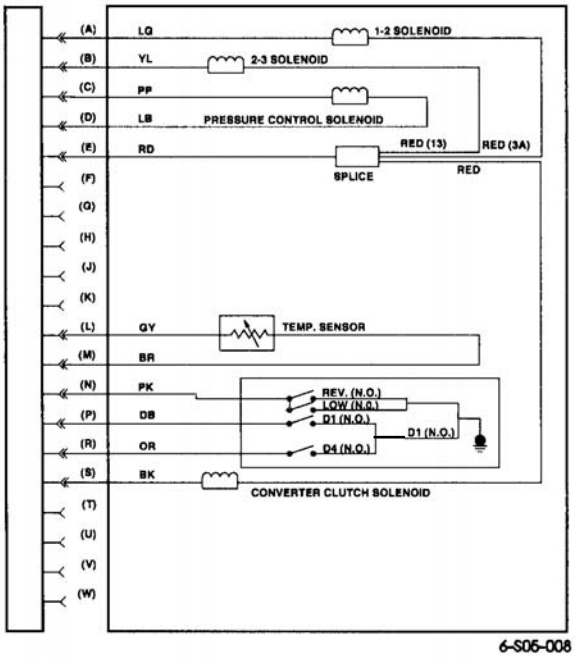



Table 29: Component Resistance Chart

| COMPONENT | WIRE COLOR | J1 CONNECTOR | RESISTANCE | CKT (2) |
|---|---|---|---|---|
| 1-2 Shift Solenoid | Red | E(1) | **18 - 24 Ohms** | 1149A |
| | Lt. Green | A | | 1222 |
| 2-3 Shift Solenoid | Red | E (1) | **18 - 24 Ohms** | 1149B |
| | Yellow | B | | 1223 |
| Pressure Control Solenoid | Purple | C | **3.5 - 5.2 Ohms** | 1228 |
| | Lt. Blue | D | | 1229 |
| TCC Solenoid | Red | E (1) | **10 - 14 Ohms** | 1149C |
| | Black | S | | 1350 |
| (1) spliced internally to Pin E. (2) Internal harness number. | | | | |

## TRANSMISSION INTERNAL WIRING HARNESS ASSEMBLY



**TCM CONNECTOR IDENTIFICATION**

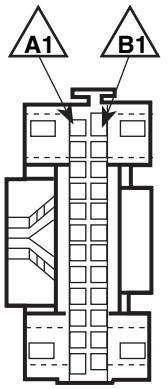
This TCM Voltage chart is for use with a DVOM to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The “B” symbol indicates a nominal system voltage of 12-14 volts. The following conditions must be met before testing:

- Engine at operating temperature.
- Engine idling (for “Engine operating” column.
- Test terminal not grounded.
- TECH 2 not installed.

* Less than .50 volt (500mV)

(1) Readings in the “P/N” position




BACK VIEW OF CONNECTOR

24 PIN A-B CONNECTOR

(PURPLE)

Table 30: TCM Connector Identification

| PIN | PIN FUNCTION | CKT# | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE | | DTC(S) AFFECTED | POSSIBLE SYMPTOMS |
|---|---|---|---|---|---|---|---|---|
| | | | | | IGNITION “ON” | ENGINE OPERATING | | |
| A1 | Not used | – | – | – | – | – | – | – |
| A2 | Not Used | – | – | – | – | – | – | – |
| A3 | Range Signal “A” | 762A | Orange | Transmission “N” | B+ | B+ (1) | 28 | – |
| A4 | Range Signal “B” | 736A | Dk Blue | Transmission “R” | 0* | 0*(1) | 28 | – |
| A5 | Range Signal “C” | 764A | Purple | Transmission “B” | B+ | B+(1) | 28 | – |
| A6 | 2-3 Shift Solenoid Control | 315a | Yellow | Transmission “P” | B+ | B+ | 81 | Incorrect Gear State |
| A7 | 1-2 Shift Solenoid Control | 237A | Lt Green | Transmission “A” | B+ | 0* | 82 | Incorrect Gear State |
| A8 | Diagnostic Request | 453A | White | Data Link Connector | 5V | 5V | None | No Change |
| A9 | Not Used | – | – | – | – | – | – | – |
| A10 | – | | | | | | | – |
| A11 | – | | | | | | | |
| A12 | Battery Feed | 537B | Orange | Battery | B+ | B+ | None | – |

**TCM CONNECTOR IDENTIFICATION**

This TCM Voltage chart is for use with a DVOM to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

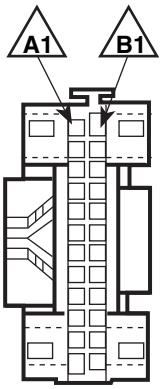
The “B” symbol indicates a nominal system voltage of 12-14 volts. The following conditions must be met before testing:

- Engine at operating temperature.
- Engine idling (for “Engine operating” column.
- Test terminal not grounded.
- TECH 2 not installed.

(1) 0 volts A/C “OFF.”

(2) Battery voltage brakes released.

(3) Varies less than .5 volts (500mV)




BACK VIEW OF CONNECTOR

24 PIN A-B CONNECTOR

(PURPLE)

Table 31: TCM Connector Identification

| PIN | PIN FUNCTION | CKT# | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE | | DTC(S) AFFECTED | POSSIBLE SYMPTOMS |
|---|---|---|---|---|---|---|---|---|
| | | | | | IGNITION “ON” | ENGINE OPERATING | | |
| B1 | Not Used | – | – | – | – | – | – | – |
| B2 | Not Used | – | – | – | – | – | – | – |
| B3 | A/C Signal | 348C | Lt Blue | A/C Pressure Cycling Switch | (1) | (1) | None | Incorrect Shift Timing |
| B4 | Brake Signal | 810B | Purple | Brake Switch | (2) | (2) | None | No TCC |
| B5 | TCC Control | 924A | Tan | Transmission “S” | B+ | B+ | 29, 83 | No TCC |
| B6 | Not Used | – | – | – | – | – | – | – |
| B7 | Not Used | – | – | – | – | – | – | – |
| B8 | Not Used | – | – | – | – | – | – | – |
| B9 | “Trans” Lamp Control | 657A | Brown | Body Harness | 0* | B+ | None | Mil Inoperative |
| B10 | Serial Data | 209A | Orange | Data Link Connector | (3) | (3) | None | No Serial Data |
| B11 | Output SP High | 497A | Red | TOSS–“A” | 0* | (3) AC Volts | 24/72 | Harsh Shifts |
| B12 | Output SP Low | 498A | Dk Green | TOSS–“B” | 0* | 0* | None | – |

## TCM CONNECTOR IDENTIFICATION

This TCM Voltage chart is for use with a DVOM to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The “B” symbol indicates a nominal system voltage of 12-14 volts. The following conditions must be met before testing:

- Engine at operating temperature.
- Engine idling (for “Engine operating” column.
- Test terminal not grounded.
- TECH 2 not installed.

* Less than .5 volt (500mV)

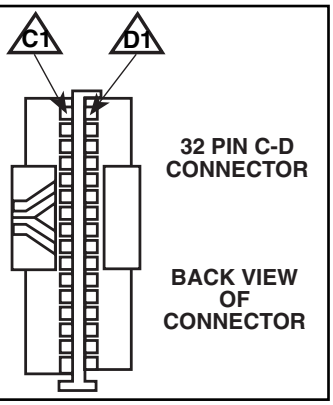



Table 32: TCM Connector Identification

| PIN | PIN FUNCTION | CKT# | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE | | DTC(S) AFFECTED | POSSIBLE SYMPTOMS |
|---|---|---|---|---|---|---|---|---|
| | | | | | IGNITION “ON” | ENGINE OPERATING | | |
| C1 | System Ground | 570B | Blk | Engine Block | 0* | 0* | None | – |
| C2 | System Ground | 570C | Blk | Engine Block | 0* | 0* | None | – |
| C3 | Sensor Ground | 359A | Tan | Splice | 0* | 0* | 21, 59 | Erratic Shifting |
| C4 | TP Reference | 350A | Gray | TP Sensor “A” | 5V | 5V | 22 | Erratic Shifting |
| C5 | Not Used | – | – | – | – | – | – | – |
| C6 | Not Used | – | – | – | – | – | – | – |
| C7 | Not Used | – | – | – | – | – | – | – |
| C8 | Not Used | – | – | – | – | – | – | – |
| C9 | Not Used | – | – | – | – | – | – | – |
| C10 | Not Used | – | – | – | – | – | – | – |
| C11 | Not Used | – | – | – | – | – | – | – |
| C12 | Not Used | – | – | – | – | – | – | – |
| C13 | Not Used | – | – | – | – | – | – | – |
| C14 | Not Used | – | – | – | – | – | – | – |
| C15 | Pres. Ctrl. Solenoid Low | 265 | Lt Blue | Transmission | 0* | .85V | 73 | Harsh Shifts |
| C16 | Ignition Feed | 291C | Lt Green | Splice | B+ | B+ | None | 2nd Gear |

**TCM CONNECTOR IDENTIFICATION**

This TCM Voltage chart is for use with a DVOM to further aid in diagnosis. These voltages were derived from a known good vehicle. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

The “B” symbol indicates a nominal system voltage of 12-14 volts. The following conditions must be met before testing:

- Engine at operating temperature.
- Engine idling (for “Engine operating” column.
- Test terminal not grounded.
- TECH 2 not installed.

* Less than .5 volt (500mV)

(1) Varies Depending on position

(2) Varies

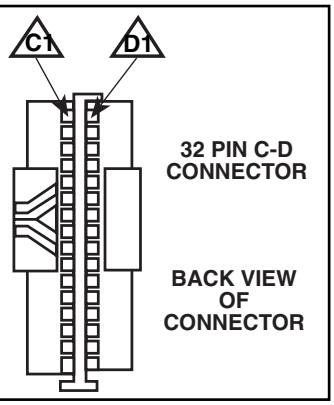


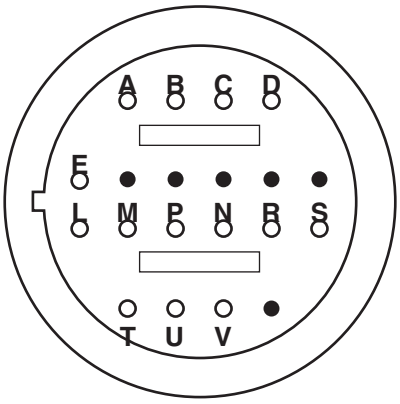

Table 33: TCM Connector Identification

| PIN | PIN FUNCTION | CKT# | WIRE COLOR | COMPONENT CONNECTOR | NORMAL VOLTAGE | | DTC(S) AFFECTED | POSSIBLE SYMPTOMS |
|---|---|---|---|---|---|---|---|---|
| | | | | | IGNITION “ON” | ENGINE OPERATING | | |
| D1 | Not used | – | – | – | – | – | – | – |
| D2 | Not Used | – | – | – | – | – | – | – |
| D3 | Transmission Input Speed Sensor low | 495A | Dk Blue | Input Speed Sensor “A” | 0* | 0* | None | – |
| D4 | Transmission Input Speed Sensor High | 496A | Gray | Input Speed Sensor “B” | 0* | (2) AC Volts | None | – |
| D5 | Not Used | – | – | – | – | – | – | – |
| D6 | Engine Speed Signal | 349A | Wht | Engine Speed Sensor “A” | 0* | (2) AC Volts | 12/71 | – |
| D7 | Sensor Gnd | 359B | Tan | Splice | 0* | )8 | 21, 59 | Harsh Shifts |
| D8 | TP Signal | 355A | Dk Blue | TP Sensor “B” | .67v | (2) | 21, 22 | Harsh Shifts |
| D9 | Not Used | – | – | – | – | – | – | – |
| D10 | – | – | – | – | – | – | – | – |
| D11 | – | – | – | – | – | – | – | – |
| D12 | – | – | – | – | – | – | – | – |
| D13 | Transmission Fluid Temp. Signal | 923A | Brown | Transmission “L” | 2V | 2v | 58, 59 | Early TCC |
| D14 | Baro | 355A | Orange | Baro “B” | (2) | (2) | 63, 64 | No Altitude Compensation |
| D15 | Not Used | – | – | – | – | – | – | – |
| D16 | Pressure Control Solenoid High | 264A | Red | Transmission “C” | .11V | 4.43V | 73 | Harsh Shifts |

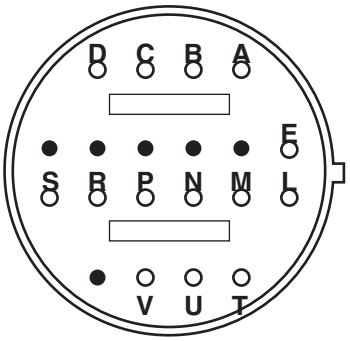
## TRANSMISSION J1 AND TRANSMISSION HARNESS CONNECTOR

A–Shift Solenoid 1-2
B–Shift Solenoid 2-3
C–PCS “HIGH”
D–PCS “LOW”
E–IGN +(12V)
L–TFT (Signal)
M–TFT (Sensor Gnd)
N–Trans Range “A”
P–Trans Range “C”
R–Trans Range “B”
S–TCC Solenoid

### TRANSMISSION J1

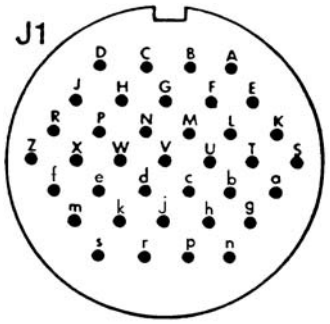



### TRANSMISSION HARNESS CONNECTOR




### TCM J1 CONNECTOR

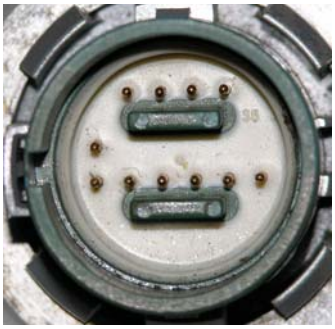
A– Trans Range Pressure A
B– Trans Range Pressure B
C– Trans Range Pressure C
D– 2-3 Shift Solenoid
E– 1-2 Shift Solenoid
F–
G–
H–
J–
K–
L–
M–
N–
P–
Not Used
R–Toss Low
S–Toss High
T– Not Used
U– Check Transmission Lamp
V– Not Used
W–Brake Switch
X– TCC Solenoid
Z– Battery Power




a–Ground
b–Ground
c–TPS Low
d–TPS +5V Reference
e–Trans Temp
f–
g– PCS High
h– Engine Speed Sensor
j– Ignition Feed
k– PCS Low
m–TISS Low
n–TISS High
p– Sensor Ground (TPS, ESS)
r– Not Used
s–TPS

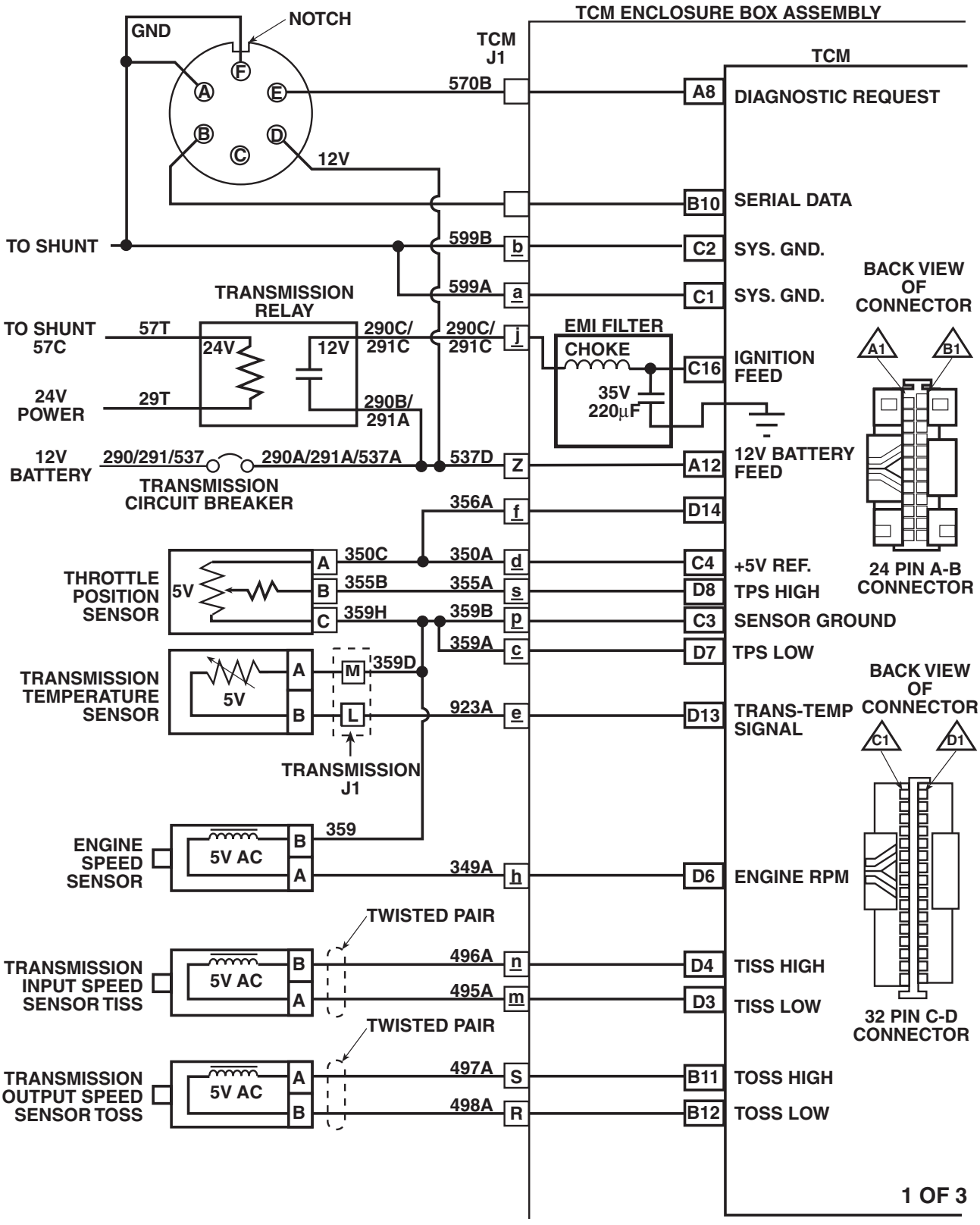
**TCM J1 Connector**

**Transmission J1 Connector**

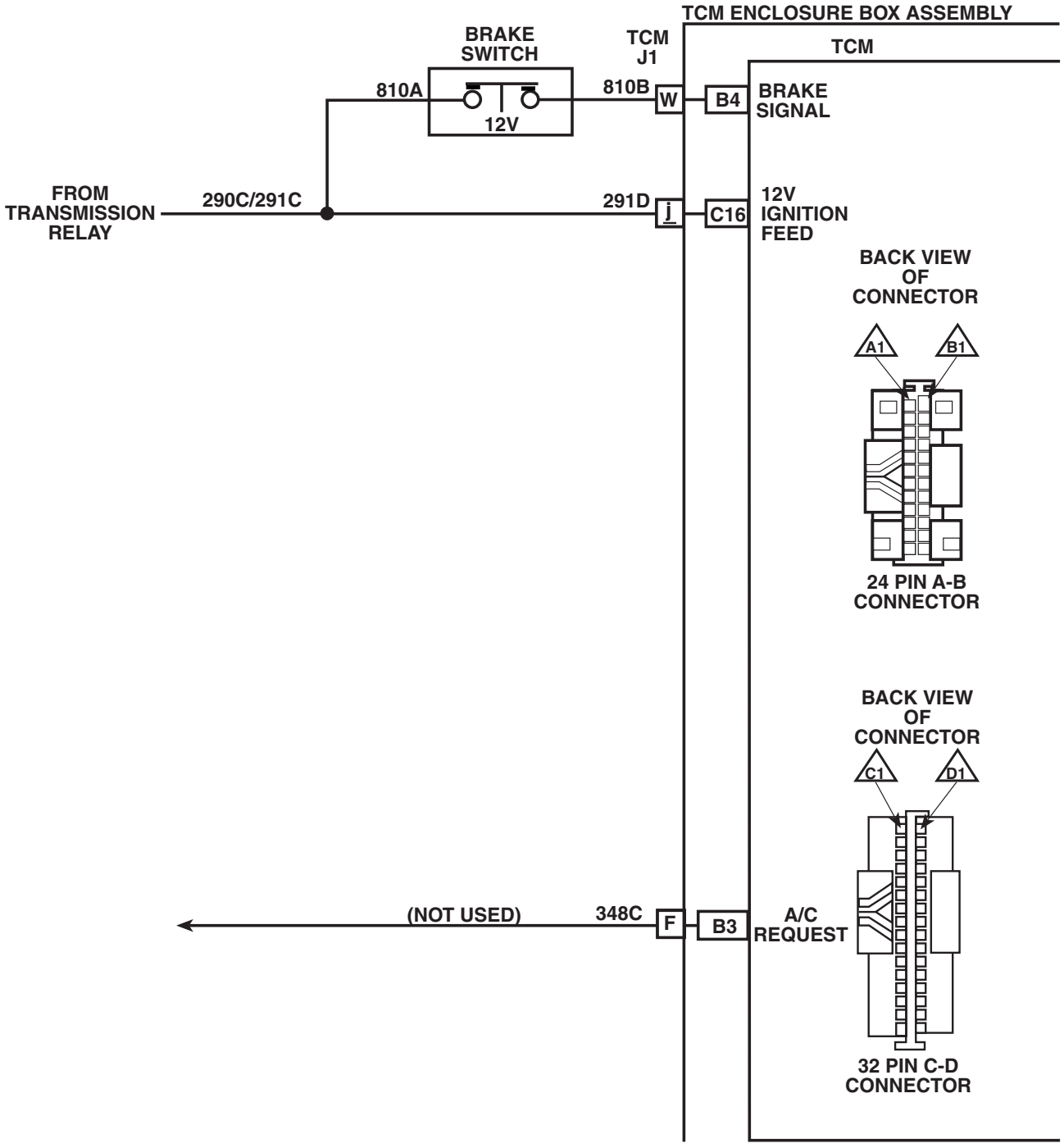


**Transmission Harness Connector**

## TCM WIRING DIAGRAM 4L80E TRANSMISSION (CONT. ON NEXT PAGE)

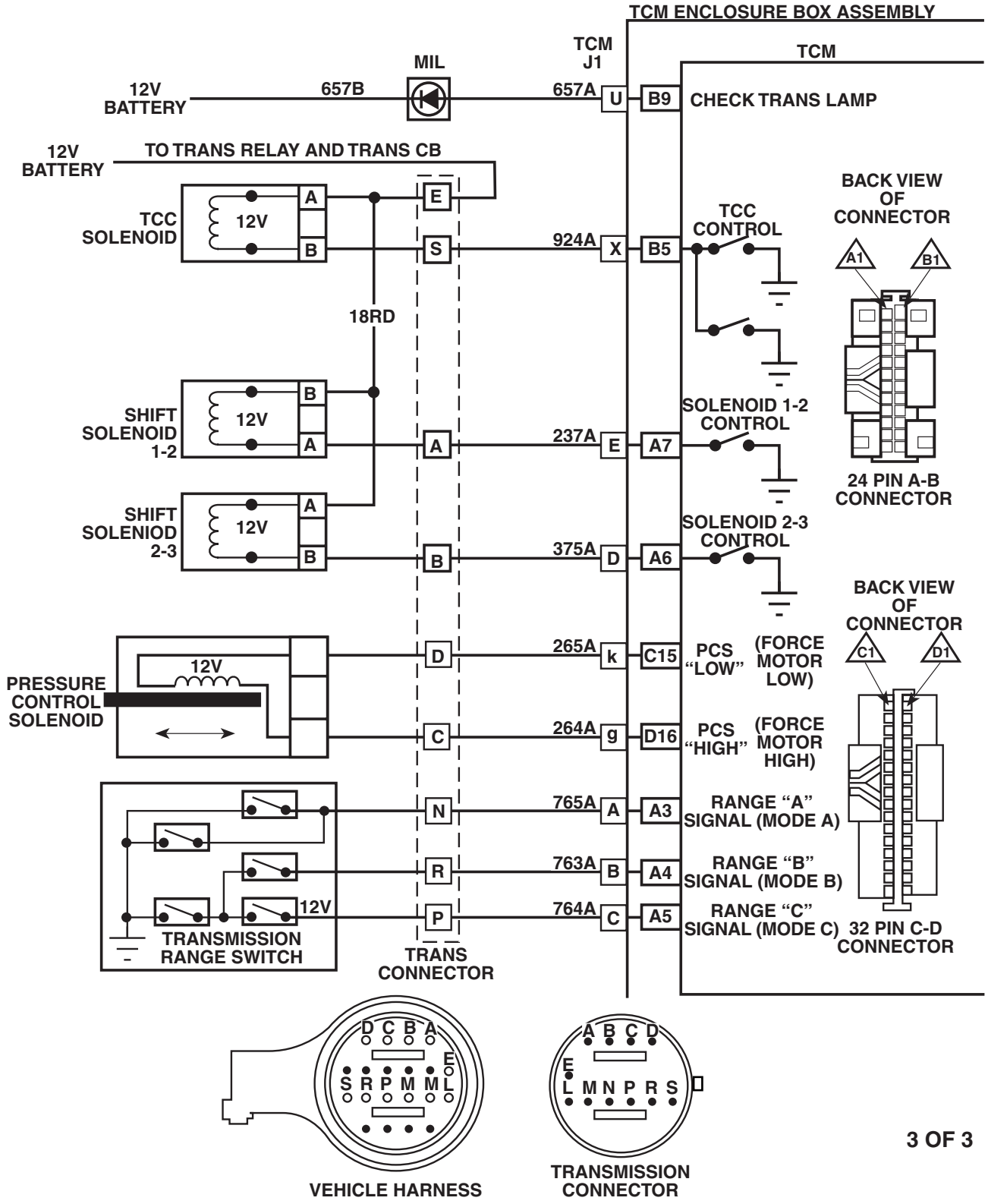


## TCM WIRING DIAGRAM 4L80E TRANSMISSION (CONT.)



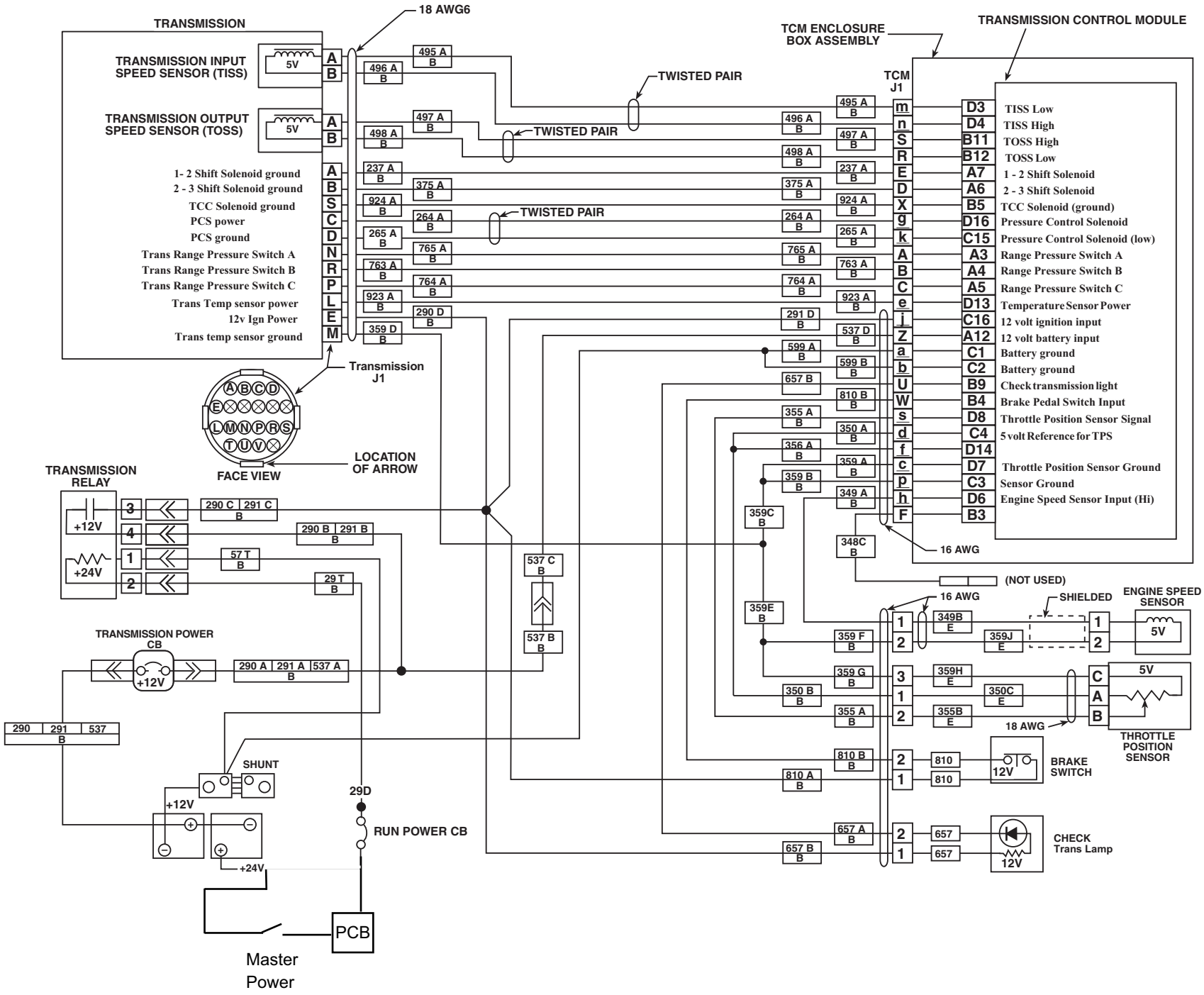

2 OF 3

## TCM WIRING DIAGRAM 4L80E TRANSMISSION (CONT.)




3 OF 3

# TRANSMISSION ELECTRICAL SCHEMATIC



# Special Tools for Troubleshooting the 4L80-E Transmission

| | Part Number | NSN |
|---|---|---|
| **TPS cable:** | **12460120** | **6150-01-412-7774** |
| **TPS block gauge:** | **J 33043** | **4820-01-179-4869** |
| **Diagnostic Switch Cable:** | **12460136** | **6150-01-410-8215** |

## Local Purchase

| | |
|---|---|
| **Scanner: OTC Tech 2 Flash Deluxe Kit** | **3646** |
| **Transmission Test harness (Kent Moore)** | **J 44152** |

# Special Tools for Troubleshooting the 4L80-E Transmission

**TPS cable**
**12460120  6150-01-412-7774**

**TPS block gauge**
**J 33043  4820-01-179-4869**

# Special Tools for Troubleshooting the 4L80-E Transmission


## J 44152
## Transmission Test harness  (Kent Moore)

# Special Tools for Troubleshooting the 4L80-E Transmission


## OTC Tech 2 Scanner Deluxe Kit
## Part Number: 3646

# Solenoid Resistance Chart

| COMPONENT | WIRE COLOR | J1 CONNECTOR | RESISTANCE | CKT (2) |
|---|---|---|---|---|
| 1-2 Shift Solenoid | Red | E(1) | 18 - 24 Ohms | 1149A |
| | Lt. Green | A | | 1222 |
| 2-3 Shift Solenoid | Red | E (1) | 18 - 24 Ohms | 1149B |
| | Yellow | B | | 1223 |
| Pressure Control Solenoid | Purple | C | 3.5-5.2 Ohms | 1228 |
| | Lt. Blue | D | | 1229 |
| TCC Solenoid | Red | E (1) | **10 - 14 Ohms** | 1149C |
| | Black | S | | 1350 |
| (1) spliced internally to Pin E. (2) Internal harness number. | | | | |

# Shift Solenoid Chart

| GEAR | 1-2 SHIFT SOLENOID | 2-3 SHIFT SOLENOID |
|---|---|---|
| 1 | ON | OFF |
| 2 | OFF | OFF |
| 3 | OFF | ON |
| 4 | ON | ON |

# Transmission Input/Output Ratio Table

| CURRENT GEAR | IF CALCULATED RATIO IS | |
|---|---|---|
| | LESS THAN | MORE THAN |
| 1st | 2.38 | 2.65 |
| 2nd | 1.43 | 1.58 |
| 3rd | .95 | 1.05 |
| Rev | 1.97 | 2.17 |

# Range Pressure Switch Chart

ON = 0 vdc at the TCM
OFF = 12 vdc at the TCM

| RANGE SIGNAL | A | B | C |
|---|---|---|---|
| PARK | OFF | ON | OFF |
| REV | ON | ON | OFF |
| NEUTRAL | OFF | ON | OFF |
| D4 | OFF | ON | ON |
| D3 | OFF | OFF | ON |
| D2 | OFF | OFF | OFF |
| D1 | ON | OFF | OFF |
| ILLEGAL | ON | OFF | ON |
| ILLEGAL | ON | ON | ON |

# 4L80-E Transmission Identification

| Model Year | NSN | EPROM Code | Remarks |
|---|---|---|---|
| 1995 | 5692-01-430-0182 | BJDL-1619-7350 | |
| 1996 | 5962-01-430-0208 | BRZY-1622-9203 | |
| 1997 | 5962-01-440-0368 | BZYD-1625-1210 | |
| 1998 | 5962-01-470-4619 | CFDD-1626-6408 | |
| 1999 | 5962-01-476-7772 | CMBB-0935-6973 | |
| 2000 | 5962-01-480-5247 | CMDJ-0935-7080 | |
| 2001 | 5962-01-497-1611 | CZSU-0938-3276 | |
| 1996 | 5962-01-431-5121 | | 6.5 Turbo Engine |
| 1997 | 5962-01-440-0369 | BZYF-1625-1212 | 6.5 Turbo Engine |
| 1998 | 5962-01-470-4621 | CFDF-1626-6428 | 6.5 Turbo Engine |
| 1999 | 5962-01-480-5246 | CMBC-0935-6976 | 6.5 Turbo Engine |
| 2000 | 5962-01-480-5248 | CMDK-0935-7082 | 6.5 Turbo Engine |
| 2001 | 5962-01-497-2519 | | 6.5 Turbo Engine |
| | | | |

| NSN | GM Part # Transmission | Model Year | Engine application | Original EPROM GM Part Number/NSN | Remarks |
|---|---|---|---|---|---|
| **2520-01-399-4691** | **24202329** | **1995** | **6.5 liter N/A** | **16197350/5962-01-430-0182** | **Trans& EPROM ordered separately** |
| **2520-01-430-5294** | **24205114** | **1996** | **6.5 liter N/A** | **16229203/5962-01-430-0208** | **Kit*** |
| **2520-01-439-6830** | **24205225** | **1997** | **6.5 liter N/A** | **16251210/5962-01-440-0368** | **Kit*** |
| **2520-01-461-7072** | **24208605** | **1998** | **6.5 liter N/A** | **16266408/5962-01-470-4619** | **Kit*** |
| **2520-01-461-7074** | **24211292** | **1999** | **6.5 liter N/A** | **9356973/5962-01-476-7772** | **Kit*** |
| **2520-01-473-7410** | **24211094** | **2000** | **6.5 liter N/A** | **9357080/5962-01-480-5247** | **Kit*** |
| **2520-01-489-0849** | **57K3569** | **2001** | **6.5 liter N/A** | **5716028/5962-01-497-1611** | |
| **2520-01-430-2765** | **24205114** | **1996** | **6.5 Liter Turbo** | **1622907/5962-01-431-5121** | **Trans & EPROM ordered separately** |
| **2520-01-439-6831** | **24205225** | **1997** | **6.5 Liter Turbo** | **16251212/5962-01-440-0369** | **Kit*** |
| **2520-01-459-8531** | **24208605** | **1998** | **6.5 Liter Turbo** | **16266438/5962-01-470-4621** | **Kit*** |
| **2520-01-461-7077** | **24211292** | **1999** | **6.5 Liter Turbo** | **9356976/5962-01-480-5246** | **Kit*** |
| **2520-01-475-1083** | **24214094** | **2000** | **6.5 Liter Turbo** | **9357082/5962-01-480-5248** | **Kit*** |
| **2520-01-489-0850** | **57k3570** | **2001** | **6.5 Liter Turbo** | **5716029/5962-01-497-2519** | |

**NOTE**

**1995-1996** **EPROMs are only compatible within their respective model year**
**1998** **EPROM is downward compatible with model year 1997**
**1999** **EPROM is downward compatible with model year 1988 & 1997**
**2000-2001** **EPROMs are downward compatible through model year 1997**
**2001-2007** **EPROMS are interchangable during these model years**