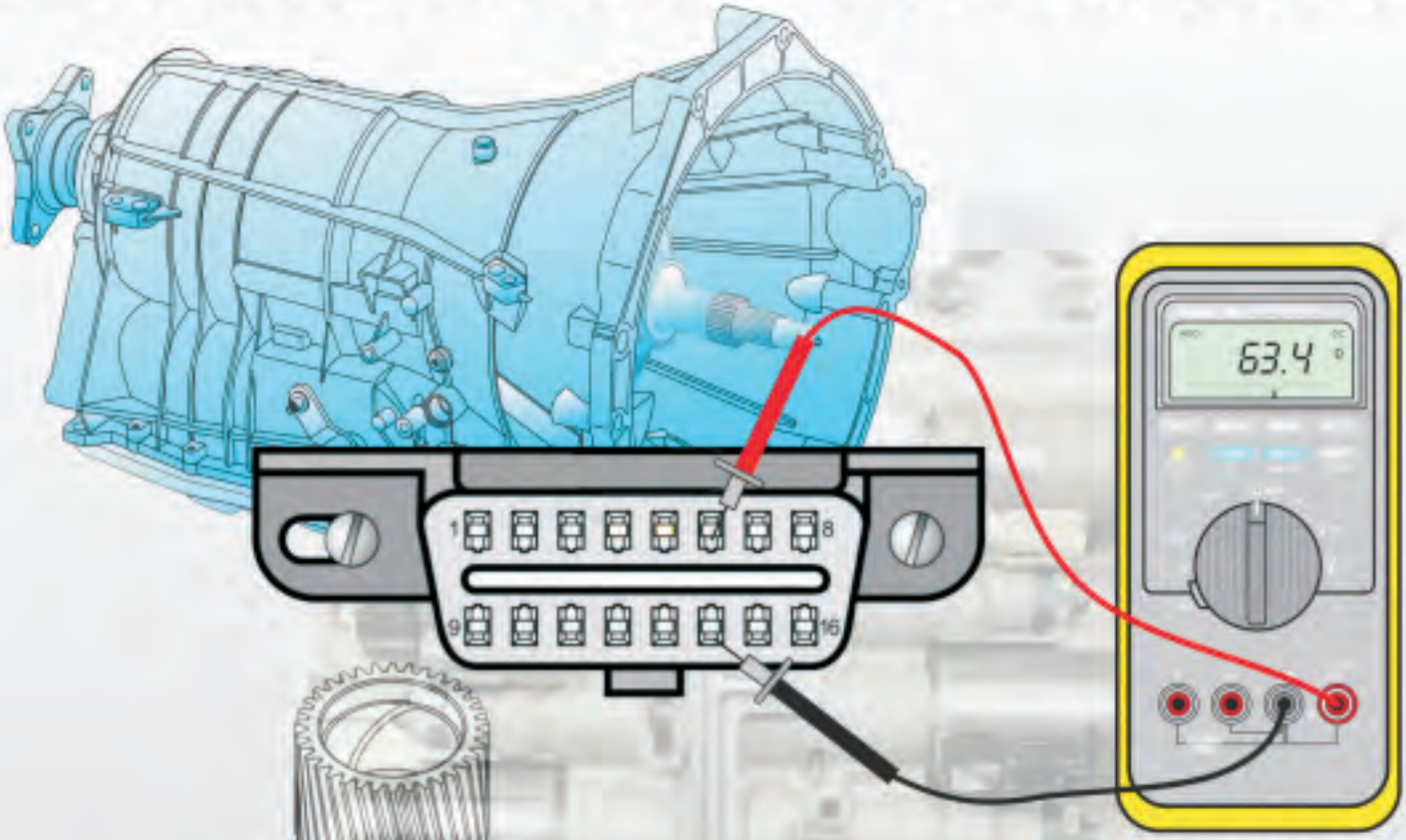
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2016 TECHNICAL SEMINAR

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FORD 4F27E
NO REVERSE

COMPLAINT: A Ford vehicle equipped with a 4F27E transmission has a "No Reverse" condition after overhaul.

CAUSE: The incorrect reverse piston was installed into the reverse drum which resulted in excessive clutch clearance making it unable to reach zero clearance (See Figures 1 and 2).

CORRECTION: Mazda vehicles equipped with the FN4A-EL transmission use a reverse piston that is 1.375" (34.925mm) tall.
Ford vehicles equipped with 4F27E transmission use a reverse piston that measures 1.455" (36.957mm) tall (Refer to Figure 3).

NOTES: Both Ford and Mazda vehicles equipped with the FNR5 or FS5A-EL use the 1.455" (36.957mm) reverse piston.

Reverse clutch steel plates come in .063" (1.60mm) or .082" (2.08mm) thicknesses. The clutch pack retaining snap ring is used to set final clutch clearance as shown in Figure 4.

The top pressure plate used by both the 4F27E/FN4A-EL and the FNR5/FS5A-EL is .226" (5.74mm) thick

The reverse frictions used by both the 4F27E/FN4A-EL and the FNR5/FS4A-EL is .064" (1.63mm) thick.

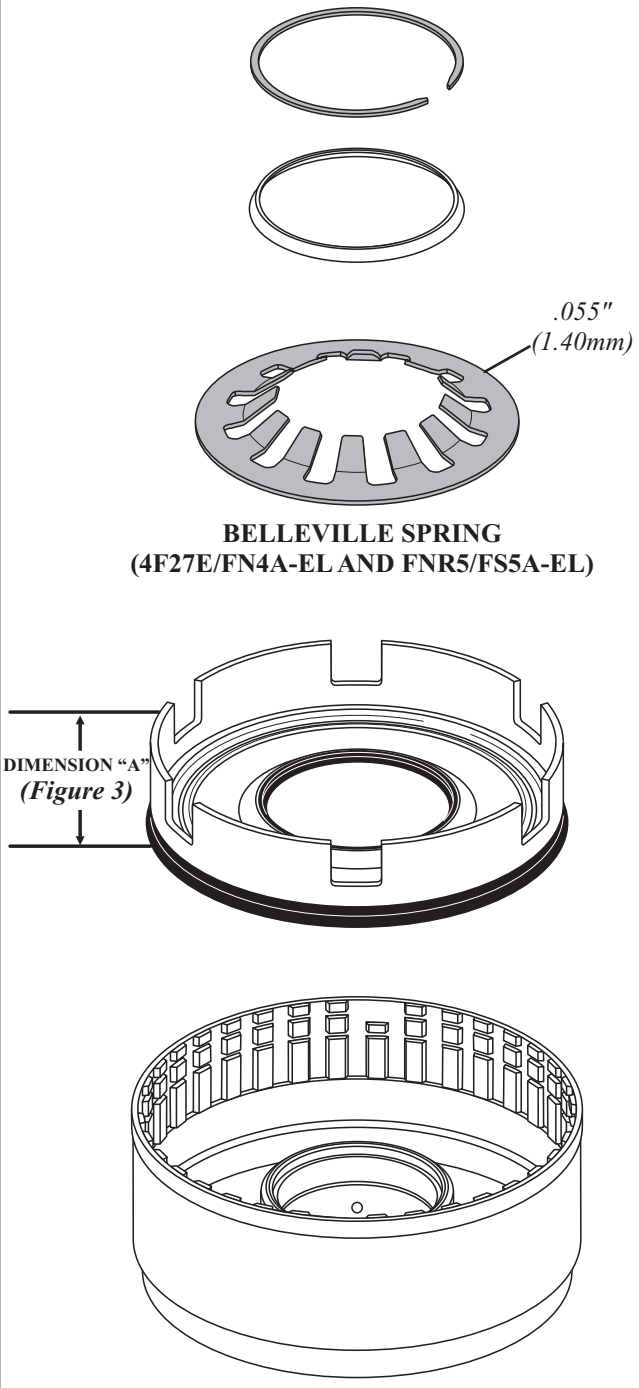
The Belleville Spring used by both the 4F27E/FN4A-EL and the FNR5/FS4A-EL is .055" (1.40mm) thick and has 12 fingers.

Only the FNR5/FS5A-EL uses a .082" (2.08mm) thick dished plate at the bottom of the reverse clutch pack.

ADDED TECH: See Figure 4 for the correct Low One-Way Clutch assembly used in both the 4 and 5 speed units.
See Figure 5 for the correct Reduction One-Way Clutch assembly used in all 5 speed units.

FORD 4F27E
NO REVERSE

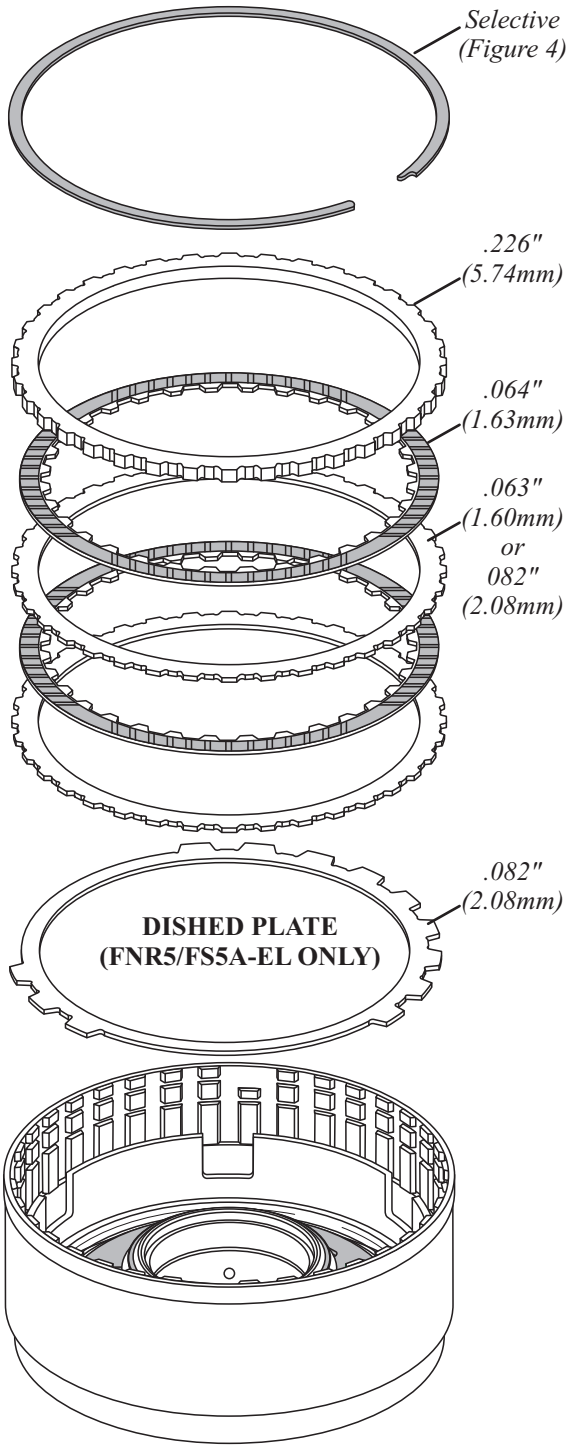
REVERSE PISTON ASSEMBLY



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Figure 1

REVERSE CLUTCH ASSEMBLY



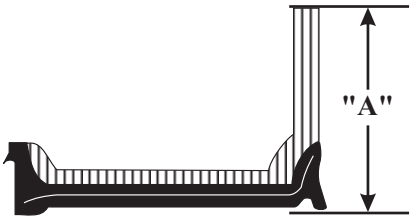
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Figure 2

FORD 4F27E
NO REVERSE

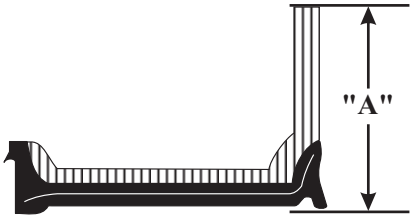
REVERSE CLUTCH PISTON HEIGHT

FORD 4F27E/FNR5 PISTON
FORD/MAZDA - FN4A-EL/FS5A-EL PISTON



DIMENSION "A" = 1.455" (36.957mm)

MAZDA FN4A-EL PISTON

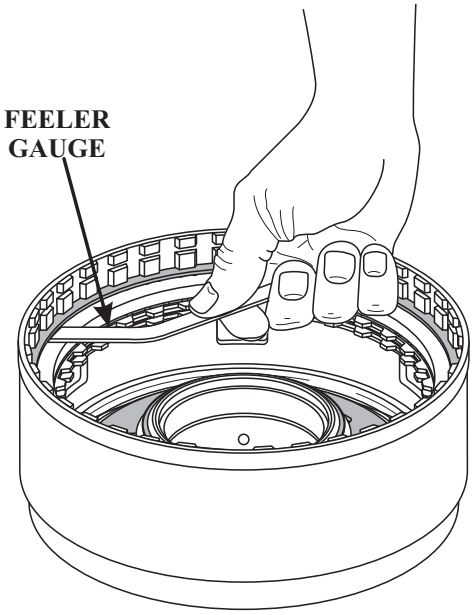


DIMENSION "A" = 1.375"(34.925mm)

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Figure 3

REVERSE CLUTCH CLEARANCE SHOULD BE
.040" - .051" (1.0 - 1.3 MM)



Selective Snap Ring Thickness Available
.045" - .049" (1.15 - 1.25 mm)
.053" - .057" (1.35 - 1.45 mm)
.061" - .065" (1.55 - 1.65 mm)
.069" - .073" (1.75 - 1.85 mm)
.077" - .081" (1.95 - 2.05 mm)
.085" - .089" (2.15 - 2.25 mm)

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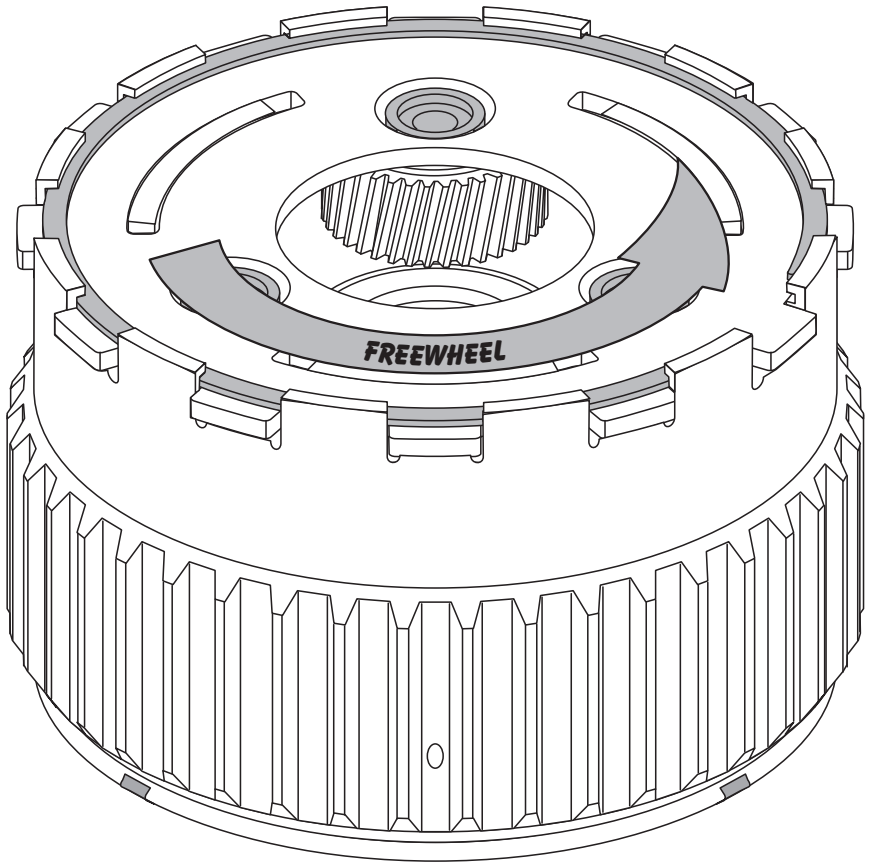
Figure 4

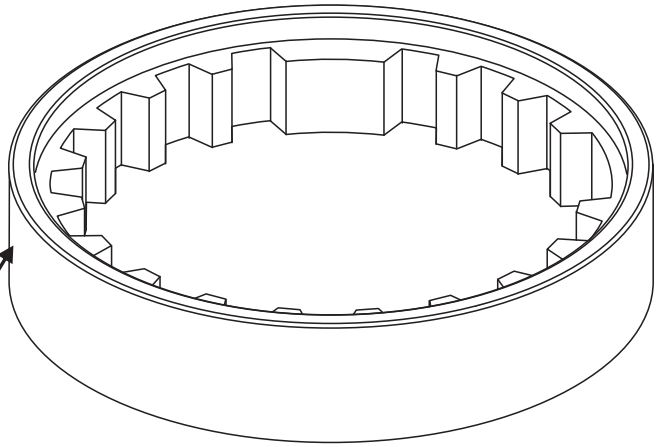
RATIOTEK - 7

FORD/MAZDA 4F27E/FNR5

LOW ONE-WAY CLUTCH

PLANETARY GEARSET SHOULD FREEWHEEL COUNTER-CLOCKWISE AND LOCK CLOCKWISE AFTER INSTALLATION IN THE TRANSAXLE CASE





SPRAG INNER RACE SECURED IN CASE ON TOP OF LOW/REVERSE PISTON RETURN SPRING

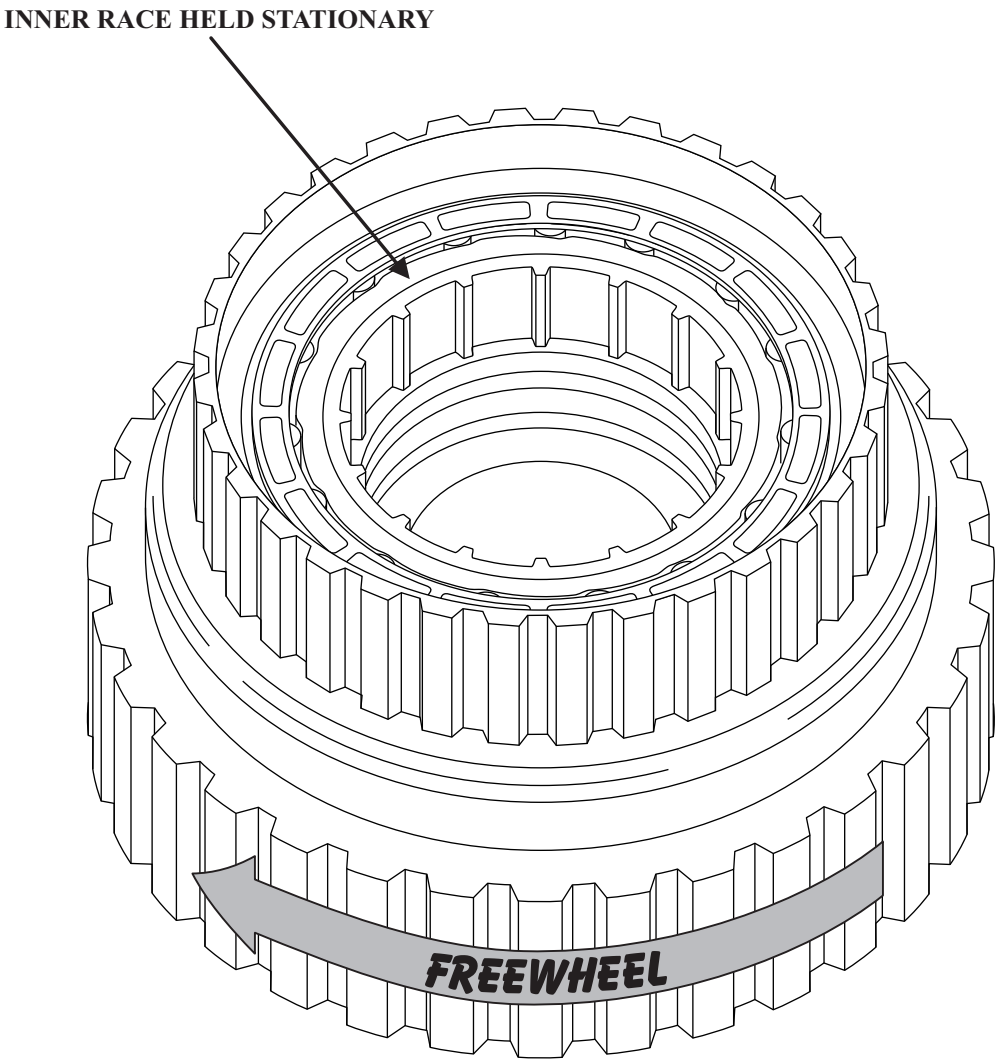
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Figure 4

FORD/MAZDA FNR5

REDUCTION ONE-WAY CLUTCH

WITH THE INNER RACE HELD STATIONARY
THE DIRECT DRUM SHOULD ROTATE CLOCKWISE



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Figure 5

FORD AF21/TF-81SC
VALVE BODY IDENTIFICATION

The TF81SC or AF21 six speed transmission is used by Ford and Mazda in the United States. This bulletin provides the rebuild technician with valve body identification, solenoid identification as well as small parts locations and identification.

We recommend that you disregard any previous information pertaining to the TF81SC/AF21 valve body that ATSG has done in the past and reference this information as it is more complete and thorough.

Refer to Figure 1 Valve Body Casting Number T1-9172 for Solenoid ID.

Refer to Figure 2 Valve Body Casting Number T2-9174 for Solenoid ID.

Refer to Figure 3 for Front Casting - Upper Side Valve ID & Spring Dimensions.

Refer to Figure 4 for Front Casting - Lower Side Valve ID, Spring Dimensions, Small Parts ID & Location.

Refer to Figure 5 for Front Casting - Lower Side Valve Body Casting, Spacer Plate & Gasket Differences.

Refer to Figure 6 for Middle Casting - Upper Side Valve ID, Spring Dimensions, Small Parts ID & Location.

Refer to Figure 7 for Middle Casting - Lower Side Valve ID, Spring Dimensions, Small Parts ID & Location.

Refer to Figure 8 for Rear Casting - Upper Side Valve ID, Spring Dimensions, Small Parts ID & Location.

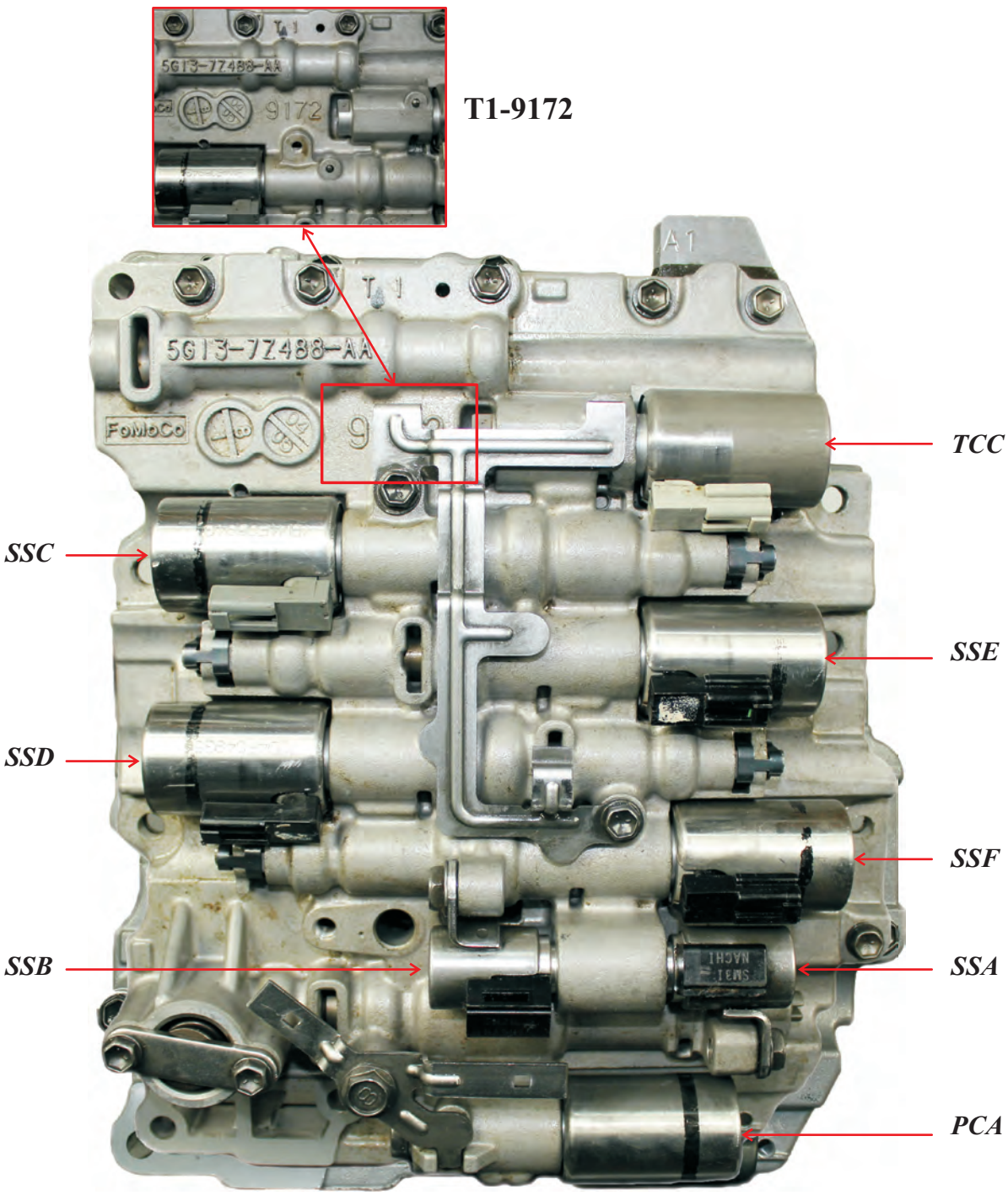
Refer to Figure 9 for Rear Casting - Lower Side Accumulator ID & Spring Dimensions.

Many thanks to Gerald of Worldwide Transmission Parts for the loan of a Valve Body.

HAYDEN - 11

AF21/TF-81SC

FRONT T1-9172 CASTING UPPER SIDE

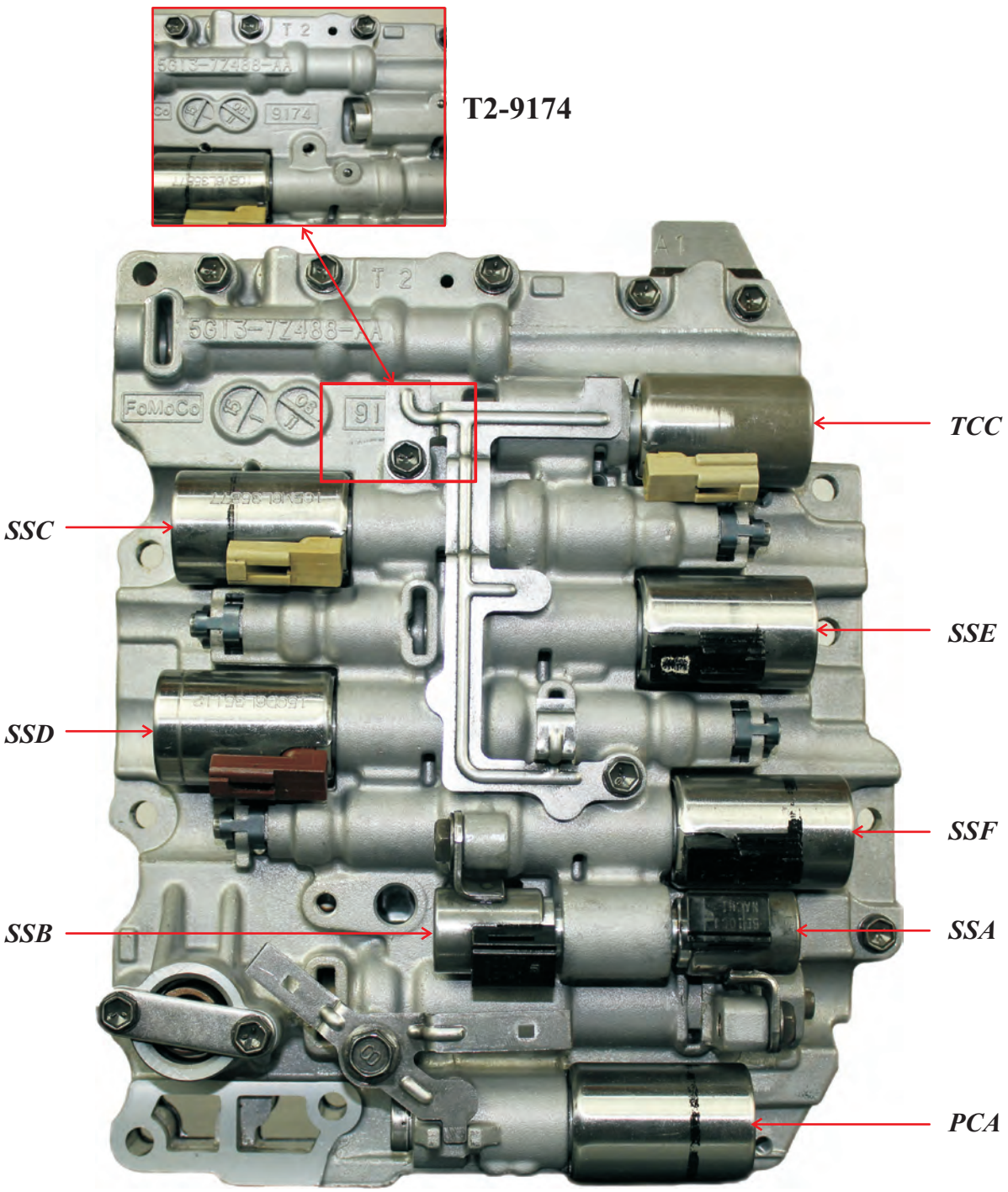


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Figure 1

AF21/TF-81SC

FRONT T1-9174 CASTING UPPER SIDE



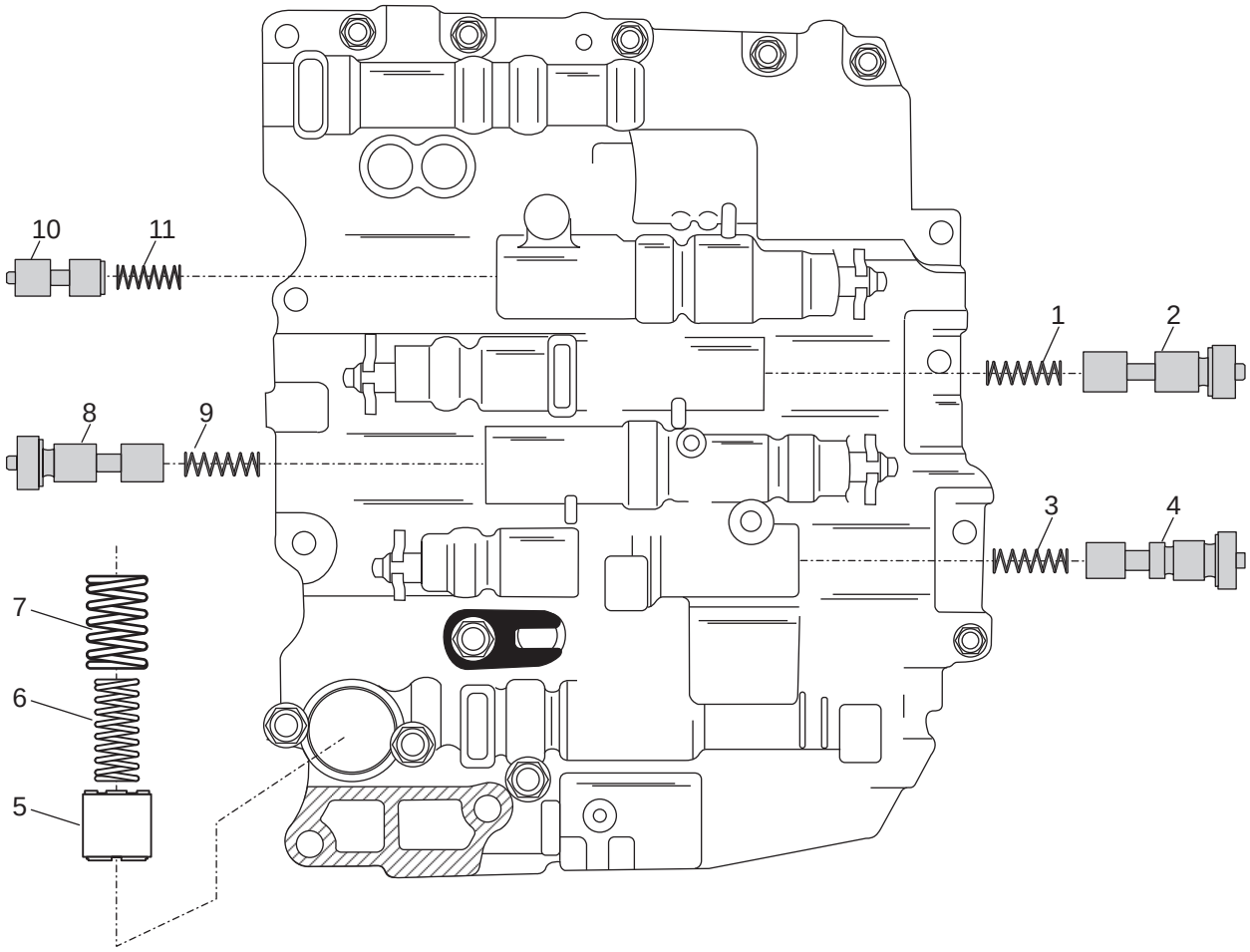
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Figure 2

Automatic Transmission Service Group

AF21/TF-81SC

FRONT CASTING UPPER SIDE



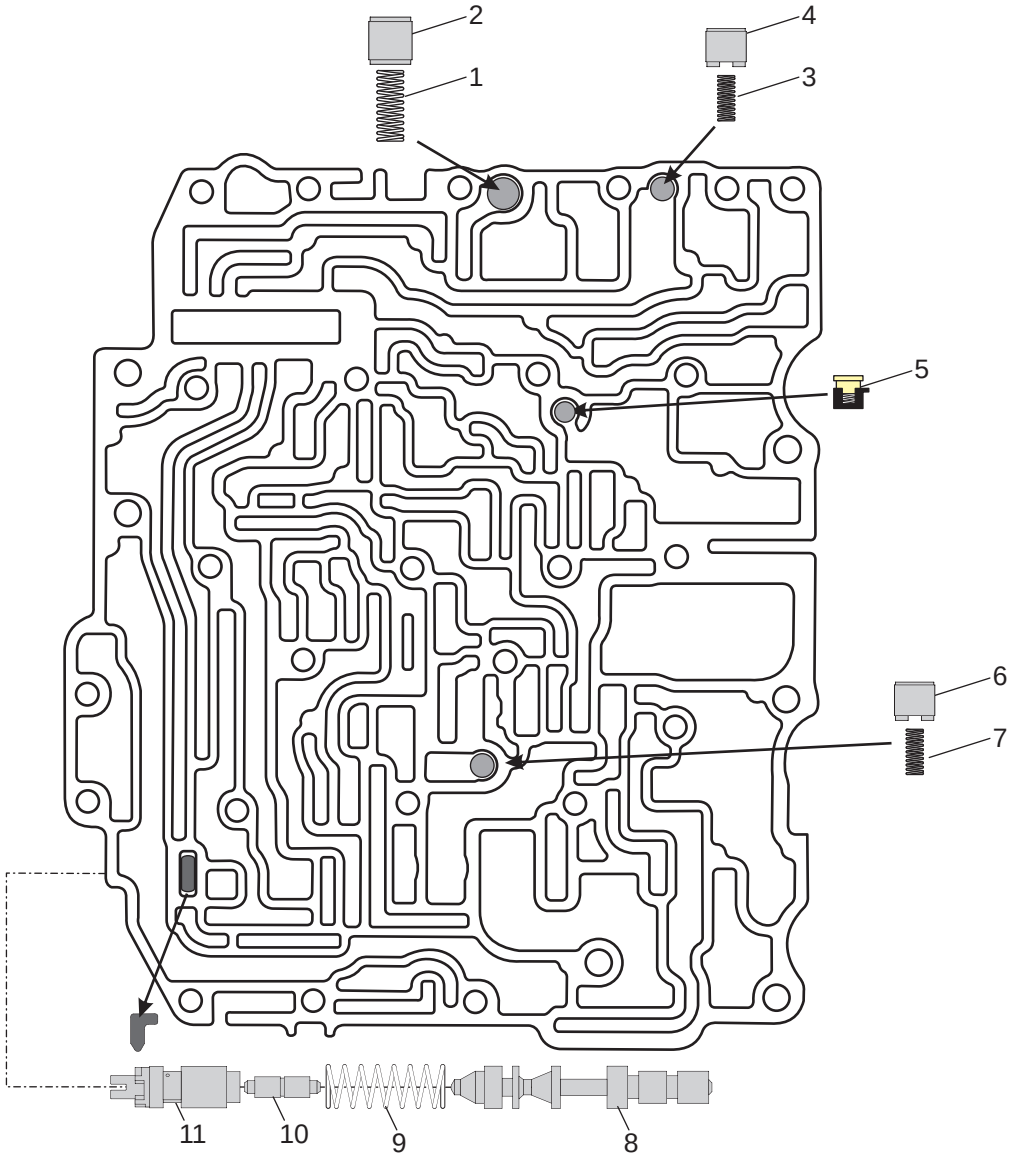
1. C3 Clutch Control Valve Spring (.746" x .254" x .033" x 10 Plain)
2. C3 Clutch Control Valve
3. B1 Band Control Valve Spring (.679" x .256" x .031" x 10 Blue)
4. B1 Band Control Valve
5. B1 Band Accumulator Piston
6. B1 Accumulator Outer Spring (1.082" x .631" x .081" x 6 Plain)
7. B1 Accumulator Inner Spring (1.082" x .426" x .064" x 9 Battleship Grey)
8. C2 Clutch Control Valve
9. C2 Clutch Control Valve Spring (.746" x .254" x .033" x 10 Plain)
10. C1 Clutch Control Valve
11. C1 Clutch Control Valve Spring (.770" x .324" x .035" x 8 Salmon)

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Figure 3

AF21/TF-81SC

FRONT CASTING LOWER SIDE

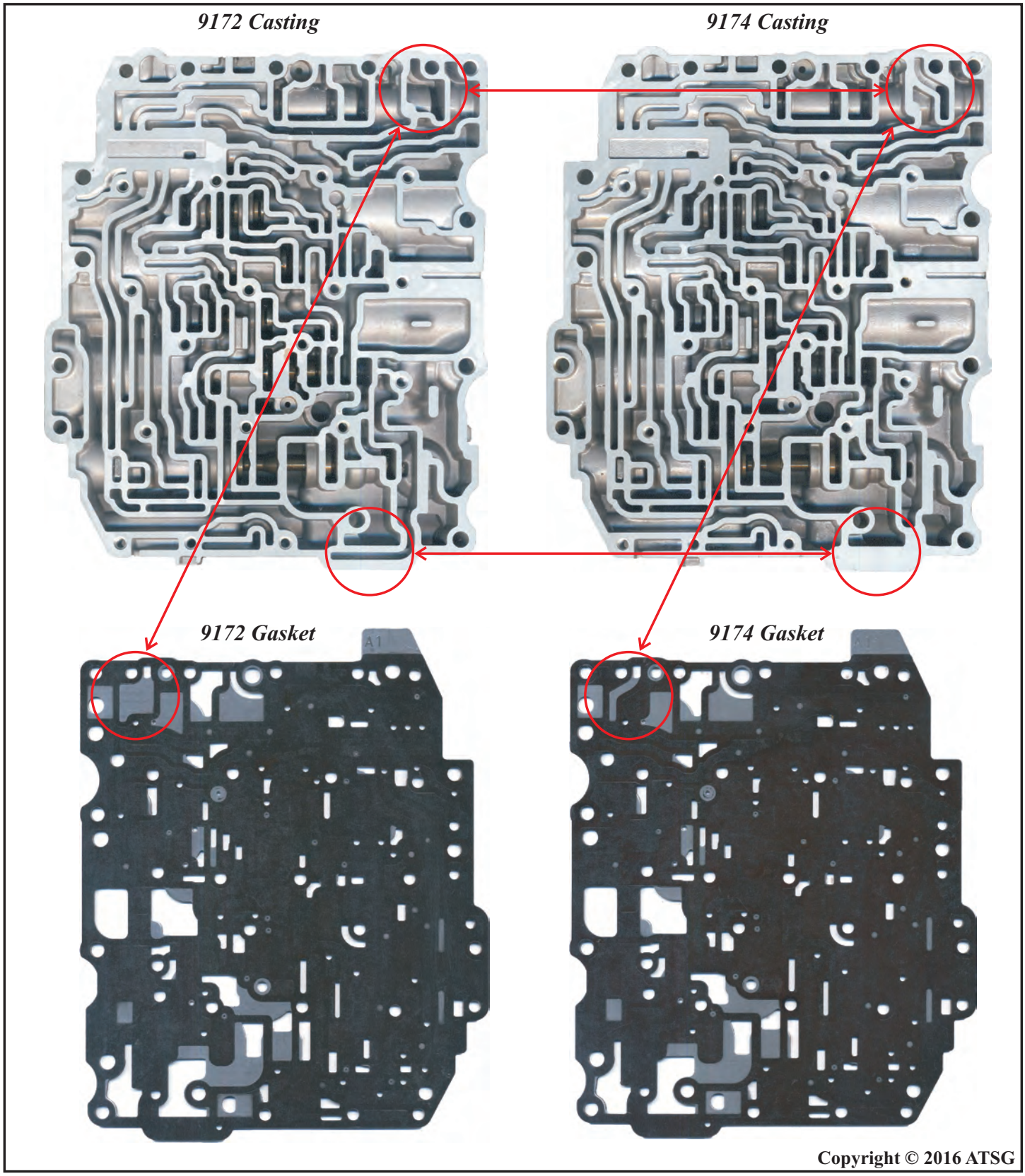


1. Manual Valve Reverse Boost Check Valve 1 Spring (.600" x .247" x .023" x 12 White)
2. Manual Valve Reverse Boost Check Valve 1
3. Forward Check Valve 1 Spring (.378" x .163" x .016" x 9.5 Red)
4. Forward Check Valve 1
5. C3 Clutch Check Valve
6. B1 Band Check Valve Spring (.378" x .163" x .016" x 9.5 Red)
7. B1 Band Check Valve
8. Primary Pressure Regulator Valve
9. Primary Pressure Regulator Valve Spring (1.562" x .548" x .047" x 8 Plain)
10. Reverse Boost Valve
11. Reverse Boost Valve and Pressure Adjusting Sleeve

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Figure 4

AF21/TF-81SC
FRONT CASTING LOWER SIDE

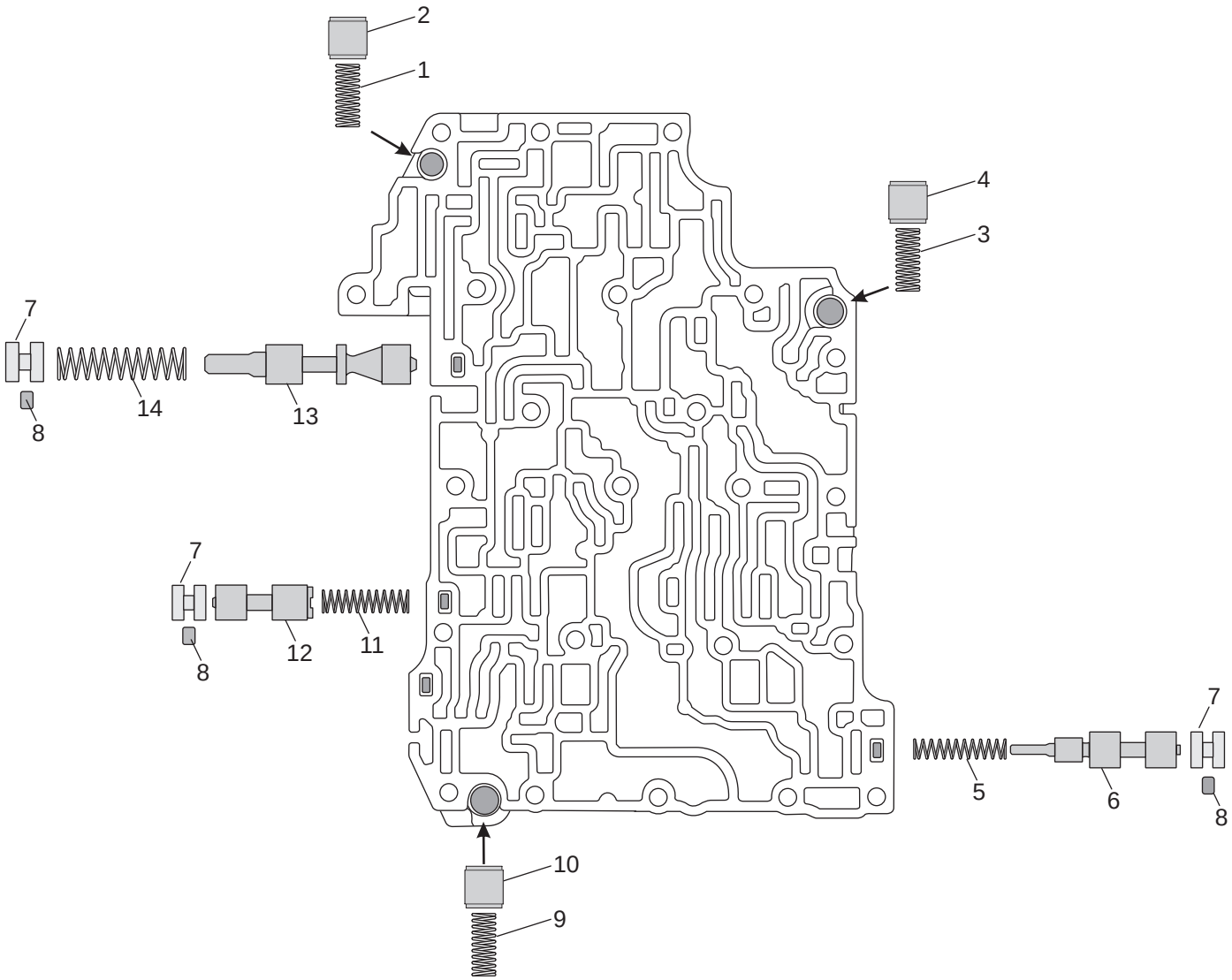


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Figure 5

AF21/TF-81SC

MIDDLE CASTING UPPER SIDE

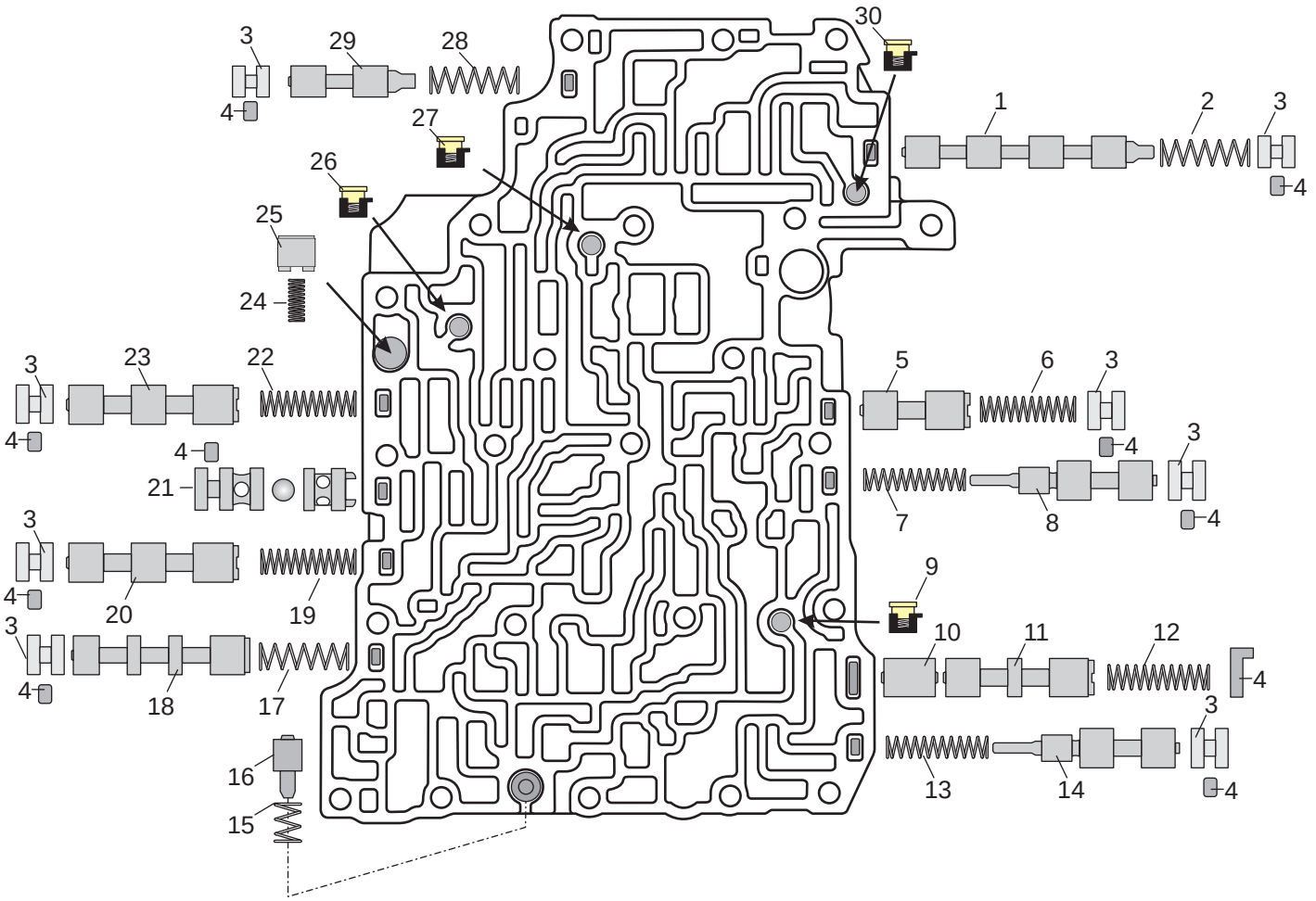


1. Cooler By-Pass Check Valve Spring (.629" x .249" x .035" x 8.5 Red)
2. Cooler By-Pass Check Valve
3. TCC Check Valve Spring (.559" x .249" x .041" x 7.5 Battleship Grey)
4. TCC Check Valve
5. C3 Signal Valve Spring (1.122" x .249" x .026" x 13.5 Red or Plain)
6. C3 Signal Valve
7. Bore Plug
8. Retainer
9. C2 Clutch Check Valve Spring (.596" x .249" x .024" x 12 White)
10. C2 Clutch Check Valve
11. B1 Signal Valve Spring (1.076" x .270" x .024" x 10.5 Salmon)
12. B1 Signal Valve
13. Secondary Pressure Regulator Valve
14. Secondary Pressure Regulator Valve Spring (1.617" x .418" x .051" x 9.5 Plain)

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Figure 6

AF21/TF-81SC
MIDDLE CASTING LOWER SIDE



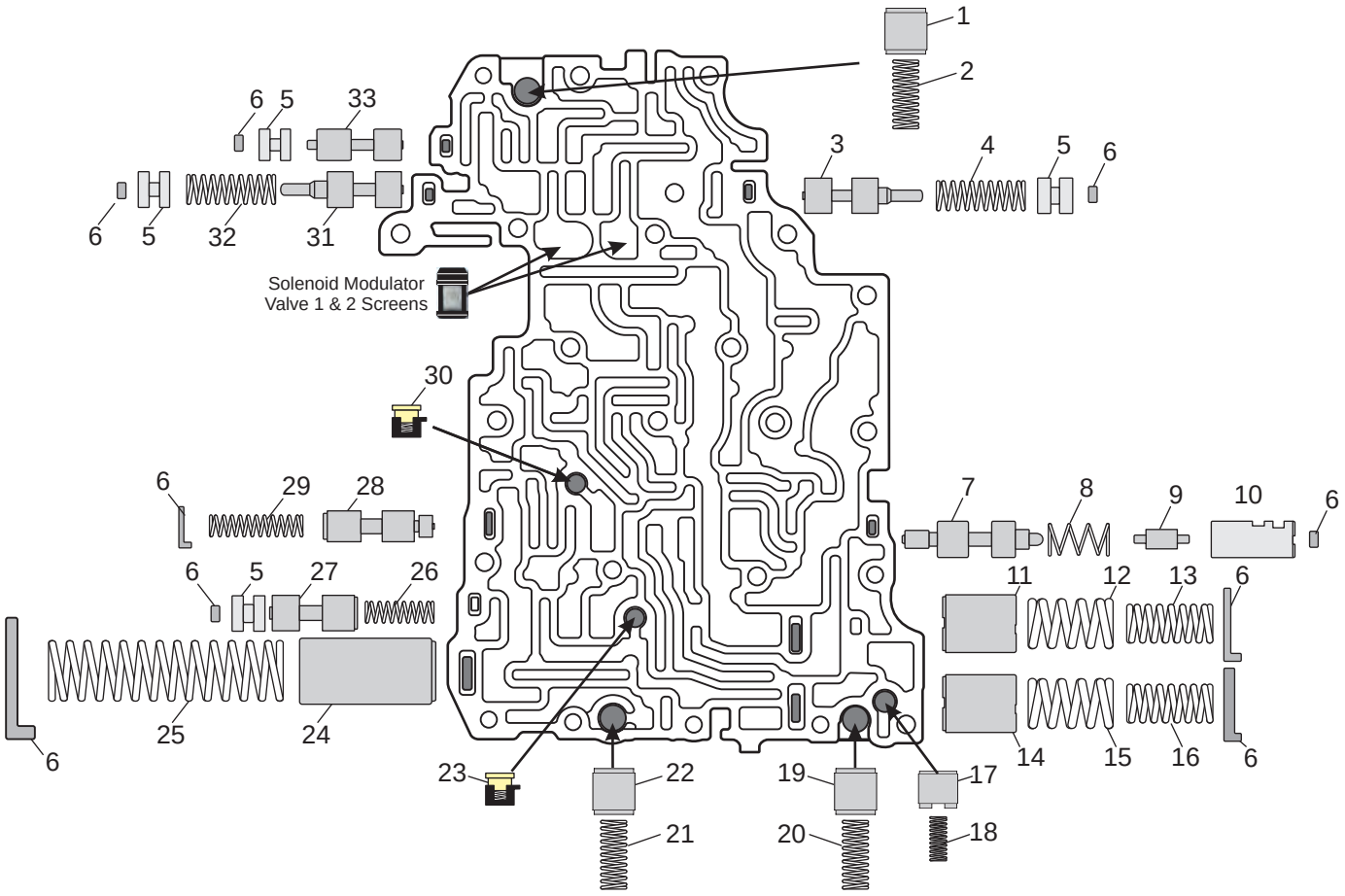
1. Sequence Valve
2. Sequence Valve Spring (1.048" x .321" x .025" x 9 Battleship Grey)
3. Bore Plug
4. Retainer
5. B1 Signal Valve
6. B1 Signal Valve Spring (1.072" x .274" x .024" x 10.5 Salmon)
7. C3 Signal Valve Spring (1.144" x .250" x .025" x 13 Red)
8. C3 Signal Valve
9. Forward Pressure Check Valve
10. B2/C2 Switch Valve A
11. B2/C2 Switch Valve B (1.076" x .270" x .024" x 10.5 Salmon)
12. B2/C2 Switch Valve Spring (1.118" x .292" x .028" x 11.5 White)
13. C1 Shift Valve Spring (1.140" x .250" x .026" x 13 Red)
14. C1 Shift Valve
15. Line Pressure Relief Valve Spring (.438" x .372" x .054" x 4 Plain)
16. Line Pressure Relief Valve
17. Lock-Up Relay Valve Spring (1.048" x .275" x .023" x 9 Battleship Grey)
18. Lock-Up Relay Valve
19. B1/C3 Relay Valve Spring (1.075" x .274" x .025" x 11 Salmon)
20. B1/C3 Relay Valve
21. B1/C3 Shift Shuttle Ball
22. B1/C3 Switch Valve Spring (1.078" x .273" x .028" x 11 Salmon)
23. B1/C3 Switch Valve
24. Secondary Pressure/TCC Check Valve Spring (.456" x .205" x .018" x 10.5 Plain)
25. Secondary Pressure/TCC Check Valve
26. B1 Band Apply Check Valve
27. Primary/Secondary PR Check Valve
28. Cutback Valve Spring (1.037" x .321" x .026" x 8 Battleship Grey)
29. Cutback Valve
30. C2 Check Valve

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Figure 7

AF21/TF-81SC

REAR CASTING UPPER SIDE

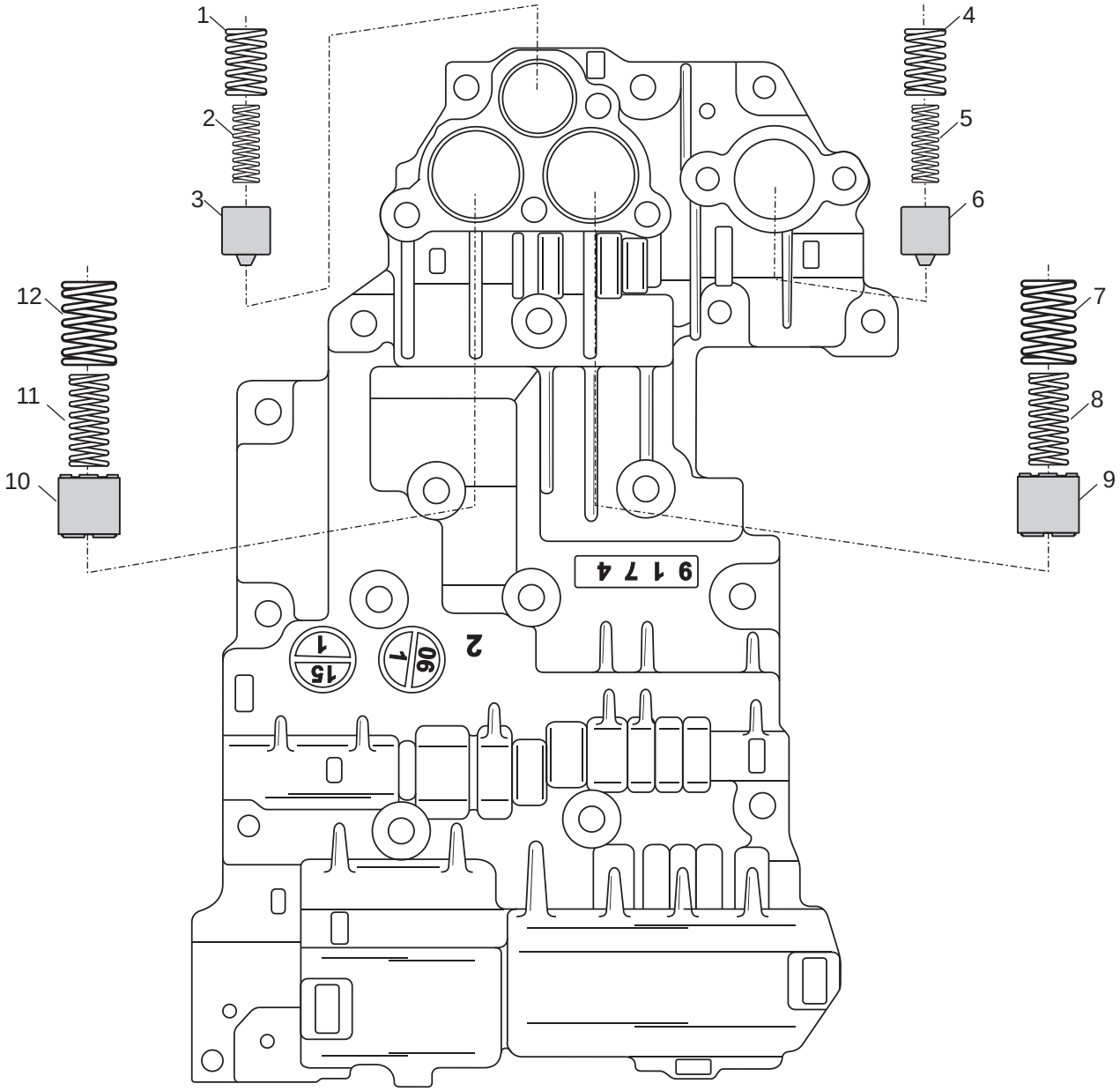


1. Cutback/Sequence Check Valve
2. Cutback/Sequence Check Valve Spring (.600" x .246" x .023" x 12 White) *(PCA, SSD, TCC)*
3. Solenoid Modulator Valve 1
4. Solenoid Modulator Valve 1 Spring (1.205" x .388" x .053" x 10 Plain)
5. Bore Plug
6. Retainer
7. Lock-Up Control Valve
8. Lock-Up Control Valve Spring (.788" x .379" x .025" x 5 Green)
9. Lock-Up Control Valve Plunger
10. Lock-Up Control Valve Sleeve
11. C3 Accumulator Piston
12. C3 Accumulator Piston Outer Spring 1.050" x .615" x .077" x 5.5 Plain)
13. C3 Accumulator Piston Inner Spring (1.060" x .413" x .055" x 9 Plain)
14. C1 Accumulator Piston
15. C1 Accumulator Piston Outer Spring (1.082" x .630" x .090" x 6 Plain)
16. C1 Accumulator Piston Inner Spring (1.085" x .426" x .074" x 9 Battleship Grey)
17. Forward Check Valve 2
18. Forward Check Valve 2 Spring (.379" x .165" x .015" x 10 Red)
19. B1/C3 Control Valve Check Valve
20. B1/C3 Control Valve Check Valve Spring (.600" x .246" x .023" x 12 White)
21. Manual Valve Reverse Boost Check Valve 2 Spring - (.600" x .246" x .023" x 12 White)
22. Manual Valve Reverse Boost Check Valve 2
23. C1 Check Valve
24. Forward Accumulator Piston
25. Forward Accumulator Spring (3.060" x .771" x .084" x 15 Plain)
26. C1 Relay Valve Spring (1.090" x .274" x .028" x 11.5 Salmon)
27. C1 Relay Valve
28. C2 Timing Valve
29. C2 Timing Valve Spring (1.159" x .293" x .032" x 12 White)
30. C2 Check Valve *(SSA, SSB, SSC, SSE, SSF)*
31. Solenoid Modulator Valve 2
32. Solenoid Modulator Vakve 2 Spring (1.217" x .387" x .052" x 10 Plain)
33. Engagement Control Valve

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Figure 8

AF21/TF-81SC
REAR CASTING LOWER SIDE



1. Solenoid Modulating Valve 1 Accumulator Piston Outer Spring - (.948" x .478" x .074" x 7 Red)
2. Solenoid Modulating Valve 1 Accumulator Piston Inner Spring - (.938" x .305" x .043" x 10 Red)
3. Solenoid Modulating Valve 1 Accumulator Piston
4. Solenoid Modulating Valve 2 Accumulator Piston Outer Spring - (.948" x .478" x .074" x 7 Red)
5. Solenoid Modulating Valve 2 Accumulator Piston Inner Spring - (.938" x .305" x .043" x 10 Red)
6. Solenoid Modulating Valve 2 Accumulator Piston
7. C2 Accumulator Piston Outer Spring (1.089" x .630" x .090" x 6 Plain)
8. C2 Accumulator Piston Inner Spring (1.089" x .430" x .075" x 9.5 Battleship Grey)
9. C2 Accumulator Piston
10. Line Pressure Control Accumulator Piston Outer Spring - (1.089" x .630" x .090" x 6 Plain)
11. Line Pressure Control Accumulator Piston Inner Spring - (1.089" x .430" x .075" x 9.5 B. G.)
12. Line Pressure Control Accumulator Piston

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Figure 9

Valve Body Pro - 21

TF81SC

SLIPS IN REVERSE & TCC CHATTER

COMPLAINT: A vehicle equipped with the TF81SC transmission may have a complaint after overhaul of a delayed or slip in reverse. A secondary complaint may be a converter clutch chatter or engine rpm drop. Other complaints may also be harsh shifts and a bind-up sensation.

CAUSE: **(1)** Installing the 9172 gasket on the 9174 valve body:

- In Reverse - Reverse chatter or slip due to loss of boost pressure.
  Stall the engine or loss of engine rpm to converter clutch apply (See Figure 1).
- In Drive - High line pressure due to cross-leak into reverse boost circuit (See Figure 1).
  Harsh and/or bump shifts with a bind-up sensation.

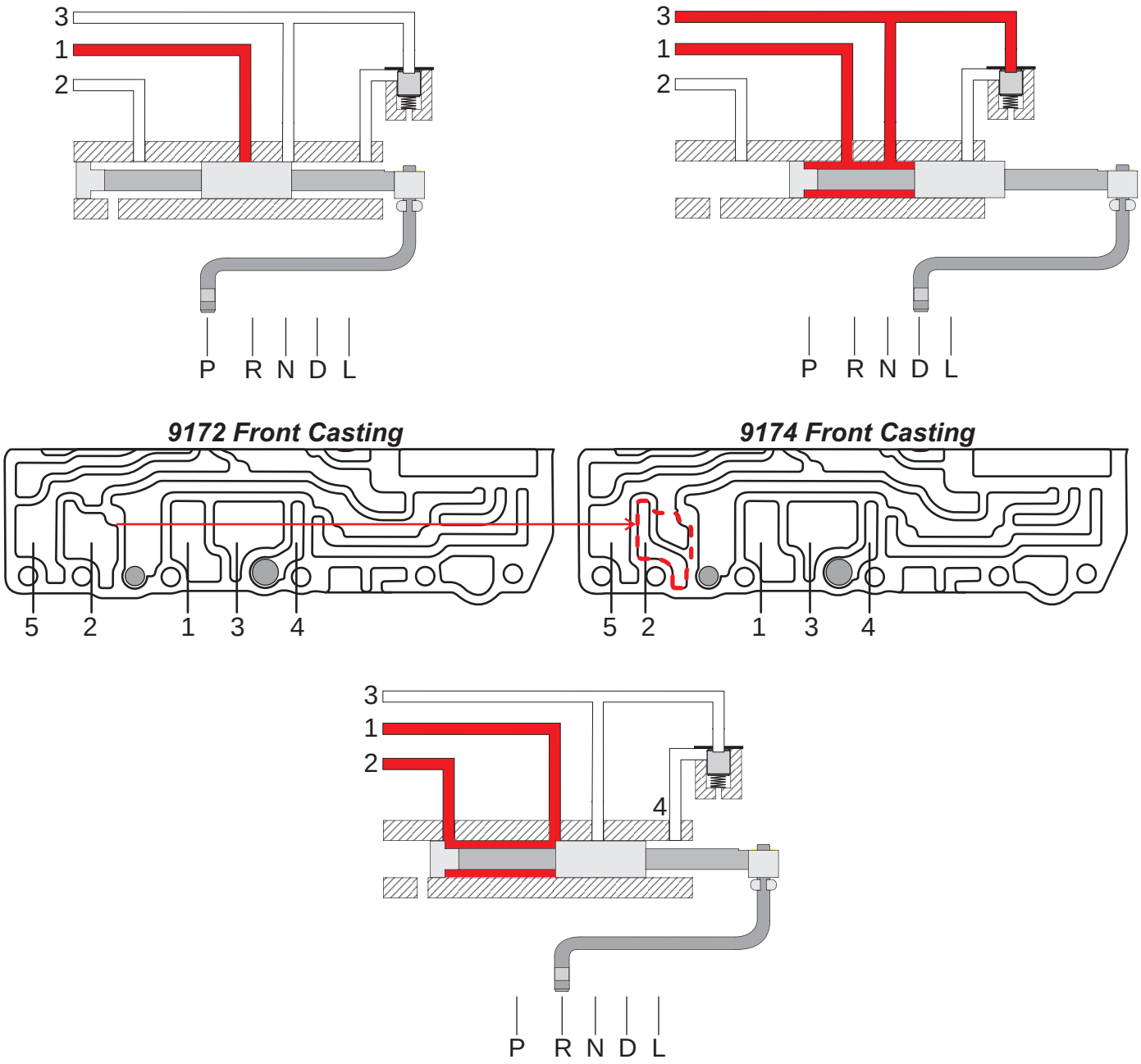
(2) Installing the 9174 gasket on the 9172 valve body:

- No Functional problems. However, if the original bonded gaskets are removed and replaced with after market gaskets, due to a part of the gasket being unsupported, a piece can break off and become lodged in the Reverse Boost Valve which could cause engagement problems (See Figure 2).

CORRECTION: Install the correct gasket onto the correct valve body casting as seen in Figure 3 or reuse the bonded plate and gaskets if they are in good condition.

Many thanks to Dean Mason from Trans Lab for his calculation contributions

Worldwide - 23



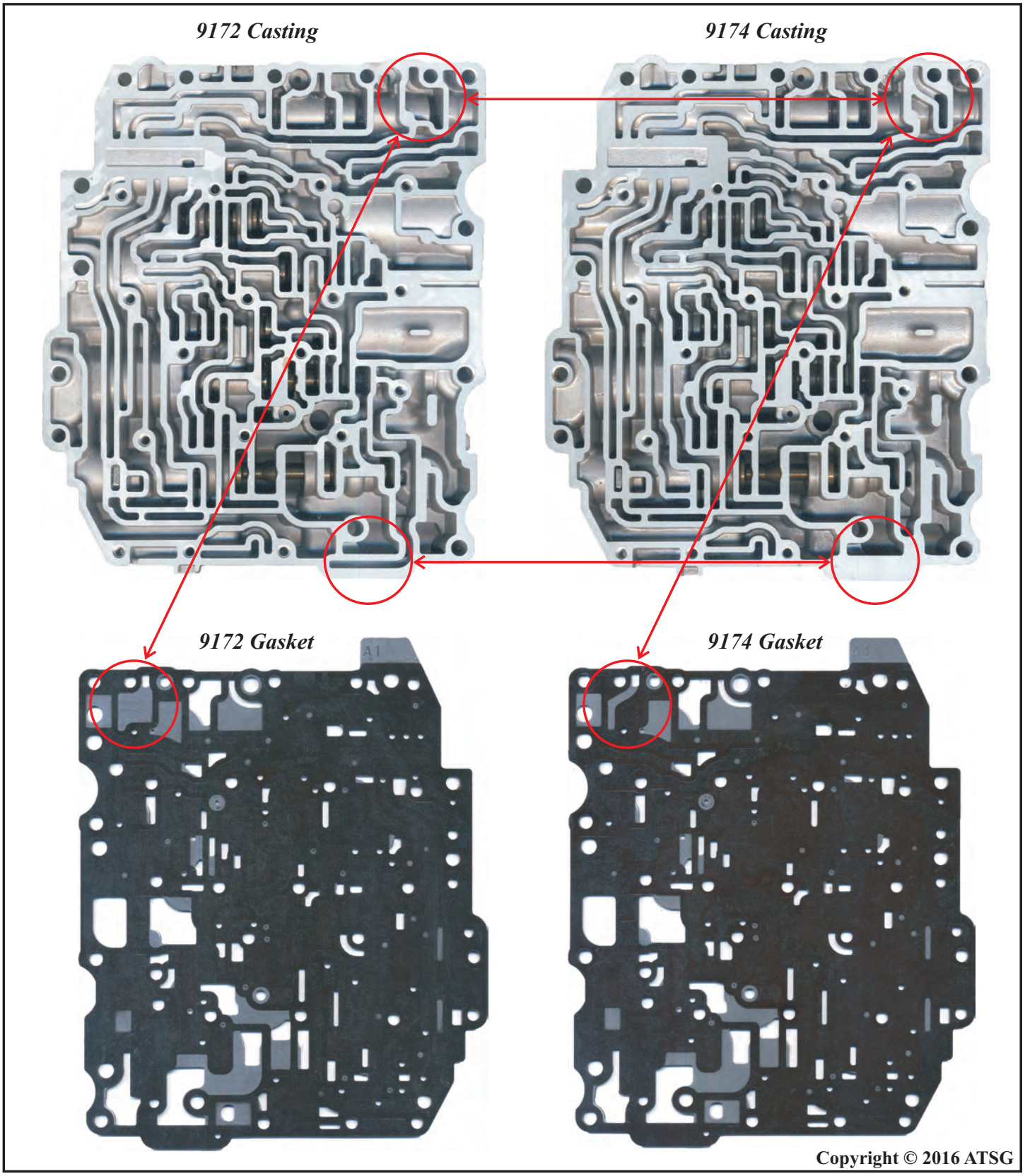
1. Line Pressure Supply to Manual Valve
2. To the Reverse Boost at Pressure Regulator Valve and to the B2/C2 Switch Valve
3. To Forward Accumulator Piston, C1 Shift Valve, B2/C2 Switch Valve and related Check Valves
4. Forward Check Valve 1
5. TC In (Clutch Release Circuit)

Summary:
When a 9172 front casting valve body gasket is used on a 9174 front casting, the wrong gasket will allow circuit 2 to intrude into circuit 5. Circuit 2 is used to raise line pressure in reverse and to supply line pressure to the related valves in the valve body for a reverse engagement. Circuit 5 is the torque converter charge pressure (TCC In/Release) circuit. Delayed and/or slipping in Reverse will be the initial observation made due to this incorrect gasket application.

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Figure 1

AF21/TF-81SC
FRONT CASTING LOWER SIDE



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Figure 2

TF81SC

SOLENOID CONNECTOR IDENTIFICATION

COMPLAINT: **(1)** A Ford vehicle equipped with the TF81SC transmission has eight solenoids to connect as well as two speed sensors and an ATF Temperature Sensor. What connects to what as well as internal wire harness routing creates confusion for the rebuild technician.

(2) The solenoid connectors can be easily broken which would allow the wire harness connectors to back out and loose contact with the solenoid or speed sensor resulting in diagnostic trouble codes to be set.

CAUSE: **(1)** Cross connecting solenoid connectors or loose fitting connectors.

(2) Excessive force used on the connector because the proper disconnect method is not obvious.

CORRECTION: **(1)** Use the illustration in Figure 1 for correct solenoid and speed sensor connections as well as proper wire harness routing.

(2) Use the disconnect method in Figures 2 and 3 to properly disconnect solenoids and speed sensors without breaking them.

SPECIAL NOTE: A version of this transmission is used in Volvo vehicles called the TF-80SC FWD and the TF-80SL AWD. To meet the high demands for fuel economy and comfort, this transmission underwent significant changes designating it as a second generation. A brief summary of the changes are as follows:

1. Tapered bearings - To reduce the inner friction losses, some of the tapered bearings now have bigger diameter and shorter length of bearing rollers. This change gives fewer rollers and thus less friction.

2. Torque converter - To reduce noise/sound when locking at lower engine RPM, the LTD (Long Travel Damper) has been provided with an inner circle of damping springs

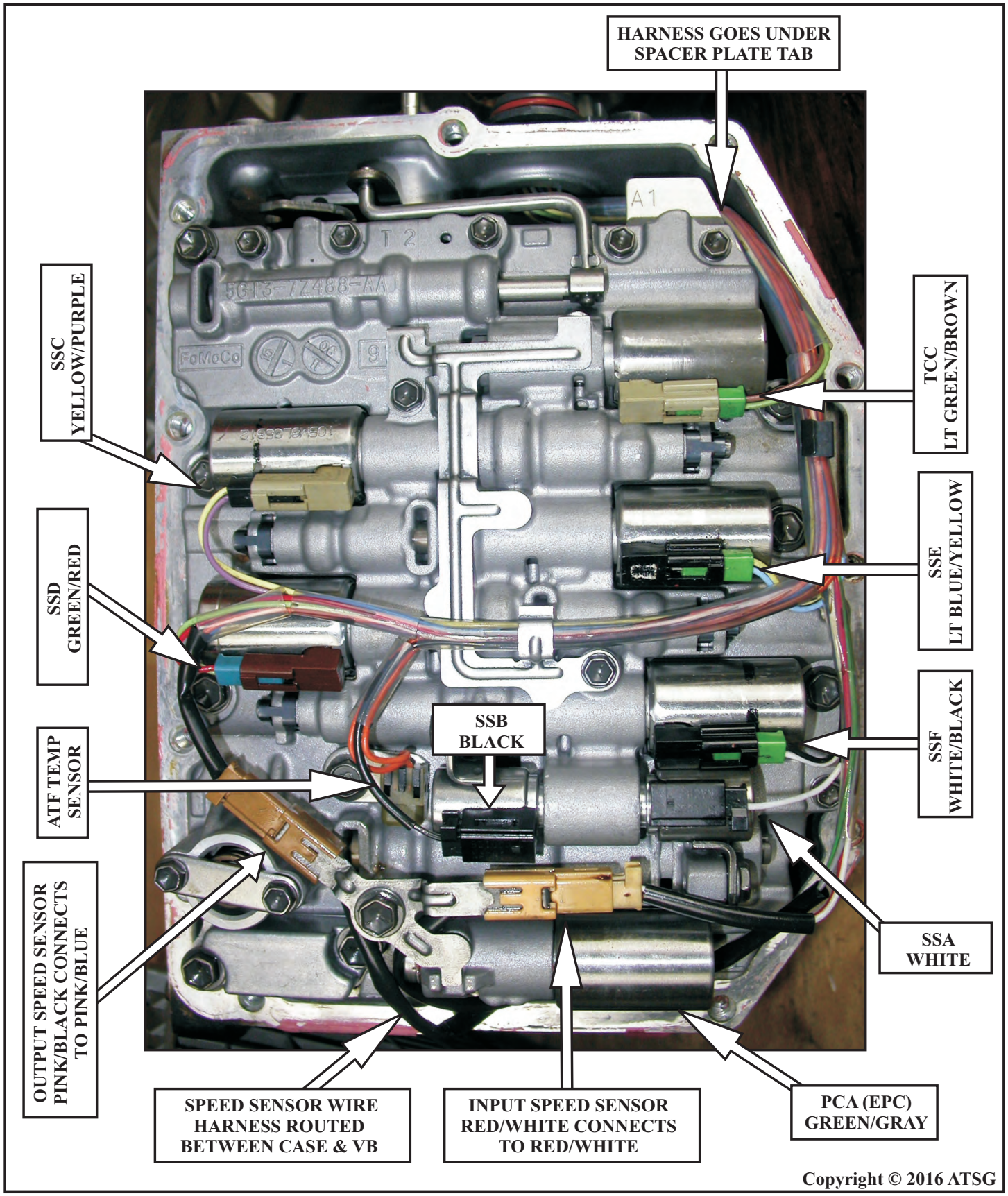
3. TCM - The TCM has the same hardware as before but the software has been changed.

4. Solenoids - Faster shifting has been achieved by making all linear solenoids that control the clutch systems more effective. This change has been achieved by removing the hydraulic part of the solenoids. Further, the magnetic flow in the solenoid has been increased and gap between thrust piston and magnetic coil has been reduced to increase power. ***Note:*** *Solenoid adjustments have been eliminated.*

5. Seal rings - New seal rings with smaller sealing surface contributes to reducing the inner friction. By tapering the seal, the sealing surface is reduced as is the pressure on the sealing surface.

6. Friction pads - The new friction pads on the discs reduce the impact of drag losses between the friction pads. This has been achieved by optimizing the oil flow channels between the friction surfaces.

TF81SC SOLENOID CONNECTOR IDENTIFICATION



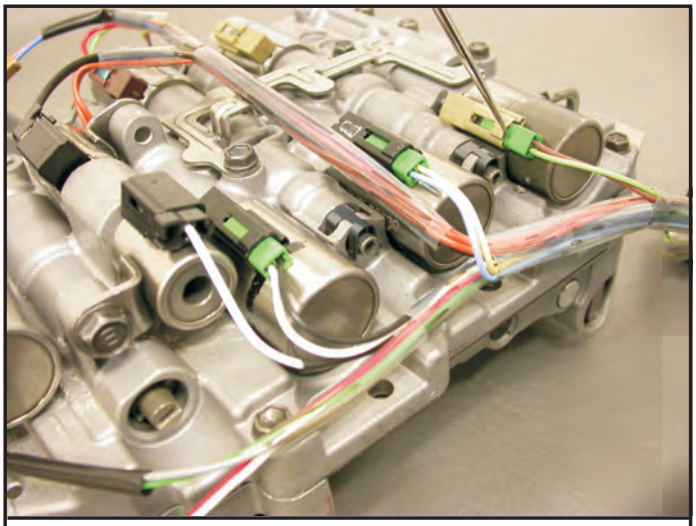
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Figure 1

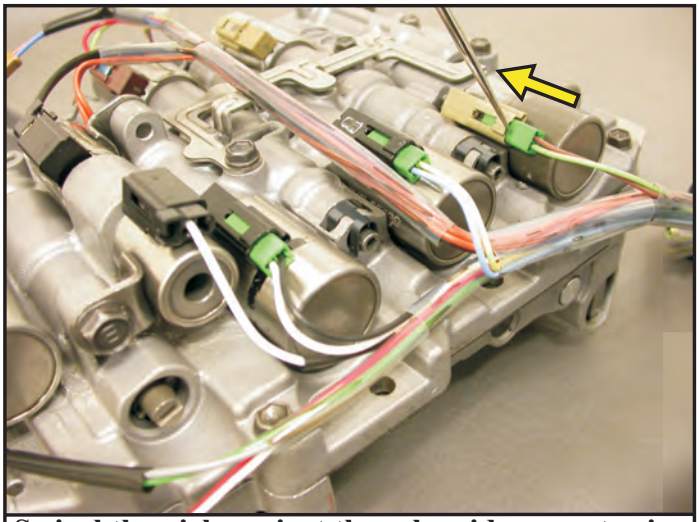
TF81SC

SOLENOID CONNECTOR IDENTIFICATION

ALL DOUBLE WIRE CONNECTORS



Stick pick into wire harness connector with the pick resting against the solenoid connector.

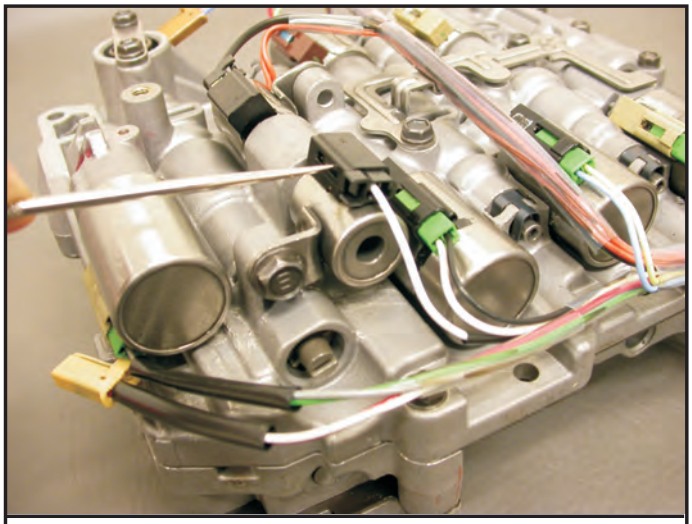


Swivel the pick against the solenoid connector in the direction of the arrow until the wire connector moves out.

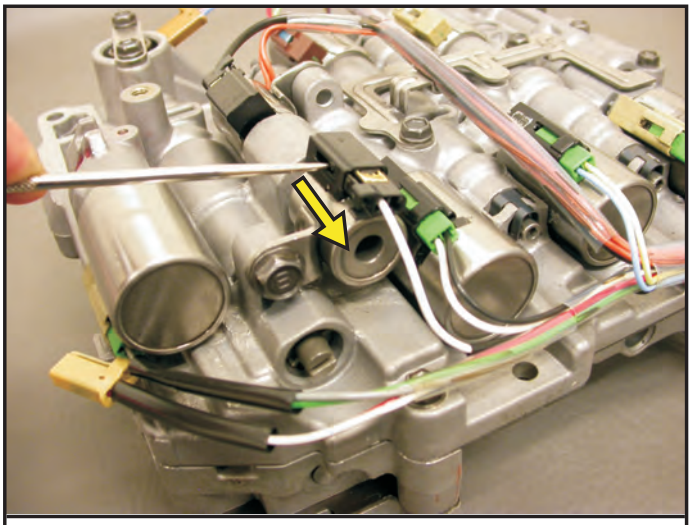
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Figure 2

ALL SINGLE WIRE CONNECTORS



Stick pick into side of wire harness connector towards the bottom of the rectangular slot in the solenoid connector.



Push the pick in the direction of the arrow until the connector moves out.

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Figure 3

WIT - 29

FORD CFT30 CVT

CASE WEAR

COMPLAINT: A Ford vehicle with the CFT30 CVT may have a complaint of noise during transmission operation. Initial diagnostics indicates the noise is coming from inside the transmission.

CAUSE: When the transmission is dis-assembled for inspection, a number of internal components have wear issues which resembles the damage that can occur when components operate off center. A more through inspection reveals the there is to much clearance between one or both of the pulley bearings and the bearing pocket in the case (See Figure 1).
There should be practically no clearance between the bearing and the case. ATSG's technical help line has encountered these transmission with having as much as ten thousandths clearance.

CORRECTION: The case will require replacement.

FORD CFT30 CVT

CASE WEAR

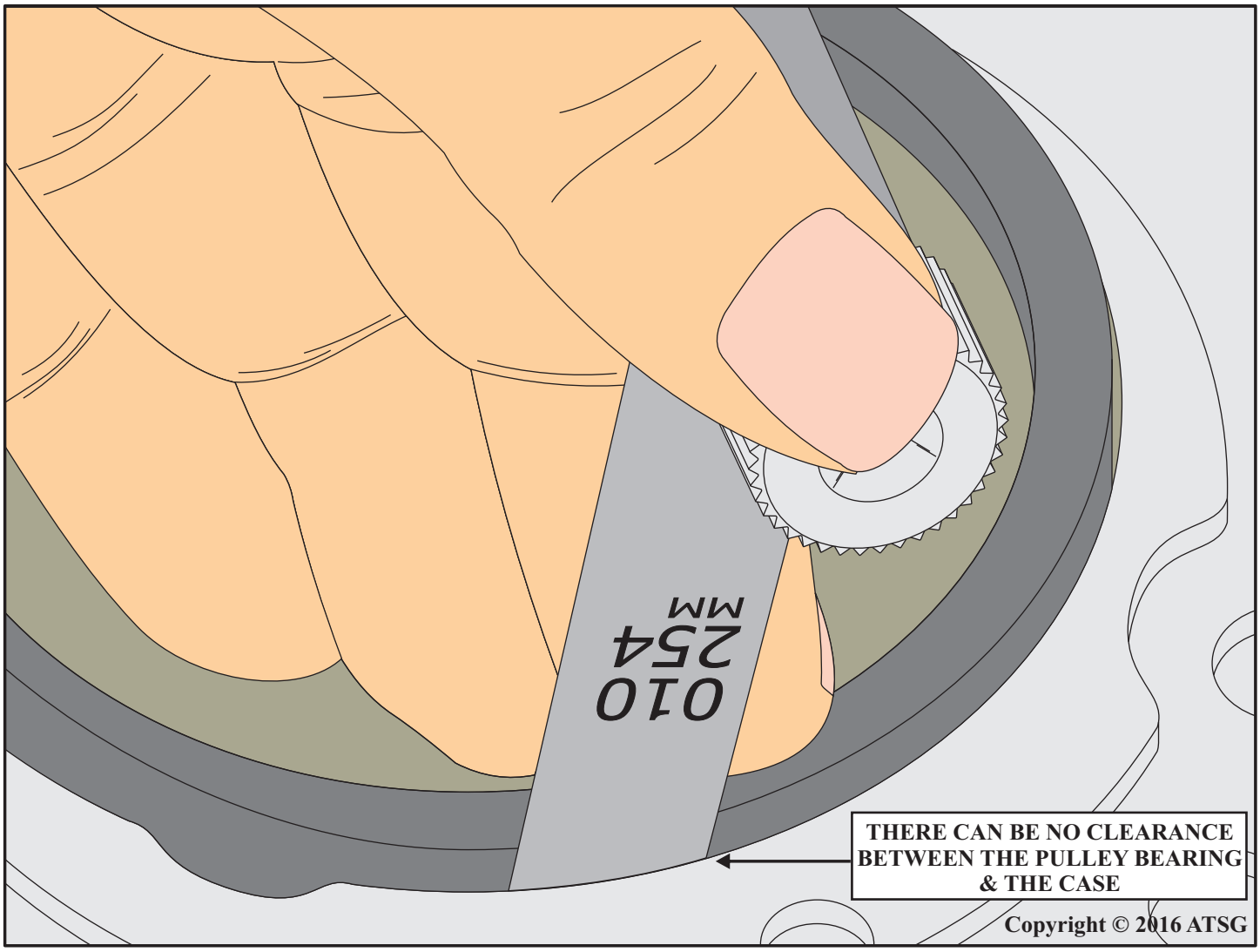


Figure 1

FORD CFT30 CVT
INTERMITTENT HARSH SHIFTS

COMPLAINT: A Ford vehicle with the CFT30 CVT may have an after overhaul complaint of erratic and intermittent harsh shifts. Stored in memory is DTC P0701for a Transmission Performance Fault, P0716 for a Turbine Speed Sensor Circuit Range/Performance problem and P0811 for Excessive Clutch Slippage.

CAUSE: A distorted turbine speed sensor tone ring on the turbine shaft and carrier assembly which is referred to as a Reverse Planetary Assembly (See Figure 1). This caused an systematic irregularity in the turbine speed signal resulting in a pulley speed ratio error yet no gear ratio codes were ever set.

CORRECTION: Replace the Reverse Planetary Assembly (Turbine Shaft/ Carrier Assembly).

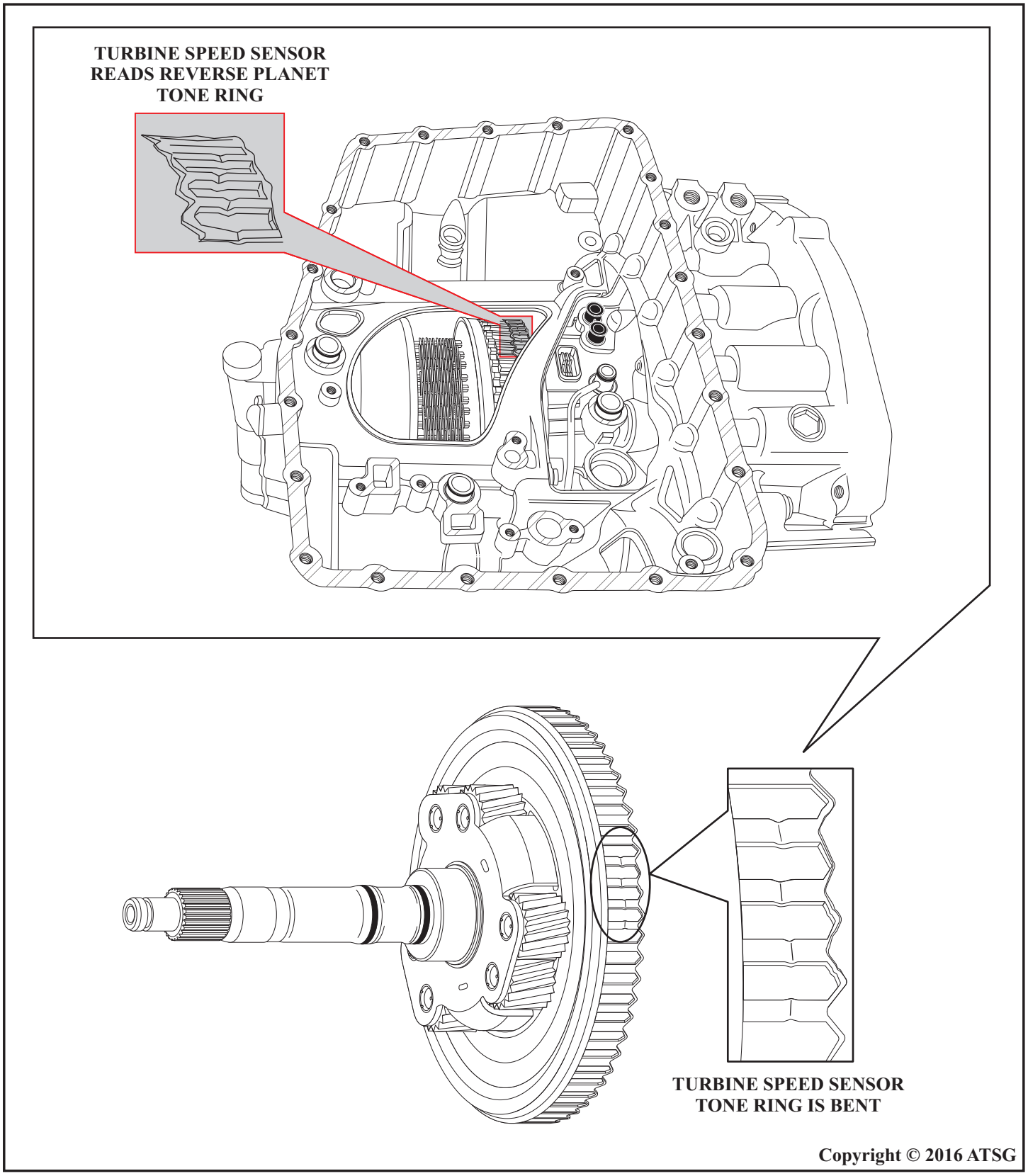
SUMMARY: The Turbine Speed Sensor and the Primary Variator Speed Sensor are Hall Effect speed sensors housed in the Mechatronic unit and are not serviceable. The Primary Variator Speed Sensor reads the toothed part of the primary pulley and therefore measures primary pulley speed.
The Turbine Speed Sensor reads the tone ring on the Reverse Planetary assembly which measures rotational speed of the turbine shaft for calculated primary pulley speeds.
The Output Speed Sensor is actually two sensors in one and is mounted to the transmission case next to the valve body. Output Speed Sensor "A" is reading the spur gear mounted on the secondary variator and measures actual output RPM. Output Speed Sensor "B" is reading the differential gear teeth and measures directional rotation for forward and reverse motion. The signals from these speed sensors is what the TCM is using to calculate gear ratio.

Comparing the two waveforms in Figures 2 and 3, notice where the cursors are parked, in Figure 2 the cursor is parked on a damaged area of the turbine speed sensor tone ring. The waveform also shows that the measured and commanded pulley speed are not the same using the VAR_CMD and VAR_MES parameters. These parameters represent commanded ratio and measured ratio which are incorrect. The correct ratio should be 1.9 but is indicating a 3.1 to 2.3 ratio.
In Figure 3 the cursor is parked over an undamaged area of the turbine speed sensor tone ring. The VAR_CMD and the VAR_MES parameters indicated approximately the same gear ratio but using the formula of Speed Pulley "A" divided by Speed Pulley "B", the gear ratio should read 0.86 but is indicating a 1.4 ratio. This means that even though the cursor is on an undamaged area of the tone ring, the TCM has not been able to calculate the correct gear ratio before the turbine speed sensor reads the damaged area of the turbine speed sensor tone ring again.

The chart in Figure 4 identifies the data parameters used in this bulletin.

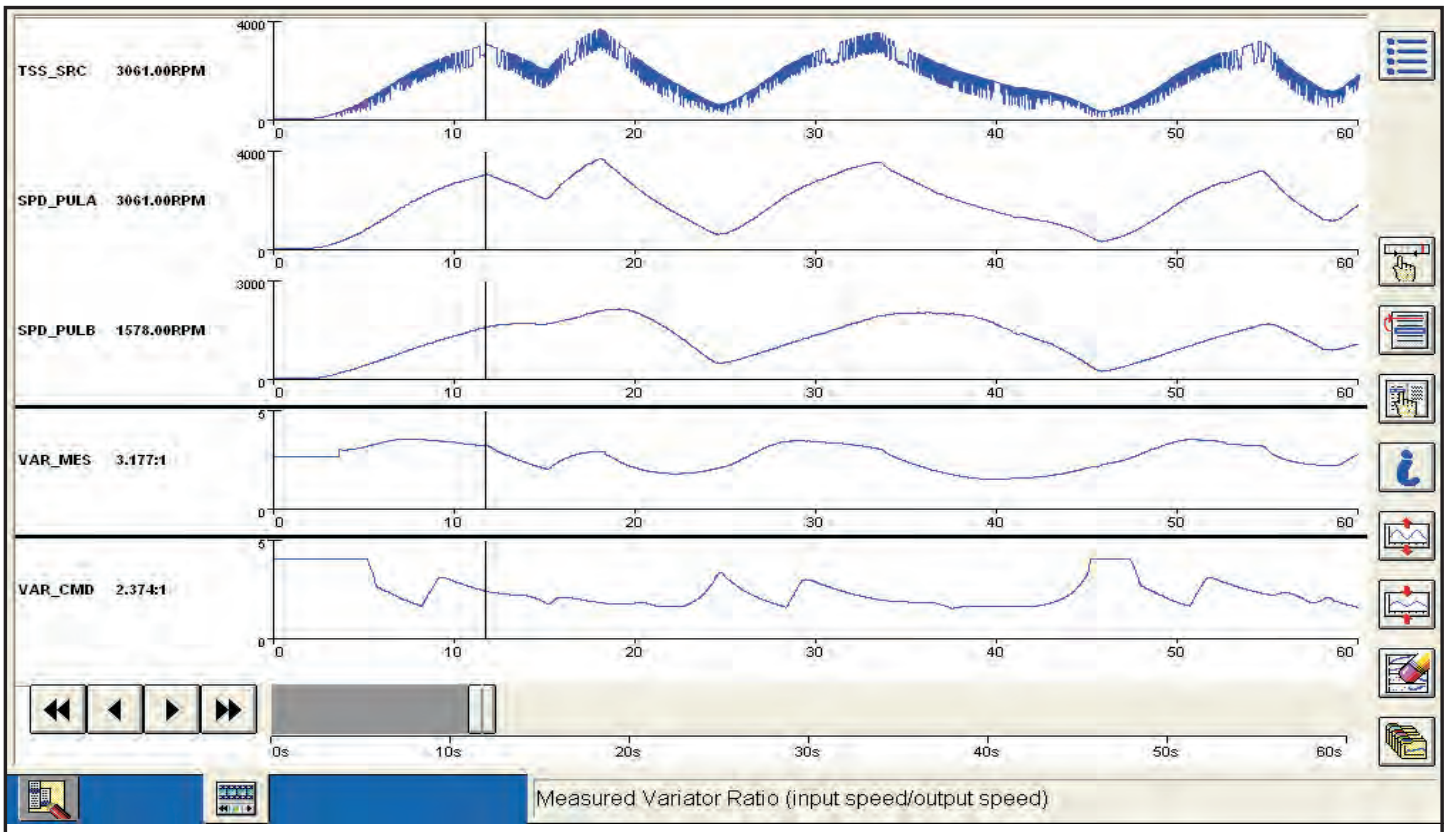
FORD CFT30 CVT

INTERMITTENT HARSH SHIFTS



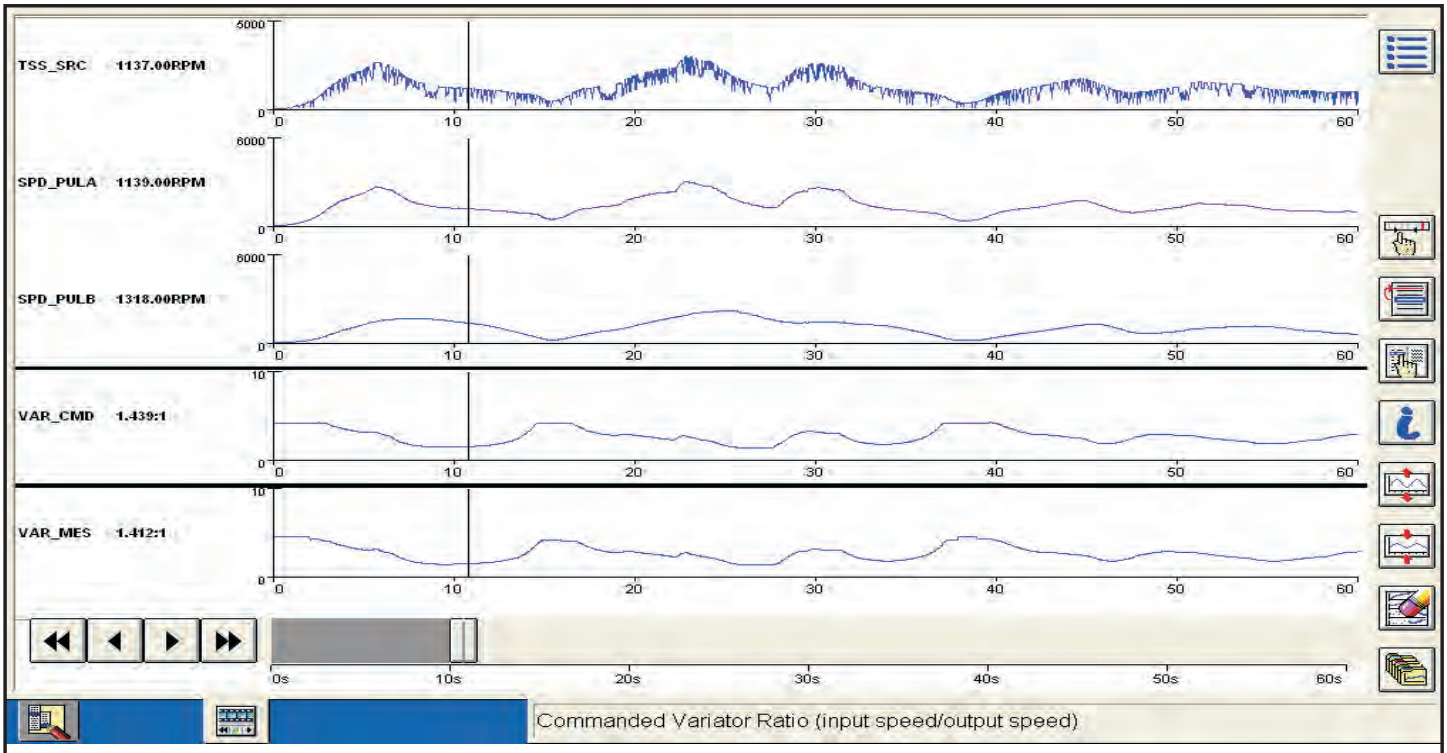
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Figure 1



With the cursor parked on a damaged area of the tone ring, the VAR_MES & VAR_CMD parameters show that measured & commanded pulley ratios are not the same. SPD PUL "A" & SPD_PUL "B" is an incorrect ratio of 3.1 to 2.3, it should be 1.9.

Figure 2



With the cursor parked on an undamaged area of the tone ring, the VAR_CMD & VAR_MES speeds are the but the SPD_PUL "A" & SPD_PUL "B" RPMs work out to a 1.4 ratio which is incorrect, it should be 0.89. The TCM could not calculate ratio before the TSS read the next damaged area of the tone ring.

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Figure 3

FORD CFT30 CVT

INTERMITTENT HARSH SHIFTS

DATA PARAMETER IDENTIFICATION			
PID NAME	**DESCRIPTION**	**UNITS**	**ADDITIONAL DESCRIPTION**
VAR_CMD	Commanded Variator Ratio Input/Output Speed	RATIO	Desired Gear Ratio
VAR_MES	Measured Variator Ratio Input/Output Speed	RATIO	Actual Gear Ratio
OSS_A	Output Shaft Speed A	RPM	Actual Output Shaft Speed
OSS_B	Output Shaft Speed B	RPM	Directional Output Speed
RPM_TCM	Engine Revolutions Per Minute	RPM	Engine RPM
SPD_PUL A	Actual Pulley Speed A	RPM	Primary Pulley RPM
SPD_PUL B	Actual Pulley Speed B	RPM	Secondary Pulley RPM
TSS_SRC	Turbine Shaft Speed	RPM	Actual Turbine Shaft Speed

Figure 4

FORD FIESTA AND FOCUS

TRANSMISSION OVER HEAT MESSAGE

COMPLAINT: Ford Fiesta (2011-2014) and Ford Focus (2012-2014) may display a "Transmission Overheating Stop Safely" message in the Base Message Center. Codes related to the Transmission Range Sensor, TCM Power Input and Communication Error Codes between the PCM and the RFA Module (Remote Function Actuator/Keles Vehicle Module) will accompany the condition.

CAUSE: Ford states that these codes may cause the Overheat message to be displayed without the transmission overheating.

CORRECTION: It is suggested by Ford to diagnose the codes set prior to diagnosing the overheat message.

Codes that may be stored are:

TRS Related Codes: P0706, P0707, P0708, P2801, P2802, P2805

TCM Power Related Codes: P0702 and P0882

Communication Codes: U0100 and U0294

Message Logic: These vehicles are equipped with a Getrag 6DCT250 otherwise known as Ford's Powershift DPS6. This is a dual dry clutch manual shift transmission that is automatically shifted by the TCM. One clutch drives odd gears (1-3-5) while the other the even gears (2-4-6). The apply and release of these two clutches as is shifts through the gears are prone to overheating under certain driving conditions. Stop and go traffic would be one such example. As a result, there are many safety measures taken to prevent damage to the clutches by informing the driver with a variety of messages. Some of the messages that can be displayed are:

Transmission Too Hot Press Brake
Transmission Overheating Stop Safely
Transmission Hot Stop Or Speed Up
Transmission Hot Wait "X number of" Minutes
Transmission Hot Wait...

These will be accompanied by a lit Information Icon . It will be Red or Amber depending on the severity of the message and will remain on until the message has been rectified. When the message is displayed it will also be accompanied with and audible chime. The message that typically comes up first is the "Transmission Hot Stop Or Speed Up" message with an Amber Information Icon and a chime. The message may repeat itself if insufficient action is taken and the Information Icon will turn Red along with a louder audible chime. If no action is taken and temperatures continue to increase, the computer will cause the clutch to shudder and display the "Transmission Overheating Stop Safely" message or "Transmission Hot Wait" or "Transmission Hot Wait "X" number of Minutes. If the transmission exceeds maximum temperatures the transmission will default to neutral.

FORD 6F35

LOW-REVERSE/1-2-3-4 IMPROVED CLUTCH HOUSING

CHANGE: The Low/Reverse/1-2-3-4 Clutch Housing was modified from the previous design (Figure 1) to accept a cupped steel support ring under the retaining snap ring along with a different style Belleville Spring on both sides of the clutch housing (See Figure 2).

REASON: To prevent the retaining snap ring from popping out.

PARTS AFFECTED:

(1) The clutch housing.
(2) The Belleville Spring.
(3) The added cupped steel support ring (See Figures 3 and 4).

INTERCHANGEABILITY:

The second design clutch housing will back service all 6F35 Transmissions as a complete assembly.

SERVICE INFORMATION:

2nd Design Low/Reverse-1-2-3-4 Clutch Housing Assembly.....DG9Z-7A130-B

6F35 LOW-REVERSE/1-2-3-4 IMPROVED CLUTCH HOUSING

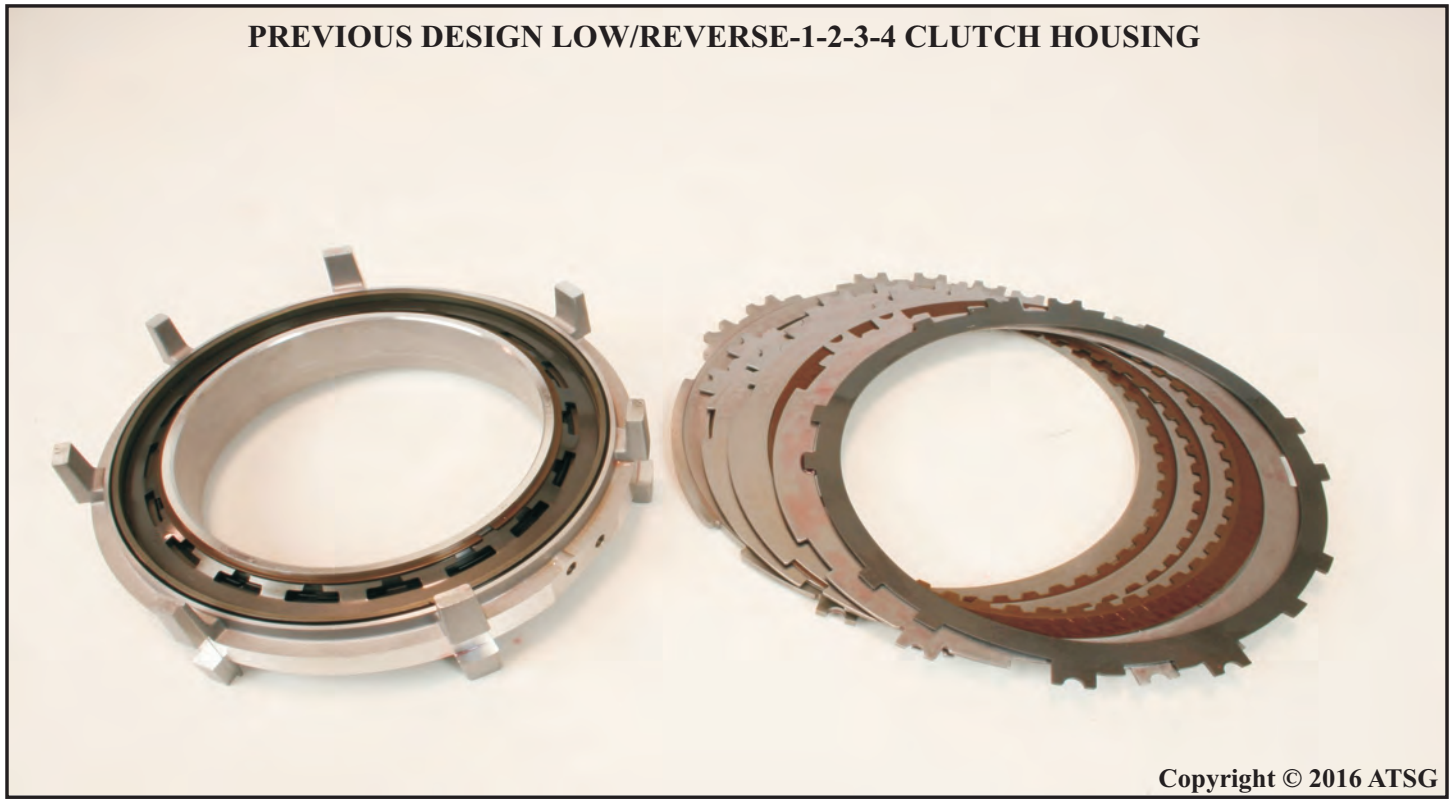


Figure 1

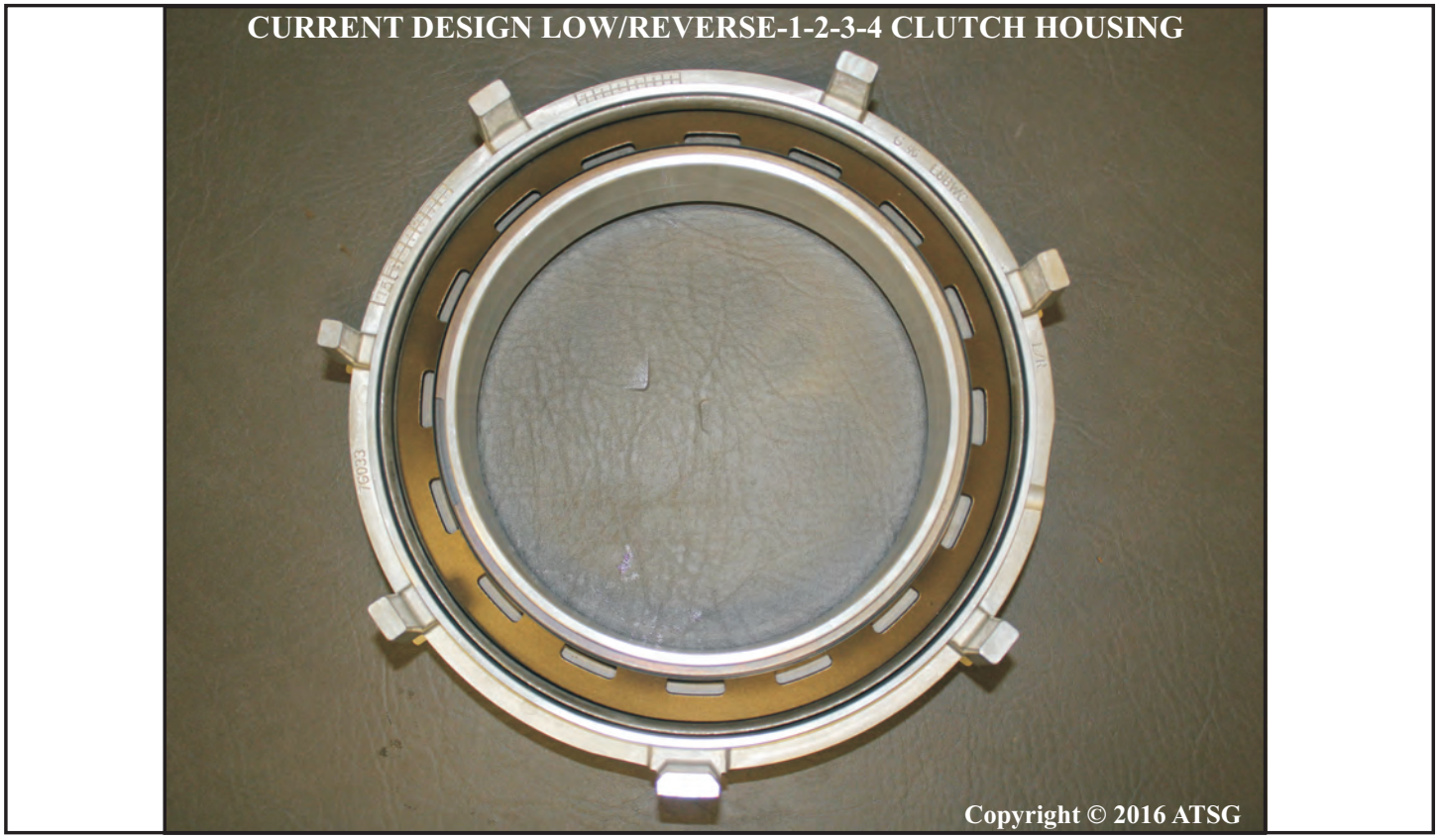


Figure 2

FORD 6F35

LOW-REVERSE/1-2-3-4 IMPROVED CLUTCH HOUSING

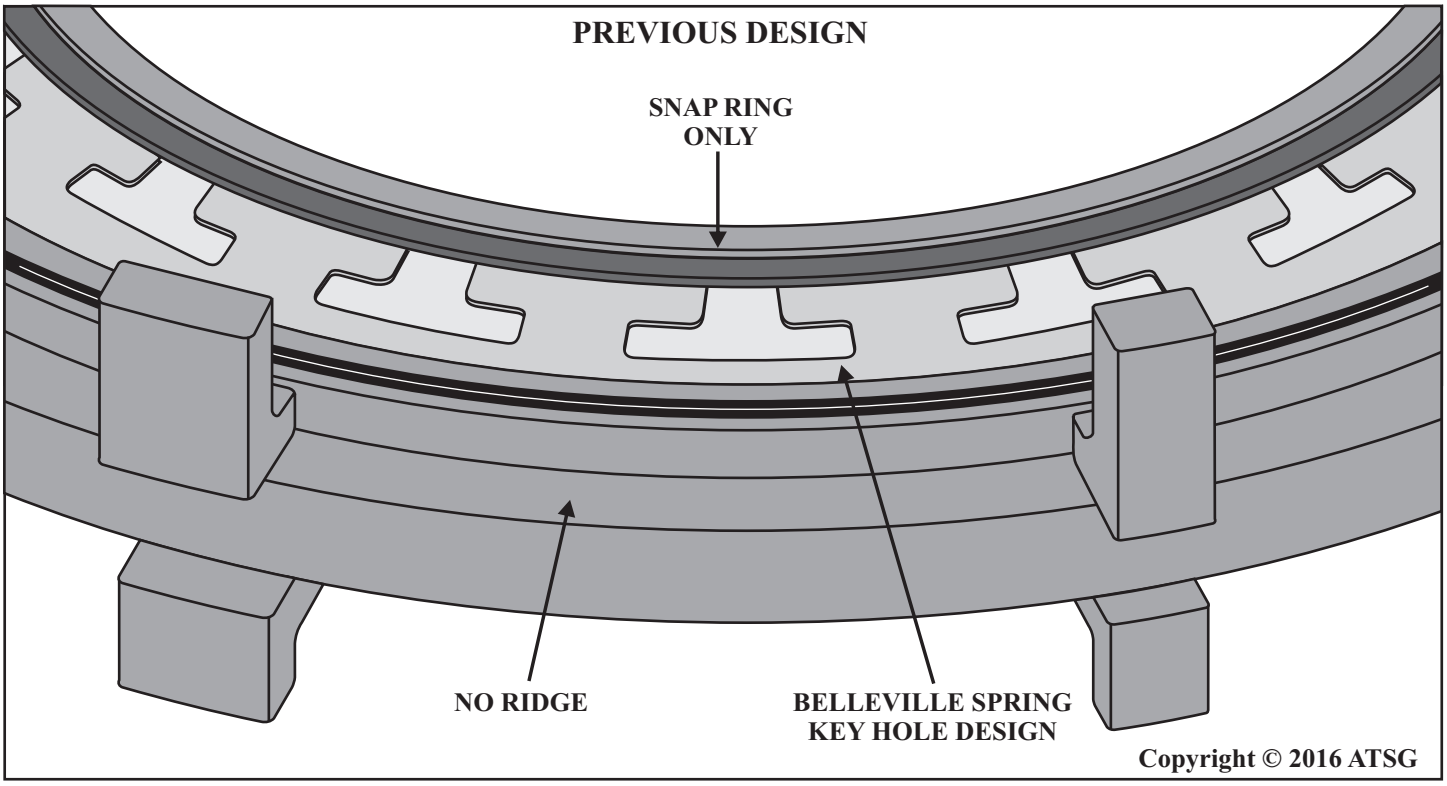


Figure 3

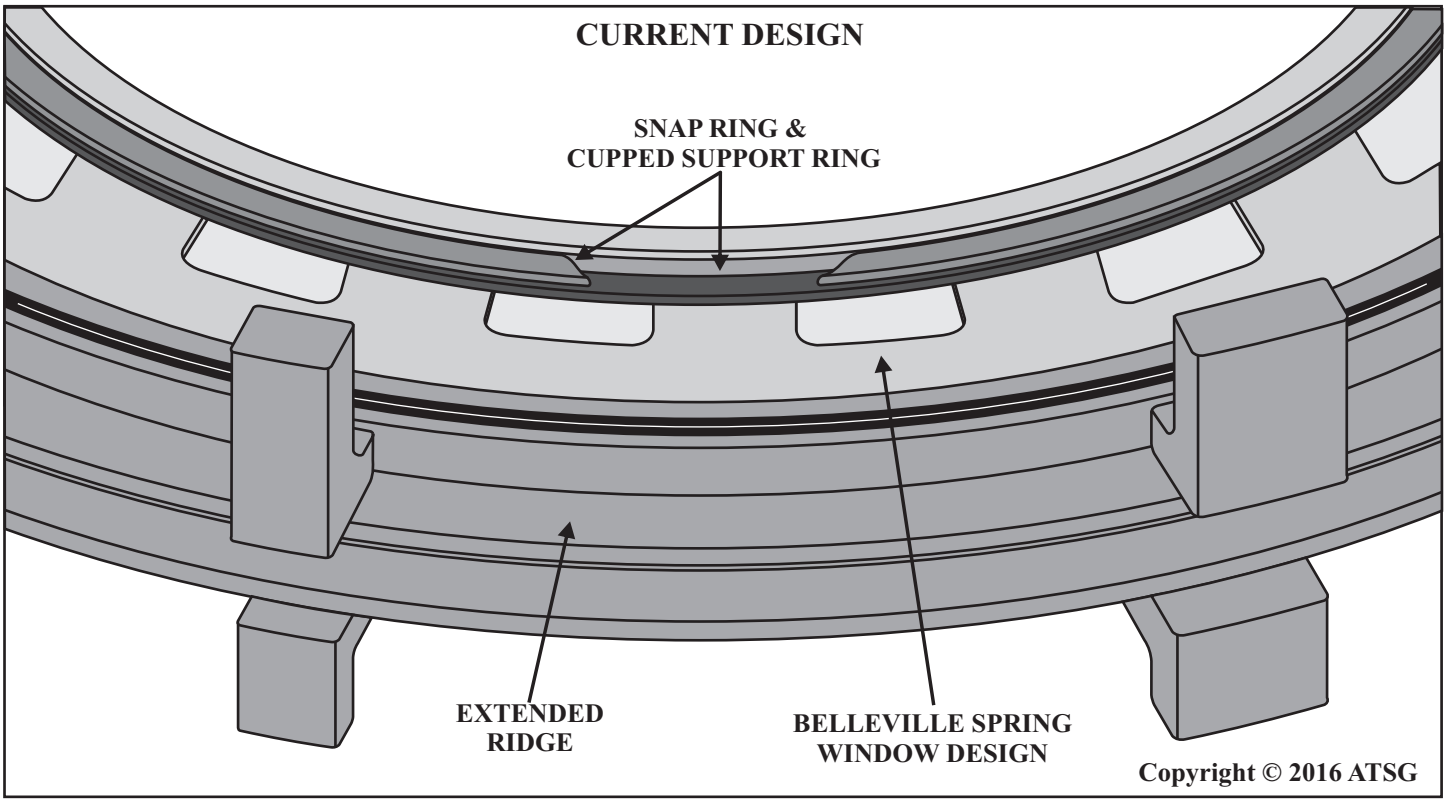


Figure 4

FORD 5R110W

PUMP DAMAGE SOON AFTER OVERHAUL

COMPLAINT: A Ford truck equipped with a 5R110W transmission is delivered to the owner after transmission repairs have been completed. The truck returns with a "No Move" condition usually within 100 miles of driving. Upon disassembly, the pump gear are welded to the pump plate and may even be broken (See Figure 1). The torque converter neck is discolored and also damaged. Close inspection of the pump spacer plate shows electrical tracking (Figure 2).

CAUSE: A compromised main ground from the negative side of the battery(s) or the ground is attached to an inappropriate location such as a bell housing bolt (See Figure 3).

CORRECTION: The battery(s) negative ground cable should always be clean and secured to the engine block as seen in Figure 4. An additional ground strap should be run from the transmission to the frame. Transmission to engine mounting surfaces should be clean and free of paint.

NOTE: It is always a good practice to perform a voltage drop test, preferably with the engine running, from the negative battery cable to a "GOOD KNOWN" ground and should never have more than 0.3 Volts DC (300 Millivolts) as seen in Figure 5.
It is also a good practice to perform this voltage drop test from the transmission case to the vehicle frame with the same voltage results to insure that the transmission is not carrying significant voltage as shown in Figure 6.
If a ground cable is being attached to a stud and double nut affair, make certain the inner nut and stud are tight before tightening the outer nut. It is a good practice to use "Star Washers" rather than lock washers which may loosen when attaching ground cables.

Many thanks to Henry Schmidt, Certified Transmission for the use of the photos that made this bulletin possible.

Exedy - 41

FORD 5R110W

PUMP DAMAGE SOON AFTER OVERHAUL

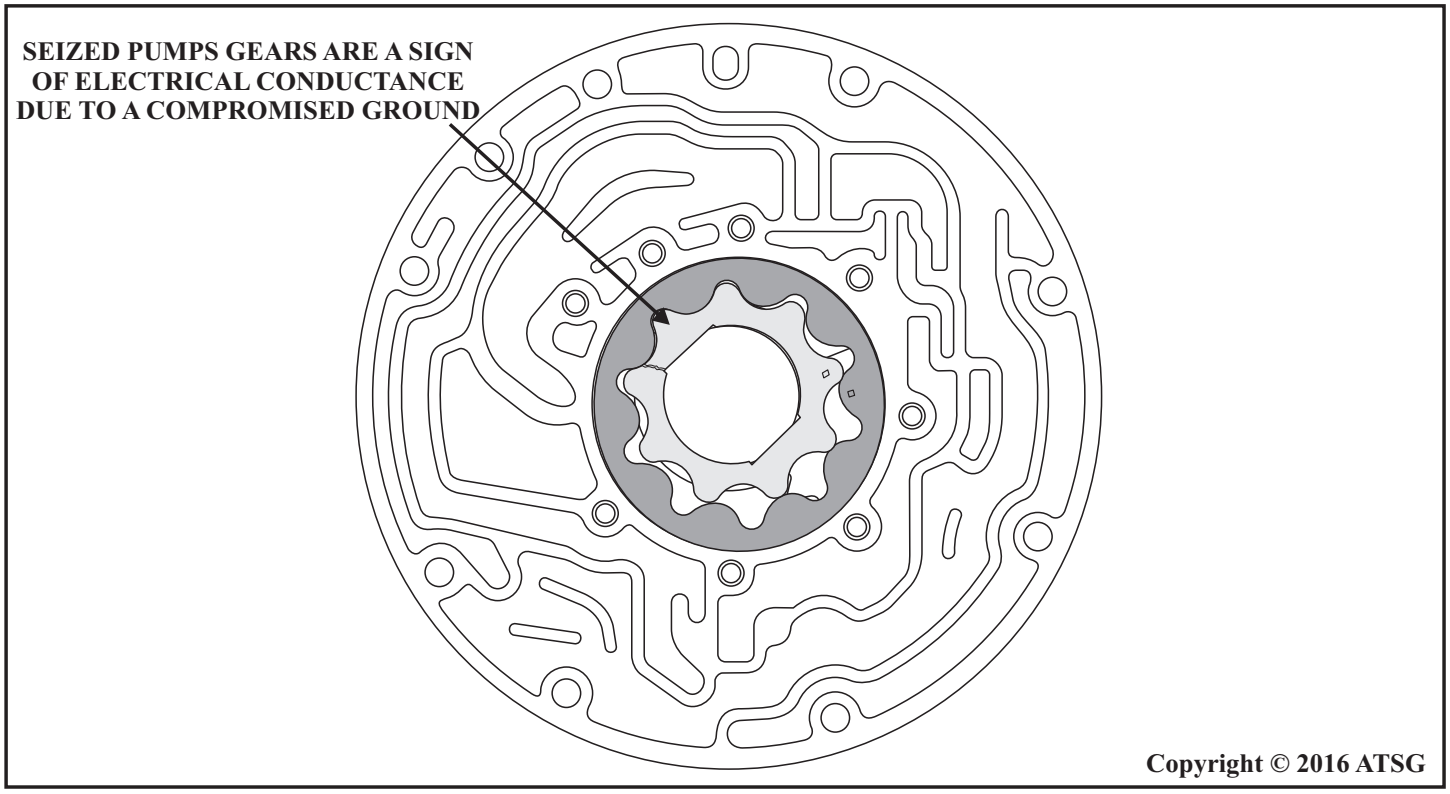


Figure 1

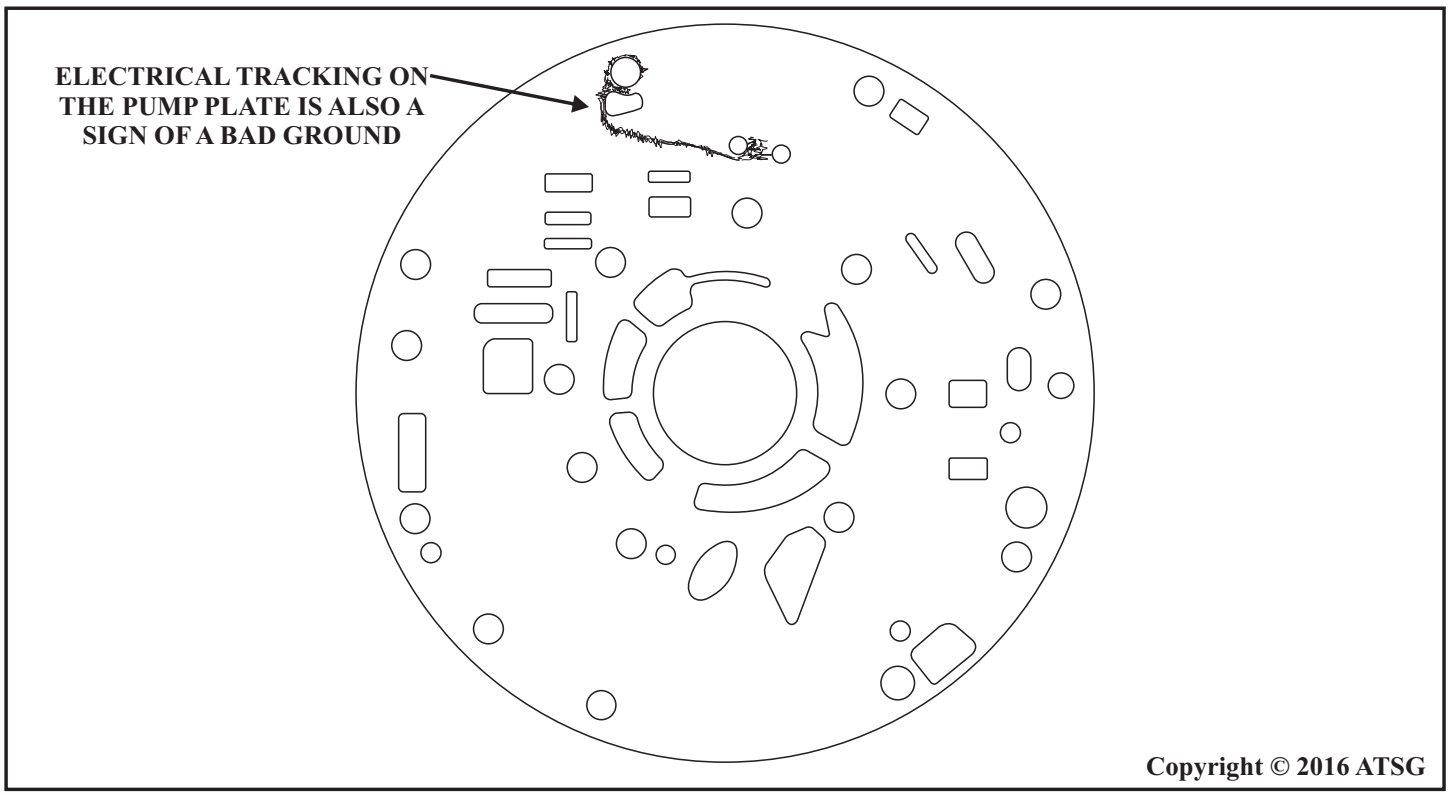
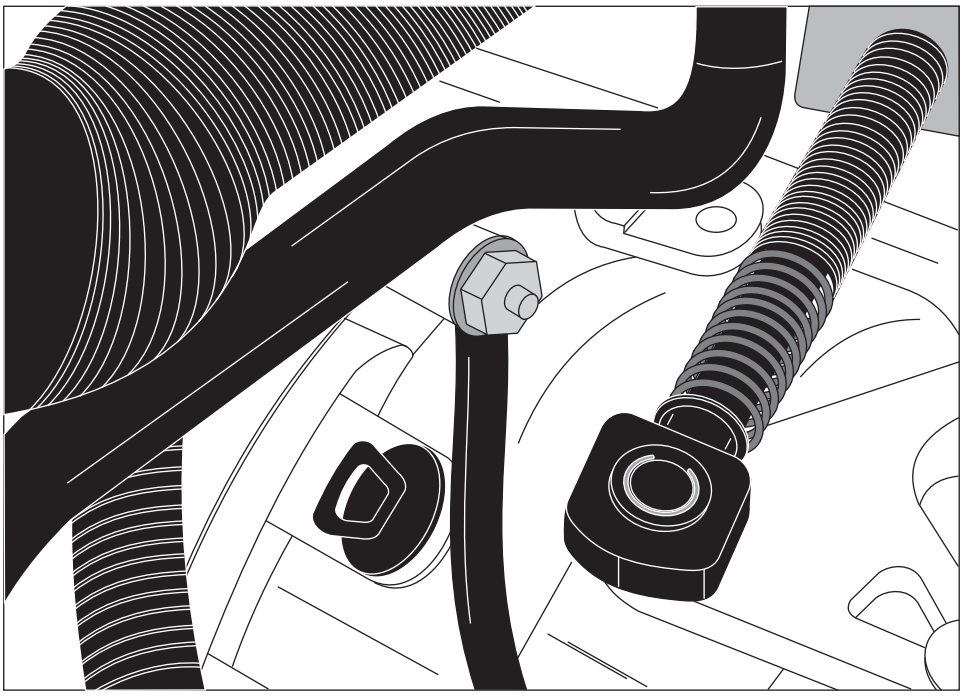


Figure 2

FORD 5R110W

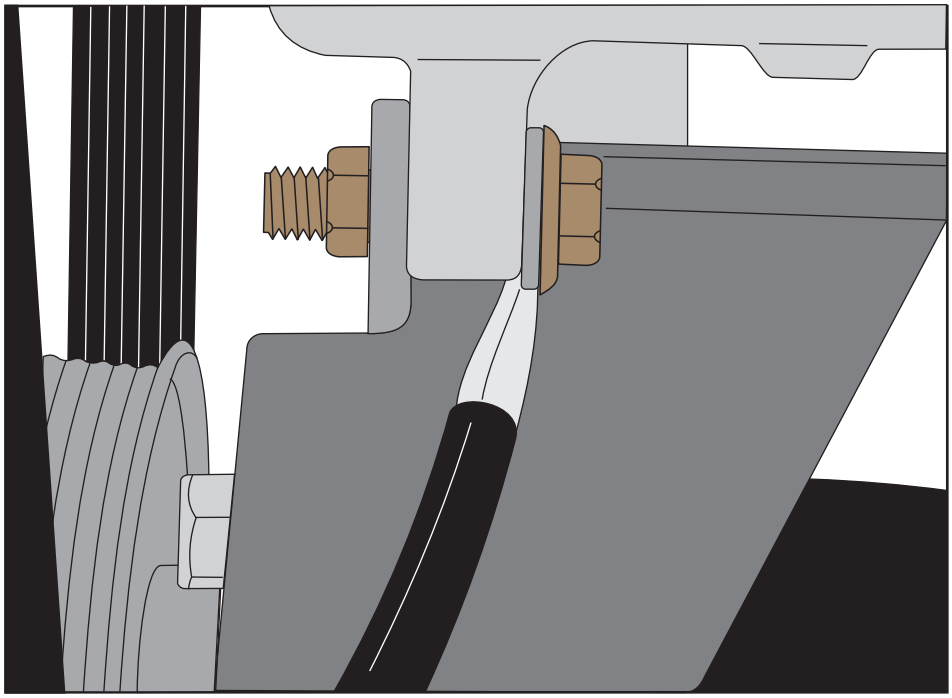
PUMP DAMAGE SOON AFTER OVERHAUL

Attaching The Negative Battery Ground Cable To A Transmission Bell Housing Bolt Is Not Recommended



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Figure 3



Attach Negative Battery Cable To Engine

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Figure 4

FORD 5R110W
PUMP DAMAGE SOON AFTER OVERHAUL

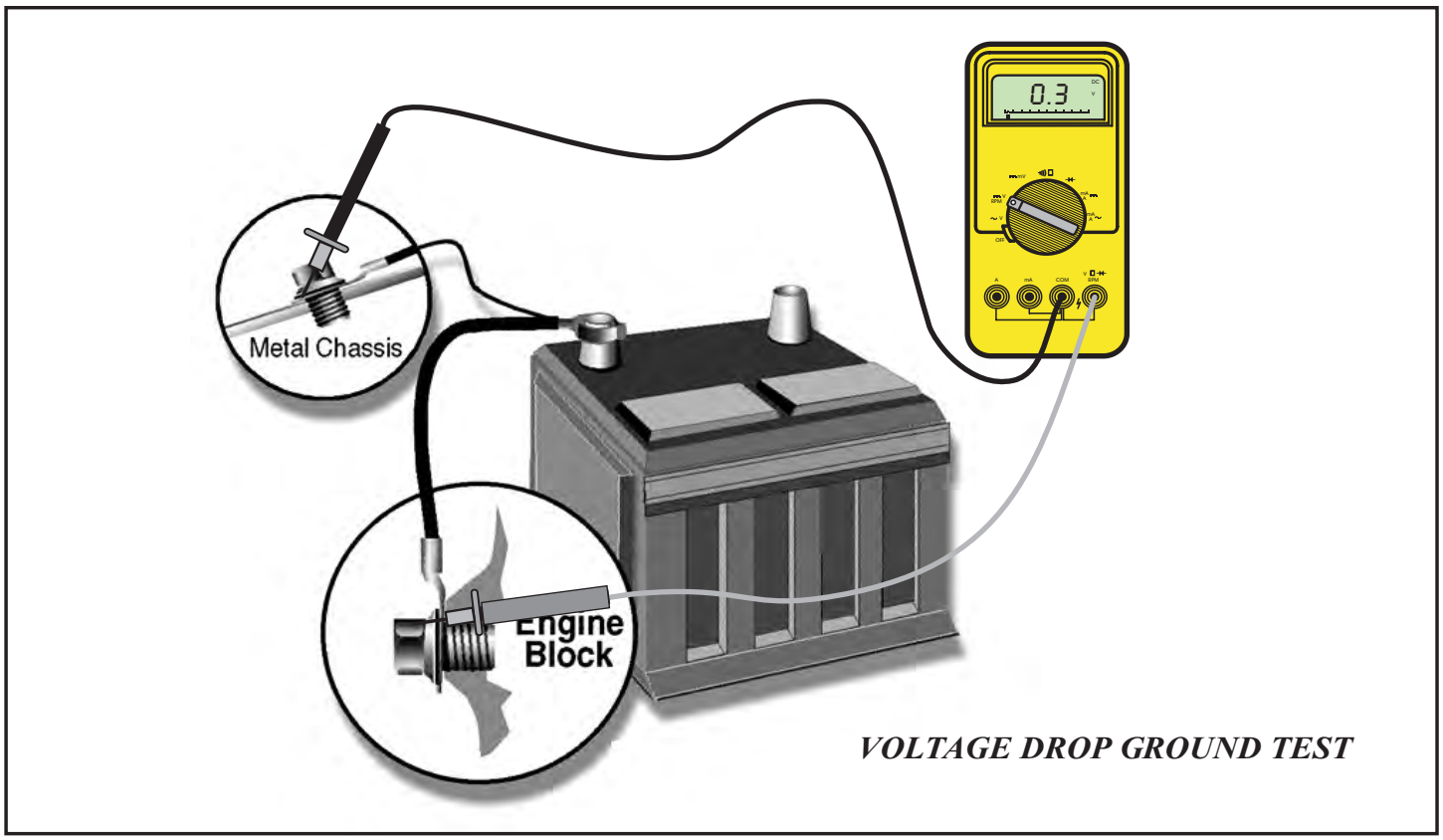


Figure 5

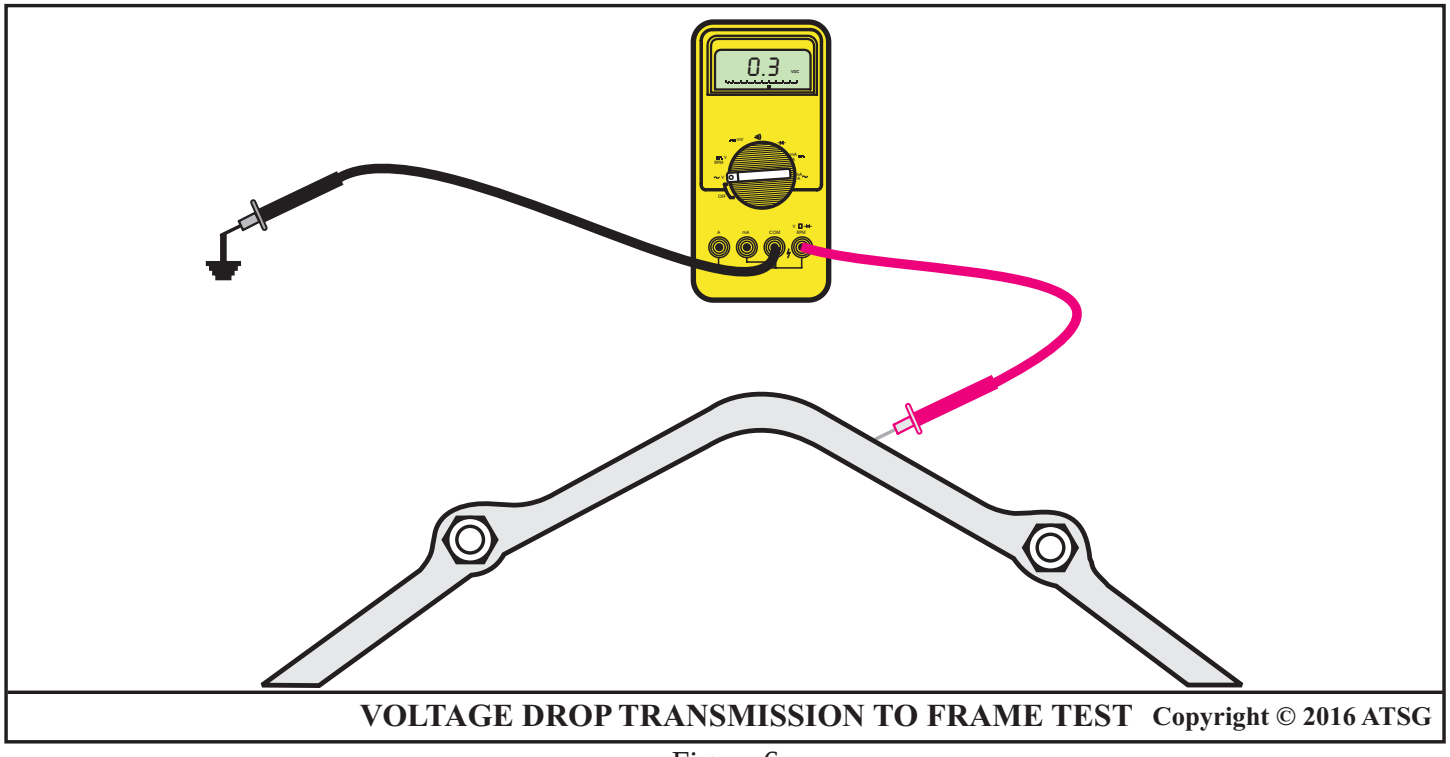


Figure 6

ATSG - 45

FORD 5R110W
FLUID OUT THE VENT

COMPLAINT: A Ford truck equipped with a 5R110W transmission has a complaint of transmission fluid being forced out of the vent. This an after overhaul condition.

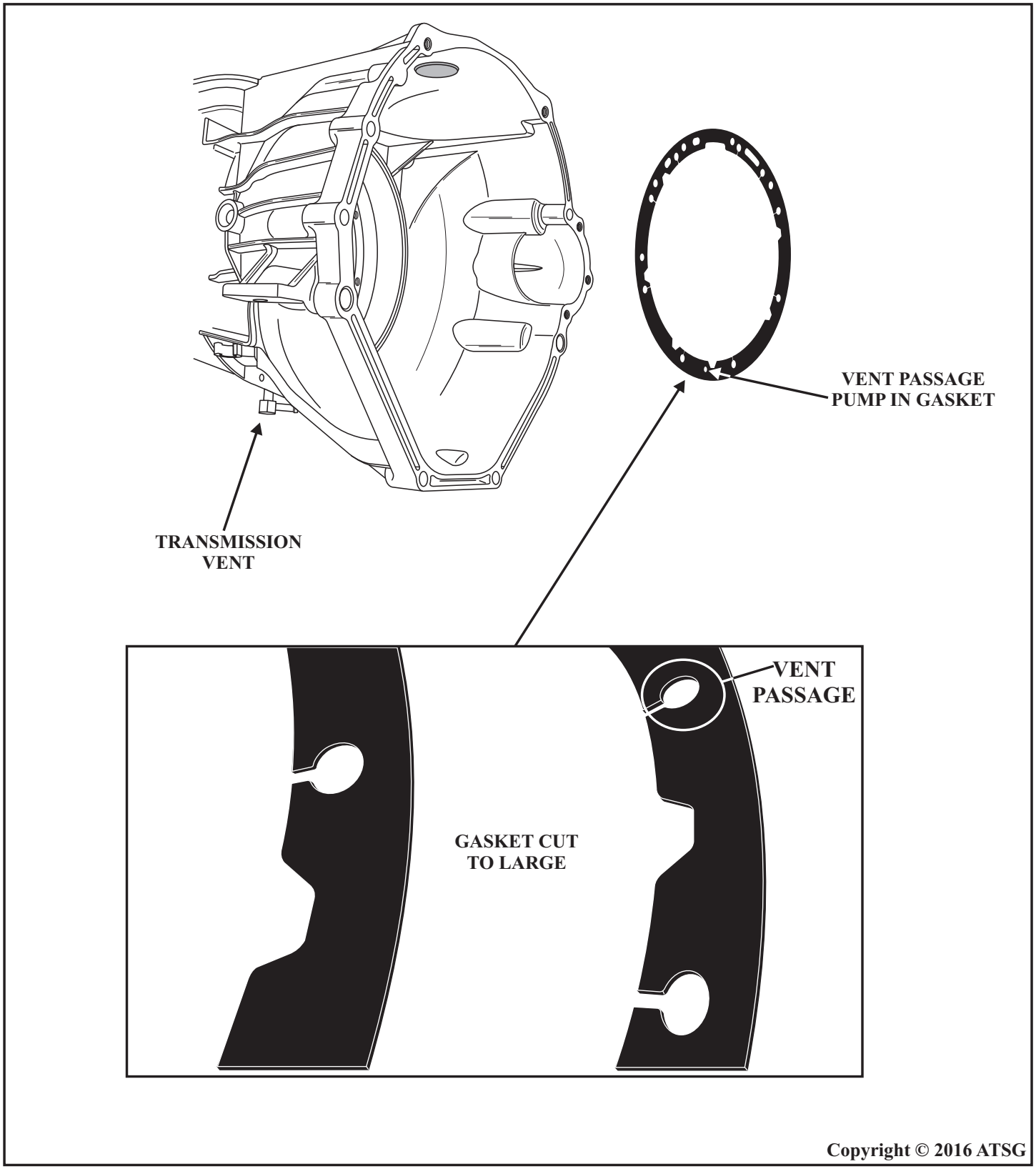
CAUSE: Some transmission overhaul kits may contain pump assembly to case gaskets that have been incorrectly cut making the gasket to large in diameter (See Figure 1). This causes the pump to not fit flush to the case allowing unwanted fluid to escape out of the vent. Figure 2 shows the vent circuit location in a 2005 and later pump control body.

CORRECTION: Be sure to place the pump gasket on the pump and case surface to insure the gasket aligns properly.

Many thanks to Max at King Transmission

FORD 5R110W

FLUID OUT THE VENT



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Figure 1

FORD 5R110W
FLUID OUT THE VENT

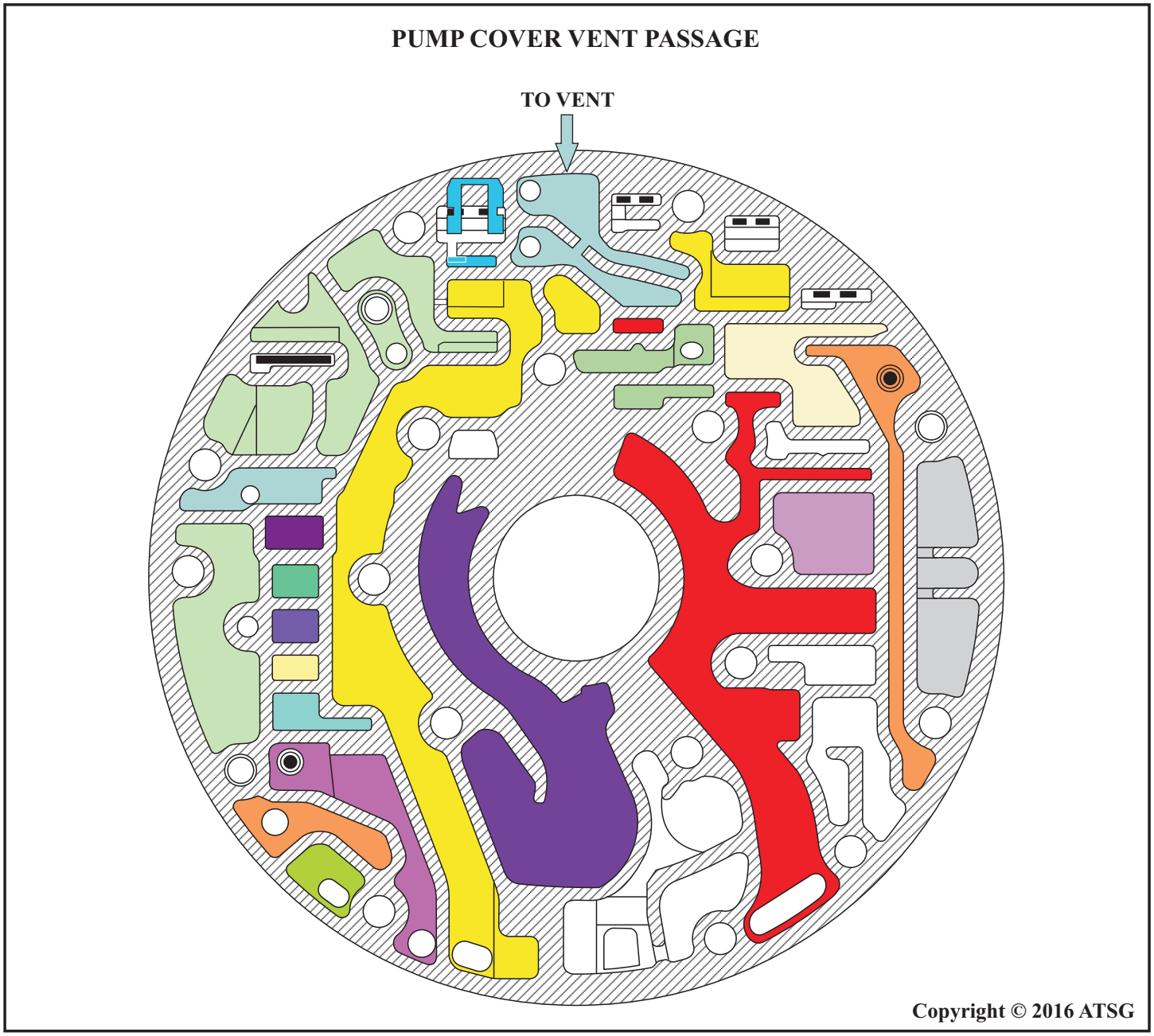


Figure 2

Trans-Go - 49

FORD 5R110W
REDESIGNED SUN GEAR SHELL

CHANGE: The Sun Gear Shell has been updated to contain a waved washer between the shell and the sun gear as seen in Figure 1. The previous design is shown in Figure 2.

REASON: To address a noise concern.

PARTS AFFECTED:
The Sun Gear Shell.

INTERCHANGEABILITY:
The redesigned Sun Gear Shell will back service all 5R110W transmissions to the 2005 model year.

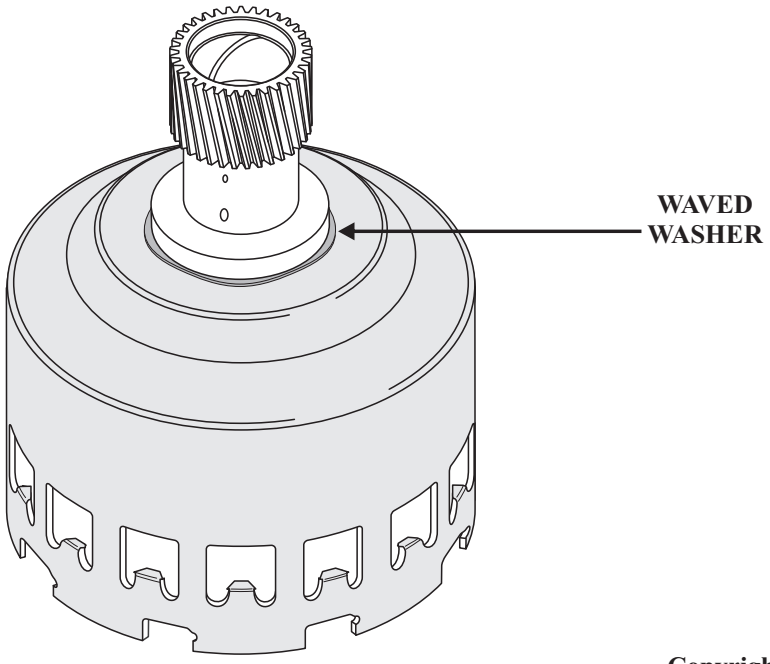
SERVICE INFORMATION:
Redesigned Sun Gear Shell.....9C3Z-7A019-A

Many thanks to Max from King Transmissions

FORD 5R110W

REDESIGNED SUN GEAR SHELL

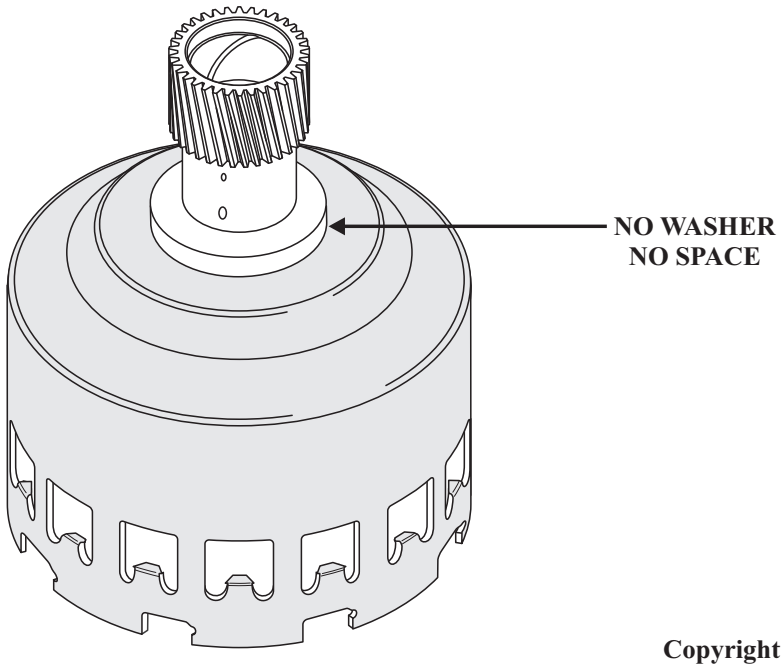
CURRENT DESIGN SUN GEAR SHELL



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Figure 1

PREVIOUS DESIGN SUN GEAR SHELL



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Figure 2

FORD 6R60 AND 6R80 TRANSMISSIONS
TCC SLIP CODE

COMPLAINT: The 6R series transmission began with the 2005 Navigator followed by the 2006 Explorer and Mountaineer (4.6L V-8). The Expedition received it in 2007, 2008 for the F150, and 2010 for Mustang. These vehicles may come in with the Transmission Control Indicator Lamp (TCIL) illuminated along with a TCC slip code P0741 stored in memory. The Malfunctioning Indicator Lamp (MIL) may or may not be illuminated.

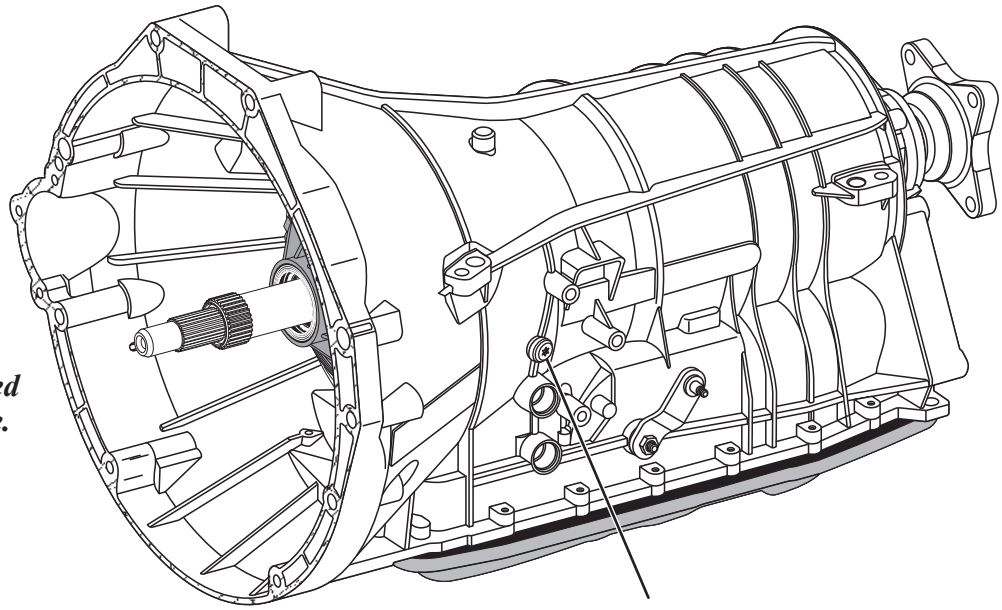
CAUSE: Many of these vehicles have defective converter clutch linings causing the slip. To verify a defective converter lining, check TCC pressure on the transmission's one and only pressure tap (Figure 1). Clear the code to allow for the computer to apply the clutch. Approximately 55-70 psi of pressure should be observed and go to 0 psi when full converter clutch apply is commanded. If this is observed yet P0741 stores, the converter clutch lining is defective. If engine RPM and Input/Turbine shaft RPM are observed during this test, when TCC is commanded on, engine RPM will remain higher than the ISS/TSS RPM. When TCC operates correctly these two values would read the same.

CORRECTION: The torque converter will need to be replaced. If the above test revealed pressures below 55 psi this could indicate that valve body bore wear may also need to be addressed.

Note: When code P0741 sets, the computer will no longer apply the converter clutch. If the driver ignores the TCIL light, it is possible that the transmission may be overheated due to extended highway driving without converter clutch applied. If this is discovered, a more thorough repair may be needed.

Park:	85 PSI
Reverse:	85 PSI
Neutral:	85 PSI
Drive:	70 PSI
3 Position:	65 PSI
2 Position:	65 PSI
1 Position:	65 PSI

Pressures listed are observed at idle and are approximate.



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Figure 1

Toledo - 53

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

COMPLAINT: A Ford family vehicle with the 6R60/80 transmission may have a complaint of extremely harsh up or downshifts under heavy throttle or forced downshifts. These shifts can be quite violent and can actually result in a fail-safe condition.
Other complaints can be but not limited to:
1. Falling in and out of gear.
2. Setting DTC U0101 - Lost Communication With TCM.
3. Setting DTC U0140 - Lost Communication With BCM.
4. Setting DTC U1900 - CAN Communication Bus Fault.
5. Setting DTC P0528 - Fan Speed Sensor Circuit No Signal.

The "Wrench" Lamp is on but no transmission codes are set (See Figure 1).
Rebuilding or replacing the transmission will not fix the vehicle. Nor will clearing the KAM and performing drive cycles fix the vehicle. Reprogramming the computer will also be ineffective.
A voltage check of the CAN BUS circuits which can be checked at DLC pins 6 and 14 indicate that the voltage is much to high. Normal voltage readings on the CAN HI circuit is typically 2.5V to 3.5V and 1.5V to 2.5V on the CAN LO circuit. A resistance check across DLC pins 6 and 14 read 63.4 Ohms which indicated there was not a CAN BUS wiring problem. It would appear the high CAN voltage was being induced from another source in the vehicle. In addition to these complaints, a few of the modules were not communicating over the network.
In some instances the transmission has been replaced more than once. The ECM is replaced and the TCM has been reprogrammed as well as the CAN wiring harness has been removed and inspected, yet the problem persists.

CAUSE: Ford three valve modular engines such as the 4.6L, 5.4L and 6.8L use Coil On Plug primary ignition and long reach spark plugs. The coil packs and/or spark plugs are faulty causing the above mentioned complaints.
The CAN BUS wire harness is routed close to these coil packs, especially Coil On Plug #4. The electrical interference produced by faulty coil packs are what induced the high voltage into the CAN BUS wiring resulting in the high voltage seen on the waveform patterns.
This is also responsible for the DTCs that were set as well as the lack of communication with certain modules. There also ***may*** be a engine miss felt but no misfire codes are set.
Most importantly it is the faulty coil packs and spark plugs that are causing the violent on throttle shifts from the transmission as well as the sudden neutralization and the limp in condition.

CORRECTION: Replace all spark plugs and coil packs preferably with O.E.M. parts.

SERVICE INFORMATION:
To begin the diagnosis, connect a multimeter set to ohms to Data Link Connector terminals 6 and 14. The resistance should be between 60 and 65 ohms, if it is, the CAN BUS wires are not shorted or open (See Figure 2).
Next, connect a scope to DLC terminals 6 and 14 in order to check the voltage on the CAN Hi and CAN LO circuits. CAN HI should be 2.5 to 3.5 Volts (Figures 3 and 4). CAN LO should be 1.5 to 2.5 Volts. Higher voltage than that indicates an EMI problem. Even though the CAN BUS wires are twisted they are not shielded and can therefore be affected by electrical noise.
Next, connect a scan tool to the DLC and proceed to the "Global OBD-II" area. Navigate to the "Misfire Counter". Check to see if misfires are present even though you do not have any misfire codes (Figure 5).

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

SERVICE INFORMATION *continued:*

If evidence of misfire events are present, use the scan tool to navigate to the Mode $06 area. The technician will be able to read the Component ID (CID) that's being test as well as the Test ID (TID) result of the test.

With Ford OBD-II Mode $06, Misfire CIDs range is from 53 to 56. CID 53 is cylinder misfire events. CID 54 is the highest rate and threshold of a Type "A" misfire. CID 55 is the highest rate and threshold of a Type "B" misfire. CID 56 is the number of cylinder events that were tested (See Figure 6).

TIDs run from 1 through 10. These numbers represent which cylinder has been tested (See Figure 6. If the test value exceeds the test limit then the respective cylinder components must be inspected.

Another test that can be performed to confirm which cylinder(s) is having the misfire event, is a Cylinder Power Balance Test as seen in Figure 7. With positive test results the malfunctioning cylinder(s) should have their spark plug(s) and coil pack(s) replaced. It is recommended that ALL coil packs and spark plugs be replaced at this time with O.E.M. components since all previous testing has been done to diagnose the electrical ignition system components.

The mechanical cylinder contribution can be accomplished by performing a "Relative Compression" test in the event that the engine has a serious mechanical problem (Figure 8).

SPECIAL SERVICE INFORMATION:

Faulty coil packs may have deteriorated boots which allow leakage causing electrical interference. They may also have a burn spot on the boot which indicates electrical arcing (See Figure 9).

When replacing the coil packs, make certain the spring contact that is inside the spark plug boot is all the way against the coil. Also check coil pack connectors and wiring for any problems that may prevent the coil pack from functioning at maximum efficiency.

The spark plugs that Ford uses in their 4.6L, 5.4L and 6.8L three valve modular engines is a long reach two piece design. Because of this, when spark plug removal is attempted by the inexperienced, the plugs break off in the cylinder head. This could turn into a very unpleasant situation unless some precautions are taken (Figure 10).

Before spark plug removal is attempted, bring the engine up to normal operating temperature. Perform a top engine decarbonizing procedure by using one of the many available cleaning products deigned to remove carbon from the lower electrode shield of the spark plug. This is what causes it to get stuck in the cylinder head.

Then, with the coil on plug removed, spray a rust inhibiting product into the spark plug hole (Figure 12). At this time, the spark plugs should unscrew in one piece. In the event the spark plug does break, repeat the rust inhibitor treatment. Acquire one of the spark plug removal tool kits such as the Lisle LIS65600 shown in Figure 13 and remove the broken piece of the spark plug.

Before the new spark plugs are installed, put a thin coating of a copper based anti-seize compound on the lower electrode shield of the spark plug to keep it from seizing to the cylinder head as seen in Figure 14. DO NOT apply any anti-seize compound at the tip of the electrode. This issue should not exist after model year 2008 as the cylinder head was redesigned and does not use a shrouded long reach spark plug.

Set spark plug gap to .045" to .051". Using a 9/16" spark plug socket, torque spark plugs to 25 lb. ft.

Many thanks to "G" Truglia of A.T.T.S

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

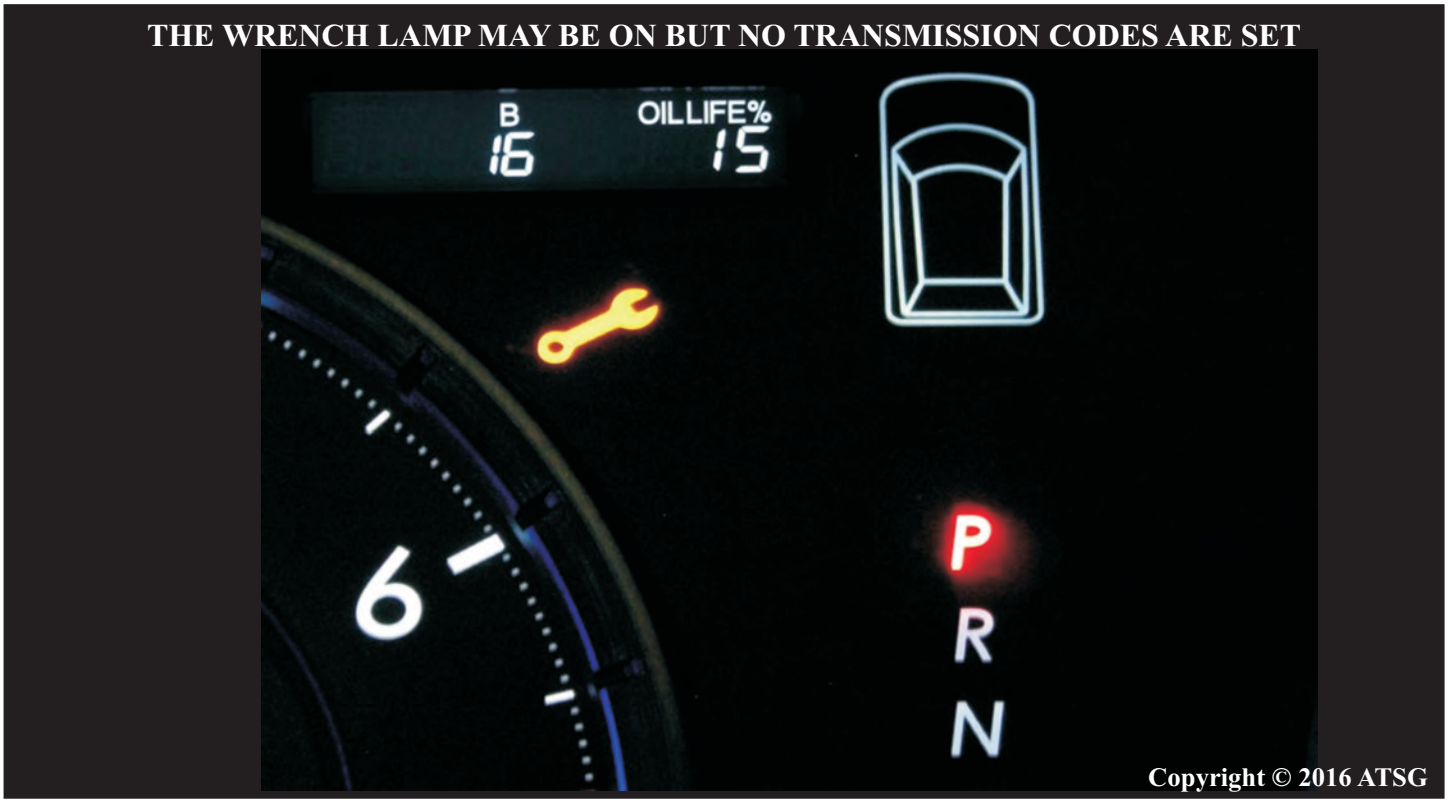


Figure 1

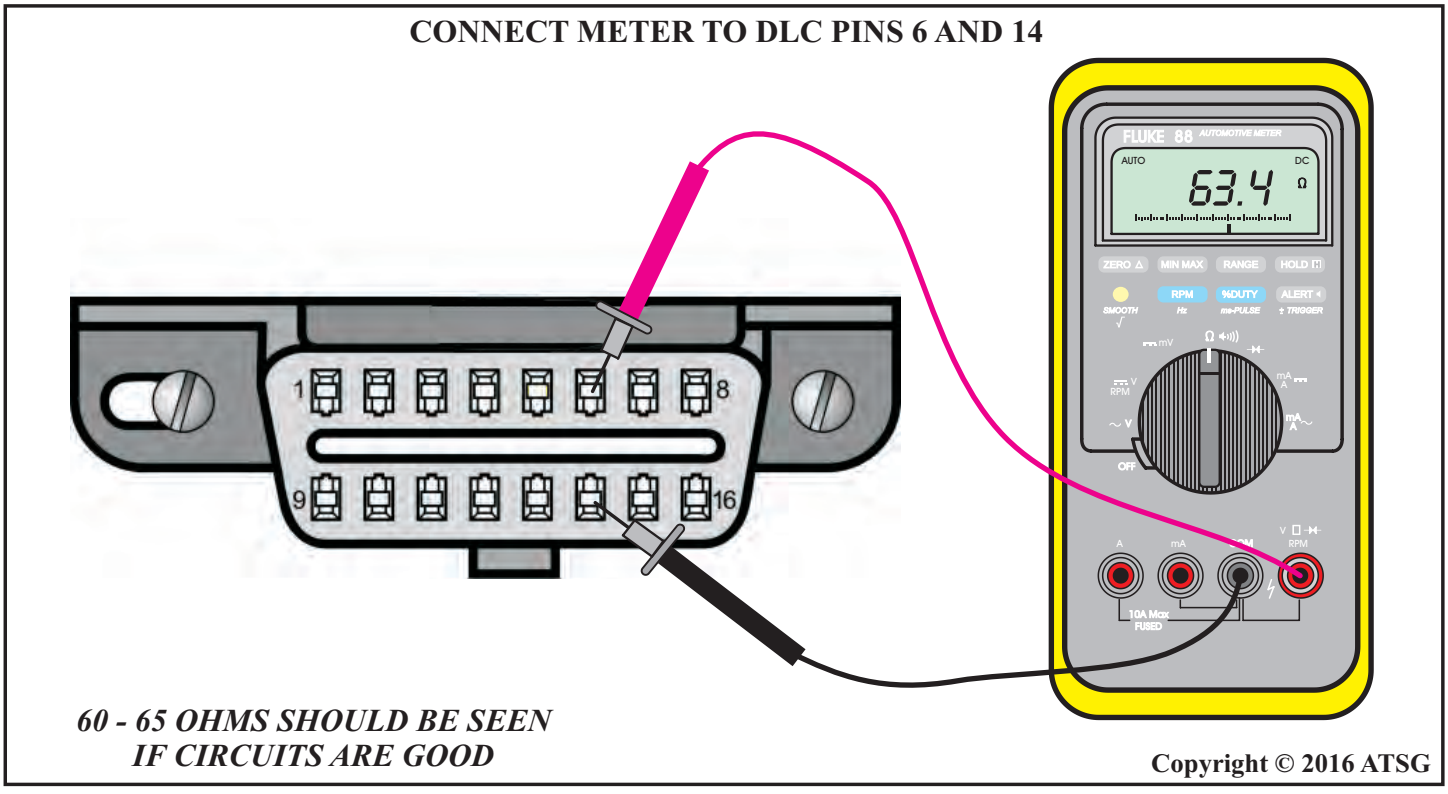


Figure 2

ATTS - 57

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

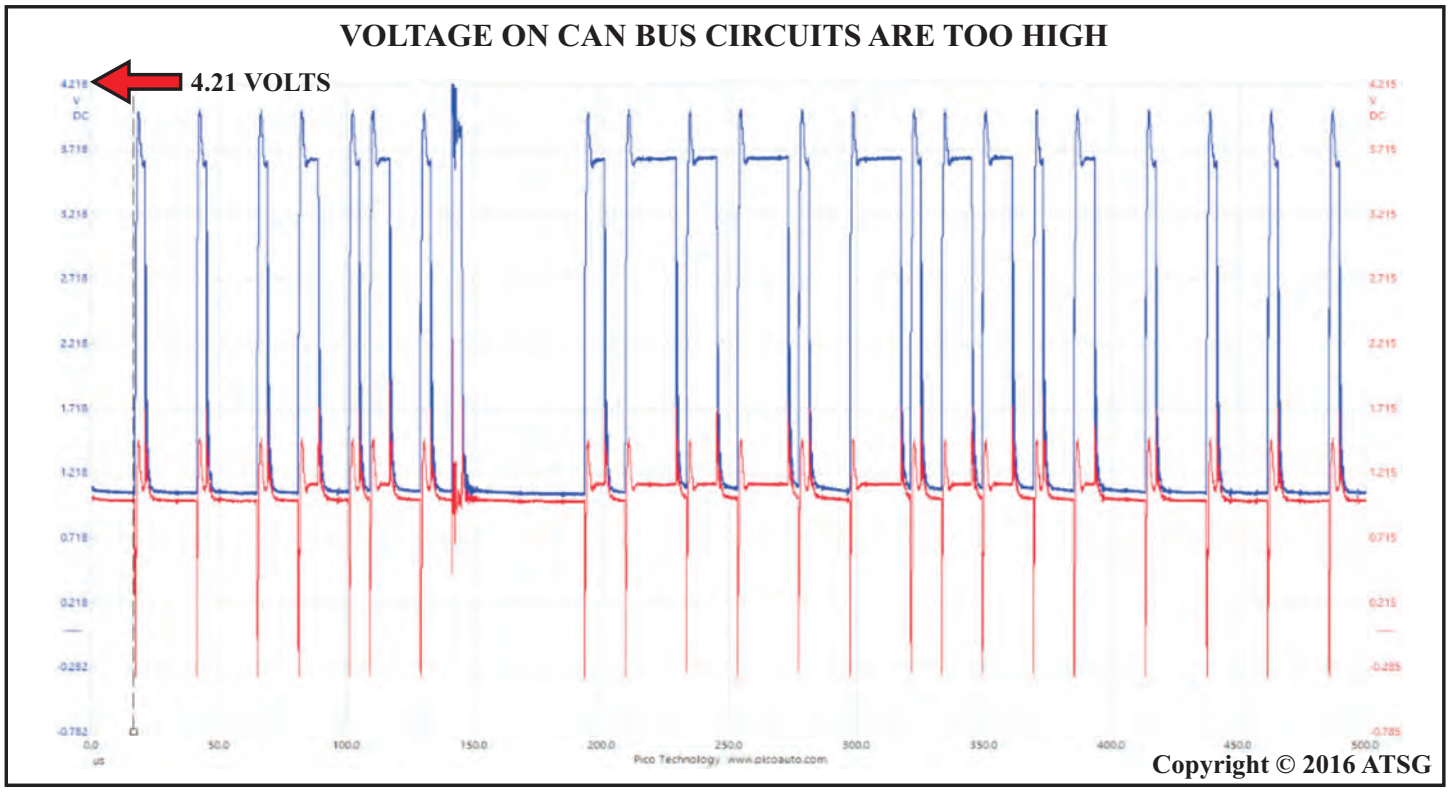


Figure 3

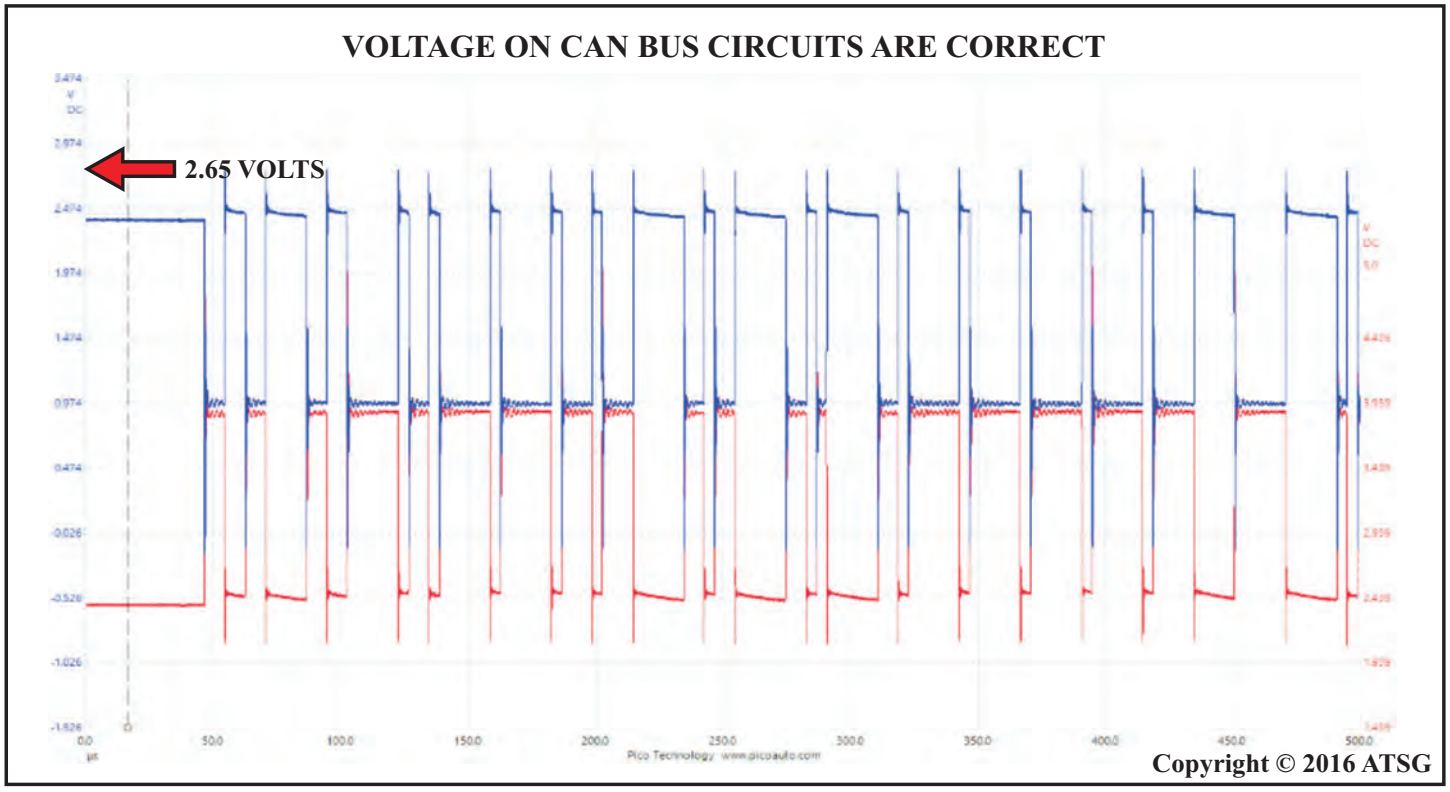
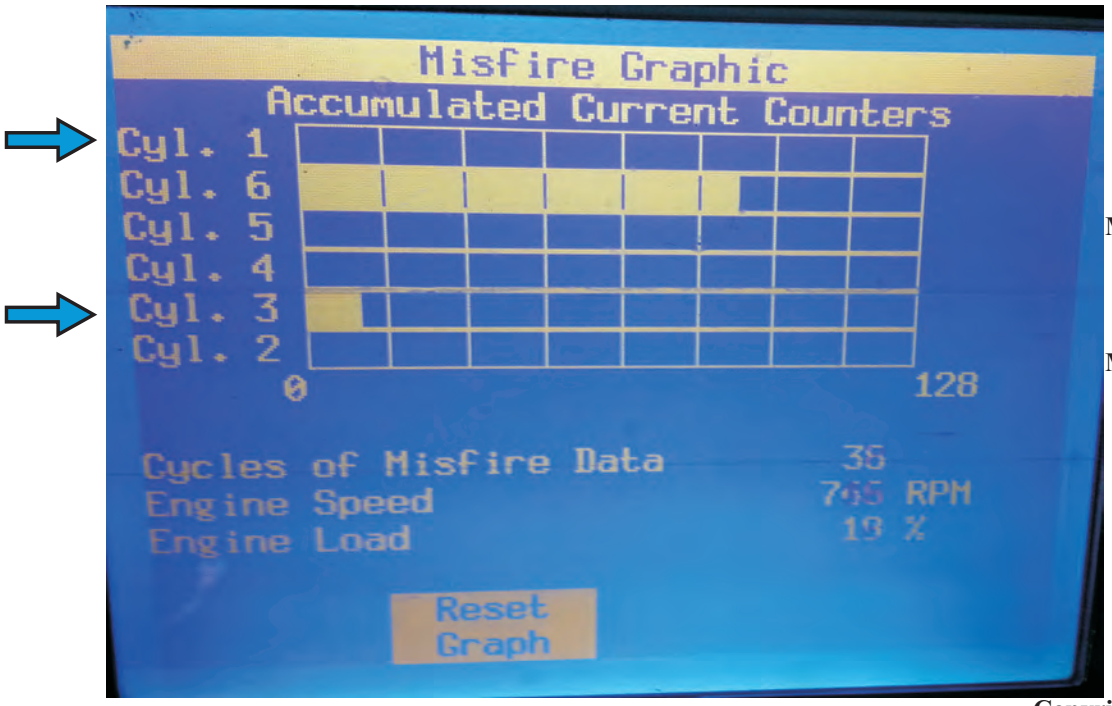


Figure 4

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

GLOBAL OBD-II MISFIRE COUNTER

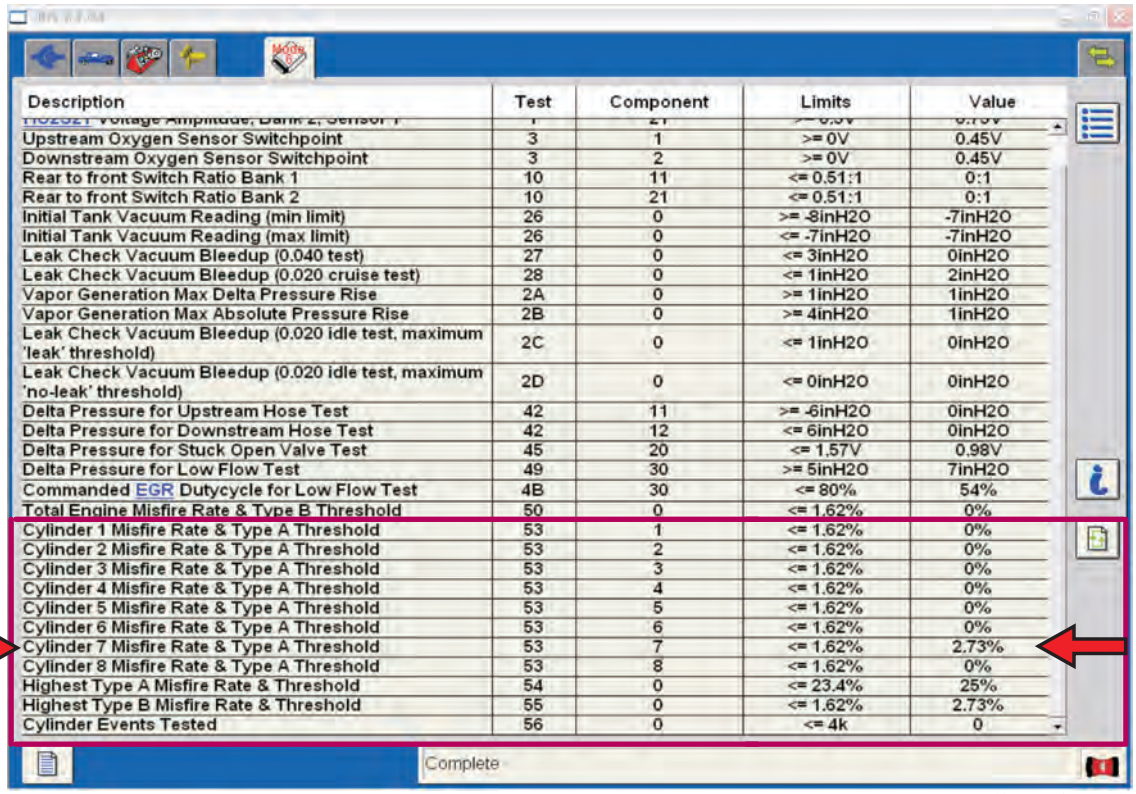


CYLINDER 6 HAS A HIGH MISFIRE COUNT

CYLINDER 3 HAS A LOW MISFIRE COUNT

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Figure 5



Description	Test	Component	Limits	Value
Upstream Oxygen Sensor Switchpoint	3	1	>= 0V	0.45V
Downstream Oxygen Sensor Switchpoint	3	2	>= 0V	0.45V
Rear to front Switch Ratio Bank 1	10	11	<= 0.51:1	0:1
Rear to front Switch Ratio Bank 2	10	21	<= 0.51:1	0:1
Initial Tank Vacuum Reading (min limit)	26	0	>= -8inH2O	-7inH2O
Initial Tank Vacuum Reading (max limit)	26	0	<= -7inH2O	-7inH2O
Leak Check Vacuum Bleedup (0.040 test)	27	0	<= 3inH2O	0inH2O
Leak Check Vacuum Bleedup (0.020 cruise test)	28	0	<= 1inH2O	2inH2O
Vapor Generation Max Delta Pressure Rise	2A	0	>= 1inH2O	1inH2O
Vapor Generation Max Absolute Pressure Rise	2B	0	>= 4inH2O	1inH2O
Leak Check Vacuum Bleedup (0.020 idle test, maximum 'leak' threshold)	2C	0	<= 1inH2O	0inH2O
Leak Check Vacuum Bleedup (0.020 idle test, maximum 'no-leak' threshold)	2D	0	<= 0inH2O	0inH2O
Delta Pressure for Upstream Hose Test	42	11	>= -6inH2O	0inH2O
Delta Pressure for Downstream Hose Test	42	12	<= 6inH2O	0inH2O
Delta Pressure for Stuck Open Valve Test	45	20	<= 1.57V	0.98V
Delta Pressure for Low Flow Test	49	30	>= 5inH2O	7inH2O
Commanded EGR Dutycycle for Low Flow Test	4B	30	<= 80%	54%
Total Engine Misfire Rate & Type B Threshold	50	0	<= 1.62%	0%
Cylinder 1 Misfire Rate & Type A Threshold	53	1	<= 1.62%	0%
Cylinder 2 Misfire Rate & Type A Threshold	53	2	<= 1.62%	0%
Cylinder 3 Misfire Rate & Type A Threshold	53	3	<= 1.62%	0%
Cylinder 4 Misfire Rate & Type A Threshold	53	4	<= 1.62%	0%
Cylinder 5 Misfire Rate & Type A Threshold	53	5	<= 1.62%	0%
Cylinder 6 Misfire Rate & Type A Threshold	53	6	<= 1.62%	0%
Cylinder 7 Misfire Rate & Type A Threshold	53	7	<= 1.62%	2.73%
Cylinder 8 Misfire Rate & Type A Threshold	53	8	<= 1.62%	0%
Highest Type A Misfire Rate & Threshold	54	0	<= 23.4%	25%
Highest Type B Misfire Rate & Threshold	55	0	<= 1.62%	2.73%
Cylinder Events Tested	56	0	<= 4k	0

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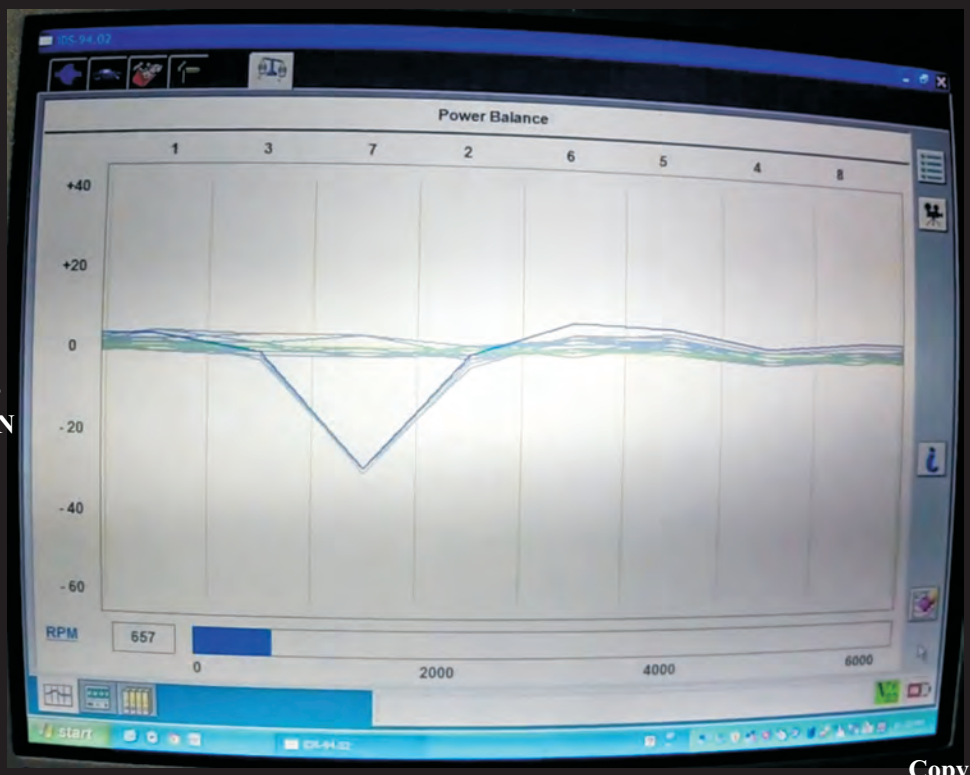
Figure 6

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

CYLINDER POWER BALANCE TEST

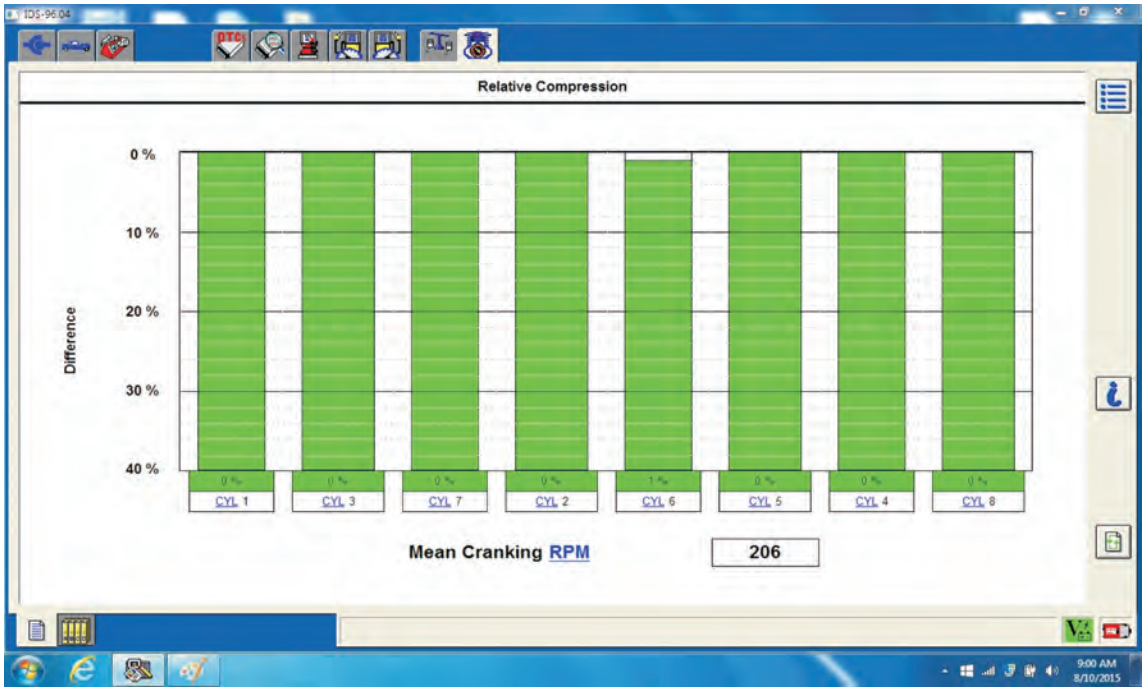
CYLINDER #7 HAS A 30% DROP IN CONTRIBUTION



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Figure 7

RELATIVE COMPRESSION TEST



Engine Is In Good Mechanical Health

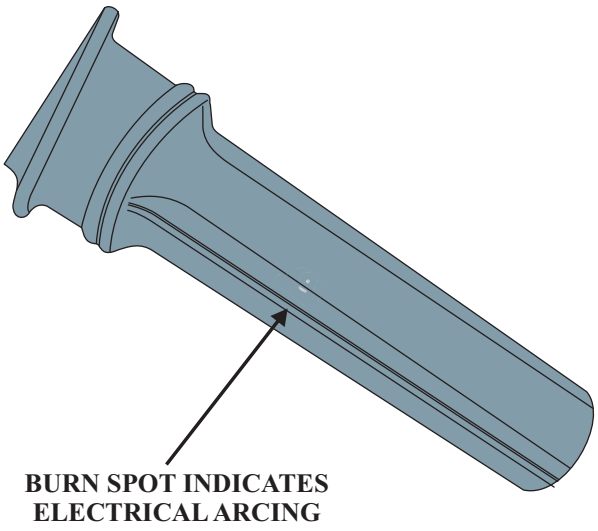
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Figure 8

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

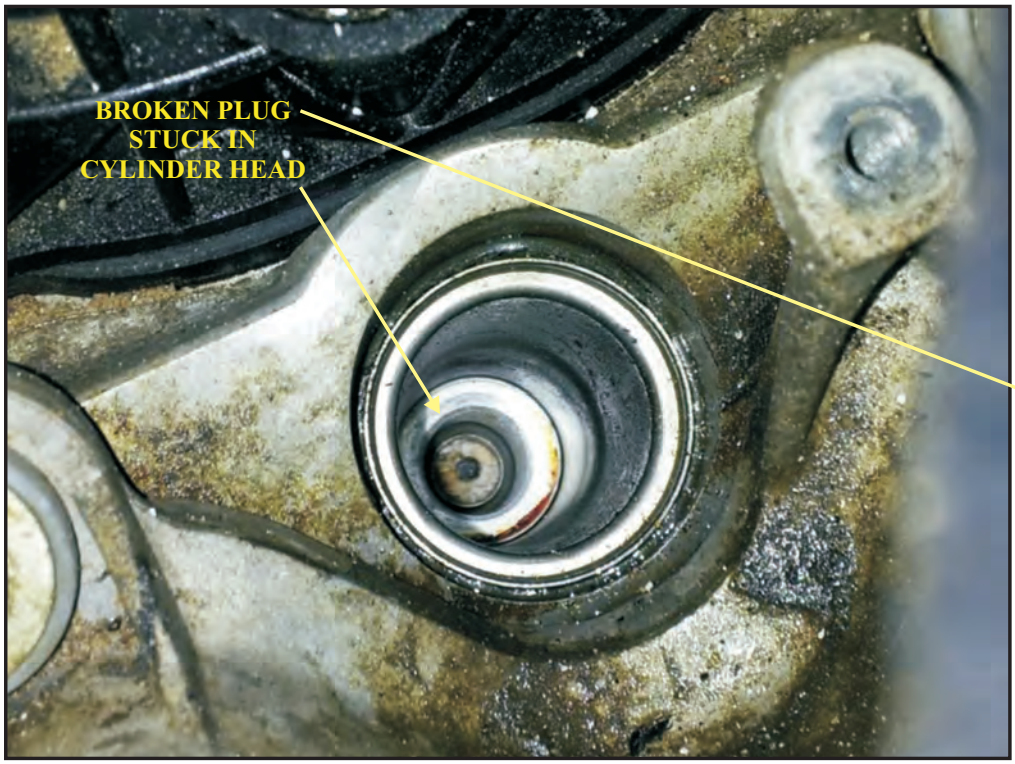
EXAMPLES OF DAMAGED COIL ON PLUG





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Figure 9





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Figure 10

Techpak - 62

Techpak - 63

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

UPPER ENGINE DECARBONIZING PROCEDURE



This Procedure Should Loosen The Spark Plug Electrode Shield

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Figure 11



Rust Inhibitor Will Help To Loosen The Spark Plug Threaded Area

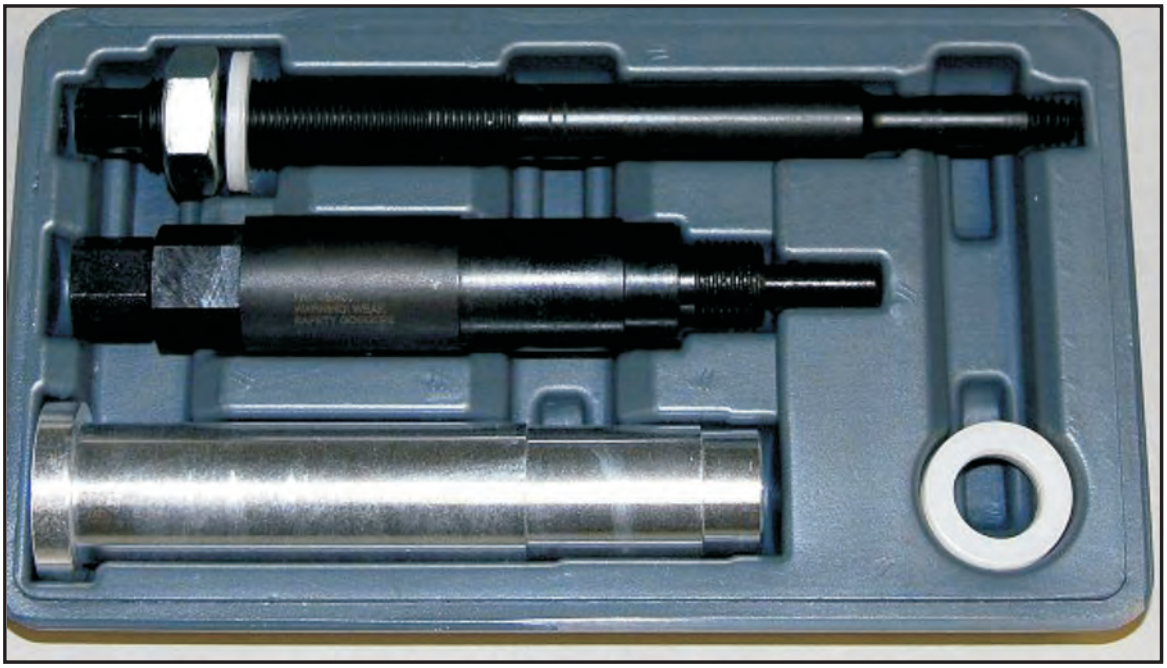
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Figure 12

FORD 6R60/80

EXTREMELY HARSH UP & DOWN SHIFTS

LISLE BROKEN SPARK PLUG REMOVAL TOOL KIT #LIS65600



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Figure 13



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Figure 14

CHRYSLER/DODGE/JEEP RE SERIES TRANSMISSIONS

P0868 - GOVERNOR PRESSURE SENSOR VOLTS TO HIGH

COMPLAINT: A 2005 Dodge 2500 4x4 with a 5.9L diesel using the 48RE transmission comes into the shop to be rebuilt. A new governor pressure transducer (sensor) was installed as part of the rebuild. The initial test drive after overhaul was perfect for approximately 5 miles before code P0868 set for governor pressure transducer volts being too high. A new transducer was installed eliminating the code but it to went several miles before setting P0868 once again.

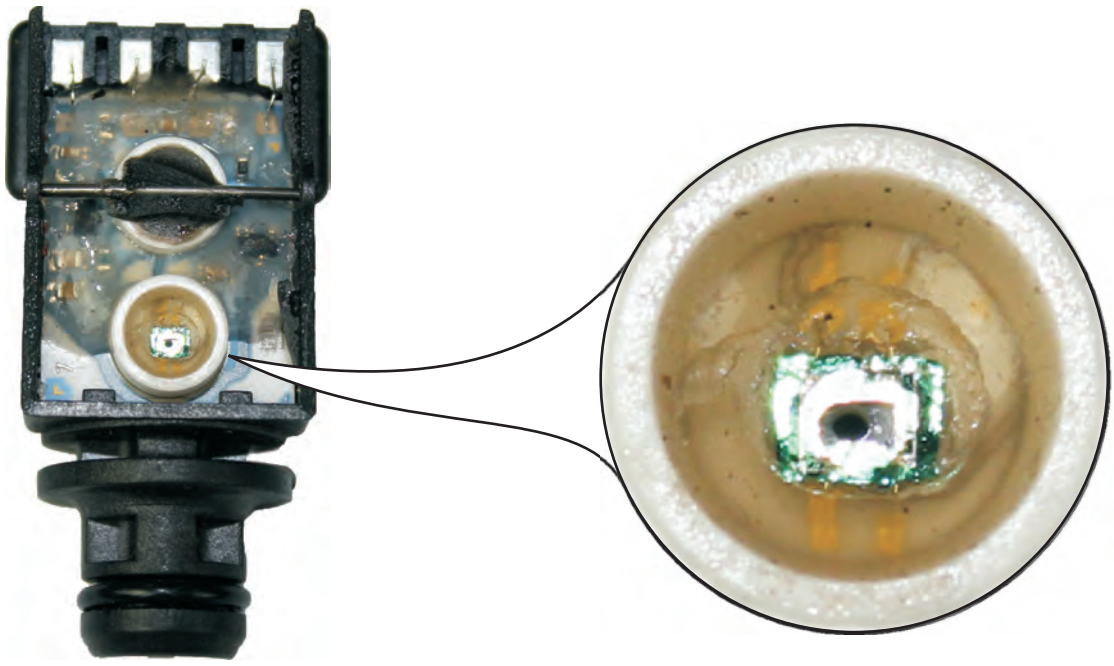
CAUSE: One cause may be new defective transducers. Governor pressure enters the transducer which it uses to provide a linear voltage signal to the computer based on pressure. Generally, the transducer will provide an approximate 0.5 volts when 0 psi of pressure is present inside of it. As pressure increases the voltage increases as well. Approximately 3.5 volts will be observed at maximum governor pressure. It is in the area where pressures are converted to voltage that the pressure build up is blowing a hole inside the transducer. This problem is more prevalent with performance transmissions which run higher line pressures.

CORRECTION: BD Diesel Performance produces a Pressure Transducer Upgrade kit which replaces the plastic transducer with a more reliable and durable metal unit.

SERVICE INFORMATION:

Complete kit.....1060602

BD Diesel Performance - www.thoroughbreddiesel.com - 1800.887.5030



Thanks to Scott Lemmon from Clay's Transmission for the bad sensor used in this bulletin and Wayne Scherado from OK Transmissions for the BD Diesel tip.

Figure 1

Sonnax - 67

DODGE MEDIUM DUTY TRUCKS

TCC CYCLING ON AND OFF

COMPLAINT: A Dodge pickup is brought in with a complaint of intermittent and erratic bumps which seem to clear up once the vehicle has reached 60 mph or greater. The technician driving the vehicle notices that the converter clutch is being commanded on and off when the bumps are felt. The way the converter clutch was being commanded on and off was not occurring in the typical fashion these vehicles are notorious for. Usually, the shuttle is more rhythmic between 45-50 mph. The convert clutch in this case was more "out/off" then quickly back "in/on" maybe once or twice then stop before intermittently repeating itself.

CAUSE: When it comes to TCC shuttle, vehicles using the RE transmission (42, 44, 46, 47 and 48), there is a healthy list of possibilities which can vary depending on it being equipped with a gas, 12 valve or 24 valve diesel engine. The vehicle cited here was a 2001 Dodge 2500 5.9L diesel with a 47RE transmission. The customer mentioned that this problem began immediately after an engine oil change. The tech decided to do look around where the filter was. He saw that the A/C High Pressure Switch was located on the discharge line near the compressor as well as being close to the filter. He unplugged it an noticed oil was in the connector. He drove the vehicle with the pressure switch unplugged and the complaint was no longer evident.

CORRECTION: In this case the connector was cleaned to remedy the complaint as the switch was still functional.
Note: The A/C high pressure switch is connected in series electrically with the low pressure switch and the heater control, between ground and the PCM (Figure 1). This means the low pressure switch (mounted on the top of the accumulator) could also become suspect. Unplugging one or the other of these switches is a quick test to see if it corrects a TCC shuttle condition. If it does, each switch will need to be tested to know which one has failed and will need to be replaced.

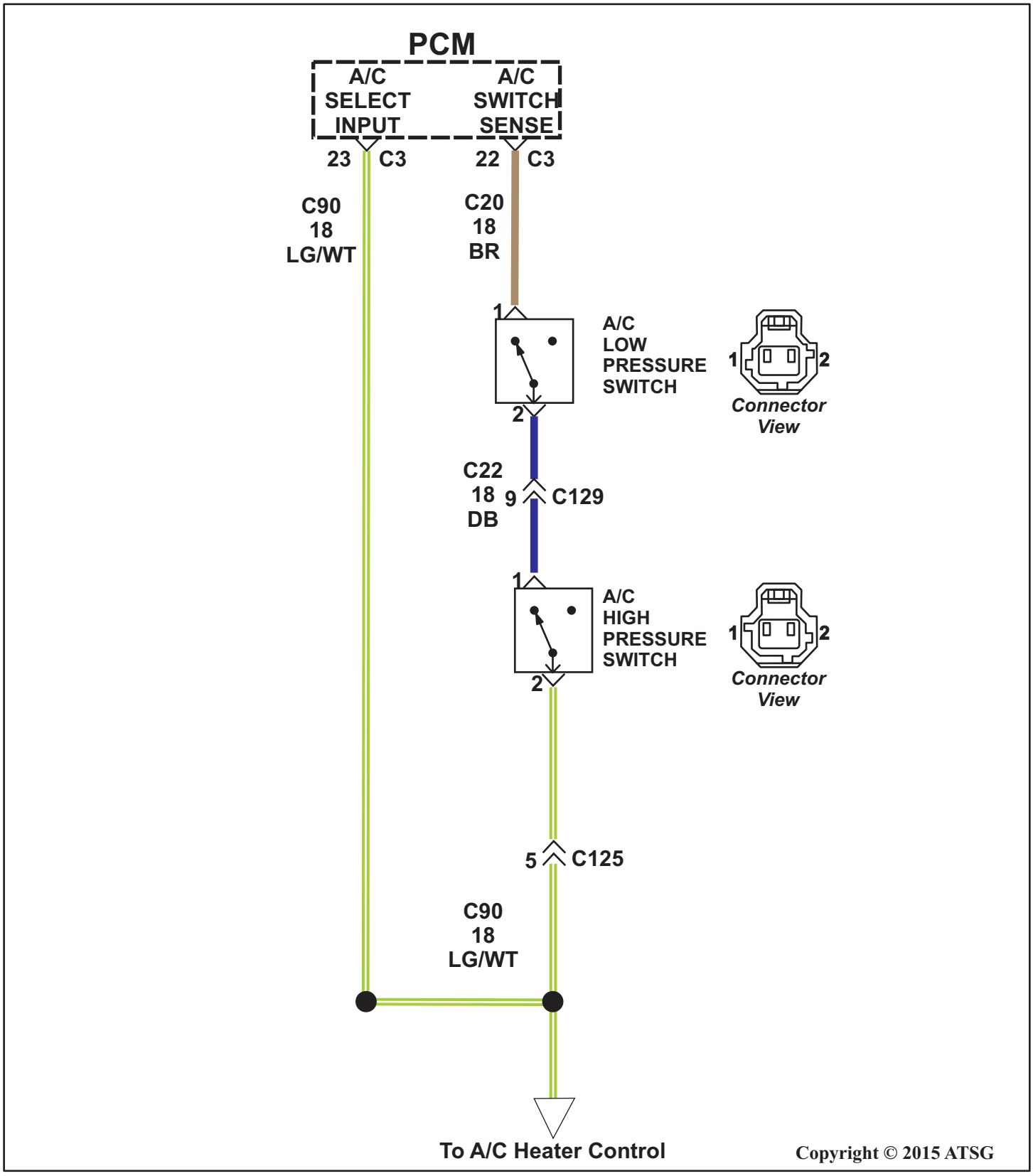
Low Pressure Switch Diagnosis:
1.Disconnect and isolate the battery negative cable.
2.Unplug the A/C low pressure switch wire harness connector from the switch on the accumulator fitting.
3.Install a jumper wire between the two cavities of the A/C low pressure switch wire harness connector.
4.Connect a manifold gauge set to the refrigerant system service ports.
5.Connect the battery negative cable.
6.Place the A/C heater mode control switch knob in any A/C position and start the engine.
7.Check for continuity between the two terminals of the low pressure cycling clutch switch. There should be continuity with a suction pressure reading of 296 kPa (43 psi) or above, and no continuity with a suction pressure reading of 172 kPa (25 psi) or below. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

High Pressure Switch Diagnosis:
1. Disconnect and isolate the battery negative cable.
2. Unplug the a/c high pressure switch wire harness connector from the switch on the refrigerant system fitting.
3. On the four terminal high pressure switch, check for continuity between terminals C and D. On the two terminal switch, check for continuity between both terminals of the A/C high pressure switch. There should be continuity. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

Special thanks to Donald Holliday at Covington Automotive

DODGE MEDIUM DUTY TRUCKS

TCC CYCLING ON AND OFF



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CHRYSLER/DODGE/RAM

GLOBAL POWERTRAIN ENGINE CONTROLLER (GPEC)

At the start of the 2007 model year, Chrysler Corporation began using the Global Powertrain Engine Controller (GPEC) in cars equipped with the new 2.4 Liter World Engine.
The original GPEC had a 96 pin and a 58 pin connector and managed both engine and transmission systems. These vehicles were usually equipped with the 41TES transmissions (See Figures 1 and 2).
As model years progressed into the present, the GPEC controller became more extensively used.

The original GPEC now was joined by the GPEC 2 Controller which uses two 96 pin connectors and is usually installed in vehicles equipped with the 62TE transmission (See Figures 3 and 4).

There is also a GPEC 3 controller which is used in vehicles that are also equipped with a separate Transmission Control Module. The GPEC 3 is used for engine management only and will not be addressed in this bulletin.

So as not to be out done, RAM Trucks at the start of the 2013 model year came out with what is called a Modified Powertrain Control Module (MOD-PCM). This is used in trucks that are equipped with the higher horsepower engines using the 65/66/68RFE transmissions (See Figures 5 and 6).

NOTES: When circuit or terminal information is needed, be sure to consult the appropriate wire and connector diagrams due to differences in wire and terminal locations between car and truck models as well as engine application.

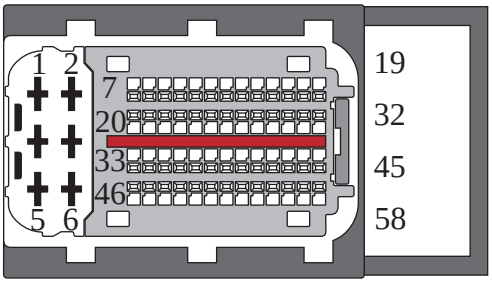
In most car and car like models, the PCM is usually located in the engine bay at the left rear corner in the area between the firewall and the shock tower.

In truck applications the PCM is usually located in the engine bay against the firewall in the right rear corner. Once again when PCM location is needed, consult the appropriate component location information.

Toledo - 71

GLOBAL POWERTRAIN ENGINE CONTROLLER (GPEC)

2009 Dodge Avenger 2.4L
Engine & 41TES
Transmission



58 Terminal
C1 Connector (Gray)

PIN CAVITY	TERMINAL FUNCTION
1	FUSED MAIN RELAY OUTPUT
2	GROUND
3	FUSED MAIN RELAY OUTPUT
4	GROUND
5	TRANSMISSION CONTROL OUTPUT
6	TRANSMISSION CONTROL OUTPUT
7	O2 1-2 HEATER CONTROL
8	NOT USED
9	NOT USED
10	NOT USED
11	NOT USED
12	NOT USED
13	STEERING CONTROL SWITCH RETURN
14	NOT USED
15	IGNITION SWITCH OUTPUT (Start-Run)
16	FUSED B+
17	NOT USED
18	SECONDARY AIR PUMP CONTROL
19	FUEL PUMP CONTROL
20	O2 1-2 RETURN
21	O2 1-2 SIGNAL
22	5 VOLT SUPPLY (APP SENSOR)
23	5 VOLT SUPPLY (APP SENSOR)
24	NOT USED
25	STARTER CONTROL
26	STEERING CONTROL SIGNAL 2
27	STEERING CONTROL SWITCH SENSE 1
28	NOT USED
29	NOT USED

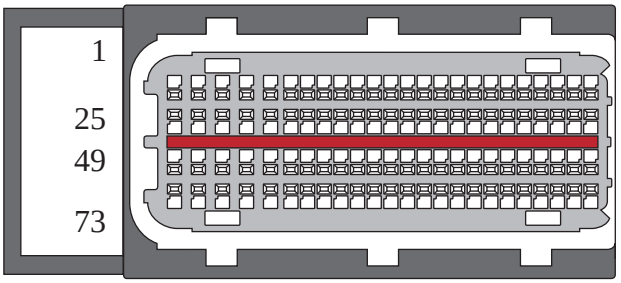
PIN CAVITY	TERMINAL FUNCTION
30	SENSOR GROUND
31	NOT USED
32	BRAKE SIGNAL 1
33	GROUND
34	APP SENSOR GROUND 2
35	EVAP PURGE RETURN
36	APP SENSOR GROUND 1
37	IGNITION SWITCH OUTPUT (Start)
38	VEHICLE SPEED SIGNAL
39	EVAP PURGE CONTROL
40	NOT USED
41	CAN BUS C +
42	NOT USED
43	NOT USED
44	NOT USED
45	NOT USED
46	NOT USED
47	ELECTRONIC SHIFT MODULE SIGNAL
48	APP SIGNAL 2
49	APP SIGNAL 1
50	TRANSMISSION RANGE SENSOR T41 SIGNAL
51	NOT USED
52	BRAKE SIGNAL 2
53	GENERATOR SENSE
54	CAN BUS C -
55	NOT USED
56	NOT USED
57	NOT USED
58	ASD/MAIN RELAY CONTROL

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Figure 1

GLOBAL POWERTRAIN ENGINE CONTROLLER (GPEC)

2009 Dodge Avenger 2.4L
Engine & 41TES
Transmission



96 Terminal
C2 Connector (Gray)

PIN CAVITY	TERMINAL FUNCTION
1	ELECTRONIC THROTTLE CONTROL MOTOR (+)
2	LINE PRESSURE VFS CONTROL
3	NOT USED
4	NOT USED
5	NOT USED
6	A/C COMPRESSOR CONTROL
7	NOT USED
8	INTAKE AIR TEMPERATURE SIGNAL
9	LINE PRESSURE VFS SIGNAL
10	LOW/REVERSE PRESSURE SWITCH SIGNAL
11	ENGINE COOLANT TEMPERATURE SIGNAL 2
12	NOT USED
13	NOT USED
14	NOT USED
15	NOT USED
16	NOT USED
17	NOT USED
18	NOT USED
19	NOT USED
20	NOT USED
21	INJECTOR 3 CONTROL
22	INJECTOR 4 CONTROL
23	INJECTOR 1 CONTROL
24	INJECTOR 2 CONTROL
25	ELECTRONIC THROTTLE CONTROL MOTOR (-)
26	NOT USED
27	MULTI-FUEL VEHICLE CONTROL
28	NOT USED
29	TRANSMISSION CONTROL (TIPM 12 VOLT SUPPLY)
30	NOT USED
31	2-4 PRESSURE SWITCH SIGNAL
32	OD PRESSURE SWITCH SIGNAL
33	O2 1-1 SIGNAL
34	NOT USED
35	NOT USED
36	O2 1-1 RETURN
37	ENGINE OIL TEMPERATURE SIGNAL
38	CAMSHAFT POSITION SENSOR 1-2 SIGNAL
39	NOT USED
40	NOT USED
41	5 VOLT SUPPLY (THROTTLE BODY)
42	5 VOLT SUPPLY (MULTIPLE SENSORS)
43	5 VOLT SUPPLY (VFS SIGNAL)
44	AUTOSTICK UPSHIFT SIGNAL
45	NOT USED
46	AUTOSTICK DOWNSHIFT SIGNAL
47	NOT USED
48	NOT USED

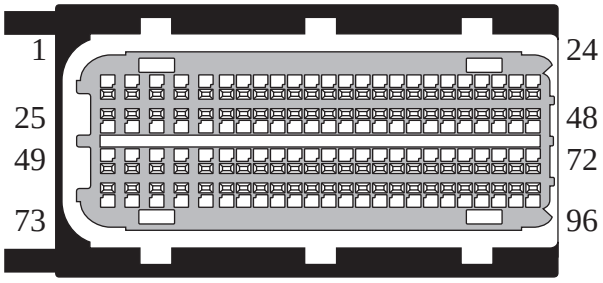
PIN CAVITY	TERMINAL FUNCTION
49	NOT USED
50	2-4 SOLENOID CONTROL
51	GENERATOR FIELD CONTROL
52	LOW/REVERSE SOLENOID CONTROL
53	UNDERDRIVE SOLENOID CONTROL
54	TRANSMISSION RANGE SENSOR T1 SIGNAL
55	IGNITION SWITCH OUTPUT (Unlock-Run-Start)
56	TRANSMISSION RANGE SENSOR T42 SIGNAL
57	CAMSHAFT POSITION SENSOR 1-1 SIGNAL
58	SENSOR GROUND (MULTIPLE SENSORS)
59	NOT USED
60	SENSOR GROUND (MAF)
61	MASS AIRFLOW SENSOR SIGNAL
62	THROTTLE POSITION SENSOR GROUND
63	THROTTLE POSITION SENSOR SIGNAL 2
64	THROTTLE POSITION SENSOR SIGNAL 1
65	KNOCK SENSOR RETURN
66	INPUT SPEED SENSOR SIGNAL
67	NOT USED
68	NOT USED
69	NOT USED
70	CAMSHAFT POSITION SOLENOID 1-2 CONTROL
71	NOT USED
72	CAMSHAFT POSITION SOLENOID 1-2 CONTROL
73	COIL 4 CONTROL
74	COIL 3 CONTROL
75	COIL 2 CONTROL
76	COIL 1 CONTROL
77	OVERDRIVE SOLENOID CONTROL
78	TRANSMISSION RANGE SENSOR T41 SIGNAL
79	CRANKSHAFT POSITION SENSOR SIGNAL
80	TRANSMISSION FLUID TEMPERATURE SIGNAL
81	TRANSMISSION RANGE SENSOR T3 SIGNAL
82	SENSOR GROUND (Multiple Sensors)
83	ENGINE COOLANT TEMPERATURE 1 SIGNAL
84	MANIFOLD FLOW VALVE SIGNAL
85	MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
86	ENGINE OIL PRESSURE SWITCH SIGNAL
87	VFS PRESSURE SENSOR GROUND
88	KNOCK SENSOR SIGNAL
89	OUTPUT SPEED SENSOR SIGNAL
90	SENSOR GROUND (Multiple Transmission Sensors)
91	NOT USED
92	NOT USED
93	NOT USED
94	NOT USED
95	NOT USED
96	NOT USED

Figure 2

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GLOBAL POWERTRAIN ENGINE CONTROLLER 2 (GPEC 2)

2014 Dodge Avenger 2.4L
Engine & 62TE
Transmission



96 Terminal
C1 Connector (Gray)

PIN CAVITY	TERMINAL FUNCTION
1	LOW/REVERSE SOLENOID CONTROL
2	DIRECT CLUTCH SOLENOID CONTROL
3	LOW CLUTCH SOLENOID CONTROL
4	UNDERDRIVE SOLENOID CONTROL
5	OVERDRIVE SOLENOID CONTROL
6	VACUUM PUMP RELAY CONTROL
7	TRANSMISSION CONTROL (TIPM 12 Volt Supply To PCM)
8	TRANSFER SHAFT SPEED SENSOR SIGNAL
9	TRANSFER, INPUT, OUTPUT SPEED SENSOR GROUND
10	INPUT SPEED SENSOR SIGNAL
11	NOT USED
12	NOT USED
13	NOT USED
14	2-4 PRESSURE SWITCH SIGNAL
15	NOT USED
16	AUTOSTICK UPSHIFT SIGNAL
17	BRAKE SIGNAL 2
18	SPEED CONTROL SWITCH SIGNAL 2
19	SPEED CONTROL SWITCH SIGNAL 1
20	LINE PRESSURE SIGNAL
21	NOT USED
22	THROTTLE BODY/OIL ENGINE TEMP SENSOR GROUND
23	IGNITION RUN/START CONTROL OUTPUT
24	FUEL TANK PRESSURE SIGNAL
25	2-4 SOLENOID CONTROL
26	TRANSMISSION CONTROL OUTPUT (Switched Battery)
27	TRANSMISSION CONTROL OUTPUT (12 Volt Pwr to TPIM)
28	TRANSMISSION CONTROL OUTPUT (12 Volt Pwr to TPIM)
29	LINE PRESSURE VFS CONTROL
30	NOT USED
31	NOT USED
32	NOT USED
33	CAN C (-)
34	OUTPUT SPEED SENSOR SIGNAL
35	NOT USED
36	NOT USED
37	DIRECT CLUTCH PRESSURE SWITCH SIGNAL
38	LOW CLUTCH PRESSURE SWITCH SIGNAL
39	TRANSMISSION RANGE SENSOR T1 SIGNAL
40	AUTOSTICK DOWNSHIFT SIGNAL
41	BRAKE SIGNAL 1
42	NOT USED
43	SPEED CONTROL SWITCH GROUND
44	TRANSMISSION FLUID TEMPERATURE SIGNAL
45	NOT USED
46	NOT USED
47	IGNITION UNLOCK/RUN/START OUTPUT
48	5 VOLT SUPPLY (Fuel Tank Pressure Sensor)

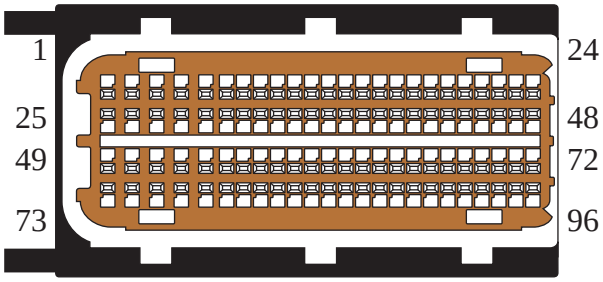
PIN CAVITY	TERMINAL FUNCTION
49	PCM GROUND
50	PCM GROUND
51	PCM GROUND
52	PCM GROUND
53	PCM GROUND
54	FUEL TANK PRESSURE SENSOR GROUND
55	NOT USED
56	NOT USED
57	CAN C (+)
58	NOT USED
59	NOT USED
60	LOW/REVERSE PRESSURE SWITCH SIGNAL
61	OVERDRIVE PRESSURE SWITCH SIGNAL
62	TRANSMISSION RANGE SENSOR T3 SIGNAL
63	NOT USED
64	NOT USED
65	EVAP PURGE SOLENOID SIGNAL
66	NOT USED
67	APP SENSOR GROUND 2
68	APP SENSOR GROUND 1
69	5 VOLT SUPPLY (EVAP System Monitor Switch)
70	EVAP SYSTEM MONITOR SWITCH SIGNAL
71	NOT USED
72	PCM GROUND
73	EMCC SOLENOID CONTROL
74	ASD CONTROL OUTPUT (TIPM 12 Volt Pwr Supply to PCM)
75	ASD CONTROL OUTPUT (TIPM 12 Volt Pwr Supply to PCM)
76	ASD CONTROL OUTPUT (TIPM 12 Volt Pwr Supply to PCM)
77	NOT USED
78	NOT USED
79	A/C CLUTCH CONTROL
80	ASD RELAY CONTROL
81	STARTER RELAY CONTROL
82	NOT USED
83	NOT USED
84	FUEL PUMP CONTROL
85	NOT USED
86	NOT USED
87	TRANSMISSION RANGE SENSOR T41 SIGNAL
88	TRANSMISSION RANGE SENSOR T42 SIGNAL
89	NOT USED
90	NOT USED
91	APP SIGNAL 2
92	APP SIGNAL 1
93	APP 2 FIVE VOLT SUPPLY
94	EVAP PURGE CONTROL
95	NOT USED
96	FUSED B+

Figure 3

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GLOBAL POWERTRAIN ENGINE CONTROLLER 2 (GPEC 2)

2014 Dodge Avenger 2.4L
Engine & 62TE
Transmission



96 Terminal
C2 Connector (Brown)

PIN CAVITY	TERMINAL FUNCTION
1	COIL CONTROL 1
2	GENERATOR FIELD CONTROL
3	ELECTRONIC THROTTLE CONTROL MOTOR (+)
4	ELECTRONIC THROTTLE CONTROL MOTOR (-)
5	NOT USED
6	NOT USED
7	SECONDARY AIR PUMP RELAY CONTROL
8	INJECTOR CONTROL 1
9	INJECTOR CONTROL 2
10	INJECTOR CONTROL 3
11	INJECTOR CONTROL 4
12	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
13	KNOCK SENSOR 2 SIGNAL
14	KNOCK SENSOR 1 SIGNAL
15	NOT USED
16	ENGINE OIL TEMPERATURE SENSOR SIGNAL
17	INTAKE AIR TEMPERATURE SENSOR SIGNAL
18	O2 SENSOR RETURN (Downstream)
19	O2 SENSOR RETURN (Upstream)
20	NOT USED
21	NOT USED
22	VVT EXHAUST CONTROL
23	VVT INTAKE CONTROL
24	O2 1-1 HEATER CONTROL
25	COIL CONTROL 2
26	NOT USED
27	NOT USED
28	NOT USED
29	NOT USED
30	NOT USED
31	NOT USED
32	NOT USED
33	NOT USED
34	NOT USED
35	NOT USED
36	NOT USED
37	KNOCK SENSOR 2 RETURN
38	KNOCK SENSOR 1 RETURN
39	NOT USED
40	GENERATOR SENSE
41	O2 2-1 SIGNAL
42	O2 2-2 SIGNAL
43	O2 1-2 SIGNAL
44	O2 1-1 SIGNAL
45	MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
46	NOT USED
47	NOT USED
48	O2 1-2 HEATER CONTROL SUPPLY

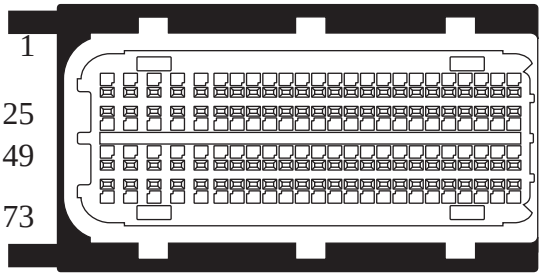
PIN CAVITY	TERMINAL FUNCTION
49	COIL CONTROL 3
50	NOT USED
51	NOT USED
52	NOT USED
53	NOT USED
54	NOT USED
55	NOT USED
56	NOT USED
57	NOT USED
58	NOT USED
59	NOT USED
60	NOT USED
61	CAMSHAFT POSITION SENSOR SIGNAL 4
62	CAMSHAFT POSITION SENSOR SIGNAL 2
63	CAMSHAFT POSITION SENSOR SIGNAL 3
64	NOT USED
65	THROTTLE POSITION SENSOR RETURN
66	CRANKSHAFT POSITION SENSOR GROUND
67	SENSOR GROUND (Multiple Sensors)
68	NOT USED
69	NOT USED
70	NOT USED
71	NOT USED
72	O2 2-1 HEATER CONTROL
73	COIL CONTROL 4
74	COIL CONTROL 5
75	COIL CONTROL 6
76	NOT USED
77	NOT USED
78	NOT USED
79	INJECTOR CONTROL 5
80	INJECTOR CONTROL 6
81	NOT USED
82	NOT USED
83	NOT USED
84	NOT USED
85	CAMSHAFT POSITION SENSOR SIGNAL
86	CRANKSHAFT POSITION SENSOR SIGNAL
87	5 VOLT SUPPLY (Multiple Sensors)
88	CRANKSHAFT POSITION SENSOR GROUND
89	THROTTLE POSITION SENSOR 1 SIGNAL
90	THROTTLE POSITION SENSOR 2 SIGNAL
91	NOT USED
92	NOT USED
93	OIL PRESSURE SOLENOID CONTROL
94	VVT INTAKE CONTROL 2
95	VVT EXHAUST CONTROL 2
96	O2 2-2 HEATER CONTROL

Figure 4

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MOD-PCM

2014 RAM 1500 5.7L
Engine & 65RFE
Transmission



96 Terminal
C1 Connector (White)

PIN CAVITY	TERMINAL FUNCTION
1	LOW/REVERSE SOLENOID CONTROL
2	MULTI-SELECT SOLENOID CONTROL
3	UNDERDRIVE SOLENOID CONTROL
4	4C SOLENOID CONTROL
5	NOT USED
6	2C SOLENOID CONTROL
7	TRANSMISSION CONTROL (RELAY 12 Volt Supply To PCM)
8	NOT USED
9	INPUT, OUTPUT SPEED SENSOR GROUND
10	INPUT SPEED SENSOR SIGNAL
11	OUTPUT SPEED SENSOR SIGNAL
12	4C PRESSURE SWITCH SIGNAL
13	NOT USED
14	2C PRESSURE SWITCH SIGNAL
15	TRANSMISSION RANGE SENSOR T4 SIGNAL
16	NOT USED
17	TRANSMISSION RANGE SENSOR T41 SIGNAL
18	TRANSMISSION RANGE SENSOR T42 SIGNAL
19	TRANSMISSION FLUID TEMPERATURE SIGNAL
20	LINE PRESSURE SIGNAL
21	NOT USED
22	FUEL PRESSURE SIGNAL
23	IGNITION RUN/START CONTROL OUTPUT
24	NOT USED
25	TRANSMISSION CONTROL OUTPUT (Switched Battery)
26	TRANSMISSION CONTROL OUTPUT (12 Volt Pwr to PDC)
27	TRANSMISSION CONTROL OUTPUT (12 Volt Pwr to PDC)
28	NOT USED
29	LINE PRESSURE VFS CONTROL
30	NOT USED
31	NOT USED
32	NOT USED
33	CAN C (-)
34	NOT USED
35	LOW/REVERSE CLUTCH PRESSURE SWITCH SIGNAL
36	OVERDRIVE CLUTCH PRESSURE SWITCH SIGNAL
37	UNDERDRIVE CLUTCH PRESSURE SWITCH SIGNAL
38	TRANSMISSION RANGE SENSOR T1 SIGNAL
39	NOT USED
40	TRANSMISSION RANGE SENSOR T3 SIGNAL
41	NOT USED
42	EVAP SYSTEM MONITOR SWITCH GROUND
43	NOT USED
44	A/C PRESSURE SIGNAL
45	NOT USED
46	NOT USED
47	IGNITION OFF/RUN/START CONTROL OUTPUT
48	5 VOLT SUPPLY (Fuel Tank Pressure Sensor)

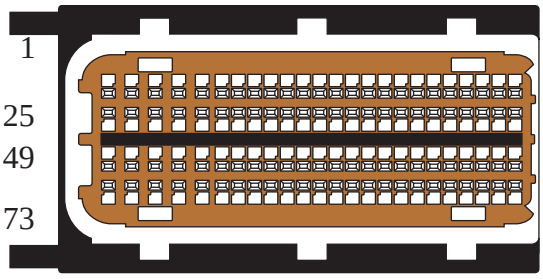
PIN CAVITY	TERMINAL FUNCTION
49	PCM GROUND
50	PCM GROUND
51	PCM GROUND
52	PCM GROUND
53	PCM GROUND
54	FUEL TANK PRESSURE SENSOR GROUND
55	NOT USED
56	NOT USED
57	CAN C (+)
58	NOT USED
59	NOT USED
60	NOT USED
61	FUEL PUMP CONTROL MODULE PWM FEEDBACK
62	NOT USED
63	NOT USED
64	NOT USED
65	NOT USED
66	NOT USED
67	APP SENSOR GROUND 2
68	APP SENSOR GROUND 1
69	5 VOLT SUPPLY
70	EVAP PURGE SOLENOID SENSE
71	NOT USED
72	PCM GROUND
73	NOT USED
74	ASD CONTROL OUTPUT (PDC 12 Volt Pwr Supply to PCM)
75	ASD CONTROL OUTPUT (PDC 12 Volt Pwr Supply to PCM)
76	ASD CONTROL OUTPUT (PDC 12 Volt Pwr Supply to PCM)
77	NOT USED
78	RADIATOR FAN RELAY CONTROL
79	A/C CLUTCH CONTROL
80	ASD RELAY CONTROL
81	STARTER RELAY CONTROL
82	LOW SPEED RADIATOR FAN CONTROL
83	FUEL PUMP CONTROL PWM CONTROL
84	FUEL PUMP CONTROL
85	NOT USED
86	NOT USED
87	NOT USED
88	FUEL TANK PRESSURE SIGNAL
89	NOT USED
90	NOT USED
91	APP SIGNAL 2
92	APP SIGNAL 1
93	APP SENSOR FIVE VOLT SUPPLY
94	EVAP PURGE CONTROL
95	NOT USED
96	FUSED B+

Figure 5

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MOD-PCM

2014 RAM 1500 5.7L
Engine & 65RFE
Transmission



96 Terminal
C2 Connector (Brown)

PIN CAVITY	TERMINAL FUNCTION
1	MULTI-DISPLACEMENT SYSTEM SOLENOID CONTROL 7
2	NOT USED
3	NOT USED
4	ENGINE OIL PRESSURE SIGNAL
5	NOT USED
6	MULTI-DISPLACEMENT SYSTEM SOLENOID CONTROL 4
7	NOT USED
8	INJECTOR CONTROL 1
9	INJECTOR CONTROL 2
10	INJECTOR CONTROL 3
11	INJECTOR CONTROL 4
12	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
13	KNOCK SENSOR 2 SIGNAL
14	KNOCK SENSOR 1 SIGNAL
15	NOT USED
16	NOT USED
17	NOT USED
18	NOT USED
19	O2 1-2 SENSOR SIGNAL
20	O2 RETURN (Downstream)
21	O2 2-2 SIGNAL
22	VARIABLE CAMSHAFT TIMING CONTROL
23	NOT USED
24	O2 1-1 HEATER CONTROL
25	MULTI-DISPLACEMENT SYSTEM SOLENOID CONTROL 6
26	NOT USED
27	NOT USED
28	NOT USED
29	NOT USED
30	NOT USED
31	MULTI-DISPLACEMENT SYSTEM SOLENOID CONTROL 1
32	GENERATOR FIELD CONTROL
33	ELECTRONIC THROTTLE CONTROL MOTOR (+)
34	ELECTRONIC THROTTLE CONTROL MOTOR (-)
35	GENERATOR SENSE
36	NOT USED
37	KNOCK SENSOR 2 RETURN
38	KNOCK SENSOR 1 RETURN
39	O2 1-1 SIGNAL
40	O2 RETURN (Upstream)
41	O2 2-1 SIGNAL
42	NOT USED
43	ENGINE OIL TEMPERATURE SIGNAL
44	INTAKE AIR TEMPERATURE SENSOR SIGNAL
45	MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL
46	NOT USED
47	NOT USED
48	O2 1-2 HEATER CONTROL SUPPLY

PIN CAVITY	TERMINAL FUNCTION
49	COIL CONTROL 3
50	COIL CONTROL 2
51	COIL CONTROL 1
52	NOT USED
53	SHORT RUNNER VALVE ACTUATOR CONTROL SIGNAL
54	NOT USED
55	NOT USED
56	NOT USED
57	NOT USED
58	NOT USED
59	NOT USED
60	SHORT RUNNER VALVE ACTUATOR SENSE OUTPUT
61	NOT USED
62	NOT USED
63	NOT USED
64	NOT USED
65	THROTTLE POSITION SENSOR RETURN
66	CAMHAFT POSITION SENSOR GROUND
67	APP 2 SENSOR GROUND
68	APP 1 SENSOR GROUND
69	NOT USED
70	NOT USED
71	NOT USED
72	O2 2-1 HEATER CONTROL
73	COIL CONTROL 4
74	COIL CONTROL 5
75	COIL CONTROL 6
76	COIL CONTROL 7
77	COIL CONTROL 8
78	NOT USED
79	INJECTOR CONTROL 5
80	INJECTOR CONTROL 6
81	INJECTOR CONTROL 7
82	INJECTOR CONTROL 8
83	NOT USED
84	NOT USED
85	CAMSHAFT POSITION SENSOR SIGNAL
86	CRANKSHAFT POSITION SENSOR SIGNAL
87	CAMSHAFT SENSOR 5 VOLT SUPPLY
88	CRANKSHAFT POSITION SENSOR GROUND
89	THROTTLE POSITION SENSOR 1 SIGNAL
90	THROTTLE POSITION SENSOR 2 SIGNAL
91	NOT USED
92	NOT USED
93	NOT USED
94	NOT USED
95	NOT USED
96	O2 2-2 HEATER CONTROL

Figure 6

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DODGE CHALLENGER WITH NAG 1 TRANSMISSION

ERRATIC SHIFTING AFTER REBUILD

COMPLAINT: A 2009 Dodge Challenger comes into the shop with a no move complaint. It is determined that the transmission needs to be rebuilt. After the rebuild, the transmission would shift erratically and sometimes neutralize during a 3-4 shift. Figures 1, 2 and 3 are screen captures showing the occasional 3-4 neutral condition. When this occurred, code P0730 would store placing the transmission into limp. After changing the valve body and conductor plate, the erratic shift and occasional neutralizing complaint persisted. It was noticed that the engine had been modified and different size tires were put on the vehicle. The shop decided to bring the car to the dealer to perform a pinion factor which seemed to settle the problem down for a short while. The shop was also told by the dealer that the 5.7L engine had 6.1L programming installed. Soon after receiving the car the problems began to return. At this point the shop chose to install a dealer transmission but the problem remained.

CAUSE: When the tech decided to make electrical checks at the TCM and to inspect it for transmission fluid being drawn up through the wiring, a modification was discovered. An Electronic shift kit / Line Lock style box was piggy backed onto select wiring (Figure 4).

CORRECTION: When the modification kit was removed, the transmission functioned as designed.

Thanks to Brian Harbour

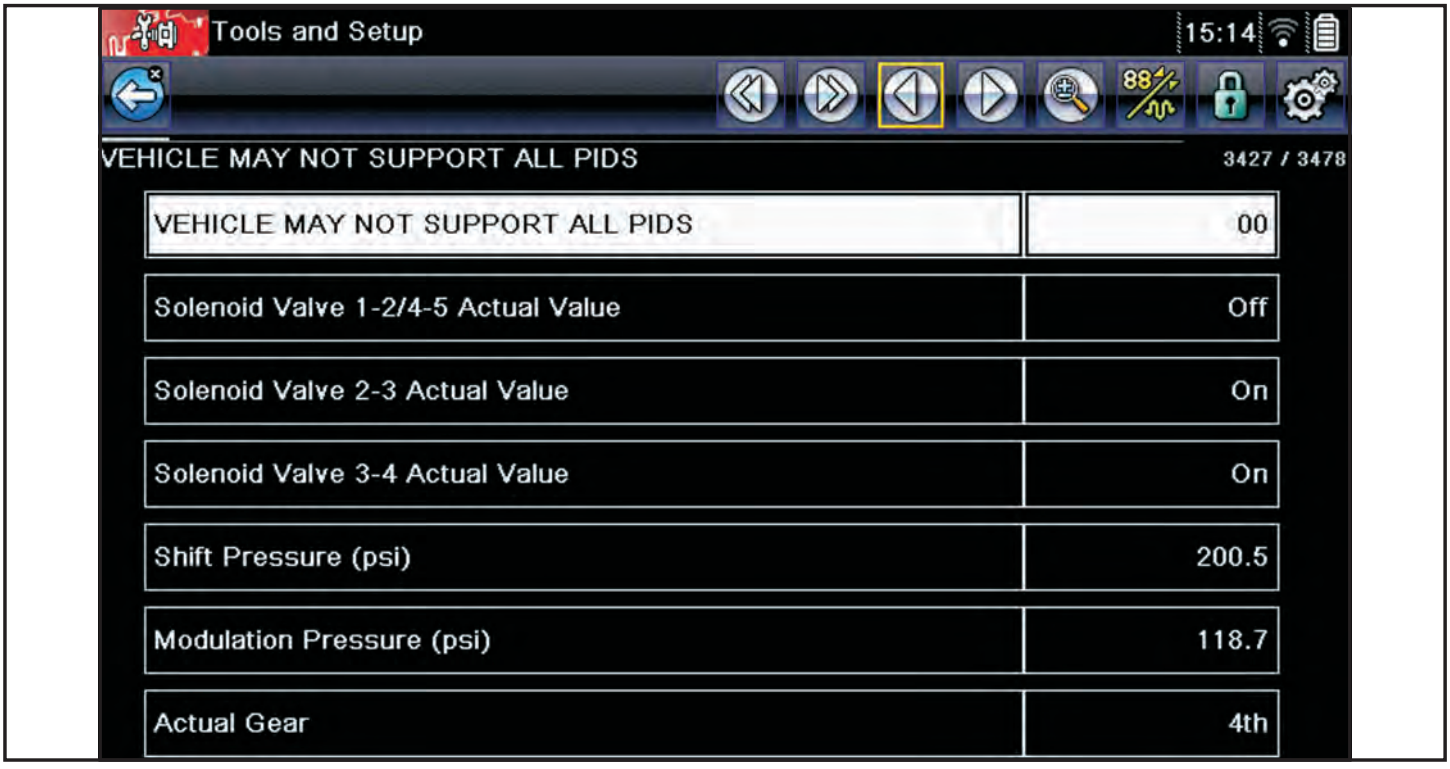


Figure 1

DODGE CHALLENGER WITH NAG 1 TRANSMISSION

ERRATIC SHIFTING AFTER REBUILD

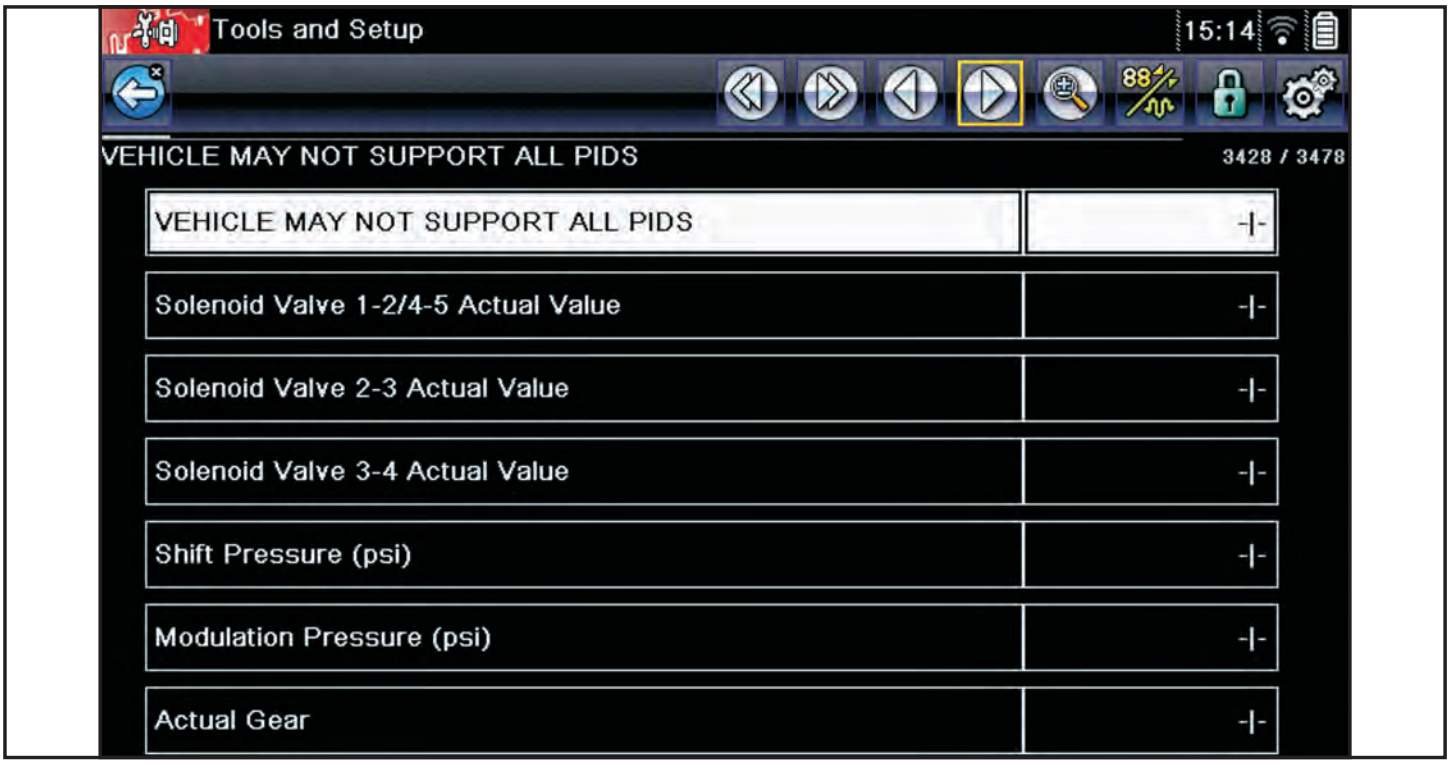


Figure 2

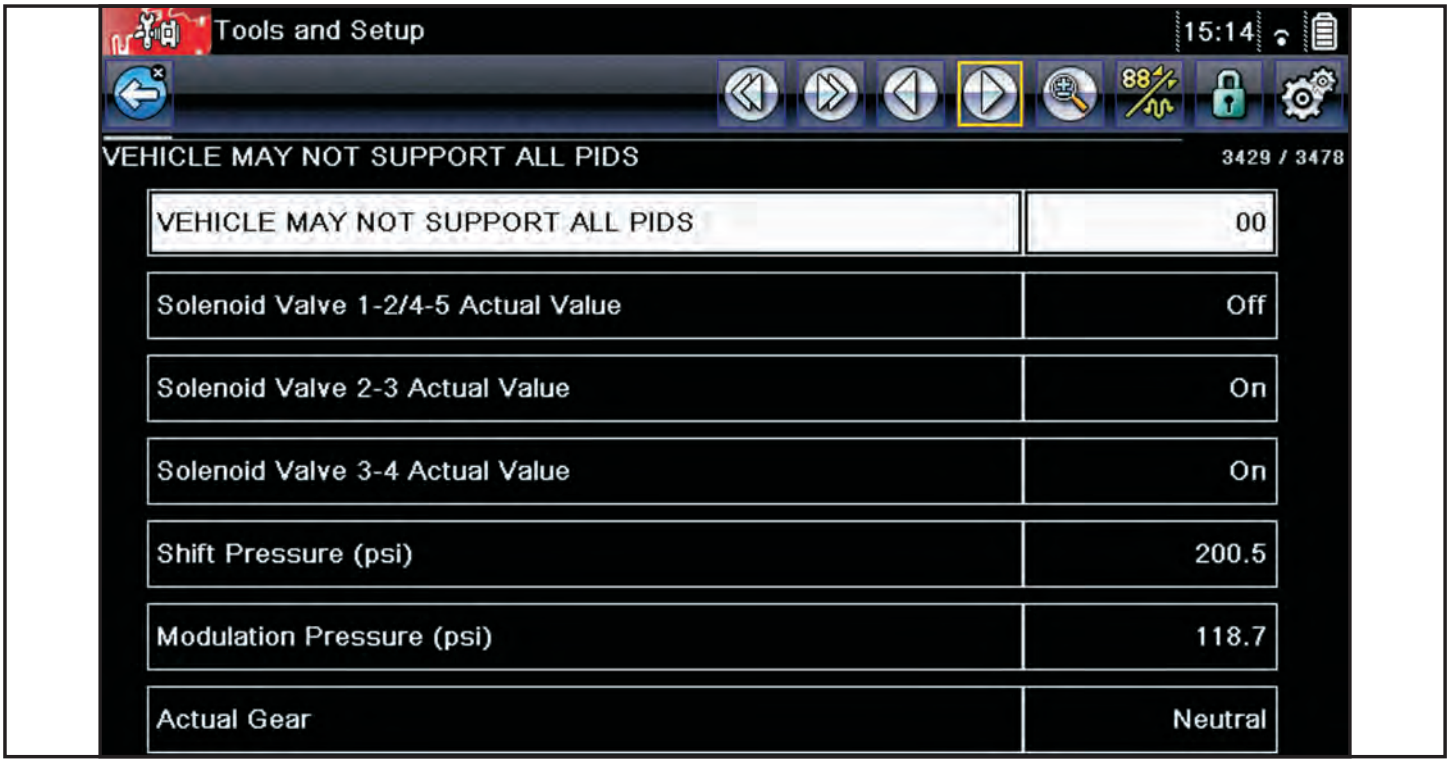


Figure 3

DODGE CHALLENGER WITH NAG 1 TRANSMISSION

ERRATIC SHIFTING AFTER REBUILD

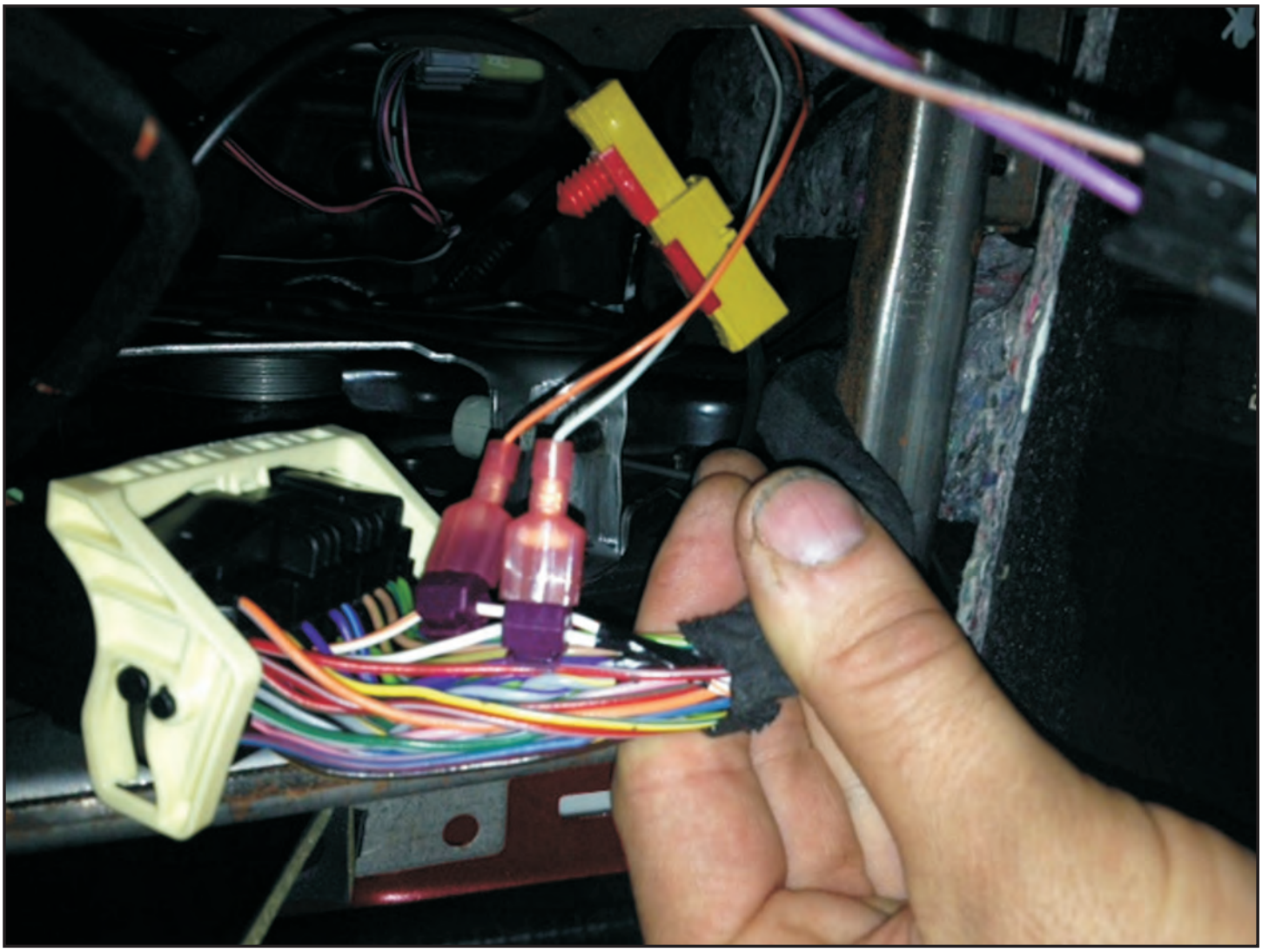


Figure 4

Raybestos - 81

4WD JEEP VEHICLES WITH NAG 1 TRANSMISSION

NO MOVE OR GOOD REVERSE NO FORWARD

COMPLAINT: A 4 wheel drive Jeep using the NAG 1 transmission suddenly develops a no forward movement while reverse operates well. In some cases a no move forward and a no reverse may be present. A grinding noise can be heard near the transfer case. When park is selected after an attempt is made to move the vehicle, the parking pawl can be heard skipping across the parking gear. Operating the transmission on the lift with the transfer case removed shows that the output shaft and flange rotates. No evidence of damage is discovered causing the problem when the transfer case is disassembled for inspection.

CAUSE: The flange which connects the output shaft of the transmission to the input gear of the transfer case is fastened to the output shaft by a nut. The spline inside the flange and the spline on the output has stripped. The retaining nut and flange needs to be removed to see the damage. In some cases the spline lays down in the drive direction enough to prevent forward movement but will engage and move in reverse. With the spline already compromised, it will not take long before reverse movement is lost as well.

CORRECTION: With both the output shaft and flange spline being stripped, transmission removal and disassembly will be necessary to change the output shaft. A new flange and nut can be changed without transmission removal.

Note: NAG1 transmissions are known to have converter clutch vibrations due to valve body wear issues. And if you replace the valve body with a remanufactured one you may find that the problem still exists afterwards. Some 2011 Jeep Grand Cherokees with a 5.7L and 3.6L engine using the 4WD Quadra-Trac (II) Transfer case may exhibit shudder during acceleration or coast deceleration in both Auto and Sport modes. In these situations the DTCM software was configured to reduce the 4WD torque to the front axle during nonslip events under normal driving conditions (NUMBER: 21-004-10 REV A).

Earlier Commanders and Grand Cherokees may also experience a transfer case electrical failure which could result in an unintentional shifting of the transfer case into the neutral position. There is a campaign to re-flash of the final drive controller which governs the transfer case. The Chrysler re-call campaign number is N23 should this be a customer complaint that comes up in your shop.

4WD JEEP VEHICLES WITH NAG 1 TRANSMISSION

NO MOVE OR GOOD REVERSE NO FORWARD

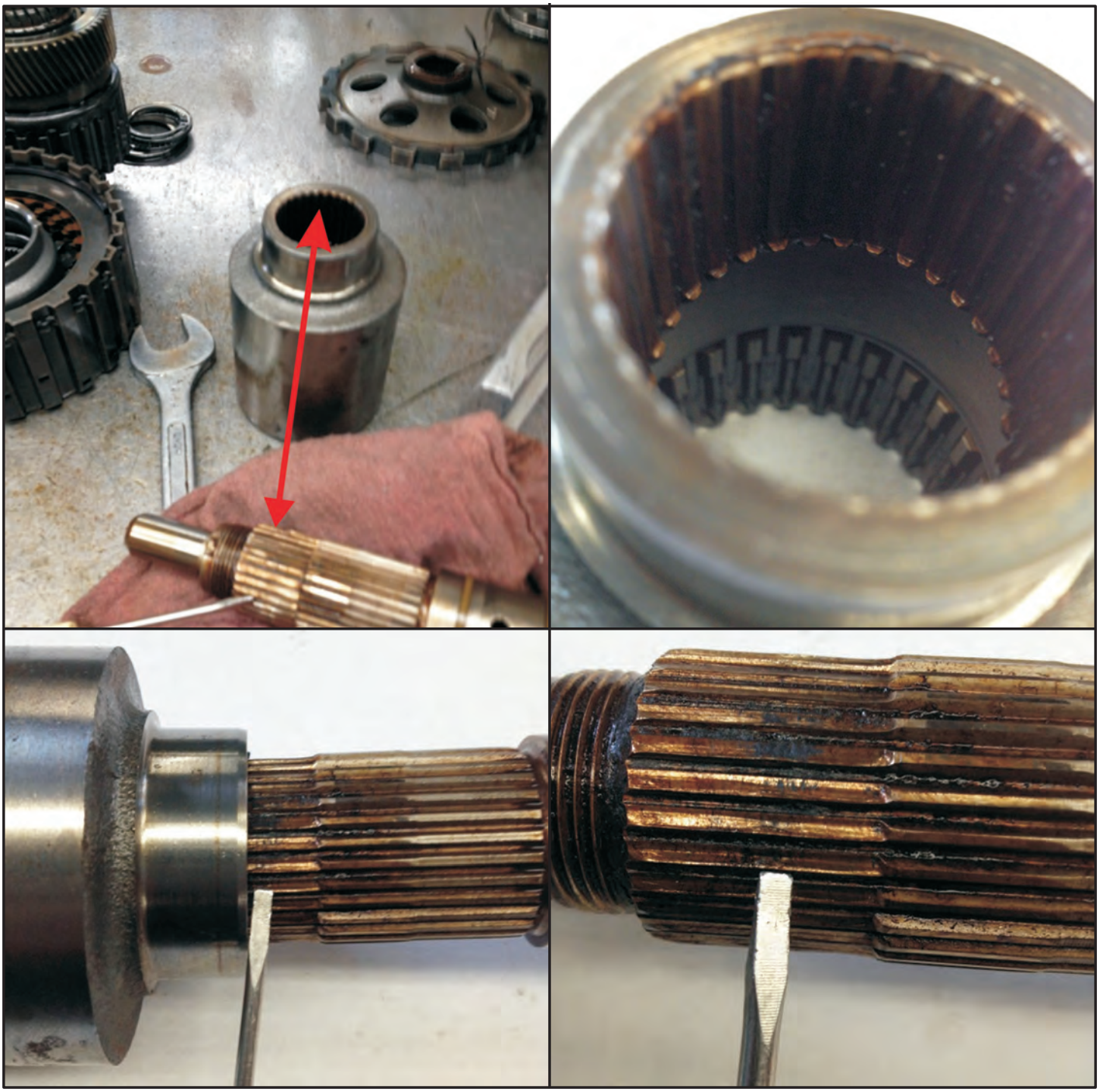
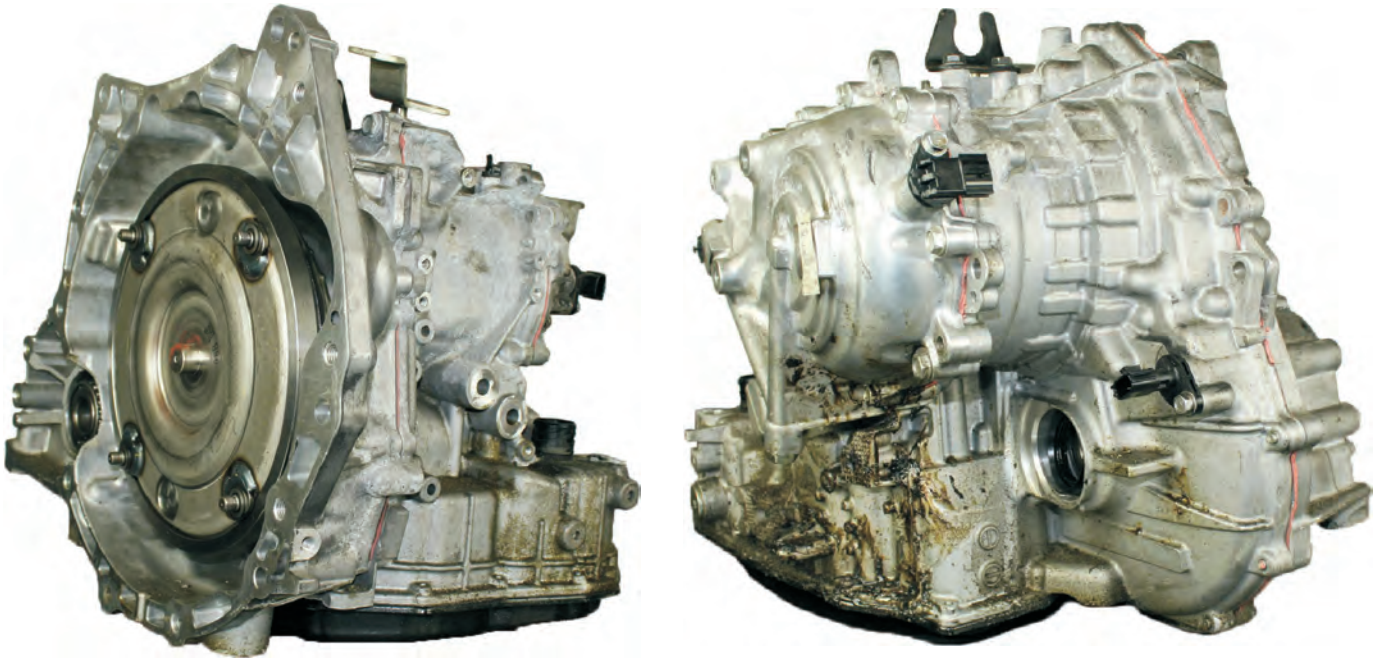
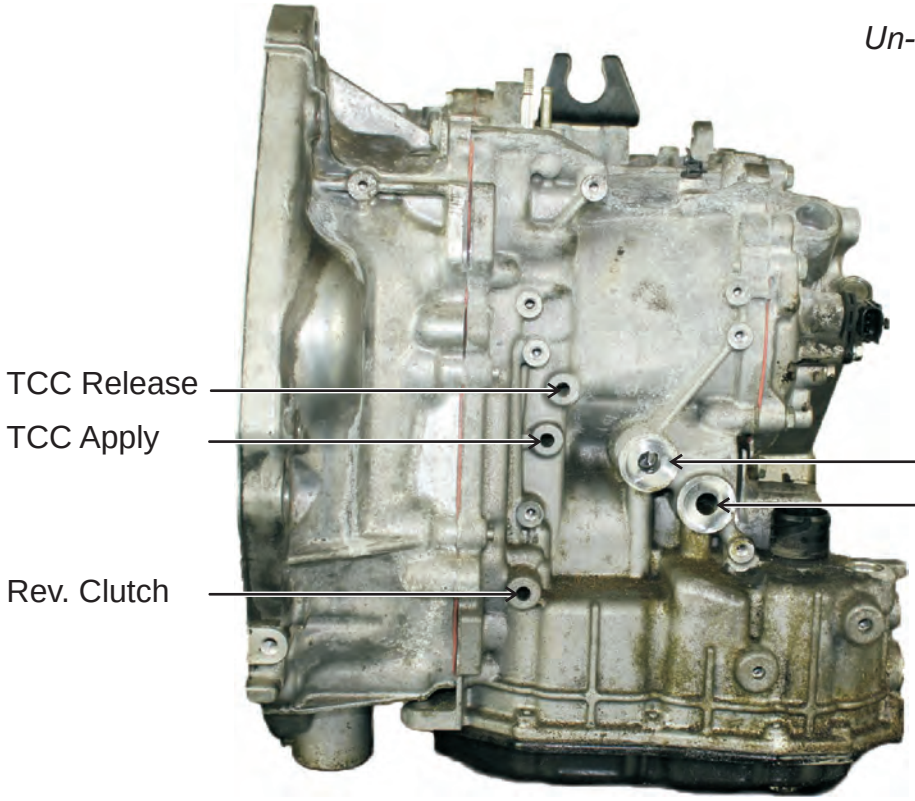


Figure 1

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION



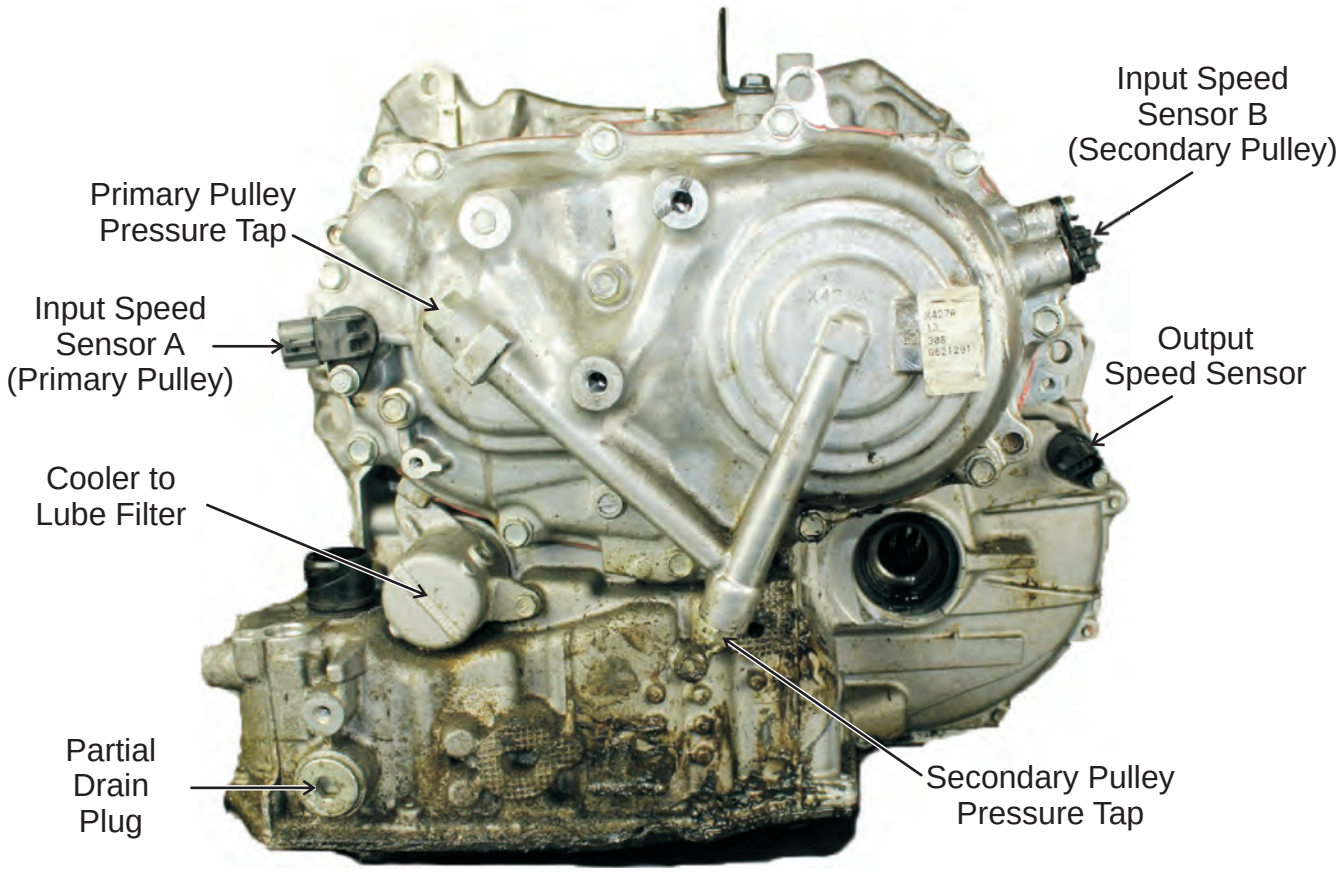


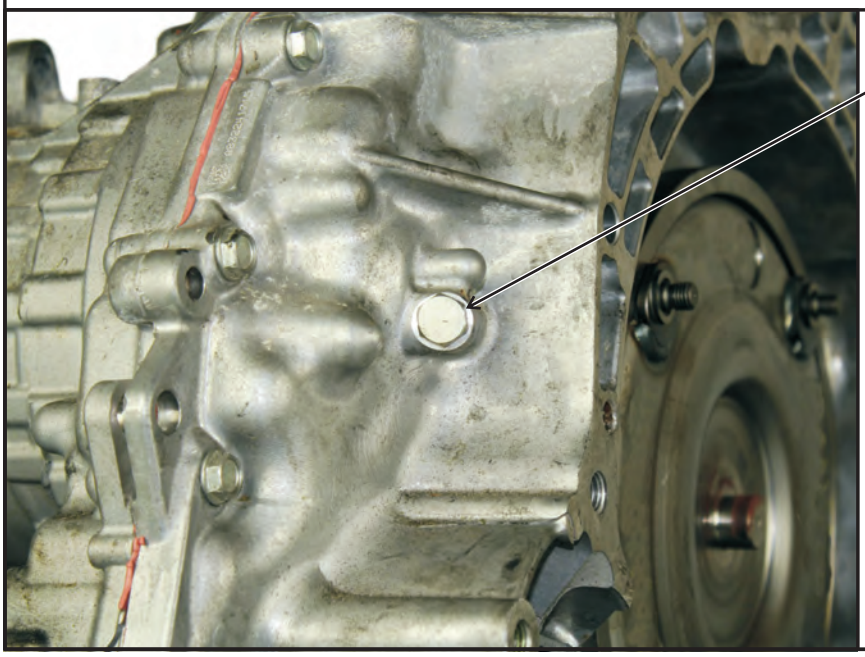
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Figure 1

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION





Main line pressure specifications:
P/N Idle - 5 Bars (72.5 psi)

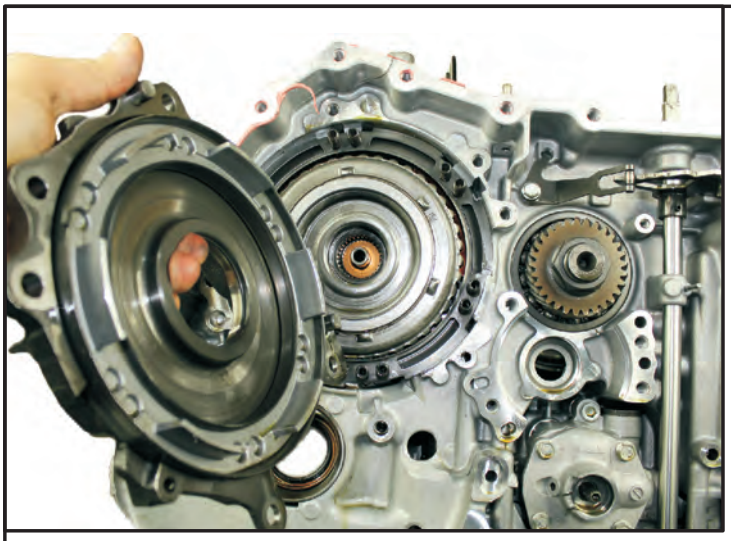
D/R Idle 5-13 Bars (72.5-200psi)
D/R Stall 41.8-46.8 Bars (607-680psi)

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Figure 2

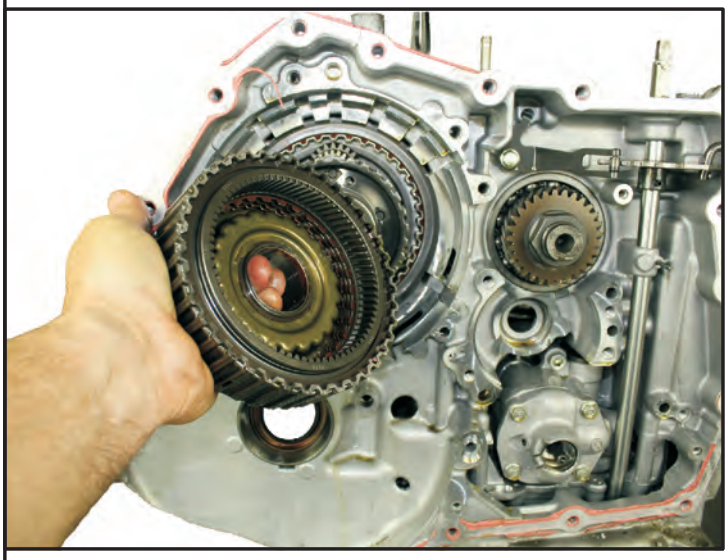
CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION



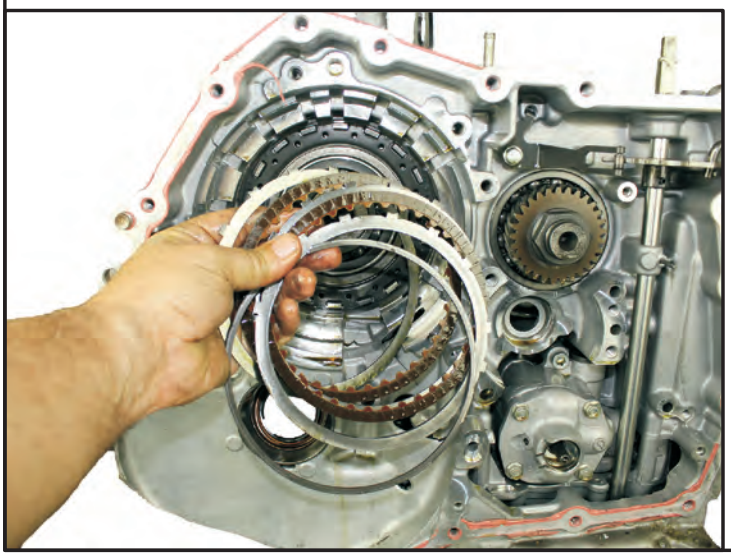
A torque converter is used to drive the input shaft which drives the pulley assembly. In-between the pulley assembly and the differential is the "Auxiliary Transmission" section. This consists of a Reverse Brake, High Clutch, Low Brake and a Ravigneaux planetary gear set.

When dismantling the transmission the Reverse Brake Assembly is the first to come out as seen to the left.



The High Clutch Drum is next to come out which includes the ring gear. When the Reverse Brake applies it holds the High Clutch Drum and ring gear stationary providing a reverse gear reduction ratio of 1.714.

The High Clutch friction plates spline to the ravigneaux carrier which is next to be removed. This carrier is driven by the secondary pulley. When the High Clutch is applied, it locks the ring gear to the carrier providing a 1 to 1 direct drive ratio.



The sun gear is next to be removed followed by the Low Brake assembly. The Low Brake assembly when applied holds the sun gear stationary providing a forward gear reduction ratio of 1.821.

The Formula:

Pulley Ratio x Aux-Trans Gear Ratio provides a 4.0 low gear ratio to a 0.55 high gear ratio.

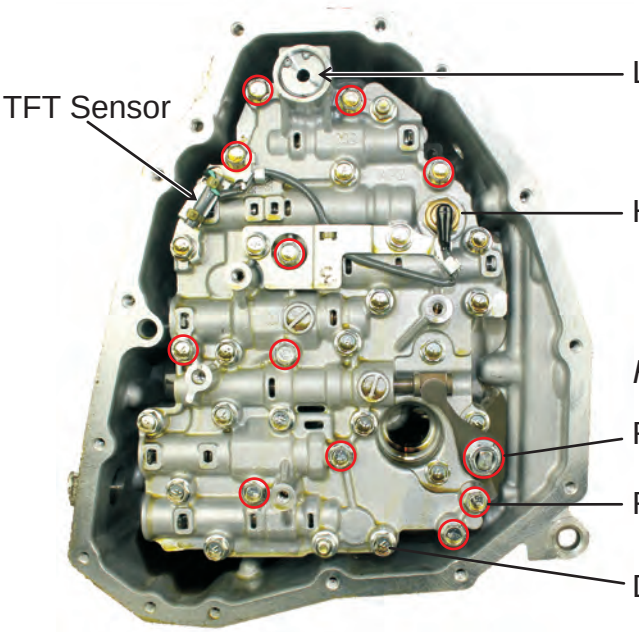
4.0 divided by 0.55 = 7.273 Ratio Coverage

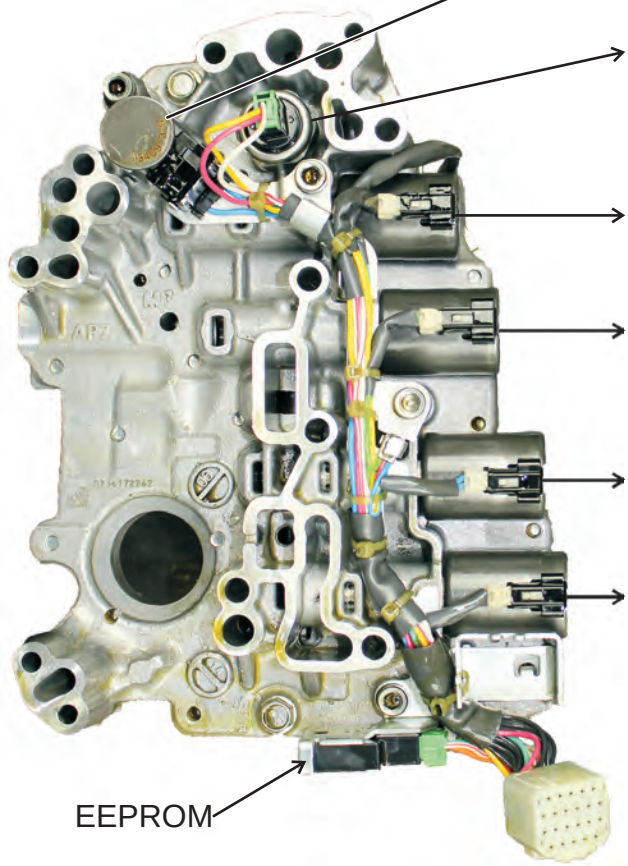
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Figure 3

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION





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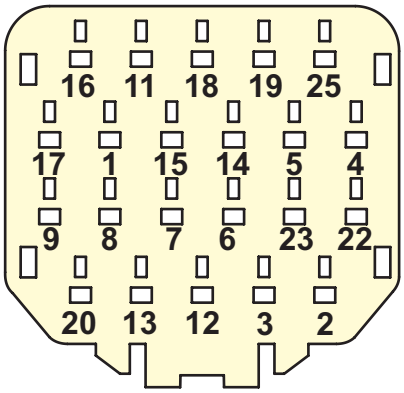
Figure 4

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION



Transmission Case Connector



Internal Harness Connector

Note: Terminal identification has been obtained from Nissan information. Terminal identification may be different with other manufacturers using this transmission (Mitsubishi, Suzuki etc.).

Terminal		Component	Condition	Value
+	-			
2	GND*	Line Pressure Solenoid (A)	20°C (68°F) 50°C (122°F) 80°C (176°F)	5.3Ù 6.0Ù 6.7Ù
3	GND*	Primary Pressure Solenoid (B)	20°C (68°F) 50°C (122°F) 80°C (176°F)	5.3Ù 6.0Ù 6.7Ù
6	GND*	TCC Solenoid	20°C (68°F) 50°C (122°F) 80°C (176°F)	6.1Ù 6.9Ù 7.7Ù
22	GND*	Low Brake Solenoid (F)	20°C (68°F) 50°C (122°F) 80°C (176°F)	5.3Ù 6.0Ù 6.7Ù
23	GND*	H. C. & R. B. Solenoid (G)	20°C (68°F) 50°C (122°F) 80°C (176°F)	5.3Ù 6.0Ù 6.7Ù

**Each solenoid is internally grounded - use case for ground when checking resistance from the case connector. Use solenoid harness bracket for ground when checking resistance from the internal harness connector.*

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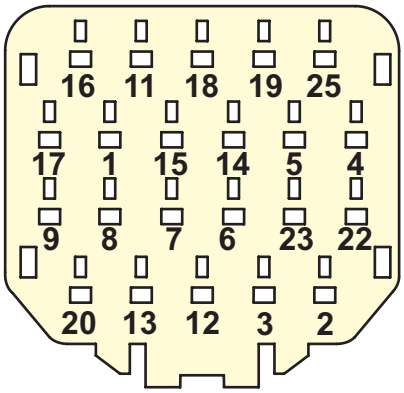
Figure 5

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION



Transmission Case Connector



Internal Harness Connector

Note: Terminal identification has been obtained from Nissan information. Terminal identification will be different with other manufacturers using this transmission (Mitsubishi, Suzuki etc.).

Terminal		Component	Condition	Value
+	-			
4	25	CVT Fluid Temp. Sensor	20°C (68°F) 50°C (122°F) 80°C (176°F)	2.00 V or 6.5 kÙ 1.50 V or 2.2 kÙ 0.90 V or 0.87 kÙ
16	Case Gnd.	Sec. Pulley Press. Sensor	Idle in Neutral	0.88-.094 V

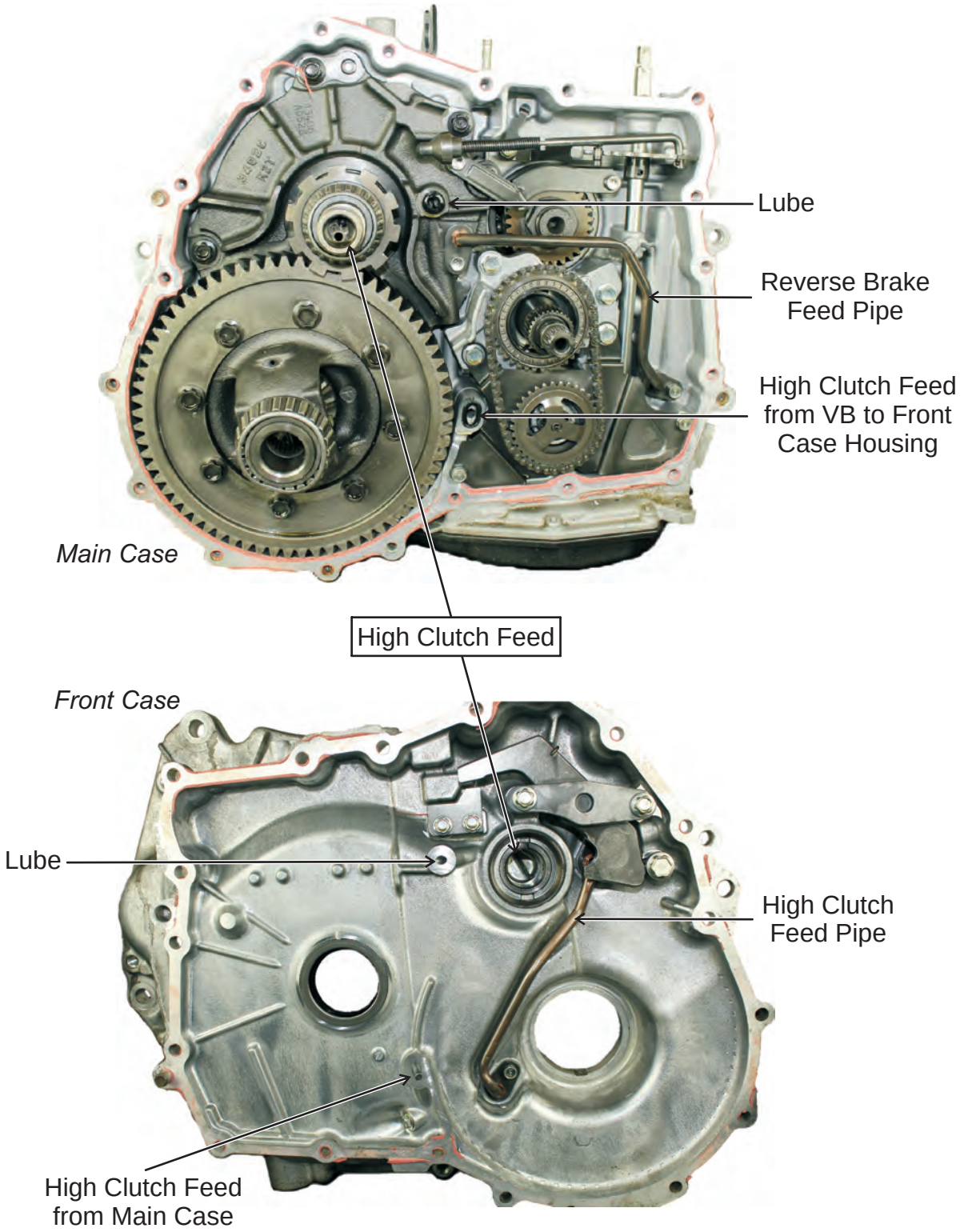
Note: The high clutch pressure switch is a normally open switch. At the time of this printing, the pressure specification to close the switch was not available.

Additionally, this high clutch pressure switch is not mentioned in Nissan factory information nor is it shown in wiring diagrams. The transmission used to produce this material has this pressure switch wired to terminal 17. Internally, this wire also splices to one of the wires going to the EEPROM. The EEPROM has a total of 5 wires plugging into it. One shares a ground with both the fluid temperature sensor and the secondary pulley pressure sensor (Terminal 25). Another is a 5 volt power supply for the EEPROM and the secondary pulley pressure sensor (Terminal 16). The remaining two wires go to terminals 1 and 15. Typically, this style pressure switch receives voltage from the TCM. When the switch closes, it pulls the voltage to ground providing a confirmation signal to the computer. This would suggest that the EEPROM is receiving this signal as a hard input as well.

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Figure 6

CVT 7 - JF015E/RE0F11A/F1CJB
INTRODUCTION

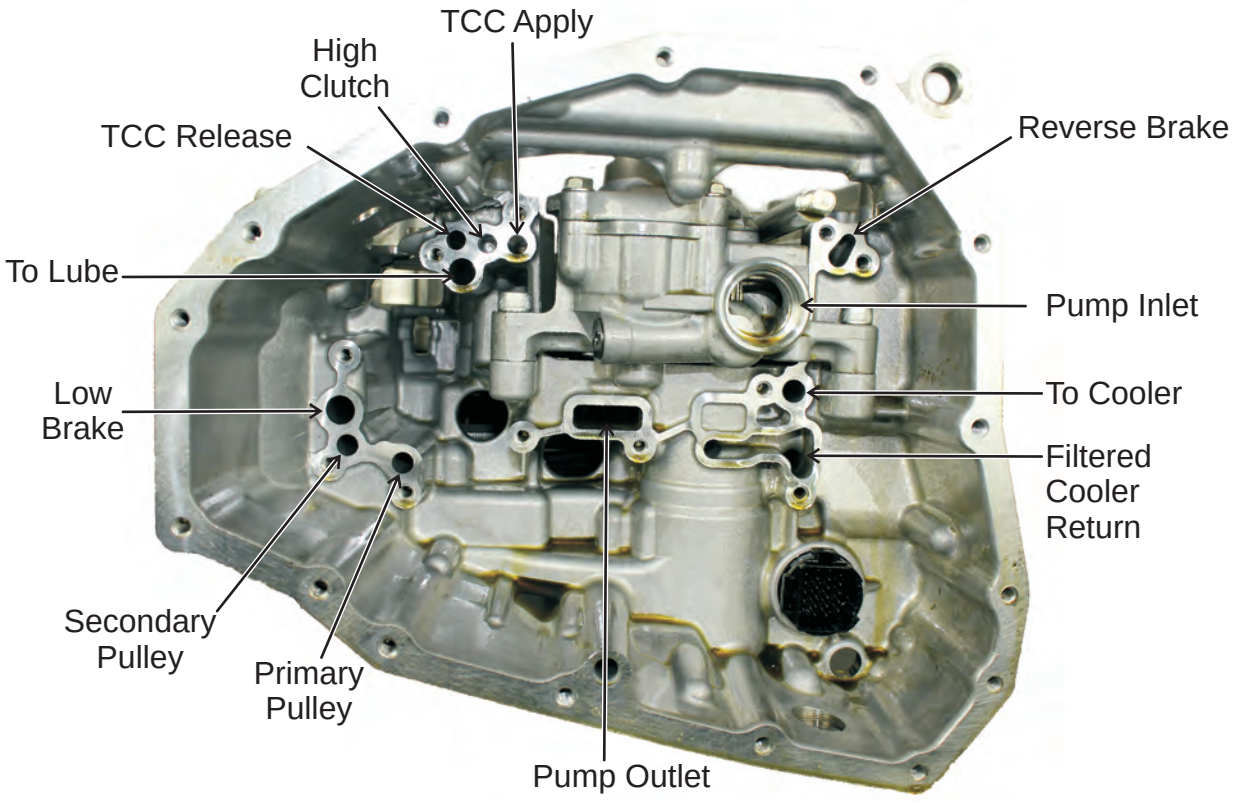


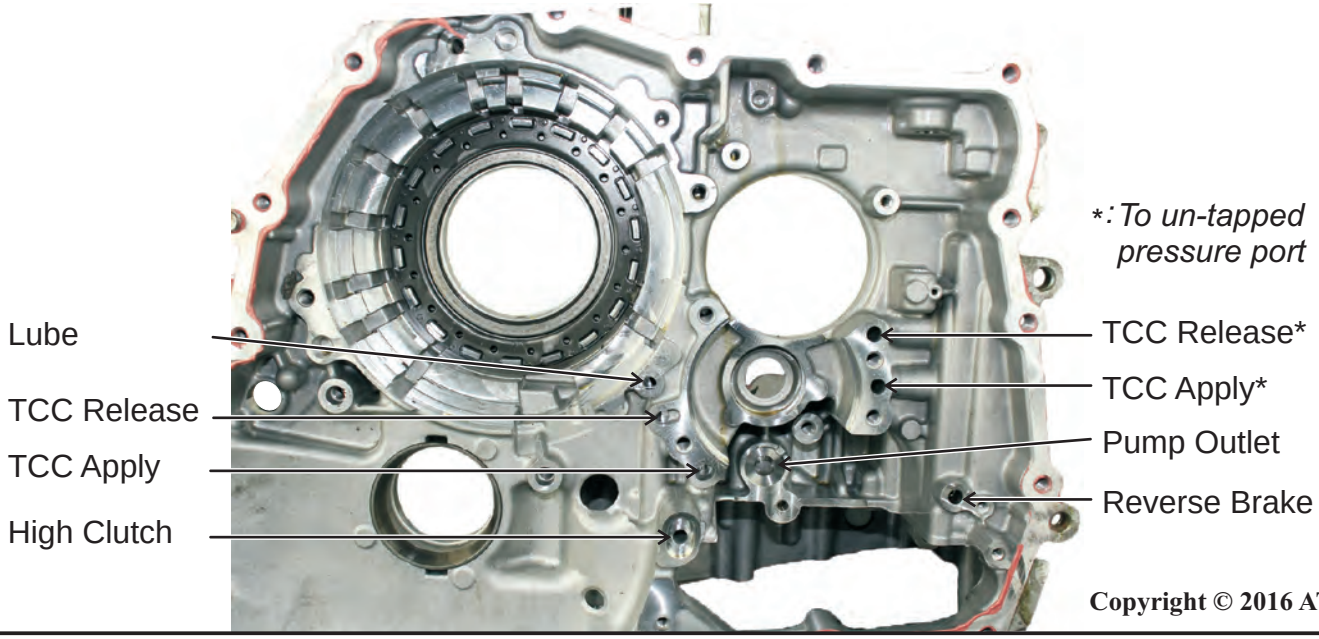
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Figure 7

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION



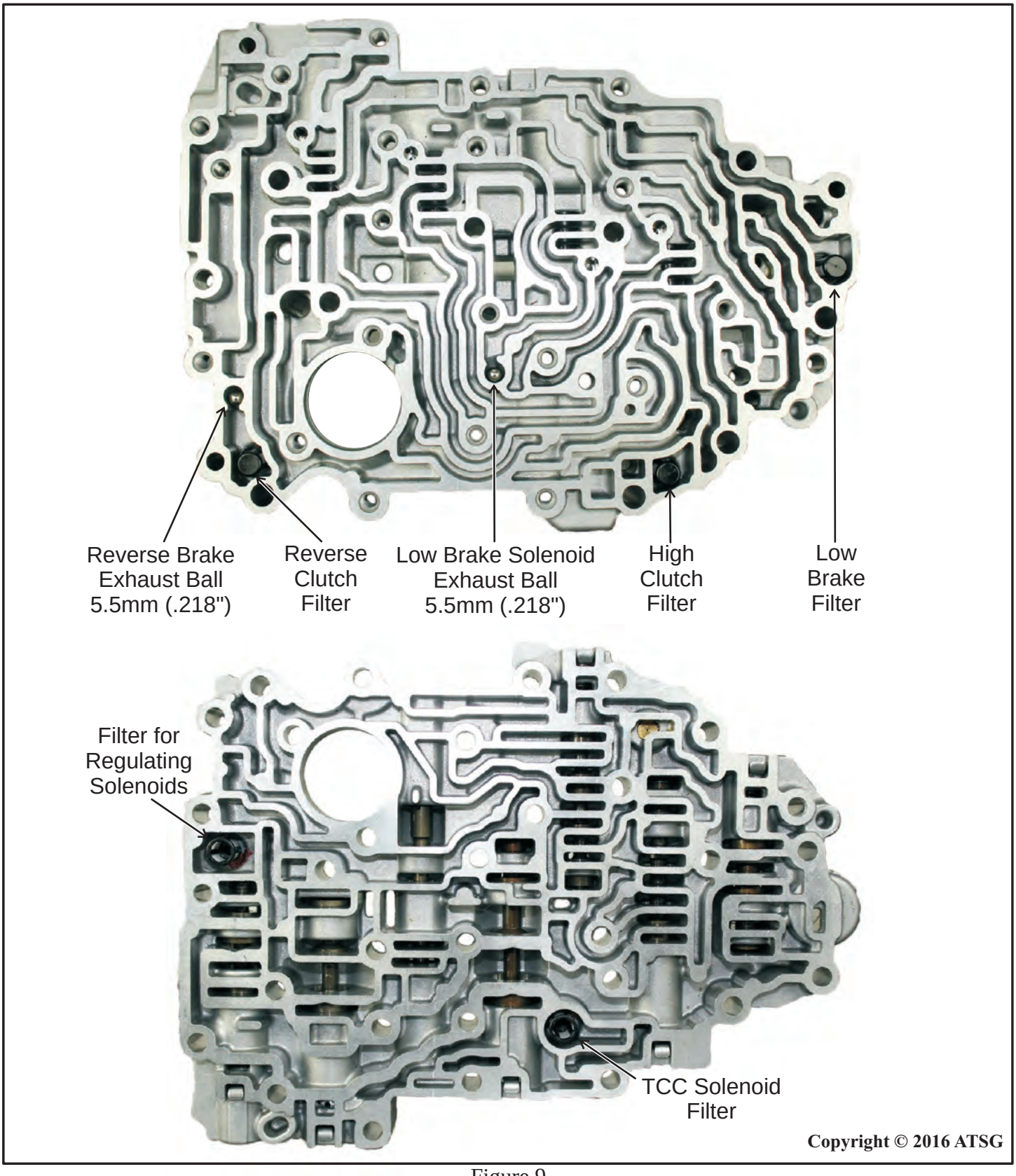


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Figure 8

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION

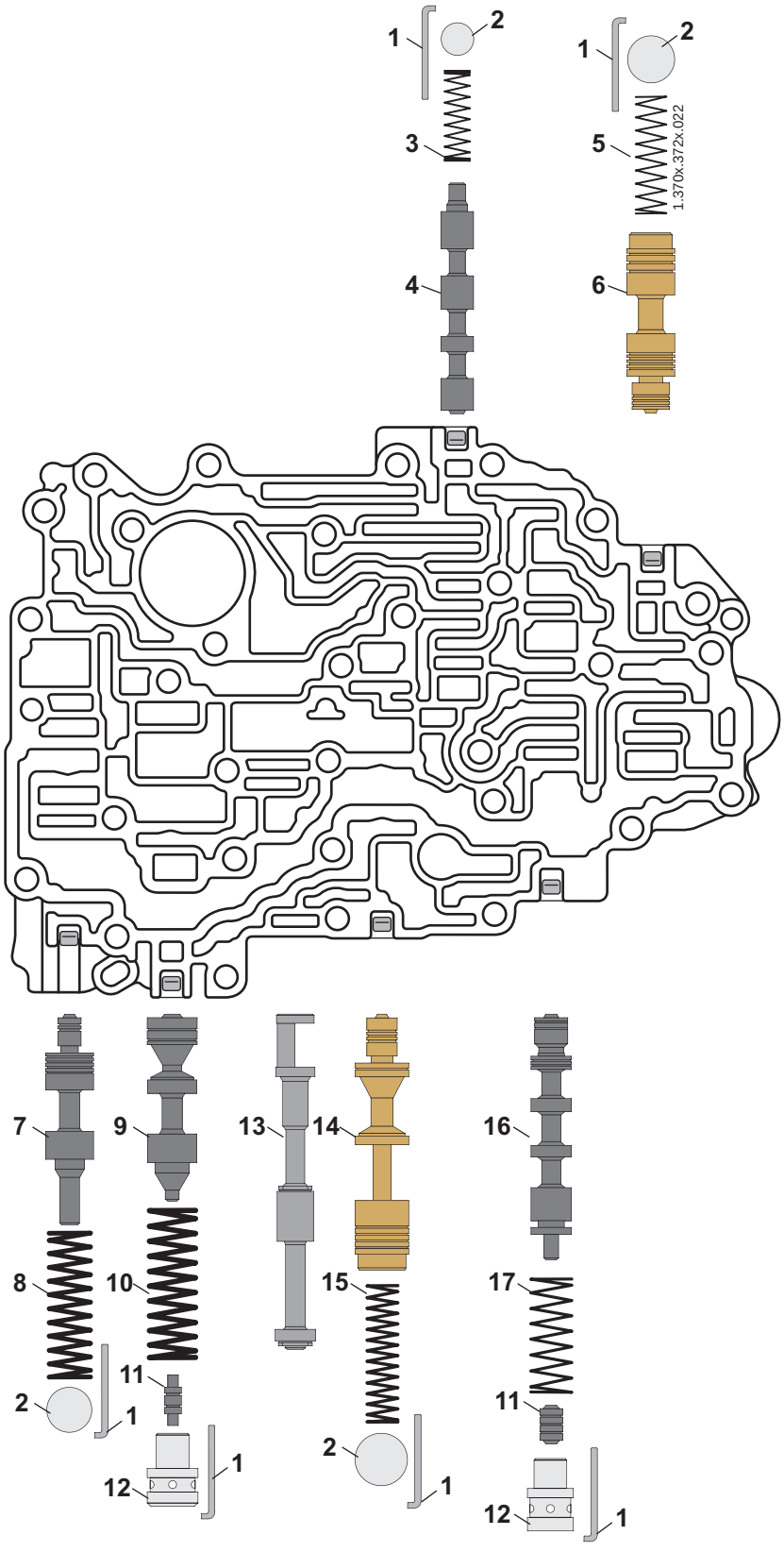


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Figure 9

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION



1. Retainer
2. Bore Plug
3. 1.064 x .319 x .022 x 11
4. Select Relay Valve
5. 1.370 x .372 x .022 x 11
6. Primary Pulley Reg. Valve
7. Solenoid Regulator Valve
8. 1.685 x .485 x .055 x 12
9. TCC Regulator Valve
10. 1.722x.540x.062 x 11
11. Boost Valve
12. Boost Valve Sleeve
13. Manual Valve
14. Secondary Pulley Reg. Valve
15. .595 x .360 x .038 x 14
16. TCC Control Valve
17. 1.325 x .480 x .035 x 9

Disclaimer: *Valve names provided by ATSG based on function. Names may change when O.E. information becomes available.*

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Figure 10

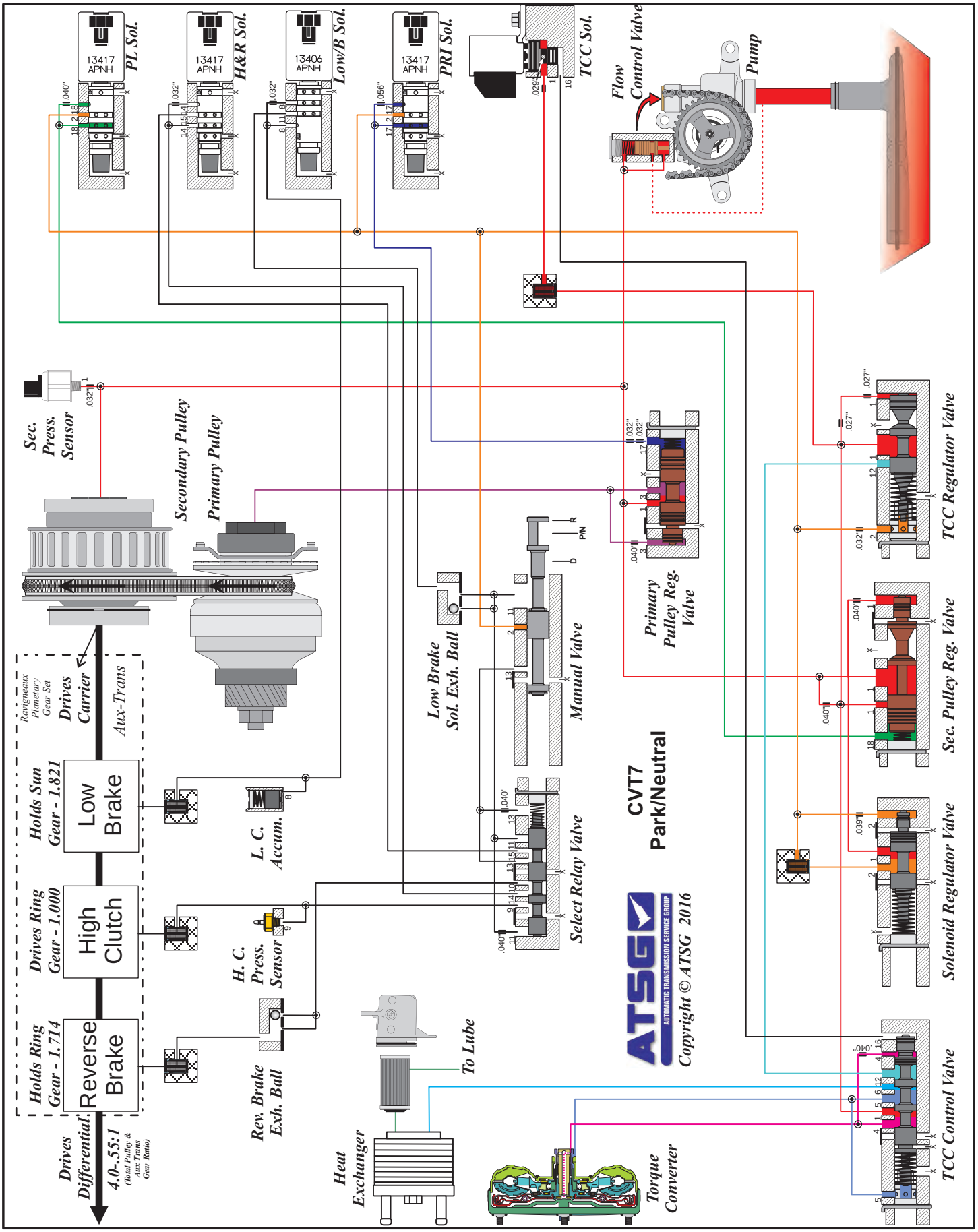


Figure 11

Automatic Transmission Service Group

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION

Fluid Fill Information

- Use only Genuine NISSAN CVT Fluid NS-3. Using transmission fluid other than Genuine NISSAN CVT Fluid NS-3 will damage the CVT, which is not covered by the (NISSAN new vehicle limited) warranty. ***Total fluid capacity - 6.9L (7 1/4 Quarts)***

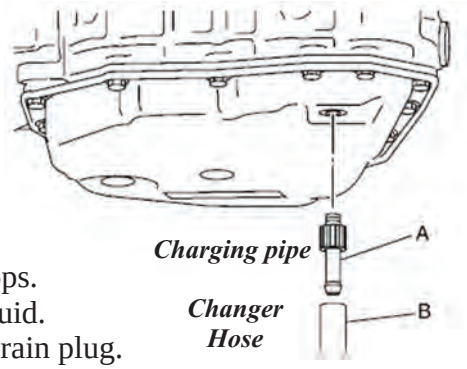
- Always use shop paper. Never use shop cloth.

- Replace a drain plug gasket with new ones at the final stage of the operation when installing.

- Use caution when looking into the drain hole as there is a risk of dripping fluid entering the eye.

- After replacement, always perform CVT fluid leakage check.

1. Select "Data Monitor" in "TRANSMISSION" using CONSULT.
2. Select "FLUID TEMP" and confirm that the CVT fluid temperature is 40°C (104°F) or less.
3. Check that the selector lever is in the "P" position, then completely engage the parking brake.
4. Lift up the vehicle.
5. Using a 19mm socket remove the drain plug. Using a 5mm allen socket, remove the overflow tube and drain the CVT fluid from the oil pan.
6. Install the charging pipe set (KV311039S0) (A) into the drain hole. Tighten the charging pipe by hand.
7. Install the ATF changer hose (B) to the charging pipe. Press the ATF changer hose all the way onto the charging pipe until it stops.
8. Fill approximately 3 liter (3-1/8 US qt, 2-5/8 Imp qt) of the CVT fluid.
9. Remove the ATF changer hose and charging pipe, then install the drain plug. NOTE: Perform this work quickly because CVT fluid leaks.
10. Lift down the vehicle.
11. Start the engine.
12. While depressing the brake pedal, shift the selector lever to the entire position from "P" to "L", and shift it to the "P" position. NOTE: Hold the lever at each position for 5 seconds.
13. Check that the CONSULT "Data monitor" in "FLUID TEMP" is 35°C (95°F) to 45°C (113°F).
14. Stop the engine.
15. Lift up the vehicle.
16. Remove the drain plug, and then drain CVT fluid from oil pan.
17. Repeat steps 6 to 16 (one time).
18. Install the overflow tube to 3.5 Nm.
19. Install the charging pipe set (KV311039S0) (A) into the drain hole. Tighten the charging pipe by hand.
20. Install the ATF changer hose (B) to the charging pipe. Press the ATF changer hose all the way onto the charging pipe until it stops.
21. Fill approximately 3 liter (3-1/8 US qt, 2-5/8 lmp qt) of the CVT fluid.
22. Remove the ATF changer hose and charging pipe, then install the drain plug. NOTE: Perform this work quickly because CVT fluid leaks.



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Figure 12

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION

Fluid Fill Information

23. Let down the vehicle.
24. Start the engine.
25. While depressing the brake pedal, shift the selector lever to the entire position from "P" to "L", and shift it to the "P" position. NOTE: Hold the lever at each position for 5 seconds.
26. Check that the CONSULT "Data monitor" in "FLUID TEMP" is 35°C (95°F) to 45°C (113°F).
27. Lift up the vehicle.
28. Remove the drain plug and confirm that the CVT fluid is drained from the overflow tube. Perform this work with the vehicle idling.
29. When the flow of CVT fluid slows to a drip, tighten the drain plug to 34.3 Nm.
30. Let down the vehicle.
31. Select "Work Support" in "TRANSMISSION" using CONSULT.
32. Select "CONFIRM CVTF DETERIORTN".
33. Touch "Erase".
34. Stop the engine.



Charging Pipe
Part # KV311039S0



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Figure 13

CVT 7 - JF015E/RE0F11A/F1CJB

INTRODUCTION

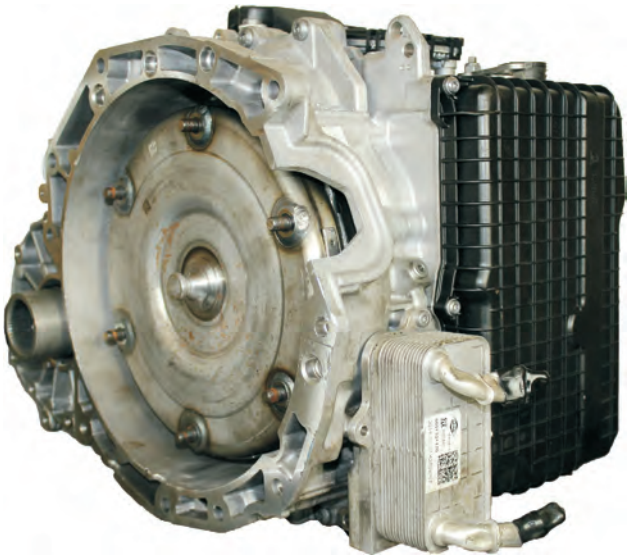
NISSAN DTC LIST

DTC	DESCRIPTION
DTC U0073	COMMUNICATION BUS A OFF
DTC U0100	LOST COMMUNICATION (ECM A)
DTC U0140	LOST COMMUNICATION (BCM)
DTC U0141	LOST COMMUNICATION (BCM A)
DTC U0155	LOST COMMUNICATION (IPC)
DTC U0300	CAN COMMUNICATION DATA
DTC U1000	CAN COMM CIRCUIT
DTC U1117	LOST COMMUNICATION (ABS)
DTC P062F	EEPROM
DTC P0705	TRANSMISSION RANGE SENSOR A
DTC P0706	TRANSMISSION RANGE SENSOR A
DTC P0711	TRANSMISSION FLUID TEMPERATURE SENSOR A (Performance)
DTC P0712	TRANSMISSION FLUID TEMPERATURE SENSOR A (Circuit Low)
DTC P0713	TRANSMISSION FLUID TEMPERATURE SENSOR A (Circuit High)
DTC P0715	INPUT SPEED SENSOR A
DTC P0720	OUTPUT SPEED SENSOR
DTC P0740	TORQUE CONVERTER (Circuit open or shorted to power)
DTC P0743	TORQUE CONVERTER (Circuit shorted to ground)
DTC P0744	TORQUE CONVERTER (Performance)
DTC P0746	PRESSURE CONTROL SOLENOID A (Performance)
DTC P0846	TRANSMISSION FLUID PRESSURE SEN/SW B (Performance)
DTC P0847	TRANSMISSION FLUID PRESSURE SEN/SW B (Circuit Low)
DTC P0848	TRANSMISSION FLUID PRESSURE SEN/SW B (Circuit High)
DTC P0863	TCM COMMUNICATION
DTC P0890	TCM
DTC P0962	PRESSURE CONTROL SOLENOID A (Circuit Low)
DTC P0963	PRESSURE CONTROL SOLENOID A (Circuit High)
DTC P0965	PRESSURE CONTROL SOLENOID B (Performance)
DTC P0966	PRESSURE CONTROL SOLENOID B (Circuit Low)
DTC P0967	PRESSURE CONTROL SOLENOID B (Circuit High)
DTC P0998	SHIFT SOLENOID F (Circuit Low)
DTC P0999	SHIFT SOLENOID F (Circuit High)
DTC P099B	SHIFT SOLENOID G (Circuit Low)
DTC P099C	SHIFT SOLENOID G (Circuit High)
DTC P1586	G SENSOR
DTC P1588	G SENSOR
DTC P2765	INPUT SPEED SENSOR B
DTC P2857	CLUTCH A PRESSURE (Sol. F Low Brake Apply Performance)
DTC P2858	CLUTCH B PRESSURE (Sol. G High Clutch Apply Performance)
DTC P2859	CLUTCH A PRESSURE (Sol. F Low Brake Release Performance)
DTC P285A	CLUTCH B PRESSURE (Sol. G High Clutch Release Performance)

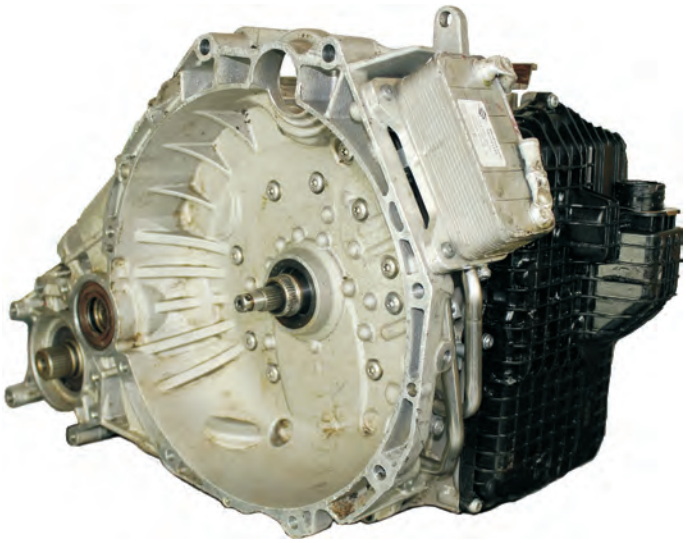
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Figure 14

ZF9HP48 - 948TE
PRELIMINARY INFORMATION



ZF9HP48



948TE

The ZF9HP48 - 948TE automatic transmission is a 9 speed, electronically controlled unit manufactured by ZF. The transmission represents the latest in automatic transmission technology for a transverse, AWD (all-wheel drive) unit. ZF describes the ZF 9HP48 transmission as having the following features:

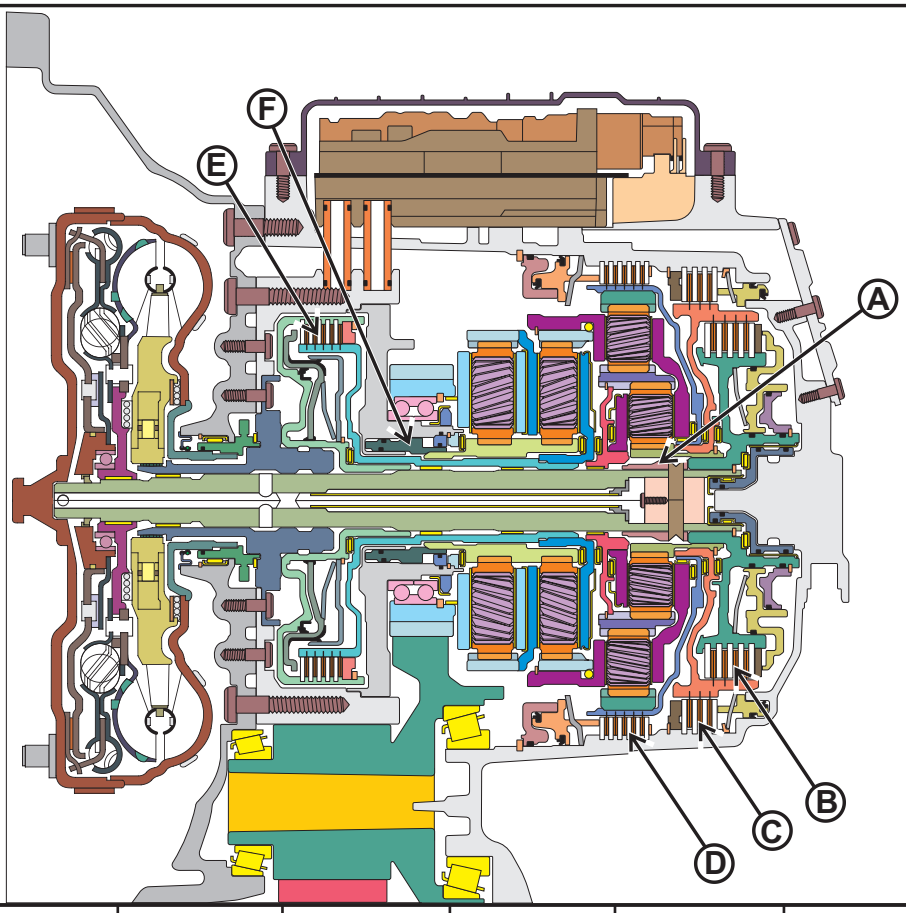
· Designed to be maintenance free
· Transmission fluid is fill for life
· The TCC strategy has a controlled slip feature with electronically regulated lock-up control on gears 1 to 9
· Planetary gearset with 9 speeds, 4 planetary geartrains, and 6 shift elements
· Wide transmission ratio spread with small ratio steps
· The first-ever use of interlocking dog clutches in a passenger car automatic transmission
· Shift programs controlled by the TCM (transmission control module)
· TCM (transmission control module) has an adaptive capability to ensure efficient gear shift quality throughout the service life of the transmission
· Diagnostics available from the TCM (transmission control module) via the high speed CAN (controller area network) Powertrain systems bus.

This transmission will be found in the following Global applications:
Acura TLX and MDX, Chrysler 200, Fiat Doblò, Fiat 500X, Honda CR-V, Jeep Cherokee (KL), Jeep Renegade, Ram ProMaster City, Range Rover Evoque, Land Rover Discovery Sport.

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Omega - 99

COMPONENT APPLICATION CHART



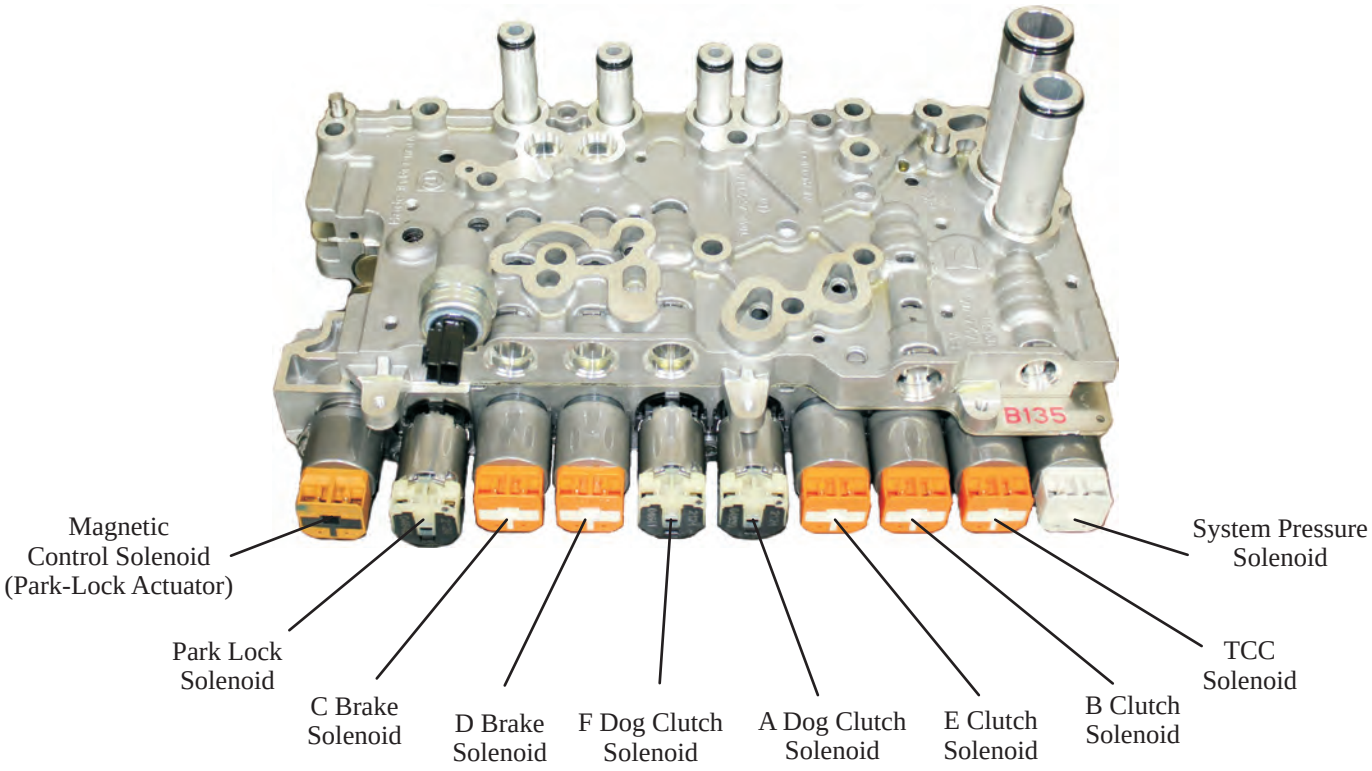
	A Clutch (Dog)***	B Clutch	C Brake	D Brake	E Clutch	F Clutch (Dog)***	Ratio
P/N	Open			ON		Closed	
Reverse	Open	ON		ON		Closed	**3.830**
1st Gear	Closed			ON		Closed	**4.713**
2nd Gear	Closed		ON			Closed	**2.842**
3rd Gear*	Closed	ON				Closed	**1.909**
4th Gear**	Closed				ON	Closed	**1.382**
5th Gear	Closed	ON			ON	Open	**1.000**
6th Gear	Closed		ON		ON	Open	**0.808**
7th Gear	Closed			ON	ON	Open	**0.699**
8th Gear	Open		ON	ON	ON	Open	**0.580**
9th Gear	Open	ON		ON	ON	Open	**0.479**

** - Failsafe Gear according to Land Rover*
*** - Default Gear according to Dodge*
**** - Dog Clutch shift transitions dependent upon proper engine and shaft speed*

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Figure 1

SOLENOID IDENTIFICATION AND APPLICATION CHART

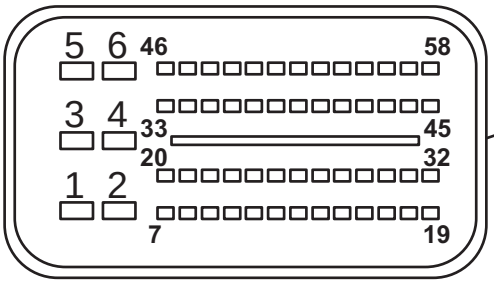


	A Sol.	B Sol.	C Sol.	D Sol.	E Sol.	F Sol.	TCC Sol.	Press. Sol.	Pk/Lk Act.	Pk/Lk Sol.
Park								Mod.		
Reverse		X		X		X		Mod.	X	X
Neutral						X		Mod.	X	X
1st Gear	X			X		X	Mod.	Mod.	X	X
2nd Gear	X		X			X	Mod.	Mod.	X	X
3rd Gear	X	X				X	Mod.	Mod.	X	X
4th Gear	X				X	X	Mod.	Mod.	X	X
5th Gear	X	X			X		Mod.	Mod.	X	X
6th Gear	X		X		X		Mod.	Mod.	X	X
7th Gear	X			X	X		Mod.	Mod.	X	X
8th Gear			X	X	X		Mod.	Mod.	X	X
9th Gear		X		X	X		Mod.	Mod.	X	X

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Figure 2

TCM PIN IDENTIFICATION



948TE



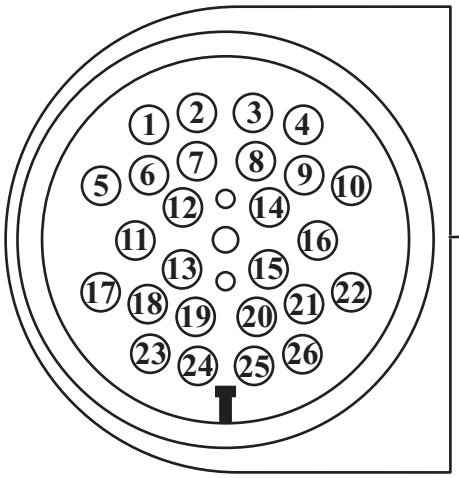
Transmission Control Module Pin Assignments

PIN #	NAME	SIGNAL DESCRIPTION
1 & 2	Z904 & Z909	Control module ground
3	T78	System voltage supply to all pressure regulating solenoids
5	A190	Control module supply voltage (Fused +)
6	T118	System voltage supply to all ON/OFF solenoids
8	T917	PRNDL Switch return (ground)
9	F1	Ignition OFF/RUN/START control output
10	T376	5 V Supply to the Oil Pressure Sensor (A & F Dog Clutch Release Pressure)
11	T41	TRS T41 Signal
12	T69	9 Volts supply for the Park Pawl Sensor and Input and Output speed sensors
13	T3	TRS T43 Signal
14	T42	TRS T42 Signal
15	T1	TRS T1 Signal
17	T54	ATF temperature sensor signal
19	T377	Oil Pressure Sensor Signal (A & F Dog Clutch Release Pressure)
30	T820	ATF temperature sensor ground
31	T52	Input Speed Signal
34	D29	CAN C +
35	T803	Hydraulic Park Lock Solenoid
36	T802	Dog Clutch "F" Solenoid
38	T801	Dog Clutch "A" Solenoid
39	T792	Pressure Control Solenoid - TCC
40	T818	Pressure Control Solenoid D
43	T14	Output Speed Signal
47	D30	CAN C -
51	T800	Mechanical Park Lock Solenoid
52	T812	Pressure Control Solenoid - Line Pressure
53	T790	Pressure Control Solenoid E
54	T814	Pressure Control Solenoid B
55	T816	Pressure Control Solenoid C

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Figure 3

948TE





Transmission Pin Assignments

PIN #	NAME	SIGNAL DESCRIPTION
1	T78	System voltage supply to all pressure regulating solenoids
2	T801	Dog Clutch "A" Solenoid
3	T814	Pressure Control Solenoid "B" - B Clutch Control
4	T118	System voltage supply to all ON/OFF solenoids
5	T816	Pressure Control Solenoid "C" - C Brake Clutch Control
6	T818	Pressure Control Solenoid "D" - D Brake Clutch Control
7	T790	Pressure Control Solenoid "E" - E Clutch Control
8	T802	Dog Clutch "F" Solenoid
9	T812	Pressure Control Solenoid - Line Pressure
10	T792	Pressure Control Solenoid - TCC
11	T803	Hydraulic Park Lock Solenoid
12	T800	Mechanical Park Lock Solenoid
15	T376	5 V Supply to the Oil Pressure Sensor (A & F Dog Clutch Release Pressure)
16	T377	Oil Pressure Sensor Signal (A & F Dog Clutch Release Pressure)
17	T917	PRNDL Switch return (ground)
18	T1	TRS T1 Signal
19	T3	TRS T3 Signal
20	T42	TRS T42 Signal
21	T41	TRS T41 Signal
22	T14	Output Speed Signal
23	T52	Input Speed Signal
24	T69	9 Volts supply for the Park Pawl Sensor and Input and Output speed sensors
25	T820	ATF temperature sensor ground
26	T54	ATF temperature sensor signal

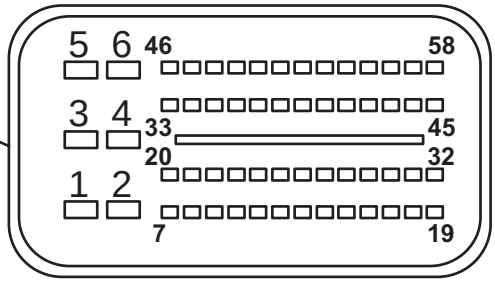
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Figure 4

ZF9HP48



TCM PIN IDENTIFICATION



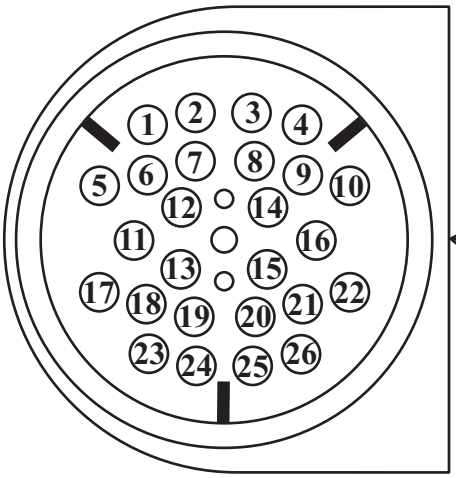
Transmission Control Module Pin Assignments

PIN #	NAME	SIGNAL DESCRIPTION
1	Ground	Control module ground
3	UDRMV1	Common voltage feed to electronic pressure regulating solenoids
5	Battery (KL30)	Control module supply voltage
6	UDRMV2	Common voltage feed to solenoid valves
8	Sensor GND	Sensor electrical ground
9	IG (KL15)	Ignition status
10	VS_5V	Sensor supply voltage (5 Volts)
12	VS_9V	Sensor supply voltage (9 Volts)
13	L3	Park position sensor (In)
15	L4	Park position sensor (Out)
17	T_Oil+	ATF temperature sensor + connection
19	Vout_Pr	Pressure sensor output voltage
30	T_Oul-	ATF temperature sensor - connection
31	N_T	Input shaft speed sensor
34	CAN0-high	High side connection for high speed controller area network powertrain bus
35	Out8	Park solenoid valve - controls parl lock pawl position hydraulically
36	Out7	Solenoid valve "F" controls dog clutch "F"
38	Out6	Solenoid valve "A" controls dog clutch "A"
39	Out4	Electronic pressure regulating solenoid - torque converter clutch
40	Out2	Electronic pressure regulating solenoid "D" - control brake "D"
43	N_OUT	Output shaft speed sensor
47	CAN0-low	Low side connection for high speed controller area network powertrain bus
48	P-Signal (HSS)	Park confirmed signal
51	Out9	Park solenoid magnet - controls parl lock pawl position mechanically
52	Out5	Electronic pressure regulating solenoid - system pressure
53	Out3	Electronic pressure regulating solenoid "E" - control clutch "E"
54	Out0	Electronic pressure regulating solenoid "B" - control clutch "B"
55	Out1	Electronic pressure regulating solenoid "C" - control brake "C"

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Figure 5

ZF9HP48





Transmission Pin Assignments

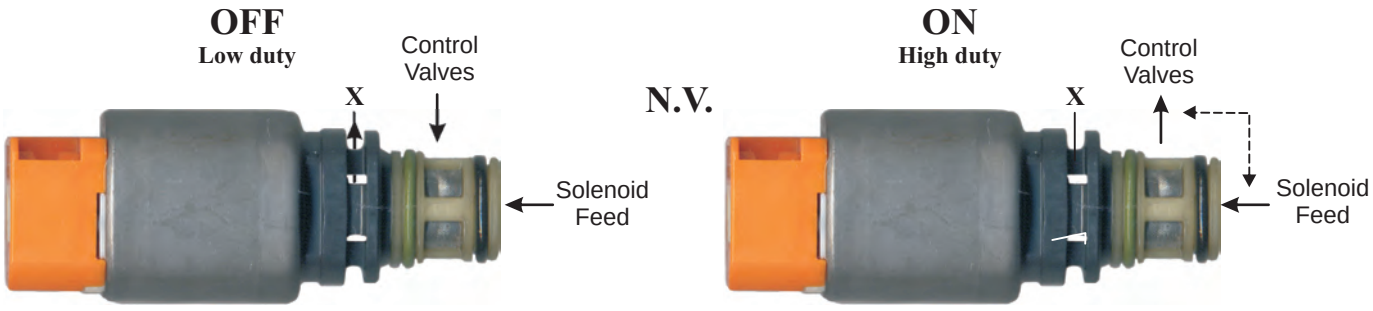
PIN #	NAME	SIGNAL DESCRIPTION
1	UDRMV1	Common voltage feed to electronic pressure regulating solenoids
2	Out6	Solenoid valve "A" controls dog clutch "A"
3	Out0	Electronic pressure regulating solenoid "B" controls clutch "B"
4	UDRMV2	Common voltage feed to solenoid valves
5	Out1	Electronic pressure regulating solenoid "C" controls brake "C"
6	Out2	Electronic pressure regulating solenoid "D" controls brake "D"
7	Out3	Electronic pressure regulating solenoid "E" controls clutch "E"
8	Out7	Solenoid valve "F" controls dog clutch "F"
9	Out5	Electronic pressure system solenoid - system pressure
10	Out4	Electronic pressure system solenoid - torque converter clutch
11	Out8	Park solenoid valve - controls park lock pawl position hydraulically
12	Out9	Park solenoid magnet - controls park lock pawl position mechanically
15	VS_5V	Sensor supply voltage (5 volts)
16	Vout_Pr	Pressure sensor output voltage
17	Sensor GND	Sensor electrical ground
18	L4	Park position sensor (Out)
19	L3	Park position sensor (In)
22	N_OUT	Output shaft speed sensor
23	N_T	Turbine speed sensor (input shaft speed)
24	VS_9V	Sensor supply voltage (9 Volts)
25	T_Oil-	ATF temperature sensor - connection
26	T_Oil+	ATF temperature sensor + connection

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Figure 6

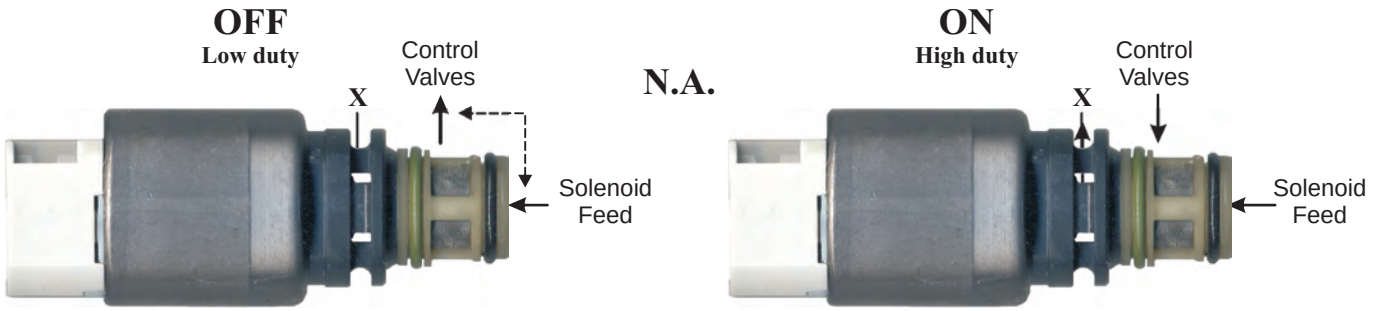
ZF9HP48 - 948TE SHIFT SOLENOID CHECKS

B, C, D, E & TC CLUTCH PRESSURE CONTROL SOLENOIDS



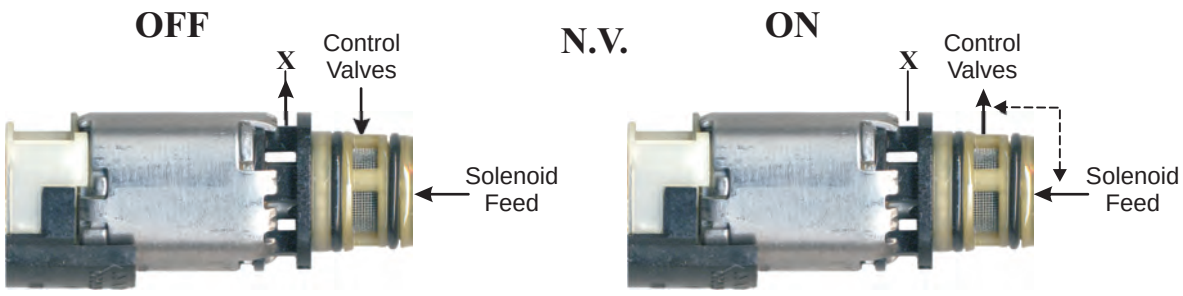
B, C, D, E and TC Clutch solenoids are Normally Vented variable Pressure Control Solenoids. When the solenoids are OFF, or at Low Duty cycle, pressure from the valves they are in control of is connected to the exhaust. When the Solenoids are ON, or at High Duty cycle, Solenoid Feed is connected thru the Solenoid to the valves they are in control of.

SYSTEM PRESSURE CONTROL SOLENOID



The System Pressure Control (LP) is a Normally Applied variable Pressure Control Solenoid. When the Solenoid is OFF, or at Low Duty cycle, Solenoid Feed is connected thru the Solenoid to the valves it is in control of. When the solenoid is ON, or at High Duty cycle, pressure from the valves it is in control of is connected to the exhaust.

DOG CLUTCH A, F & PARK LOCK ON/OFF SOLENOID



Dog clutch A, F and Park Lock Solenoids are a Normally Vented On/Off type solenoid. When the Solenoid is OFF, pressure from the valves it is in control of is connected to the exhaust. When the solenoid turns ON, Solenoid Feed is connected thru the Solenoid to the valves they are in control of.

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Figure 7

ZF9HP48 - 948TE SHIFT SOLENOID CHECKS

B, C, D, E & TC CLUTCH PRESSURE CONTROL SOLENOIDS

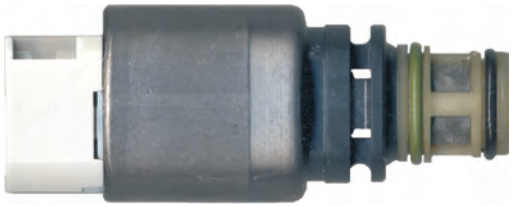
Resistance
Value 5-6 Ohms
20°C (68°F)



Solenoid Output
Pressure Specs.
Off- 0psi/bar
On- 68.17psi
4.7 bars

SYSTEM PRESSURE CONTROL SOLENOID

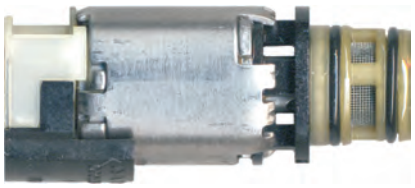
Resistance
Value 5-6 Ohms
20°C (68°F)



Solenoid Output
Pressure Specs.
Off- 68.17psi
4.7 bars
On- 0psi/bar

DOG CLUTCH A, F & PARK RELEASE ON/OFF SOLENOID

Resistance
Value 10-12 Ohms
20°C (68°F)

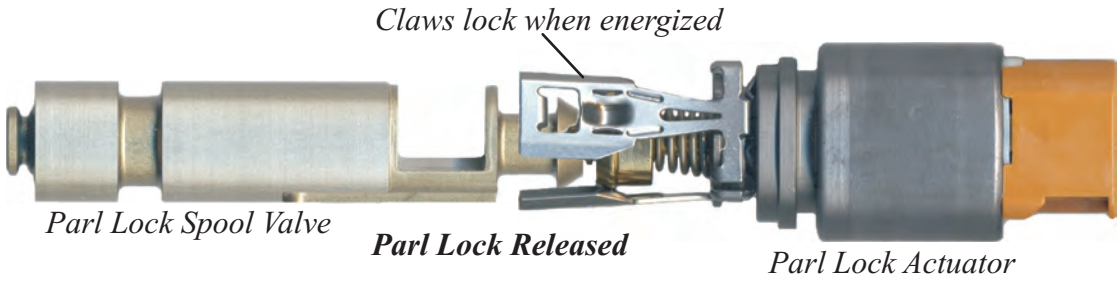


ON/OFF
Type
Solenoid

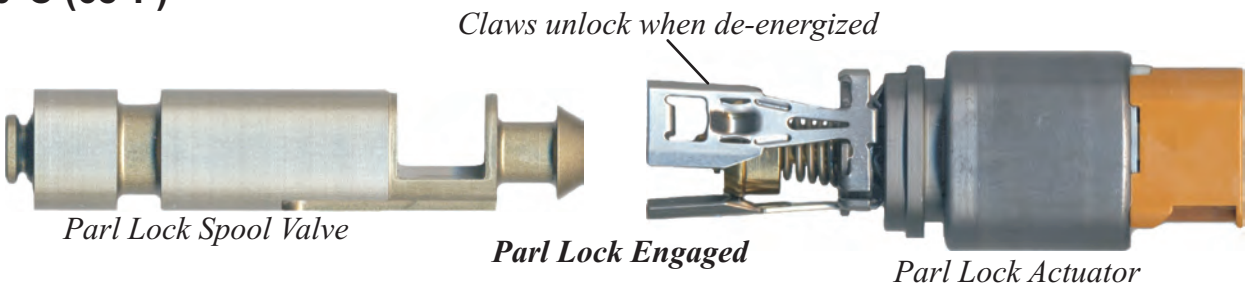
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Figure 8

ZF9HP48 - 948TE SHIFT SOLENOID CHECKS



Resistance Value 25 Ohms 20°C (68°F)



A control solenoid called the Park Lock Actuator is located in the valve block. The solenoid is controlled by the TCM (transmission control module) and converts electrical signals into hydraulic control signals to control the electronic park lock function.

The control solenoid is an on/off solenoid which is controlled by the TCM (transmission control module) by switching the solenoid to earth.

When the Park lock is to be released, the park lock solenoid valve sends ATF (automatic transmission fluid) pressure to the spool valve and moves it into contact with the claws of the solenoid. Movement of the spool valve moves the park rod and releases the park pawl from the park interlock gear. The control solenoid is energized by the TCM (transmission control module) and the claws close to retain the spool valve in the unlocked position. A shuttle valve retains ATF (automatic transmission fluid) pressure on the spool to prevent inadvertent park lock operation in the event of an electrical failure until the engine is stopped.

When the Park lock is to be engaged, ATF (automatic transmission fluid) pressure is released from the spool valve and the TCM (transmission control module) de-energises the control solenoid. The claws are released, the spool valve returns under spring pressure to the park lock position and the park lock is engaged. A Service Park Release (SPR) procedure must be performed to release the parking lock manually if an electrical failure occurs or the engine is not running.

To allow the vehicle to roll through a car wash, the control solenoid remains energized if the engine is stopped with the TCS (transmission control switch) in neutral. This holds the transmission out of park without hydraulic pressure for 10 minutes. After this time the control solenoid is de-energised, releasing the claws and allowing the spool valve to return to the park position.

The resistance of the solenoid coil winding is 25 Ohms at 20 °C (68 °F).

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Figure 9

SERVICE PARK RELEASE

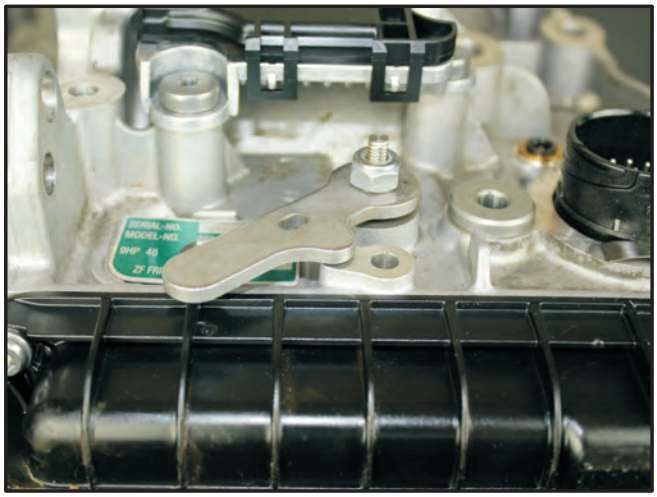


Service Park Applied

948TE



Service Park Released



Service Park Applied

ZF8HP48



Service Park Released

948TE (MPR) - *Park by wire applications*

Dodge/Chrysler vehicles utilize an emergency Manual Park Release Lever to disengage Park should power be lost. On the bench, the lever can be flipped and bolted down to service the valve body assembly.

ZF8HP48 Land Rover Service Park Release (SPR) - *Park by wire applications*

The SPR is a mechanical procedure which requires removal of the air filter housing for access. The procedure is required when there has been a loss of vehicle electrical power or a failure to the automatic transmission preventing release of the park lock. The following procedure must be used to release the park lock before moving the vehicle. The vehicle must be held by either the electric park brake or wheel chocks to prevent it unintentionally moving when the park lock is released.

1. Make sure that the ignition is off.
2. Remove the air filter assembly to get access to the SPR lever on the automatic transmission
3. ZF8HP48 - Rotate the SPR lever in a counter clockwise direction until the slot in the SPR lever aligns with a corresponding hole in the transmission's casing. Hold the SPR lever in this position and insert a suitable 5mm diameter locking pin through the slot in the SPR lever and into the hole in the transmission's casing. The vehicle can now be moved.

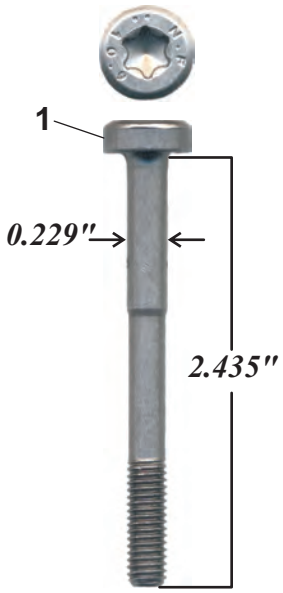
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Figure 10

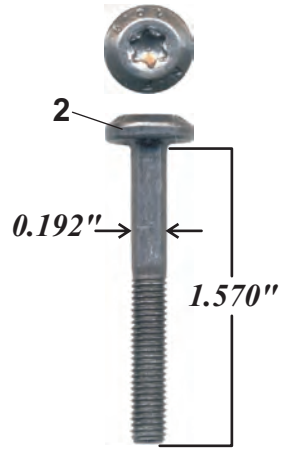
VALVE BODY CIRCUIT IDENTIFICATION

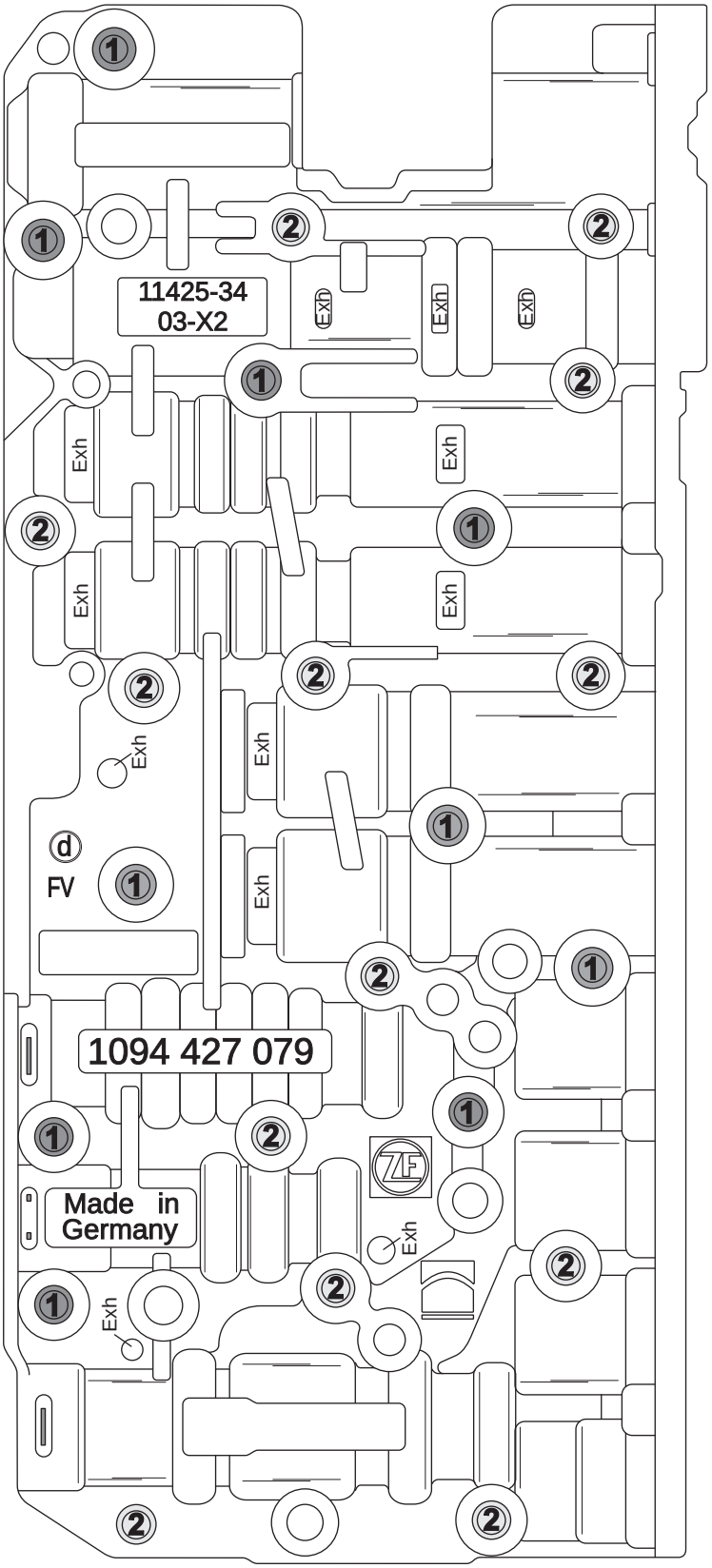
Outer Valve Body Housing Upper Side

#40 Torx



#27 Torx





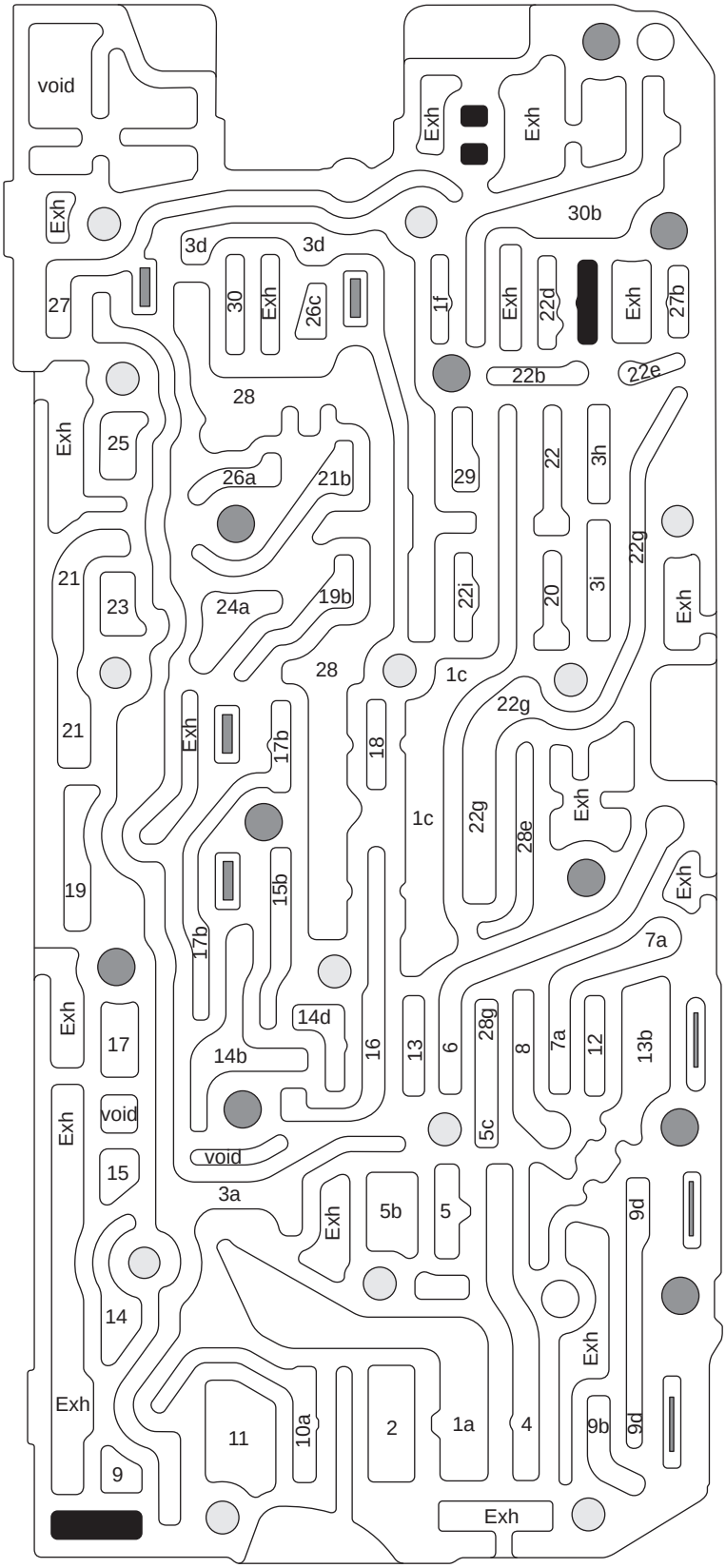
1 Valve Body to Case Bolt - M6x62 [8Nm/71in.Lb.] (10)
2 Outer to Inner Valve Body Bolt - M5x40 [6Nm/53in.Lb.] (13)

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Figure 11

VALVE BODY CIRCUIT IDENTIFICATION

Outer Valve Body Housing Inner Side



Hydraulic Circuit Legend

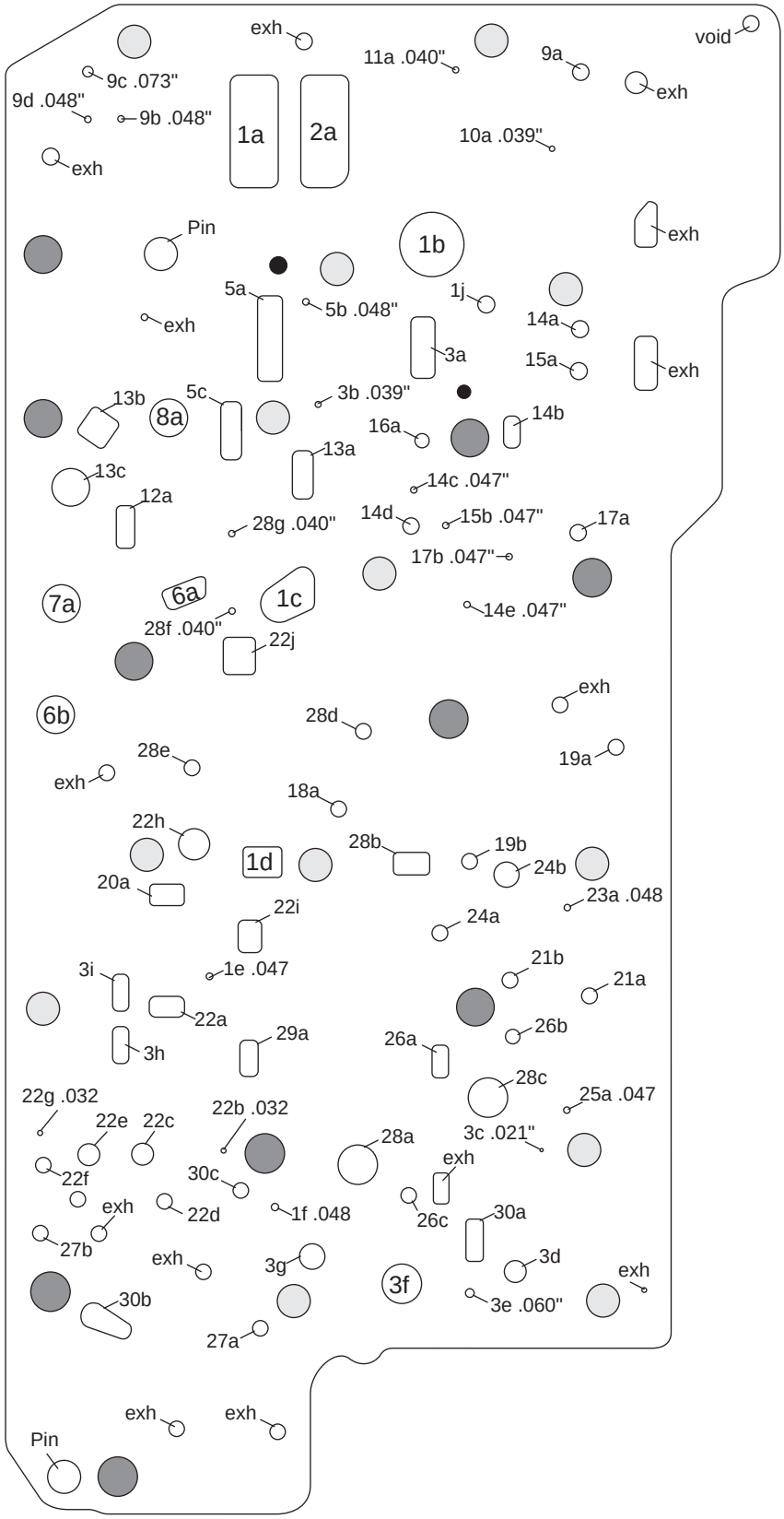
1 System Pressure Circuit
2 Pump Return Circuit
3 Solenoid Feed Pressure Circuit
4 Lubrication Valve Feed Circuit
5 Pre-fill/Converter Circuit
6 TCC Release Pressure Circuit
7 TCC Apply Pressure Circuit
8 To Heat Exchanger Circuit
9 Pressure System Solenoid Circuit (EPC)
10 Shift Valve-System Pressure Circuit (SV-SP)
11 System Pressure Valve Exhaust Circuit
12 TCC Circuit
13 TCC Exhaust Circuit
14 TCC Solenoid Circuit
15 B Clutch Solenoid Circuit
16 B Clutch Apply Circuit
17 E Clutch Solenoid Circuit
18 E Clutch Apply Circuit
19 A (Dog) Clutch Solenoid Circuit
20 A (Dog) Clutch Release Circuit
21 F (Dog) Clutch Solenoid Circuit
22 F (Dog) Clutch Release/
A (Dog) Clutch Apply Circuit
23 D Brake Solenoid Circuit
24 D Brake Apply Circuit
25 C Brake Solenoid Circuit
26 C Brake Apply Circuit
27 Park Control Solenoid Circuit
28 Pre-fill Pressure Circuit (B, C, D & E)
29 F (Dog) Clutch Apply Circuit
30 Park Cylinder Circuit (PCYL)

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Figure 12

VALVE BODY CIRCUIT IDENTIFICATION

Spacer Plate



Hydraulic Circuit Legend

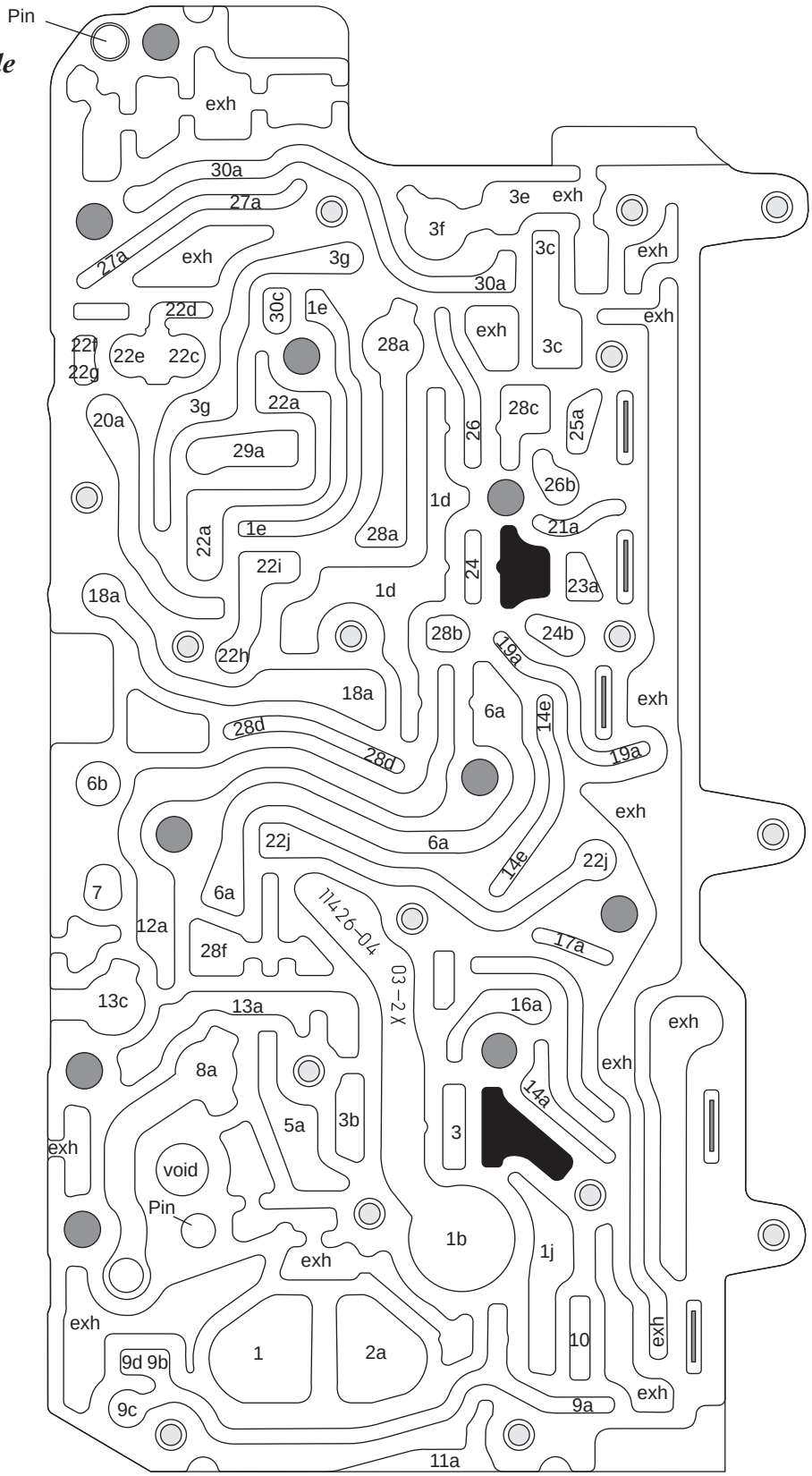
1 System Pressure Circuit
2 Pump Return Circuit
3 Solenoid Feed Pressure Circuit
4 Lubrication Valve Feed Circuit
5 Pre-fill/Converter Circuit
6 TCC Release Pressure Circuit
7 TCC Apply Pressure Circuit
8 To Heat Exchanger Circuit
9 Pressure System Solenoid Circuit (EPC)
10 Shift Valve-System Pressure Circuit (SV-SP)
11 System Pressure Valve Exhaust Circuit
12 TCC Circuit
13 TCC Exhaust Circuit
14 TCC Solenoid Circuit
15 B Clutch Solenoid Circuit
16 B Clutch Apply Circuit
17 E Clutch Solenoid Circuit
18 E Clutch Apply Circuit
19 A (Dog) Clutch Solenoid Circuit
20 A (Dog) Clutch Apply Circuit
21 F (Dog) Clutch Solenoid Circuit
22 F (Dog) Clutch Release/
A (Dog) Clutch Apply Circuit
23 D Brake Solenoid Circuit
24 D Brake Apply Circuit
25 C Brake Solenoid Circuit
26 C Brake Apply Circuit
27 Park Control Solenoid Circuit
28 Pre-fill Pressure Circuit (B, C, D & E)
29 F (Dog) Clutch Apply Circuit
30 Park Cylinder Circuit (PCYL)

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Figure 13

VALVE BODY CIRCUIT IDENTIFICATION

Inner Valve Body Housing Upper Side



Hydraulic Circuit Legend

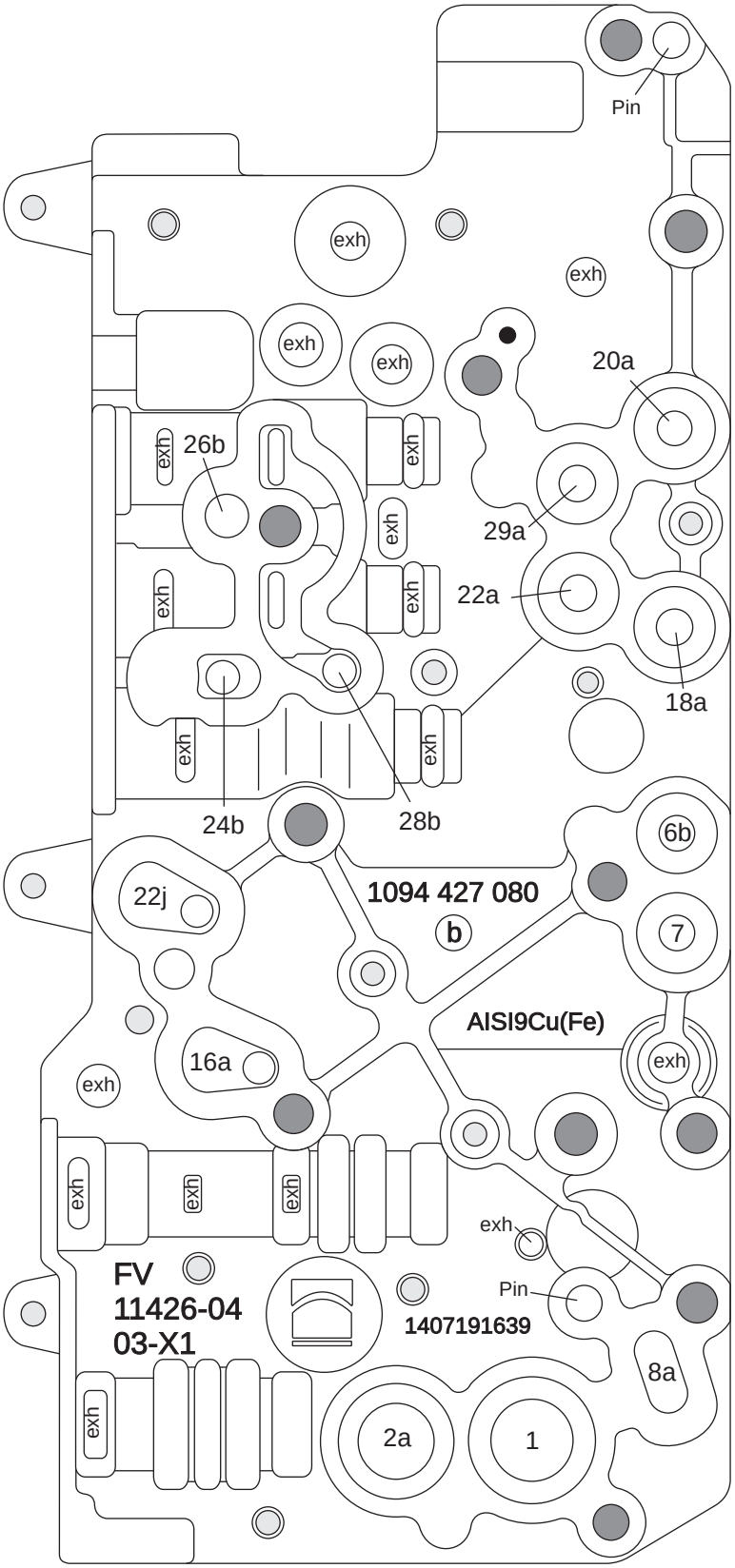
1 System Pressure Circuit
2 Pump Return Circuit
3 Solenoid Feed Pressure Circuit
4 Lubrication Valve Feed Circuit
5 Pre-fill/Converter Circuit
6 TCC Release Pressure Circuit
7 TCC Apply Pressure Circuit
8 To Heat Exchanger Circuit
9 Pressure System Solenoid Circuit (EPC)
10 Shift Valve-System Pressure Circuit (SV-SP)
11 System Pressure Valve Exhaust Circuit
12 TCC Circuit
13 TCC Exhaust Circuit
14 TCC Solenoid Circuit
15 B Clutch Solenoid Circuit
16 B Clutch Apply Circuit
17 E Clutch Solenoid Circuit
18 E Clutch Apply Circuit
19 A (Dog) Clutch Solenoid Circuit
20 A (Dog) Clutch Apply Circuit
21 F (Dog) Clutch Solenoid Circuit
22 F (Dog) Clutch Release/
A (Dog) Clutch Apply Circuit
23 D Brake Solenoid Circuit
24 D Brake Apply Circuit
25 C Brake Solenoid Circuit
26 C Brake Apply Circuit
27 Park Control Solenoid Circuit
28 Pre-fill Pressure Circuit (B, C, D & E)
29 F (Dog) Clutch Apply Circuit
30 Park Cylinder Circuit (PCYL)

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Figure 14

VALVE BODY CIRCUIT IDENTIFICATION

Inner Valve Body Housing Case Side



Hydraulic Circuit Legend

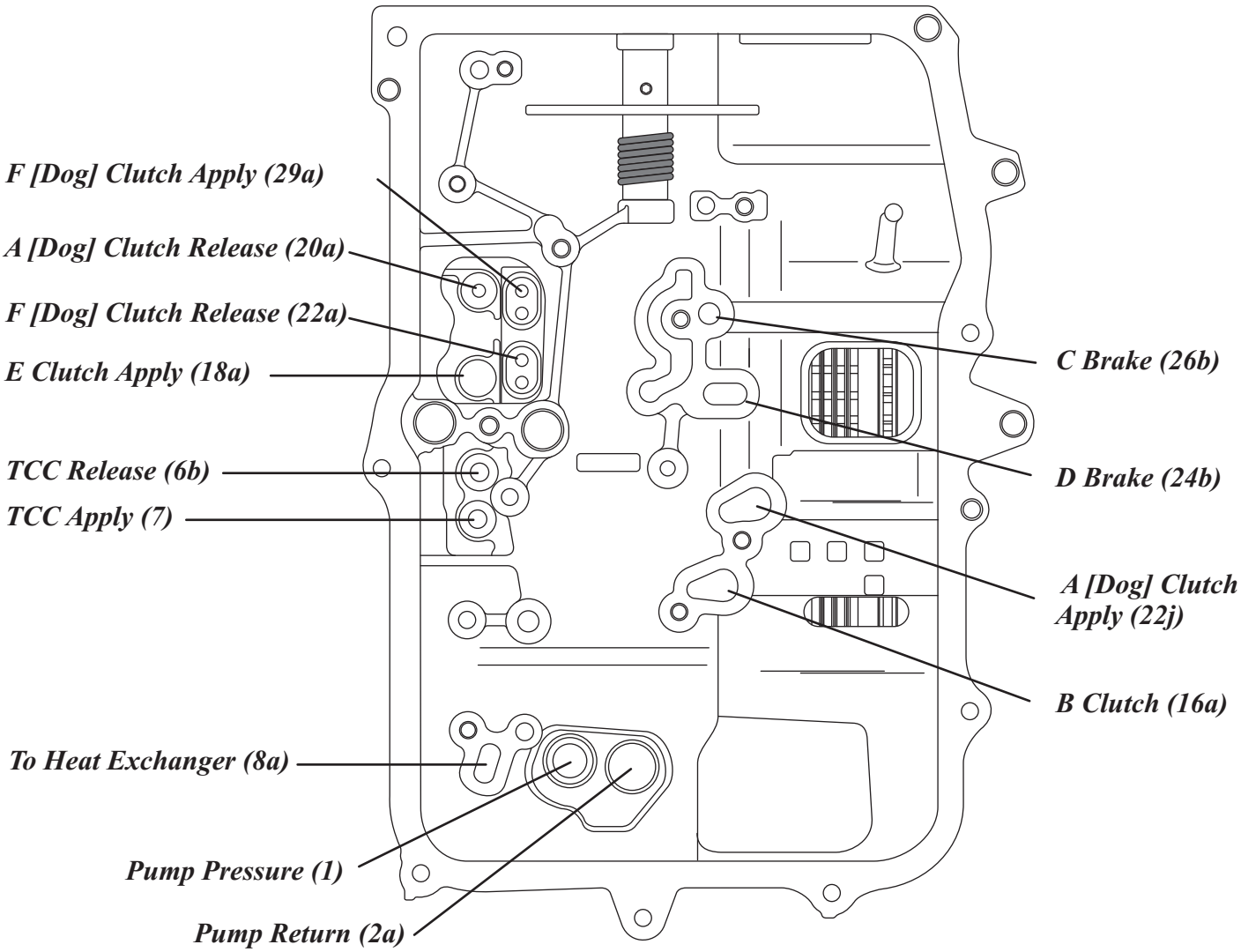
1 System Pressure Circuit
2 Pump Return Circuit
3 Solenoid Feed Pressure Circuit
4 Lubrication Valve Feed Circuit
5 Pre-fill/Converter Circuit
6 TCC Release Pressure Circuit
7 TCC Apply Pressure Circuit
8 To Heat Exchanger Circuit
9 Pressure System Solenoid Circuit (EPC)
10 Shift Valve-System Pressure Circuit (SV-SP)
11 System Pressure Valve Exhaust Circuit
12 TCC Circuit
13 TCC Exhaust Circuit
14 TCC Solenoid Circuit
15 B Clutch Solenoid Circuit
16 B Clutch Apply Circuit
17 E Clutch Solenoid Circuit
18 E Clutch Apply Circuit
19 A (Dog) Clutch Solenoid Circuit
20 A (Dog) Clutch Apply Circuit
21 F (Dog) Clutch Solenoid Circuit
22 F (Dog) Clutch Release/
A (Dog) Clutch Apply Circuit
23 D Brake Solenoid Circuit
24 D Brake Apply Circuit
25 C Brake Solenoid Circuit
26 C Brake Apply Circuit
27 Park Control Solenoid Circuit
28 Pre-fill Pressure Circuit (B, C, D & E)
29 F (Dog) Clutch Apply Circuit
30 Park Cylinder Circuit (PCYL)

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Figure 15

VALVE BODY CIRCUIT IDENTIFICATION

Case Passage Identification



Hydraulic Circuit Legend

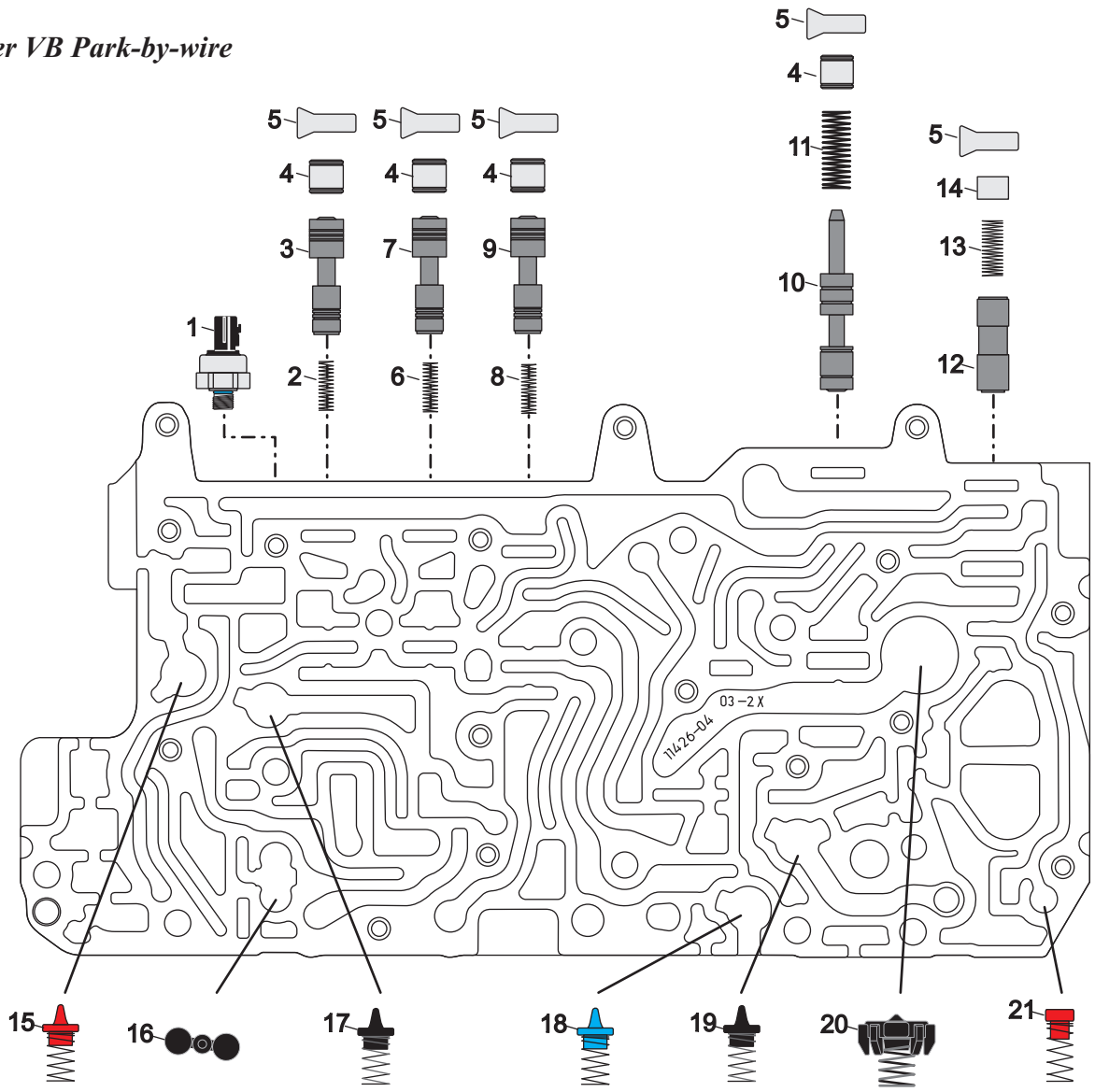
1 System Pressure Circuit
2 Pump Return Circuit
3 Solenoid Feed Pressure Circuit
4 Lubrication Valve Feed Circuit
5 Pre-fill/Converter Circuit
6 TCC Release Pressure Circuit
7 TCC Apply Pressure Circuit
8 To Heat Exchanger Circuit
9 Pressure System Solenoid Circuit (EPC)
10 Shift Valve-System Pressure Circuit (SV-SP)
11 System Pressure Valve Exhaust Circuit
12 TCC Circuit
13 TCC Exhaust Circuit
14 TCC Solenoid Circuit
15 B Clutch Solenoid Circuit
16 B Clutch Apply Circuit
17 E Clutch Solenoid Circuit
18 E Clutch Apply Circuit
19 A (Dog) Clutch Solenoid Circuit
20 A (Dog) Clutch Apply Circuit
21 F (Dog) Clutch Solenoid Circuit
22 F (Dog) Clutch Release/
A (Dog) Clutch Apply Circuit
23 D Brake Solenoid Circuit
24 D Brake Apply Circuit
25 C Brake Solenoid Circuit
26 C Brake Apply Circuit
27 Park Control Solenoid Circuit
28 Pre-fill Pressure Circuit (B, C, D & E)
29 F (Dog) Clutch Apply Circuit
30 Park Cylinder Circuit (PCYL)

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Figure 16

VALVE BODY

Lower VB Park-by-wire



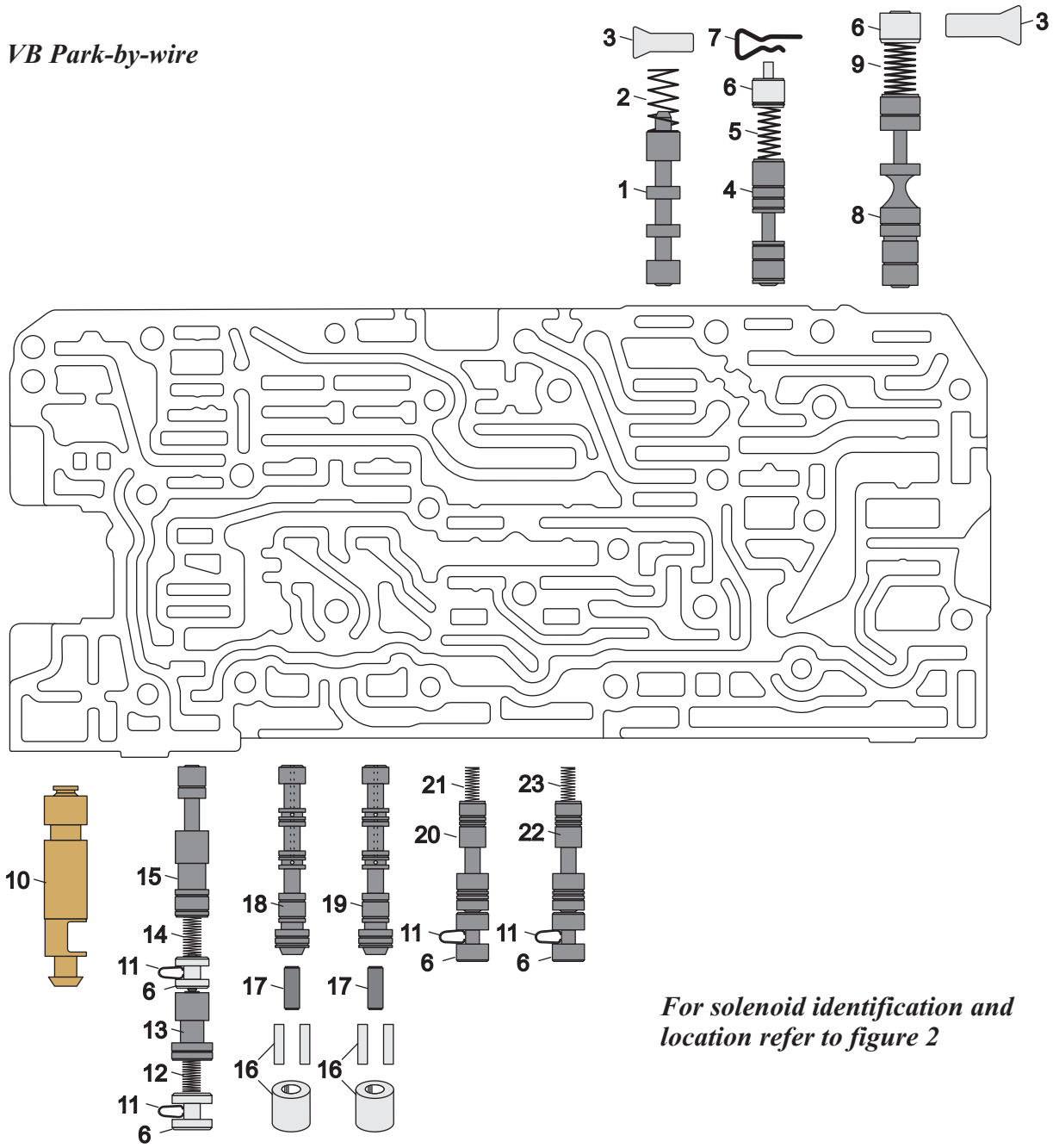
1. Dog Clutch Pre-Fill Exhaust Pressure Sensor
2. C Clutch Valve (CV-C) Spring (0.798" x 0.202" x 0.015")
3. C Clutch Valve (CV-C)
4. Bore Plug
5. Retainer
6. D Clutch Valve (CV-D) Spring (0.798" x 0.202" x 0.015")
7. D Clutch Valve (CV-D)
8. Lockup Clutch Valve (LC-V) Spring (0.955" x 0.204" x 0.022")
9. Lockup Clutch Valve (LC-V)
10. Solenoid Pressure Regulator Valve (PR-V)
11. Solenoid Pressure Regulator Valve (PR-V) Spring (1.745" x 0.355" x 0.042")
12. Shift Valve-System Pressure (SV-SP)
13. Shift Valve-System Pressure (SV-SP) Spring (1.352" x 0.258" x 0.034")
14. Shift Valve-System Pressure (SV-SP) Spring Cap
15. Dog Clutch Pre-Fill Check Valve
16. A & F Dog Clutch Rocker Ball
17. Clutch Pre-Fill Pressure Check Valve
18. TCC Release Pressure Exhaust Check Valve
19. Cooler Pressure Check Valve
20. Drain Back Check Valve
21. Line Boost Damper Check Valve

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Figure 17

VALVE BODY

Upper VB Park-by-wire

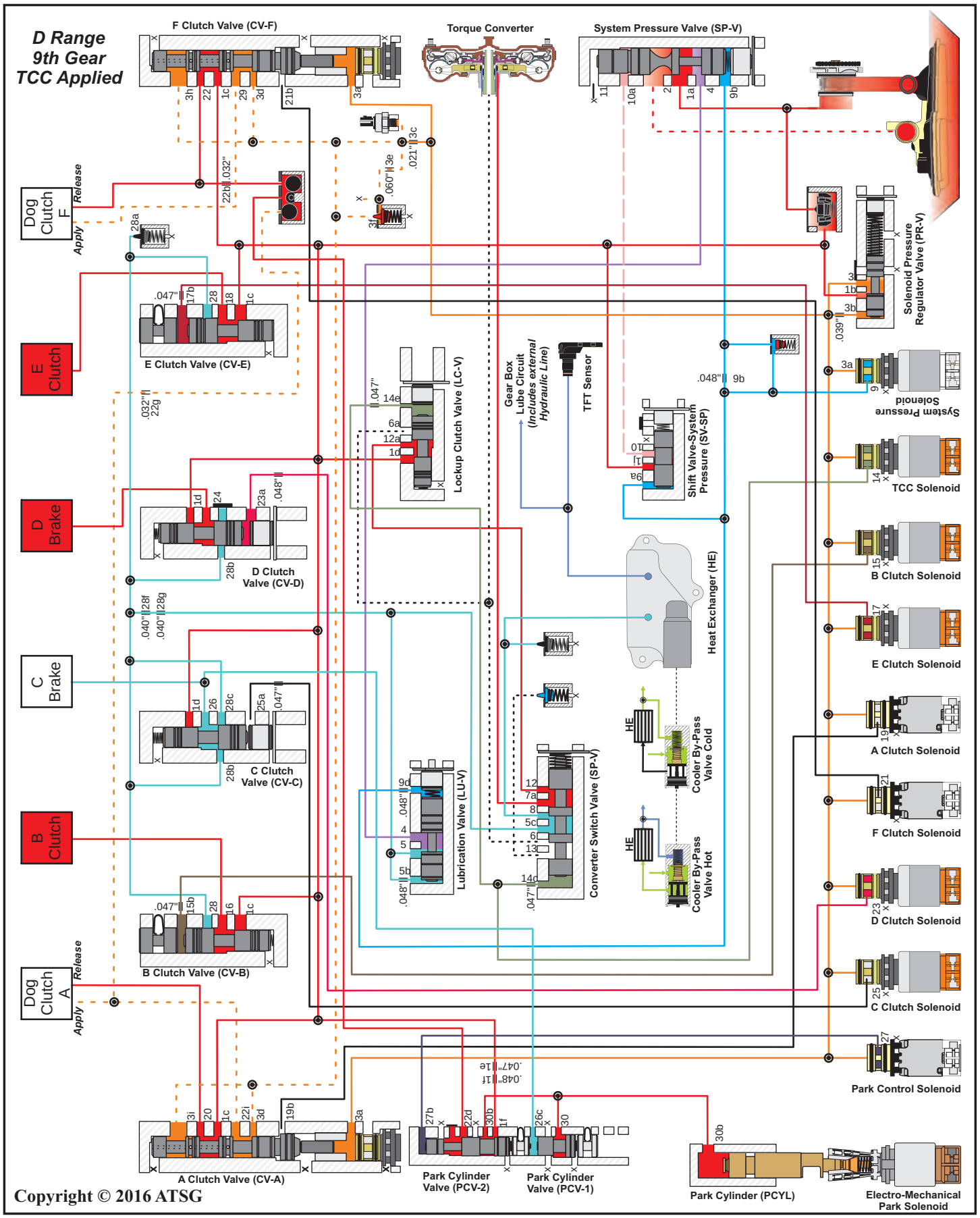


For solenoid identification and location refer to figure 2

1. Converter Switch Valve (SP-V)
2. Converter Switch Valve (SP-V) Spring (0.760" x 0.450" x 0.031")
3. Retainer
4. Lubrication Valve (LU-V)
5. Lubrication Valve (LU-V) Spring (1.310" x 0.316" x 0.031")
6. Bore Plug
7. Wire Retainer
8. System Pressure Valve (SP-V)
9. System Pressure Valve (SP-V) Spring (1.905" x 0.445" x 0.038")
10. Park Cylinder (PCYL)
11. Tension Retainer
12. Park Cylinder Valve (PCV-1) Spring (1.060" x 0.042" x 0.027")
13. Park Cylinder Valve (PCV-1)
14. Park Cylinder Valve (PCV-2) Spring (1.060" x 0.042" x 0.027")
15. Park Cylinder Valve (PCV-2)
16. Valve Pin Sleeve
17. Valve Pin
18. F Clutch Valve (CV-F) - Dog
19. A Clutch Valve (CV-A) - Dog
20. E Clutch Valve (CV-E)
21. E Clutch Valve (CV-E) Spring (0.800" x 0.205" x 0.015")
22. B Clutch Valve (CV-B)
23. B Clutch Valve (CV-B) Spring (0.800" x 0.205" x 0.015")

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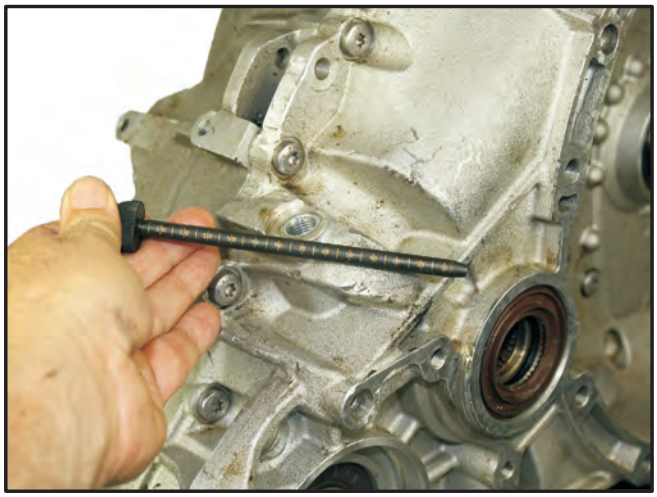
Figure 18

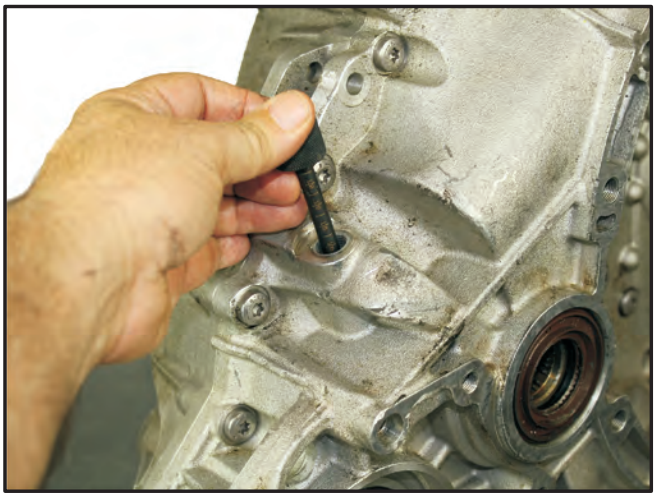


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Figure 19

948TE FLUID SPECIFICATIONS





948TE Fluid Specifications

Use MOPAR ZF 8 & 9 Speed ATF part number: 68157995AB

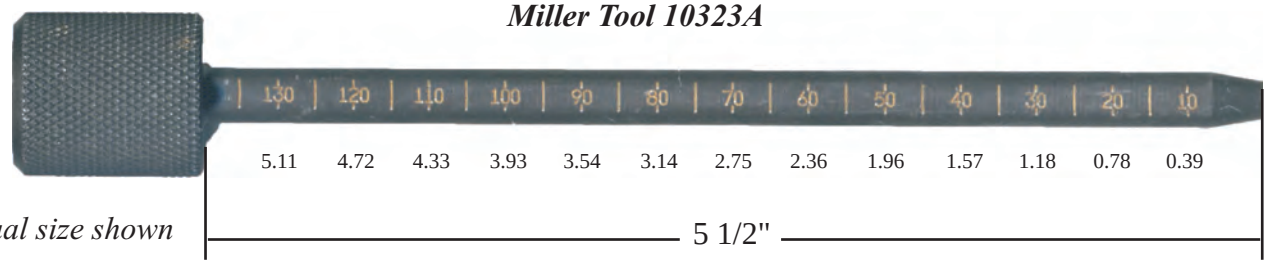
Fluid level can be checked using Miller tool dipstick part number: 10323A - approximate cost is $35.00

Use Fluid Level Table to determine the proper level according to temperature.

Dry fill: 6.5L

TEMP C° (F°)	MIN LEVEL (mm)	NOMINAL LEVEL (mm)	MAX LEVEL (mm)
50 C° (122 F°)	21 mm	26 mm	31.5 mm
55 C° (131 F°)	23 mm	27.5 mm	33 mm
60 C° (140 F°)	25 mm	30 mm	34 mm
65 C° (149 F°)	27 mm	31 mm	35.5 mm
70 C° (158 F°)	28.5 mm	33 mm	36.5 mm
75 C° (167 F°)	30 mm	35 mm	38 mm
80 C° (176 F°)	31.5 mm	36 mm	39 mm
85 C° (185 F°)	32.5 mm	37 mm	40 mm
90 C° (194 F°)	34 mm	38 mm	41.5 mm

Miller Tool 10323A

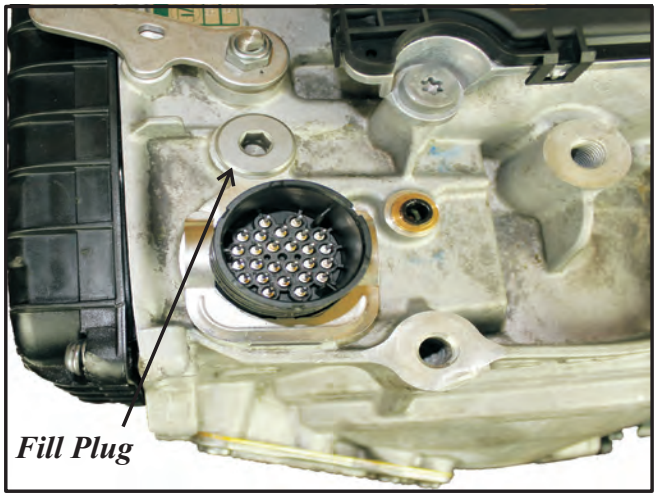


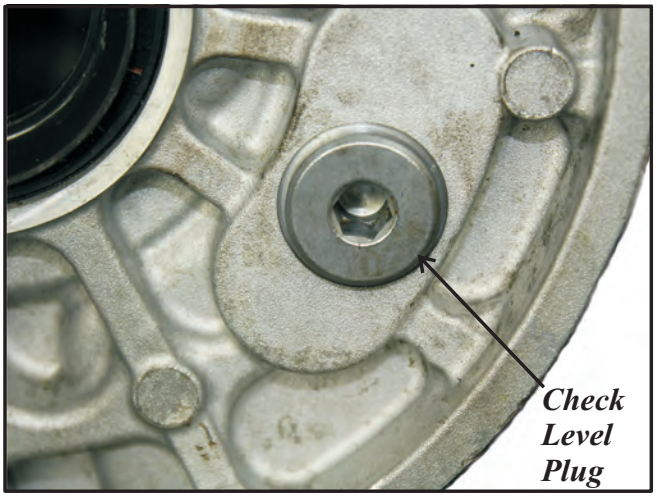
Actual size shown

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Figure 20

ZF9HP48 FLUID SPECIFICATIONS





ZF9HP48 Fluid Specifications

Use Shell L12108 (ZF Lifeguard 8) Automatic Transmission Fluid. Dry fill: 6.5L

The transmission fluid must be checked only when temperatures are between 37°C (99°F) and 45°C (113°F) Make sure that all four wheels are off the ground for this step.

Move the transmission control switch (TCS) from D to S then using the steering paddles pause in each gear for a minimum 10 seconds until you reach 4th gear. (max 2000rpm)

Decelerate the wheels until they stop, then turn the (TCS) back into the P position.

Make sure that torque converter is full of oil by raising the engine speed to 2000rpm for 10 seconds, return to idle speed.

Engine must be running to carry out the fluid level check. When transmission fluid temperature reaches 37°C, remove the level plug and wait until oil stops dripping out.

If the transmission fluid does not come out of the transmission fluid level plug hole the transmission fluid level is insufficient. If this is the case add the transmission fluid in 0.5 litre units into the transmission fluid fill plug hole until fluid comes out.

Install plug and torque to: 35 Nm.

Both the 948TE and the ZF9HP48 have a drain plug located at the bottom of the case to be used for partial drains.

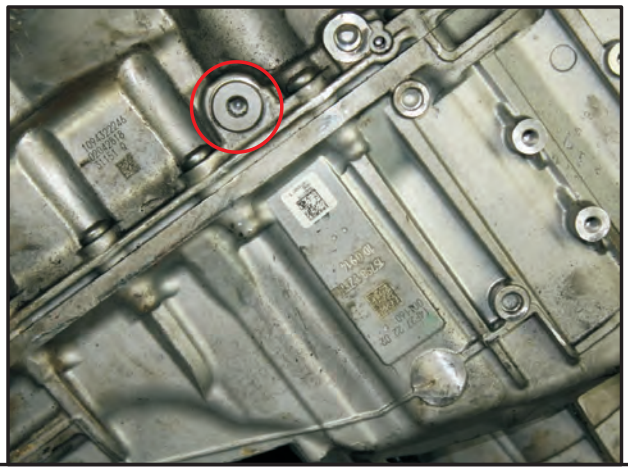


Figure 21

DOG CLUTCH "A" AND "F"

A unique feature to this 9 speed front wheel drive transmission is the use of dog clutches.

Both dog clutches are similar in their operation. Each clutch is operated by fluid pressure acting on a double action piston to move the dog clutch into and out of engagement.

Dog Clutch 'A' (figures 22 and 23) connects the input shaft to the number 2 sun gear which is also the number 1 ring gear (figure 24).

Dog clutch 'F' holds stationary the number 3 and 4 sun gears (which is one long sun gear working to carriers - figure 25) to the centering plate mounted in the transmission casing (figure 26).

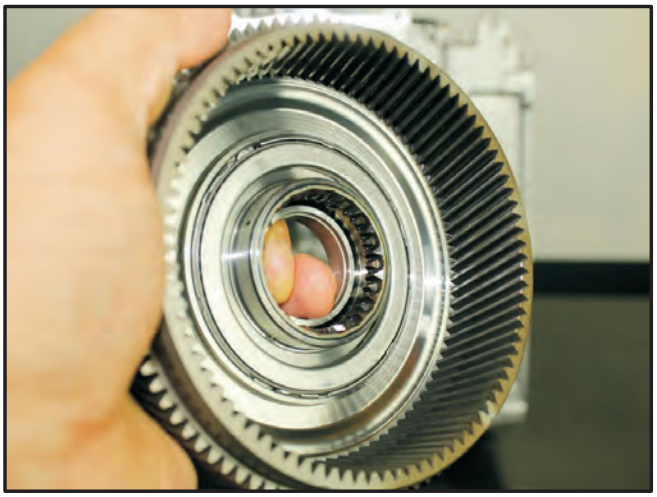


Figure 24

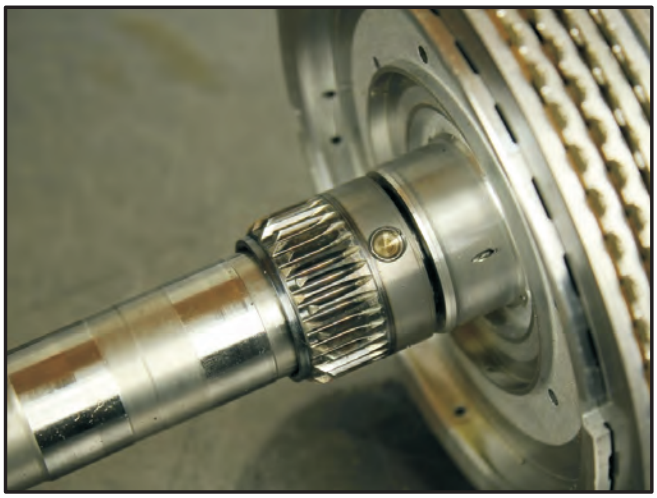


Figure 22

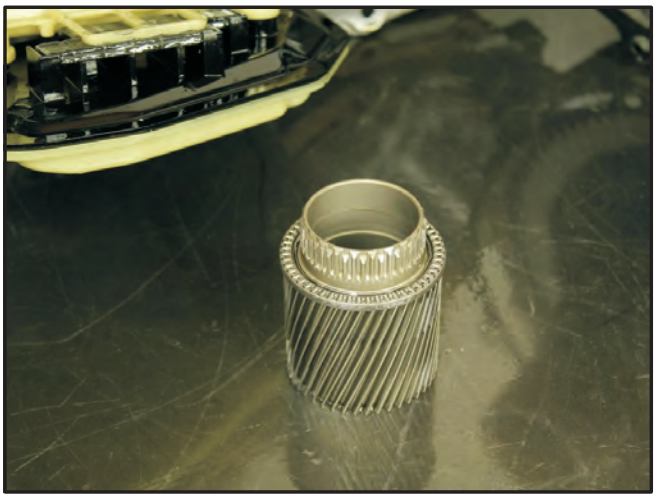


Figure 25

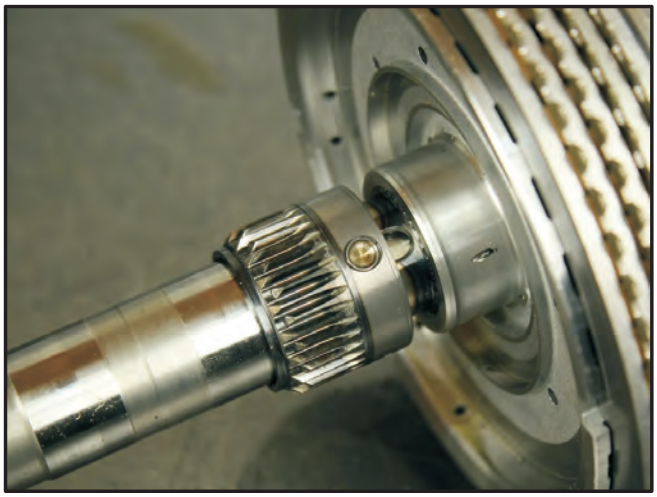


Figure 23

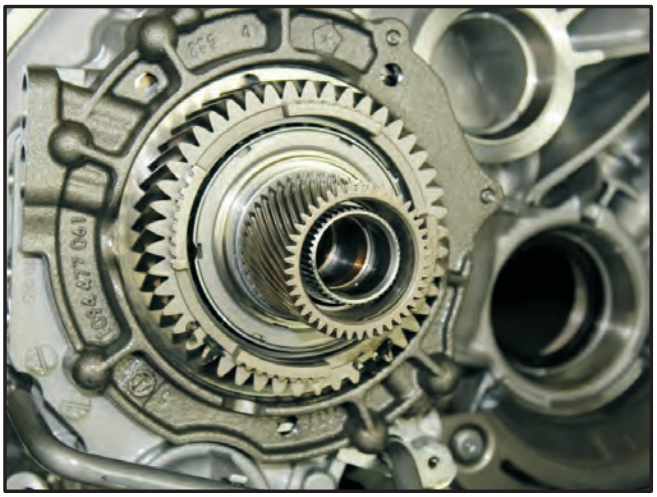


Figure 26

DOG CLUTCH "A" DETAILS"

As seen in figures 22 and 23, Dog clutch 'A' is located at the end of the input shaft and is controlled by a double acting piston located within the input shaft. This piston moves within the shaft when fluid pressure is applied to either side of the piston. The piston is connected to the dog 'A' by a pin which moves in a slot in the input shaft.

Dog 'A' itself is a sleeve with internal and external splines which is permanently engaged with the input shaft via the internal splines. When the piston moves dog 'A' along the input shaft to the 'closed' position, dog 'A' engages with splines on the gearset 1 and 2 planet carrier, transferring drive from the input shaft to the gear set 2. When the dog 'A' is to be disengaged to the 'open' position, fluid pressure is applied to the opposite side of the piston and dog 'A' is moved along the input shaft and is disengaged from the planet carrier. Dog 'A' is in the 'closed' position in gears 1 through 7.

The dog 'A' has two states; open and closed. The piston cannot determine if the dog 'A' has traveled its full distance into or out of engagement with the ring gear carrier or has remained in an intermediate position. The piston is fitted with a sensing piston and the fluid pressure leakage through the sensing piston can be measured by the pressure sensor (transducer) located on the valve body.

The sensing piston is hollow and moves axially within the piston. When fluid pressure is applied to the right side of the piston, the piston and the sensing piston are pushed to the left. During the movement of the piston, a small amount of fluid pressure is passed through the sensing piston. This leakage pressure is measured at the left side of the piston by the pressure sensor (transducer). When the piston has moved fully to the left and reached its end position, the leakage through the sensing piston is blocked. The pressure drop on the left side of the piston is sensed and the transmission control module can determine the dog clutch 'A' is fully disengaged with the ring gear carrier.

If the pressure on the left side of the piston does not drop within a specified shift time, the TCM (transmission control module) can determine that the dog 'A' has stopped in an intermediate position.

The dog clutch 'A' has four possible states of operation as follows:

A. Dog 'A' Open - Fluid pressure is applied to the piston from the left side chamber and the dog clutch 'A' is open. The fluid pressure in the right chamber is almost zero because the sensing piston is pushed to its limit of movement and leakage through the sensing piston is prevented.

B. Dog 'A' Closing - Fluid pressure is applied from the right side chamber which starts the piston moving to the left into engagement with the ring gear carrier. The piston is now in the intermediate position and leakage pressure is passed through the sensing piston into the left side chamber. Pressure in the left side chamber can be measured and will be approximately 2 bar (29 psi).

C. Dog 'A' Closed - Fluid pressure is applied to the piston from the right side chamber, the dog 'A' is closed and fully engaged with the ring gear carrier. The ATF (automatic transmission fluid) pressure in the left chamber is almost zero because the sensing piston is pushed to its limit of movement and leakage through the sensing piston is prevented.

D. Dog 'A' Opening - Fluid pressure is applied to the piston from the left side chamber which starts the piston moving to the right and disengaging from the ring gear carrier. The piston is now in the intermediate position and leakage pressure is passed through the sensing piston into the right side chamber. Pressure in the right side chamber can be measured and will be approximately 2 bar (29 psi).

DOG CLUTCH "F" DETAILS"

Dog clutch 'F' is a sleeve with internal and external splines located between the multi-plate clutch 'E' and planetary gear set 4 (Figures 27 and 28). The external splines are engaged to the splines within the bearing support housing, which in turn is fixed stationary to the transmission casing. When dog 'F' is moved to the closed position (Figure 30), the internal splines engage sun gears 3 and 4 holding it stationary in planetary gear set 4 (Figure 31). When dog "F" is moved to the open position (Figure 29), the sun gear is released and freewheels.

The dog 'F' has two states; open and closed. Dog 'F' employs a more simple sensing system than dog 'A'. Dog 'F' is also the piston itself and does not use a sensing piston. The piston of dog 'F' has a leakage sensing hole which is used to detect its current position via pressure sensing.

When fluid pressure is applied to the right side of the piston, the piston is pushed to the left. During the movement of the piston, a small amount of fluid pressure is passed through the leakage sensing hole. This leakage pressure is measured at the left side of the piston by the pressure sensor in the sensor unit. When the piston has moved fully to the left and reached its end position, the leakage through the leakage sensing hole is blocked. The pressure drop on the left side of the piston is sensed and the transmission control module can determine that dog clutch 'F' is fully engaged with sun gears 3 and 4.

If the pressure on the left side of the piston does not drop within a specified shift time, the transmission control module can determine that the dog 'F' has stopped in an intermediate position.

The dog clutch 'F' has four possible states of operation as follows:

A. Dog 'F' Open - Fluid pressure is applied to the piston from the right side chamber and the dog clutch 'F' is open. The fluid pressure in the left chamber is almost zero because the piston is pushed to its limit of movement and leakage through the leakage sensing hole is prevented.

B. Dog 'F' Closing - Fluid pressure is applied from the left side chamber which starts the piston moving to the right into engagement with the sun gears 3 and 4. The piston is now in the intermediate position and leakage pressure is passed through the leakage sensing hole into the right side chamber. Pressure in the right side chamber can be measured and will be approximately 2 bar (29 psi).

C. Dog 'F' Closed - Fluid pressure is applied to the piston from the left side chamber, the dog 'F' is closed and fully engaged with the sun gears 3 and 4. The fluid pressure in the right chamber is almost zero because the piston is pushed to its limit of movement and leakage through the leakage sensing hole is prevented.

D. Dog 'F' Opening - Fluid pressure is applied to the piston from the right side chamber which starts the piston moving to the left and disengaging from the sun gears 3 and 4. The piston is now in the intermediate position and leakage pressure is passed through the leakage sensing hole into the left side chamber. Pressure in the left side chamber can be measured and will be approximately 2 bar (29 psi).

DOG CLUTCH "F"

The "F" dog sleeve is located inside the bearing support bolted to the case (Figure 27).

Figure 28 shows the bearing support removed from the case with the bearing removed to reveal the "F" dog sleeve.

Figure 29 shows the "F" dog in the disengaged position allowing the sun gear to freewheel.

Figure 30 shows the "F" dog clutch in the engaged position which will hold the sun gear stationary,

Figure 31 shows the sun gear (sun gears 3 and 4) inside planetary gear set 4.



Figure 29

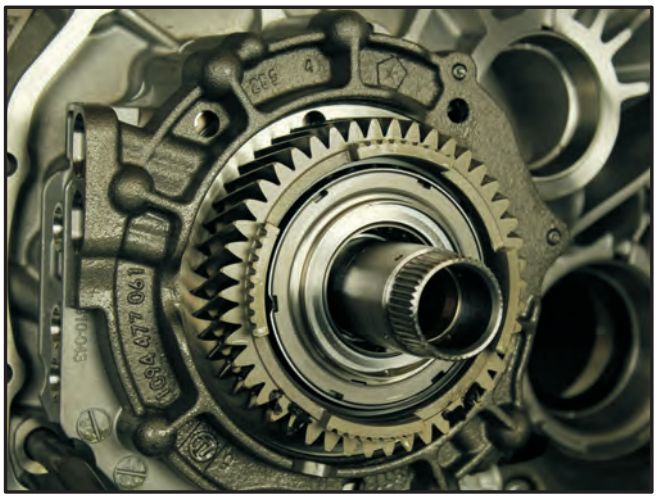


Figure 27



Figure 30



Figure 28



Figure 31

OTC - 125

ALTO - 126

Precision - IBC

Lube - BC