



ZF9HP48 / 948TE Introduction



***Presented by:
Mike Souza
ATRA Senior
Research Technician***



948TE Intro Webinar ©2015 ATRA. All Rights Reserved.





Vehicle Application

Acura (ZF9HP48)

MDX 2014-15 AWD V6 3.5L

RLX 2014-15 FWD V6 3.5L/3.7L

Land Rover

Range Rover Evoque 2013-15 FWD/4X4 L4 2.0/2.2L

Discovery (LR4) 2015 FWD/AWD L4 2.0

Chrysler (948TE)

TL 2014-15 AWD V6 3.5L/3.7L

200 2014-15 FWD L4 2.4L V6 3.2L

Town & Country 2013-15 FWD 2013-14 L4 2.4L V6 3.6L

Dodge (948TE)

Caravan 2014-15 FWD V6 3.6L

Fiat (EP2)

500X 2014-15 FWD L4 2.4L

Doblo 2015 FWD L4 2.4L

Jeep (948TE)

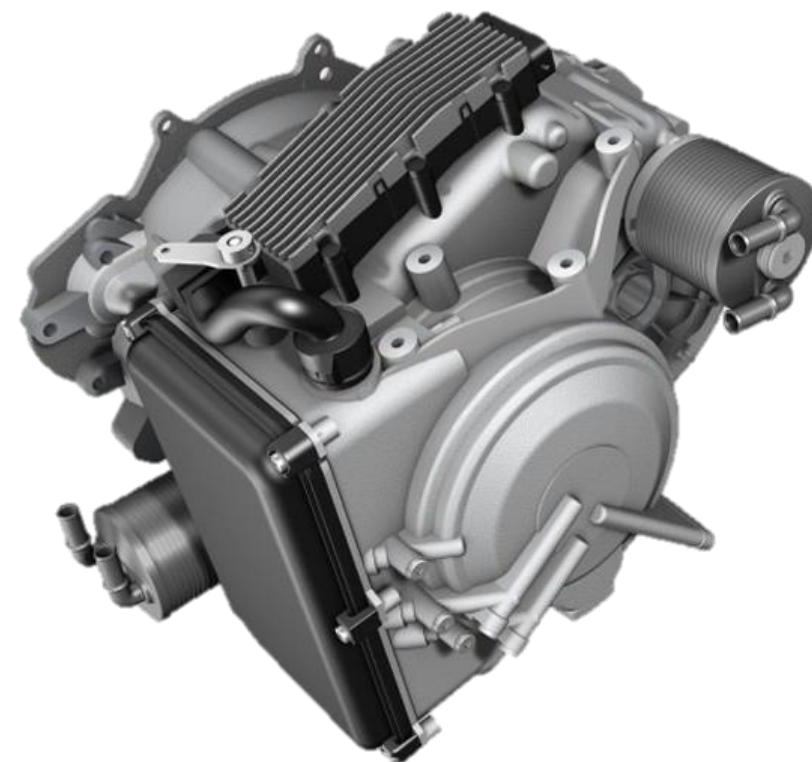
Cherokee (KL) 2013-15 FWD L4 2.4L V6 3.2L

Renegade 2014-15 FWD L4 2.4L

Honda (ZF9HP48)

Civic 2014-15 FWD L4 1.6L

CRV 2014-15 FWD L4 1.6L

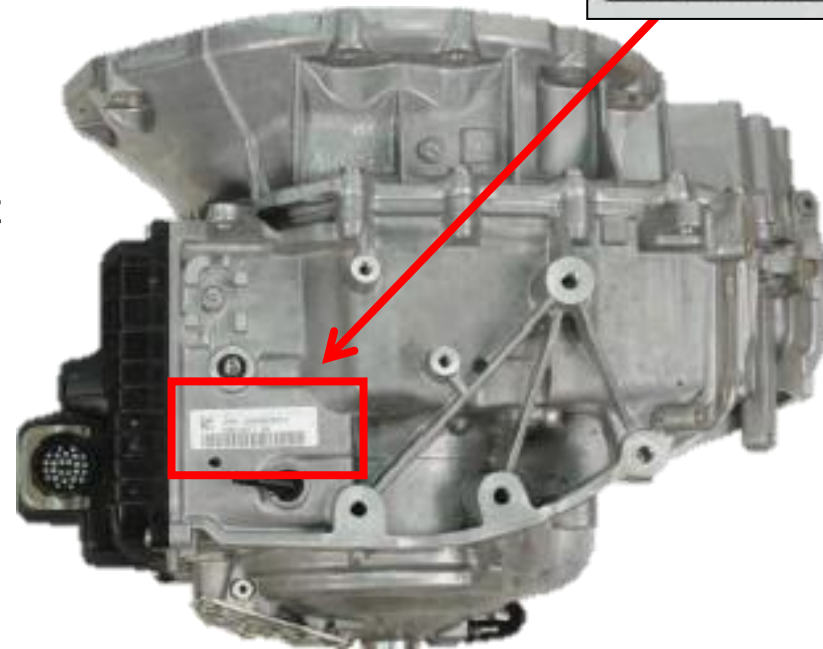




Transmission Identification

Chrysler 948TE (Kokomo IN) ZF 9HP48 (Germany)

- Externally the two units are visually similar
- Parts cannot be interchanged.
- VIN should always be used as the key for parts lookup.
- Barcode label includes the manufacturer identification in the second and third characters of the traceability number.



9 Nine forward gear speeds
48 480 Nm torque capacity 354 lbs ft
T Transverse mounted
E Electronic control
HP Hydraulic planetary





Introduction

ZF developed the first nine-speed automatic transmission for front wheel drive vehicles. Although it was built in June 2011 it did not make its debut until mid 2013.

This new transmission delivers extremely short shifting times and exceptionally smooth shifts. The electronic controls select the right gear for the driving conditions, eliminating unnecessary stepping and constant shifting using over 40 shift maps.

The 9-speed automatic transmission is, without an additional oil pump, stop-start capable. Since, in the case of restarting, it is only one friction shift element that needs to be closed, response times are very fast. It can also be used as a hybrid transmission by replacing the torque converter with an electric motor.

The ZF nine-speed automatic has been designed so that an additional transfer case can be connected for all wheel drive; ZF itself has an all-wheel drive that can be decoupled (AWD Disconnect). It actuates the rear axle drive only when needed and saves five percent less fuel compared to the permanent all-wheel drive (Chrysler already uses a similar system).

The ZF-built unit is known as the ZF9HP48, while the Chrysler-built unit is known as the 948TE. These transmissions look nearly identical, parts are not necessarily interchangeable





Introduction

In normal driving, the transmission starts in second gear, but can be manually shifted with paddle shifters into first gear for max acceleration or a low range ratio of 4.7:1 for off-road driving.

The transmission features a skip-shift feature that allows it to downshift directly without hitting every gear. Shift times and firmness are also based on driver input.





Component Identification

Oil Pan

Control unit / TCU*
Oil pump* (axially parallel)

Torque Converter
Housing (2-Piece)

Cooler*

Differential

Brake D

Clutch C

Clutch B

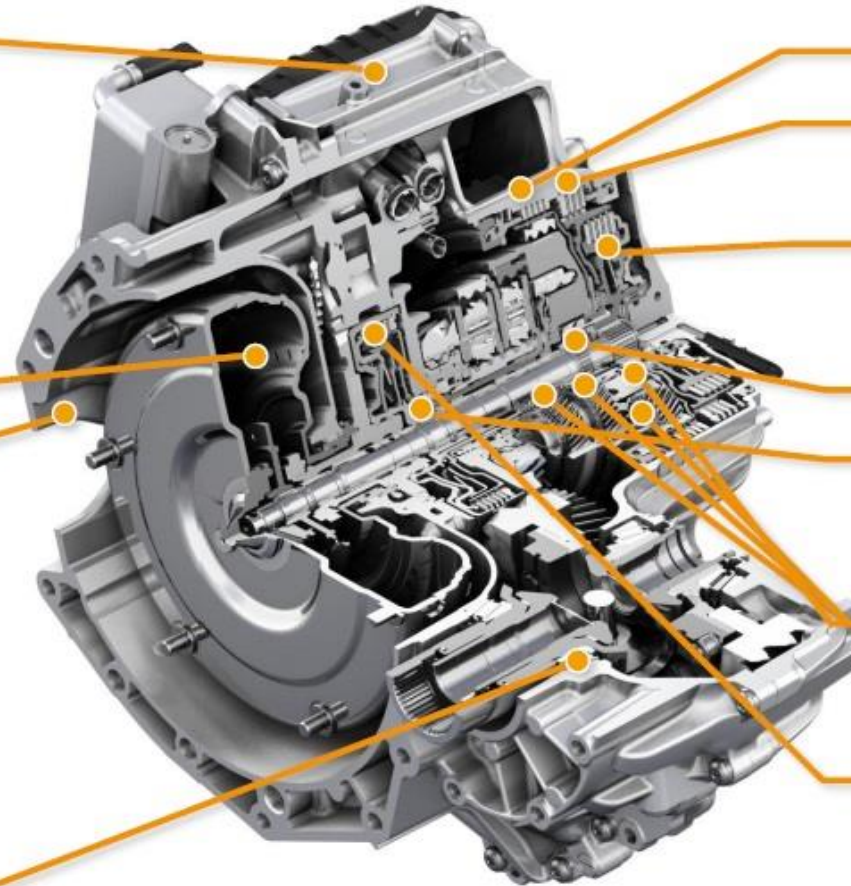
Dog Clutch A

Dog Clutch F

Gear Sets 1 to 4

Clutch E

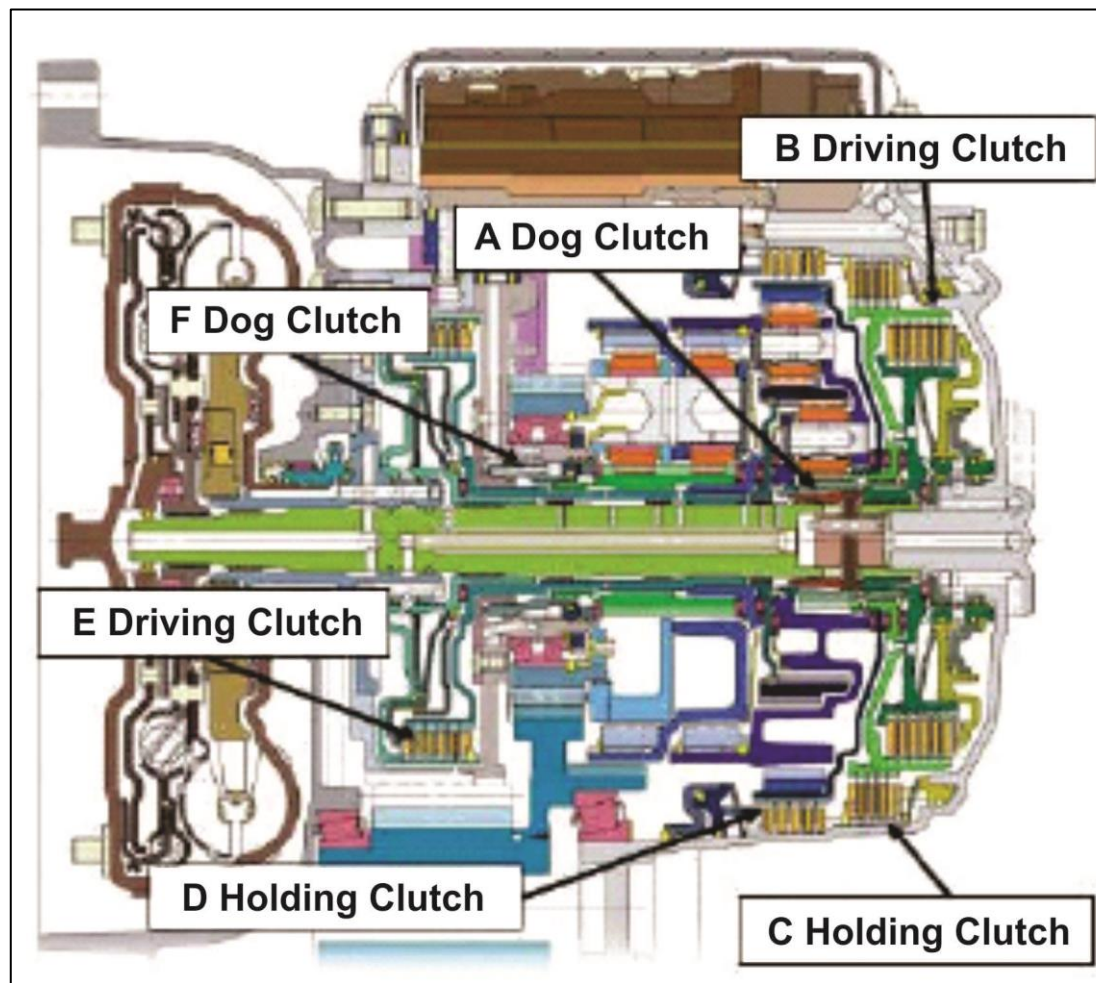
* Not shown





Clutch Identification

There are 6 clutches, labeled A–F according to power flow from input to final drive, 4 multi-plate friction clutches and 2 dog clutches





Clutch Apply Chart

Gear		Ratio	A Dog	B	C	D	E	F Dog
			Driving	Driving	Braking	Braking	Driving	Braking
P/N						X		X
R		3.80		X		X		X
1		4.70	X			X		X
2		2.84	X		X			X
3		1.91	X	X				X
4		1.38	X				X	X
5		1.00	X	X			X	
6		0.81	X		X		X	
7		0.70	X			X	X	
8		0.58			X	X	X	
9		0.48		X		X	X	
4 Default*							X	X
Rock Cycle**	Braking				X	X		X
	N-1 Transition		Delayed Apply			X	Slipping	X
	N-2 Transition		Delayed Apply		Applied	Released	Slipping	X
* Default is only available on park-by-cable systems.								
** These modes are only used during a R-D rocking cycle								





Failsafe Operation

Function/Characteristic	948TE park by wire	948TE park by cable	8HP45/845RE
Shifter System	Electronic Shift PRND selected by wire Park by wire with manual park release cable	Electronic Shift PRND selected by cable Park by cable	Electronic Shift PRND by wire Park by wire with manual park release cable
Electrical Fail-safe (Limited transmission operating using normal electrical control)	Drive/Reverse	Drive/Reverse	Drive/Reverse
Mechanical Fail-safe – When MIL is set (Limited transmission operation using hydraulic/mechanical control)	Neutral	Neutral	If failure occurred in a forward gear: Drive (6 th gear) Else: Neutral/Park
Mechanical Fail-safe – When restarted after MIL is set (Limited transmission operation using hydraulic/mechanical control)	Neutral	Drive (4 th gear)/Reverse	Neutral





Dog Clutch Function

The “A” dog clutch is one of two dog clutches in the 948TE. The dog clutch uses hydraulic pressure to engage and disengage the spline teeth between two components.

This provides a non-slipping connection that does not use friction discs. The “A” dog clutch is a driving clutch located at the rear of the transmission and part of the input shaft. This clutch is on in 1st through 7th gear.

When the TCM calls for a shift that engages one of the dog clutches, a message is sent to the PCM requesting that the engine be brought to a certain rpm.

The dog clutches in the 948TE cannot simply be applied during downshifts without consideration for speed difference between the splined components.

Dog clutches do not have disc-style clutch packs that can provide slip to match component speed.

As a result, the transmission control module (TCM) can request an engine RPM and torque increase or decrease to allow speed matching.





Dog Clutch Speed Matching

As the engine rpm increases, the transmission slips one or more of the multi-disc clutches until the components of the dog clutch are at the same speed.

Because the A-dog clutch is used in 1st but not in reverse, the TCM may use transitional phases in some situations such as rocking the vehicle out of snow or mud.

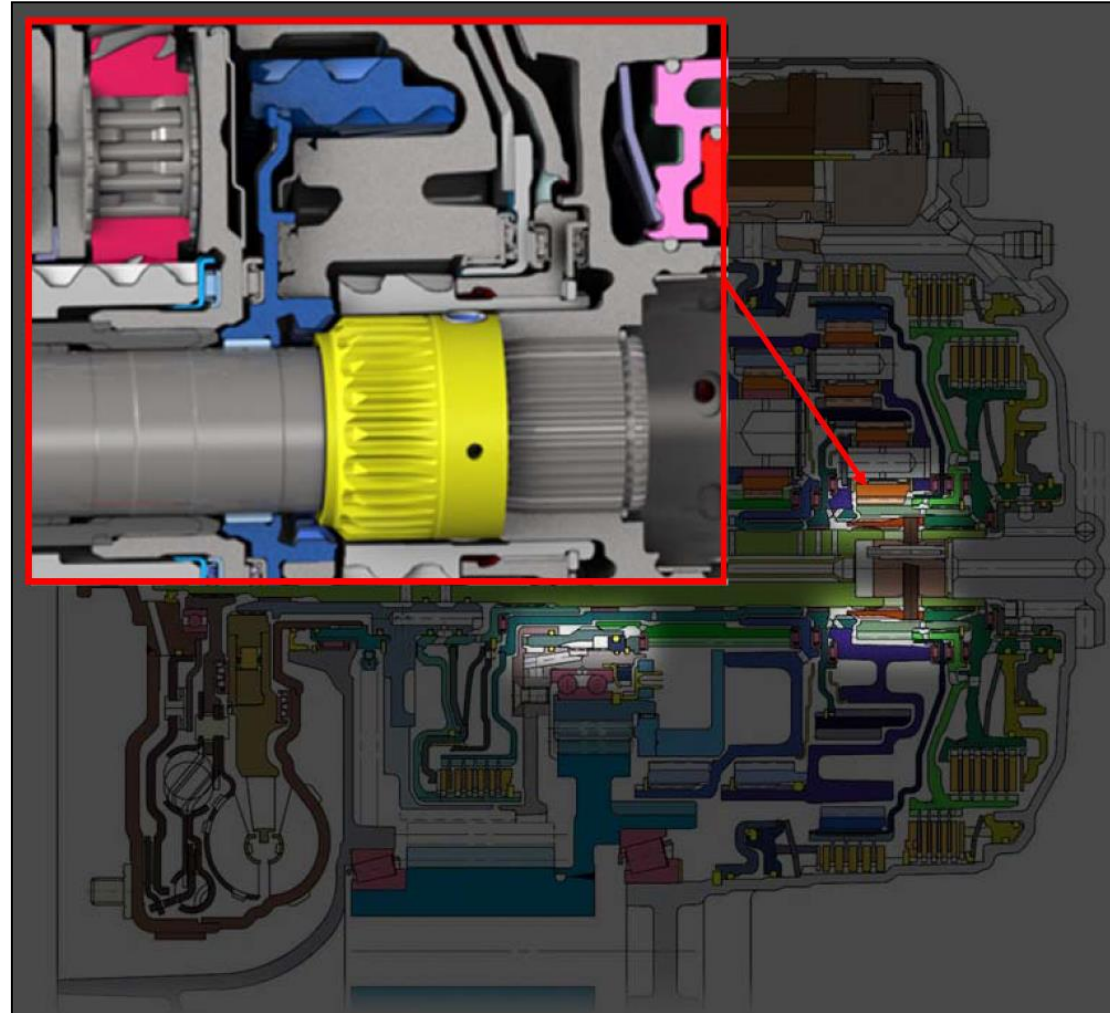
The TCM uses other clutches to synchronize the speed of the dog clutch and the input shaft as the wheel speed transitions between forward and reverse motions. You'll





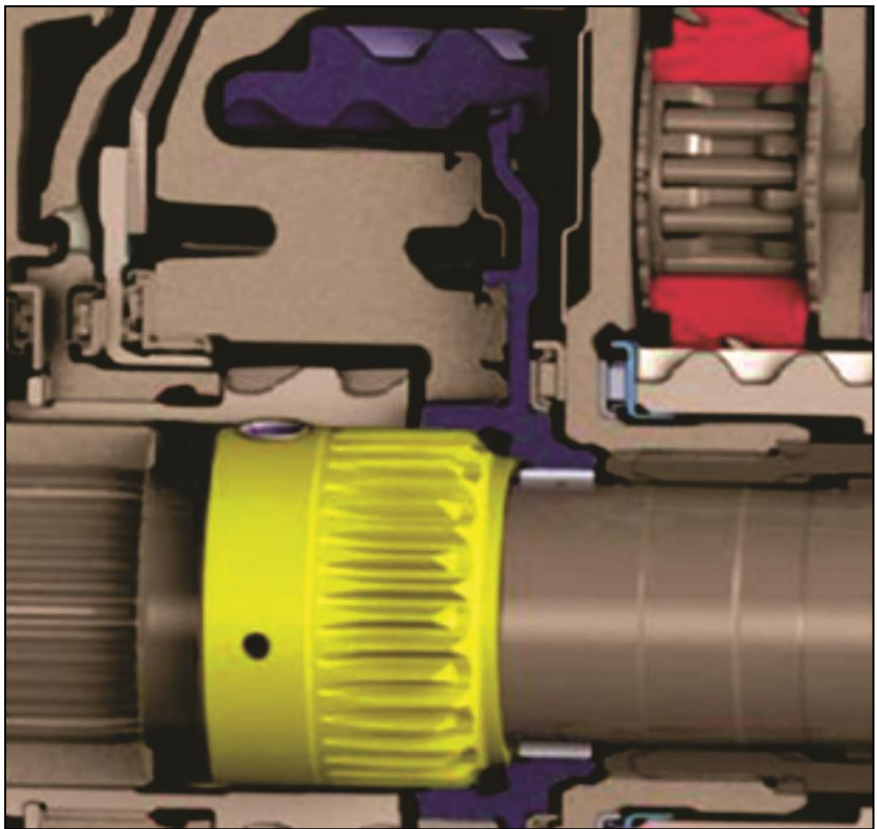
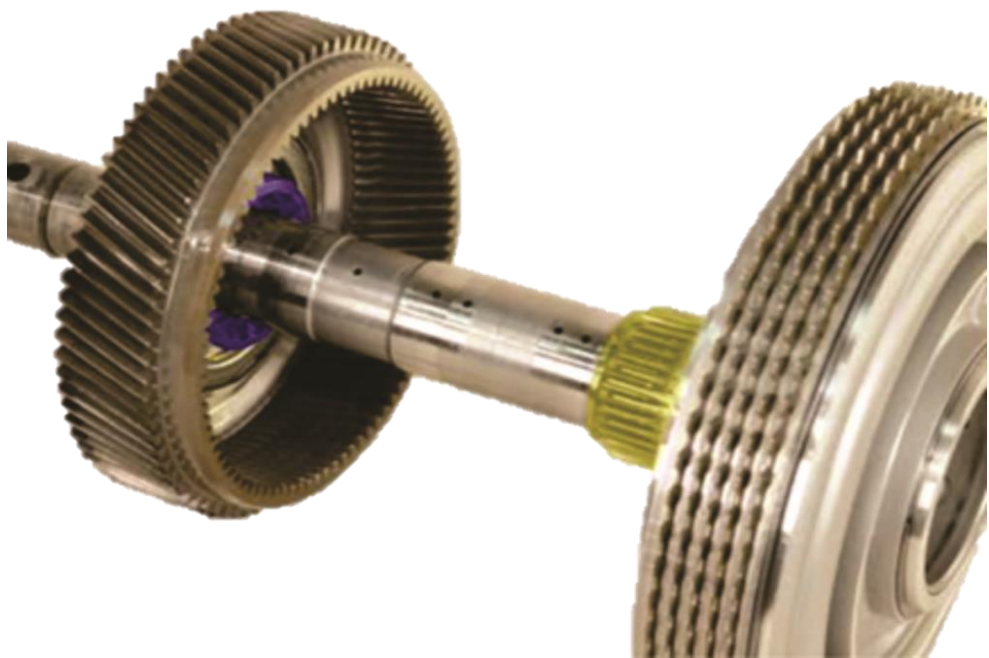
A Dog Clutch Function

The A-dog clutch is a driving clutch located at the rear of the transmission; it is part of the input shaft. This clutch is on in 1st gear through 7th gear.





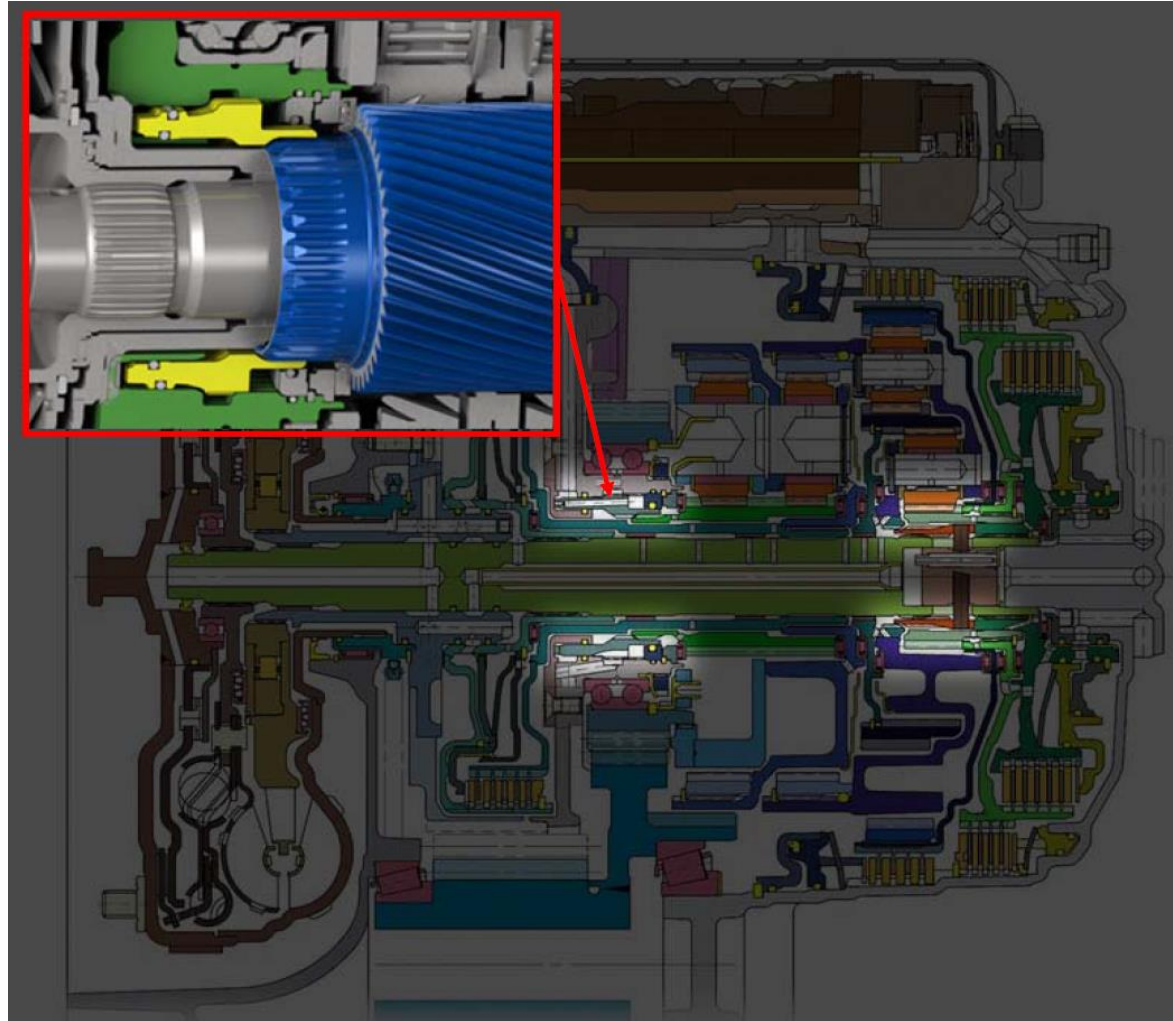
A Dog Clutch





F Dog Clutch Function

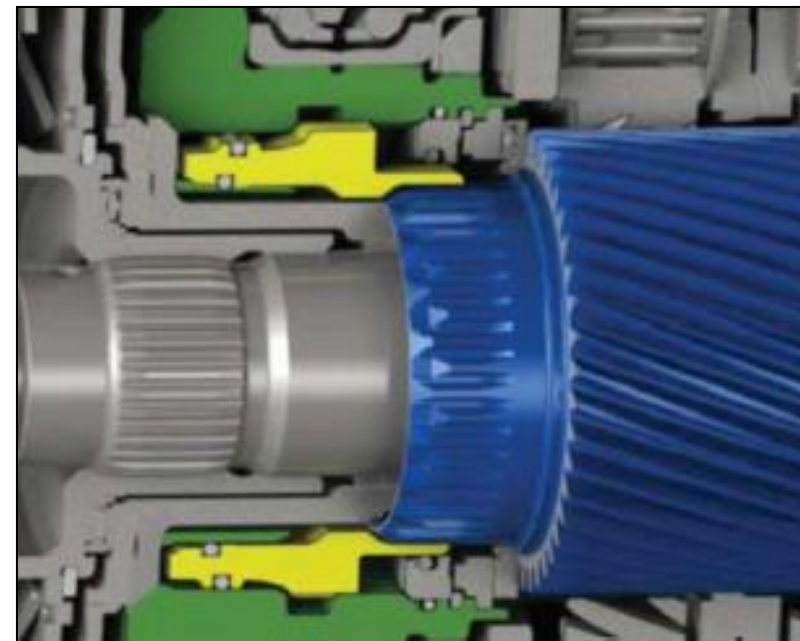
The F dog clutch is a braking clutch. When applied, the F dog clutch holds the P3 and P4 sun gear. The F-dog is on in 1st through 4th gears, as well as reverse and park/neutral.





F Dog Clutch

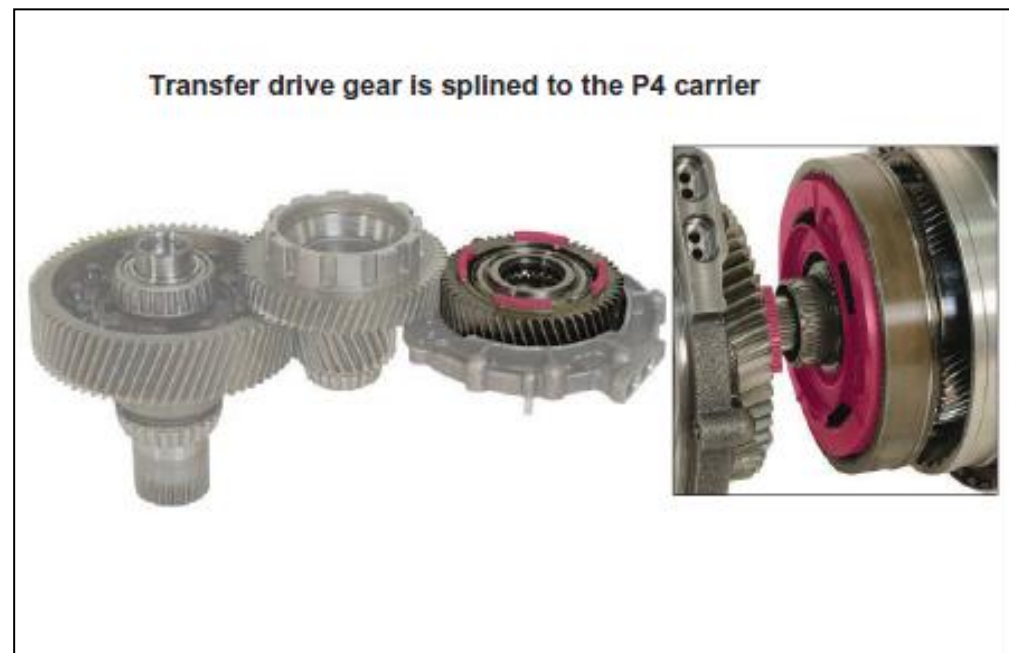
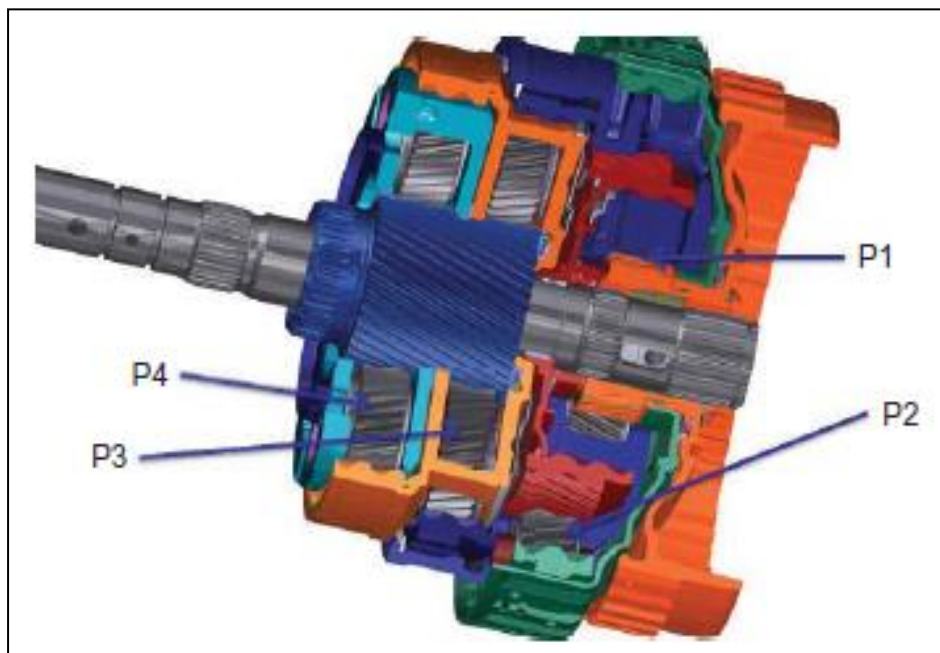
Transfer Gear





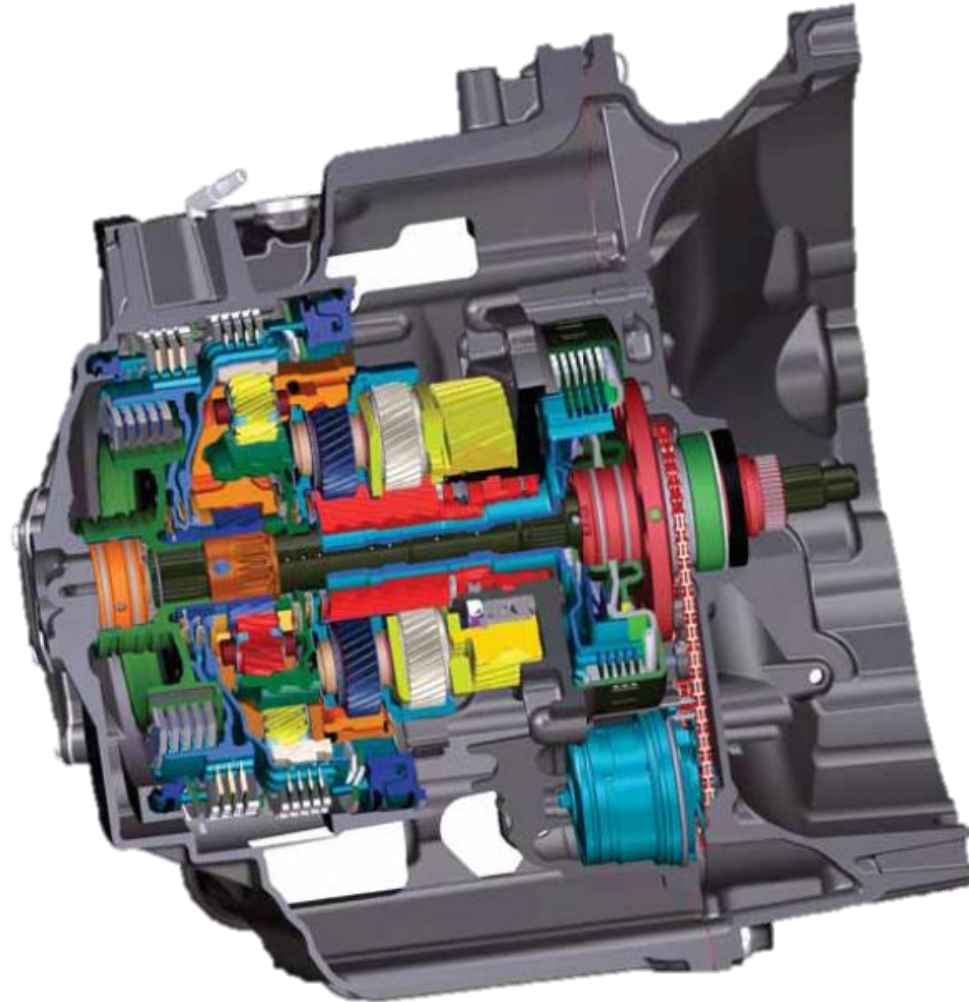
Dog Clutch Function

The transfer drive gear is splined to the P4 planet.



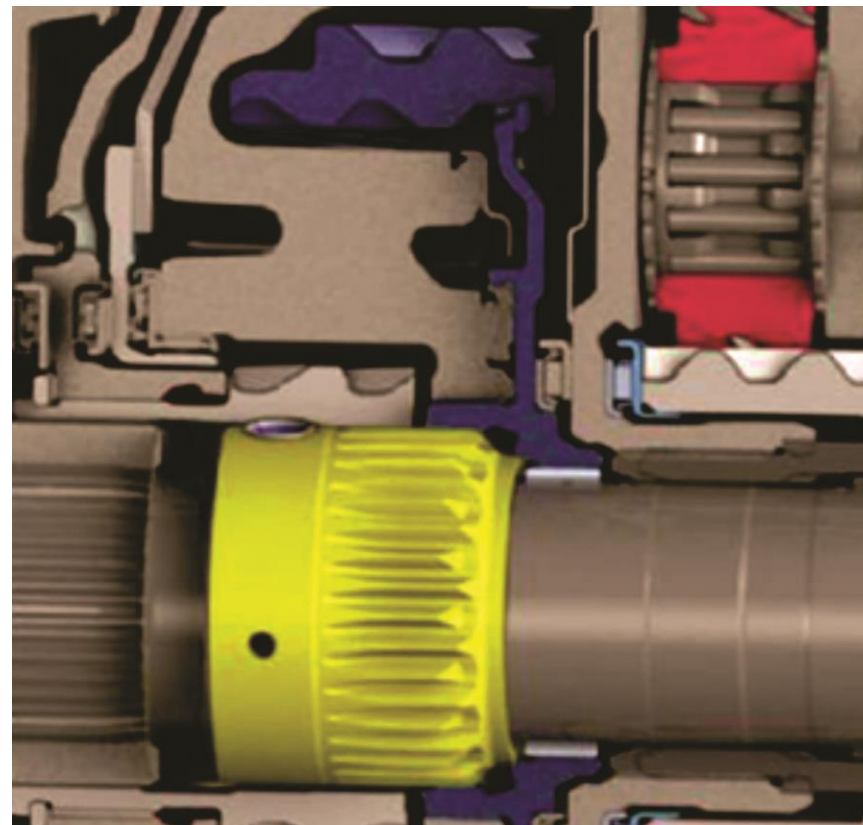
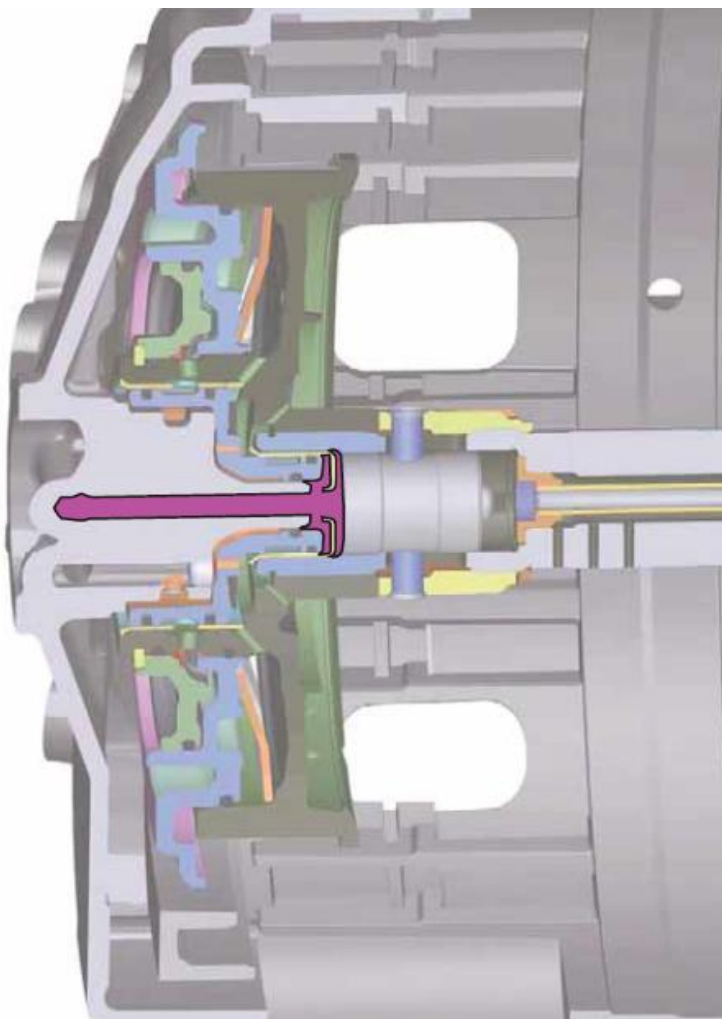


A & F Dog Clutch Hydraulics



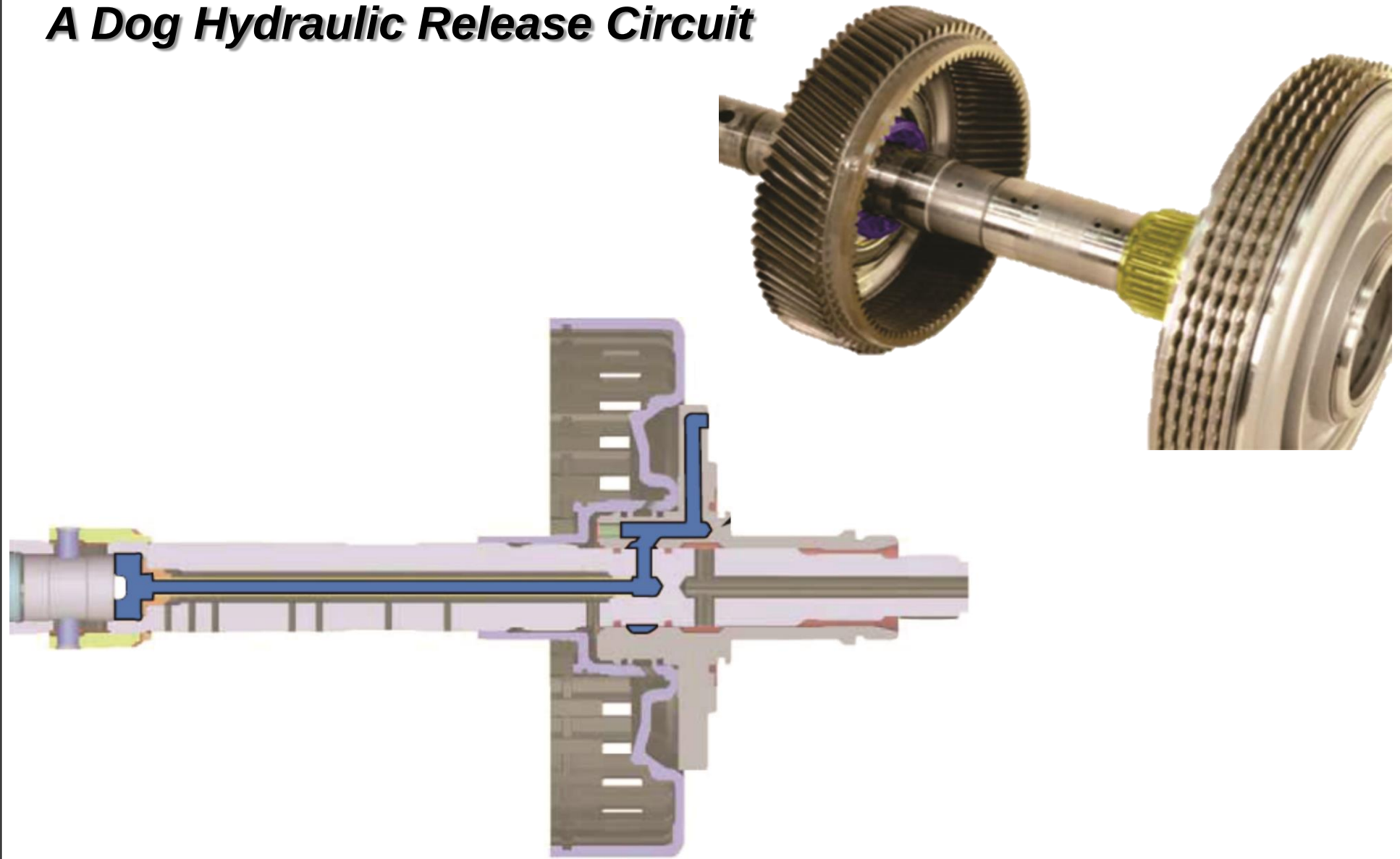


A Dog Hydraulic Apply Circuit



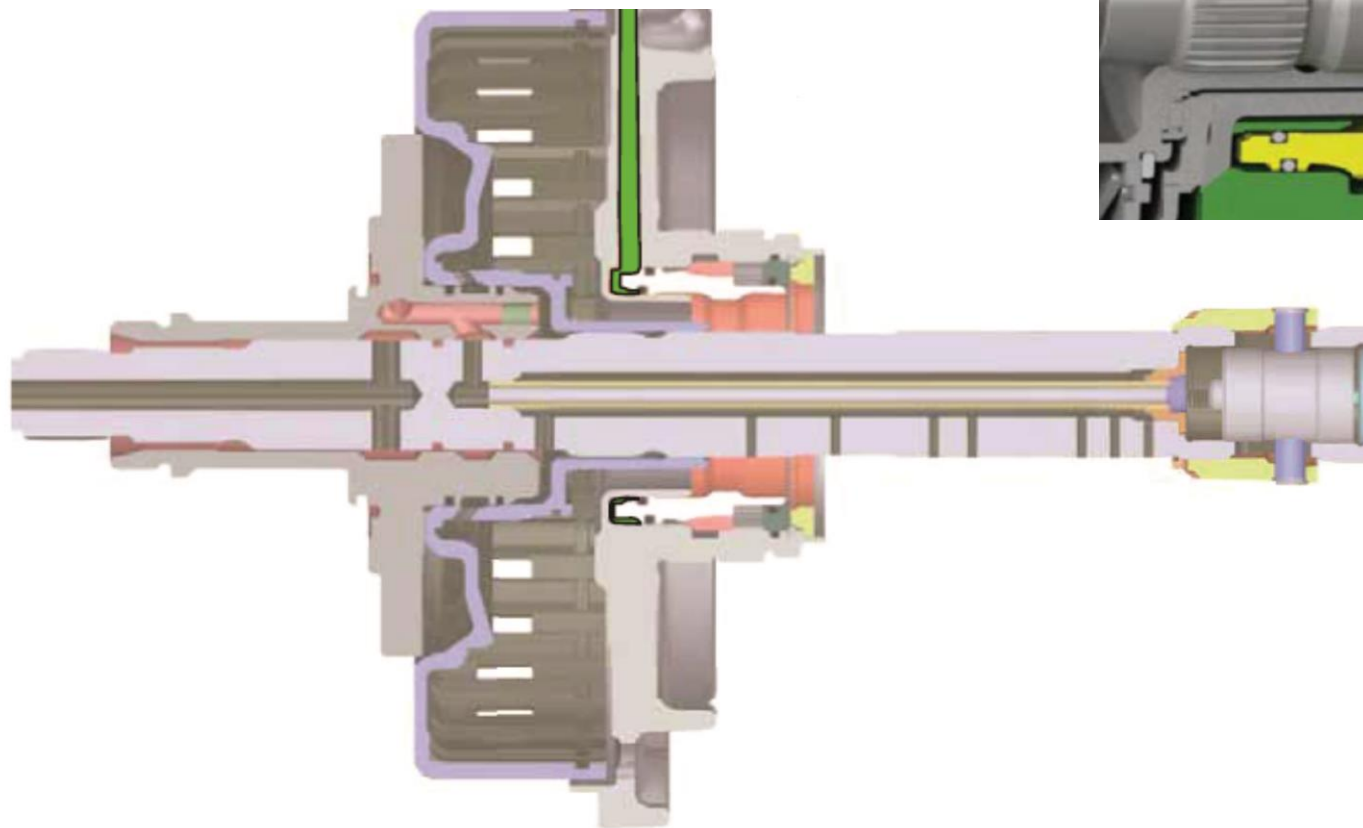
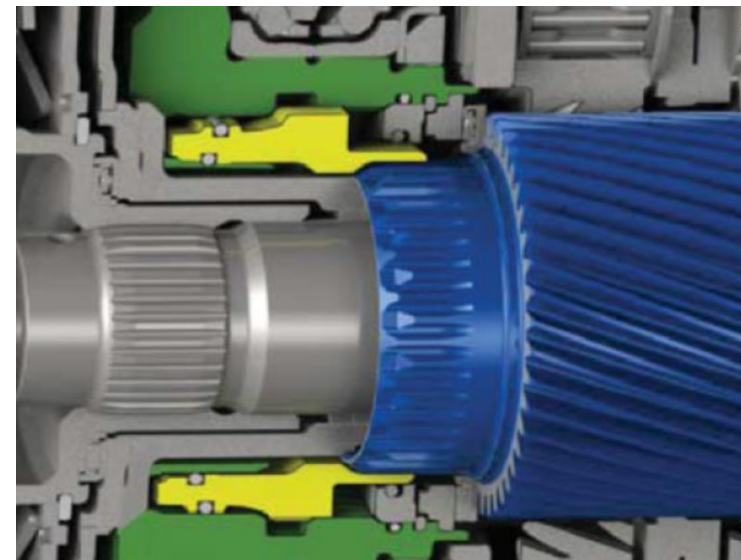


A Dog Hydraulic Release Circuit



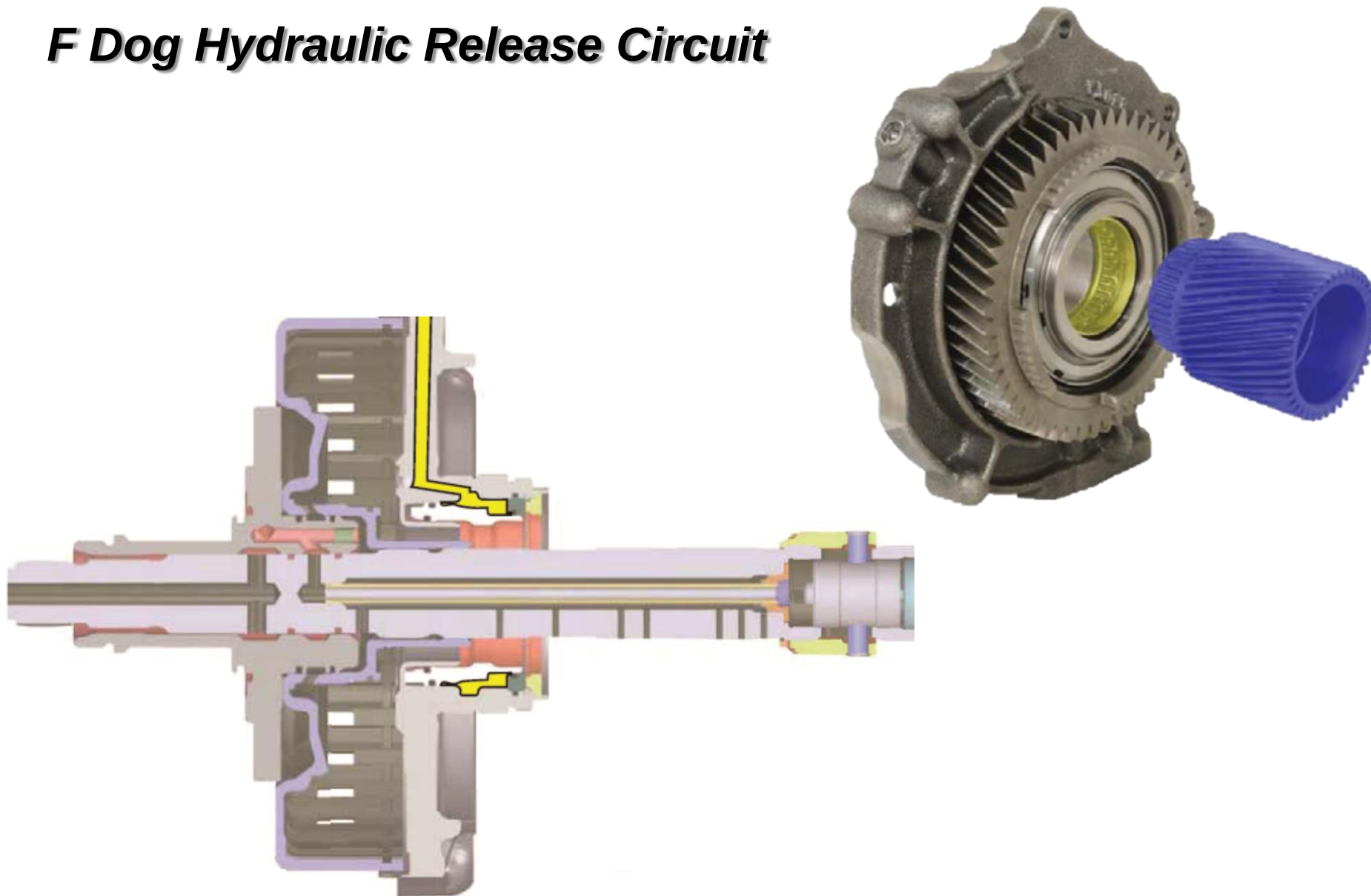


F Dog Hydraulic Apply Circuit





F Dog Hydraulic Release Circuit





Jeep 9-speed needs a reset again (3rd software upgrade) Software tweak aims to smooth out issues with Cherokee shifting

The dog clutch is the linchpin that allows Chrysler's nine-speed transmission to be so compact. Chrysler delayed the Jeep Cherokee's launch to tweak the transmission's software. Now, it's under its third five-minute software reset or "reflash".

A new software recalibration covers more than 100,000 Jeep Cherokees to address continuing issues with the way some of the nine-speeds shift gears.

A service bulletin advises technicians in certain cases to perform an "adaptation drive learn" taking the Cherokee out for a test drive of up to 78 minutes to ensure that it is shifting correctly.

Not all Cherokees sold require the reflash, according to the automaker, but it is available under warranty to customers who complain about the feel or operation of the transmission.

In a written statement, a Chrysler spokeswoman said the reflash was being done "to respond to customer feedback and improve satisfaction." She said dealers were "asked to perform the software update on any unsold vehicles in inventory and for any customer who has requested improved throttle response or shift feel."

About half of the 30 consumer complaints where "while it can be engaged in highway driving, it'll likely shift down to 8th gear at higher speeds because the drag starts to slow the car down".



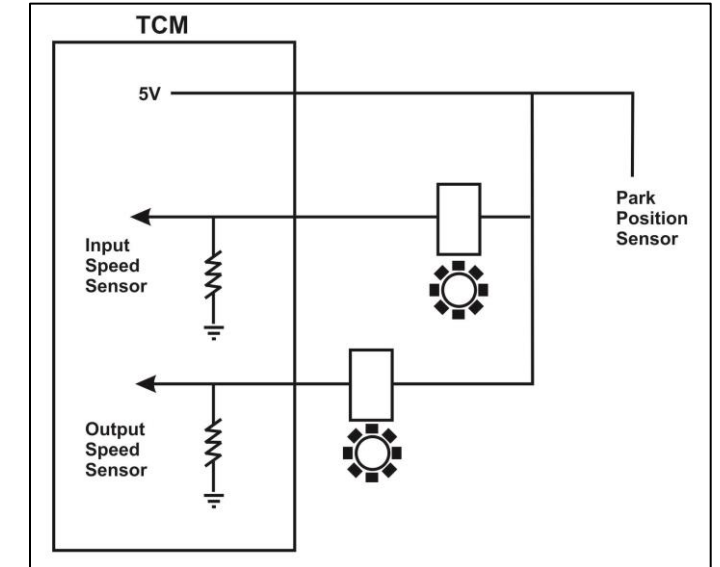
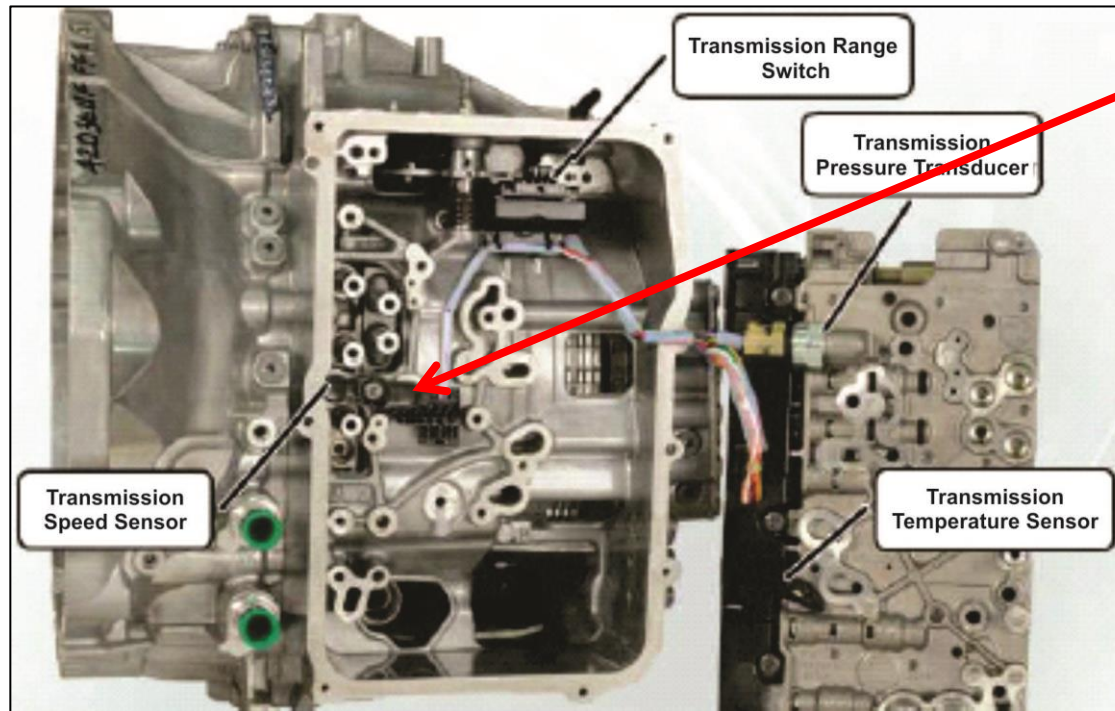


Speed Sensors

The input and output sensor are part of a single assembly located under the valve body.

The sensors produce a 9V square wave based on the speed of the rotating components.

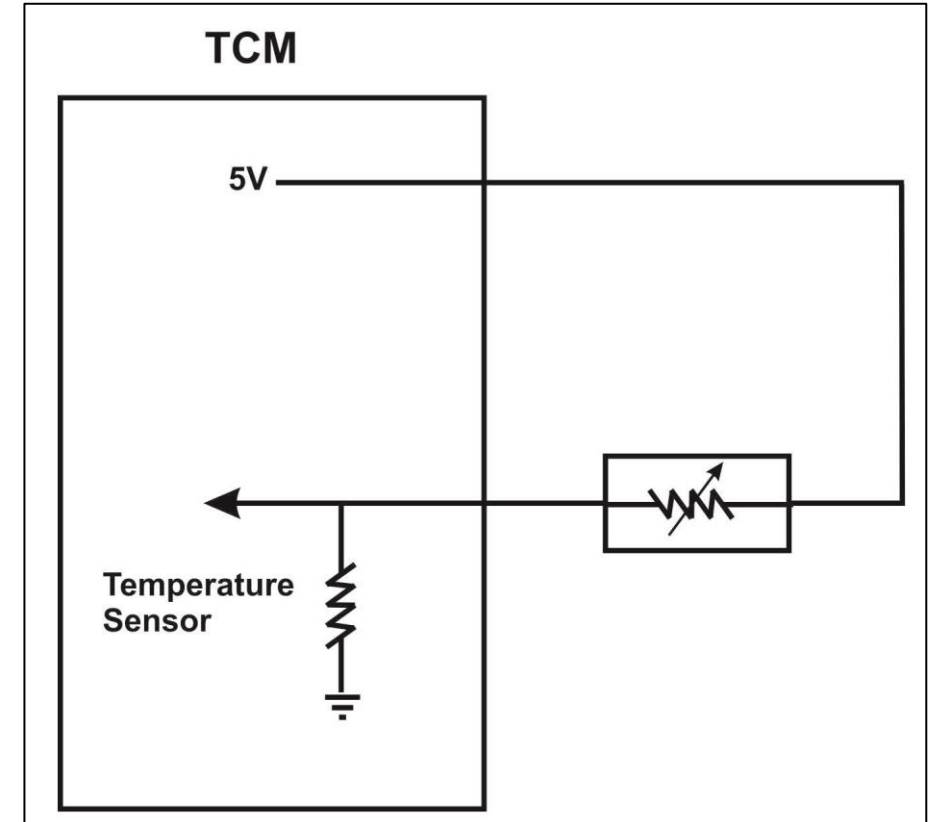
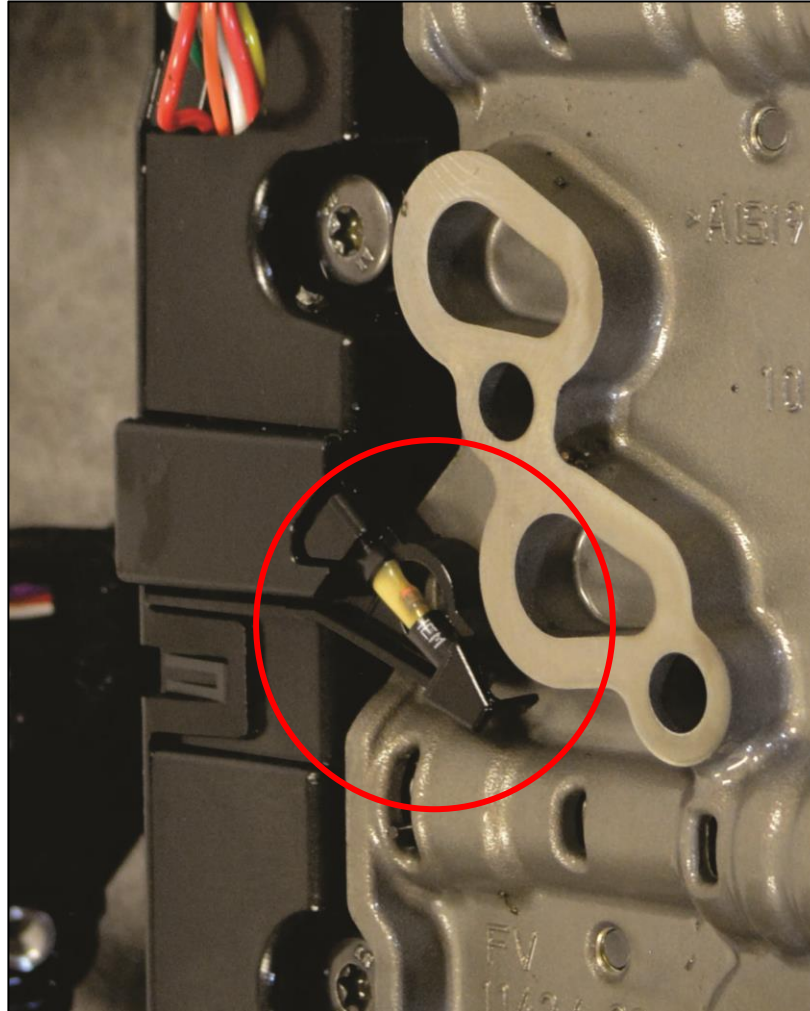
The input speed sensor uses the E clutch housing as a tone wheel and the output speed sensor uses the transfer gear.





Transmission Fluid Temperature Sensor

The transmission fluid temperature sensor is part of the internal pass through wiring harness.





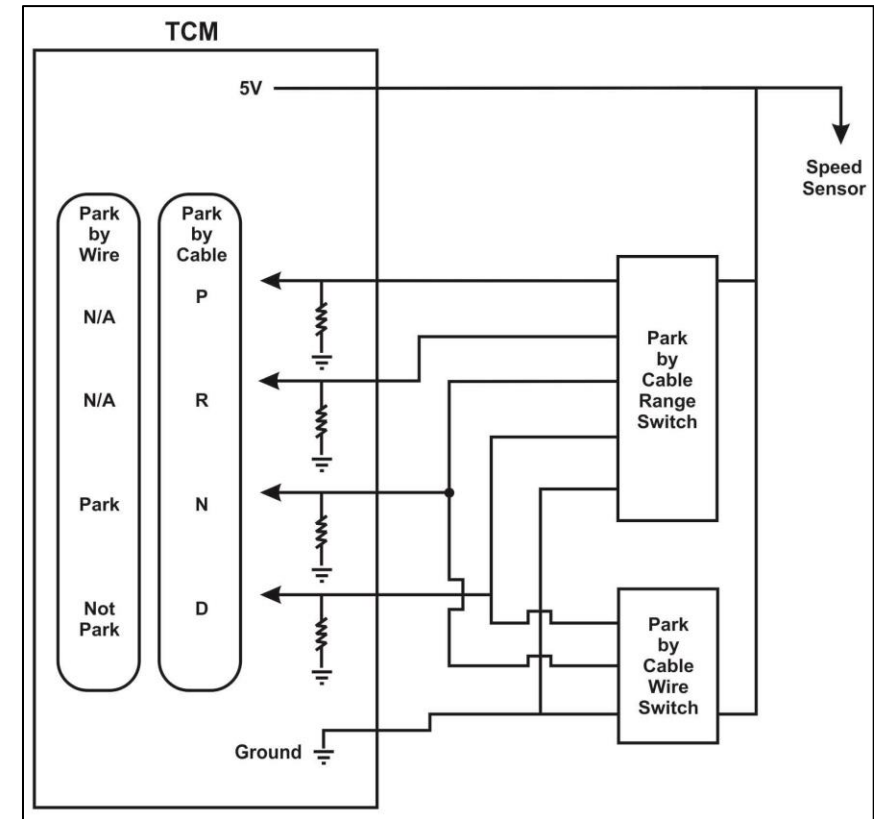
Transmission Range Sensor (IMS)

There are two range switch variants—shift-by-wire and shift-by-cable. Both are non-contact magnetic based sensors.

The shift-by-wire range switch is very similar in operation to the 8HP45 transmission.

The park by-cable range switch is typical with circuits for park, reverse, neutral, and drive.

The range sensor is mounted internal to the transmission and operates like an IMS.





Electronic Range Selector (ERS)

Moving the shift lever to the ERS position (other than drive) will activate ERS mode.

Which will display the current gear in the instrument cluster, and maintain that gear as the top available gear.

Once in ERS mode, moving the shift lever forward (-) or rearward (+) will change the top available gear.



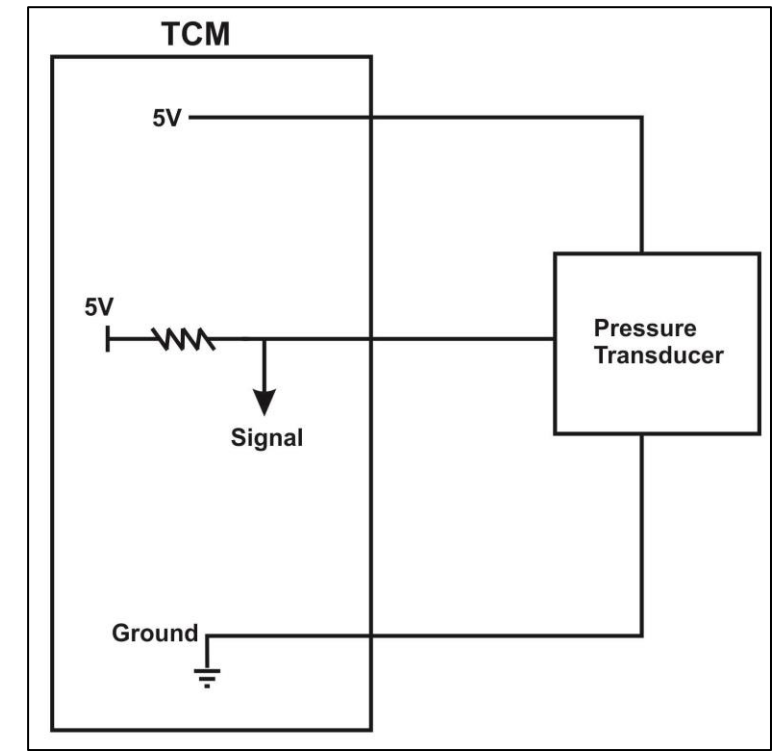
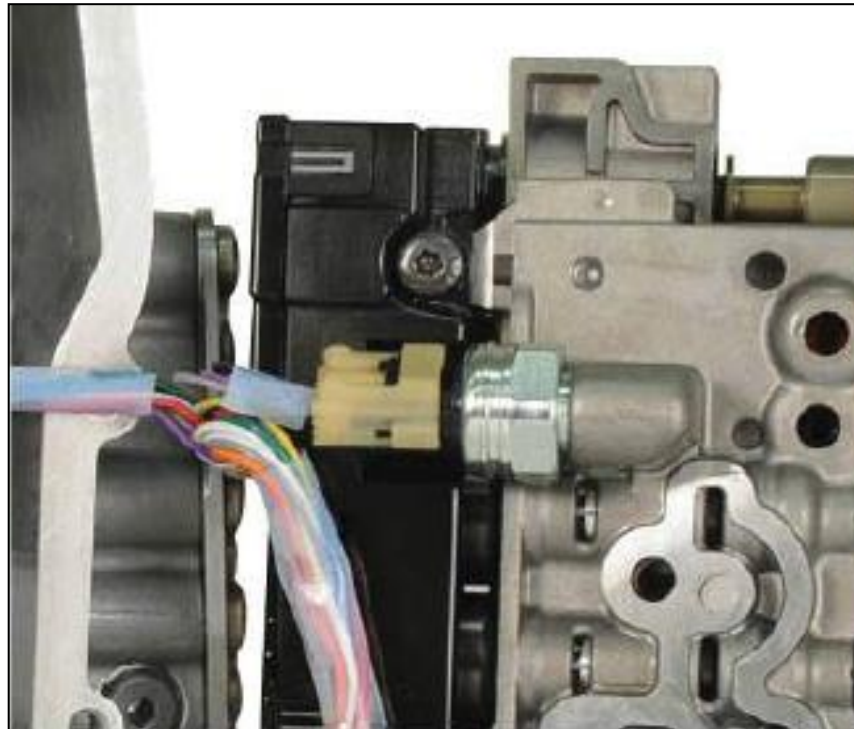


Dog Clutch Pressure Transducer

The pressure transducer is mounted to the valve body and is used by the TCM to monitor release pressure of both dog clutches.

When one of the dog clutches releases, there is a momentary increase in the dog clutch exhaust circuit pressure.

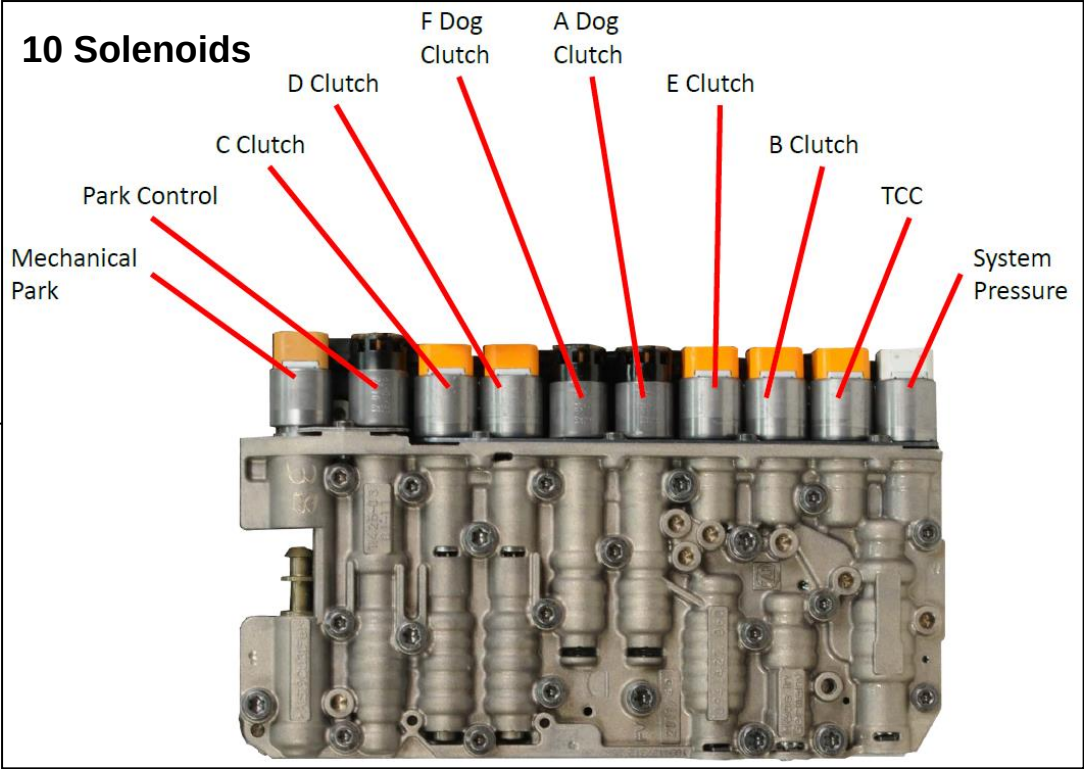
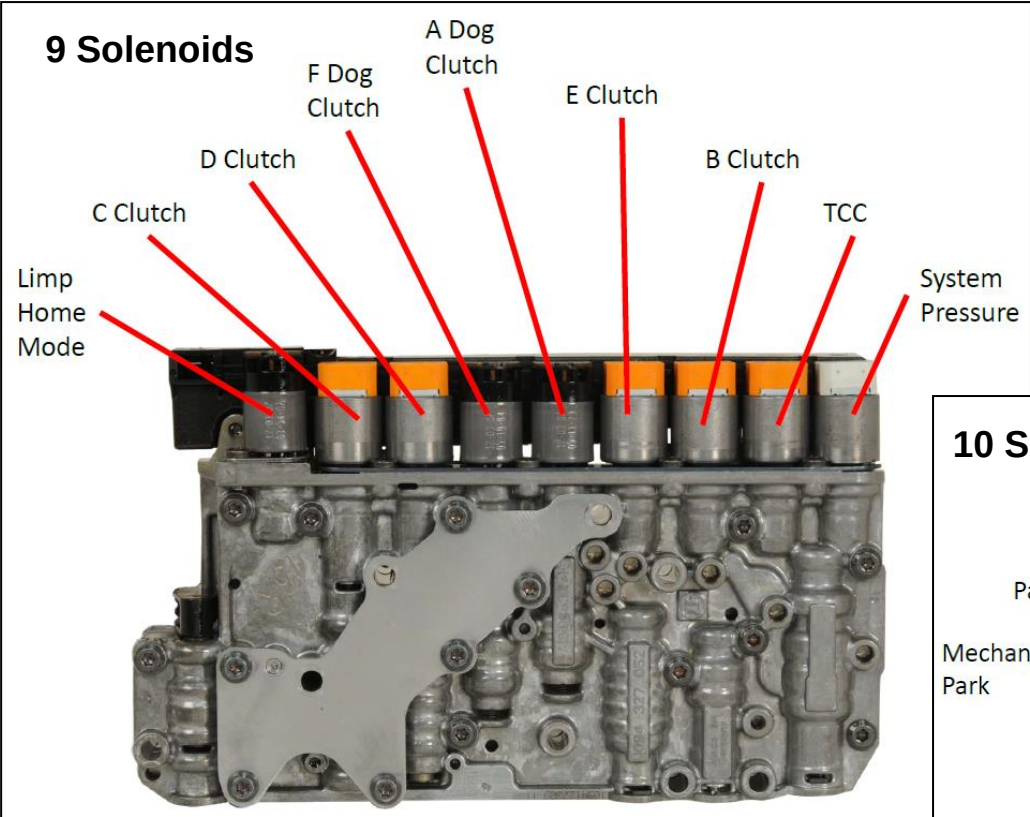
The transducer signal pattern is monitored by the TCM for control and diagnostics.





Solenoid Identification

Park By Cable



Park By Wire





Solenoid Apply Chart

Gear	Clutch Solenoids						TCC	SYS	Park	Mech Park	Limp Home Mode
	A	B	C	D	E	F					
P						X		X			
N						X		X	X	X	X
R		X	X	X		X		+/-	X	X	X
1	X		X	X		X	+/-	+/-	X	X	X
2	X					X	+/-	+/-	X	X	X
3	X	X				X	+/-	+/-	X	X	X
4	X				X	X	+/-	+/-	X	X	X
5	X	X			X		+/-	+/-	X	X	X
6	X		X		X		+/-	+/-	X	X	X
7	X			X	X		+/-	+/-	X	X	X
8			X	X	X		+/-	+/-	X	X	X
9		X		X	X		+/-	+/-	X	X	X
LHM R								Off Max	NA	NA	
LHM D4								Off Max	NA	NA	
X = ON +/- = VARIABLE											



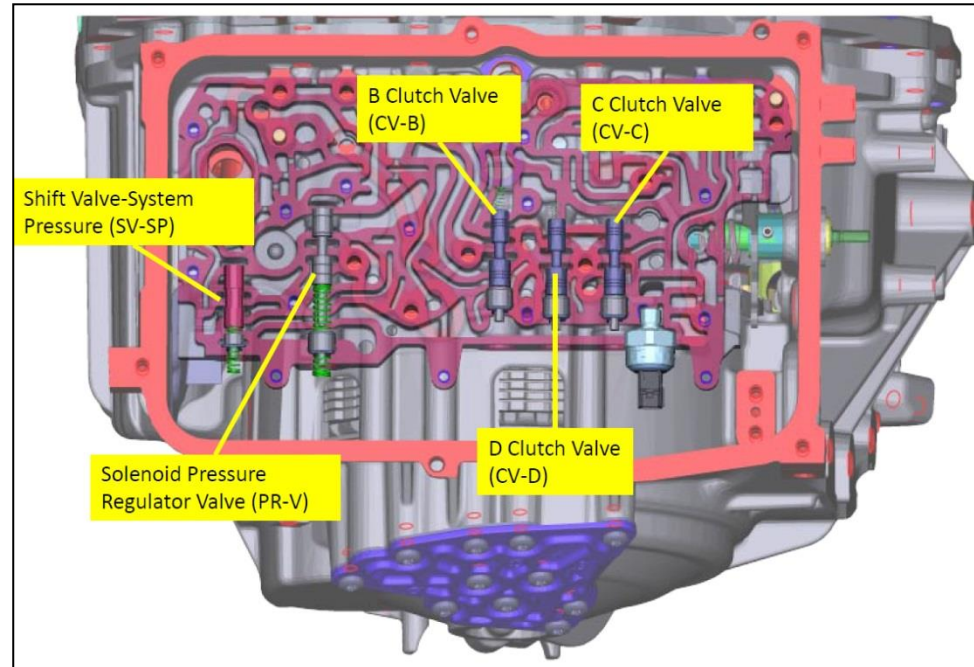


Park by Wire

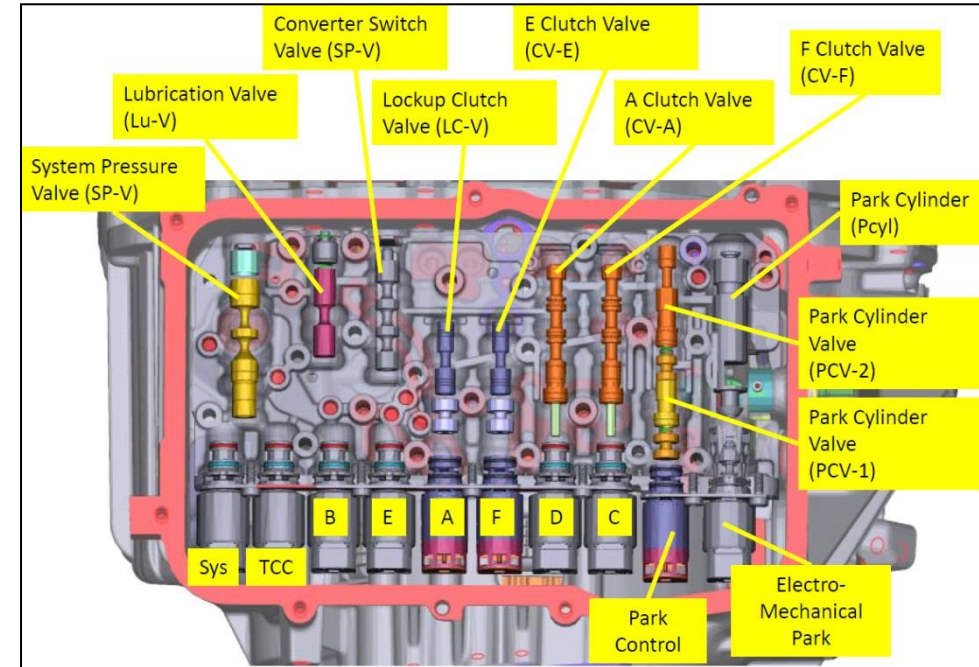
Similar to the system used with the 845RE there is no mechanical connection between the shifter and the transmission.

A park lock piston is used to control the position of the parking pawl. The linkage is spring-loaded to default into the park position.

Lower Valve Body



Upper Valve Body

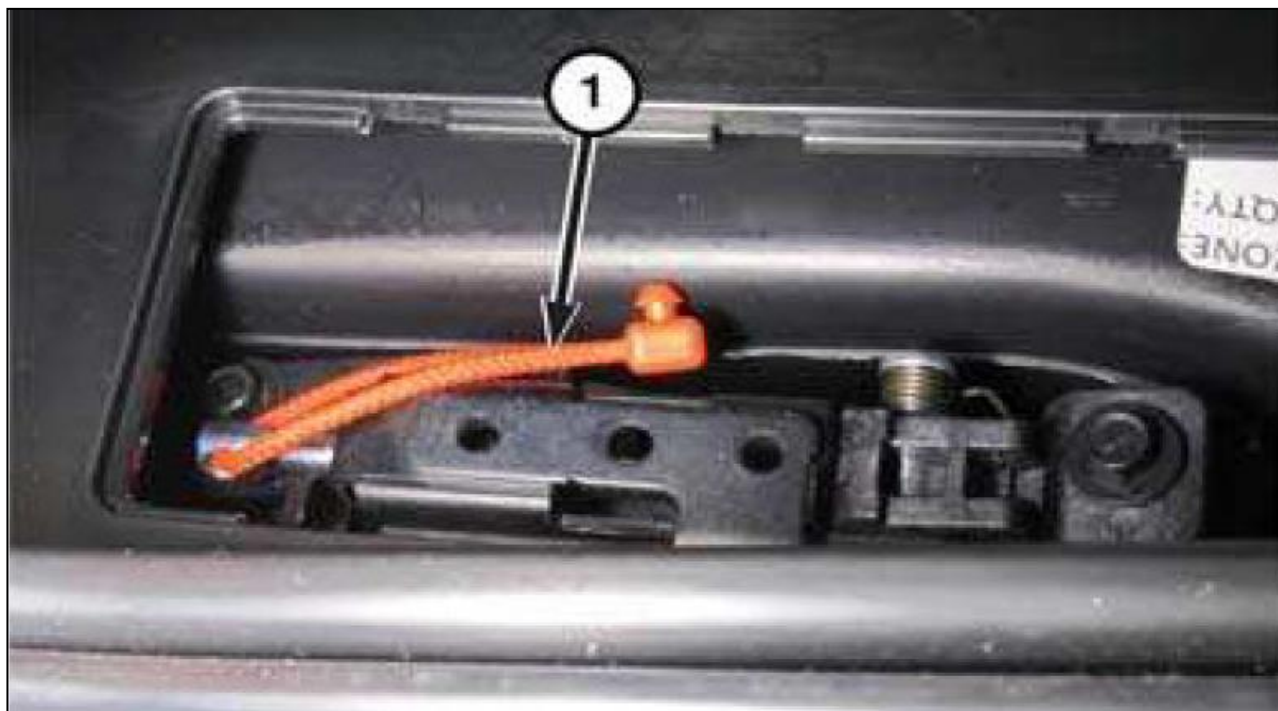




Park by Wire

The Manual Park Release lever is used for putting the transmission in neutral anytime the vehicle needs to be moved with the engine off. This is achieved by a cable attached to the transmission park pawl.

When the cable is pulled, the transmission is put into neutral, and when the cable is released, the transmission is back into park. (Located in center console).





Acura Push Button Park by Wire Not Holding Park

Acura is halting sales of their 2015 TLX equipped with push button transmission shifter.

The 9 speed 948TE may indicate park but still roll away as the park lock fails to work. As of January 6 2015 Acura is notifying customers of the recall.





Chrysler Vehicles Use Shift Knob Trans Control

No park issues have occurred at this point in time with Chrysler models.

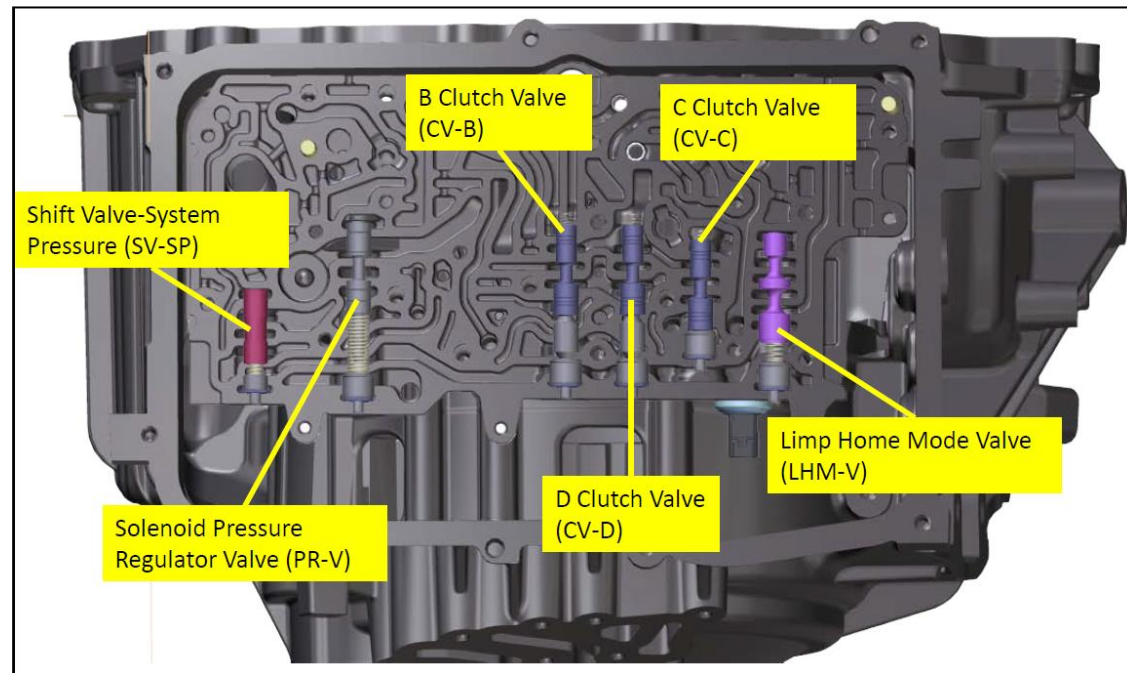




Park by Cable

The manual valve provides gates for park (by way of a parking pawl), reverse, neutral and drive.

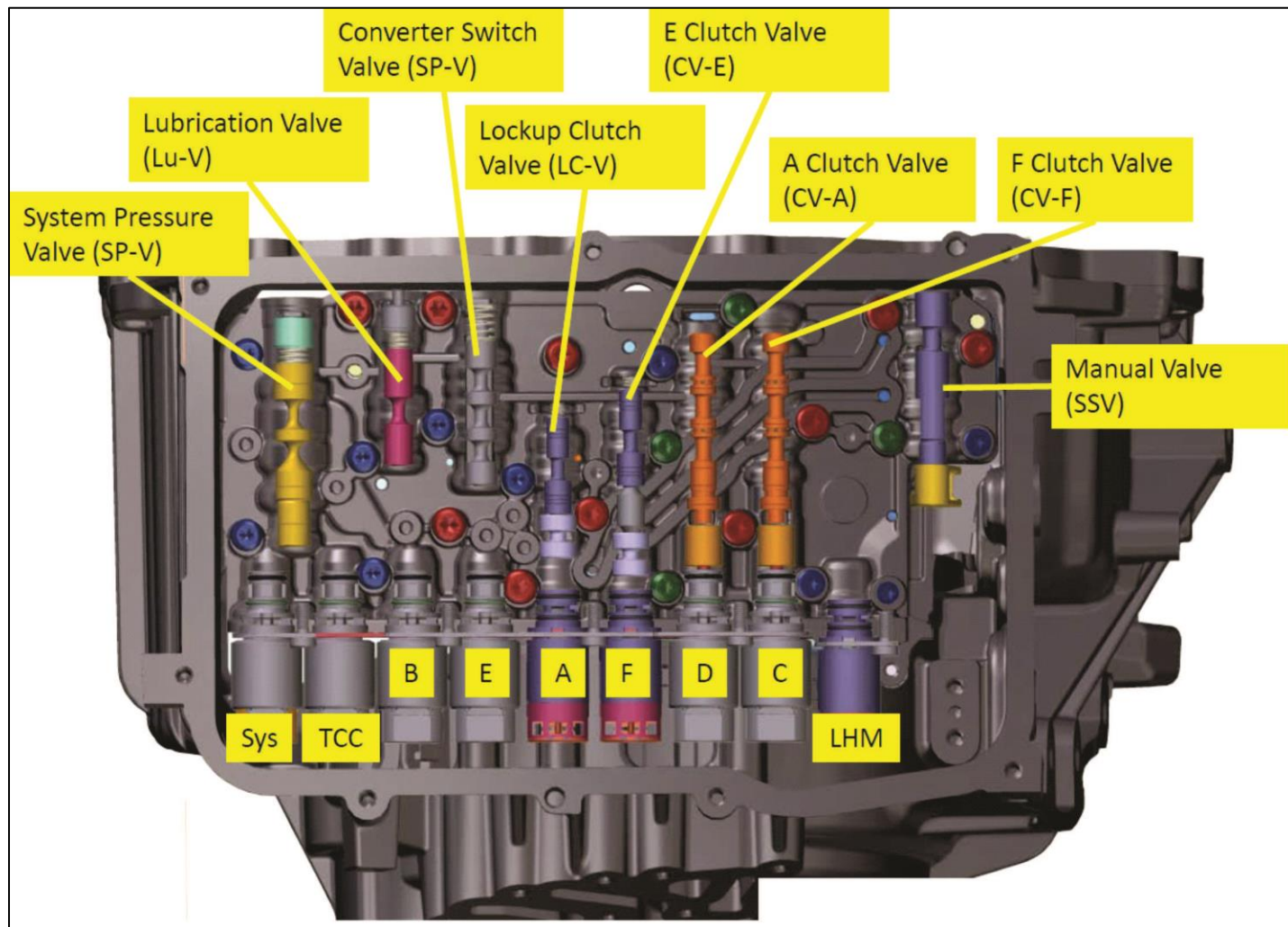
Lower Valve Body





Park by Cable

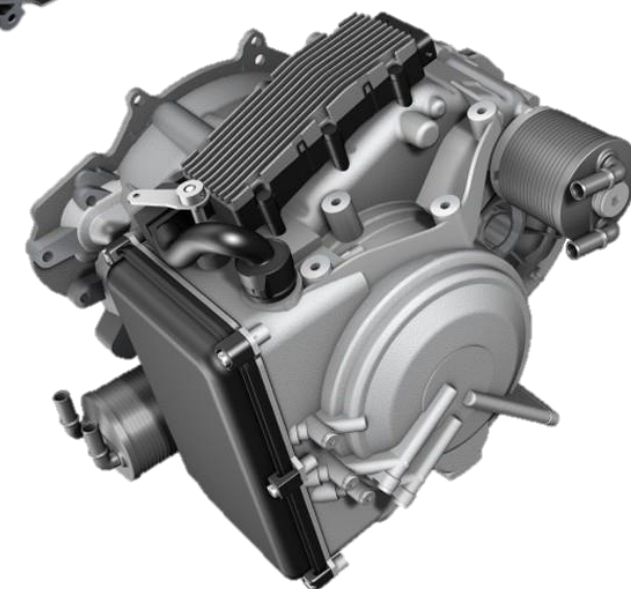
Upper Valve Body





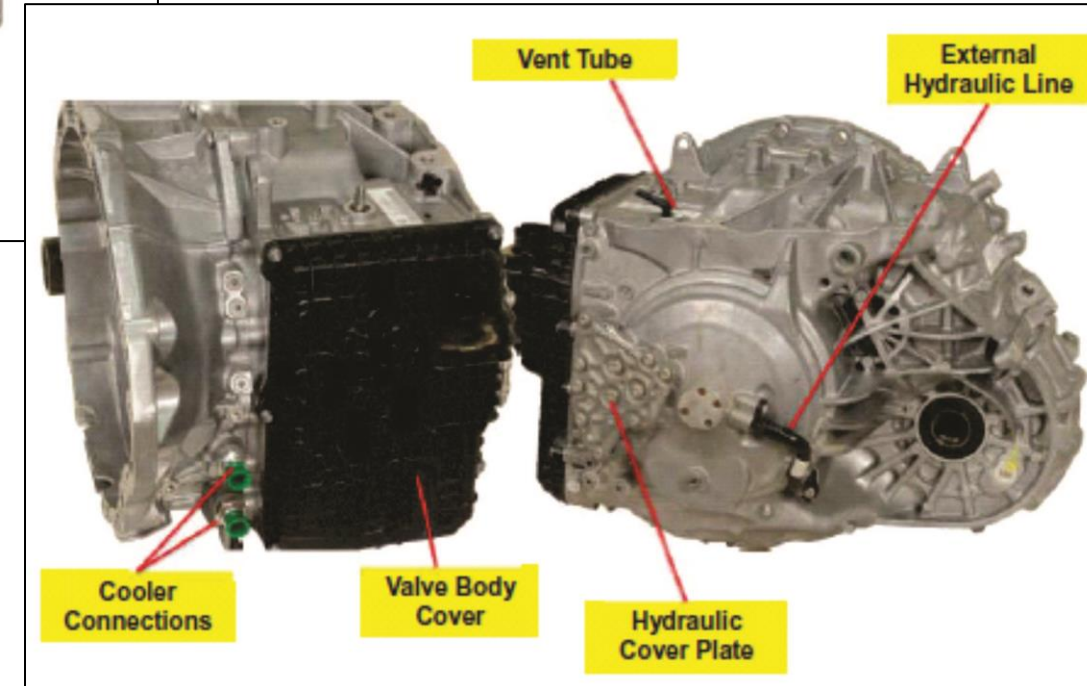
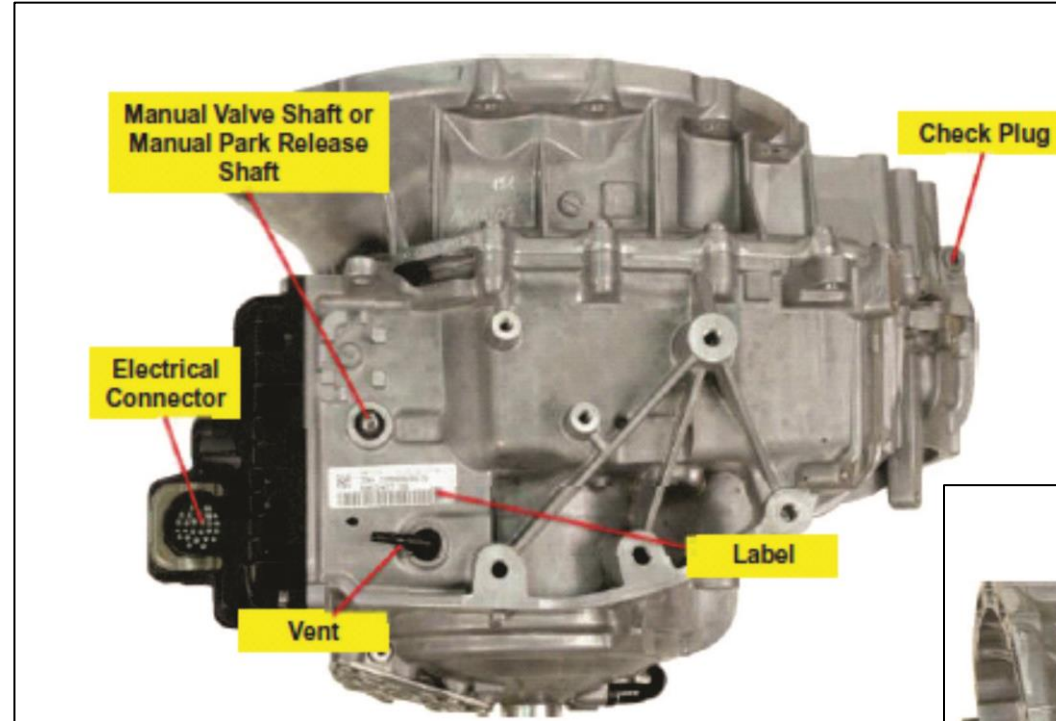
TCM Locations

The TCM may have Chrysler & ZF markings with both Chrysler & Fiat part numbers.



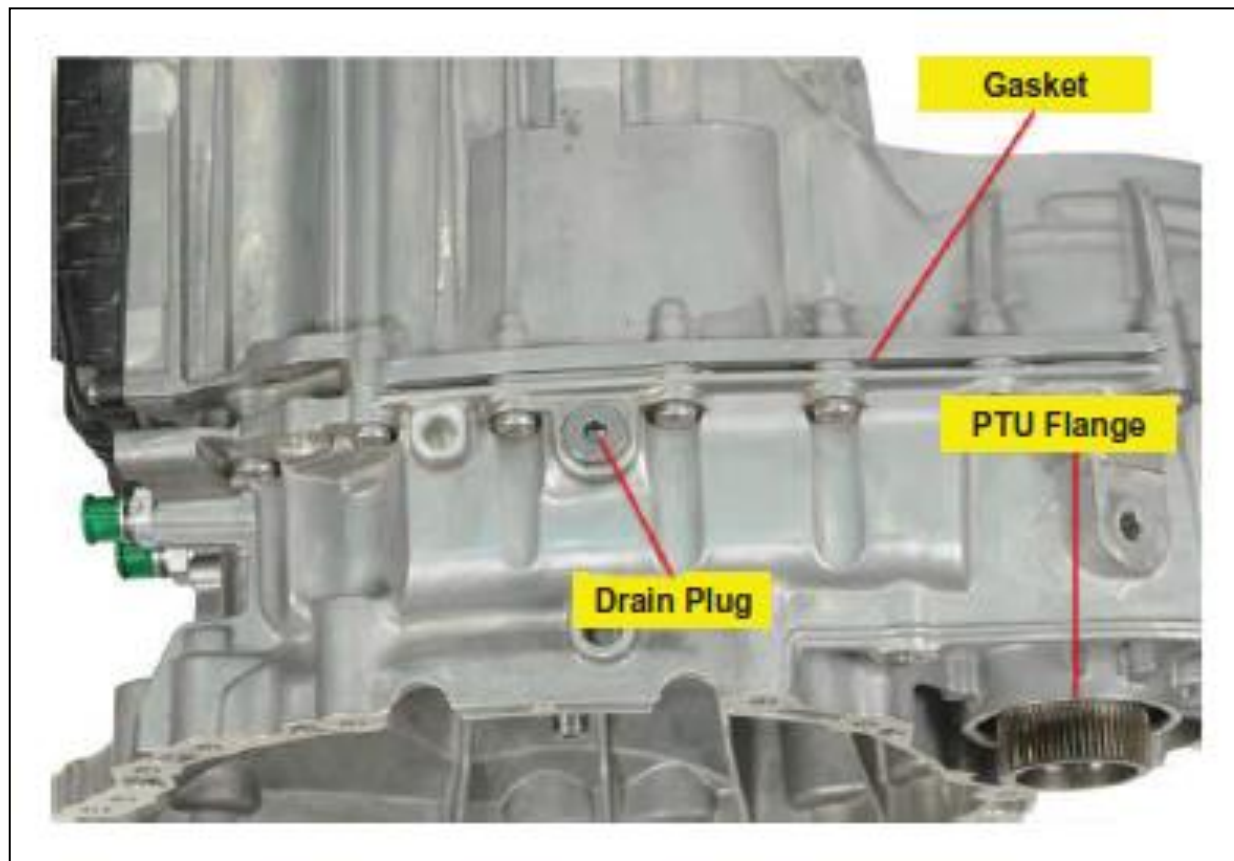


External Components





External Components





Fluid Level Check 2.4L Engine

NOTE: It is not necessary to check the fluid level unless there are shifting issues and/or has evidence of a transmission fluid leak.

NOTE: Special dipstick tool 10323A and a scan tool are required to accurately measure the fluid level.

To check the fluid level; measure the distance from the upper lip of the fluid level check port, located on top of the transmission housing above the differential, down to the surface of the fluid.

Dipstick tool 10323A is marked in 5 mm increments.

The engine must be running at idle with the transmission in park and the vehicle in a level position.

1. Connect a scan tool to the diagnostic connector under the instrument panel on the driver's side of the vehicle.
2. View the scan tool data display and read the transmission fluid temperature.
3. Start the engine and allow it to run at idle with the transmission in Park.
4. Verify that the fluid temperature is above 50 °C.

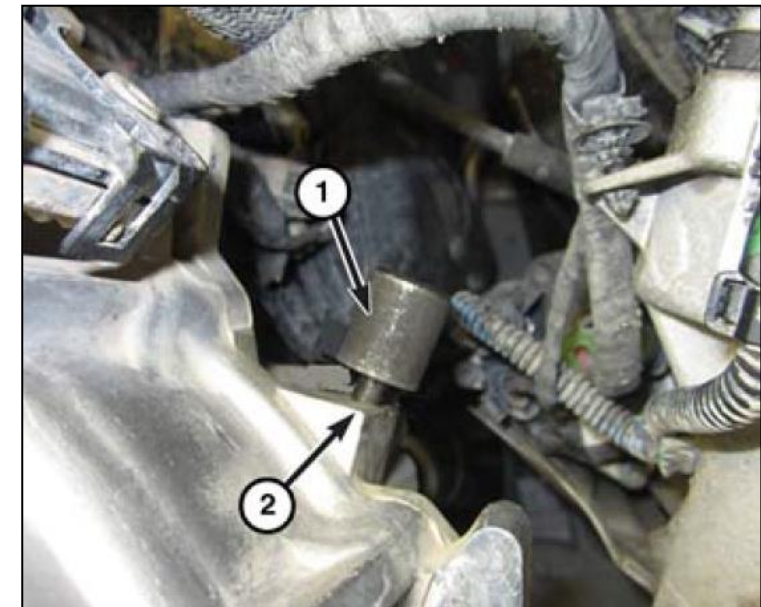
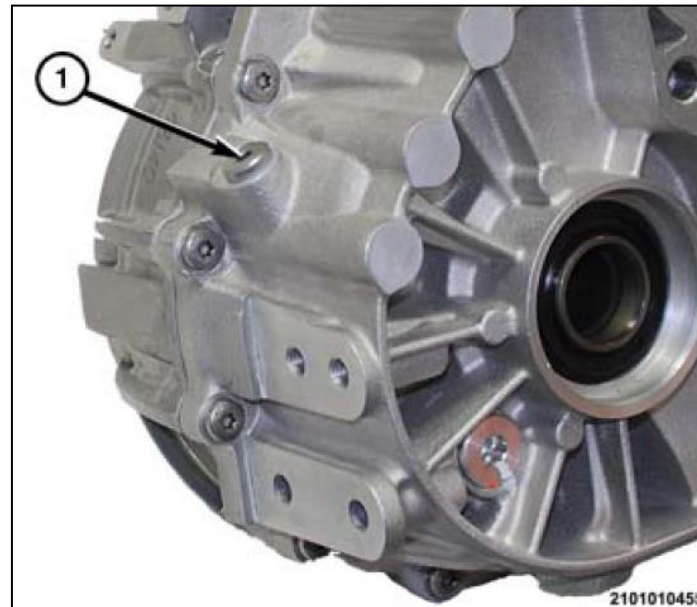




Fluid Level Check 2.4L Engine

NOTE: Vehicle must be level for accurate transmission fluid level readings.

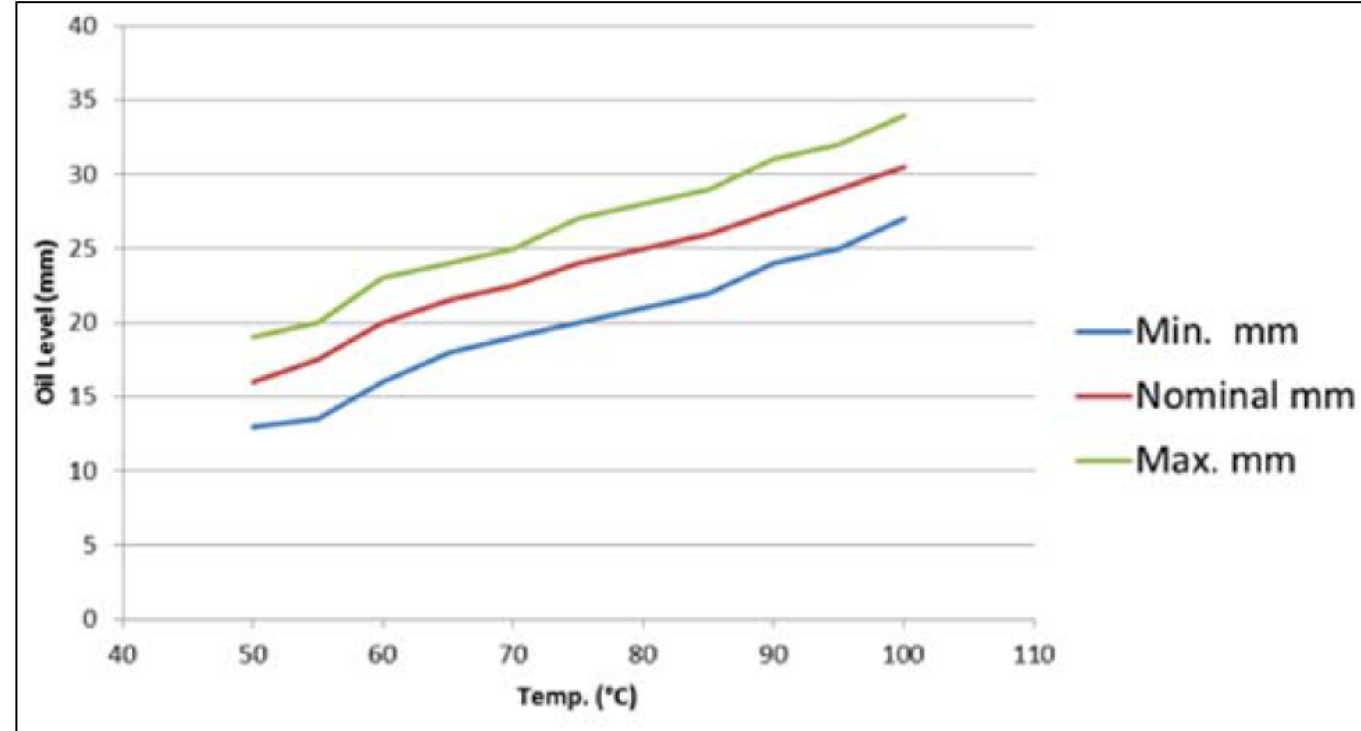
5. Raise and support the vehicle.
6. Remove the left front tire and wheel assembly.
7. Turn the steering wheel to the full left position.
8. Remove the plug (1) from the fluid level check port.
9. Insert dipstick tool 10323A (1) into the fluid level check port and allow the handle of the tool to rest on the flat surface of the transmission housing (2) around the check port.
10. Remove the dipstick tool 10323A (1) from the check port (2), keeping the handle above the tip so the level reading remains accurate.





Fluid Level Check 2.4L Engine

11. Note the increment on the shaft of the Dipstick 10323A where the fluid left a witness mark.
12. Based on the temperature of the fluid and the measurement on the tool, refer to the graph or table to determine the proper level.
13. Install the plug into the fluid level check port and tighten to the proper torque specifications.
14. Install the left front tire and wheel assembly.





Fluid Level Fill Table

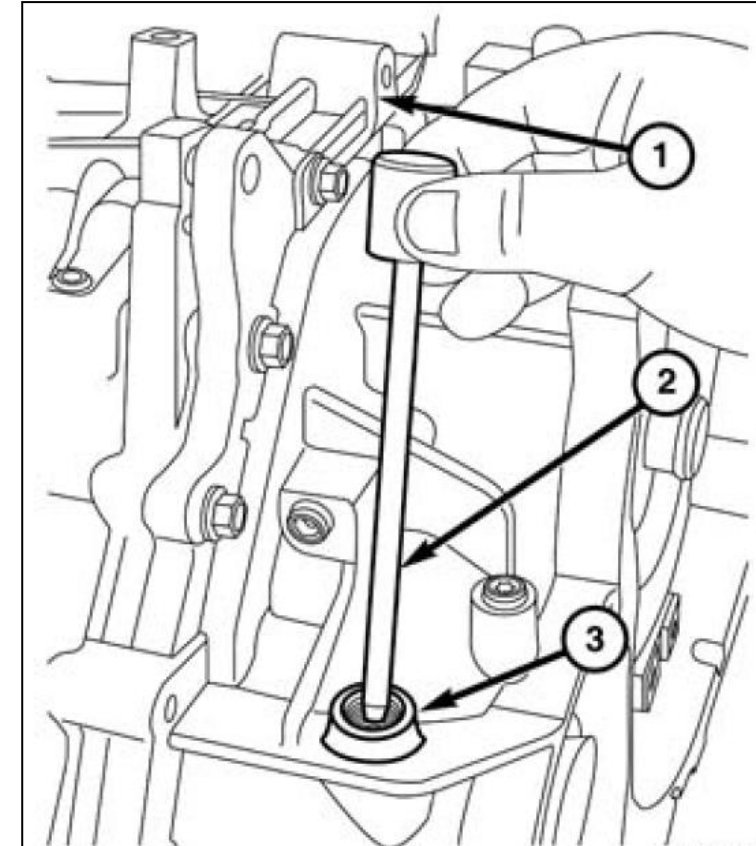
TEMP in °C	MIN LEVEL (mm)	NOMINAL LEVEL (mm)	MAX LEVEL (mm)
50°	13 mm	16 mm	19 mm
55°	13.5 mm	17.5 mm	20 mm
60°	16 mm	20 mm	23 mm
65°	18 mm	21.5 mm	24 mm
70°	19 mm	22.5 mm	25 mm
75°	20 mm	24 mm	27 mm
80°	21 mm	25 mm	28 mm
85°	22 mm	26 mm	29 mm
90°	24 mm	27.5 mm	31 mm
95	25 mm	29 mm	32 mm
100	27 mm	30.5 mm	34 mm





Fluid Level Check 3.2L / 3.6L Engine

1. Repeat steps 1 – 4 as previously shown.
5. Remove the engine cover.
6. Remove the plug from the fluid level check port.
7. Insert dipstick tool 10323A (2) into the fluid level check port (3) and allow the handle of the 10323A dipstick to rest on the flat surface of the transmission housing (1) around the check port.
8. Remove the dipstick 10323A from the check port, keeping the handle above the tip so the level reading remains accurate.
9. Note the increment on the shaft of the dipstick where the fluid left a witness mark.
10. Based on the temperature of the fluid and the measurement on the tool, refer to the graph or the table (shown previously) to determine the proper level.
11. Install the plug into the fluid level check port and tighten to the proper torque specifications.
12. Install the engine cover.





Recommended Fluid & Filter Location

Mopar ZF 8 & 9 speed transmission “Fill for Life” fluid is recommended part #68157995AB. Pale green in color and use of leak dye not recommended.

The filter is mounted directly to the oil pump housing and is internal to the transmission case.

The filter is only replaced as part of a major transmission repair. (Bell housing must be removed to access)

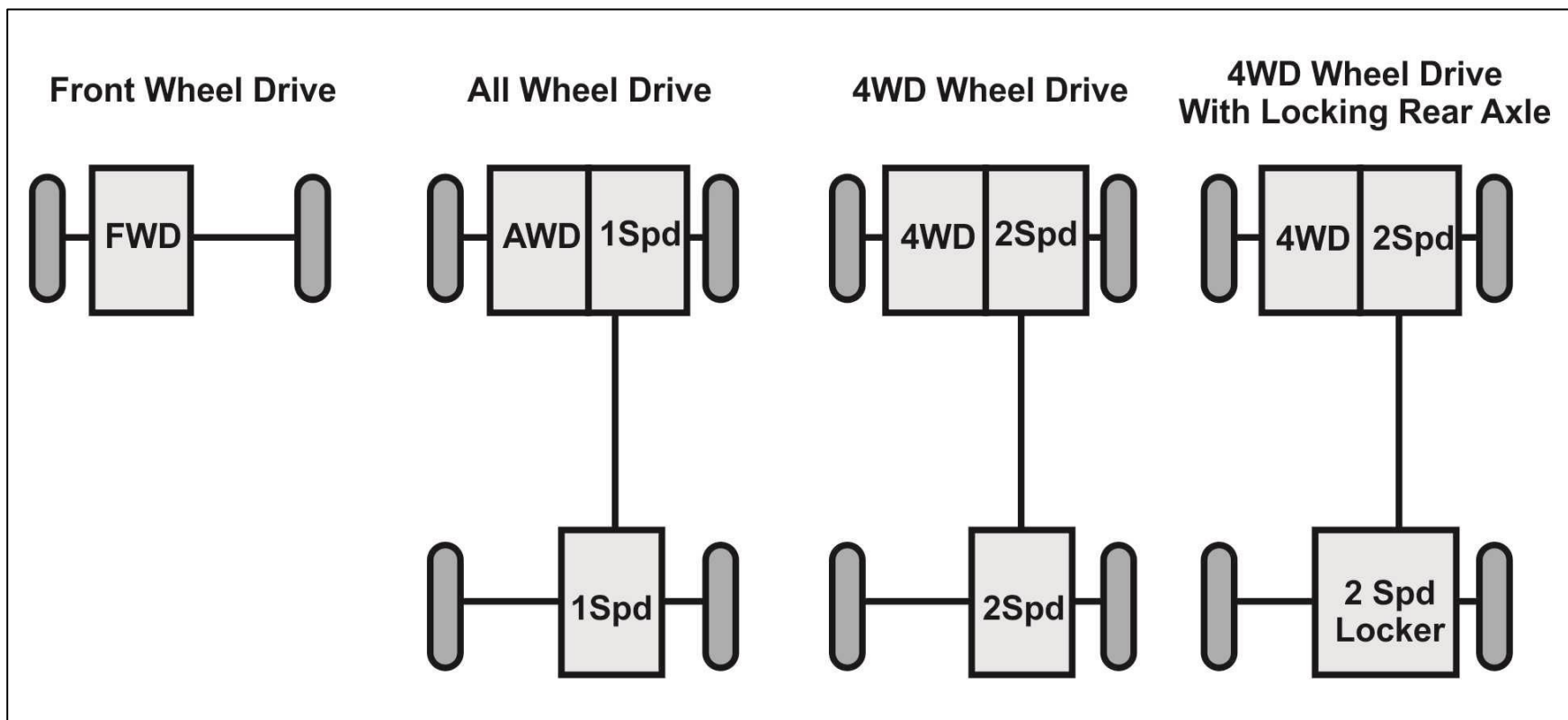




All Wheel Drive Systems

There are 3 types of all wheel drive (AWD) systems used with the 948TE transmission.

- Active Drive 1 AWD Single Speed.
- 4 Wheel Drive 2 Speed.
- 4 Wheel Drive 2 Speed with Locking Rear Axle.



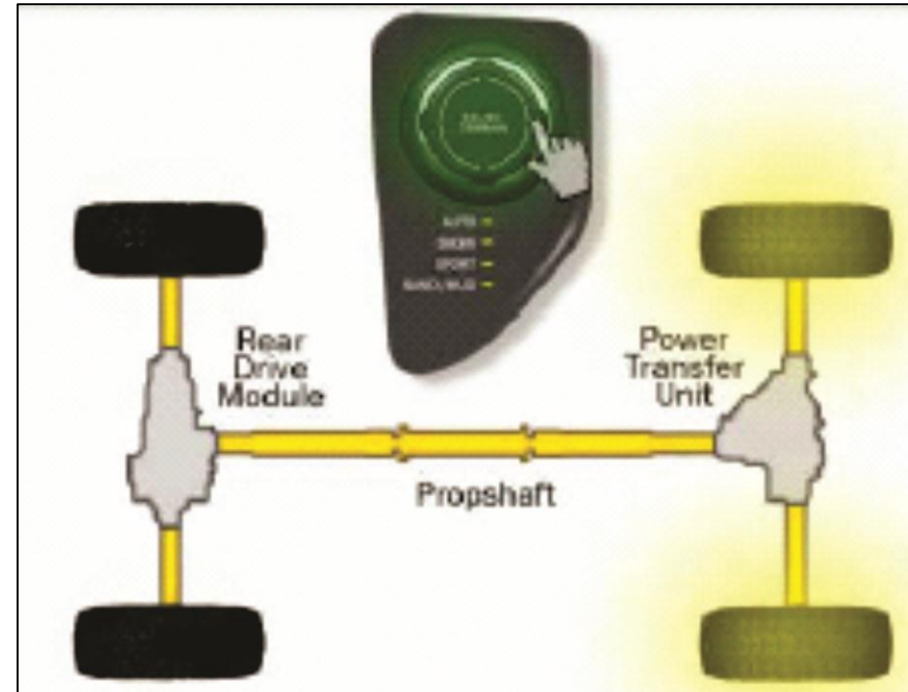


Active Drive 1 Single Speed

Active Drive 1 AWD system uses a Single Speed Power Transfer Unit (PTU) with a Single Speed Rear Driveline Module (RDM).

Which operates in FWD mode until AWD is needed. AWD is automatically selected when conditions and driving style are operated in Auto Mode.

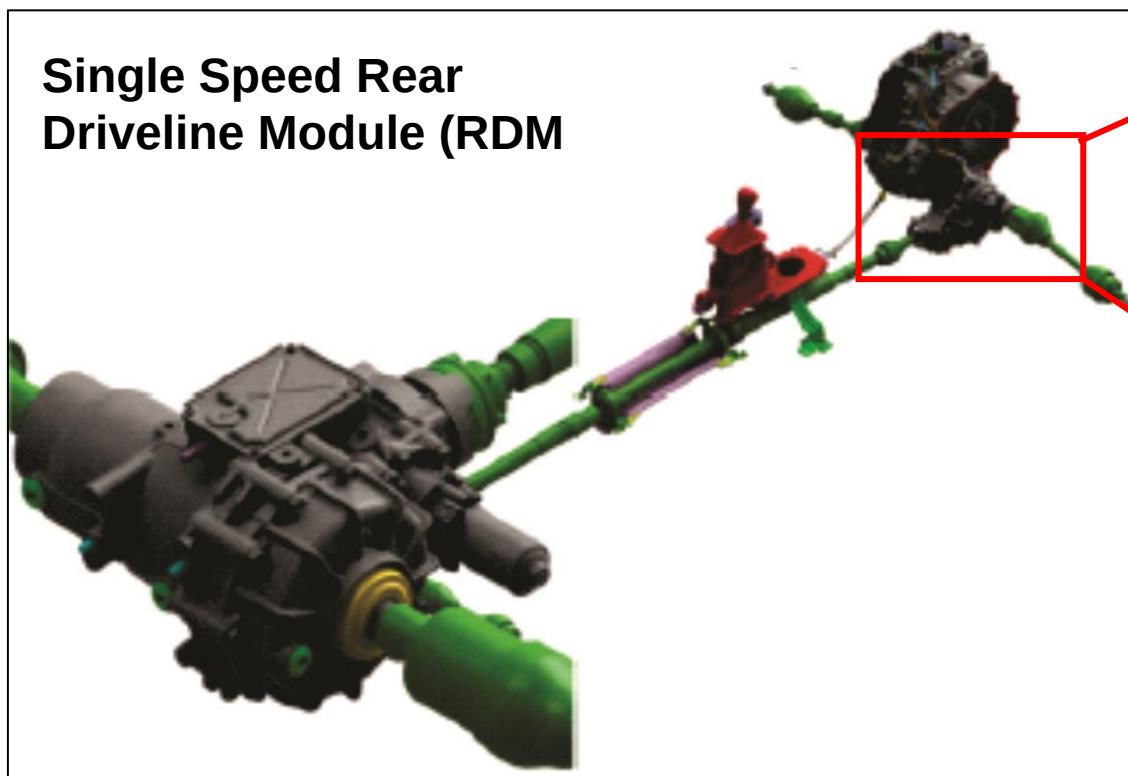
All time AWD is also available by way of a Select Terrain Dial.





All Wheel Drive (Active Drive 1)

Single Speed Rear
Driveline Module (RDM)



Single Speed Power
Transfer Unit (PTU)

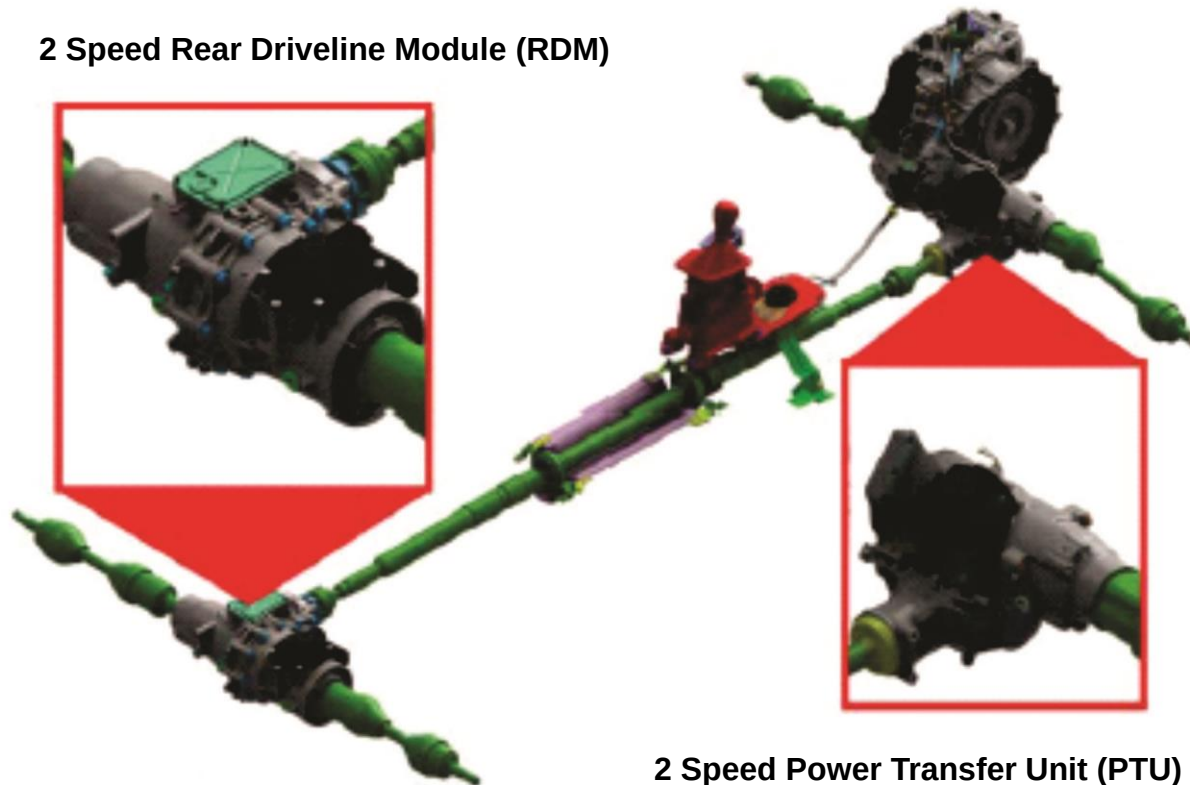




4 Wheel Drive (2 Speed)

2 Speed Power Transfer Unit (PTU) with a 2 Speed Rear Driveline Module (RDM). The RDM can be locked per driver request on Locking Rear Axle models.

2 Speed Rear Driveline Module (RDM)



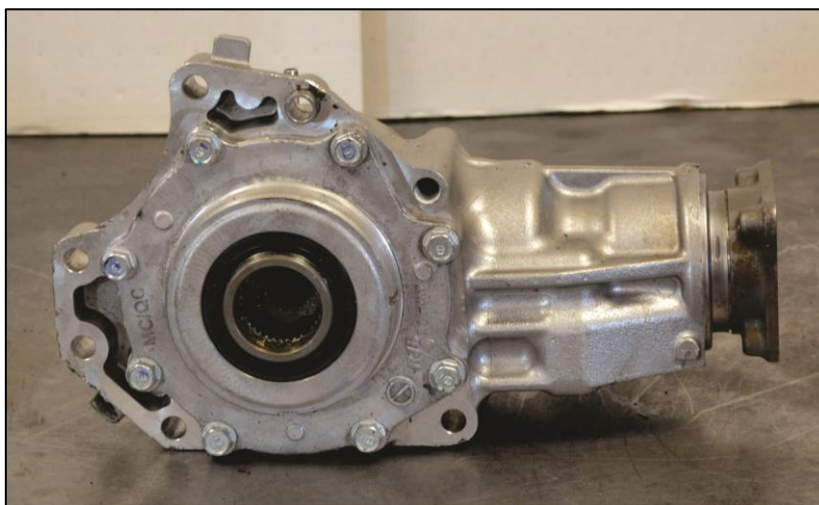
2 Speed Power Transfer Unit (PTU)





4 Wheel Drive Differential

Transfer driven gear and final drive pinion are a single assembly that include the parking gear.

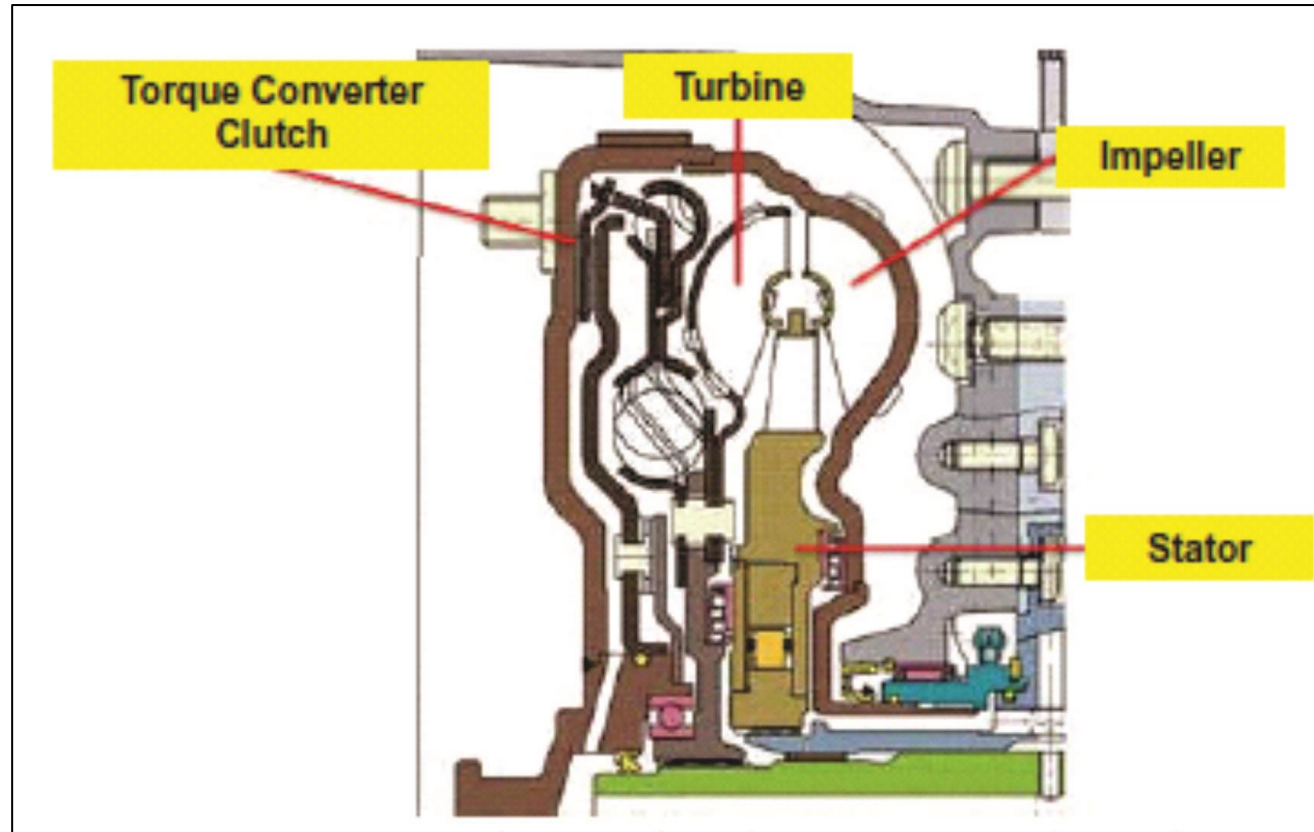




Torque Converter

The 948TE uses a conventional torque converter with a pump, stator and turbine.

The converter uses a single disc friction clutch splined to the dampening spring assembly.





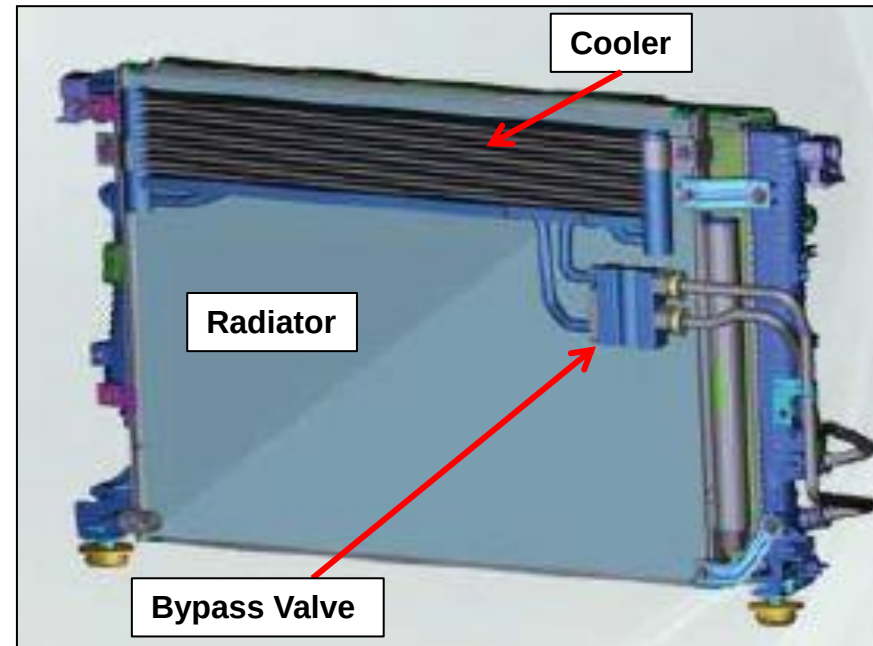
Cooling System

The 948TE uses a bypass valve in the cooling circuit. The operation and location may vary by vehicle make and model.

The typical bypass valve allows fluid flow to bypass the cooler until the fluid reaches operating temperature.

When the correct temperature is reached, the bypass valve opens and directs flow to the cooler.

Most bypass valves are designed to bypass the cooler if restricted and excessive back pressure is present.





Adaptation Learn

There is a factory TSB 21-013-13 on the following pages that will take you through the adaptation learn procedure step by step.



NUMBER: 21-013-13

GROUP: Transmission and Transfer Case

DATE: November 14, 2013

This bulletin is supplied as technical information only and is not an authorization for repair. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, or otherwise, without written permission of Chrysler Group LLC.

SUBJECT:

Transmission Shift Enhancements - Adaptation Learn Procedure

OVERVIEW:

This bulletin involves performing a subjectivity shift quality rating and performing the transmission adaptation learn procedure if required.

MODELS:

2014 KL Cherokee

NOTE: This bulletin applies to vehicles equipped with the 948TE (9-Speed Automatic Transmission - Sales Codes DFJ or DFH).

DISCUSSION:

The 948TE automatic transmission uses a sophisticated shift algorithm that includes learned information so that the shift quality remains excellent even as the transmission wears. This learned information is recorded in memory cells referred to "Adaptation Memory Cells". Each applied clutch records the amount of time it takes to fill the clutch (Fast Filling Counter/Filling Time) and the amount of pressure (Filling Counter/Filling Pressure). The adaptation memory cells are set to zero (0) on every new transmission (new in vehicle and/or replaced for service) and when the transmission control module is replaced for service. In addition, the adaptation memory cells are set to zero (0) anytime the transmission control module is flashed, and when the transmission control module adaptation memory cells are cleared using the wiTECH diagnostic scan tool (Quick Learn/Valve Body Solenoid Learn). Until the adaptation has been learned/relearned, the transmission shift quality may not meet the customers expectations.

NOTE: Anytime the valve body assembly is replaced and/or the transmission has been overhauled, the adaptation memory cells must be cleared using the wiTECH.





Adaptation Learn

The adaptive learn procedure should be performed anytime the valve body assembly is replaced and/or the transmission has been overhauled, the adaptation memory cells must be cleared using the wiTECH or capable scan tool.



CAUTION: THE ADAPTATION LEARN PROCEDURE SHOULD NOT BE CONFUSED WITH "QUICK LEARN" SOON TO BE CALLED "VALVE BODY SOLENOID LEARN". THIS LEARN PROCEDURE IS REQUIRED TO MATCH THE TRANSMISSION CONTROL MODULE ELECTRICAL SYSTEM WITH THE SOLENOIDS IN THE VALVE BODY. THIS PROCEDURE SHOULD ONLY BE PERFORMED WHEN THE VALVE BODY AND/OR THE TRANSMISSION CONTROL MODULE HAS BEEN REPLACED. DO NOT PERFORM A QUICK LEARN WHEN THE TRANSMISSION ASSEMBLY HAS BEEN REPLACED. QUICK LEARN/VALVE BODY SOLENOID LEARN WILL ERASE ALL FACTORY SETTINGS WHEN PERFORMED. IT ALSO WILL ERASE ALL ADAPTATION MEMORY CELLS AS WELL. DO NOT PERFORM THE QUICK LEARN WHEN THE ADAPTATION LEARN PROCEDURE IS ALL THAT IS REQUIRED.

The following 948TE Clutch Application Chart has been provided for your reference only. This chart will help in identifying what clutches are applied in specific gears. Keep in mind that shift quality is greatly affected by the timing of disengaging one clutch and applying another smoothly. If a clutch remains on too long, then harsh shifts can occur or if the clutch disengages too quickly, then poor shift quality can be observed.

948TE Clutch Application Chart							
Gear	Clutch - A (Dog Clutch)	Clutch - B	Clutch - C	Clutch - D	Clutch - E	Clutch - F (Dog Clutch)	Ratio
First	X			X		X	4.700
Second	X		X			X	2.842
Third	X	X				X	1.909
Fourth	X				X	X	1.382
Fifth	X	X			X		1.000
Sixth	X		X		X		0.808
Seventh	X			X	X		0.699
Eight			X	X	X		0.580
Ninth		X		X	X		0.479
N/P				X		X	
Reverse		X		X		X	3.805
Default Fourth Gear					X	X	

The adaptation memory cells appear on the wiTECH for every clutch except the dog clutches. Each clutch will include:

- Fast Filling Counter = the number of filling time events that has taken place
- Filling Time = +/- number of ms (milli seconds) from zero (standard set value).
- Filling Counter = the number of filling pressure events that has taken place



Performance Pistons

Electronics

(800) 662-2700



Adaptation Learn

This factory TSB's as well as others can be found on a free website along with factory wire diagrams.

<http://www.revbase.com/BBBMOTOR>



- Filling Pressure = +/- mb (millibar)/PSI (Pounds Per Square Inch) from zero (standard set value)
- If the adaptation memory cell "counter" is zero (0), than the adaptation memory cell has not been updated. It will take a minimum of two counts to improve shift quality and with each subsequent count, shift quality will improve even more.

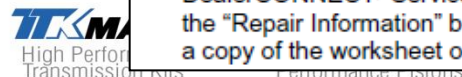
Typical wiTECH Display of 948TE Adaptation Memory Cells				
Graph	Name	Value	Unit	Type
	Clutch B - Filling Pressure	0	PSI	Sensors
	Clutch B - Filling Counter	6	Counts	Sensors
	Clutch B - Filling Time	0	ms	Sensors
	Clutch B - Fast Filling Counter	2	Counts	Sensors
	Clutch C- Filling Pressure	1	PSI	Sensors
	Clutch C- Filling Counter	6	Counts	Sensors
	Clutch C- Filling Time	18	ms	Sensors
	Clutch C- Fast Filling Counter	2	Counts	Sensors
	Clutch D- Filling Pressure	1	PSI	Sensors
	Clutch D- Filling Counter	6	Counts	Sensors
	Clutch D- Filling Time	-6	ms	Sensors
	Clutch D- Fast Filling Counter	2	Counts	Sensors
	Clutch E- Filling Pressure	2	PSI	Sensors
	Clutch E- Filling Counter	6	Counts	Sensors
	Clutch E- Filling Time	2	ms	Sensors
	Clutch E- Fast Filling Counter	3	Counts	Sensors





Adaptation Learn

This adaptive learn procedure must be performed completely step by step.



SYMPTOM/CONDITION:

Customers may indicate that their transmission shift quality does not meet their expectations.

DIAGNOSIS:

The following procedure should be performed if poor shift quality has been identified during the New Vehicle Preparation "Road Test". In addition, perform this diagnosis anytime a customer indicates that their shift quality does not meet their expectations, TCU is flashed or replaced, Valve Body is replaced, Transmission is replaced, Transmission has been overhauled, and/or the adaptation memory cells have been cleared with the wiTECH.

To ensure that the process is repeatable, dealers should perform the following recommendations:

- Identify specific employees to perform the Subjective Shift Quality Analysis. These employees become the Qualified Subjective Shift Quality Auditors.
- Each Qualified Subjective Shift Quality Auditor should drive approximately five (5) Jeep Cherokees to establish a baseline for the shift quality of each shift as received at the dealerships.

NOTE: This evaluation and procedure **MUST NOT** be done while the vehicle is still in Shipping Mode. Place the vehicle in Customer Mode prior to performing.

1. Using the wiTECH, check for active Diagnostic Trouble Codes (DTC) in the Transmission Control Module's (TCM) memory.
2. Were there any active DTC's in the TCM's memory?
 - a. YES>>>Using the appropriate trouble shooting procedure, diagnose and repair conditions that may have set the DTC(s).
 - b. NO>>>Proceed to the next step.
3. Start the vehicle and operate the engine until the transmission oil temperature is greater than 50°C (122°F). It may be necessary to apply the service brake and shift the transmission into gear to improve warm-up time and/or drive the vehicle until the transmission temperature reaches 50°C (122°F).

NOTE: Some vehicles may be equipped with a message center in the cluster that provides transmission temperature values. If the vehicle is not equipped with this message center, than the wiTECH must be used to identify transmission temperature.

Determining Shift Quality Subjective Measurement Chart

Condition Noted									
Not Tolerable	Severe	Very Poor	Poor	Marginal	Barely Accept	Fair	Good	Very Good	Perfect
1	2	3	4	5	6	7	8	9	10

4. The "Shift Quality Worksheet" will be used for documenting the Shift Quality Subjective rating as well as the Adaptation Memory Cell data. Refer to DealerCONNECT>Service>Diagnostic Check Sheets (Located on the Service Tab in the "Repair Information" box)>Transmission. Print a copy of the worksheet and attach a copy of the worksheet on the Repair Order once completed.



Adaptation Learn

The adaptation learn procedure should not be confused with “QUICK LEARN” soon to be called “VALVE BODY SOLENOID LEARN”.



5. Determine shift quality using the “Determining Shift Quality Subjective Measurement Chart”. Shift quality will be evaluated on a scale of 1 to 10. The shifts should include 1-2, 2-3, 3-4, 4-5, 5-6 upshifts along with 6-5, 5-4, 4-3, 3-2, and 2-1 down shifts with light braking and reverse engagement.
6. The transmission adaptations will improve as the vehicle is driven. Typically, normal shift quality upon receiving a vehicle will be as follows:

Shift Quality Evaluation			
Upshift			Downshift
	Target as Shipped		Target as Shipped
1 - 2 Shift	6	6 - 5 Shift	8
2 - 3 Shift	6	5 - 4 Shift	7
3 - 4 Shift	7	4 - 3 Shift	7
4 - 5 Shift	7	3 - 2 Shift	6
5 - 6 Shift	8	2 - 1 Shift	6

7. Drive the vehicle in a safe area where the transmission is allowed to shift from first gear through each gear up to sixth gear. From a stop, slowly accelerate the vehicle using a constant throttle/pedal to approximately 72 KPH to 80 KPH (45 MPH to 50 MPH). The transmission must shift from first gear up to sixth gear.
8. Record the Shift Quality Subjective Rating for each shift.

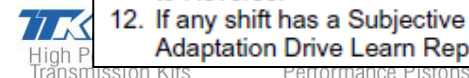
NOTE: The Shift Quality Subjective Rating should not be established by comparing each shift event to other shift events in a single vehicle. Example: Do not compare the 1-2 shift to the 3-4 to establish the subjective rating. The Subjective Quality Rating for each shift should be established by comparing the shift quality of a specific shift to the baseline of that specific shift established from driving multiple vehicles.

9. From 72 KPH (45 MPH), lightly brake to a stop.

NOTE: To confirm current gear position, move the gear shifter to the left and read the gear on the central dash digital display. Return the shifter to the far right immediately after reading current gear or wiTECH can be used to display actual transmission gear position.

NOTE: The time allowance includes time to perform the Subjective Shift Quality assessment (upshift from first gear to sixth gear and down shift from sixth gear to first gear) three times if necessary.

10. On the Shift Quality Worksheet, record the Shift Quality Subjective Rating for each shift.
11. While the vehicle is static and the service brake is applied perform a shift from Neutral to Reverse.
12. If any shift has a Subjective Shift Quality Evaluation less than five (5), perform the Adaptation Drive Learn Repair Procedure.





Adaptation Learn

This learn procedure is required to match the transmission control module electrical system with the solenoids on the valve body.



SEAL AFTERMARKET
PRODUCTS



NOTE: Customers may need to be informed that adaptation will continue to update as the vehicle is driven providing improved shifts as the vehicle mileage increases.

SPECIAL TOOLS/EQUIPMENT REQUIRED:

NPN	wiTECH VCI Pod Kit
NPN	Laptop

REPAIR PROCEDURE:

- To ensure that the process is repeatable, dealers should perform the following recommendations:
 - Identify specific employees to perform the Adaptation Procedure. These employees become the Qualified Adaptation Procedure Technicians.
 - Each Qualified Adaptation Procedure Technician should drive approximately five (5) Jeep Cherokees to establish a baseline for the shift quality of each shift as received at the dealerships.
- The Adaptation Drive Learn procedure is very sensitive to transmission temperature, transmission input shaft torque, and transmission turbine RPM. The Adaptation Drive Learn procedure must be performed at the following:
 - Transmission Oil Temperature between 50°C (122°F) - 110°C (230°F).
 - Transmission input Shaft Torque between 24 Nm (18 ft. lbs.) - 150 Nm (110 ft. lbs.) (will be monitored on wiTECH as Engine Crankshaft Torque).
 - Transmission input shaft RPM 1100 - 2500 RPM (can be monitored by monitoring Engine RPM using the tachometer on the cluster).
- The Adaptation Drive Learn procedure will be performed driving the vehicle while maintaining the previous criteria. The following needs to be considered when determining the Adaptation Drive Learn procedure drive route:
 - The Adaptation Drive Learn procedure needs to be performed on a road that can be driven safely while maintaining a constant speed of 80 - 96 KPH (50 - 60 MPH) for approximately 15 miles (B and C clutches) and 64 - 80 KPH (40 - 50 MPH) (D clutch).
 - The route road needs to be very smooth - imperfections in the road surface such as pot holes, tar strips, etc. can cause minor deflections in torque causing a delay in obtaining the adaptation.
 - Avoid hills although a constant slight incline will allow the transmission input shaft torque to be obtained easier. A too severe of an incline may cause the transmission to down shift. The adaptation must be learned in the proper gear. The procedure will restart once the proper gear has been obtained. Also, if the route contains hills that both incline and decline, the transmission input shaft torque load may be too light and the adaptations will not be recorded.
 - Traffic congestion should be avoided. The procedure will require the vehicle to be driven at a constant speed of 80 - 96 KPH (50 - 60 MPH) and 64 - 80 KPH (40 - 50 MPH). Vehicle speeds that drop to low may cause a delay in obtaining the adaptation.
 - Avoid Traffic Lights/Stop Signs/Yield Signs/etc. The procedure will require the vehicle to be driven at a constant speed of 80 - 96 KPH (50 - 60 MPH) and 64 - 80 KPH (40 - 50 MPH). Vehicle speeds that drops to low may cause a delay in obtaining the adaptation.
 - The Adaptation Drive Learn procedure is performed with an assistant so that wiTECH can be properly monitored while maintaining safe driving practices.



Adaptation Learn

This procedure should only be performed when the valve body and/or transmission control module has been replaced.



g. The order in which the clutch adaptations occur are not important. Based on the subjectivity rating on each shift will determine which clutch(es) may require the adaptation to be learned.

NOTE: The longer the previous criteria is held constant, the quicker the procedure can be accomplished.

B AND C CLUTCHES ADAPTATION LEARN PROCEDURE:

NOTE: Primary Shifts Affected by the B and C Clutch Drive Learn Procedure are Reverse Engagement, 1-2 upshift, 2-1 coast downshift, 2-3 upshift, 3-2 downshift, 4-5 up shift, 5-6 up shift, 6-5 down shift, 5-4 power on down shift, 3-2 down shift, 4-3 coast downshift.

1. Connect wiTECH VCI Pod to vehicle and to the laptop.
2. Start the engine and monitor transmission temperature to ensure that the temperature is between 50°C (122°F) - 110°C (230°F) before the adaptation drive learn process starts (vehicle can still be driven to targeted Adaptation Drive Learn procedure drive route to help obtain proper temperature).
3. Accelerate the vehicle moderately to seventh (7th) gear. It will be necessary to maintain seventh gear during this process by utilizing Electronic Range Shifter (ERS).
4. Drive vehicle at constant vehicle speed between 80 - 96 KPH (50 - 60 MPH).
5. Maintain seventh gear, steady pedal, and constant speed continuously for approximately 10 minutes.
 - a. Transmission input Shaft Torque should be between 24 Nm (18 ft. lbs.) - 150 Nm (110 ft. lbs.) (will be monitored on wiTECH as Engine Crankshaft Torque).
 - b. Transmission input shaft RPM should be between 1100 - 2500 RPM (can be monitored by monitoring Engine RPM using the tachometer on the cluster).

NOTE: The learn process may produce small, regular torque pulsations. This is normal, and indicates the learn process is working.

6. Using the wiTECH, inspect Clutch - B and Clutch - C Filling Counter/Fast Filling Counter status.
7. Are Clutch - B and Clutch - C Filling Counters and Fast Filling Counters less than 2?
 - a. YES>>>Continue the drive adaptation procedure until Clutch - B and Clutch - C Filling and Fast Filling Counters are at least 2 or greater.
 - b. NO>>>If not already completed, proceed to the "D Clutch Adaptation Learn Procedure". Once the D Clutch Adaptation Learn Procedure is complete, perform the Shift Quality Subjective Rating (Steps 5 - 11) for shifts affected by the B, C, and D clutches. Refer to the Diagnosis section of this Service Bulletin.

NOTE: Only perform the second Subjective Shift Quality Evaluation once the Adaptation Learn Procedure of all clutches of the affected poor quality shift(s) are complete. The following steps should be taken during the second Subjective Shift Quality Evaluation.

8. On the Shift Quality Worksheet - After Performing Adaptation Learn Procedure, record the Shift Quality Subjective Rating for each shift.
9. Compare the final results to the Initial Subjective ratings listed in the Diagnosis section. The Subjective Shift Quality rating should improve with each adaptation learned increment.





Adaptation Learn

**Do not perform a quick learn
when the transmission
assembly has been replaced.**



10. Did the Subjective Shift Quality Rating improve to at least the ratings identified in the "Target as Shipped Shift Quality Rating"?
 - a. YES>>>Procedure Complete
 - b. NO>>>Repeat procedure. Each Adaptation Drive Learn increment will improve shift quality. However, once the increment has reached 5 or greater, improvements to shift quality will be negligible.

D CLUTCH ADAPTATION LEARN PROCEDURE:

NOTE: Primary Shifts Affected: 1-2 upshift, 2-1 downshift, 6-7 up shift, 7-6 down shift, drive engagement when rolling backwards (or in cases of spline locked dog A)

1. Connect wiTECH VCI Pod to vehicle and to the laptop.
2. Start the engine and monitor transmission temperature to ensure that the temperature is between 50°C (122°F) - 110°C (230°F) before the adaptation drive learn process starts (vehicle can still be driven to targeted Adaptation Drive Learn procedure drive route to help obtain proper temperature).
3. Accelerate the vehicle moderately to sixth (6th) gear. It will be necessary to maintain sixth gear during this process by utilizing Electronic Range Shifter (ERS).
4. Drive vehicle at constant vehicle speed between 64 - 80 KPH (40 - 50 MPH).
5. Maintain sixth gear, steady pedal, and constant speed continuously for approximately of 5 minutes.
 - a. Transmission input Shaft Torque should be between 24 Nm (18 ft. lbs.) - 150 Nm (110 ft. lbs.) (will be monitored on wiTECH as Engine Crankshaft Torque).
 - b. Transmission input shaft RPM should be between 1100 - 2500 RPM (can be monitored by monitoring Engine RPM using the tachometer on the cluster).

NOTE: The learn process may produce small, regular torque pulsations. This is normal, and indicates the learn process is working.

6. Using the wiTECH, inspect Clutch D Filling Counter/Fast Filling Counter status.
7. Is Clutch - D Filling Counter and Fast Filling Counter less than 2?
 - a. YES>>>Continue the drive adaptation procedure until Clutch - D Filling and Fast Filling Counters are at least 2 or greater.
 - b. NO>>>If not already completed, proceed to the "B and C Clutches Adaptation Learn Procedure". Once the B and C Clutches Adaptation Learn Procedure is complete, perform the Shift Quality Subjective Rating (Steps 5 - 11) for shifts affected by the B, C, and D clutches. Refer to the Diagnosis section of this Service Bulletin.

NOTE: Only perform the second Subjective Shift Quality Evaluation once the Adaptation Learn Procedure of all clutches of the affected poor quality shift(s) are complete. The following steps should be taken during the second Subjective Shift Quality Evaluation.

8. On the Shift Quality Worksheet - After Performing Adaptation Learn Procedure, record the Shift Quality Subjective Rating for each shift.
9. Compare the final results to the Initial Subjective ratings listed in the Diagnosis section. The Subjective Shift Quality rating should improve with each adaptation learned increment.
10. Did the Subjective Shift Quality Rating improve to at least the ratings identified in the "Target as Shipped Shift Quality Rating"?
 - a. YES>>>Procedure Complete

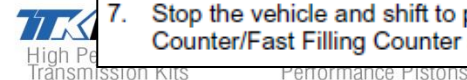




Adaptation Learn

Quick learn / valve body solenoid learn will erase all factory settings when performed.

It also will erase all adaptation memory cells as well.



b. NO>>>Repeat procedure. Each Adaptation Drive Learn increment will improve shift quality. However, once the increment has reached 5 or greater, improvements to shift quality will be negligible.

NOTE: If shift quality has not improved after performing the adaptation learn procedure, before any other diagnosis is performed, verify that the fluid level in the transmission is at the proper level. Refer to DealerCONNECT>Service Info>TechCONNECT>Service>21 - Transmission and Transfer Case>Automatic - 948TE>FLUID and FILTER>Standard Procedure>Fluid Level Check for additional information.

NOTE: If the "Determining Shift Quality Subjective Measurement" indicates that the 3-4 upshift and/or the 4-3 downshift has a subjectivity rating less than five, perform the "E Clutch Adaptation Learn Procedure. This procedure will require the vehicle to be driven on a smooth road that is mostly flat that can be driven safely while maintaining a constant speed of 24- KPH (15 MPH) for approximately 10 miles.

E CLUTCH ADAPTATION LEARN PROCEDURE:

NOTE: Primary Shifts Affected: 3-4 upshift, 4-3 downshift, PRNDL select into Drive

1. Connect wiTECH VCI Pod to vehicle and to the laptop.
2. Start the engine and monitor transmission temperature to ensure that the temperature is between 50°C (122°F) - 110°C (230°F) before the adaptation drive learn process starts (vehicle can still be driven to targeted Adaptation Drive Learn procedure drive route to help obtain proper temperature).
3. Accelerate the vehicle moderately to third (3rd) gear. It will be necessary to maintain third gear during this process by utilizing Electronic Range Shifter (ERS).

NOTE: It is very critical that this procedure be performed on a smooth road that is mostly flat or has a slight incline.

4. Drive vehicle at constant vehicle speed between 24 KPH (15 MPH).
5. Maintain 3rd gear, steady pedal and constant vehicle speed continuously for a minimum of 1 minute, ensure engine speed tachometer is less than 2000 rpm while driving 24 KPH (15 MPH). This will require adjusting the gas pedal position to keep the engine speed below 2000rpm.

NOTE: The learn process may produce small, regular torque pulsations. This is normal, and indicates the learn process is working.

6. After 1 minute of driving at 15mph, bring vehicle to a stop, then proceed to 24 KPH (15 MPH) as described above and repeat 5 times

NOTE: The vehicle must come to a complete stop in between each adaptation in order to learn the next adaptation. In some cases, it may be necessary to shift the transmission into Park, then into Reverse, then back to Park before proceeding to the next adaptation learn cycle.

7. Stop the vehicle and shift to park. Using the wiTECH, inspect Clutch E Filling Counter/Fast Filling Counter status.



Adaptation Learn

Do not perform the quick learn
when the adaptation learn
procedure is all that is
required.



SEAL AFTERMARKET
PRODUCTS



8. Is Clutch - E Filling Counter and Fast Filling Counter less than 2?
 - a. YES>>>Continue the drive adaptation procedure until Clutch - E Filling and Fast Filling Counters are at least 2 or greater.
 - b. NO>>>Perform the Shift Quality Subjective Rating (Steps 5 - 11) for shifts affected by the E clutch. Refer to the Diagnosis section of this Service Bulletin.

NOTE: Only perform the second Subjective Shift Quality Evaluation once the Adaptation Learn Procedure of all clutches of the affected poor quality shift(s) are complete. The following steps should be taken during the second Subjective Shift Quality Evaluation.

9. On the Shift Quality Worksheet - After Performing Adaptation Learn Procedure, record the Shift Quality Subjective Rating for each shift.
10. Compare the final results to the Initial Subjective rating listed in the Diagnosis section. The Subjective Shift Quality rating should improve with each adaptation learned increment.
11. Did the Subjective Shift Quality Rating improve to at least the ratings identified in the "Estimated Subjective Rating With Adaptation Cell Counter at Zero"?
 - a. YES>>>Procedure Complete
 - b. NO>>>Repeat procedure. Each Adaptation Drive Learn increment will improve shift quality. However, once the increment has reached 5 or greater, improvements to shift quality will be negligible.

POLICY:

Reimbursable within the provisions of the warranty.

TIME ALLOWANCE:

Labor Operation No:	Description	Skill Category	Amount
08-19-05-95	Adaptation Drive Learn - Determining Shift Quality Subjective Measurement, (2 -Skilled)	2- Automatic Transmission	0.4 Hrs.
08-19-05-96	Adaptation Drive Learn - Determining Shift Quality Subjective Measurement and Learn - B, C, and D Clutches (2 -Skilled)	2- Automatic Transmission	0.9 Hrs.
95-21-44-02	Adaptation Drive Learn - Determining Shift Quality Subjective Measurement — Porters Time Flat Fee Allowance		\$20.00
95-14-01-02	Adaptation Drive Learn -Fuel Allowance		\$8.00
	Optional Repair Labor Operation No:		
08-19-05-97	Adaptation Drive Learn - E Clutch, Determining Shift Quality Subjective Measurement (2 -Skilled)	2- Automatic Transmission	0.4 Hrs.

FAILURE CODE:

ZZ	Service Action
----	----------------



SEAL AFTERMARKET
PRODUCTS



General Specifications

Specifications	
948TE	9=9 speed 48= Torque Capacity in N-m T= Transverse E= Electronic
Manufactured in	Kokomo 3rd/4th digit of the id tag will read PK. Several part differences between Chrysler unit and its brother the ZF 9HP48 unit
Availability	Standard with the 2.4L I-4 and the 3.2L V-6 on some Jeep applications for 2014. Used on some 2.0L diesel applications in international applications
Transmission	9 Speed FWD/AWD/FWD Electronically controlled, TCM mounted external to the transmission. Clutch to Clutch shift
Max Engine Torque Capacity	480 N-m (354 lb ft)
Max Input Torque Capacity	550 N-m (406 lb ft)
Max Shift Speed	6500 RPM
GCW rating	9590 lbs
Max static torque at park gear	1000 N-m (740 lb ft)
Overall length	381 mm
Center Distance	215 mm
Final Drive Drop	68 mm
Install Weight	209 lbs
Fluid Type	Mopar (ZF) 8-9 speed #66157995AB Fluid is pale green in color
Fluid Capacity	12.7 pints (6L) No Dipstick, Requires Miller Special tool 10323A to check level. Fluid and filter are extended drain. Filter is not serviced except during an overhaul
Torque Converter	TCC, 242mm
Pump	Off Access Chain Driven Vane Style
Engagement System	Available in 2 versions
	* Shift by cable * Shift by wire

Specifications	
Gear Ratios	Ratio Spread 9.79 1 st 4.70-1 2 nd 2.84-1 3 rd 1.91-1 4 th 1.38-1 5 th 1-1-1 6 th .81-1 7 th .70-1 8 th .58-1 9 th .48-1
Final Drive Ratio	3.2L 4X2 or 4X4 non trailer tow= 3.25-1 3.2L 4X4 trailer tow= 3.517-1 2.4L 4X2 or 4X4 non trailer tow= 3.734-1 2.4L 4X4 trailer tow= 4.048-1
Planetary	4 Planetaries P1, P2, P3, P4
Clutch Arrangement	2 Holding Clutch Packs (Brakes)
	2 Driving Clutch Packs 2 DOG clutches
Clutch Specifications	A Clutch= Dog Clutch B Clutch= 5 discs C Clutch= 4 discs D Clutch= 4 discs E Clutch= 5 discs F Clutch= Dog Clutch
	Clutch Clearances B Clutch= .050-.70" 1.26-1.77mm C Clutch= .030-.045" .76-1.15mm D Clutch= .040-.059" 1.01-1.50mm E Clutch= .050-.70" 1.26-1.77mm
Valve Body	Limp in =4 th 14 valves in Shift by Cable system 14 valves plus the park cylinder in Shift by Wire system
	9 Solenoids in Shift by Cable system 10 Solenoids in Shift by wire system

Special thanks to Robert Bateman at Seal Aftermarket for all his help compiling this information & pictures.





Today's Presentation Sponsored By:



Any Questions? Thank You For Attending



TTK MAXX
HIGH PERFORMANCE OVERHAUL KITS
Racing, Diesel, Heavy Duty and RV Applications

Introducing Toledo Trans-Kit® TTK Maxx—whether you have a high performance street car, diesel, heavy duty or RV—TTK Maxx has the kit for you.

TTK Maxx includes everything you need in a transmission rebuilding kit for optimal performance. When it comes to transmission kits and components, Seal Aftermarket Products is dedicated to giving you the best quality components and technical support you need when you need it.

TTK Maxx high performance kit advantages include:

- Checkballs changed from metal to Torlon® to reduce wear
- Rings upgraded to optimize performance (based on application); PTFE, metal or Viton®
- Upgraded rubber compounds to improve sealing properties
- Additional components, like:
Cup Plug(s)
Poppet Valve(s)

If you want the best sealing kit in the industry, ask for Toledo Trans-Kit by name.

For custom application details, call your TTK Maxx sales representative toll free at: **800-582-2760**

SEAL AFTERMARKET PRODUCTS™
your source for engineered solutions

Technical Questions or Comments? Contact us: technicalsupport@sealsap.com
New Web Address: www.sealsap.com ©2015 Seal Aftermarket Products. All rights reserved.
All trademarks are owned by their respective companies.



948TE Intro Webinar ©2015 ATRA. All Rights Reserved.