



# SERVICE BULLETIN

**NUMBER:** 21-012-16

**GROUP:** Transmission and  
Transfer Case

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**THIS BULLETIN SUPERSEDES SERVICE BULLETIN 21-007-15, DATED JANUARY 30, 2015 WHICH SHOULD BE REMOVED FROM YOUR FILES. ALL REVISIONS ARE MARKED WITH \*\*ASTERISKS\*\* AND IS BEING REVISED TO INCLUDE NEW MODELS, UPDATED NOTE IN DISCUSSION HEADER AND UPDATED LABOR OP.**

**SUBJECT:**

9 Speed 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:**

**2016	(FB)	Fiat 500X
2015	(UF)	Chrysler 200
2015 - 2016	(BU)	Jeep Renegade**
2014 - 2015	(KL)	Jeep Cherokee

**NOTE: This bulletin applies to vehicles equipped with the 948TE 9-Speed Automatic Transmission - (Sales Code DFJ) or (Sales Code DFH) and equipped with the following engines:**

- **\*\*2016 FB equipped with all engines.**
- **2015 UF equipped with all engines.**
- **2015 - 2016 BU equipped with all engines.\*\***
- **2014 KL equipped with a 3.2L engine (Sales Code EHB), 2.4L engine (Sales Code ED6), or 2.0L diesel engine (Sales Code EBT).**
- **2015 KL equipped with a 2.0L diesel engine (Sales Code EBT) only.**

**DISCUSSION:**

The 948TE automatic transmission uses a shift algorithm, that includes learned information so that the shift quality remains, even as the transmission wears. This learned information is recorded in memory cells, referred to as "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 customer's expectations.

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

**NOTE: \*\*The valve body adaptation learn procedure should not be confused with "quick learn", "quick learn" is used for clutch learning and shift quality improvement only. "valve body solenoid learn" procedure is required to match the transmission control module with the solenoids in the valve body. This procedure should only be performed when the valve body, transmission control module, or whole transmission assembly have been replaced. "valve body solenoid learn" will replace all factory settings when performed and should only be used in the cases stated above. Do not perform the "valve body solenoid learn" when the clutch adaptation procedure "quick learn" 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
Eighth			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
- Filling Pressure = +/- mb (millibar)/PSI (Pounds Per Square Inch) from zero (standard set value)

If the adaptation memory cell “counter” is zero (0), then 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.

<b>Typical wiTECH Display of 948TE Adaptation Memory Cells</b>				
<b>Graph</b>	<b>Name</b>	<b>Value</b>	<b>Unit</b>	<b>Type</b>
	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

**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 any time a customer indicates that their shift quality does not meet their expectations, Transmission Control Unit (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 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 vehicles with 9-speed automatic transmissions 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 wiTECH, check for active Diagnostic Trouble Codes (DTCs) in the Transmission Control Module's (TCM) memory.
2. Were there any active DTCs 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, then the wiTECH must be used to identify transmission temperature.**

<b>Determining Shift Quality Subjective Measurement Chart</b>									
<b>Condition Noted</b>									
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 on the Repair Order once completed.
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:

<b>Shift Quality Evaluation</b>			
<b>Upshift</b>			<b>Downshift</b>
	<b>Target as Shipped</b>		<b>Target as Shipped</b>
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.

**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.**

**REPAIR PROCEDURE:**

1. To ensure that the process is repeatable, dealers should perform the following recommendations:
  - a. Identify specific employees to perform the Adaptation Procedure. These employees become the Qualified Adaptation Procedure Technicians.
  - b. Each Qualified Adaptation Procedure Technician should drive approximately five vehicles with 9-speed automatic transmissions to establish a baseline for the shift quality of each shift as received at the dealerships.
2. 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:
  - a. Transmission Oil Temperature between 50°C (122°F) - 110°C (230°F).
  - b. Transmission input Shaft Torque, between 24 N·m (18 ft. lbs.) - 150 N·m (110 ft. lbs.) (will be monitored on wITECH as Engine Crankshaft Torque).
  - c. Transmission input shaft RPM, between 1100 - 2500 RPM (can be monitored by monitoring Engine RPM using the tachometer on the cluster).
3. 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:
  - a. 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).
  - b. The routes 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.
  - c. 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.
  - d. 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.

- e. 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 drop too low, may cause, a delay in obtaining the adaptation.
- f. The Adaptation Drive Learn procedure is performed with an assistant. So that wiTECH, can be properly monitored, while maintaining safe driving practices.
- 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 N·m (18 ft. lbs.) - 150 N·m (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 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.
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 the wiTECH VCI Pod to the 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 5 minutes.
  - a. Transmission input Shaft Torque should be, between 24 N·m (18 ft. lbs.) - 150 N·m (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 a 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
  - 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 a wiTECH VCI Pod to the 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 15 mph, 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.
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 five or greater, improvements to shift quality will be negligible.

**POLICY:**

Reimbursable within the provisions of the warranty.

**TIME ALLOWANCE:**

<b>Labor Operation No:</b>	<b>Description</b>	<b>Skill Category</b>	<b>Amount</b>
08-19-05-95	Adaptation Drive Learn - Determining Shift Quality Subjective Measurement, (2 -Skilled)	2- Automatic Transmission	0.4 Hrs.
**08-19-05-9G**	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
<b>Optional Repair Labor Operation No:</b>			
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
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