



Solution K58556584

Wednesday, May 27, 2020 5:38:06 PM CEST

**** SOLUTION ****

Title	Volvo Chassis - Automated Manual Transmission (AMT, I-Shift) Clutch Control Actuator (CCA), Diagnostic And Inspection Information; CCA Reuse Or Replace Guidelines - US07 And Newer Emissions, Common Model Years 2008 And Newer
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Volvo Models

Volvo Model	VN , VNL , VNM , VNR , VNX , VAH , VHD , VT
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Emission Standard

Emission Standard	US07 , US10 , US10+OBD13 , US14+OBD13 , US14+OBD15 , US14+OBD16 , US17+OBD16 , US17+OBD18
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Engine family

Engine family	11L Engine , 13L Engine , 16L Engine
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Transmission

Transmission	AMT-C , AMT-D , AMT-F With Crawler Gears , AMT-F Without Crawler Gears
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**** SOLUTION ****

Cause	Information concerning the inspection and diagnosis of the clutch control actuator and reuse/replace guidelines for observed wear.
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The CCA is in constant contact with the clutch diaphragm spring. The bearing face rotates constantly with the clutch. In an ideal situation, the bearing face and clutch would always rotate at the same rate. However in real-world operation there is always some slippage between the two, and because of that there will be wear over time.

Solution	When Fault tracing for a shifting complaint or fault codes the following items should be considered:
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I. Gather information and check system function

1. Review service history to determine if the CCA has ever been replaced. Note the vehicle's current age, mileage, and engine hours.

- High mileage or age of the vehicle can be a contributing factor in whether or not the CCA is worn and causing control problems that are being picked up in the diagnostic that logs the codes listed in the Fault Codes section.

2. Using Premium Tech Tool (PTT), perform the clutch tests below. Review the results to get a baseline of the health of the system.

NOTE: If a failure is identified, the failure should be investigated and repaired. The remaining tests should only be completed if the problem is still present following the repair. Warranty will not cover time spent on tests performed after an issue is found.

- 4111-08-03-02 - Clutch Wear Check, Test
- 4111-08-03-05 - Clutch Drag, Test
- 4111-08-03-06 - PWM Valves Clutch Activation, Test
- 4313-08-03-01 - Counter Shaft Brake Solenoid Valve, Test
- 4320-08-03-01 - Clutch Cylinder, Test
- 4320-08-03-32 - PWM Valves Clutch, Test

II. Check the Clutch Control Actuator (CCA) for leaks, Inspect Clutch components



IMPORTANT

- While this is intended to evaluate CCA function prior to removing the transmission from the chassis, the steps below may also be performed with the transmission out of the vehicle and PTT connected directly to the TECU.
- When evaluating the CCA for a leak and the unit still in the chassis, the Clutch Leak Test in PTT **will likely pass** in all but the most severe cases. Even when it does fail, the cause may not be the CCA. The airline or the CVU may be the cause.

1. From the Test tab in PTT, open operation 4320-08-03-32 PWM Valves Clutch. Run the Leak Test. This will cause the TECU to stop its attempts to release the clutch.

- **NOTE:** If the tests from section I were run immediately before this step and the ignition has not been cycled, this step may be skipped.

2. Open operation 4311-08-03-02 - Input Signals for Gear Selection from the Test tab in PTT. Expand the sections for Clutch and Gear.

Refer to the animations below for Steps 3 and 4. The first method shown is preferred.

0:00 / 0:35

Method 1: Connect a hand-operated vacuum pump to the air supply port for the CVU. Drawing a vacuum via this port will compress the CCA.

0:00 / 0:21

Method 2: Insert a pry bar through the CVU opening. **Making sure the electrical harness is held aside**, use the pry bar to compress the CCA. Plug the CVU air supply port once correct position is reached.



IMPORTANT

When using a pry bar, do not use excessive force on the CCA. Damage to the housing or other components could result.

The electrical harness is not a suitable surface for leverage and must be held out of the way when using a pry bar.

3. Unbolt the CVU and remove it from the housing. Leave the electrical connector plugged in.

4. Compress the CCA approximately half of its total travel.

5. Leave the vacuum pump connected or plug the air supply port.

6. In PTT, watch the value for Clutch Cylinder Position.

- **If the value increases**, there is an air leak in either the CCA or one of the air supply components that should be located and repaired.
- **If the value remains the same**, proceed to the next step.



IMPORTANT

A CCA assembled with the rubber boot to prevent dirt and debris intrusion will most likely not be the source of an air leak. Other components should be checked carefully first, then the CCA checked thoroughly as outlined in section III-3 below.

7. Holding the electrical harness to the side, insert a pry bar into the CVU opening and rock the CCA back and forth as shown below.

0:00 / 0:20

- Some play is normal and acceptable unless air leakage is observed while moving the CCA.
- If excessive play is observed, the CCA will need to be replaced. An example of excessive play (transmission removed for example only) can be viewed below:

0:00 / 0:05

8. Watch the Clutch Cylinder Position signal in PTT while moving the CCA as shown in the animation above.

- **If the signal shows large fluctuation, jumps or creeps up in value,** the CCA is worn and allowing air to pass around its seals.
- **If the signal shows a small fluctuation but returns to the same value each time,** the CCA is not leaking.

9. If the CCA is not leaking, inspect the other clutch components while the CCA is still compressed. A borescope is useful for this.

III. After removing the gearbox

1. Check the face of the CCA bearing for wear.

- The example below shows a bearing face with normal wear, caused by the movement between the clutch fingers and the bearing face.



Wear as shown above does not cause a functional issue. The bearing should be reused if nothing else is found wrong.

- **NOTE:** With excessive wear accompanied by a clutch replacement, Replacement of the CCA should be considered as well.

2. Check the function of the CCA Bearing

- The bearing should turn freely and smoothly.

3. Check the CCA Guide Sleeves

The CCA has guide sleeves inside the assembly to keep the unit centered on the clutch. A video of a new, properly functioning CCA can be viewed below:

0:00 / 0:17



3.1. Compress the CCA about half way back in its travel and rock the bearing from side to side.

- Some play is normal and acceptable unless air leakage is observed while moving the CCA.
- If excessive play is observed, the CCA will need to be replaced. Refer to the video in the previous section for an example of excessive play.

4. Check for Air Leaks



IMPORTANT

If performing this portion of the test with the gearbox removed: Air must be supplied to the Gearbox or to the CVU directly to more closely simulate normal operating conditions.

Failure to do this may lead to a false indication of a leak.

4.1. Push the CCA all the way back and plug the Clutch Valve Unit (CVU).

0:00 / 0:07



4.2. Observe the CCA for movement.

- **If air leaks out immediately and the CCA cannot hold position**, replace the CCA and its air supply line.
- **If air does not leak immediately but the CCA exhibited excessive wear**, rock the CCA from side to side as shown in the video below:

0:00 / 0:09



- **If air leaks are observed**, replace the CCA and the o-rings for the air supply line. The airline o-rings are available as a kit in IMPACT. **The air line should not be replaced unless it is damaged.** There is normally nothing wrong with the airline itself and the o-rings are all that is needed.
- **If rocking the bearing does not produce an air leak**, the CCA is likely **not** leaking.

5. Check for Heat Damage

- **A CCA that has had a clutch failure with extreme heat should be inspected using the above procedures. A melted center dust boot or missing dust boot with extreme wear should be replaced. A CCA that passes all of the tests but has a melted position sensor can be reused**

and the sensor replaced separately. An example is shown below:



IV. Check The Transmission Electronic Control Unit (TECU) Software Level - Vehicles built between 11/16 and 6/17 with an AMT-F ONLY

- **If the software is not the current version:**

1. Update the TECU software if the SW is 23090996 or older.
2. Test drive the vehicle to ensure there are no other issues, then release.

- **If the software is current:**

1. No further action is required.

NA_Sister solutions [K63231010](#)

Solution visibility Dealer distribution

Function(s)/component(s) affected

Function affected MID 130 – TECU , engagement , Clutch Control Actuator (CCA)

Function Group

Function Group 412 release bearing, fork, shaft , 413 clutch control , 43 gearbox

Customer effect

Main customer effect noise , road behaviour , diagnostics/methodology , judder , slipping

Noise hissing noise , blowing noise

Fluid problem leak

Fluid implicated Air

Road behaviour driveability

Fault Codes And Error Codes

J1939 Fault Codes
(MID-PID-FMI Format) MID 130 PSID 27 FMI 7 , MID 130 PSID 27 FMI 8

OBDII Diagnostic
Trouble Codes (P, U, B
Format) P1075-38 , P1075-94

Conditions

Vehicle operating
mode when activating , when driving , cruise control , when stationary

Frequency of
occurrence of problem random

Location of problem underneath cab

Administration

Author UT9268H

Dealer ID UT9268H

Last modified by RU4469V

Creation date 22-06-2018 20:06

Date of last update 13-05-2020 19:05

Review date 22-06-2019 00:06

Status Published

Average score 1

Number of scores 1

NA_Reviewer ut9268h

NA_Author_Group GTT

Variantes Kola

RWX - TRANSMISSION D SERIES , AT2812D - VOLVO AUTOMATED TRANSMISSION 2800NM
12SPEED

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2549-08-03-03 NOx Conversion

Simulation



1		= 0 rpm		0 rpm	
2				(P)	
3		N	N	N	
4		> 94 psi	99 psi	99 psi	

4111-08-03-02 Clutch wear check

Simulation

Information >> Conditions >> Execution >> Result

Automatically checked conditions

- 1 Ignition key in ON position. Engine not running
- 2 Parking brake applied
- 3 Transmission in neutral position
- 4 Air pressure above 94 psi

2549-08-03-03 NOx Conversion

Simulation



1	= 0 rpm	0 rpm	
2			
3			
4	> 94 psi	99 psi	

4111-08-03-02 Clutch wear check

Simulation

Information >> Conditions >> Execution >> Result

Automatically checked conditions

- 1 Ignition key in ON position. Engine not running
- 2 Parking brake applied
- 3 Transmission in neutral position
- 4 Air pressure above 94 psi

Simulation

JAMES JOHNSON

Simulation

JAMES JOHNSON

Information >> Conditions >> Execution >> Result

Information

- 1
 - X1 is the calibrated engagement point for a newly installed clutch plate
 - X2 is the current engagement point for the clutch plate
 - The difference between X2 and X1 is a measure of the clutch wear
- 2
 - The ball represents the X2 value
 - If the X2 value is less than the service due position, the clutch is worn out

Note: The X2 value might vary slightly between each test execution due to different conditions, such as oil temperature. On a relatively new clutch, these variations might cause an indication of a small negative wear (X2 > X1). This is normal and not a fault indication



1

X1 =

X2 =

X1-X2 =

2

Service due position

2549-08-03-03 NOx Conversion

Simulation

Test

Select an operation and click Start

- 1 - Service and maintenance
- 2 - Engine, Engine mounting and equipment
- 3 - Electrical system and instruments
- 4 - Transmission
- 4000-08-03-11 Gear Activation, Control Housing (for Removal/Replacement)
- 4111-08-03-02 Clutch wear check
- 4111-08-03-05 Clutch Drag**
- 4111-08-03-06 PWM Valves Clutch Activation
- 4311-08-03-02 Input Signals for Gear Selection
- 4315-08-02-01 Interlock System
- 4313-08-03-01 Solenoid valve, Transmission brake (Input shaft brake/ Countershaft brake)
- 4313-08-04-01 Solenoid valve, Transmission brake (Input shaft brake/Countershaft brake)(Transmission removed)
- 4320-08-03-01 Clutch cylinder

4111-08-03-05 Clutch Drag

Run the operation in simulation mode

Purpose

Check the clutch drag

Description

The test performs the following steps:

- 1 The clutch is engaged
- 2 The clutch is disengaged
- 3 The control module waits for the input shaft to stop
- 4 The clutch is slowly engaged until the input shaft starts to rotate
- 5 The clutch position when the input shaft starts to accelerate is stored
- 6 The clutch is engaged

2549-08-03-03 NOx Conversion

Simulation

4111-08-03-05 Clutch Drag

Simulation

Information >> Conditions >> Execution >> Result

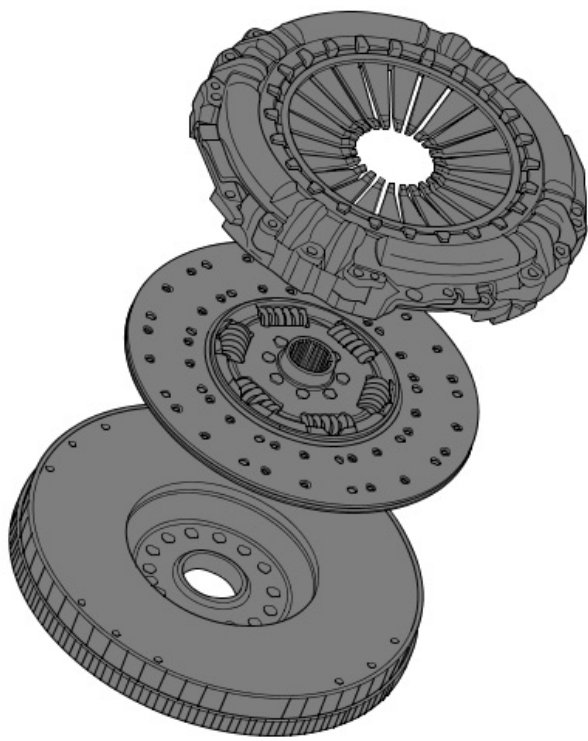
Purpose

Check the clutch drag

Description

The test performs the following steps:

- 1 The clutch is engaged
- 2 The clutch is disengaged
- 3 The control module waits for the input shaft to stop
- 4 The clutch is slowly engaged until the input shaft starts to rotate
- 5 The clutch position when the input shaft starts to accelerate is stored
- 6 The clutch is engaged



2549-08-03-03 NOx Conversion

Simulation



1	= 0 rpm	0 rpm	<input checked="" type="checkbox"/>
2			<input checked="" type="checkbox"/>
3			<input checked="" type="checkbox"/>
4	> 94 psi	99 psi	<input checked="" type="checkbox"/>

4111-08-03-05 Clutch Drag

Simulation

Information >> Conditions >> Execution >> Result

Automatically checked conditions

- 1 Ignition key in ON position. Engine not running
- 2 Parking brake applied
- 3 Transmission in neutral position
- 4 Air pressure above 94 psi

2549-08-03-03 NOx Conversion

Simulation

4111-08-03-05 Clutch Drag

Simulation

Information >> Conditions >> Execution >> Result

Result

The test result is approved



Detailed information

2549-08-03-03 NOx Conversion

Simulation

Test

Select an operation and click Start

- 1 - Service and maintenance
- 2 - Engine, Engine mounting and equipment
- 3 - Electrical system and instruments
- 4 - Transmission
- 4000-08-03-11 Gear Activation, Control Housing (for Removal/Replacement)
- 4111-08-03-02 Clutch wear check
- 4111-08-03-05 Clutch Drag
- 4111-08-03-06 PWM Valves Clutch Activation**
- 4311-08-03-02 Input Signals for Gear Selection
- 4315-08-02-01 Interlock System
- 4313-08-03-01 Solenoid valve, Transmission brake (Input shaft brake/ Countershaft brake)
- 4313-08-04-01 Solenoid valve, Transmission brake (Input shaft brake/Countershaft brake)(Transmission removed)
- 4320-08-03-01 Clutch cylinder

4111-08-03-06 PWM Valves Clutch Activation

Run the operation in simulation mode

Purpose

Check the clutch PWM valves and check for air leakage

Components to be tested are:

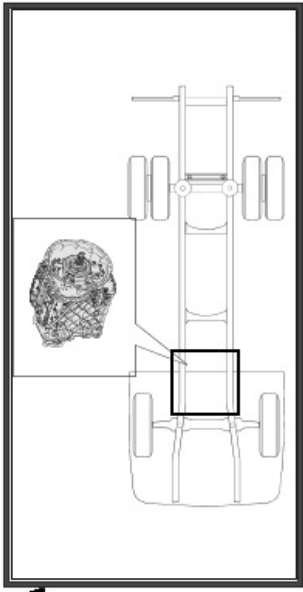
Clutch system

Description

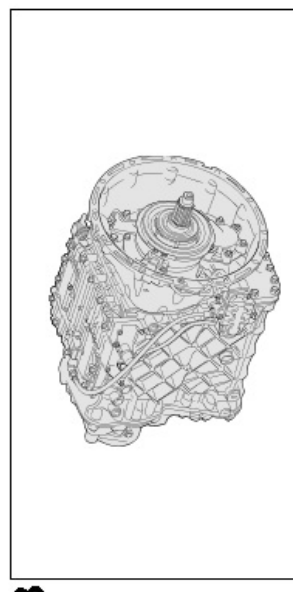
- A leak check can be performed by either listening or using soapy water
- Air will be applied and released to the clutch PWM valves in order to disengage and engage the clutch to check for proper operation (Transmission installed Only)

2549-08-03-03 NOx Conversion

Simulation



A



B

4111-08-03-06 PWM Valves Clutch Activation

Simulation

Information >> Conditions >> Execution

Purpose

Check the clutch PWM valves and check for air leakage

Components to be tested are:

Clutch system

Description

- A leak check can be performed by either listening or using soapy water
- Air will be applied and released to the clutch PWM valves in order to disengage and engage the clutch to check for proper operation (Transmission installed Only)

Selections







Simulation

Simulation

Simulation

Information >> Conditions >> Execution

Automatically checked conditions

- 1  = 0 rpm 
- 2  = 0 mph 
- 3  > 94 psi 

- 1 Engine not running
- 2 The product must be stationary
- 3 Air pressure above 94 psi

Simulation

JAMES JOHNSON

Simulation

Information >> Conditions >> Execution

Action

- Engage and disengage the clutch with the buttons
- Listen to the component and verify that it activates
- Perform leak check by listening or using soapy water

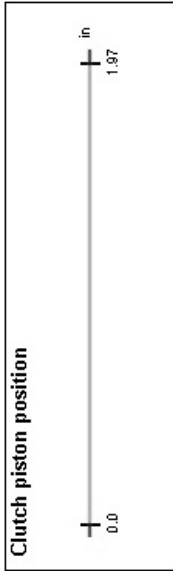
Note: Disengaging the clutch will apply air and engaging the clutch will release the air

Test result

Select one of the following alternatives

OK

Not OK



Slow disengagement

Fast disengagement

Slow engagement

Fast engagement

2549-08-03-03 NOx Conversion

Simulation

Test

Select an operation and click Start

Sort by function

- 1 - Service and maintenance
- 2 - Engine, Engine mounting and equipment
- 3 - Electrical system and instruments
- 4 - Transmission
 - 4000-08-03-11 Gear Activation, Control Housing (for Removal/Replacement)
 - 4111-08-03-02 Clutch wear check
 - 4111-08-03-05 Clutch Drag
 - 4111-08-03-06 PWM Valves Clutch Activation
 - 4311-08-03-02 Input Signals for Gear Selection
 - 4315-08-02-01 Interlock System
 - 4313-08-03-01 Solenoid valve, Transmission brake (Input shaft brake/ Countershaft brake)**
 - 4313-08-04-01 Solenoid valve, Transmission brake (Input shaft brake/Countershaft brake)(Transmission removed)
 - 4320-08-03-01 Clutch cylinder

Run the operation in simulation mode

Purpose

Check braking effect of transmission brake (countershaft brake / input shaft brake)

Components to be tested are:

- Speed sensor, counter shaft
- Transmission brake (Countershaft brake / Input shaft brake)
- Solenoid Valve

Description

During the test the Transmission Control Module (TCM) will activate the transmission solenoid valve for the transmission brake (countershaft brake / input shaft brake) actuator and record the braking effect time

2549-08-03-03 NOx Conversion

Simulation

4313-08-03-01 Solenoid valve, Transmission brake (Input shaft brake / Countershaft brake)

Simulation

Information >> Conditions >> Execution

Purpose

Check braking effect of transmission brake (countershaft brake / input shaft brake)

Components to be tested are:

- Speed sensor, counter shaft
- Transmission brake (Countershaft brake / Input shaft brake)
- Solenoid Valve

Description

During the test the Transmission Control Module (TCM) will activate the transmission solenoid valve for the transmission brake (countershaft brake / input shaft brake) actuator and record the braking effect time

Speed sensor, counter shaft



Transmission brake (Countershaft brake / Input shaft brake)



Solenoid Valve



2549-08-03-03 NOx Conversion

Simulation



- 1
- 2
- 3
- 4

4313-08-03-01 Solenoid valve, Transmission brake (Input shaft brake/ Countershaft brake)

Simulation

Information >> Conditions >> Execution

Automatically checked conditions

- 1 Parking brake applied
- 2 Engine speed above 400 rpm
- 3 Air pressure above 94 psi
- 4 Transmission in neutral position

2549-08-03-03 NOx Conversion

Simulation



94 psi	Air pressure
	Solenoid valve
Retardation time with braking	
	ms 0.0 100.0
Retardation time without braking	
	ms 0.0 19000.0

4313-08-03-01 Solenoid valve, Transmission brake (Input shaft brake/ Countershaft brake)

Simulation

Information >> Conditions >> Execution

Action

- Start the test
- Repeat twice

Note: Idle shutdown function is enabled in this product. Prior to starting the test, depress the accelerator pedal to inhibit engine shutdown

Evaluation

Check that values are within limits and that the status icon turns green

Note: For Retardation time without braking to be successful, the action should take less than 19 (19000 ms) seconds

Test result

2549-08-03-03 NOx Conversion

Simulation

4320-08-03-01 Clutch cylinder

Simulation

Information >> Conditions >> Execution

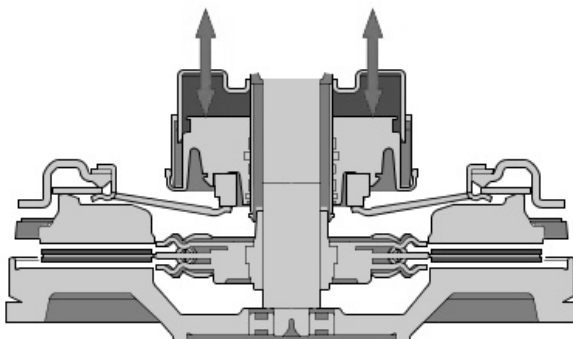
Purpose

Check the Clutch Piston Control

Description

The following can be checked:

- Clutch piston position
- Clutch piston stroke length



2549-08-03-03 NOx Conversion

Simulation

4320-08-03-01 Clutch cylinder

Simulation

Information >> Conditions >> Execution

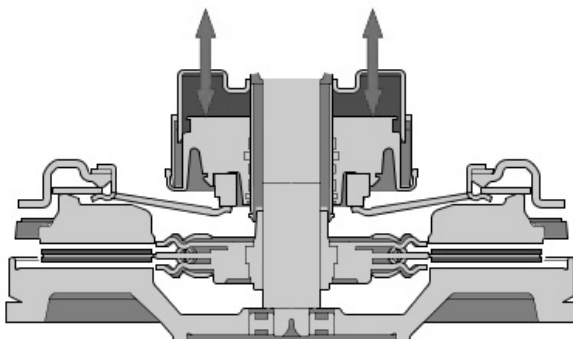
Purpose

Check the Clutch Piston Control

Description

The following can be checked:

- Clutch piston position
- Clutch piston stroke length



2549-08-03-03 NOx Conversion

Simulation



- 1
- 2 **> 94 psi** **99 psi**
- 3 **= 0 rpm** **0 rpm**
- 4 **N** **N**

4320-08-03-01 Clutch cylinder

Simulation

Information >> Conditions >> Execution

Automatically checked conditions

- 1 Parking brake applied
- 2 Air pressure above 94 psi
- 3 Ignition key in ON position. Engine not running
- 4 Transmission in neutral position

2549-08-03-03 NOx Conversion

Simulation



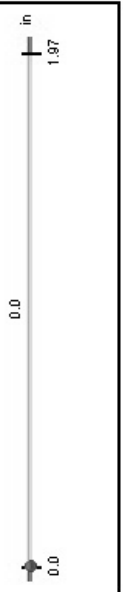
94 psi Air pressure

Clutch piston position

Engage



Disengage



1

Clutch piston stroke length



2

4320-08-03-01 Clutch cylinder

Simulation

Information >> Conditions >> Execution

Information

The clutch will be disengaged when the test exits correctly

Action

1

Clutch piston position

- Engage and disengage the clutch with the buttons
- Check that the value changes and the status icon indicates an active state
- The value must be stable when the clutch is disengaged

2

Clutch piston stroke length

2549-08-03-03 NOx Conversion

Simulation

4320-08-03-32 PWM Valves Clutch

Run the operation in simulation mode

Purpose

Check for air leakage in the clutch cylinder system and check the performance and function of the clutch

Components to be tested are:

Clutch system

Description

- The leakage test will disengage the clutch, turn off all valves to the clutch, then wait a specified time to see if the clutch position has changed
- The clutch performance test will engage and disengage the clutch and present the measured times to check for proper operation of the clutch system

Test

Select an operation and click Start

- 1 - Service and maintenance
- 2 - Engine, Engine mounting and equipment
- 3 - Electrical system and instruments
- 4 - Transmission
 - 4000-08-03-11 Gear Activation, Control Housing (for Removal/Replacement)
 - 4111-08-03-02 Clutch wear check
 - 4111-08-03-05 Clutch Drag
 - 4111-08-03-06 PWM Valves Clutch Activation
 - 4311-08-03-02 Input Signals for Gear Selection
 - 4315-08-02-01 Interlock System
 - 4313-08-03-01 Solenoid valve, Transmission brake (Input shaft brake/ Countershaft brake)
 - 4313-08-04-01 Solenoid valve, Transmission brake (Input shaft brake/Countershaft brake)(Transmission removed)
 - 4320-08-03-01 Clutch cylinder
 - 4320-08-03-02 Range Cylinder

2549-08-03-03 NOx Conversion

Simulation

4320-08-03-32 PWM Valves Clutch

Simulation

Information >> Conditions >> Execution

Purpose

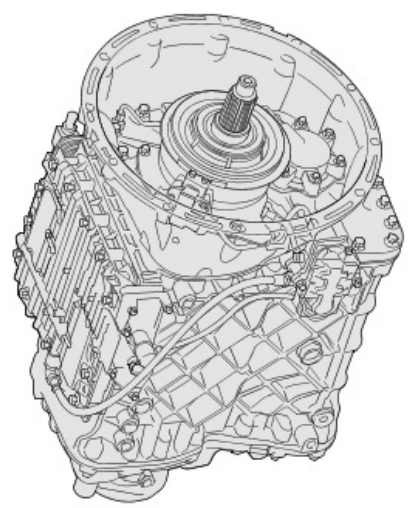
Check for air leakage in the clutch cylinder system and check the performance and function of the clutch

Components to be tested are:

Clutch system

Description

- The leakage test will disengage the clutch, turn off all valves to the clutch, then wait a specified time to see if the clutch position has changed
- The clutch performance test will engage and disengage the clutch and present the measured times to check for proper operation of the clutch system



2549-08-03-03 NOx Conversion

Simulation



1		= 0 rpm	0 rpm	
2		= 0 mph	0 mph	
3		> 94 psi	99 psi	

4320-08-03-32 PWM Valves Clutch

Simulation

Information >> Conditions >> Execution

Automatically checked conditions

- 1 Engine not running
- 2 The product must be stationary
- 3 Air pressure above 94 psi

2549-08-03-03 NOx Conversion

Simulation



1

Leak test

▶

0 in Value before test

0 in Value after test

0 in MIN

0 in MAX

Clutch piston position 0.0

0.0 1.00

2

Clutch performance test

▶

0.0 Slow disengagement

0.0 2000.0

0.0 Fast disengagement

0.0 1200.0

0.0 Slow engagement

4320-08-03-32 PWM Valves Clutch

Simulation

Information >> Conditions >> Execution

Action

- 1 Start the test
Check that the value is within limits and the status light turns green
Note: This action takes about 45 seconds to perform
- 2 Start the test
Check that the value is within limits and the status light turns green
Note: This action takes about 10 seconds to perform

Test result