

SERVICE INFORMATION

Trucks

Group **593**

Release **01**

Diagnostic Trouble Codes

OBD2013 – OBD2015

CHU/CXU



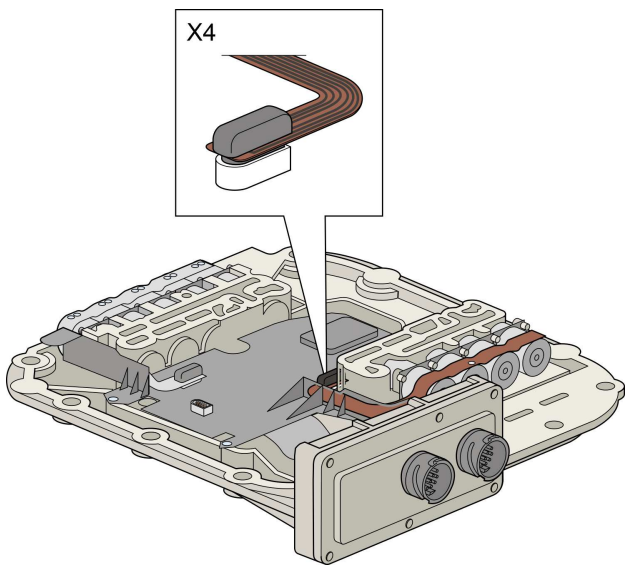
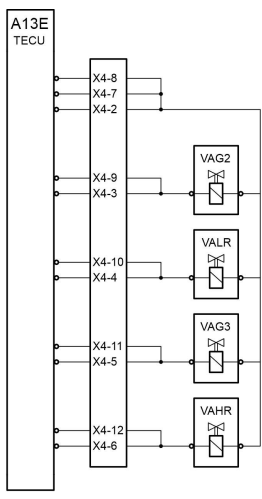
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Malfunction

TECU - P106D - 17, Gear 3 Valve (VAG3)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106D FTB 17	Short circuit to battery voltage.	- The solenoid valve can not be activated - Gears missing - Incorrect gear selection	- Solenoid valve assembly (VAG3). - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

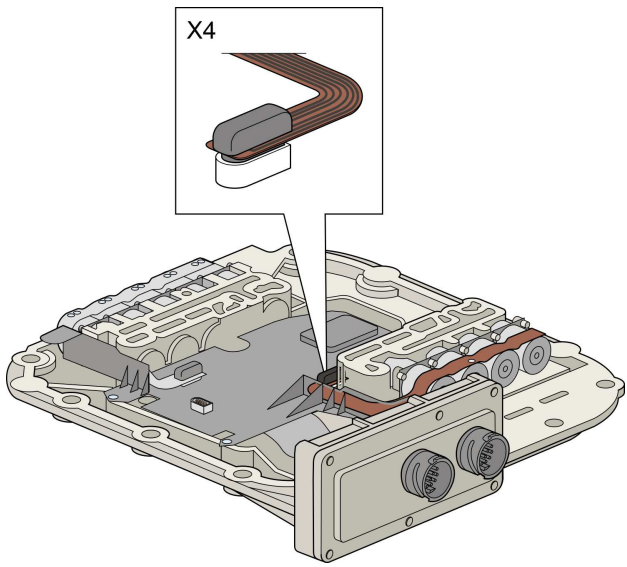
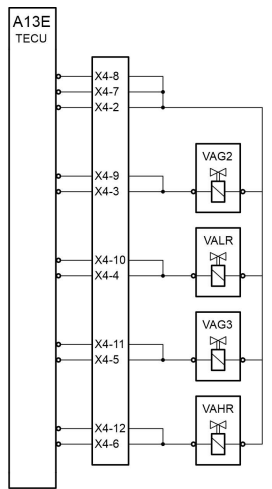
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106D - 18, Gear 3 Valve (VAG3)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106D FTB 18	Current below normal or open circuit.	- The solenoid valve can not be activated - Incorrect gear selection	Solenoid valve assembly (VAG3).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

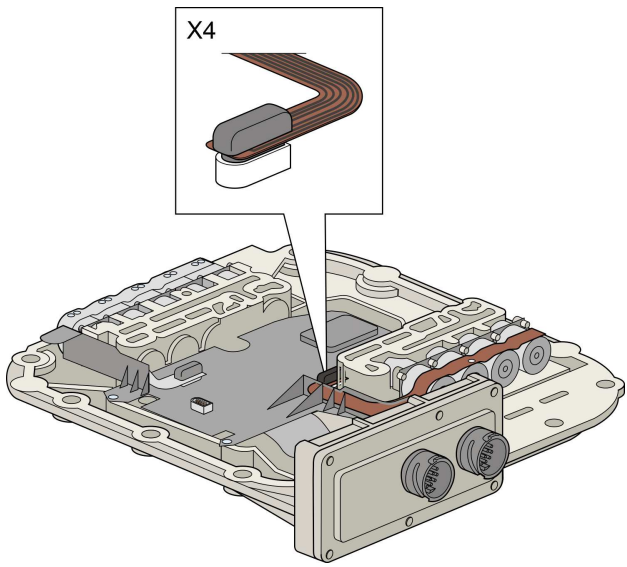
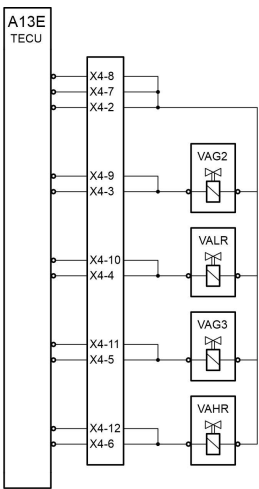
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106D - 19, Gear 3 Valve (VAG3)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106D FTB 19	Short circuit to ground.	- The solenoid valve can not be activated - Gears missing. - Incorrect gear selection	Solenoid valve assembly (VAG3).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

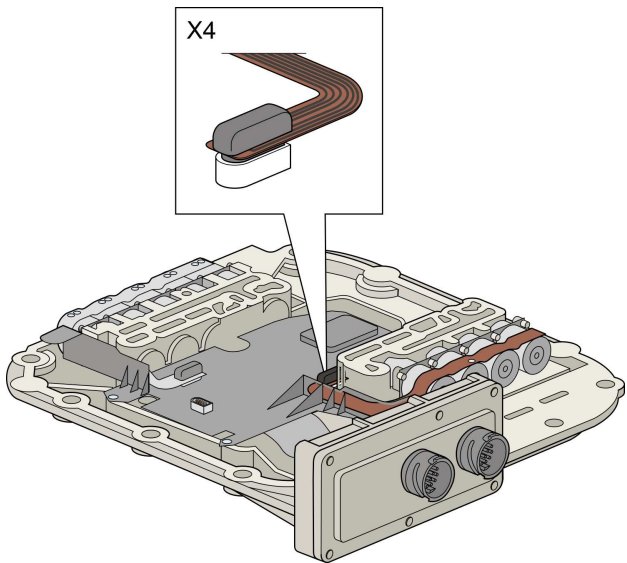
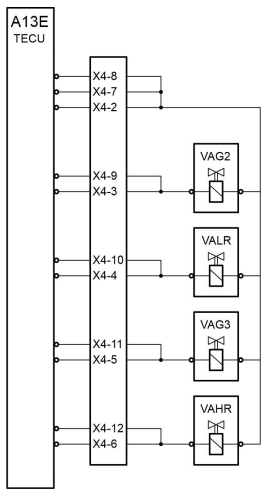
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106C - 17, Gear 2 Valve (VAG2)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106C FTB 17	Short circuit to battery voltage.	- The solenoid valve can not be activated - Gears missing - Incorrect gear selection	Solenoid valve assembly (VAG2).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

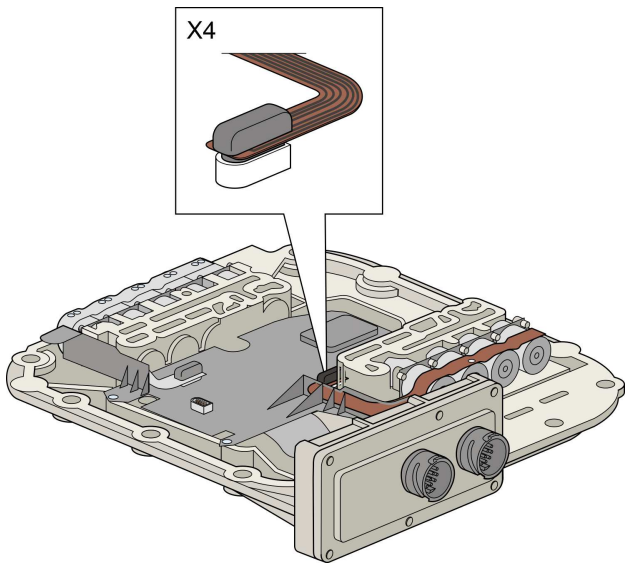
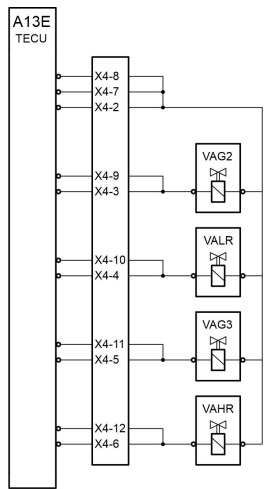
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106C - 18, Gear 2 Valve (VAG2)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106C FTB 18	Current below normal or open circuit.	- The solenoid valve can not be activated - Incorrect gear selection	Solenoid valve assembly (VAG2).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

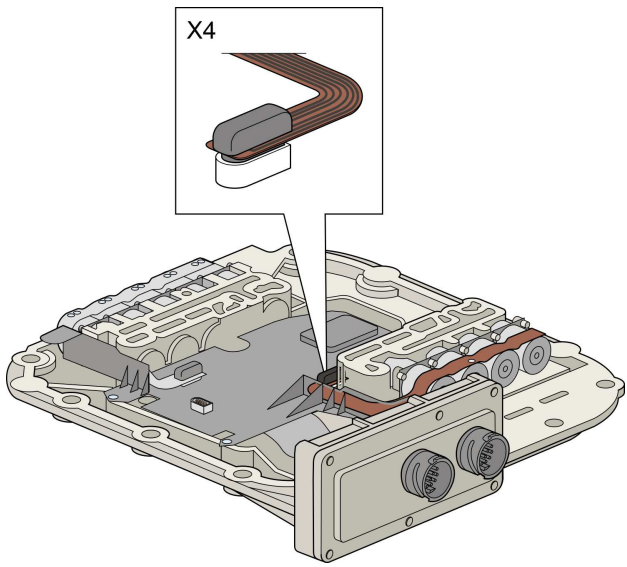
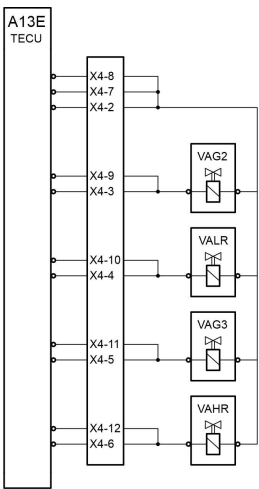
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106C - 19, Gear 2 Valve (VAG2)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106C FTB 19	Short circuit to ground.	- The solenoid valve can not be activated - Gears missing. - Incorrect gear selection	Solenoid valve assembly (VAG2).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

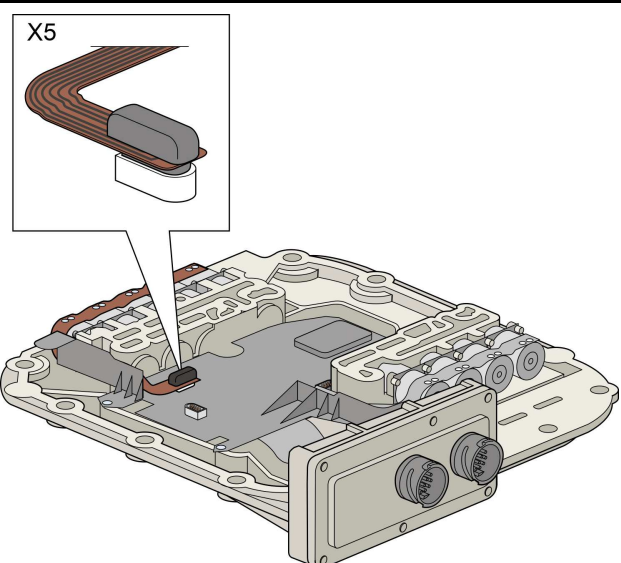
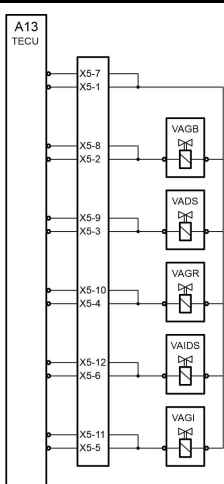
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106A - 17, Gear 1 Valve (VAG1)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106A FTB 17	Short circuit to battery voltage.	- The solenoid valve can not be activated - Gears missing - Incorrect gear selection	Solenoid valve assembly (VAG1).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

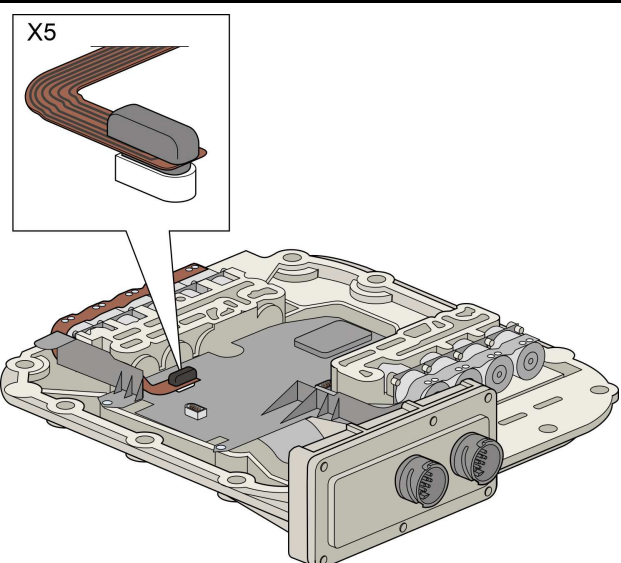
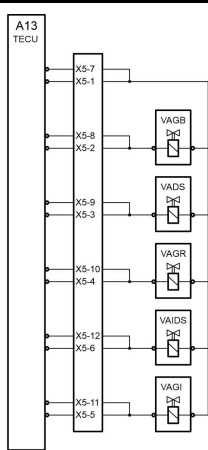
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106A - 18, Gear 1 Valve (VAG1)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106A FTB 18	Current below normal or open circuit.	- The solenoid valve can not be activated - Incorrect gear selection	Solenoid valve assembly (VAG1).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

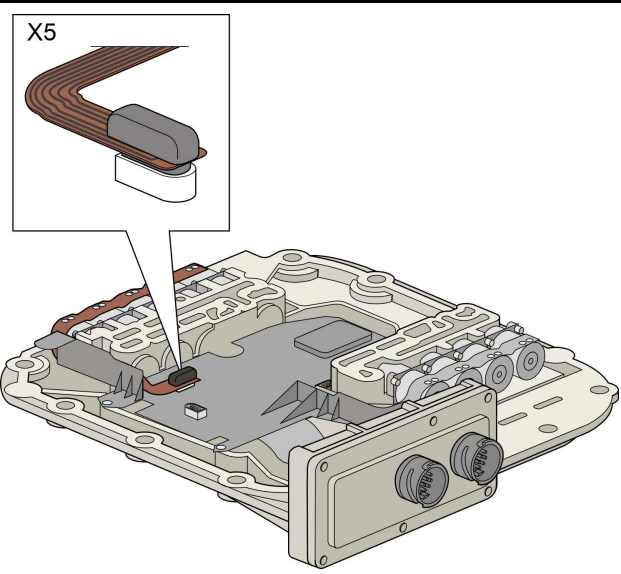
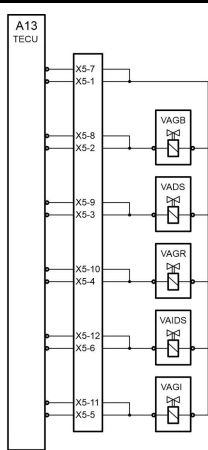
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position. • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106A - 19, Gear 1 Valve (VAG1)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106A FTB 19	Short circuit to ground.	- The solenoid valve can not be activated. - Gears missing. - Incorrect gear selection.	Solenoid valve assembly (VAG1).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

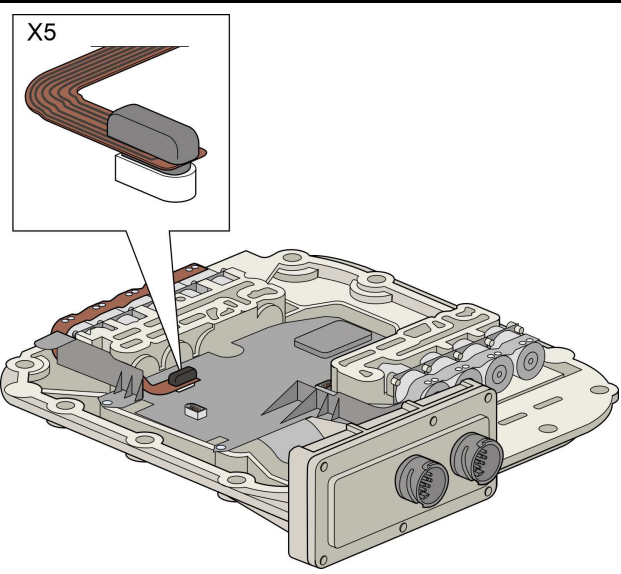
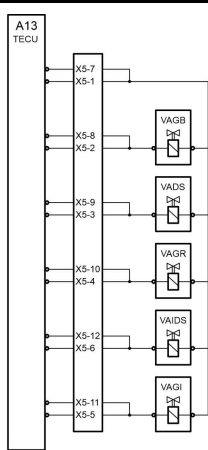
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106B - 17, Gear Reverse Valve (VAGR)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106B FTB 17	Short circuit to battery voltage.	- The solenoid valve can not be activated - Gears missing - Incorrect gear selection	Solenoid valve assembly (VAGR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

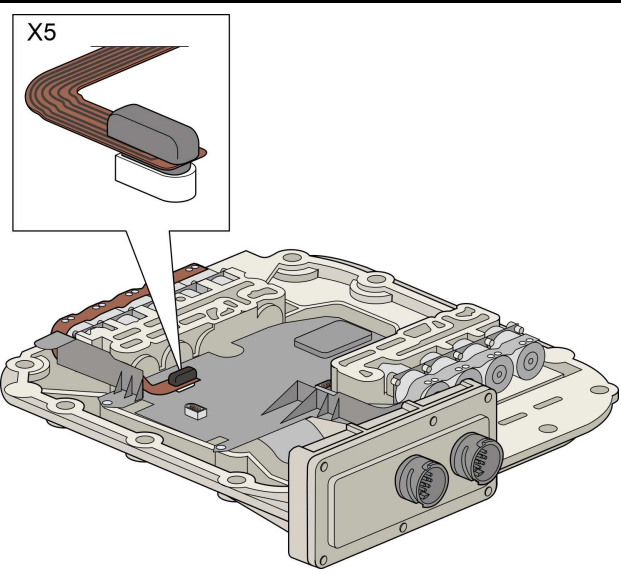
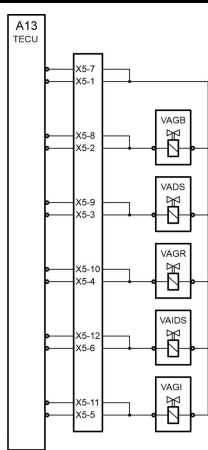
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106B - 18, Gear Reverse Valve (VAGR)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106B FTB 18	Current below normal or open circuit.	- The solenoid valve can not be activated. - Not possible to engage reverse gear. - Incorrect gear selection.	Solenoid valve assembly (VAGR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

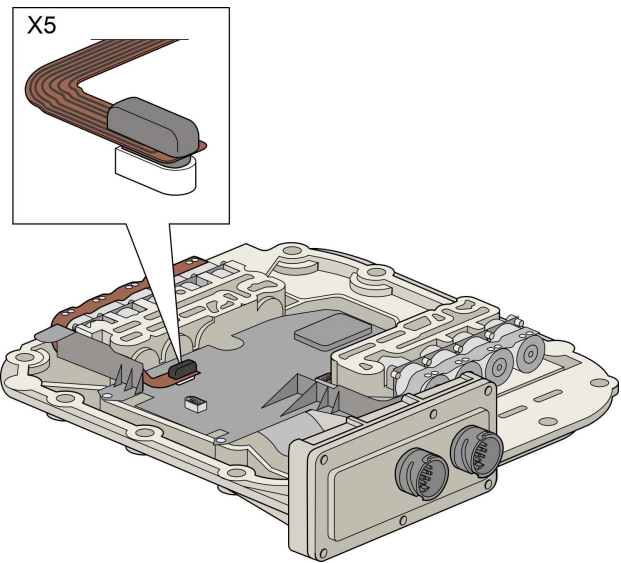
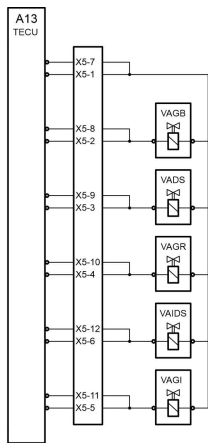
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position. • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106B - 19, Gear Reverse Valve (VAGR)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106B FTB 19	Short circuit to ground.	- The solenoid valve can not be activated - Gears missing. - Incorrect gear selection	Solenoid valve assembly (VAGR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

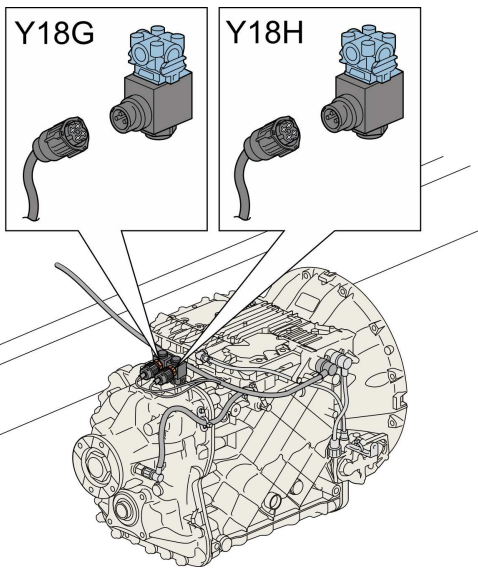
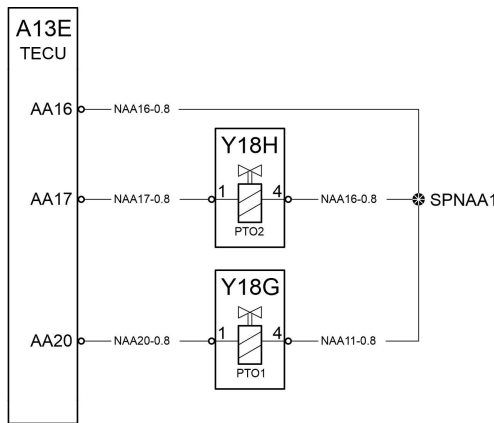
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106E - 17, PTO 1 Engagement Valve (VAP1)

Component Location:	Schematics:
 T3160745	 A13E.AA:16 - Y18GH:4 Ground wire A13E.AA:17 - Y18H:1 Control wire A13E.AA:20 - Y18G:1 Control wire T3160746

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106E FTB 17	Short circuit to higher voltage: AA:20.	- The solenoid valve is activated - The power take-off (PTO) can not be deactivated - Rough gear shift	- Solenoid valve, power take-off 1. - Connector. - Wiring harness. - Transmission Control Module (TCM).

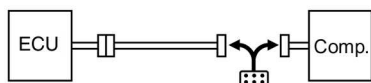
Visual wiring harness check — Y18G, Y18H, AA:

Purpose:	Action:	Evaluation:
Check the wiring harness.	Visually check that wiring harness is not damaged.	None.

Connector check: AA

Purpose:	Action:	Evaluation:
Check connector AA .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

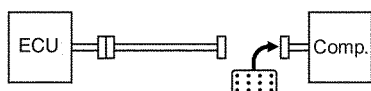
Voltage measurement:



Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	20 — 16	A13.AA.Pin 20 — A13.AA.Pin 16	V= 300 mV – 700 mV		9990041, 9998699,999-0061/62

Resistance measurement



Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit to higher voltage	OFF	18 — 20	A13.AA.Pin 20 — A13.AA.Pin 18	R ≥ 500 KΩ		9990061/62, 9998699, 9990041

Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program control unit - Reload software** programming operation.

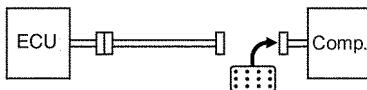
Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

If the test (A13.AA.Pin 20 — A13.AA.Pin 18), Fails:

Continue the next step

Connector check: Y18G & Y18H

Purpose:	Action:	Evaluation:
Check connector Y18G & Y18H .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Voltage measurement:

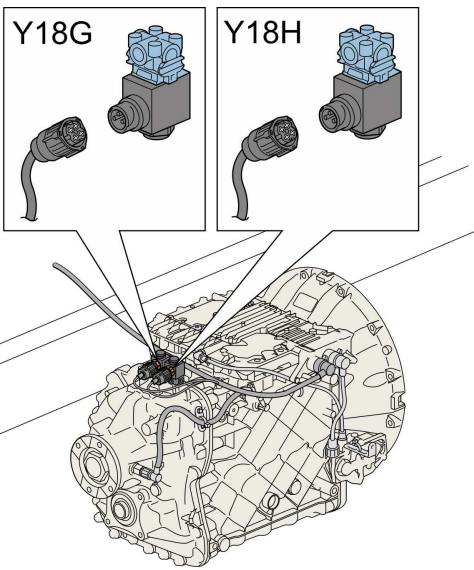
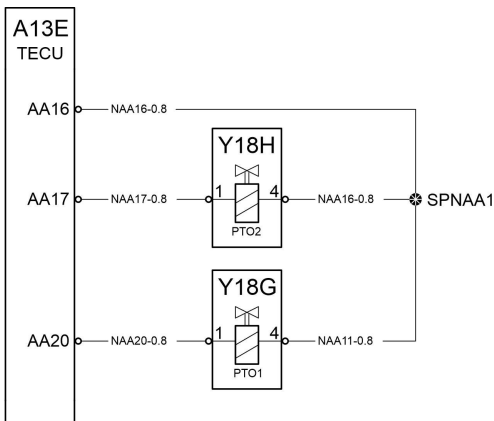
Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	1—4	Y18G.Pin 1 — Y18G.Pin 4	V= 300 mV – 700 mV		88890039

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P106E - 18, PTO 1 Engagement Valve (VAP1)

Component Location:	Schematics:
 T3160745	 A13E.AA:16 - Y18GH:4 Ground wire A13E.AA:17 - Y18H:1 Control wire A13E.AA:20 - Y18G:1 Control wire T3160746

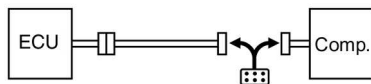
Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106E FTB 18	Open circuit: AA:20.	- The solenoid valve can not be activated - The power take-off (PTO) does not function	- Solenoid valve, power take-off 1. - Wiring harness. - Connector. - Transmission Control Module (TCM).

Visual wiring harness check — Y18G, Y18H, AA:

Purpose:	Action:	Evaluation:
Check the wiring harness.	Visually check that wiring harness is not damaged.	None.

Connector check: AA

Purpose:	Action:	Evaluation:
Check connector AA .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

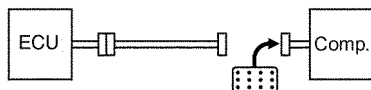
Voltage measurement:

Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	ON	20 — 16	A13.AA.Pin 20 — A13.AA.Pin 16	V= 300 mV – 700 mV		9990041, 9998699, 999-0061/62
Check component function	ON	20 — GND	A13.AA.Pin 20 — Chassis GND	V= 300 mV – 700 mV		9990041, 9998699, 999-0061/62

If the test (A13.AA.Pin 20 — A13.AA.Pin 16), Fails:

Continue the next step

Voltage measurement:

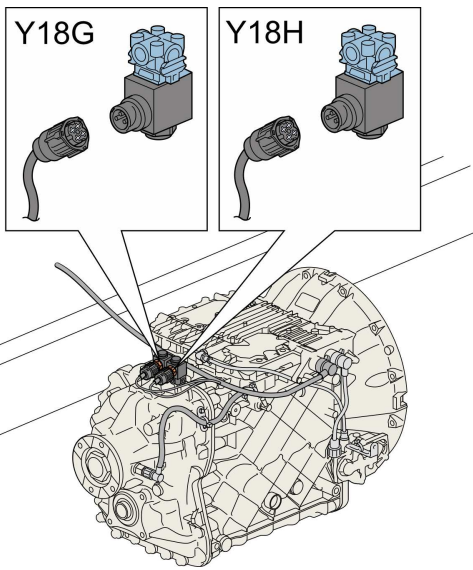
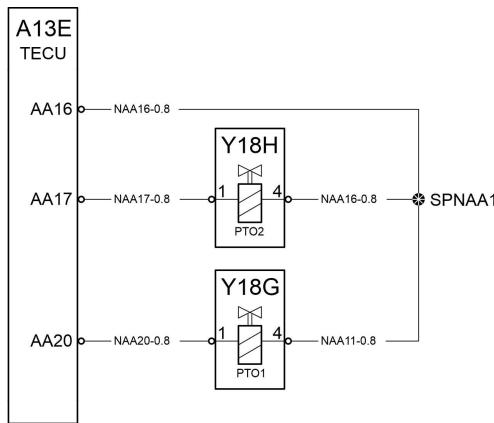
Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	1 — 4	Y18G:1 — Y18G:4	V= 300 mV – 700 mV		88890039

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106E - 19, PTO 1 Engagement Valve (VAP1)

Component Location:	Schematics:
 T3160745	 A13E.AA:16 - Y18GH:4 Ground wire A13E.AA:17 - Y18H:1 Control wire A13E.AA:20 - Y18G:1 Control wire T3160746

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106E FTB 19	Short circuit to ground: AA:20.	- The solenoid valve can not be activated - The power take-off (PTO) does not function	- Solenoid valve, power take-off (PTO) 1. - Wiring harness. - Connector - Transmission Control Module (TCM)

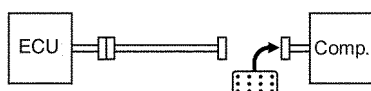
Visual wiring harness check — Y18G, Y18H, AA:

Purpose:	Action:	Evaluation:
Check the wiring harness.	Visually check that wiring harness is not damaged.	None.

Connector check: AA

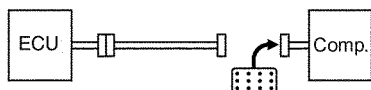
Purpose:	Action:	Evaluation:
Check connector AA .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Resistance measurement:



Measure-ment	Key position	Measurement points		Reference Value	Meas-ured value	Other (Spe-cial Tool PN)
		Breakout box	Wiring diagram			
Check for short-circuit to ground	OFF	20 — 10	A13.AA Pin20 — A13.AA Pin10	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699
Check for short-circuit to ground	OFF	20 — GND	A13.AA Pin20 — Chassis Ground	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699

Voltage measurement:



Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measure-ment	Key position	Measurement points		Reference Value	Meas-ured value	Other (Spe-cial Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	20 — 16	A13.Pin AA:20 — A13.Pin AA:16	$V = 300 \text{ mV} - 700 \text{ mV}$		9990041, 9990061/62, 9998699
Check component function	OFF	20 — GND	A13.Pin AA:20 — Chassis Ground	$V = 300 \text{ mV} - 700 \text{ mV}$		9990041, 9990061/62, 9998699

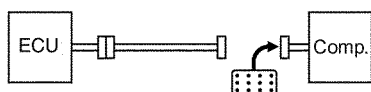
If the test (A13.Pin AA:20 — A13.Pin AA:16), Fails:

Continue the next step

Connector check: Y18G & Y18H

Purpose:	Action:	Evaluation:
Check connector Y18G & Y18H.	- Check that the connectors are properly connected and locked into position. - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Voltage measurement:



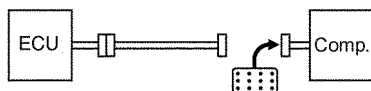
Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measure-ment	Key position	Measurement points		Reference Value	Meas-ured value	Other (Spe-cial Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	1 — 4	Y18G.Pin1 — Y18G.Pin4	$V = 300 \text{ mV} - 700 \text{ mV}$		88890039

If the test (A13.AA Pin20— A13.AA Pin10), Fails:

Continue the next step

Resistance measurement:



Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short-circuit to ground	OFF	20 — GND	Y18G.Pin1 — Chassis Ground	$R \geq 500 \text{ K}\Omega$		88890039

Verification:

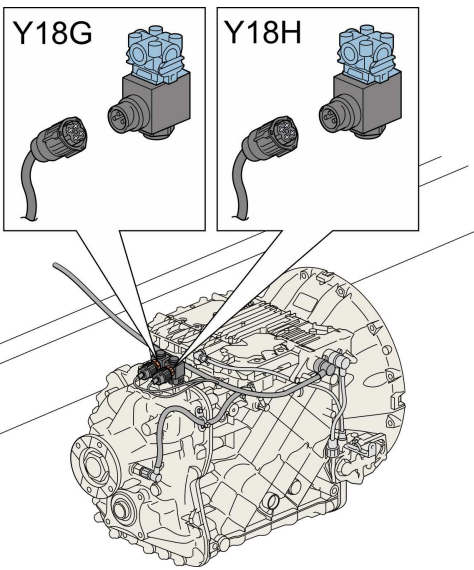
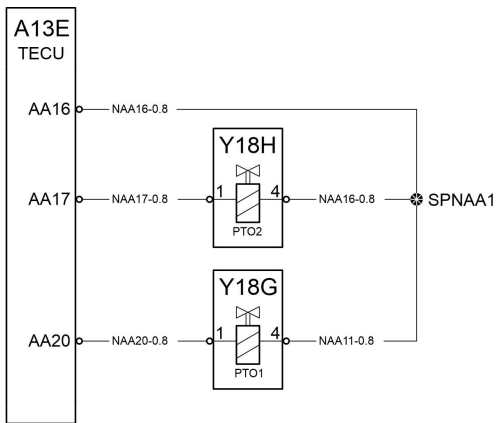


CAUTION

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P106F - 17, PTO 2 Engagement Valve (VAP2)

Component Location:	Schematics:
 T3160745	 A13E.AA:16 - Y18GH:4 Ground wire A13E.AA:17 - Y18H:1 Control wire A13E.AA:20 - Y18G:1 Control wire T3160746

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106F FTB 17	Short circuit to higher voltage: AA:17.	- The solenoid valve is activated - The power take-off (PTO) does not function - Rough gear shift	- Solenoid valve, power take-off (PTO) 2. - Connector. - Wiring harness. - Transmission Control Module (TCM).

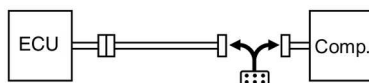
Visual wiring harness check — Y18G, Y18H, AA:

Purpose:	Action:	Evaluation:
Check the wiring harness.	Visually check that wiring harness is not damaged.	None.

Connector check: AA

Purpose:	Action:	Evaluation:
Check connector AA .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Voltage measurement:



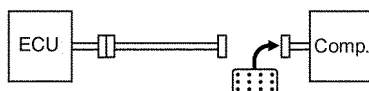
Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	17 — 16	A13.AA.Pin 17 — A13.AA.Pin 16	V= 300 mV – 700 mV		9990041, 9998699,9990061/ 62

If the test (A13.AA.Pin 17 — A13.AA.Pin 16), Pass:

Continue the next step

Resistance measurement



Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit to higher voltage	OFF	17 — 18	A13.AA.Pin 17 — A13.AA.Pin 18	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041

If the test (A13.AA.Pin 17 — A13.AA.Pin 18), Pass:

Continue the next step

Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program control unit - Reload software** programming operation.

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

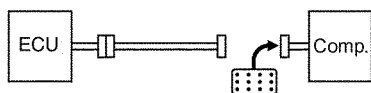
If the test (A13.AA.Pin 17 — A13.AA.Pin 16), Fail:

Continue the next step

Connector check: Y18G & Y18H

Purpose:	Action:	Evaluation:
Check connector Y18G & Y18H .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Voltage measurement:



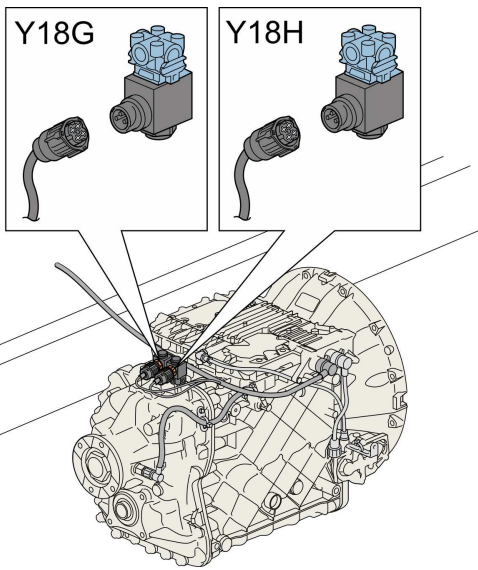
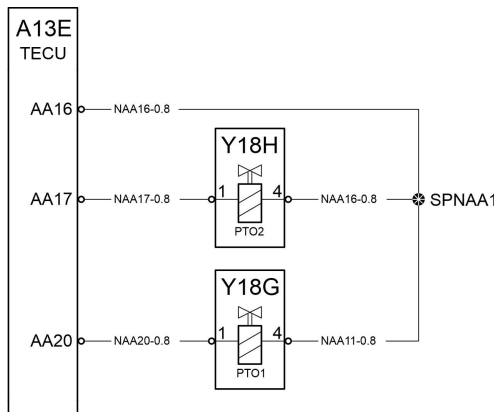
Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	1 — 4	Y18G.Pin 1 — Y18G.Pin 4	V= 300 mV – 700 mV		88890039

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P106F - 18, PTO 2 Engagement Valve (VAP2)

Component Location:	Schematics:
 T3160745	 A13E.AA:16 - Y18GH:4 Ground wire A13E.AA:17 - Y18H:1 Control wire A13E.AA:20 - Y18G:1 Control wire T3160746

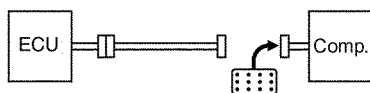
Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106F FTB 18	Open circuit: AA:17.	- The solenoid valve can not be activated - The power take-off (PTO) does not function	- Solenoid valve, power take-off (PTO) 2. - Wiring harness. - Connector. - Transmission Control Module (TCM).

Visual wiring harness check — Y18G, Y18H, AA:

Purpose:	Action:	Evaluation:
Check the wiring harness.	Visually check that wiring harness is not damaged.	None.

Connector check: AA

Purpose:	Action:	Evaluation:
Check connector AA.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

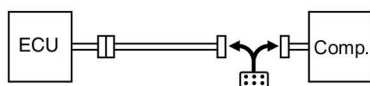
Voltage measurement:

Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	17 — 16	A13.AA.Pin 17 — A13.AA.Pin 16	V= 300 mV – 700 mV		9990041, 9998699,999-0061/62

If the test (A13.AA.Pin 17 — A13.AA.Pin 16), Pass:

Continue the next step

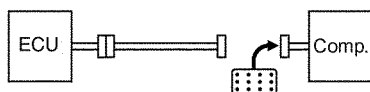
Voltage measurement:

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	ON	17 — GND	A13.AA.Pin 17 — Chassis Ground	V= 300 mV – 700 mV		9990041, 9998699,999-0061/62

If the test (A13.AA.Pin 17 — Chassis Ground), Fails:

Continue the next step

Purpose:	Action:	Evaluation:
Check connector Y18G & Y18H .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Voltage measurement:

Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

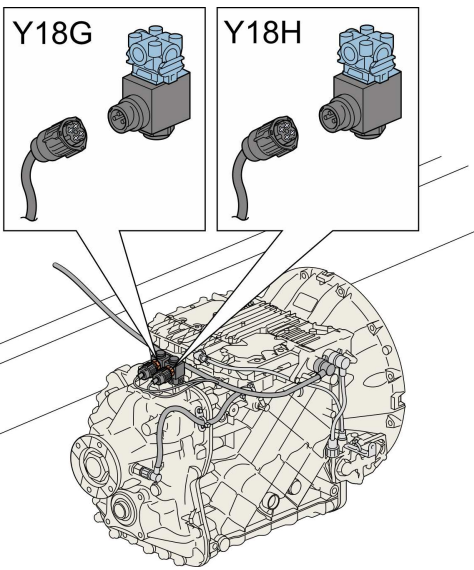
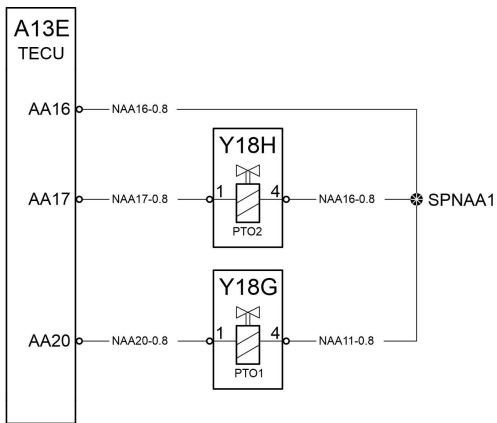
Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	1 — 4	Y18G:1 — Y18G:4	V= 300 mV – 700 mV		88890039

Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P106F - 19, PTO 2 Engagement Valve (VAP2)

Component Location:	Schematics:
 T3160745	 A13E.AA:16 - Y18GH:4 Ground wire A13E.AA:17 - Y18H:1 Control wire A13E.AA:20 - Y18G:1 Control wire T3160746

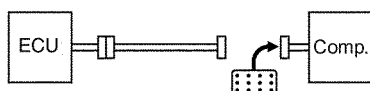
Fault type	Condition for Fault	Observable Symptoms	Possible cause
P106E FTB 19	Short circuit to ground: AA:17.	- The solenoid valve can not be activated - The power take-off (PTO) does not function	- Solenoid valve, power take-off (PTO) 1. - Wiring harness. - Connector - Transmission Control Module (TCM)

Visual wiring harness check — Y18G, Y18H, AA:

Purpose:	Action:	Evaluation:
Check the wiring harness.	Visually check that wiring harness is not damaged.	None.

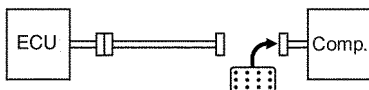
Purpose:	Action:	Evaluation:
Check connector A13. AA .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Resistance measurement:



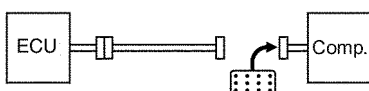
Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check for short-circuit to ground	OFF	17 — 10	A13.AA Pin17 — A13.AA Pin10	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699

Resistance measurement:



Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check for short-circuit to ground	OFF	17 — GND	A13.AA Pin17 — Chassis Ground	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699

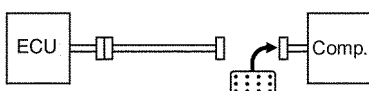
Voltage measurement:



Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	17 — 16	A13.Pin AA:17 — A13.Pin AA:16	$V = 300 \text{ mV} - 700 \text{ mV}$		9990041, 9990061/62, 9998699

Voltage measurement:



Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	17 — GND	A13.Pin AA:17 — Chassis Ground	$V = 300 \text{ mV} - 700 \text{ mV}$		9990041, 9990061/62, 9998699

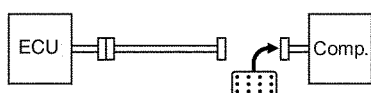
If the test (A13.Pin AA:17 — A13.Pin AA:16), Fails:

Continue the next step

Connector check: Y18G & Y18H

Purpose:	Action:	Evaluation:
Check connector Y18G & Y18H.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Voltage measurement:



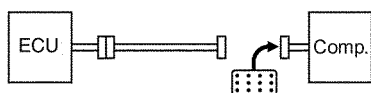
Note: This circuit contains a diode. This circuit cannot be checked by resistance testing and must be tested in diode test mode on the multimeter.

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component function	OFF	1 — 4	Y18H.Pin1 — Y18H.Pin4	V = 300 mV – 700 mV		88890039

If the test (A13.AA Pin17 — A13.AA Pin10), Fails:

Continue the next step

Resistance measurement:



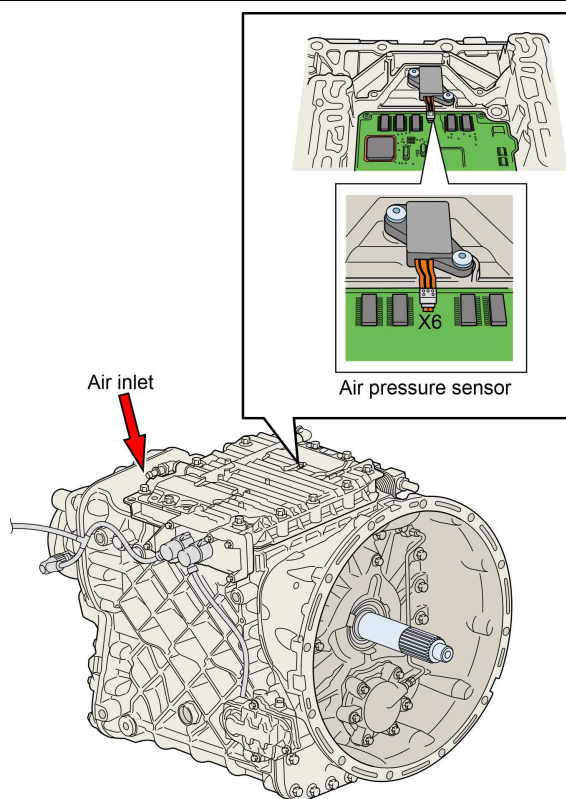
Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short-circuit to ground	OFF	20 — GND	Y18H.Pin1 — Chassis Ground	R ≥ 500 KΩ		88890039

Verification:

Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1054 - 21, Tank Air Pressure Sensor (SEPrSA)

Component Location:



T1162157

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1054 FTB 21	The air pressure is below 500 kPa (72.5 psi).	- The symbol for compressed air, transmission lights up. - Gear changes may not be possible. - Erratic clutch performance.	- Air pressure sensor. - The pneumatic system does not function.

Conditions for diagnostic trouble code (DTC)

Only occurs at initial start-up or after the vehicle has been parked for a minimum of 4 hours

When the vehicle is moving or the fault is erratic or intermittent

Only occurs at initial start-up or after the vehicle has been parked for a minimum of 4 hours

Visual Check

Purpose:	Component to be tested :	Action:	Evaluation:
Leakage check.	Automatic transmission Air tank.	Apply soapy water to the lines and connections.	None.

Visual Check

Purpose:	Component to be tested :	Action:	Evaluation:
Leakage check.	Chassis air tank.	Apply soapy water to the lines and connections.	None.

Visual Check

Purpose:	Component to be tested :	Action:	Evaluation:
Leakage check.	One-way check valve.	Build up the pressure to the governor cut out and shut off the engine or remove the external air supply. • Drain the chassis air tanks and leave the Automated Manual Transmission (AMT) tank full. • Remove the inlet air line from the check valve of the Automated Manual Transmission (AMT) tank. Check for air bleeding back through the check valve to the tank.	This is a check valve that does not let air into the Automated Manual Transmission (AMT) reservoir until the pressure in the chassis air tanks is ≥ 70 psi. The valve also do not allow air to drain from the AMT tank in the event of the chassis air tanks losing air pressure.

When the vehicle is moving or the fault is erratic or intermittent

Visual Check

Purpose:	Component to be tested :	Action:	Evaluation:
Visual inspection.	• Automatic transmission Air tank. • Chassis Air tank. • Air system.	Check for excessive moisture and contamination.	None.

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Note: Before fault tracing the diagnostic trouble code (DTC) in question, any related DTCs should be investigated.

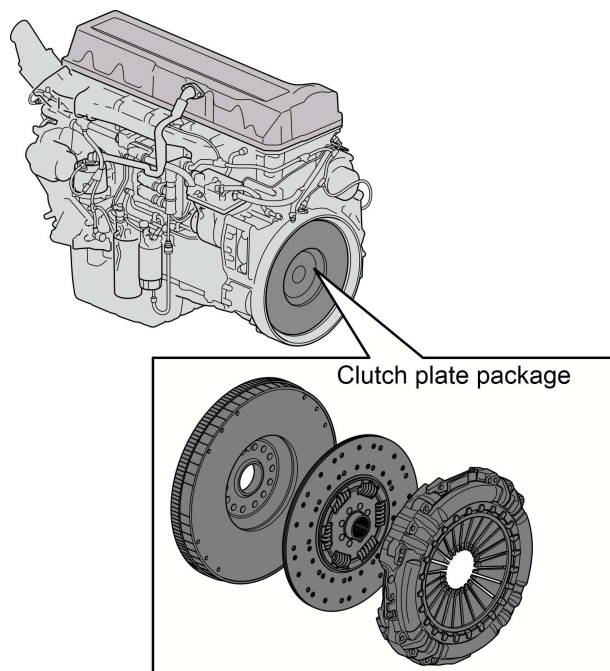
Purpose:	Component to be tested :	Action:	Evaluation:
The following procedures must be performed first.	• Air compressor. • Air system.	Continue fault tracing using information in Impact and the relevant operation.	None.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1060 - 63, Clutch Plate Load

Component Location:



T1160853

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1060 FTB 63	The clutch is overloaded.	• Gear changes may not be possible. • Erratic clutch performance.	• Clutch wear. • Incorrect Transmission installed During Repair.

Select the type of failure from the list below

The symbol for overloaded clutch is shown in the display.

The transmission exhibits a drivability problem with excessively high DTC counts for the faults.

Drivability problem occurred after transmission replacement.

The symbol for overloaded clutch is shown in the display.

Description:	Action:
- The vehicle has been operated incorrectly. The driver is most likely using the throttle to hold the vehicle on a hill. The driver should only use the brake to hold the vehicle stationary. - A too high starting gear may have been used.	- See the drivers manual for more information about using the transmission. - Check parameter - Highest Start Gear in Automatic Mode - P1ASM or P1LCM. - Check parameter - Highest Start Gear in Manual Mode - P1ASL or P1LCL. Open the relevant programming operation - Start the relevant operation. - Function group: 17. 1700-22-03-03 Parameter, programming. - Check that observed symptoms do not remain. - To fully verify the repair it may be necessary to road test the vehicle. - Before verification is performed, take into consideration faults that have possibly not yet been attended to.

The transmission exhibits a drivability problem with excessively high DTC counts for the faults.

Select fault tracing procedure
Since no fault can be found in this DTC diagnostic procedure, exit this procedure, step back to the start menu and select the closest matching symptom in the symptom fault tracing menu

Drivability problem occurred after transmission replacement.**Visual Check**

Purpose:	Component to be tested :	Action:	Evaluation:
Perform a visual check.	Transmission.	Verify that the installed transmission is of the same model as the replaced transmission. Compare the component identification labels located on the transmission housings	Choose one of the following reasons for fault - The transmission model designation displayed on the data labels are the same. - The model designation on the data labels do not match.

The transmission model designation displayed on the data labels are the same

Test instruction

Purpose:	Component to be tested :	Action:	Evaluation:
Perform a visual check.	Gear and engaging clutch teeth.	- Remove the transmission cover on both transmissions. - Compare the diameter of all gears between the original and the replacement transmission. - All gears should be the same size between both the old and the replacement transmission.	Are the gears of the same size?.

**CAUTION**

:It is not allowed to disassemble the clutch assembly. If the clutch is disassembled, the clutch will be damaged and the clutch assembly must be replaced

Test instruction

Purpose:	Component to be tested :	Action:	Evaluation:
- Perform a visual check. - Check for signs of foreign debris.	Clutch plate package.	Clutch plate - Check that the spring is undamaged. - Check the clutch plate for wear. Pressure plate - Check for signs of excessive heat. - Check the surface for signs of damage and/or signs of foreign debris. - Check that the spring is undamaged. Flywheel - Check the surface for signs of damage and/or signs of foreign debris.	One of the following components is faulty: - Clutch plate. - Pressure plate. - Flywheel. - No fault.

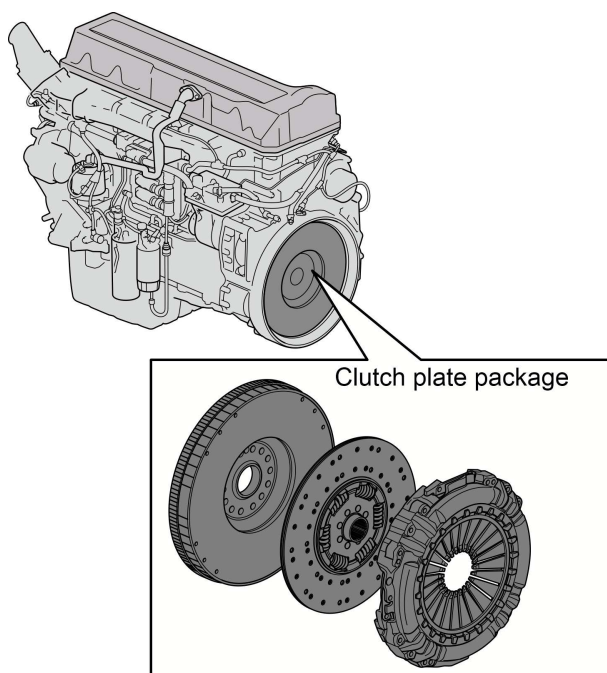
Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1060 - 74, Clutch Plate Load

Component Location:



T1160853

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1060 FTB 74	- The clutch is about to be overloaded - The clutch has been slipping too long	Gear changes may not be possible.	Standstill in uphill with accelerator pedal pressed.

Test instruction

Description:	Action:
- The vehicle has been operated incorrectly. The driver is most likely using the throttle to hold the vehicle on a hill. The driver should only use the brake to hold the vehicle stationary. - A too high starting gear may have been used.	- See the drivers manual for more information about using the transmission. - Check parameter - Highest Start Gear in Automatic Mode - P1ASM or P1LCM. - Check parameter - Highest Start Gear in Manual Mode - P1ASL or P1LCL. Open the relevant programming operation - Start the relevant operation. - Function group: 17. 1700-22-03-03 Parameter, programming. - Check that observed symptoms do not remain. - To fully verify the repair it may be necessary to road test the vehicle. - Before verification is performed, take into consideration faults that have possibly not yet been attended to.

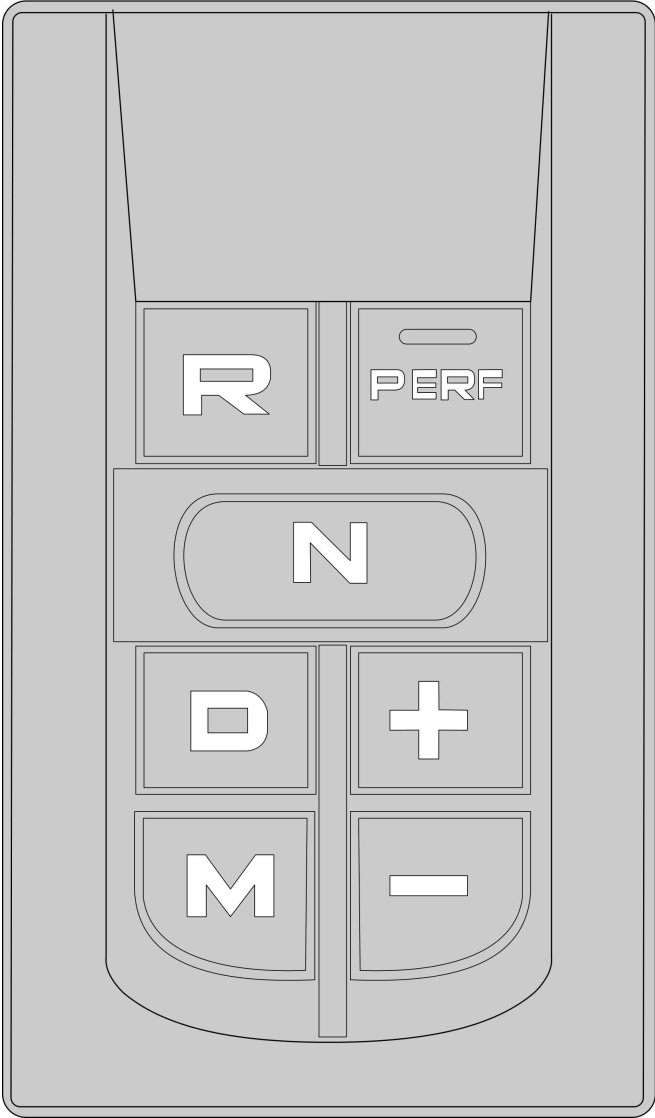
Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1060 - 92, Clutch Plate Load

Component Location:

S171



T1162211

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1060 FTB 92	Attempt to start at high range in manual position.	It is not possible to drive the vehicle.	Attempt to start on a high range gear.

Test instruction

Description:	Action:
High range is engaged.	Engage low range.

Verification:



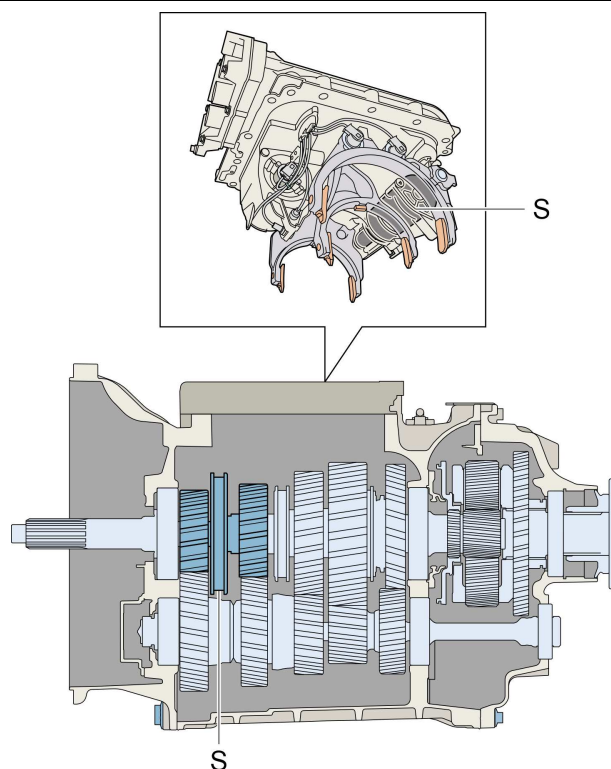
CAUTION

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1071 - 77, Split Engagement System

Component Location:



T1162212

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1071 FTB 77	Not possible to engage low split.	- Loss of torque. - Slow gear changes. - Poor accelerator pedal (AP) response. - Incorrect gear selection.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Seals, solenoid valve. - Split cylinder stop - Gear and engaging clutch teeth. - Piston rod. - Split gear detent assembly.

Test instruction

Note: The control housing must be in the vehicle when performing the check.

Preconditions:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air.	Is the control housing free from leakage?

Connect TECHTOOL to the vehicle and run the **4320-08-03-03 Split Cylinder** Test operation.

After executing the operation if the result Select Fail value :

Continue the next step

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Test operation.

After executing the Split Cylinder operation if the result Select Pass value :

Continue the next step

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Position sensor, split cylinder.	- Inspect. - Position sensor, split cylinder. - Bracket. - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Description:	Evaluation:
1 Check that the detent assembly is not damaged. 2 Check if any of the brass lugs are damaged. 3 Check that the cylinder stop is undamaged. 4 Check if the shift fork is secured onto the rod and is undamaged.	- Damaged detent assembly. - Damaged brass lugs. - Cylinder stop. - Faulty selector forks. - No damaged component.

Test instruction

Description:	Evaluation:
1 Check that the gear and engaging sleeve clutch teeth are not damaged. 2 Check that the detent assembly is not damaged. 3 Check that the cylinder stop is undamaged 4 Check if the shift fork is secured onto the rod and is undamaged	- Damaged detent assembly. - Damaged brass lugs. - Cylinder stop. - Faulty selector forks. - No damaged component.

Fault tracing outside Guided Diagnostics

Note: The next component to fault trace is not yet covered by Guided Diagnostics

Component:	Action:

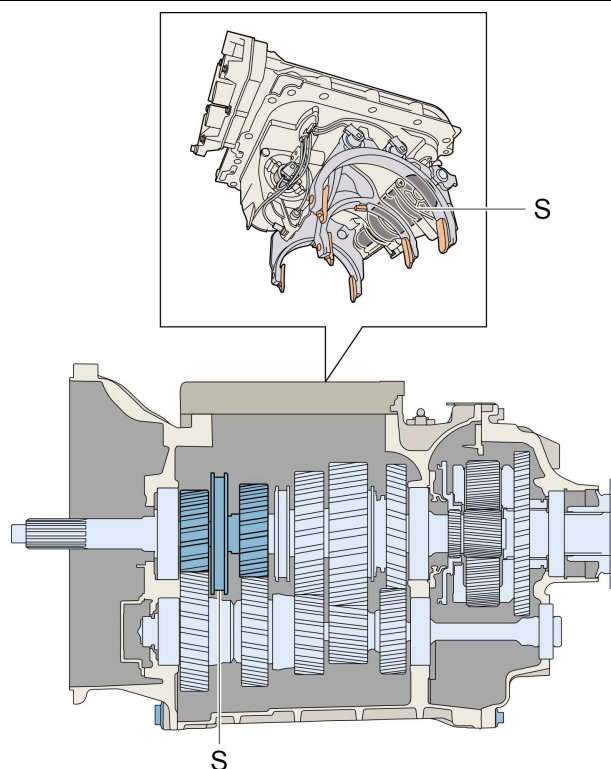
Split, Synchronizer components.	Continue fault tracing using information in Impact and the relevant operation. After completed fault tracing for the component, return to Guided Diagnostics.
For more information, see Impact: Reference to service information Input shaft, overhaul (Impact operation: 4313-04-05-04 (43197-5))	
For more information, see Impact: Reference to service information Main shaft, overhaul (Impact operation: 4313-04-05-01 (43173-5))	
After executing the operation if the result Select Pass value : Continue the next step	

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	Start the engine and let it idle.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1071 - 79, Split Engagement System

Component Location:



T1162212

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1071 FTB 79	Neutral split jumps out.	Slow gear changes.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Split cylinder stop. - Piston rod. - Split gear detent assembly.

Test instruction

Note: The control housing must be in the vehicle when performing the check.

Preconditions:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air.	Is the control housing free from leakage?

Connect TECHTOOL to the vehicle and run the **4320-08-03-03 Split Cylinder** Test operation.

After executing the operation if the result Select Fail value :

Continue the next step

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

After executing the Split Cylinder operation if the result Select Pass value :

Continue the next step

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Position sensor, split cylinder.	- Inspect. - Position sensor, split cylinder. - Bracket. - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check that the cylinder stop is undamaged. - Check if the shift fork is secured onto the rod and is undamaged.	- Damaged detent assembly. - Damaged brass lugs. - Cylinder stop. - Faulty selector forks. - No damaged component.

Test instruction

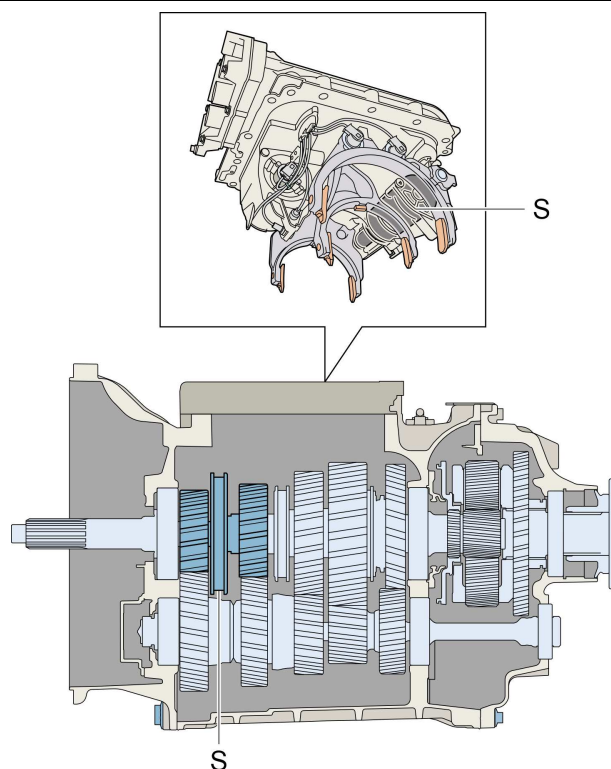
Action:	Evaluation:
Check that the detent assembly is not damaged.	Is the detent assembly fault free?

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1071 - 92, Split Engagement System

Component Location:



T1162212

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1071 FTB 92	Not possible to engage neutral split.	- EconoRoll Not available. - Slow gear changes.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Seals, solenoid valve. - Split cylinder stop. - Piston rod. - Split gear detent assembly. - Engaging sleeve.

Test instruction

Note: The control housing must be in the vehicle when performing the check.

Preconditions:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air.	Is the control housing free from leakage?

Connect TECHTOOL to the vehicle and run the **4320-08-03-03 Split Cylinder** Test operation.

After executing the operation if the result Select Fail value :

Continue the next step

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Test operation.

After executing the Split Cylinder operation if the result Select Pass value :

Continue the next step

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Position sensor, split cylinder.	- Inspect. - Position sensor, split cylinder. - Bracket. - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check that the cylinder stop is undamaged. - Check if the shift fork is secured onto the rod and is undamaged.	- Damaged detent assembly. - Damaged brass lugs. - Cylinder stop. - Faulty selector forks. - No damaged component.

Test instruction

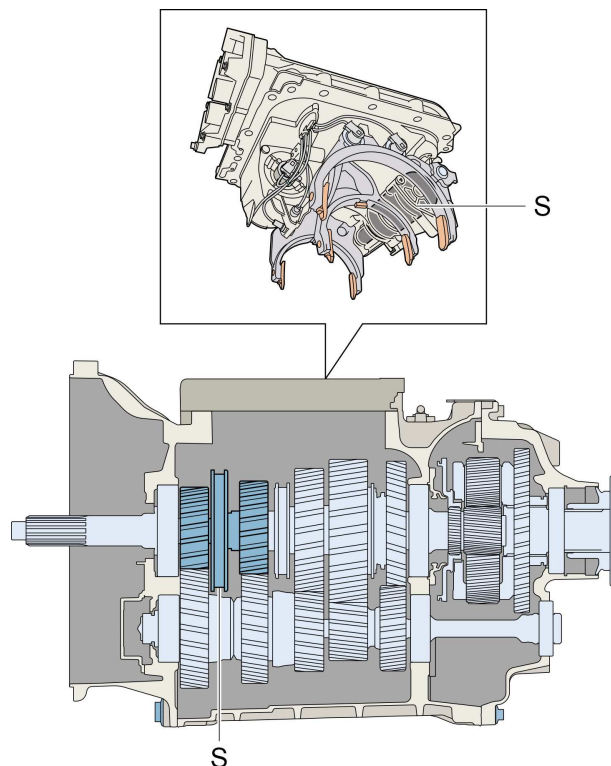
Action:	Evaluation:
Check that the engaging sleeve can move back and forth.	Is it possible to move the engaging sleeve?
Check that the detent assembly is not damaged.	Is the detent assembly fault free?

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	Start the engine and let it idle.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1071 - 94, Split Engagement System

Component Location:



T1162212

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1071 FTB 94	Low split jumps out.	Loss of torque.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Split cylinder stop. - Gear and engaging sleeve back-taper. - Piston rod. - Split gear detent assembly. - Gear wheel - Wiring harness between component connector and electronic control unit (ECU) connector - Position sensor, split cylinder.

Test instruction

Note: The control housing must be in the vehicle when performing the check.

Preconditions:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air.	Is the control housing free from leakage?

Connect TECHTOOL to the vehicle and run the **4320-08-03-03 Split Cylinder** Test operation.

After executing the operation if the result Select Fail value :

Continue the next step

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?
Check that the detent assembly is not damaged.	Is the detent assembly fault free?

After executing the Split Cylinder operation if the result Select Pass value :

Continue the next step

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Position sensor, split cylinder.	- Inspect. - Position sensor, split cylinder. - Bracket. - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check that the cylinder stop is undamaged. - Check if the shift fork is secured onto the rod and is undamaged.	- Damaged detent assembly. - Damaged brass lugs. - Cylinder stop. - Faulty selector forks. - No damaged component.

Test instruction

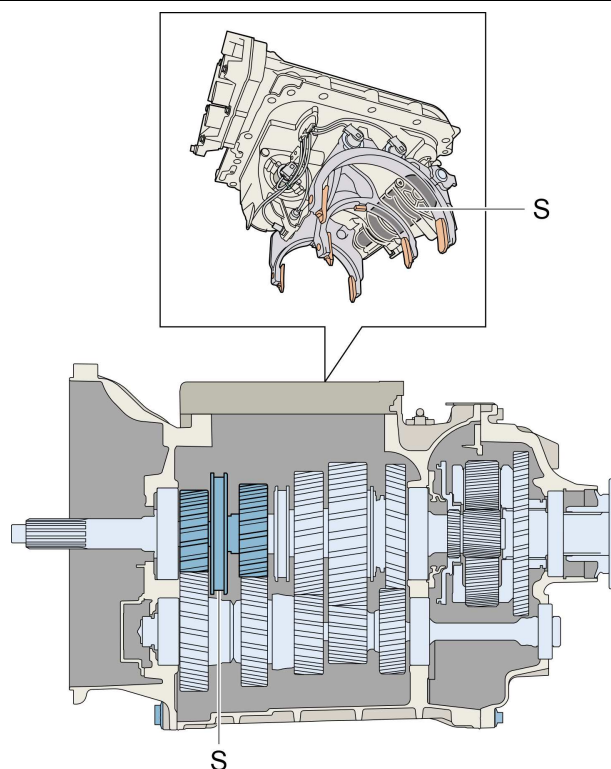
Description:	Evaluation:
1 Check that the gear and engaging sleeve back-taper is undamaged. 2 Check that the detent assembly is not damaged. 3 Check that the gear wheels are undamaged.	Worn gear or engaging sleeve back-taper. • Damaged detent assembly. • Damaged gear wheel. • No damaged component.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1071 - 96, Split Engagement System

Component Location:



T1162212

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1071 FTB 96	- High split jumps out. - The condition(s) must be fulfilled 3 times in order for the DTC to set.	Loss of torque.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Split cylinder stop. - Gear and engaging sleeve back-taper. - Piston rod. - Split gear detent assembly.

Test instruction

Note: The control housing must be in the vehicle when performing the check.

Preconditions:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air.	Is the control housing free from leakage?

Connect TECHTOOL to the vehicle and run the **4320-08-03-03 Split Cylinder** Test operation.

After executing the operation if the result Select Fail value :

Continue the next step

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

After executing the Split Cylinder operation if the result Select Pass value :

Continue the next step

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Position sensor, split cylinder.	- Inspect. - Position sensor, split cylinder. - Bracket. - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check that the cylinder stop is undamaged. - Check if the shift fork is secured onto the rod and is undamaged.	- Damaged detent assembly. - Damaged brass lugs. - Cylinder stop. - Faulty selector forks. - No damaged component.

Test instruction

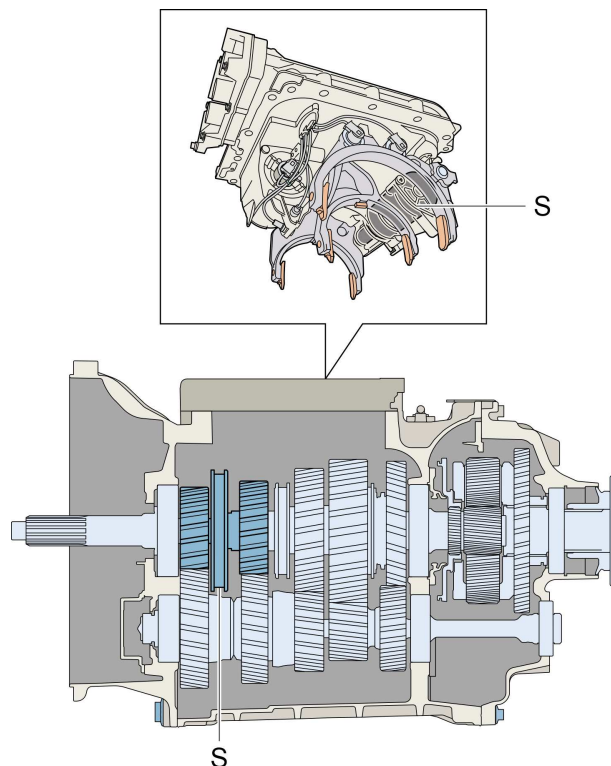
Description:	Evaluation:
- Check that the gear and engaging sleeve back-taper is undamaged. - Check that the detent assembly is not damaged. - Check that the gear wheels are undamaged.	- Worn gear or engaging sleeve back-taper. - Damaged detent assembly. - Damaged gear wheel. - No damaged component.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1071 - 97, Split Engagement System

Component Location:



T1162212

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1071 FTB 97	Not possible to engage high split.	- Loss of torque. - Slow gear changes. - Poor accelerator pedal (AP) response. - Incorrect gear selection.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Seals, solenoid valve. - Split cylinder stop. - Gear and engaging clutch teeth. - Piston rod. - Split gear detent assembly.

Test instruction

Note: The control housing must be in the vehicle when performing the check.

Preconditions:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air.	Is the control housing free from leakage?

Connect TECHTOOL to the vehicle and run the **4320-08-03-03 Split Cylinder** Test operation.

After executing the operation if the result Select Fail value :

Continue the next step

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Test operation.

Test instruction

After executing the Split Cylinder operation if the result Select Pass value :

Continue the next step

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Position sensor, split cylinder.	- Inspect. - Position sensor, split cylinder. - Bracket. - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check that the cylinder stop is undamaged. - Check if the shift fork is secured onto the rod and is undamaged.	- Damaged detent assembly. - Damaged brass lugs. - Cylinder stop. - Faulty selector forks. - No damaged component.

Test instruction

Description:	Evaluation:
- Check that the gear and engaging sleeve back-taper is undamaged. - Check that the detent assembly is not damaged. - Check that the gear wheels are undamaged.	- Worn gear or engaging sleeve back-taper. - Damaged detent assembly. - Damaged gear wheel. - No damaged component.

Fault tracing outside Guided Diagnostics

Note: The next component to fault trace is not yet covered by Guided Diagnostics

Component:	Action:

Split, Synchronizer components.	Continue fault tracing using information in Impact and the relevant operation. After completed fault tracing for the component, return to Guided Diagnostics.
For more information, see Impact: Reference to service information Input shaft, overhaul (Impact operation: 4313-04-05-04 (43197-5))	
For more information, see Impact: Reference to service information Main shaft, overhaul (Impact operation: 4313-04-05-01 (43173-5))	

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	Start the engine and let it idle.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1067 - 17, Clutch Slow Disengagement Valve (VASD)

Component Location:

T1162195

Schematics:

A13
TECU

B15

B6

B7

B1

B2

B10

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

A42

Y22

Y23

Y21

Y26

VAFD

VAFE

VASD

VASE

A13.B:1 - Y21 Control wire

A13.B:2 - Y26 Control wire

A13.B:10 - Y21/Y26 Ground wire

A13.B:6 - Y21:1 Control wire

A13.B:7 - Y23 Control wire

A13.B:15 - Y22/Y23 Ground wire

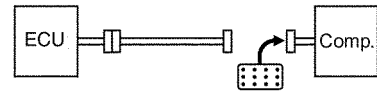
T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1067 FTB 17	Higher voltage than normal on pin B:1.	Uneven shifting at start and at slow speed.	- Clutch valve assembly. - Transmission Control Module (TCM).

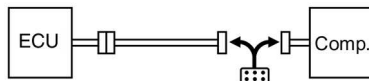
Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	01 — 10	A13.Pin B:1 — A13.Pin B:10	R = 3.2 Ω — 5.2 Ω		9990061/62, 9998699, 9990041

Voltage measurement

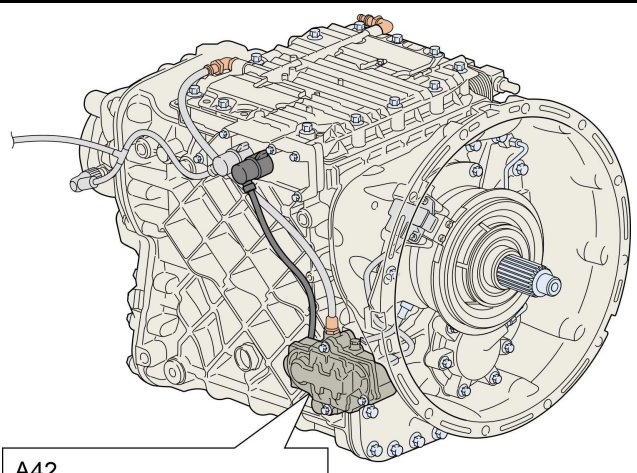
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	01 — 10	A13.Pin B:1 — A13.Pin B:10	V= 0 mV — 500 mV		9990061/62, 9998699, 9990041

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1067 - 18, Clutch Slow Disengagement Valve (VASD)

Component Location:



T1162195

Schematics:

A13
TECU

B15

B6

B7

B1

B2

B10

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

A42

Y22

VAFD

Y23

VAFE

Y21

VASD

Y26

VASE

A13.B:1 - Y21 Control wire

A13.B:2 - Y26 Control wire

A13.B:10 - Y21/Y26 Ground wire

A13.B:6 - Y21:1 Control wire

A13.B:7 - Y23 Control wire

A13.B:15 - Y22/Y23 Ground wire

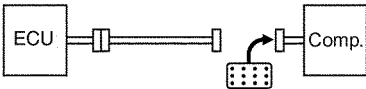
T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1067 FTB 18	Open circuit, Pin B:1.	Uneven shifting at start and at slow speed.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	01 — 10	A13.Pin B:1 — A13.Pin B:10	R = 3.2 Ω — 5.2 Ω		9990061/62, 9998699, 9990041

Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

Test instruction

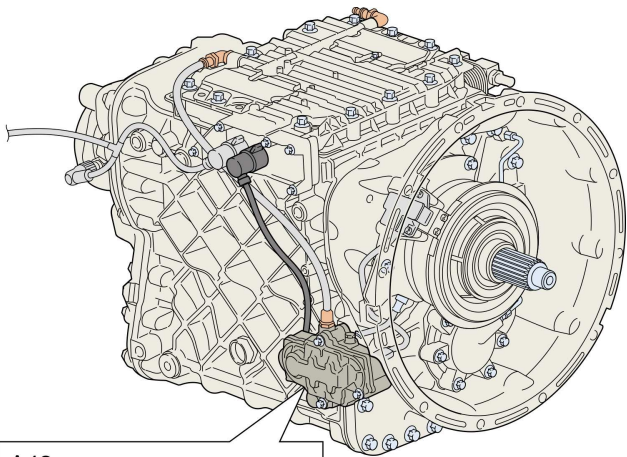
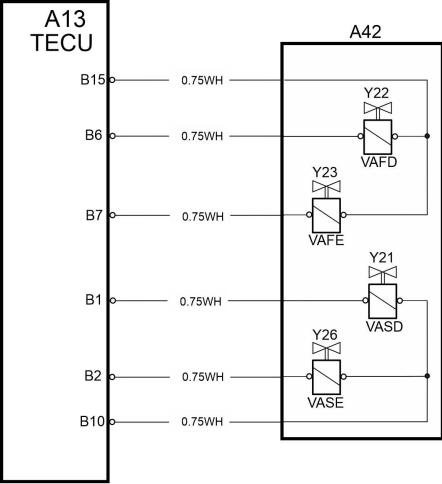
Purpose:	Component to be tested :	Action:	Evaluation:
This test determines if the diagnostic trouble code (DTC) status changes when the component connector is disconnected.	Clutch valve assembly.	- Ignition key in OFF position. - Disconnect A42 connector. - Ignition key in ON position.	None.

Note: Continue and read out the status of the diagnostic trouble code (DTC) in TECHTOOL.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

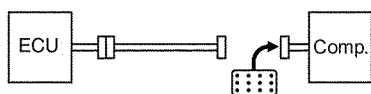
TECU - P1067 - 19, Clutch Slow Disengagement Valve (VASD)

Clutch valve assembly	Schematics
 A42 T1162195	 A13.B:1 - Y21 Control wire A13.B:2 - Y26 Control wire A13.B:10 - Y21/Y26 Ground wire A13.B:6 - Y21:1 Control wire A13.B:7 - Y23 Control wire A13.B:15 - Y22/Y23 Ground wire T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1067 FTB 19	Short circuit to ground on B:1.	Uneven shifting at start and at slow speed.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	1 — 10	A13.Pin B:1 — A13.Pin B:10	$R = 3.2 \Omega - 5.2 \Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	1 — 15	A13.Pin B:1 — A13.Pin B:15	$R \geq 500 K\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	1 — 12	A13.Pin B:1 — A13.Pin B:12	$R \geq 500 K\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	1 — GND	A13.Pin B:1 — Chassis Ground	$R \geq 500 K\Omega$		9990061/62, 9998699, 9990041

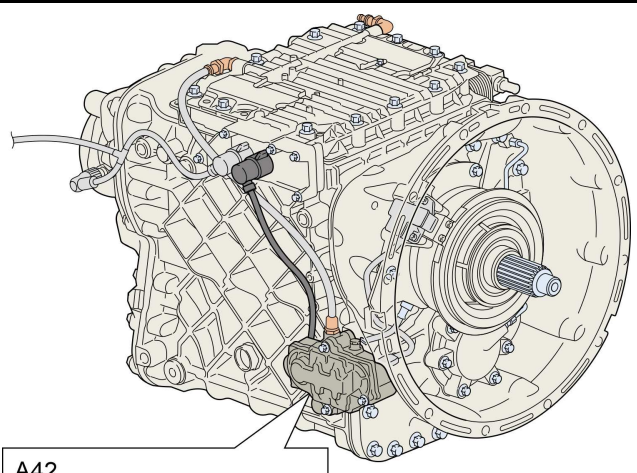
Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1066 - 17, Clutch Fast Disengagement Valve (VAFD)

Component Location:



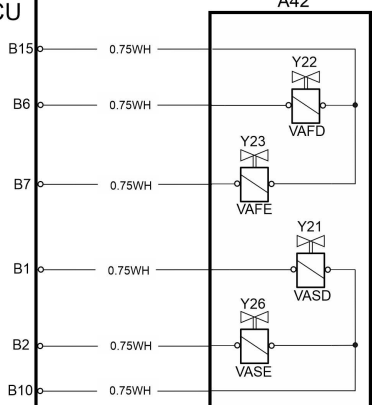
T1162195

Schematics:

A13
TECU

B15
B6
B7
B1
B2
B10

A42



A13.B:1 - Y21 Control wire
A13.B:2 - Y26 Control wire
A13.B:10 - Y21/Y26 Ground wire
A13.B:6 - Y21:1 Control wire
A13.B:7 - Y23 Control wire
A13.B:15 - Y22/Y23 Ground wire

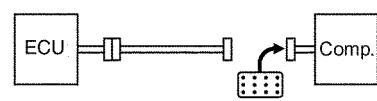
T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1066 FTB 17	Higher voltage than normal on pin B:6.	Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

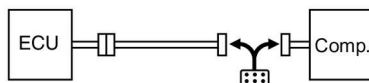
Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	6 — 15	A13.Pin B:6 — A13.Pin B:15	R = 3.2 Ω — 5.2 Ω		9990061/62, 9998699, 9990041

Voltage measurement

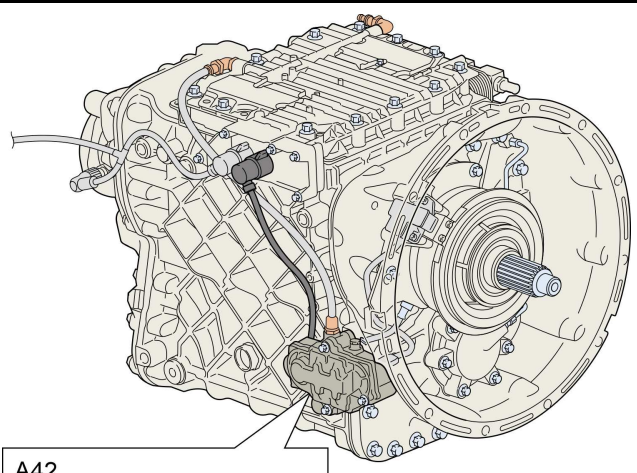
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	6 — 15	A13.Pin B:6 — A13.Pin B:15	V= 0 mV — 500 mV		9990061/62, 9998699, 9990041

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1066 - 18, Clutch Fast Disengagement Valve (VAFD)

Component Location:



T1162195

Schematics:

A13
TECU

B15

B6

B7

B1

B2

B10

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

A42

Y22

VAFD

Y23

VAFE

Y21

VASD

Y26

VASE

A13.B:1 - Y21 Control wire

A13.B:2 - Y26 Control wire

A13.B:10 - Y21/Y26 Ground wire

A13.B:6 - Y21:1 Control wire

A13.B:7 - Y23 Control wire

A13.B:15 - Y22/Y23 Ground wire

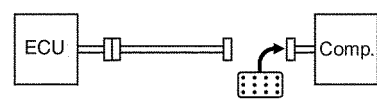
T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1066 FTB 18	Open circuit, Pin B:6.	Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	6 — 15	A13.Pin B:6 — A13.Pin B:15	R = 3.2 Ω — 5.2 Ω		9990061/62, 9998699, 9990041

Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

Test instruction

Purpose:	Component to be tested :	Action:	Evaluation:
This test determines if the diagnostic trouble code (DTC) status changes when the component connector is disconnected.	Clutch valve assembly.	- Ignition key in OFF position. - Disconnect A42 connector. - Ignition key in ON position.	None.

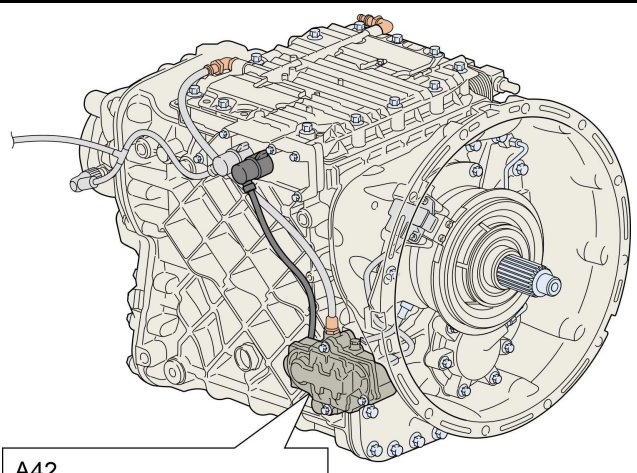
Note: Continue and read out the status of the diagnostic trouble code (DTC) in TECHTOOL.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1066 - 19, Clutch Fast Disengagement Valve (VAFD)

Component Location:



T1162195

Schematics:

A13
TECU

B15

B6

B7

B1

B2

B10

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

A42

Y22

VAFD

Y23

VAFE

Y21

VASD

Y26

VASE

A13.B:1 - Y21 Control wire

A13.B:2 - Y26 Control wire

A13.B:10 - Y21/Y26 Ground wire

A13.B:6 - Y21:1 Control wire

A13.B:7 - Y23 Control wire

A13.B:15 - Y22/Y23 Ground wire

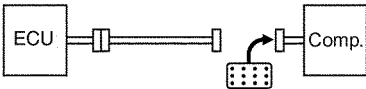
T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1066 FTB 19	Short circuit to ground on B:6.	Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



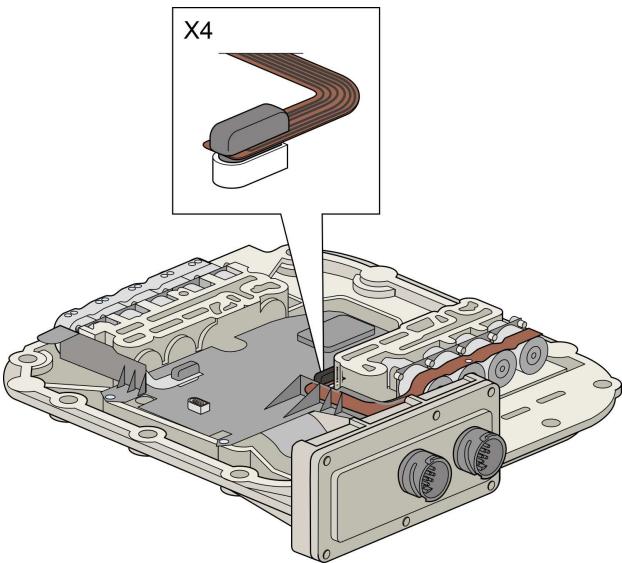
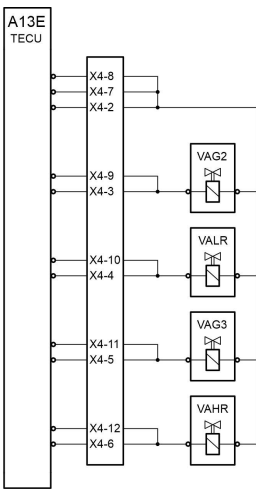
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	6 — 15	A13.Pin B:6 — A13.Pin B:15	$R = 3.2 \Omega - 5.2 \Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	6 — 10	A13.Pin B:6 — A13.Pin B:10	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	6 — 12	A13.Pin B:6 — A13.Pin B:12	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	6 — GND	A13.Pin B:6 — Chassis Ground	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041

Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1065 - 17, Clutch Slow Engagement Valve (VASE)

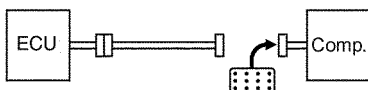
Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1065 FTB 17	Higher voltage than normal on pin B:2.	Uneven shifting at start and at slow speed.	- Clutch valve assembly. - Transmission Control Module (TCM).

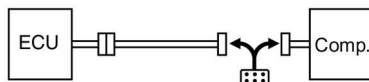
Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	2 — 10	A13.Pin B:2 — A13.Pin B:10	R = 3.2 Ω — 5.2 Ω		9990061/62, 9998699, 9990041

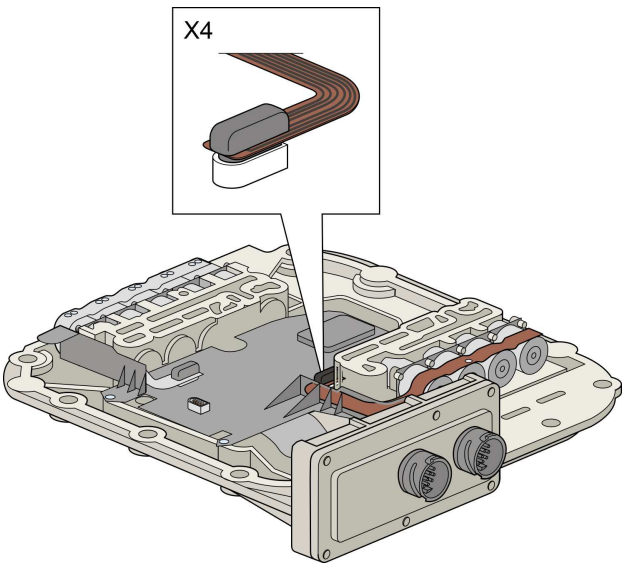
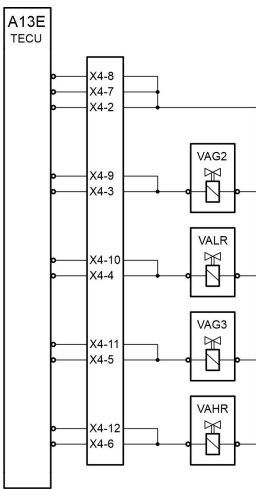
Voltage measurement

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	2 — 10	A13.Pin B:2 — A13.Pin B:10	V= 0 mV — 500 mV		9990061/62, 9998699, 9990041

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1065 - 18, Clutch Slow Engagement Valve (VASE)

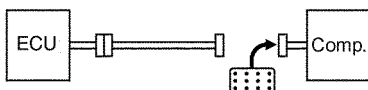
Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1065 FTB 18	Open circuit, Pin B:2.	Uneven shifting at start and at slow speed.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	2 — 10	A13.Pin B:2 — A13.Pin B:10	R = 3.2 Ω — 5.2 Ω		9990061/62, 9998699, 9990041

Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

Test instruction

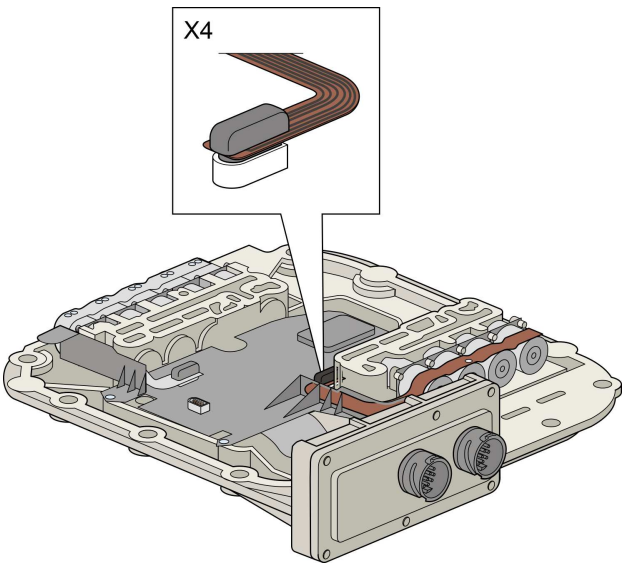
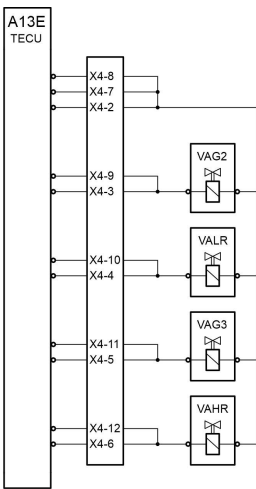
Purpose:	Component to be tested :	Action:	Evaluation:
This test determines if the diagnostic trouble code (DTC) status changes when the component connector is disconnected.	Clutch valve assembly.	- Ignition key in OFF position. - Disconnect A42 connector. - Ignition key in ON position.	None.

Note: Continue and read out the status of the diagnostic trouble code (DTC) in TECHTOOL.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1065 - 19, Clutch Slow Engagement Valve (VASE)

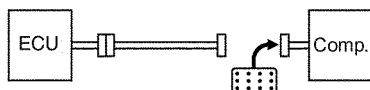
Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1065 FTB 19	Short circuit to ground on B:2.	Uneven shifting at start and at slow speed.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



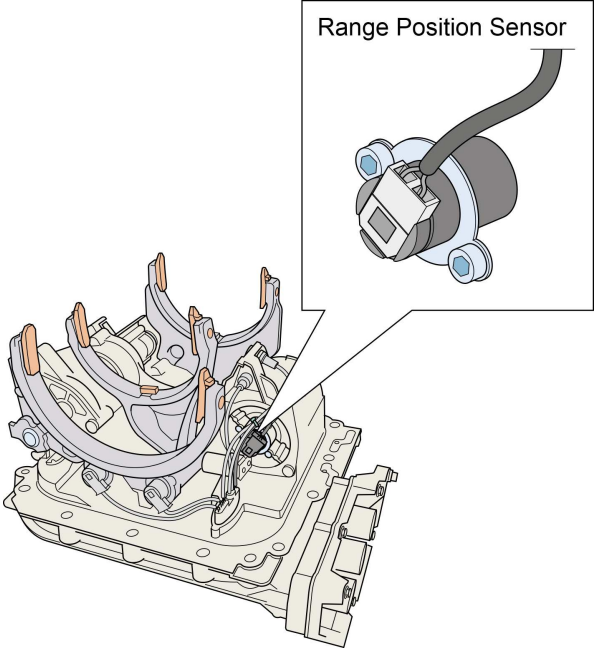
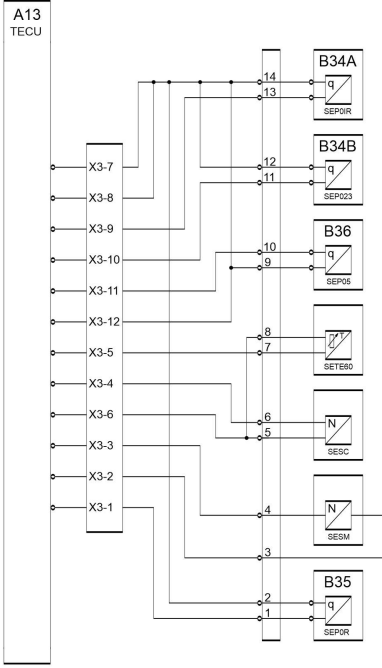
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	2 — 10	A13.Pin B:6 — A13.Pin B:15	$R = 3.2 \Omega - 5.2 \Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	2 — 15	A13.Pin B:2 — A13.Pin B:15	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	2 — 12	A13.Pin B:2 — A13.Pin B:12	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	2 — GND	A13.Pin B:2 — Chassis Ground	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041

Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1050 - 17, Range Position Sensor (SEPoR)

Component Location:	Schematics:
 T1162158	 X3:1 - B35:1 Signal wire X3:7 - B35:2 Ground wire X3:8 - B35:2 Ground wire X3:12 - B35:2 Ground wire T1162159

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1050 FTB 17	Higher voltage than normal on pin X3:1.	Slow gear changes.	- Range Position Sensor (SEPoR). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

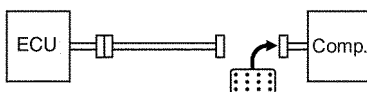
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B35

Purpose:	Action:	Evaluation:
Check connector B35.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, range cylinder).	OFF	2 — 1	B35.Pin 2 — B35. Pin 1	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

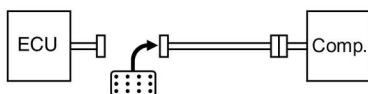
Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.	
For more information, see Impact:	
Reference to service information Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
 CAUTION Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

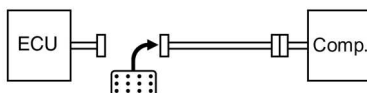


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	2 — 1	A13.X3 Pin 2 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	3 — 1	A13.X3 Pin 3 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	4 — 1	A13.X3 Pin 4 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	5 — 1	A13.X3 Pin 5 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	9 — 1	A13.X3 Pin 9 — A13.X3 Pin 1	$R = 128 \Omega \text{ — } 148 \Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	10 — 1	A13.X3 Pin 10 — A13.X3 Pin 1	$R = 128 \Omega \text{ — } 148 \Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	11 — 1	A13.X3 Pin 11 — A13.X3 Pin 1	$R = 128 \Omega \text{ — } 148 \Omega$		9990008 (Grey test pins)

If the test (B35.Pin 2 — B35.Pin 1), Fails:

Continue the next step

Resistance measurement

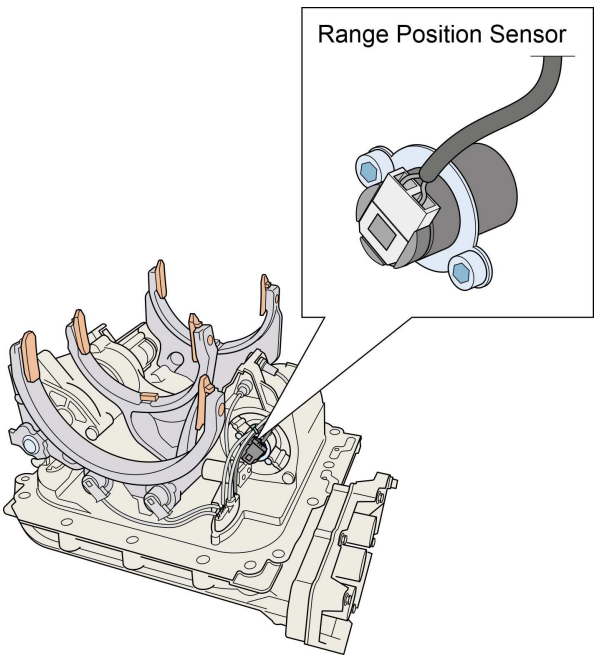
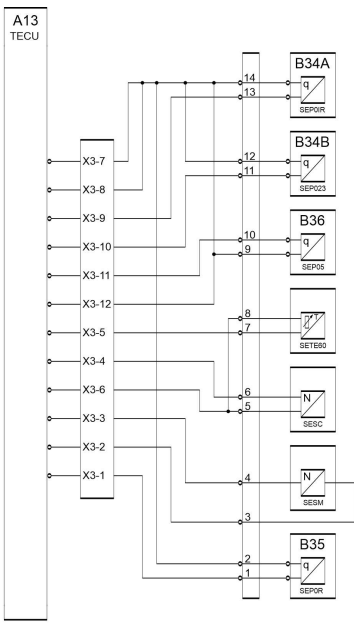


Note: Disconnect B35 connector						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	2 — 1	A13.X3 Pin 2 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	3 — 1	A13.X3 Pin 3 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	4 — 1	A13.X3 Pin 4 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	5 — 1	A13.X3 Pin 5 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	9 — 1	A13.X3 Pin 9 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	10 — 1	A13.X3 Pin 10 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	11 — 1	A13.X3 Pin 11 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1050 - 18, Range Position Sensor (SEPoR)

Component Location:	Schematics:
 T1162158	 X3:1 - B35:1 Signal wire X3:7 - B35:2 Ground wire X3:8 - B35:2 Ground wire X3:12 - B35:2 Ground wire T1162159

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1050 FTB 18	Open circuit: Pin X3:1.	Slow gear changes.	- Range Position Sensor (SEPoR). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

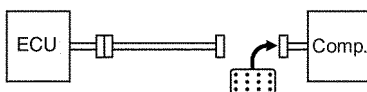
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B35

Purpose:	Action:	Evaluation:
Check connector B35.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, range cylinder).	OFF	2 — 1	B35.Pin 2 — B35. Pin 1	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

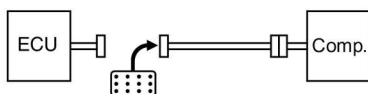
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

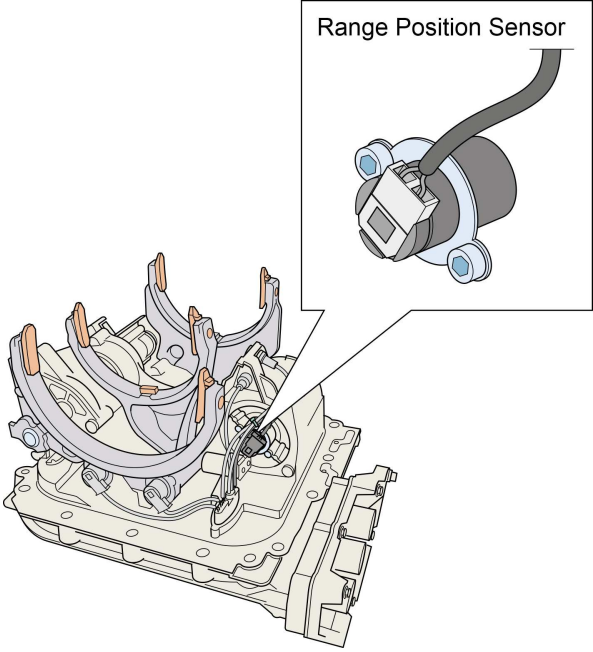
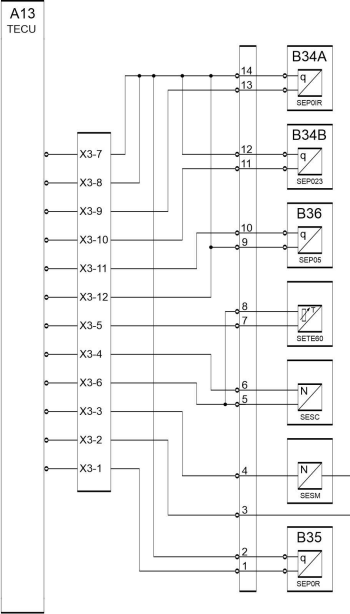


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for open-circuit (Wiring harness).	OFF	12 — 1	A13.X3 Pin 12 — A13.X3 Pin 1	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1050 - 19, Range Position Sensor (SEPoR)

Component Location:	Schematics:
 T1162158	 X3:1 - B35:1 Signal wire X3:7 - B35:2 Ground wire X3:8 - B35:2 Ground wire X3:12 - B35:2 Ground wire T1162159

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1050 FTB 19	Short circuit to ground: Pin X3:1.	Slow gear changes.	- Range Position Sensor (SEPoR). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

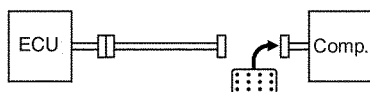
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B35

Purpose:	Action:	Evaluation:
Check connector B35.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, range cylinder).	OFF	2 — 1	B35.Pin 2 — B35. Pin 1	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

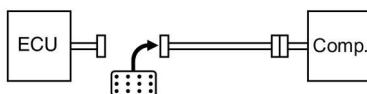
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

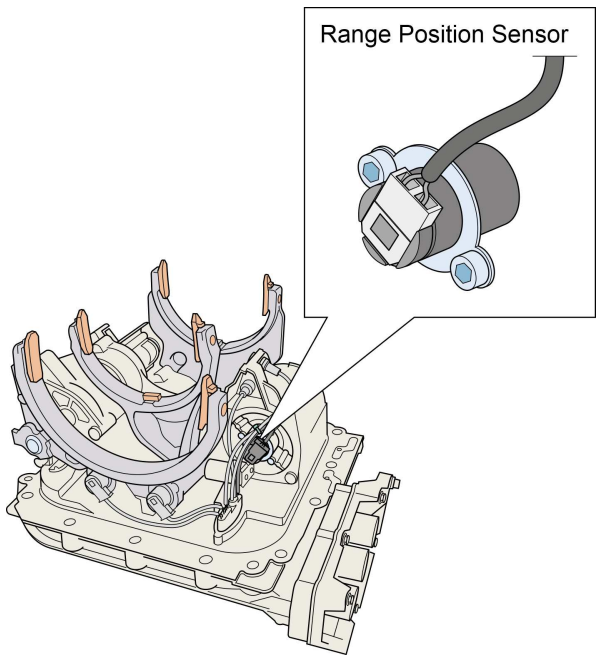
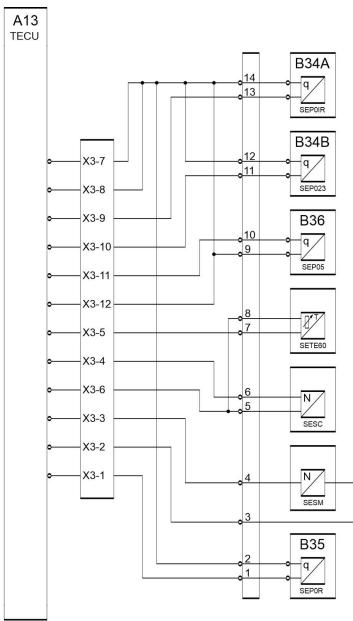


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	2 — 1	A13.X3 Pin 2 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	3 — 1	A13.X3 Pin 3 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	4 — 1	A13.X3 Pin 4 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	5 — 1	A13.X3 Pin 5 — A13.X3 Pin 1	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	9 — 1	A13.X3 Pin 9 — A13.X3 Pin 1	$R = 128 \text{ }\Omega \text{ — } 148 \text{ }\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	10 — 1	A13.X3 Pin 10 — A13.X3 Pin 1	$R = 128 \text{ }\Omega \text{ — } 148 \text{ }\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	11 — 1	A13.X3 Pin 11 — A13.X3 Pin 1	$R = 128 \text{ }\Omega \text{ — } 148 \text{ }\Omega$		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1050 - 54, Range Position Sensor (SEPoR)

Component Location:	Schematics:
 T1162158	 T1162159

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1050 FTB 54	Uncalibrated sensor.	Engine does not start.	- Range Position Sensor (SEPoR). - Transmission Control Module (TCM).

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

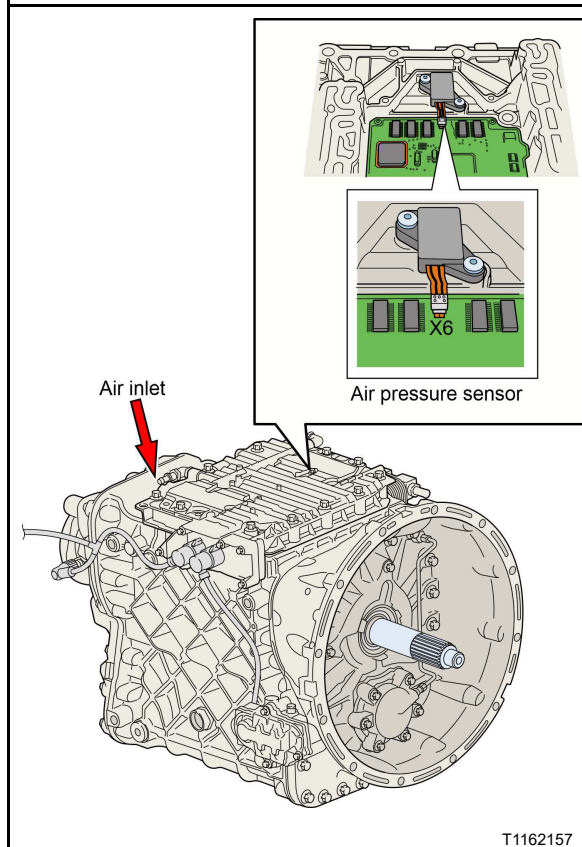
Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1054 - 22, Tank Air Pressure Sensor (SEPrSA)

Component Location:



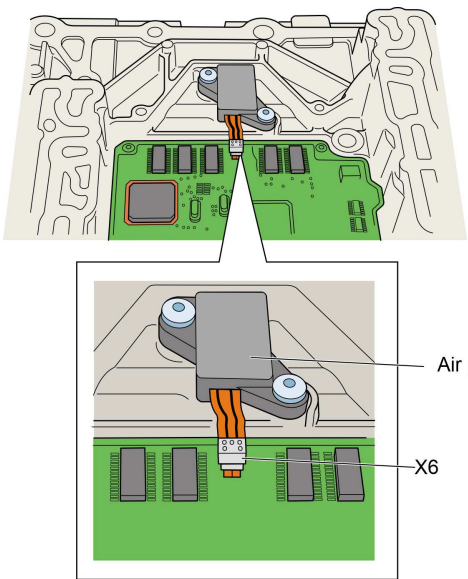
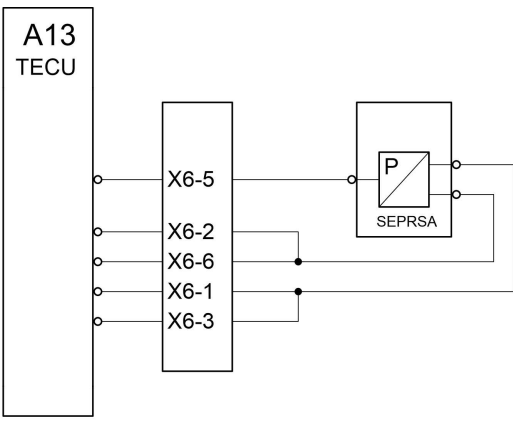
Fault type	Condition for Fault	Observable Symptoms	Possible cause	Detailed information
P105-4 FTB 22	The air pressure is above 1 mPa (145 psi).	Erratic clutch performance.	- Pressure sensor.. - Pressure regulator.	DTC also set for retarder control unit (RECU).

Connect TECHTOOL to the vehicle and run the **4320-08-03-34 Pressure sensor** Test operation.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1054 - 17, Tank Air Pressure Sensor (SEPrSA)

Component Location:	Schematics:
 Air pressure sensor X6 T1162155	 A13 TECU X6:1 - SEPrSA(Sensor ground) X6:2 - SEPrSA(Signal) X6:3 - SEPrSA(Sensor ground) X6:5 - SEPrSA(5V) X6:6 - SEPrSA(Signal) T1162156

Fault type	Condition for Fault	Diagnostic operating conditions	Possible cause
P1054 FTB 17	Short circuit to higher voltage.	Ignition key in ON position.	- Connector. - Wiring harness. - Air pressure sensor. - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Connector check: X6

Purpose:	Action:	Evaluation:
Check connector X6.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Note: After completed procedure, reconnect all connectors.

Evaluation

- Connector faulty, repair Connector or replace Upper cover.
- Connector fault free, replace Air pressure sensor.

Repair instructions

For more information, see Impact:

Reference to service information

Repair instructions: Cable Repair

Repair instructions

For more information, see Impact:

Reference to service information

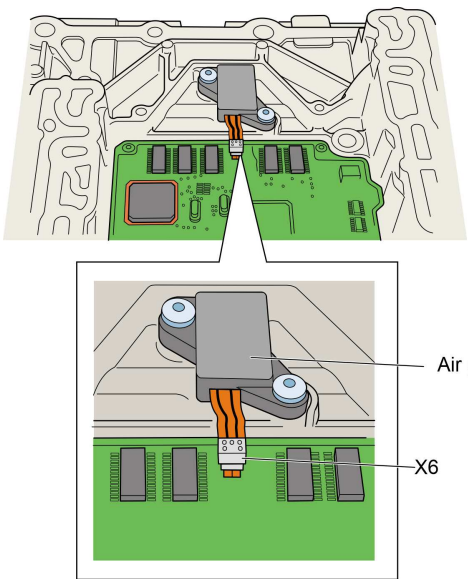
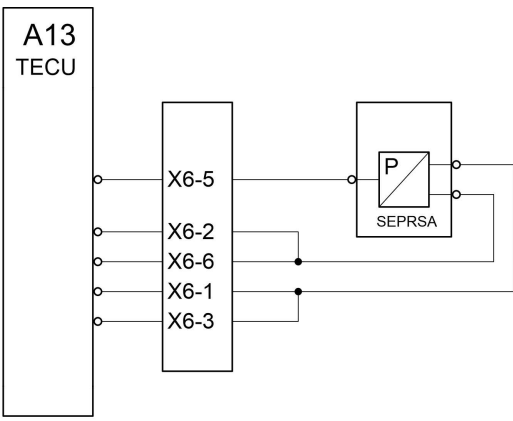
Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1054 - 18, Tank Air Pressure Sensor (SEPrSA)

Component Location:	Schematics:
 Air pressure sensor X6 T1162155	 A13 TECU X6-5 X6-2 X6-6 X6-1 X6-3 SEPrSA X6:1 - SEPrSA(Sensor ground) X6:2 - SEPrSA(Signal) X6:3 - SEPrSA(Sensor ground) X6:5 - SEPrSA(5V) X6:6 - SEPrSA(Signal) T1162156

Fault type	Condition for Fault	Diagnostic operating conditions	Possible cause
P1054 FTB 18	Low signal voltage from sensor.	Ignition key in ON position.	- Connector. - Wiring harness. - Air pressure sensor. - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Connector check: X6

Purpose:	Action:	Evaluation:
Check connector X6.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Note: After completed procedure, reconnect all connectors.

Evaluation

- Connector faulty, repair Connector or replace Upper cover.
- Connector fault free, replace Air pressure sensor.

Repair instructions

For more information, see Impact:

Reference to service information

Repair instructions: Cable Repair

Repair instructions

For more information, see Impact:

Reference to service information

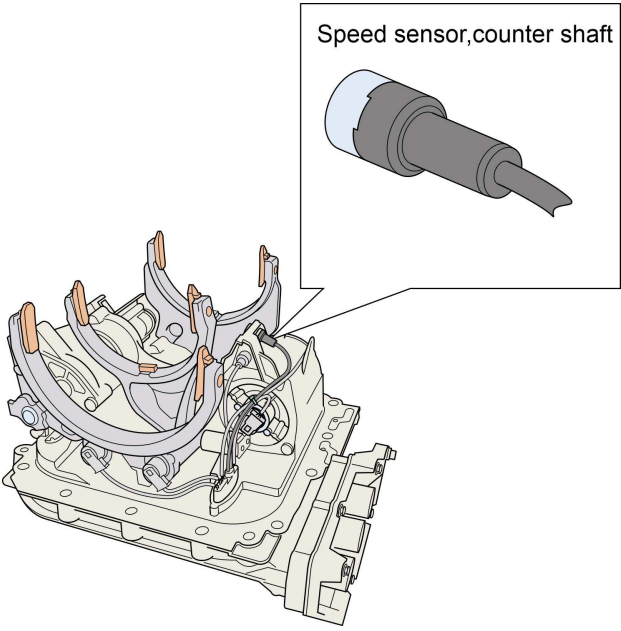
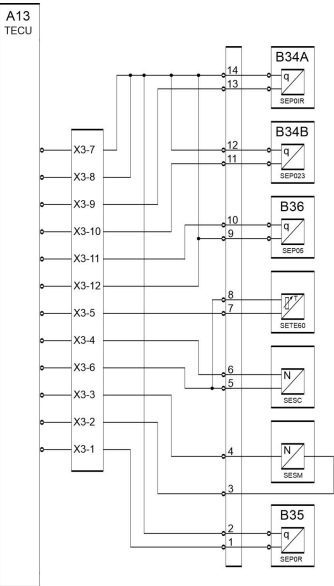
Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1058 - 16, Countershaft Speed Sensor (SESC)

Component Location:	Schematics:
 Speed sensor, counter shaft T1162153	 A13 TECU X3:4 Signal wire X3:6 Supply wire T1162154

Fault type	Condition for Fault	Observable symptoms	Possible cause
P1058 FTB 16	The voltage at pin A13. X3:4 is less than 0.2 V.	• Slow gear shifts. • Transmission brake up-shifts cannot be used. • Engagement point not functioning properly. • Starting gear can only be engaged when the vehicle is stationary or when the vehicle speed is high enough to synchronise the transmission with the engine.	• Speed sensor and wiring harness. • Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

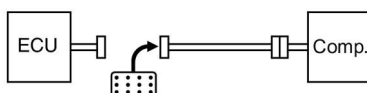
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



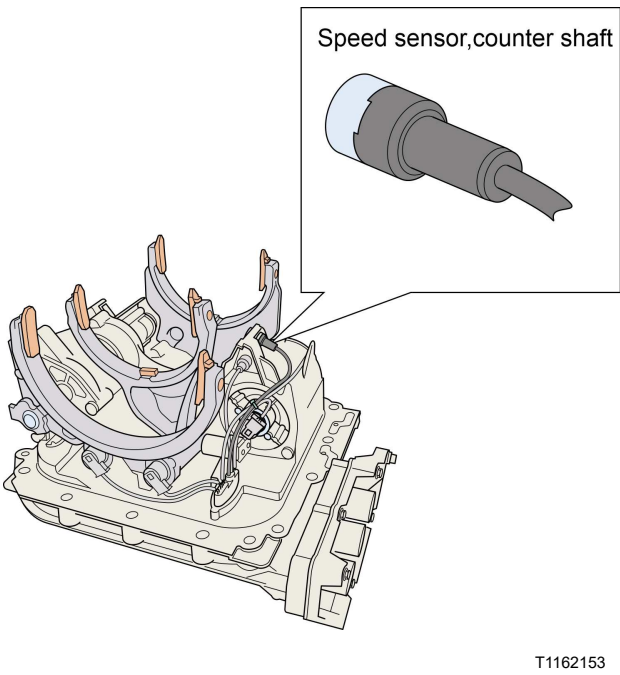
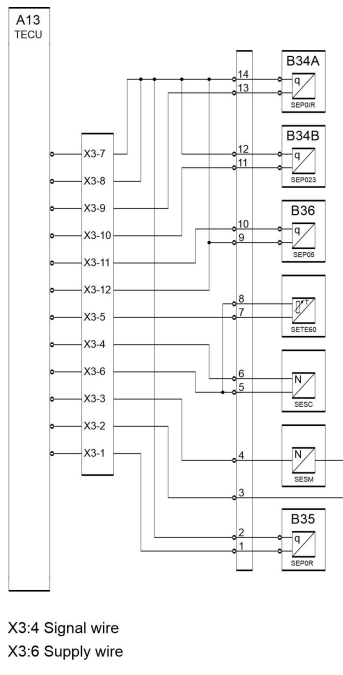
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Speed sensor, counter shaft).	OFF	5 — 4	A13.X3 Pin 5 — A13.X3 Pin 4	R = 4.65 K Ω — 10 K Ω		9990008 (Grey test pins)
Check component (Speed sensor, counter shaft).	OFF	6 — 4	A13.X3 Pin 6 — A13.X3 Pin 4	R = 1.05 K Ω — 1.3 K Ω		9990008 (Grey test pins)
Check component (Speed sensor, counter shaft).	OFF	7 — 4	A13.X3 Pin 7 — A13.X3 Pin 4	R $\geq$ 500 K Ω		9990008 (Grey test pins)

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check com- ponent (Speed sen- sor, counter shaft).	OFF	8 — 4	A13.X3 Pin 8 — A13.X3 Pin 4	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check com- ponent (Speed sen- sor, counter shaft).	OFF	12 — 4	A13.X3 Pin 12 — A13.X3 Pin 4	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1058 - 18, Countershaft Speed Sensor (SESC)

Component Location:	Schematics:
 Speed sensor, counter shaft T1162153	 A13 TECU X3:4 Signal wire X3:6 Supply wire T1162154

Fault type	Condition for Fault	Observable symptoms	Possible cause
P1058 FTB 18	The voltage at pin A13. X3:4 is more than 4.5 V.	- Slow gear shifts. - Transmission brake up-shifts cannot be used. - Engagement point not functioning properly. - Starting gear can only be engaged when the vehicle is stationary or when the vehicle speed is high enough to synchronise the transmission with the engine.	- Speed sensor and wiring harness. - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

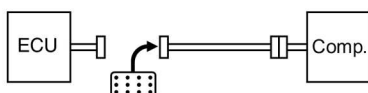
Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.	
For more information, see Impact:	
Reference to service information	
Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
 CAUTION Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

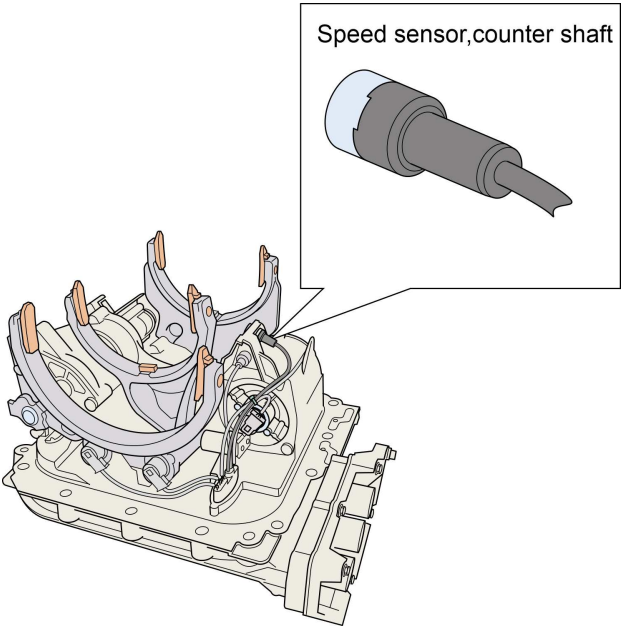
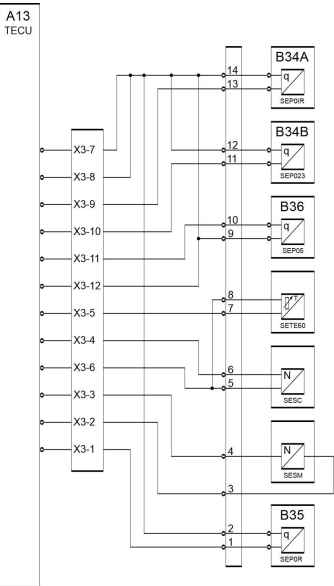
Resistance measurement

Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Speed sensor, countershaft).	OFF	6 — 4	A13.X3 Pin 6 — A13.X3 Pin 4	R = 4.65 KΩ — 10 KΩ		9990008 (Grey test pins)

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1058 - 21, Countershaft Speed Sensor (SESC)

Component Location:	Schematics:
 T1162153	 X3:4 Signal wire X3:6 Supply wire T1162154

Fault type	Condition for Fault	Observable symptoms	Possible cause
P1058 FTB 21	The countershaft speed differs from the value of the main shaft speed and vehicle speed received from the vehicle ECU.	• Slow gear shifts. • Transmission brake up-shifts cannot be used. • Engagement point not functioning properly. • Starting gear can only be engaged when the vehicle is stationary or when the vehicle speed is high enough to synchronise the transmission with the engine.	• Speed sensor and wiring harness. • Second gear wheel on main shaft.

Connect TECHTOOL to the vehicle and run the **4320-08-03-33 Transmission Speed Sensors** Test operation.

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

Test instruction

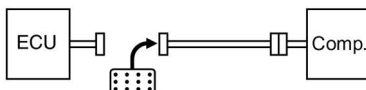
Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.	
For more information, see Impact:	
Reference to service information	
Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
 CAUTION	
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Countershaft speed sensor, check.	Speed sensor, counter shaft.	Check that the sensor is correctly installed.	Is the sensor correctly installed?
Check that the detent assembly is not damaged.	Is the detent assembly fault free?	Is the detent assembly fault free?	Is the detent assembly fault free?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

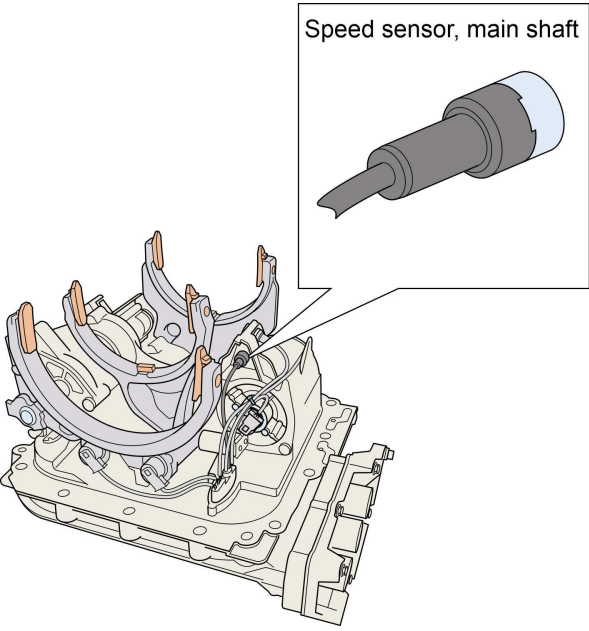
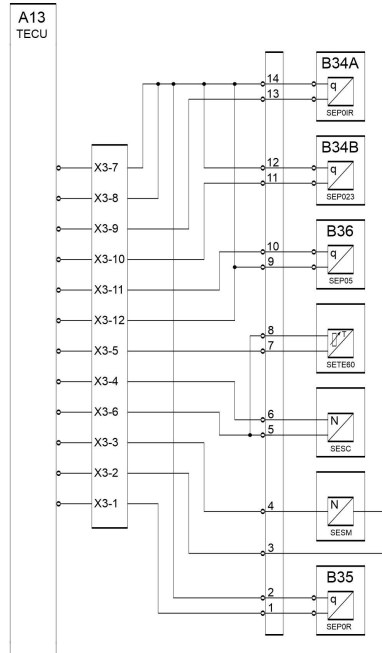
Resistance measurement

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check com- ponent (Speed sen- sor, counter shaft).	OFF	5 — 4	A13.X3 Pin 5 — A13.X3 Pin 4	R = 4.65 K Ω — 10 K Ω		9990008 (Grey test pins)
Check com- ponent (Speed sen- sor, counter shaft).	OFF	6 — 4	A13.X3 Pin 6 — A13.X3 Pin 4	R = 1.05 K Ω — 1.3 K Ω		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Start the vehicle. - Run the test drive for at least 15 minutes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1057 - 16, Main Shaft Speed Sensor (SESM)

Component Location:	Schematics:
 T1162151	 X3:2 - SESM.3 Supply wire X3:3 - SESM.4 Signal wire T1162152

Fault type	Condition for Fault	Observable symptoms	Possible cause
P1057 FTB 16	- The voltage at pin A13.X3:2 is less than 8 V. - The voltage at pin A13.X3:3 is less than 0.1 V	- Rough gear shift. - Slow gear shifts.	- Wiring harness. . - Connector. - Speed sensor, main shaft. - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

**CAUTION**

Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

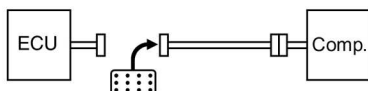
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Speed sensor, main shaft.	Inspect the sensor for physical damage or debris on the contact surface.	Is the sensor fault free?

Resistance measurement

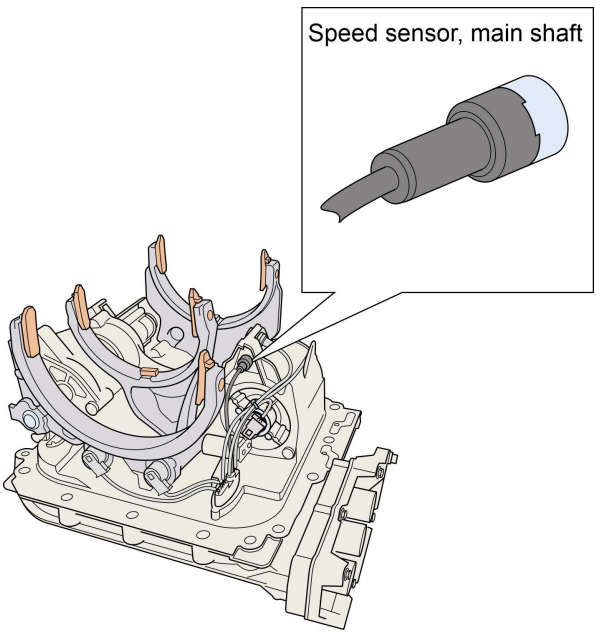
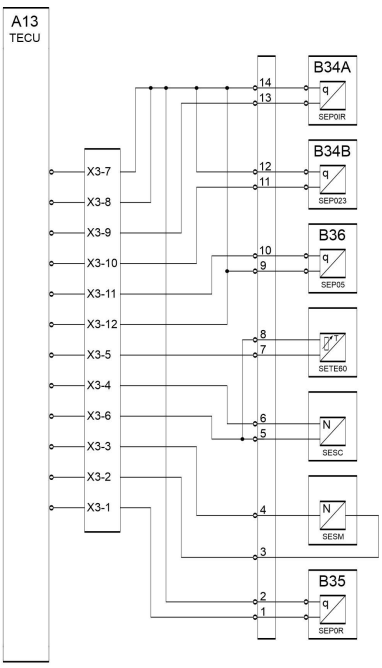
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short-circuit to ground (Speed sensor, main shaft).	OFF	6 — 2	A13.X3 Pin 6— A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short-circuit to ground (Speed sensor, main shaft).	OFF	7 — 2	A13.X3 Pin 7 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Speed sensor, counter shaft).	OFF	8 — 2	A13.X3 Pin 8 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short-circuit to ground (Speed sensor, main shaft).	OFF	12 — 2	A13.X3 Pin 12 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short-circuit to ground (Speed sensor, main shaft).	OFF	6 — 3	A13.X3 Pin 6 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short-circuit to ground (Speed sensor, main shaft).	OFF	7 — 3	A13.X3 Pin 7 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check component (Speed sensor, counter shaft).	OFF	8 — 3	A13.X3 Pin 8 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short-circuit to ground (Speed sensor, main shaft).	OFF	12 — 3	A13.X3 Pin 12 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Start the vehicle. - Run the test drive for at least 15 minutes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1057 - 17, Main Shaft Speed Sensor (SESM)

Component Location:	Schematics:
 Speed sensor, main shaft T1162151	 A13 TECU X3:2 - SESM.3 Supply wire X3:3 - SESM.4 Signal wire T1162152

Fault type	Condition for Fault	Observable symptoms	Possible cause
P1057 FTB 17	- The voltage at pin A13.X3:2 is more than 12 V. Or - The voltage at pin A13.X3:3 is more than 4.5 V.	- Rough gear shift. - Slow gear shifts.	- Wiring harness. . - Connector. - Speed sensor, main shaft. - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

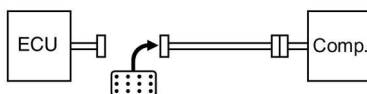
Reference to service information	
Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
 CAUTION Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Speed sensor, main shaft.	Inspect the sensor for physical damage or debris on the contact surface.	Is the sensor fault free?

Resistance measurement

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	1 — 2	A13.X3 Pin 1 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage (Speed	OFF	4 — 2	A13.X3 Pin 4 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

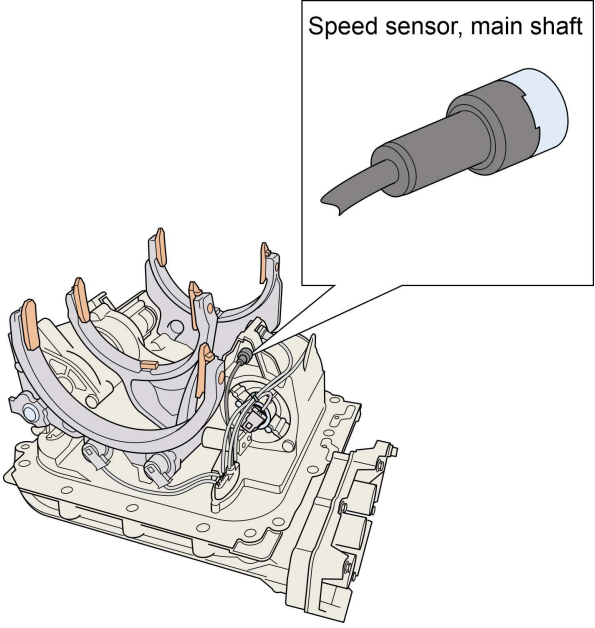
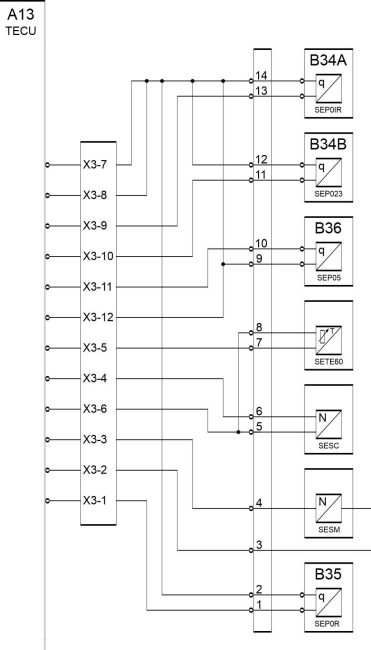
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
sensor, main shaft).						
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	5 — 2	A13.X3 Pin 5 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	9 — 2	A13.X3 Pin 9 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	10 — 2	A13.X3 Pin 10 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	11 — 2	A13.X3 Pin 11 — A13.X3 Pin 2	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	1 — 3	A13.X3 Pin 1 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	4 — 3	A13.X3 Pin 4 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	5 — 3	A13.X3 Pin 5 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage	OFF	9 — 3	A13.X3 Pin 9 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
(Speed sensor, main shaft).						
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	10 — 3	A13.X3 Pin 10 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit to higher voltage (Speed sensor, main shaft).	OFF	11 — 3	A13.X3 Pin 11 — A13.X3 Pin 3	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1057 - 18, Main Shaft Speed Sensor (SESM)

Component Location:	Schematics:
 T1162151	 A13 TECU X3:2 - SESM.3 Supply wire X3:3 - SESM.4 Signal wire T1162152

Fault type	Condition for Fault	Observable symptoms	Possible cause	Detailed information
P105-7 FTB 18	The voltage at pin A13.X3:3 is less than 0.1 V.	- Rough gear shift. - Slow gear shifts.	- Wiring harness. . - Connector. - Speed sensor, main shaft. - Transmission Control Module (TCM).	Low signal voltage from sensor.

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
 CAUTION Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

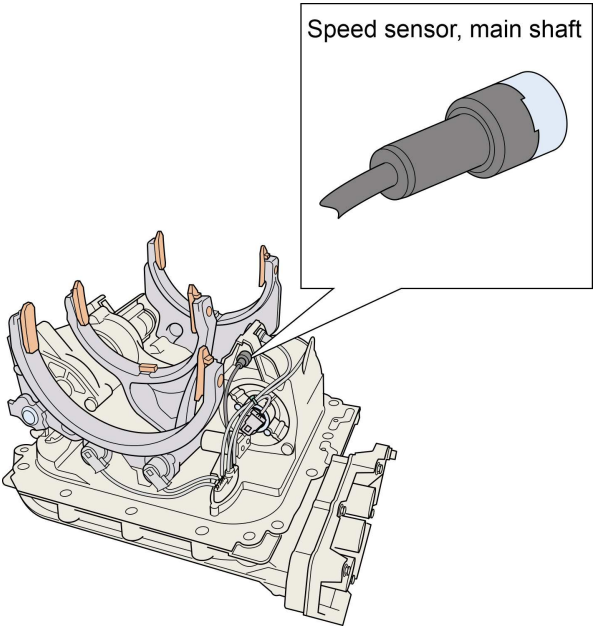
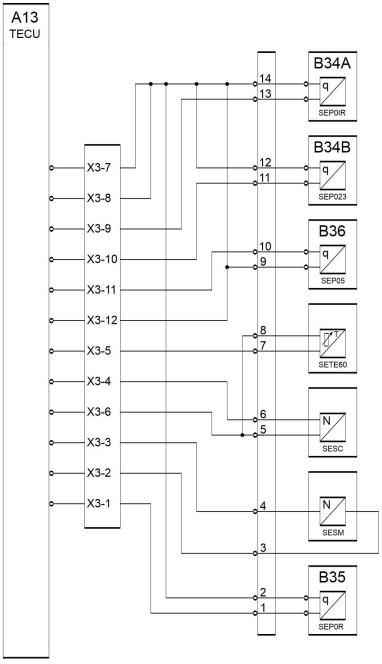
Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Speed sensor, main shaft.	Inspect the sensor for physical damage or debris on the contact surface.	Is the sensor fault free?

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1057 - 21, Main Shaft Speed Sensor (SESM)

Component Location:	Schematics:
 Speed sensor, main shaft T1162151	 A13 TECU X3:2 - SESM.3 Supply wire X3:3 - SESM.4 Signal wire T1162152

Fault type	Condition for Fault	Observable symptoms	Possible cause
P1057 FTB 21	The main shaft speed differs from the value of the countershaft speed and vehicle speed recieved from the vehicle ECU.	- Rough gear shift. - Slow gear shifts.	- Brass lugs. - Tooth wheel, main shaft. - Speed sensor, main shaft.

Connect TECHTOOL to the vehicle and run the **4320-08-03-33 Transmission Speed Sensors** Test operation.

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

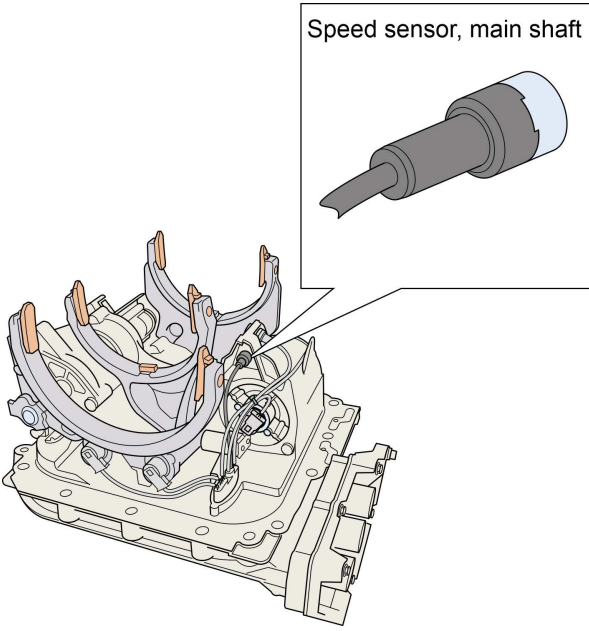
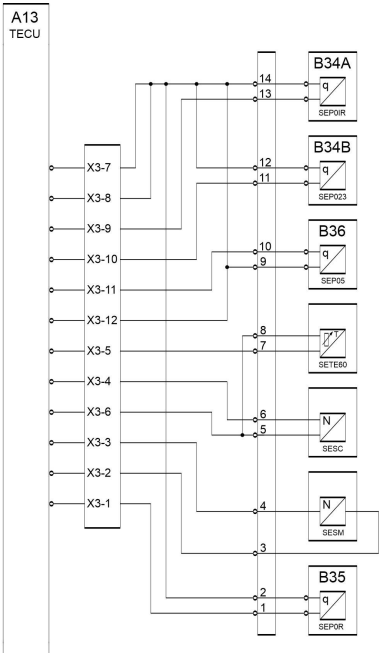
Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Brass lugs.	Check if any of the brass lugs are damaged.	Are the brass lugs fault free?
Visual inspection.	Tooth wheel.	Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position Ensure the component is installed properly.	Is the toothed wheel properly attached to the mainshaft?
Check the runout of the toothed wheel.	Tooth wheel, main shaft.	- Check the mainshaft toothed wheel. - Measure the runout with a dial indicator. - Special tool: 9999696 Magnetic stand. - Special tool: 9989876 Dial indicator.	Is the toothed wheel fault free?

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Start the vehicle.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1057 - 29, Main Shaft Speed Sensor (SESM)

Component Location:	Schematics:
 T1162151	 X3:2 - SESM.3 Supply wire X3:3 - SESM.4 Signal wire T1162152

Fault type	Condition for Fault	Observable symptoms	Possible cause
P1057 FTB 29	The speed sensor indicates wrong direction.	Slow gear shifts.	- Brass lugs. - Speed sensor, main shaft.

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	- Tooth wheel. - Speed sensor and wiring harness. - Transmission Control Module (TCM)	Check if any of the components are damaged.	Have any of the components recently been replaced?

Test instruction

Note: Fault tracing outside Guided Diagnostics

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	- Tooth wheel. - Speed sensor and wiring harness. - Transmission Control Module (TCM)	- Continue fault tracing according to referred document. - After completed fault tracing for the component, return to Guided Diagnostics.	Is the component free from faults?

For more information, see Impact:

Reference to service information

Service and maintenance, AMT-C Mixed Comp 431_001 (4319)

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

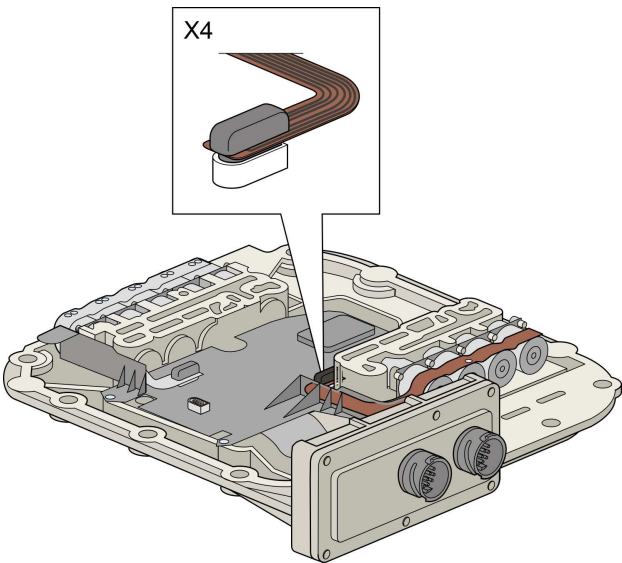
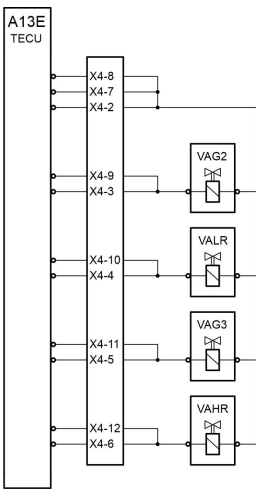
Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Brass lugs.	Check if any of the brass lugs are damaged.	Are the brass lugs fault free?
Visual inspection.	Tooth wheel.	Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position Ensure the component is installed properly.	Is the toothed wheel properly attached to the mainshaft?

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Start the vehicle. - Run the test drive for at least 15 minutes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P105A - 17 , High Range Valve (VAHR)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105A FTB 17	Short circuit to battery voltage.	- The solenoid valve is activated. - Low range gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VAHR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

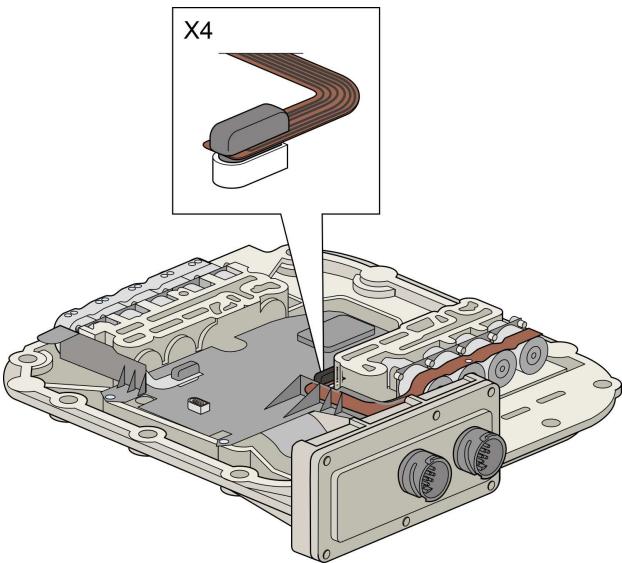
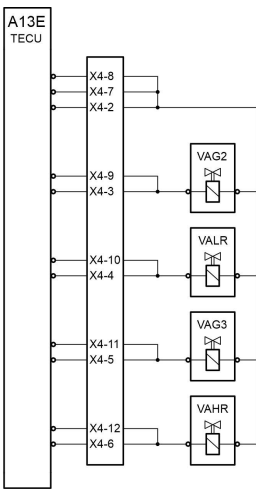
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105A - 18 , High Range Valve (VAHR)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105A FTB 18	Current below normal or open circuit.	- The solenoid valve cannot be activated. - High range gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VAHR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

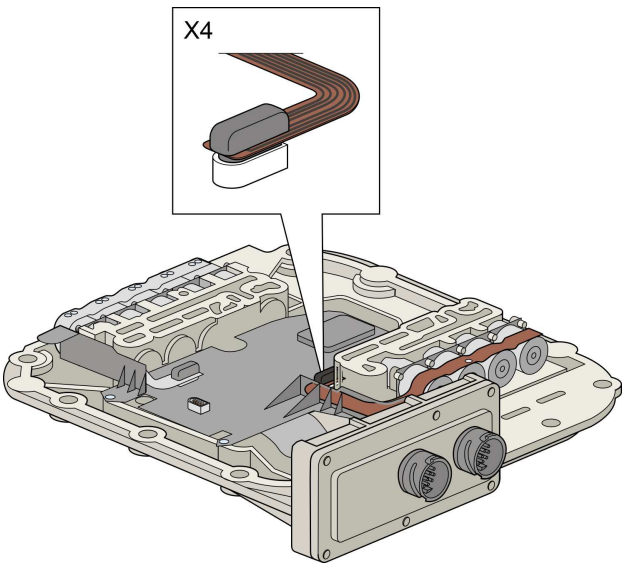
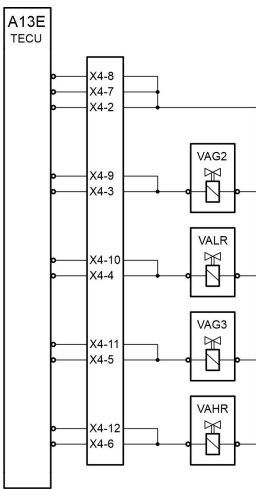
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105A - 19 , High Range Valve (VAHR)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105A FTB 19	Short circuit to ground.	- The solenoid valve cannot be activated. - Range gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VAHR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

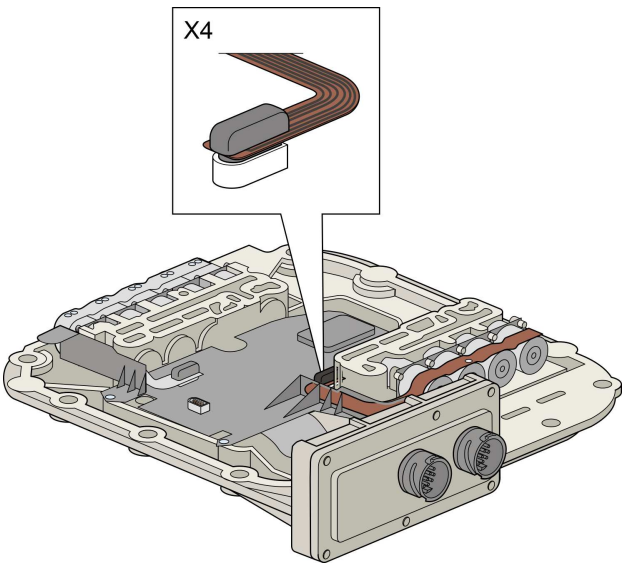
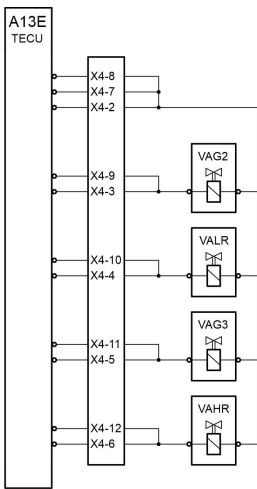
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105B - 17 , Low Range Valve (VALR)

Component Location:	Schematics:
 T3160747	 T3160748 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire)

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105B FTB 17	Short circuit to battery voltage.	- The solenoid valve is activated. - Low range gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VALR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

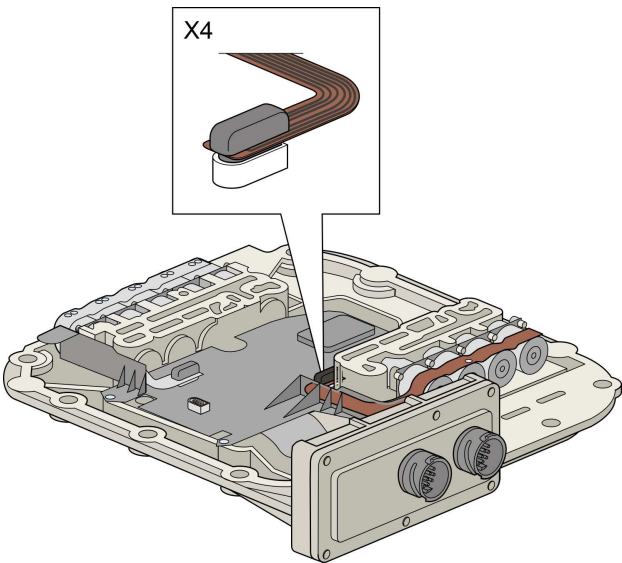
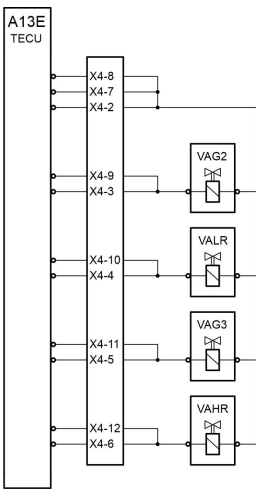
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105B - 18 , Low Range Valve (VAHR)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105B FTB 18	Current below normal or open circuit.	- The solenoid valve cannot be activated. - Low range gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VALR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

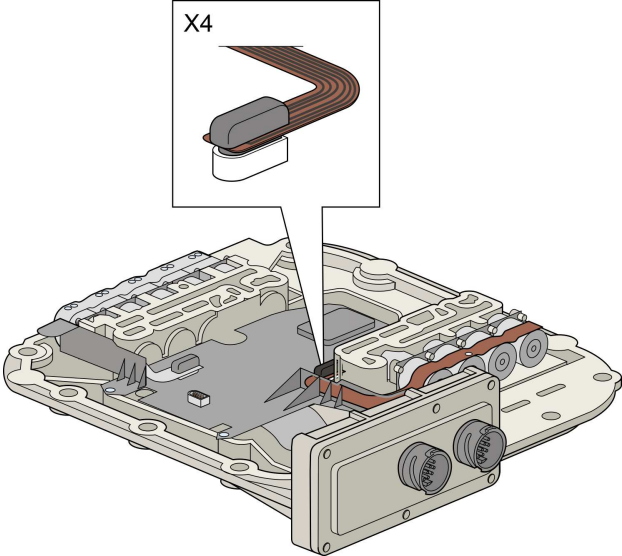
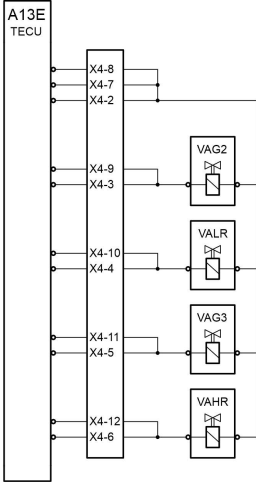
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105B - 19, Low Range Valve (VAHR)

Component Location:	Schematics:
 T3160747	 X4:8/X4:7/X4:2 - VAG2 / VALR/ VAG3/ VAHR(Ground wire) X4:9/X4:3 - VAG2(Signal wire) X4:10/X4:4 - VALR(Signal wire) X4:11/X4:5 - VAG3(Signal wire) X4:12/X4:6 - VAHR(Signal wire) T3160748

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105B FTB 19	Short circuit to ground.	- The solenoid valve cannot be activated. - Range gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VALR).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

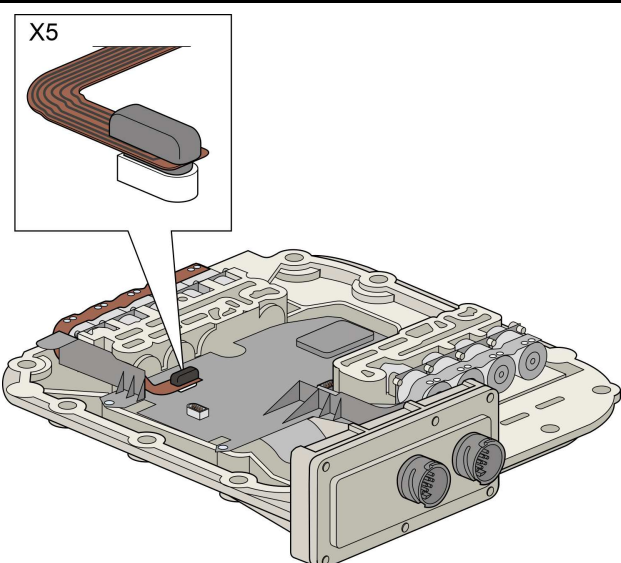
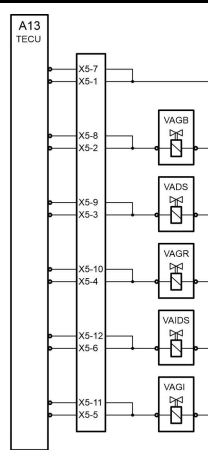
Connector check: X4

Purpose:	Action:	Evaluation:
Check connector X4 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105C - 17 , Direct Split Valve (VADS)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105C FTB 17	Short circuit to battery voltage.	- The solenoid valve is activated. - Indirect and neutral split gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VADS).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

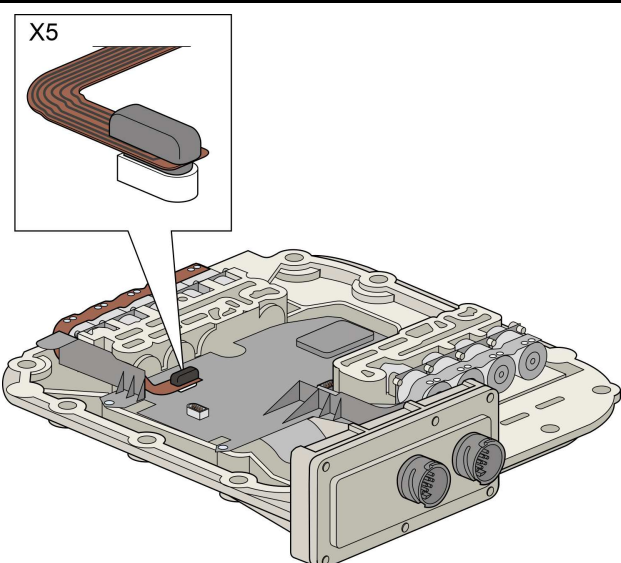
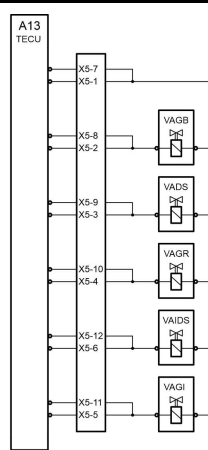
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105C - 18 , Direct Split Valve (VADS)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105C FTB 18	Current below normal or open circuit.	- The solenoid valve cannot be activated. - Direct and neutral split gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VADS).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

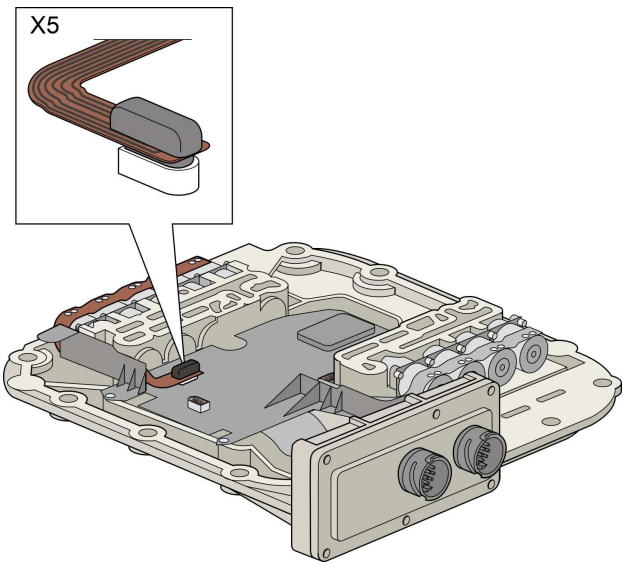
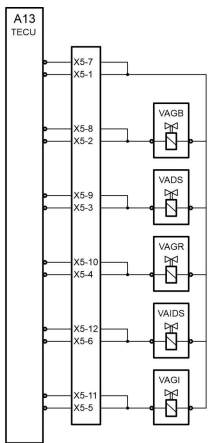
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5.	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105C - 19, Direct Split Valve (VADS)

Component Location:	Schematics:
X5  T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105C FTB 19	Short circuit to ground.	- The solenoid valve cannot be activated. - Split gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VADS).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

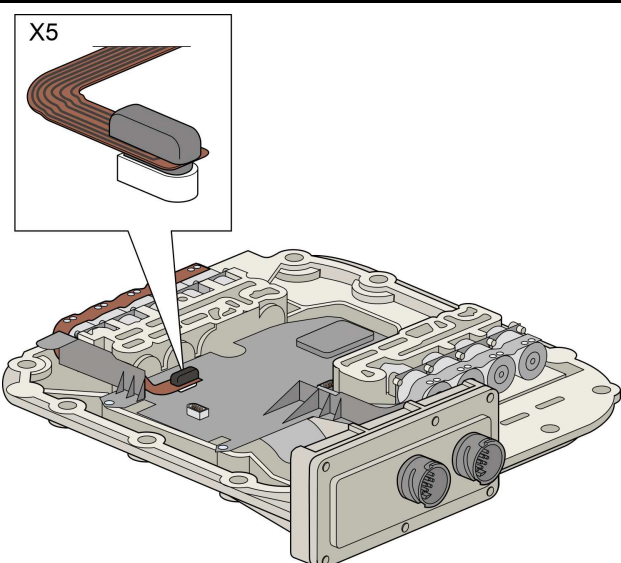
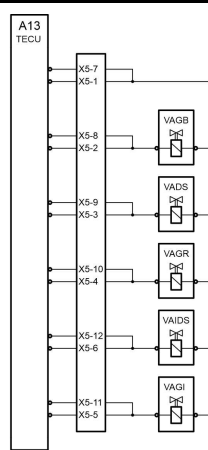
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5.	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105D - 17 , Indirect Split Valve (VAIDS)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105D FTB 17	Short circuit to battery voltage.	- The solenoid valve is activated. - Direct and neutral split gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VAIDS).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

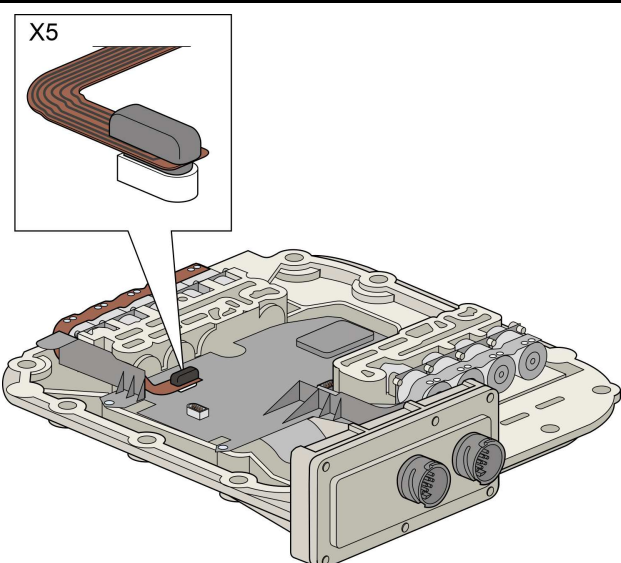
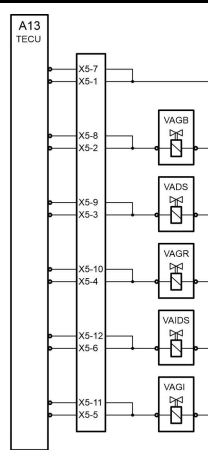
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105D - 18 , Indirect Split Valve (VAIDS)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105D FTB 18	Current below normal or open circuit.	- The solenoid valve cannot be activated. - Split gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VAIDS).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

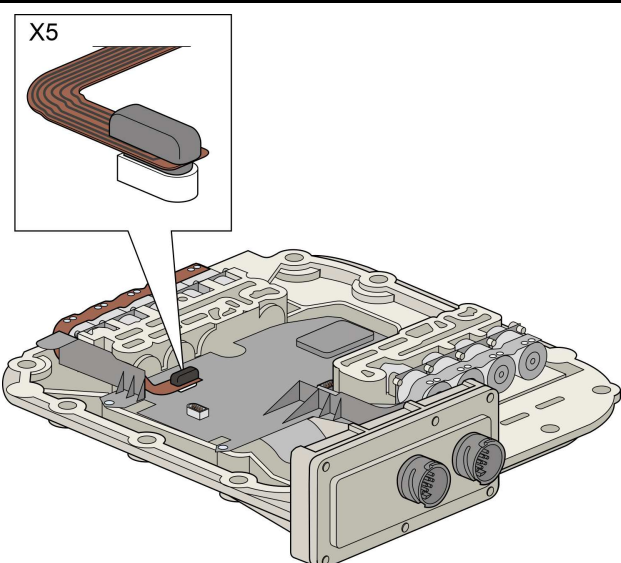
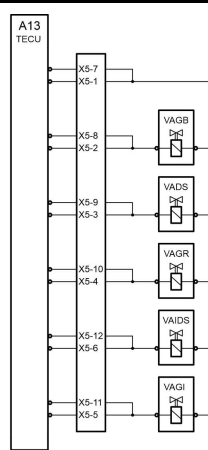
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5.	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105D - 19, Indirect Split Valve (VAIDS)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable symptoms	Possible cause
P105D FTB 19	Short circuit to ground.	- The solenoid valve cannot be activated. - Split gears are missing. - Incorrect gear selection.	Solenoid valve assembly (VAIDS).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing

For more information, see Impact:

Reference to service information

Control Housing, Remove (Impact operation: 4329-01-01-01 (43222-1))

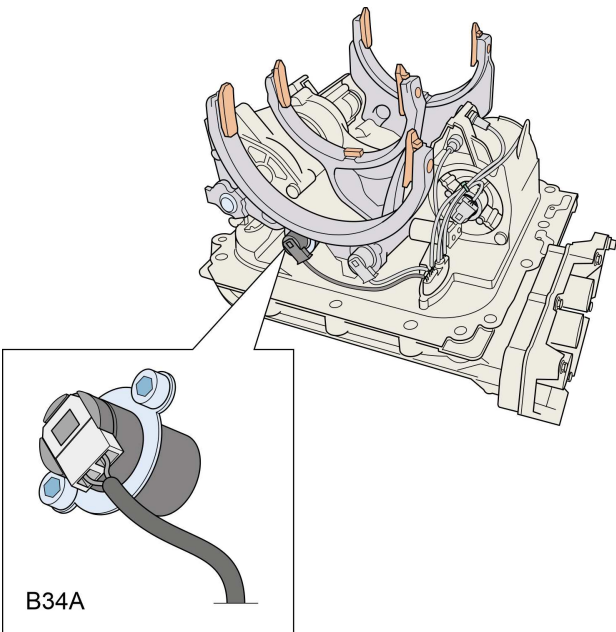
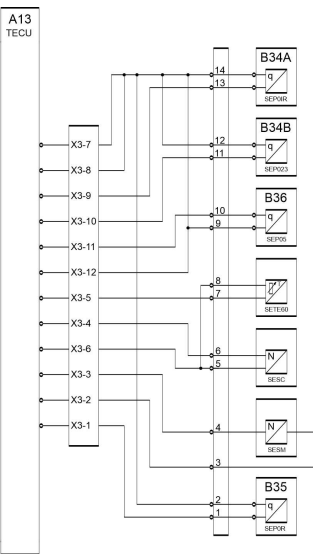
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5.	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs).	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105E - 17, Shifter 1 Position Sensor (SEPo1R)

Component Location:	Schematics:
 T1162138	 T1162139 X3:9 - B34A:13 Signal wire X3:7 - B34A:14 Ground wire X3:8 - B34A:14 Ground wire X3:12 - B34A:14 Ground wire

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P105E FTB 17	Higher voltage than normal on pin X3:9.	Slow gear changes.	- Shifter 1 Position Sensor (SEPo1R). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

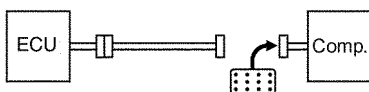
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B34A

Purpose:	Action:	Evaluation:
Check connector B34A.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, gear selector cylinder for gear 1 and reverse).	OFF	2 — 1	B34A.Pin 2 — B34A.Pin 1	R = 61 Ω — 77 Ω		88870014 (Test pins)

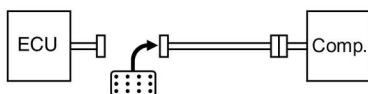
Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.	
For more information, see Impact:	
Reference to service information Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
CAUTION Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

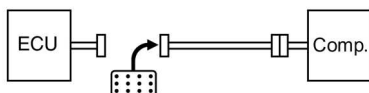


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	1 — 9	A13.X3 Pin 1 — A13.X3 Pin 9	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	2 — 9	A13.X3 Pin 2 — A13.X3 Pin 9	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	3 — 9	A13.X3 Pin 3 — A13.X3 Pin 9	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	4 — 9	A13.X3 Pin 4 — A13.X3 Pin 9	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	5 — 9	A13.X3 Pin 5 — A13.X3 Pin 9	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	10 — 9	A13.X3 Pin 10 — A13.X3 Pin 9	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	11 — 9	A13.X3 Pin 11 — A13.X3 Pin 9	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)

If the test (B36:1 – B36:2), Fails:

Continue the next step

Resistance measurement

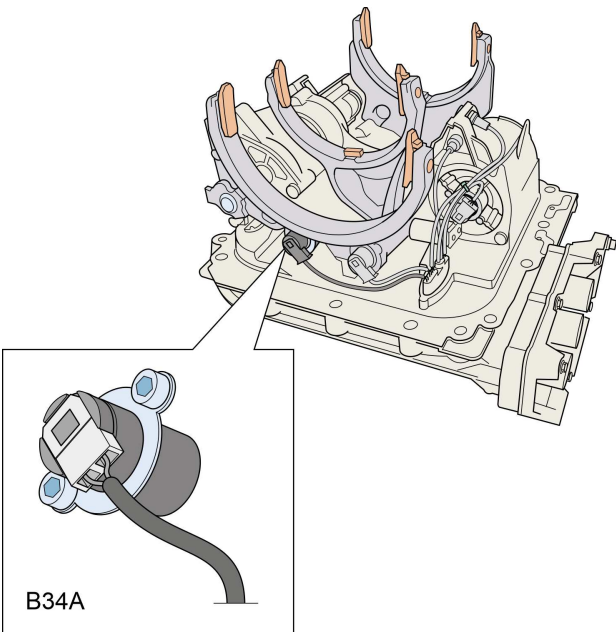
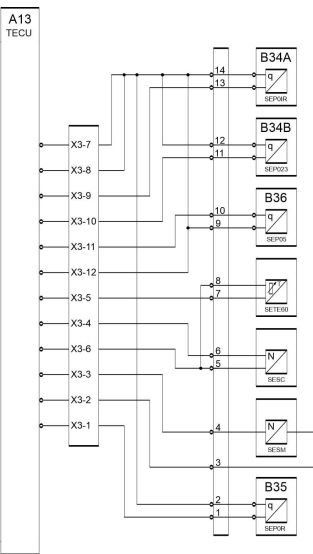


Note: Disconnect B34A connector						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	1 — 9	A13.X3 Pin 1 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	2 — 9	A13.X3 Pin 2 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	3 — 9	A13.X3 Pin 3 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	4 — 9	A13.X3 Pin 4 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	5 — 9	A13.X3 Pin 5 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	10 — 9	A13.X3 Pin 10 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	11 — 9	A13.X3 Pin 11 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P105E - 18, Shifter 1 Position Sensor (SEPo1R)

Component Location:	Schematics:
 T1162138	 T1162139 X3:9 - B34A:13 Signal wire X3:7 - B34A:14 Ground wire X3:8 - B34A:14 Ground wire X3:12 - B34A:14 Ground wire

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P105E FTB 18	Open circuit: Pin X3:9.	Slow gear changes.	- Shifter 1 Position Sensor (SEPo1R). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

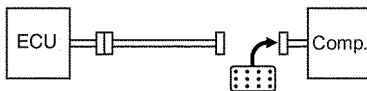
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B34A

Purpose:	Action:	Evaluation:
Check connector B34A.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Position sensor, gear selector cylinder for gear 1 and reverse).	OFF	2 — 1	B34A.Pin 2 — B34A.Pin 1	R = 61 Ω — 77 Ω		9990008 (test pins)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

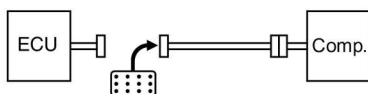
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

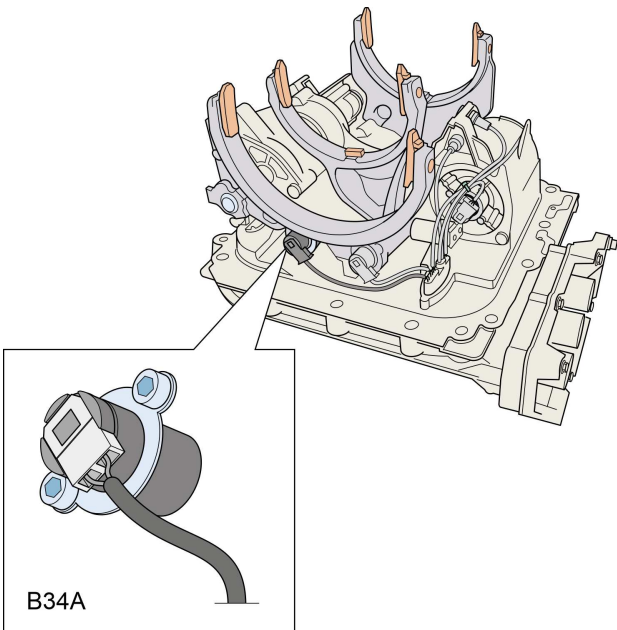
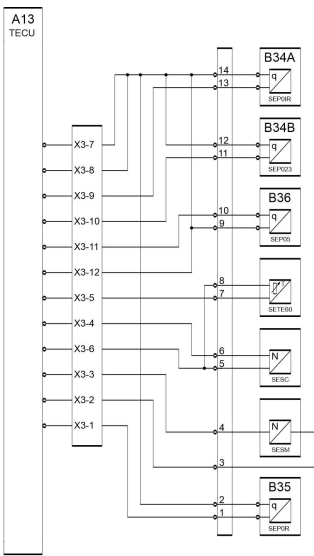


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for open-circuit (Wiring harness).	OFF	12 — 9	A13.X3 Pin 12 — A13.X3 Pin 9	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P105E - 19, Shifter 1 Position Sensor (SEPo1R)

Component Location:	Schematics:
 T1162138	 X3:9 - B34A:13 Signal wire X3:7 - B34A:14 Ground wire X3:8 - B34A:14 Ground wire X3:12 - B34A:14 Ground wire T1162139

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P105E FTB 19	Short circuit to ground: Pin X3:9.	Slow gear changes.	- Shifter 1 Position Sensor (SEPo1R). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

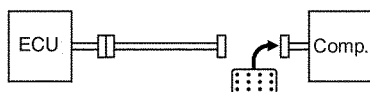
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B34A

Purpose:	Action:	Evaluation:
Check connector B34A.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, gear selector cylinder for gear 1 and reverse).	OFF	2 — 1	B34A.Pin 2 — B34A.Pin 1	R = 61 Ω — 77 Ω		9990008 (Test pins)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

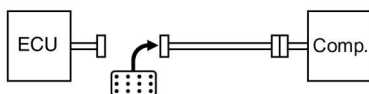
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

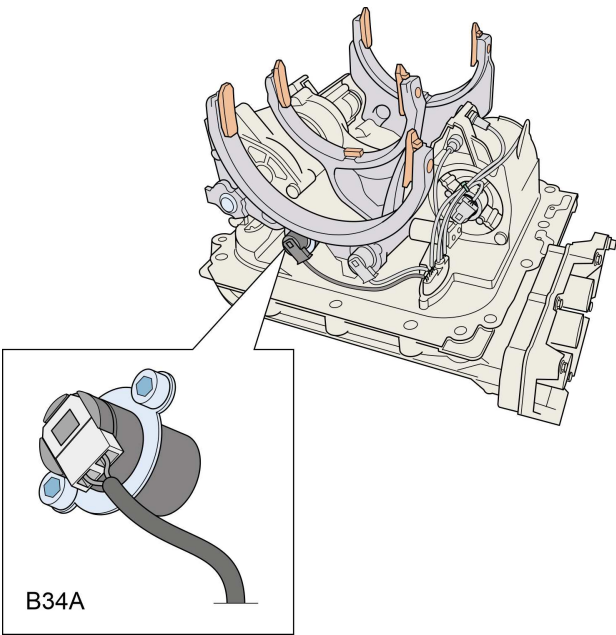
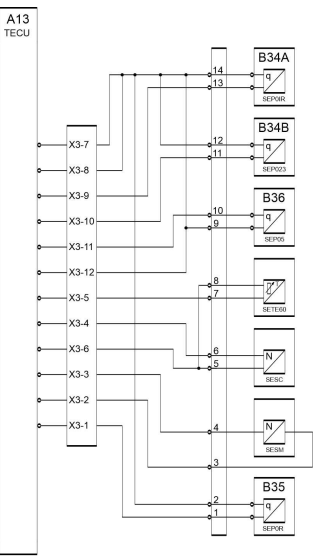


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	6 — 9	A13.X3 Pin 6 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	7 — 9	A13.X3 Pin 7 — A13.X3 Pin 9	$R = 61 \Omega - 77 \Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	8 — 9	A13.X3 Pin 8 — A13.X3 Pin 9	$R = 61 \Omega - 77 \Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	12 — 9	A13.X3 Pin 12 — A13.X3 Pin 9	$R = 61 \Omega - 77 \Omega$		9990008 (Grey test pins)

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P105E - 54, Shifter 1 Position Sensor (SEPo1R)

Component Location:	Schematics:
 T1162138	 T1162139 X3:9 - B34A:13 Signal wire X3:7 - B34A:14 Ground wire X3:8 - B34A:14 Ground wire X3:12 - B34A:14 Ground wire

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P105E FTB 54	Uncalibrated sensor.	Engine does not start.	- Shifter 1 Position Sensor (SEPo1R). - Transmission Control Module (TCM).

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission
For more information, see Impact:

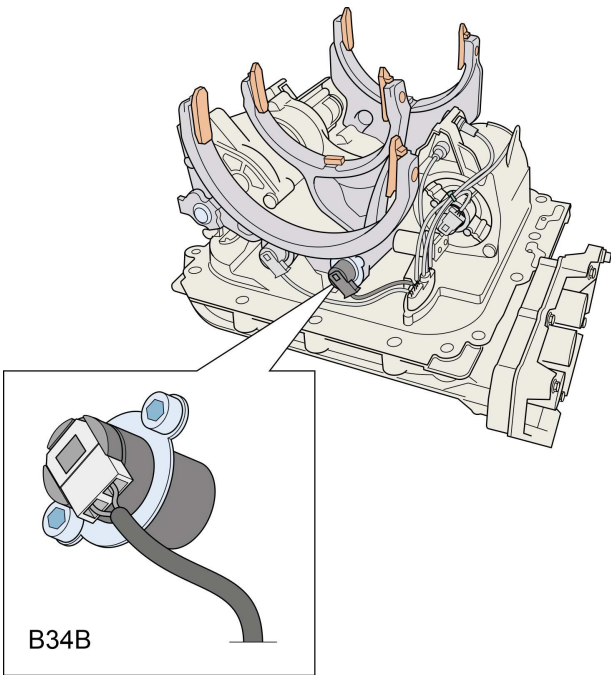
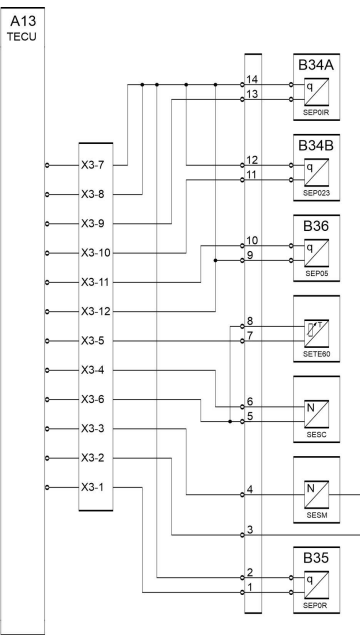
Reference to service information
Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P105F - 17, Shifter 2 Position Sensor (SEPo23)

Component Location:	Schematics:
 T1162137	 T1162136 X3:10 - B34B:11 Signal wire X3:7 - B34B:12 Ground wire X3:8 - B34B:112 Ground wire X3:12 - B34B:12 Ground wire

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P105F FTB 17	Higher voltage than normal on pin X3:10.	Slow gear changes.	- Shifter 2 Position Sensor (SEPo23). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

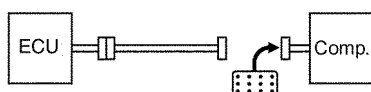
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B34B

Purpose:	Action:	Evaluation:
Check connector B34B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, gear selector cylinder for gear 2 and 3).	OFF	2 — 1	B34B.Pin 2 — B34B.Pin 1	R = 61 Ω — 77 Ω		9990008 (Test pins)

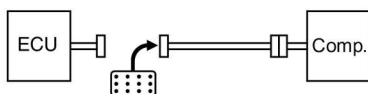
Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.	
For more information, see Impact:	
Reference to service information Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
 CAUTION Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

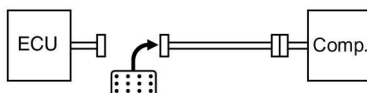


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	1 — 10	A13.X3 Pin 1 — A13.X3 Pin 10	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	2 — 10	A13.X3 Pin 2 — A13.X3 Pin 10	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	3 — 10	A13.X3 Pin 3 — A13.X3 Pin 10	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	4 — 10	A13.X3 Pin 4 — A13.X3 Pin 10	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	5 — 10	A13.X3 Pin 5 — A13.X3 Pin 9	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	10 — 9	A13.X3 Pin 10 — A13.X3 Pin 9	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	11 — 10	A13.X3 Pin 11 — A13.X3 Pin 9	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)

If the test (B34B.Pin 2 — B34B.Pin 1), Fails:

Continue the next step

Resistance measurement

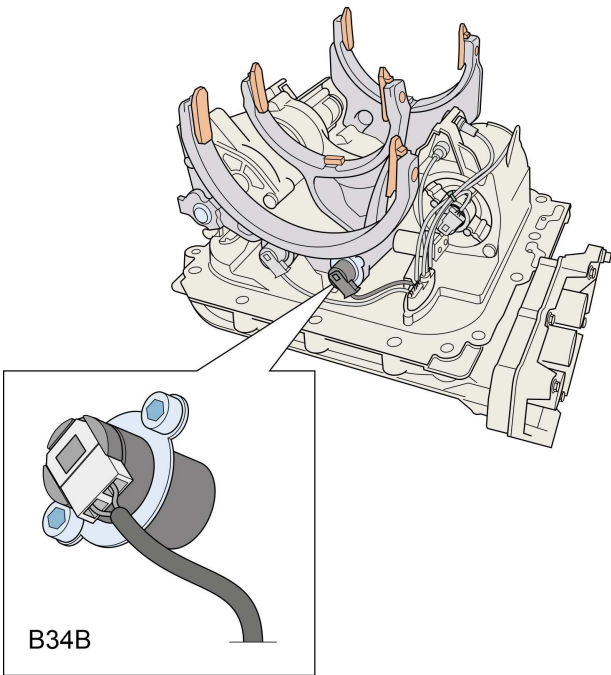
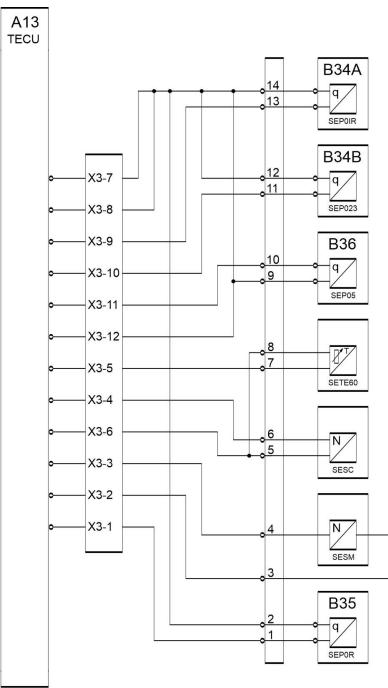


Note: Disconnect B34B connector						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	1 — 10	A13.X3 Pin 1 — A13.X3 Pin 10	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	2 — 10	A13.X3 Pin 2 — A13.X3 Pin 10	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	3 — 10	A13.X3 Pin 3 — A13.X3 Pin 10	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	4 — 10	A13.X3 Pin 4 — A13.X3 Pin 10	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	5 — 10	A13.X3 Pin 5 — A13.X3 Pin 10	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	10 — 9	A13.X3 Pin 10 — A13.X3 Pin 9	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	11 — 10	A13.X3 Pin 11 — A13.X3 Pin 10	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P105F - 18, Shifter 2 Position Sensor (SEPo23)

Component Location:	Schematics:
 T1162137	 T1162136 X3:10 - B34B:11 Signal wire X3:7 - B34B:12 Ground wire X3:8 - B34B:112 Ground wire X3:12 - B34B:12 Ground wire

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P105F FTB 18	Open circuit: Pin X3:10.	Slow gear changes.	- Shifter 2 Position Sensor (SEPo23). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

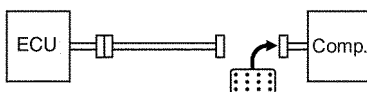
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B34B

Purpose:	Action:	Evaluation:
Check connector B34B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Position sensor, gear selector cylinder for gear 2 and 3).	OFF	2 — 1	B34B.Pin 2 — B34B.Pin 1	R = 61 Ω — 77 Ω		9990008 (Test pins)

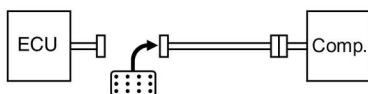
Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.	
For more information, see Impact:	
Reference to service information Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
CAUTION Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

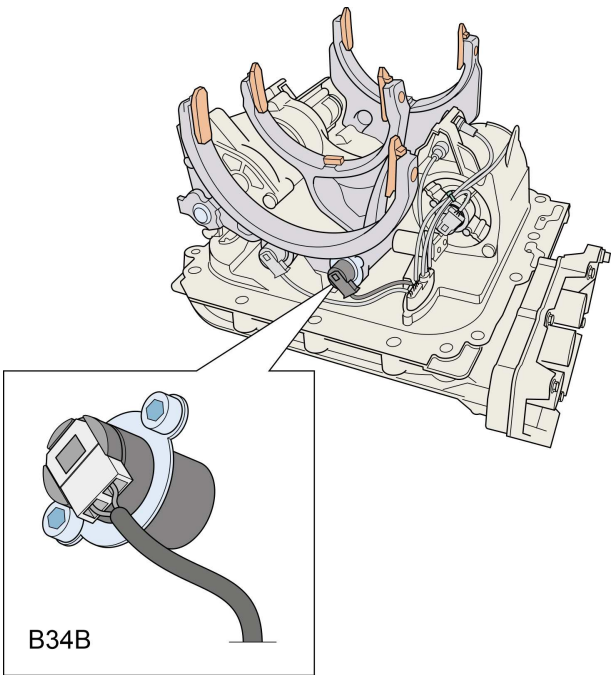
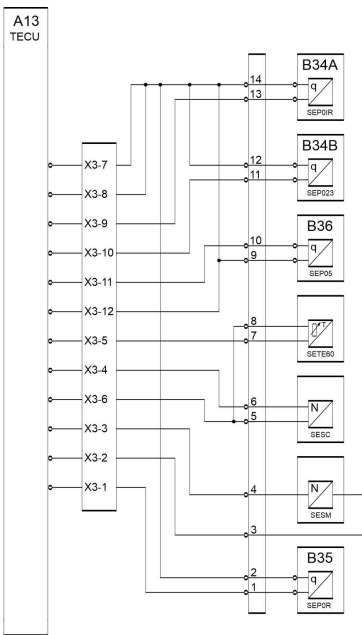


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for open-circuit (Wiring harness).	OFF	12 — 10	A13.X3 Pin 12 — A13.X3 Pin 10	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P105F - 19, Shifter 2 Position Sensor (SEPo23)

Component Location:	Schematics:
 T1162137	 T1162136 X3:10 - B34B:11 Signal wire X3:7 - B34B:12 Ground wire X3:8 - B34B:112 Ground wire X3:12 - B34B:12 Ground wire

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P105E FTB 19	Short circuit to ground: Pin X3:10.	Slow gear changes.	- Shifter 2 Position Sensor (SEPo23). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

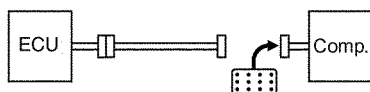
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B34B

Purpose:	Action:	Evaluation:
Check connector B34B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, gear selector cylinder for gear 2 and 3).	OFF	2 — 1	B34B.Pin 2 — B34B.Pin 1	R = 61 Ω — 77 Ω		9990008 (Test pins)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

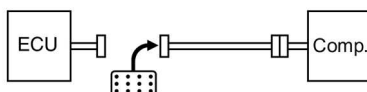
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

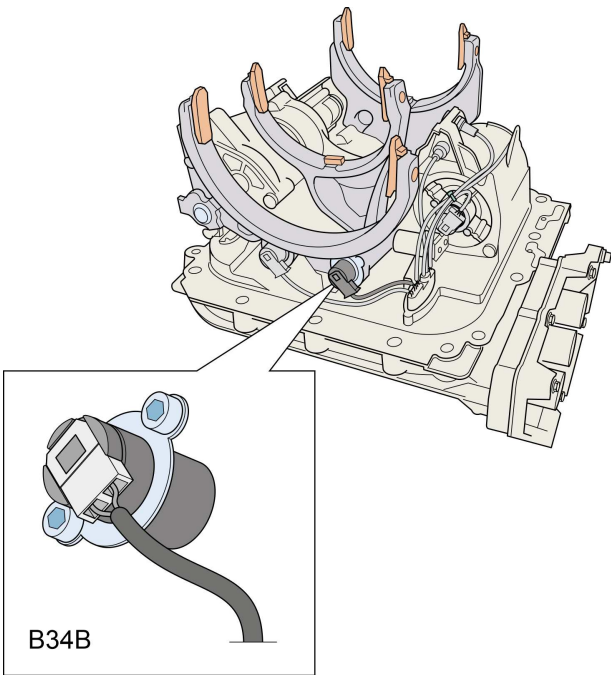
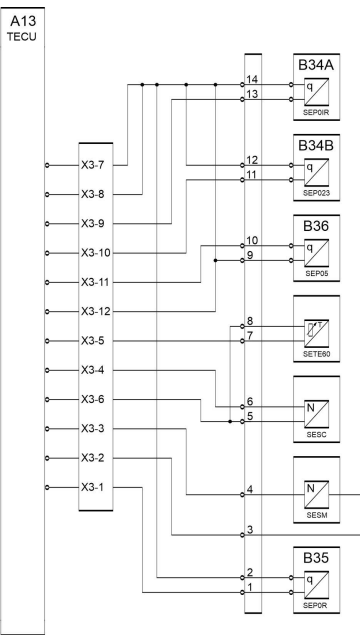


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit (Wiring harness).	OFF	7 — 10	A13.X3 Pin 7 — A13.X3 Pin 10	R = 61 Ω — 77 Ω		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	6 — 10	A13.X3 Pin 6 — A13.X3 Pin 10	R ≥ 500 KΩ		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	8 — 10	A13.X3 Pin 8 — A13.X3 Pin 10	R = 61 Ω — 77 Ω		9990008 (Grey test pins)
Check for short circuit (Wiring harness).	OFF	12 — 10	A13.X3 Pin 12 — A13.X3 Pin 10	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P105F - 54, Shifter 2 Position Sensor (SEPo23)

Component Location:	Schematics:
 T1162137	 X3:10 - B34B:11 Signal wire X3:7 - B34B:12 Ground wire X3:8 - B34B:112 Ground wire X3:12 - B34B:12 Ground wire T1162136

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P105F FTB 54	Uncalibrated sensor.	Engine does not start.	- Shifter 2 Position Sensor (SEPo23). - Transmission Control Module (TCM).

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission
For more information, see Impact:

Reference to service information
Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

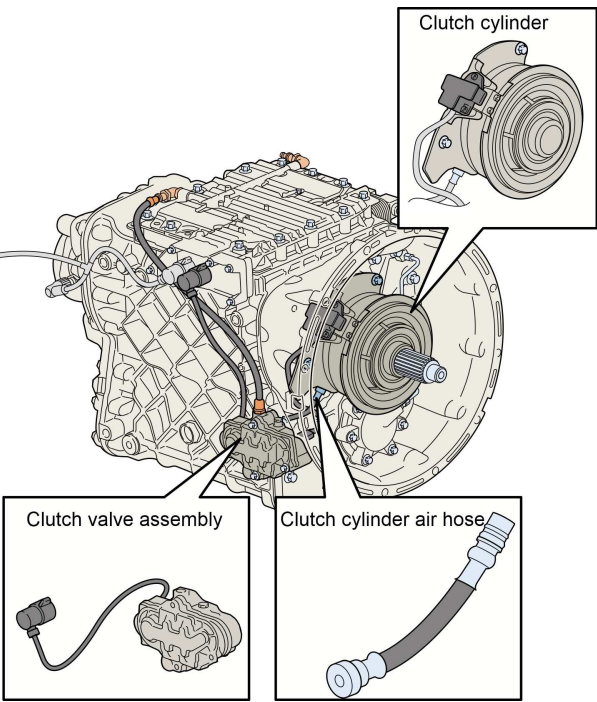
Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1075 - 38, Clutch System

Component Location:



The diagram illustrates the component location for the clutch system. It shows a side view of the transmission assembly. A callout box labeled 'Clutch cylinder' points to the cylinder on the transmission. Another callout box labeled 'Clutch valve assembly' points to the valve assembly on the side of the transmission. A third callout box labeled 'Clutch cylinder air hose' points to the hose connecting the valve assembly to the cylinder. The diagram is labeled T1162134.

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1075 FTB 38	Uncalibrated sensor. - Set point for clutch position can not be reached using normal actuator control. - The limit for the use of control valves is exceeded. - Clutch position is outside tolerance at dis-engaged position.	- Gear shifting inoperative. - Shifting scrape. - Stuck in gear. - Creeps forward with brakes applied. - Air leakage. - Harsh start. - Harsh shifting. - Slow shifting.	- Worn, damaged or dirty component. - Ambient temperature below -20°C (-4°F). Leakage from the following component(s): - Clutch cylinder air hose. - Clutch cylinder air connection. - Clutch cylinder. - Clutch valve assembly.

Note: After the fault is corrected, the DTC will remain active until the transmission is shifted into gear with the parking brake released and with the engine running.

 **WARNING**

Before working on a vehicle, set the parking brake, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

I have read and understand the above advisory

Test instruction

Purpose:	Information:	Action:	Special tools:
• Check for worn component. • Check for air leakage.	• The next step in the fault tracing depends on the special tools available. • The preferred method is to use a vacuum pump, but if that is not available, a pry bar may be used.	Continue by selecting one of the following alternatives: • Vacuum pump method. • Pry bar method.	• 88890275 Or equivalent tool. • Pry bar.

If selected Vacuum pump method:

Continue the next step

Test instruction

Purpose:	Action:	Evaluation:
• Check for worn component. • Check for air leakage.	Note: Read the instructions carefully, then watch the instructional video <i>Instructional video:</i> "https://youtu.be/CC6bGJFeOoc" 1 Have the ignition key in ON position and wait approximately 5 minutes. The transmission control unit is monitoring the clutch position sensor and if the clutch valve assembly is removed during this time. There can be bursts of air heard and felt. After this waiting period, the system will time out. 2 Remove the clutch valve assembly and push it to the side. Do not disconnect the wiring for the clutch position sensor. 3 Execute operation 4311-08-03-02 Input Signals for Gear Selection, expand the section for clutch and gear so that the clutch position sensor value can be observed. 4 Connect a vacuum pump to the port for the clutch cylinder and apply the vacuum. 5 Position the clutch position sensor so that its value is approximately 0.7 inch (18 mm). The clutch cylinder should hold this position for at least 5 minutes. 6 Insert a pry bar through the hole where the wiring for the clutch position sensor exits. 7 Use a pry bar to gently rock the clutch cylinder back and forth to see if there is any movement. A worn clutch cylinder can move enough to cause a leak and you will see this movement in the clutch position sensor graph. Reference to service information Input signals for Gear selection operation: 4311-08-03-02(43170-01))  CAUTION :Do not pry against the wires to the clutch position sensor. Do not use excessive force on the clutch actuator. Doing this could result in damage to the wiring, housing or other components Additional information: Clutch cylinder inspection	Is the test result acceptable?

	Case Based Reasoning: "Case No: K63231010"	

If selected Pry bar method:

Continue the next step

Test instruction

Purpose:	Action:	Evaluation:
• Check for worn component. • Check for air leakage.	Note: Read the instructions carefully, then watch the instructional video <i>Instructional video:</i> "https://youtu.be/vQo29eKchuU" 1 Have the ignition key in ON position and wait approximately 5 minutes. The transmission control unit is monitoring the clutch position sensor and if the clutch valve assembly is removed during this time. There can be bursts of air heard and felt. After this waiting period, the system will time out. 2 Remove the clutch valve assembly and push it to the side. Do not disconnect the wiring for the clutch position sensor. 3 Execute operation 4311-08-03-02 Input Signals for Gear Selection, expand the section for clutch and gear so that the clutch position sensor value can be observed. 4 Insert a pry bar through the hole where the wiring for the clutch position sensor exits. 5 Carefully compress the clutch cylinder. 6 Position the clutch position sensor so that its value is approximately 0.7 inch (18 mm). Plug the port to the clutch cylinder. The clutch cylinder should hold this position for at least 5 minutes. 7 Use a pry bar to gently rock the clutch cylinder back and forth to see if there is any movement. A worn clutch cylinder can move enough to cause a leak and you will see this movement in the clutch position sensor graph. Reference to service information Input signals for Gear selection operation: 4311-08-03-02(43170-01))  CAUTION :Do not pry against the wires to the clutch position sensor. Do not use excessive force on the clutch actuator. Doing this could result in damage to the wiring, housing or other components Additional information: Clutch cylinder inspection	Is the test result acceptable?

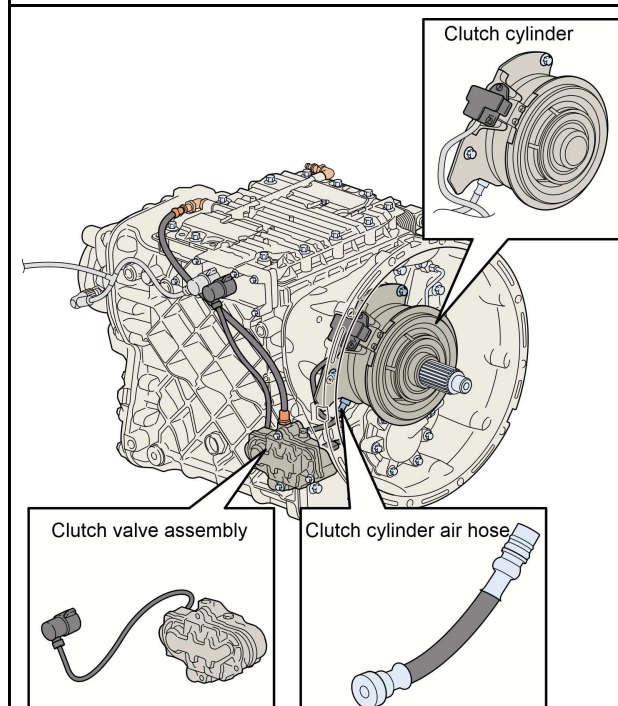
	Case Based Reasoning: "Case No: K63231010"	

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1075 - 71, Clutch System

Component Location:



T1162134

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1075 FTB 71	Clutch slippage.	- The vehicle tends to jerk. - With heavy overload smoke and smell of smoke may occur.	Clutch.

Checks:

Action:	Evaluation:
Check in the display that the vehicle has the same chassis number in all electronic control units (ECUs)	Is the chassis number the same?

If the above check result is YES:

Continue the next step

Connect TECHTOOL to the vehicle and run the **4111-08-03-02 Clutch wear check** Test operation.Connect TECHTOOL to the vehicle and run the **4320-08-03-32 PWM Valves Clutch** Test operation.

Remove the Transmission :

For more information, see Impact:

Reference to service information

Transmission, Removal (Impact operation: 4311-01-01-01 (43170-1))

Test instruction

Purpose:	Action:	Evaluation:
Check for oil leakage between engine and transmission.	Check for oil leaks at the seals of the engine and the transmission.	Leakage; Transmission input shaft. - Leakage; Transmission brake (Countershaft brake / Input shaft brake). - Leakage; Crankshaft. - No fault.

Test instruction

Description:	Action:	Evaluation:
Incorrect clutch type causes vibrations and shortened service life.	Check that the correct clutch is installed in the vehicle.	Is the correct clutch fitted to the vehicle?
None	Check if there are signs of blue annealing on the flywheel.	Is the flywheel fault free?
None	Check the pressure plate assembly.	Is the pressure plate assembly fault free?

If the chassis number check result is NO:

Continue the next step

Checks:

Action:	Evaluation:
Choose one of the following reasons for fault.	Is it the wrong software type in the transmission electronic control unit (ECU)? Is it the wrong software type in the engine control module (ECM)?

Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program Electronic Control Unit - Reload software** Transmission ECU (TECU).

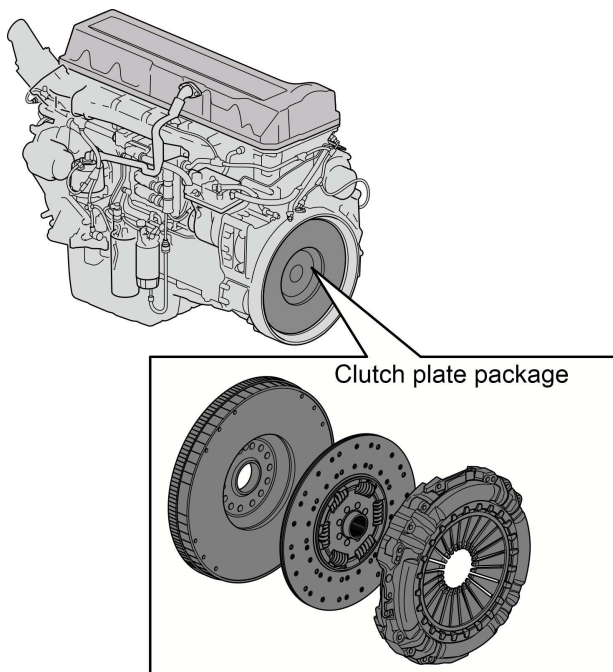
Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program Electronic Control Unit - Reload software** Engine Control Module (EMS).

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1075 - 74, Clutch System

Component Location:



T1160853

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1075 FTB 74	Disengaged clutch transfers too much torque.	The vehicle tends to creep on flat ground at idle.	- Clutch. - Warped flywheel. - Transmission input shaft. - The clutch is not calibrated.

Connect TECHTOOL to the vehicle and run the **4111-08-03-05 Clutch Drag** Test operation.

If test result of the operation 4111-08-03-05 Clutch Drag, Fail.

Continue the next step

Connect TECHTOOL to the vehicle and run the **4111-08-03-02 Clutch wear check** Test operation.

Remove the Transmission :

For more information, see Impact:

Reference to service information

Transmission, Removal (Impact operation: 4311-01-01-01 (43170-1))

Check flywheel:

Flywheel, check For more information, see Impact: Information type: Repair Reference to service information Flywheel, check (Pressure plate removed) 2166-06-03-01 (21631-3)
Evaluation:
Is the flywheel fault free?

If test result of the operation 4111-08-03-05 Clutch Drag, Pass. Continue the next step

Connect TECHTOOL to the vehicle and run the 4320-07-03-01 Transmission, clutch, engagement point Calibration operation.

Remove the Transmission : For more information, see Impact: Reference to service information Transmission, Removal (Impact operation: 4311-01-01-01 (43170-1))

Test instruction

Action:	Evaluation:
Check that the clutch plate slides on the transmission input shaft and the splines are clean.	Does the clutch plate slide unobstructed on the transmission input shaft?

Flywheel, check For more information, see Impact: Function group: 216 Information type: Repair Reference to service information Flywheel, check (Pressure plate removed) 2166-06-03-01 (21631-3)
Evaluation:
Is the flywheel fault free?

Test instruction

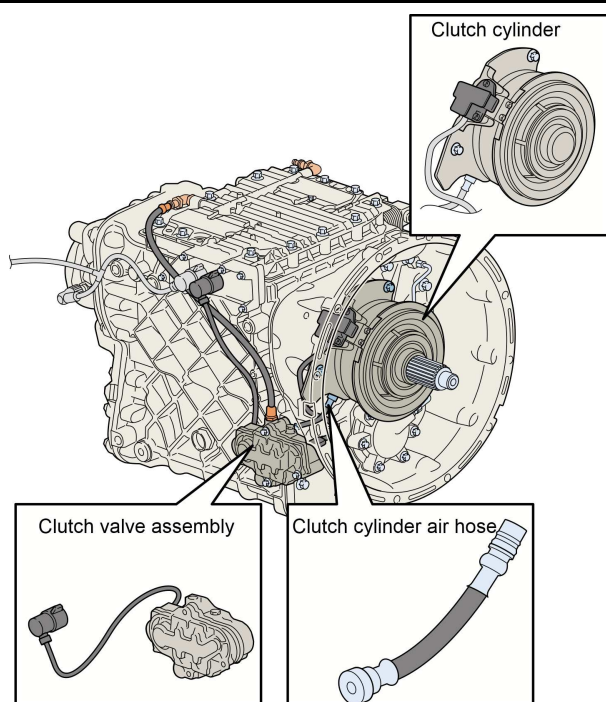
Action:	Evaluation:
Check the pressure plate assembly.	Is the pressure plate assembly fault free?

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Gear selector in neutral position. • Engine running.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1075 - 75, Clutch System

Component Location:



T1162134

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1075 FTB 75	Not possible to disengage the clutch.	- Engine Shut Down. - Not possible to shift gears. - Not possible to engage neutral gear.	Leakage from the following component(s): - Clutch cylinder. - Clutch valve assembly. - Clutch cylinder air hose. - Clutch cylinder air connection.

Connect TECHTOOL to the vehicle and run the **4111-08-03-02 Clutch wear check** Test operation.

If the above operation, Fails.

Continue the next step

Connect TECHTOOL to the vehicle and run the **4320-08-03-32 PWM Valves Clutch** Test operation.



DANGER

The Clutch Valve Unit contains air under high pressure. Do not remove the drain plug entirely because doing so may allow the plug to quickly and forcefully and become a projectile. Leave the drain plug slightly cracked to allow air pressure to be released. Failure to do so may result in serious personal injury.

I have read and understand the above advisory

Test instruction

Purpose:	Components:	Action:	Evaluation:
Drain Plug, Check.	Clutch valve assembly.	- Check that the seal is installed correctly and undamaged. - Check the drain plug seal.	Is the drain plug seal fault free?

Remove the Transmission :

For more information, see Impact:

Reference to service information

Transmission, Removal (Impact operation: 4311-01-01-01 (43170-1))

**WARNING**

While performing this test, the actuator moves to its end positions with considerable force. The actuator can crush fingers or pinch hands if not kept away from the clutch actuator and transmission input shaft when performing this test. To avoid injury, keep body parts clear of the actuator while it is in motion.

I have read and understand the above advisory

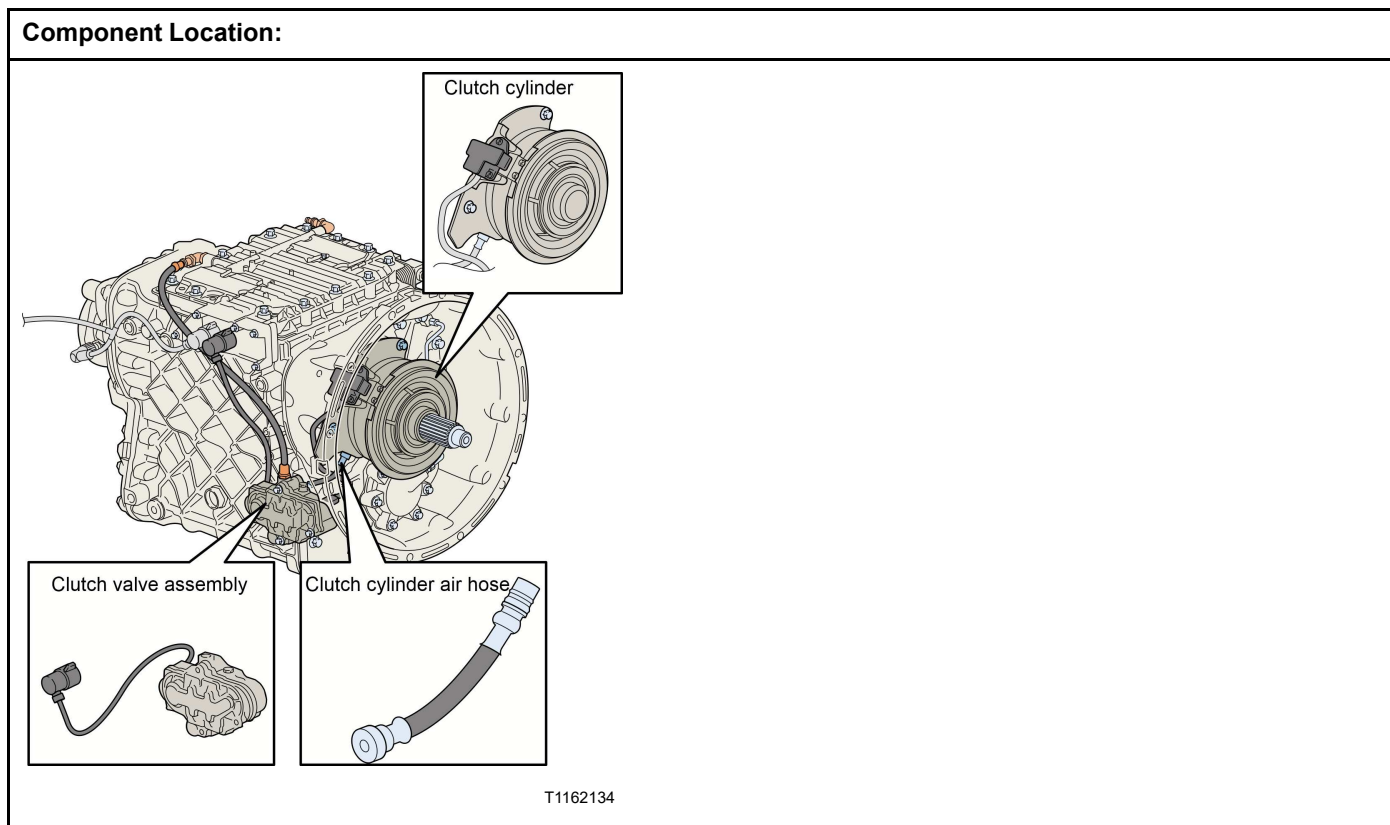
Connect TECHTOOL to the vehicle and run the **4111-08-03-06 PWM Valves Clutch** Activation operation.

Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1075 - 77, Clutch System



Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1075 FTB 77	The mechanical system of the clutch does not work correctly.	• Slow gear changes. • Slow shifting.	Leakage from the following component(s): • Clutch. • Clutch cylinder. • Clutch valve assembly. • Clutch cylinder air hose. • Clutch valve assembly air supply.

Connect TECHTOOL to the vehicle and run the **4320-08-03-01 Clutch cylinder** Test operation.

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** Calibration operation.

If the above operation, Fails.

Continue the next step

For further guidance, choose symptom for Calibration

If the above operation, Passes.

Continue the next step

Connect TECHTOOL to the vehicle and run the **4320-08-03-32 PWM Valves Clutch** Test operation.

Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

Test instruction

Purpose:	Action:	Evaluation:
Clutch system, Check for leakage.	Check where the leak is with soapy water.	Is the clutch valve assembly air supply free from leakage?

**DANGER**

The Clutch Valve Unit contains air under high pressure. Do not remove the drain plug entirely because doing so may allow the plug to quickly and forcefully become a projectile. Leave the drain plug slightly cracked to allow air pressure to be released. Failure to do so may result in serious personal injury.

I have read and understand the above advisory

Test instruction

Purpose:	Action:	Evaluation:
Drain Plug, Check.	- Loosen the drain plug. - Check the drain plug seal.	Is the drain plug seal fault free?
Check of air supply of the valve assembly.	- Check for dirt in the air hose by blowing through it with an air jet. - Check the air hose connections.	Is the air supply to the valve assembly correct?

Remove the Transmission :

For more information, see Impact:

Reference to service information

Transmission, Removal (Impact operation: 4311-01-01-01 (43170-1))

**WARNING**

While performing this test, the actuator moves to its end positions with considerable force. The actuator can crush fingers or pinch hands if not kept away from the clutch actuator and transmission input shaft when performing this test. To avoid injury, keep body parts clear of the actuator while it is in motion.

I have read and understand the above advisory

Connect TECHTOOL to the vehicle and run the **4111-08-03-06 PWM Valves Clutch** Activation operation.

Verification:



CAUTION

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1075 - 92, Clutch System

Component Location:

The diagram illustrates the components of the clutch system on a transmission. The main image shows the transmission housing with the clutch cylinder and valve assembly. Callouts provide detailed views of the Clutch cylinder, Clutch valve assembly, and Clutch cylinder air hose.

Clutch cylinder

Clutch valve assembly

Clutch cylinder air hose

T1162134

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1075 FTB 92	Unintentional engagement.	• Slow gear changes.	Leakage from the following component(s): • Clutch. • Clutch cylinder. • Clutch valve assembly. • Clutch cylinder air hose. • Clutch cylinder air connection. • Clutch valve assembly air supply.

Select fault tracing procedure.

This fault tracing is done in two steps.

First the Transmission is fault traced while mounted in the vehicle. If the fault is not found in this step the Transmission must be removed and the fault tracing restarted by finishing the session under Tech Tool Product tab and restart communication directly to the Transmission.

Choose the most suitable alternative:

- Transmission installed
- Transmission removed

If chose, Transmission installed

Continue the next step

Connect TECHTOOL to the vehicle and run the **4320-08-03-32 PWM Valves Clutch** Test operation.

Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

**DANGER**

The Clutch Valve Unit contains air under high pressure. Do not remove the drain plug entirely because doing so may allow the plug to quickly and forcefully become a projectile. Leave the drain plug slightly cracked to allow air pressure to be released. Failure to do so may result in serious personal injury.

I have read and understand the above advisory

Test instruction

Purpose:	Components:	Action:	Evaluation:
Drain Plug, Check.	Clutch valve assembly.	- Check that the seal is installed correctly and undamaged. - Check the drain plug seal.	Is the drain plug seal fault free?

For further diagnosis the transmission must be removed from the vehicle

- An earlier test indicates a fault.
- The system has passed all subsequent tests

Suggested actions

- Terminate fault tracing by selecting "Finish the session" under Tech Tool product tab.
- Remove the transmission.
- Connect special tools according to illustration.
- Establish communication directly to the TCM and restart the fault tracing

Connect TECHTOOL to the vehicle and run the **4320-08-03-01 Clutch cylinder** Test operation.

Remove the Transmission :

For more information, see Impact:

Reference to service information

Transmission, Removal (Impact operation: 4311-01-01-01 (43170-1))

If chose, Transmission removed.

Continue the next step

**WARNING**

While performing this test, the actuator moves to its end positions with considerable force. The actuator can crush fingers or pinch hands if not kept away from the clutch actuator and transmission input shaft when performing this test. To avoid injury, keep body parts clear of the actuator while it is in motion.

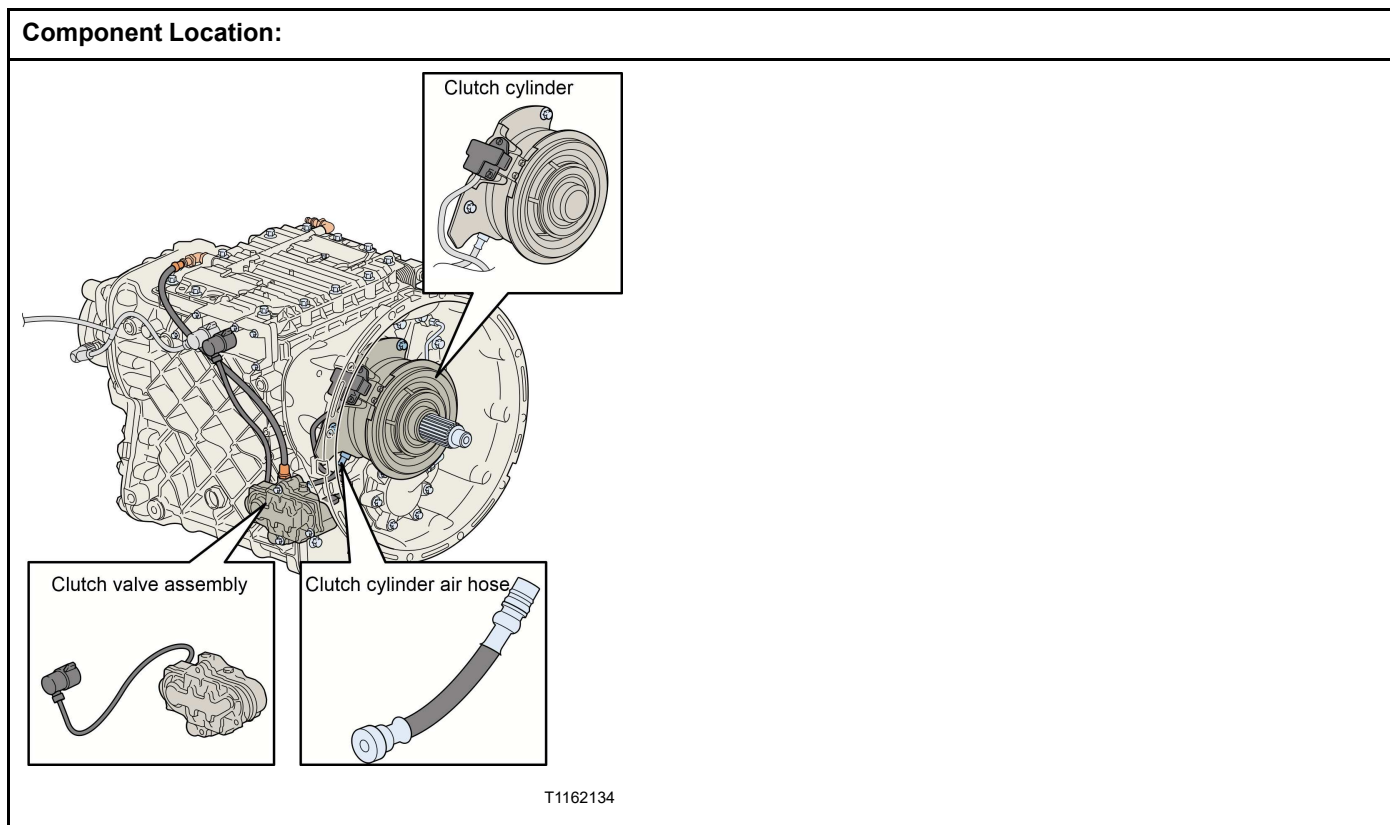
I have read and understand the above advisory

Connect TECHTOOL to the vehicle and run the **4111-08-03-06 PWM Valves Clutch** Activation operation.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1075 - 94, Clutch System



Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1075 FTB 94	Unintentional disengagement.	Slow gear changes.	- Air leakage, Clutch system. - Clutch cylinder air hose. - Clutch cylinder air connection. - Clutch cylinder. - Clutch valve assembly.



WARNING

Before working on a vehicle, set the parking brake, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

I have read and understand the above advisory

Test instruction

Purpose:	Information:	Action:	Special tools:
- Check for worn component. - Check for air leakage.	- The next step in the fault tracing depends on the special tools available. - The preferred method is to use a vacuum pump, but if that is not available, a pry bar may be used.	Continue by selecting one of the following alternatives: - Vacuum pump method. - Pry bar method.	88890275 Or equivalent tool. - Pry bar.

If selected Vacuum pump method:

Continue the next step

Test instruction

Purpose:	Action:	Evaluation:
• Check for worn component. • Check for air leakage.	Note: Read the instructions carefully, then watch the instructional video <i>Instructional video:</i> "https://youtu.be/CC6bGJFeOoc" 1 Have the ignition key in ON position and wait approximately 5 minutes. The transmission control unit is monitoring the clutch position sensor and if the clutch valve assembly is removed during this time. There can be bursts of air heard and felt. After this waiting period, the system will time out. 2 Remove the clutch valve assembly and push it to the side. Do not disconnect the wiring for the clutch position sensor. 3 Execute operation 4311-08-03-02 Input Signals for Gear Selection, expand the section for clutch and gear so that the clutch position sensor value can be observed. 4 Connect a vacuum pump to the port for the clutch cylinder and apply the vacuum. 5 Position the clutch position sensor so that its value is approximately 0.7 inch (18 mm). The clutch cylinder should hold this position for at least 5 minutes. 6 Insert a pry bar through the hole where the wiring for the clutch position sensor exits. 7 Use a pry bar to gently rock the clutch cylinder back and forth to see if there is any movement. A worn clutch cylinder can move enough to cause a leak and you will see this movement in the clutch position sensor graph. Reference to service information Input signals for Gear selection operation: 4311-08-03-02(43170-01))  CAUTION :Do not pry against the wires to the clutch position sensor. Do not use excessive force on the clutch actuator. Doing this could result in damage to the wiring, housing or other components Additional information: Clutch cylinder inspection	Is the test result acceptable?

	Case Based Reasoning: "Case No: K63231010"	

If selected Pry bar method:
Continue the next step

Test instruction

Purpose:	Action:	Evaluation:
• Check for worn component. • Check for air leakage.	Note: Read the instructions carefully, then watch the instructional video <i>Instructional video:</i> "https://youtu.be/vQo29eKchuU" 1 Have the ignition key in ON position and wait approximately 5 minutes. The transmission control unit is monitoring the clutch position sensor and if the clutch valve assembly is removed during this time. There can be bursts of air heard and felt. After this waiting period, the system will time out. 2 Remove the clutch valve assembly and push it to the side. Do not disconnect the wiring for the clutch position sensor. 3 Execute operation 4311-08-03-02 Input Signals for Gear Selection, expand the section for clutch and gear so that the clutch position sensor value can be observed. 4 Insert a pry bar through the hole where the wiring for the clutch position sensor exits. 5 Carefully compress the clutch cylinder. 6 Position the clutch position sensor so that its value is approximately 0.7 inch (18 mm). Plug the port to the clutch cylinder. The clutch cylinder should hold this position for at least 5 minutes. 7 Use a pry bar to gently rock the clutch cylinder back and forth to see if there is any movement. A worn clutch cylinder can move enough to cause a leak and you will see this movement in the clutch position sensor graph. Reference to service information Input signals for Gear selection operation: 4311-08-03-02(43170-01))  CAUTION :Do not pry against the wires to the clutch position sensor. Do not use excessive force on the clutch actuator. Doing this could result in damage to the wiring, housing or other components Additional information: Clutch cylinder inspection	Is the test result acceptable?

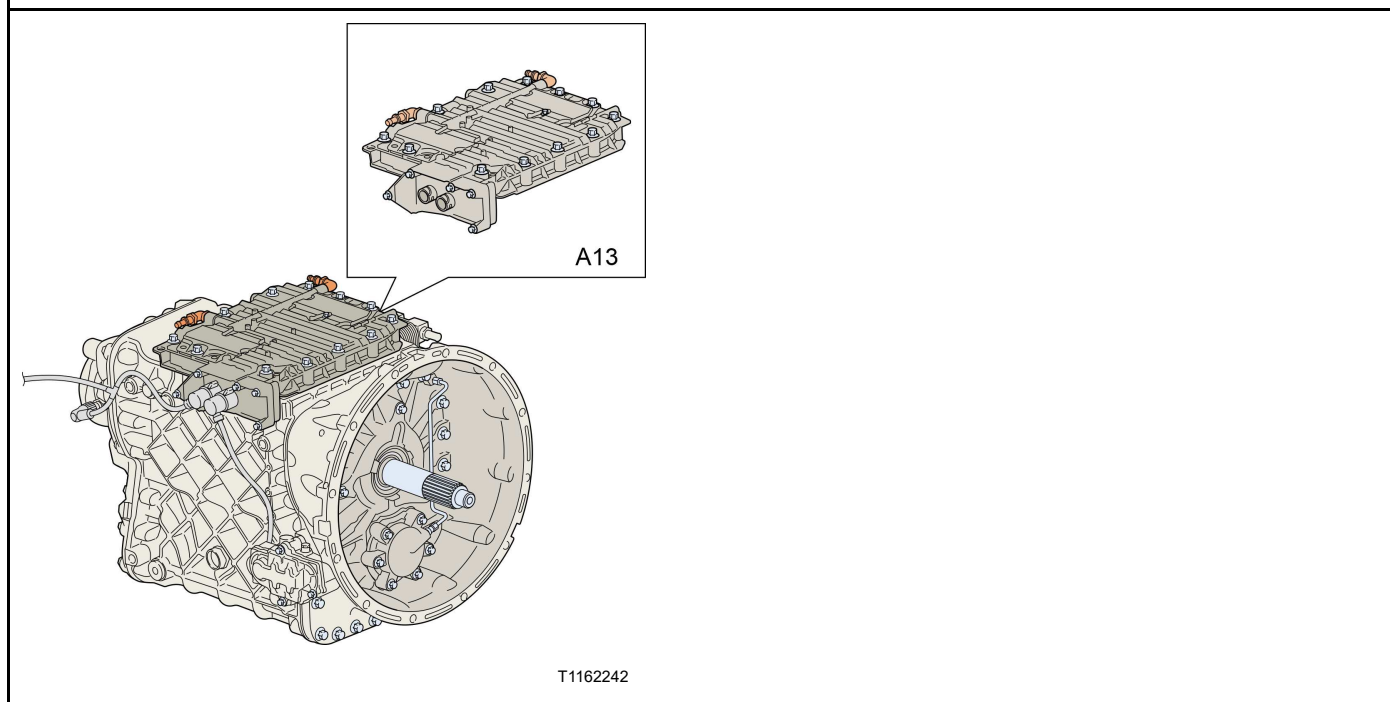
	Case Based Reasoning: "Case No: K63231010"	

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Perform a test drive. - Shift through all gears, including reverse.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - U3000 - 44, Electronic Control Unit

Component Location:



Fault type	Condition for Fault	Observable Symptoms	Possible cause
U3000 FTB 44	Faulty data in Program memory.	It is not possible to drive the vehicle.	Transmission Control Module (TCM).

Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program control unit - Reload software** programming operation.

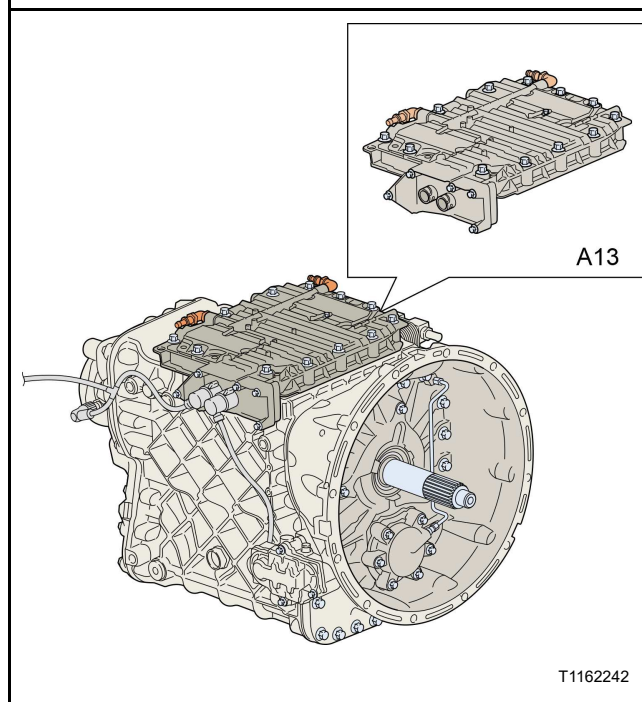
Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - U3000 - 46, Electronic Control Unit

Component Location:



Fault type	Condition for Fault	Observable Symptoms	Possible cause
U3000 FTB 46	Checksum dataset error or program code missing.	• Cranking is inhibited. • Engine does not start	• Transmission Control Module (TCM).

Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program control unit - Reload software** programming operation.

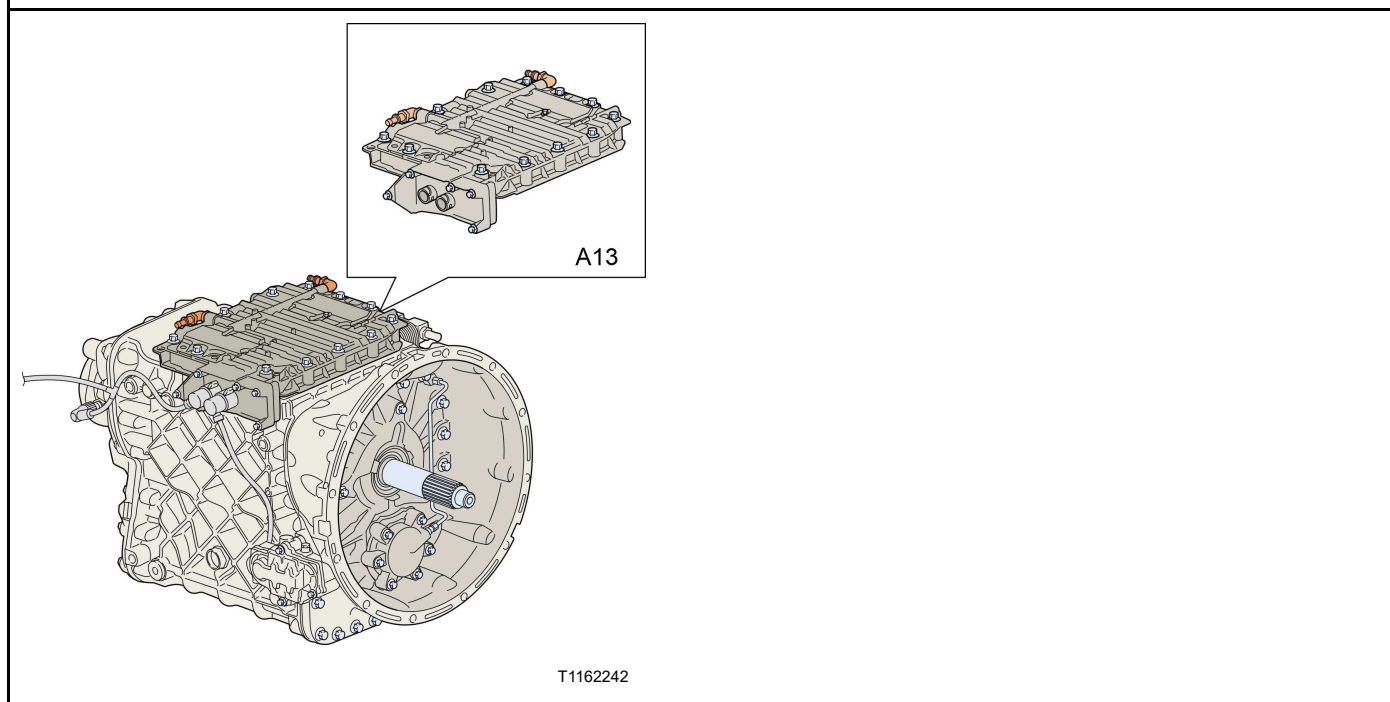
Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - U3000 - 4B, Electronic Control Unit

Component Location:



Fault type	Condition for Fault	Observable Symptoms	Detailed information
U3000 FTB 4B	Temperature too high.	- Faulty sensor. - Transmission Control Module (TCM).	The Temperature Sensor is an internal part of the TCM.

If DTC: P1059 FTB 98, inactive:

Continue fault tracing

Test instruction

Purpose:	Evaluation:
- Check engine coolant level. - Check transmission oil level.	Are the fluids at an acceptable level?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Transmission	- Check for oil leakage on the transmission. - Check for coolant leakage.	Is there leakage?

Test instruction

**CAUTION**

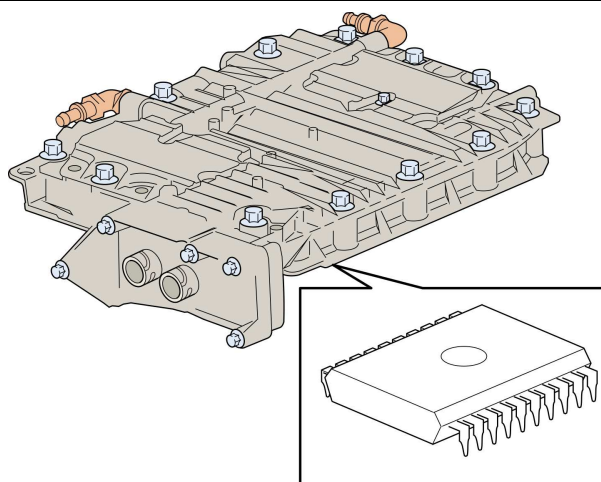
HOT TRANSMISSION! Use caution when installing test equipment and keep yourself away from hot transmission components. A hot transmission can damage test equipment and can cause personal injury due to burns.

Purpose:	Components:	Action:	Evaluation:
Check engine oil temperature (EOT) sensor signal.	Oil temperature sensor.	- Special tools: Thermometer. - Point the thermometer in the area(s) as illustrated. - Compare sensor value with external thermometer value.	Does temperature sensor show correct temperature?
Check if any newly repaired, serviced or replaced parts in Transmission and oil cooler are fully functioning.	Transmission Oil Cooler.	Check if any additional equipment or installations are interfering with transmission cooling.	Are the installations correct?
Perform a visual check.	- Transmission Oil Cooler. - Coolant hose.	- Leakage from hoses or connections. - Check for cracks, cuts or chafe. - Restrictions.	Is the component free from faults?

Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - U0300 - 55, Program Memory EEPROM Development SW**Component Location:**

T1162247

Fault type	Condition for Fault	Probable cause
U0300 FTB 55	Temperature too high. • Software error. • Software update needed.	• Transmission Control Module (TCM). • TCM Programmed with erroneous software.

Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program control unit - Reload software** programming operation.

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Action

For further guidance, choose symptom for Calibration

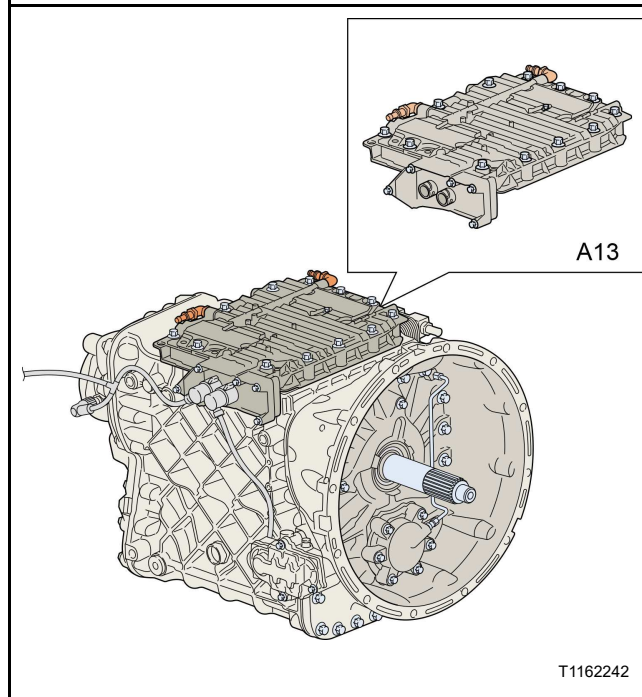
Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - U1FFF - 68, Factory Mode Active

Component Location:



Fault type	Condition for Fault	Probable cause
U1FFF FTB 68	- Factory Mode Active. - The function has been activated.	Programming sequence interrupted.

Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program control unit - Reload software** programming operation.

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Action

For further guidance, choose symptom for Calibration

Verification:

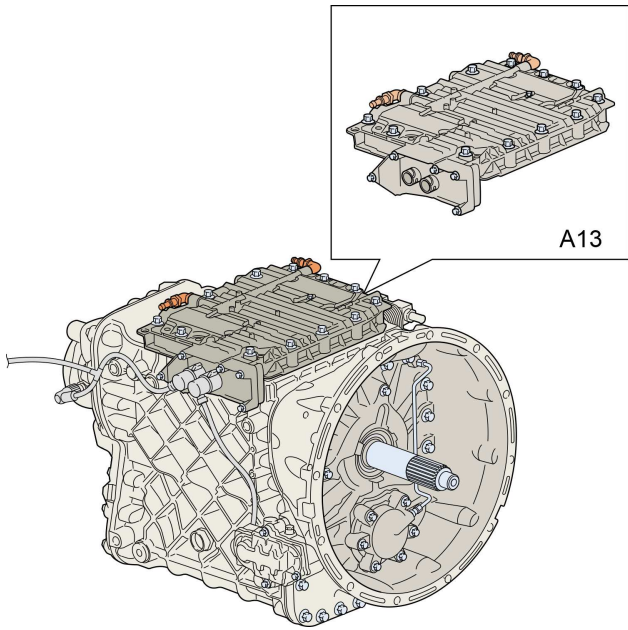
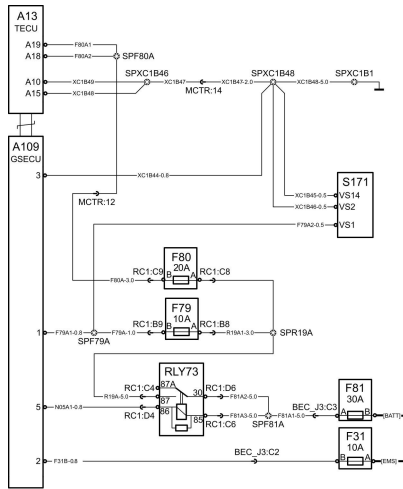


CAUTION

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - U3000 - 17, Electronic Control Unit

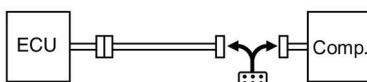
Component Location:	Schematics:
 T1162242	 A13.A:6 - DLEE signal A13:10 - SPXC1B46 Ground wire A13:15 - SPXC1B46 Ground wire A13:18 - SPF80A Supply wire A13:19 - SPF80A Supply wire T1160851

Fault type	Condition for Fault	Observable symptoms	Probable cause
U3000 FTB 17	The voltage at pin A13.A:6 is more than 5 V.	- Engine does not start. - All communication with the electronic control unit (ECU) is disabled except for programming of main software. - Cranking is inhibited.	- Connector. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position. - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

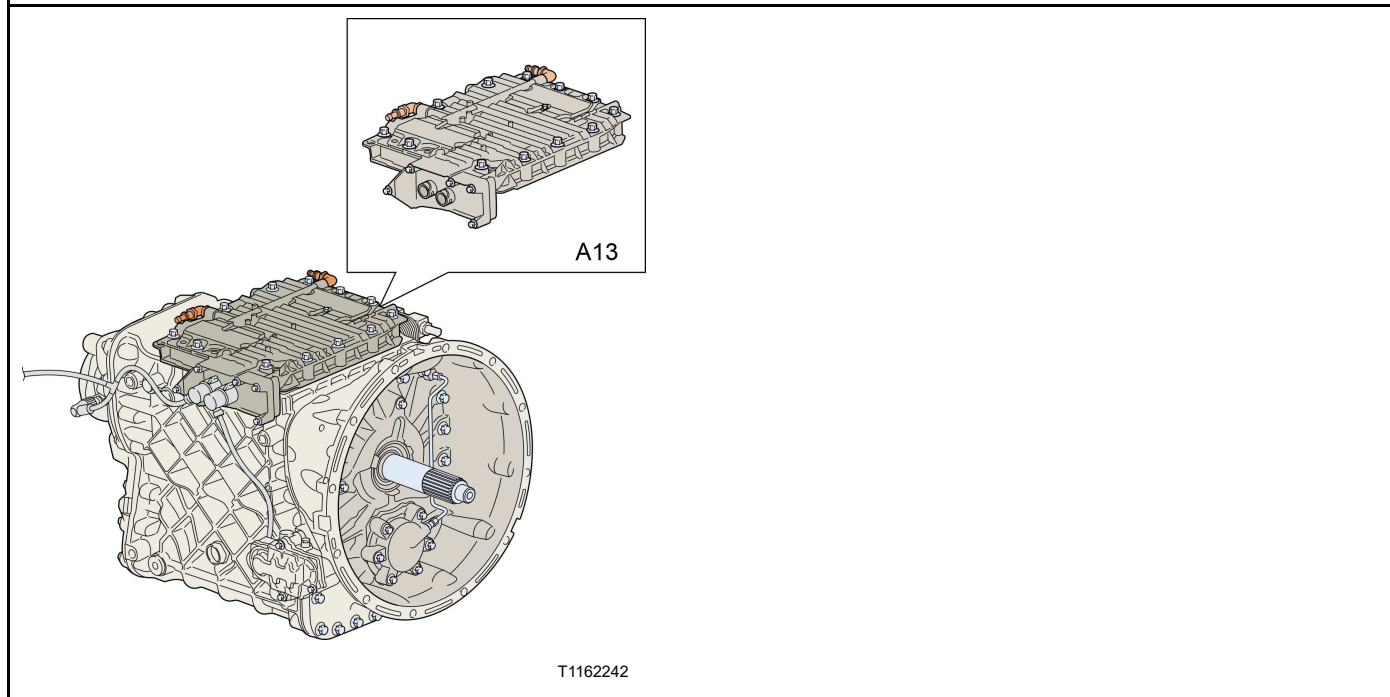
Voltage measurement:



Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	10 — 6	A13.A:10— A13.A:6	V= 0V – 5V		9990041, 9990061/62, 9998699

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P0601 - 00, Internal Control Unit Memory Checksum Error**Component Location:**

Fault type	Condition for Fault	Observable Symptoms	Probable cause
P0601 FTB 10	Checksum fault.	None.	- Transmission Control Module (TCM). - Programmed with erroneous software.

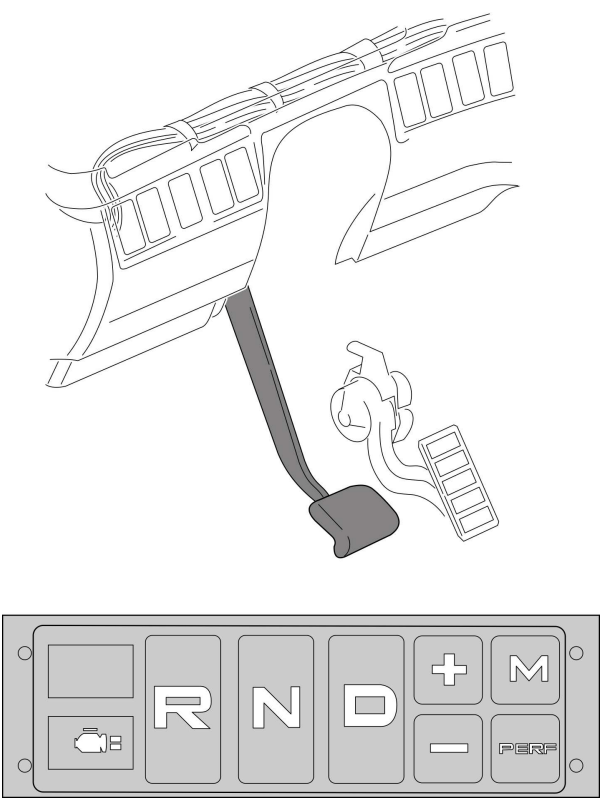
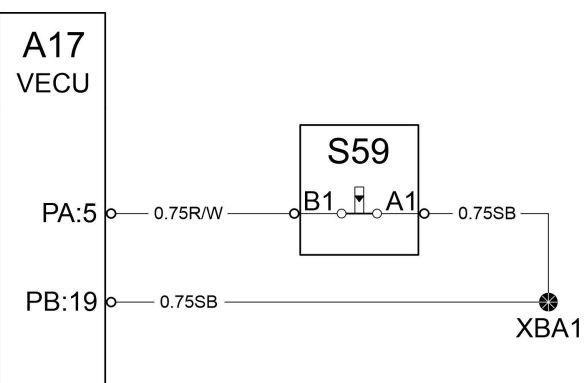
Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program control unit - Reload software** programming operation.

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1055 - 94, Brake Switch Status

Component Location:	Schematic:
 T1162263	 A17 VECU S59 PA:5 — 0.75R/W — B1 — A1 — 0.75SB — XBA1 PB:19 — 0.75SB — A17.PB19 - S59.A1 Supply wire 12V A17.PA:5 - S59.B1 Signal wire T1162264

Fault type	Condition for Fault	Observable Symptoms	Detailed information
P1055 FTB 94	- Brake pedal switch. - The gear shift lever has moved from neutral position to FOLD position before the foot brake was activated.	- Starting gear D/Rev does not engage. - Impossible to engage a gear ratio.	Deactivation - Vehicle speed is greater than 3 mph. - Gear selector is returned to neutral or folded position.

Connect TECHTOOL to the vehicle and run the **2751-08-03-02 Cruise Control** programming operation.

If the above operation, fails:

Continue the next step

Fault tracing outside Guided Diagnostics

Note: The next component to fault trace is not yet covered by Guided Diagnostics

Component:	Action:
Brake pedal switch.	- Proceed according to instructions in Impact. - After completed fault tracing for the component, return to Guided Diagnostics.

For more information, see Impact:

Reference to service information

Pedal pad, brake pedal, replace 5241-03-02-01 (52401-2)

Purpose:	Components:	Action:	Evaluation:
Check that the component is free from faults.	Brake pedal contact.	Check switch for proper mounting and adjustment.	Is the switch fault free?

Connector check: S59

Purpose:	Action:	Evaluation:
Check connector S59.	- Check that the connectors are properly connected and locked into position. - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Visual wiring harness check — S59:

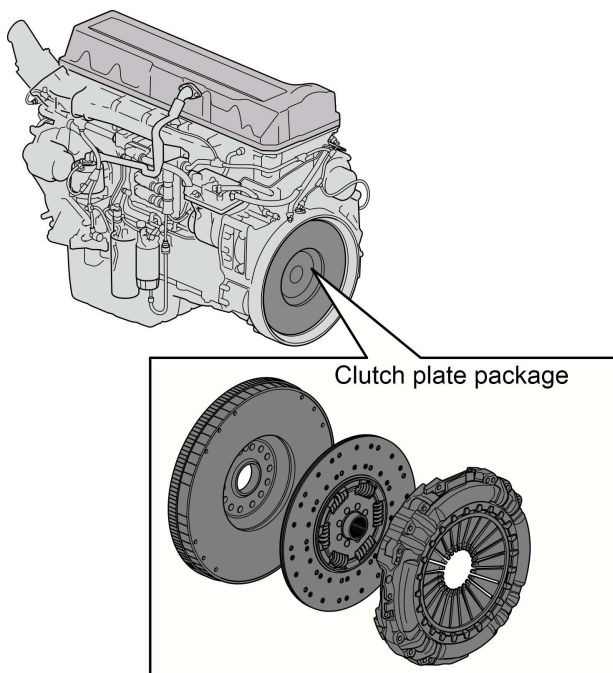
Purpose:	Action:	Evaluation:
Check the wiring harness.	Visually check that wiring harness is not damaged.	Is the wiring harness free from obvious faults.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1053 - 78, Clutch Plate Wear

Component Location:



T1160853

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1053 FTB 78	The threshold value for worn out clutch plate has been reached.	Excessive clutch wear.	Clutch plate.

Connect TECHTOOL to the vehicle and run the **4111-08-03-02 Clutch wear check** Test operation.

Verification:

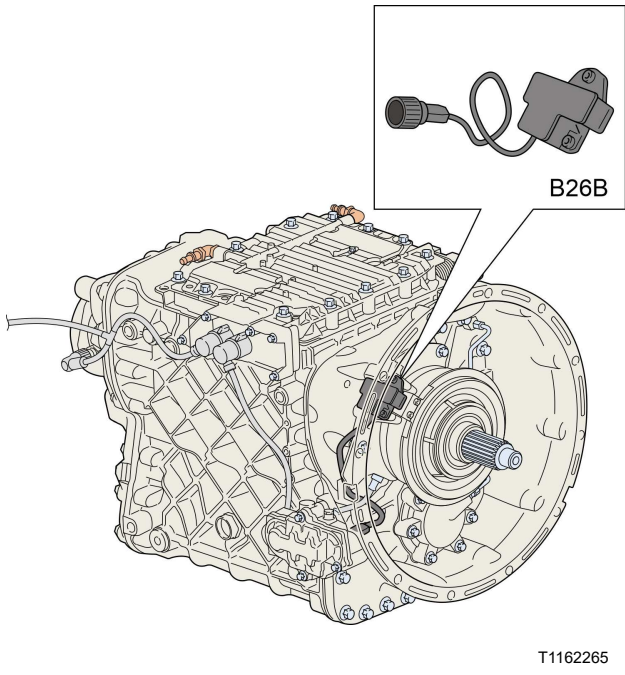


CAUTION

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Operate engine until it reaches normal operating temperature. - Shift through all gears, including reverse.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1052 - 62, Clutch Plate Wear

Component Location:	Schematics:
 T1162265	A13A TECU A42 B26B SECP B16 — 0.75WH — 3 B12 — 0.75WH — 2 B11 — 0.75WH — 4 B4 — 0.75WH — 1 A13:B:12 - B26B:2 Ground wire A13:B:4 - B26B:1 Supply wire A13:B:16 - B26B:3 Signal wire A13:B:11 - B26B:4 Inverted signal T1162266

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1052 FTB 62	The sum of the signals on B:11 and B:16 is less than 4.75 V or more than 5.25 V.	- Uneven shifting at start and at slow speed. - Slow gear shifts.	- Position sensor. - Clutch valve assembly.

Connector check: A42

Purpose:	Action:	Evaluation:
Check connector A42 .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

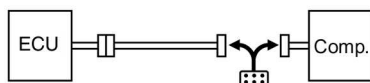


DANGER

Never work under a vehicle equipped with air suspension without the support of jack stands of an adequate rating under the vehicle. Failure to do so can cause serious personal injury or death.

I have read and understand the above advisory

Voltage measurement:



Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	11 — 12	A13.B:11— A13. B:12	V= 0.5V– 4.7V		9990041, 9990061/62, 9998699
Check of voltage level	ON	12 — 16	A13.B:12— A13. B:16	V= 0.5V– 4.7V		9990041, 9990061/62, 9998699

DANGER

The Clutch Valve Unit contains air under high pressure. Do not remove the drain plug entirely because doing so may allow the plug to quickly and forcefully become a projectile. Leave the drain plug slightly cracked to allow air pressure to be released. Failure to do so may result in serious personal injury.

I have read and understand the above advisory

Special instructions

Perform operation.

- Loosen the drain plug.
- Remove the clutch valve assembly but let the air hose stay connected.

For more information, see Impact:

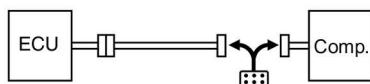
Reference to service information

Valve Assembly, Clutch Control Valve 4119-03-02-01 (41183-2)

Connector check: B26B

Purpose:	Action:	Evaluation:
Check connector B26B.	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Voltage measurement:



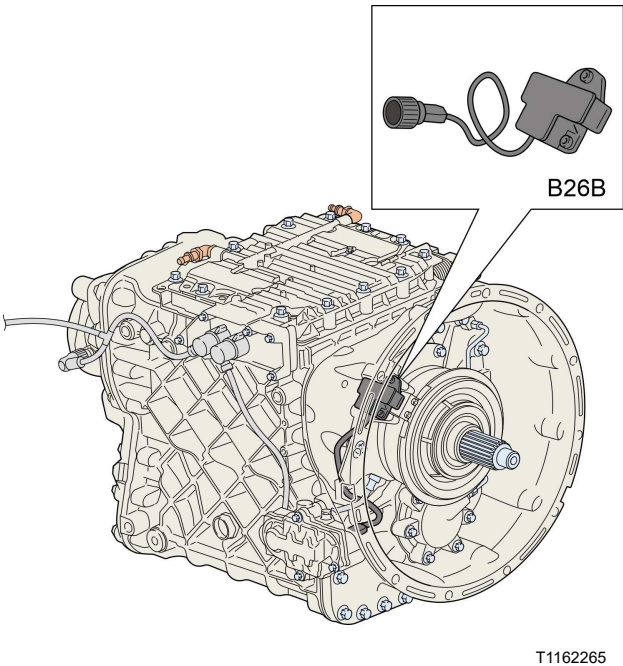
Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	3 — 2	B26B.3 — B26B.2	V= 0.5V– 4.7V		88890039
Check of voltage level	ON	4 — 2	B26B.4 — B26B.2	V= 0.5V– 4.7V		88890039

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Operate engine until it reaches normal operating temperature. • Shift through all gears, including reverse.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1052 - 54, Clutch Cylinder Position

Component Location:



The diagram illustrates the location of the clutch cylinder position sensor, labeled B26B, mounted on the transmission assembly. A callout shows the sensor's wiring and connector. The transmission is shown in a cutaway view to reveal internal components like the clutch shaft and flywheel. The sensor is positioned near the clutch shaft. The diagram is identified by the code T1162265.

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1052 FTB 54	The clutch is not calibrated.	Engine does not start.	Transmission Control Module (TCM).

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Verification:

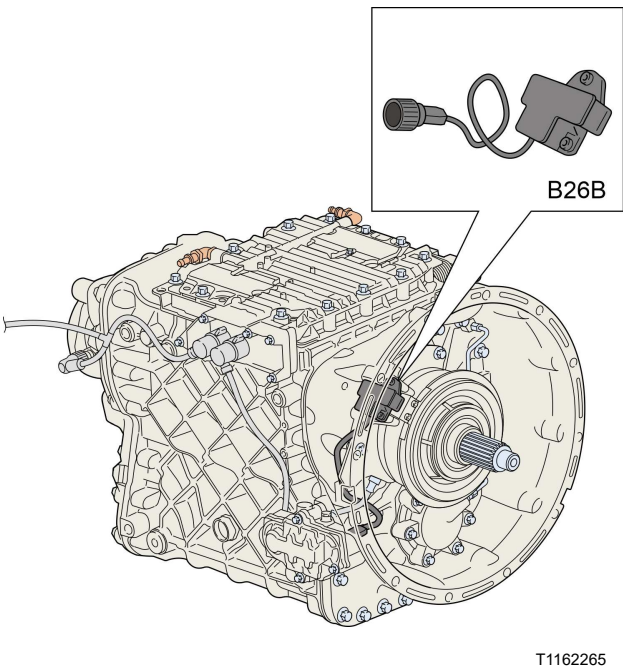


CAUTION

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1052 - 29, Clutch Cylinder Position

Component Location:	Schematics:
 T1162265	A13A TECU A42 B26B SECP B16 — 0.75WH — 3 B12 — 0.75WH — 2 B11 — 0.75WH — 4 B4 — 0.75WH — 1 A13:B:12 - B26B:2 Ground wire A13:B:4 - B26B:1 Supply wire A13:B:16 - B26B:3 Signal wire A13:B:11 - B26B:4 Inverted signal T1162266

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1052 FTB 29	- Lower voltage than normal on pin B:11. - Lower voltage than normal on pin B:16.	- Erratic clutch performance. - Uneven shifting at start and at slow speed. - Slow gear changes.	- Position sensor, clutch cylinder. - Clutch valve assembly. - Clutch cylinder Magnet. - Transmission Control Module (TCM).

Connector check: A42

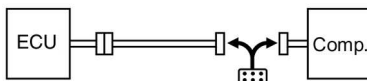
Purpose:	Action:	Evaluation:
Check connector A42 .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.



DANGER

Never work under a vehicle equipped with air suspension without the support of jack stands of an adequate rating under the vehicle. Failure to do so can cause serious personal injury or death.

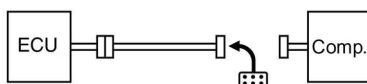
I have read and understand the above advisory

Voltage measurement:

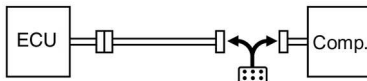
Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	4 — 12	A13.B:4— A13.B:12	V= 4.75V– 5.25V		9990041, 9990061/62, 9998699

If the above test, fails:

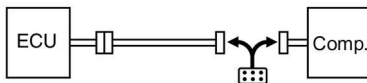
Continue the next step



Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Note: Disconnect A42 connector						
Check of voltage level	ON	4 — 12	A13.B:4— A13.B:12	V= 4.75V– 5.25V		9990041, 9990061/62, 9998699



Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	1 — 2	B26B.1 — B26B.2	V= 4.75V– 5.25V		88890039



Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	12 — 16	A13.B12— A13.B:16	V= 1.75V – 2.4V		9990041, 9990061/62, 9998699
Check of voltage level	ON	11 — 12	A13.B11— A13.B:12	V= 2.6V – 3.25V		9990041, 9990061/62, 9998699

DANGER

The Clutch Valve Unit contains air under high pressure. Do not remove the drain plug entirely because doing so may allow the plug to quickly and forcefully become a projectile. Leave the drain plug slightly cracked to allow air pressure to be released. Failure to do so may result in serious personal injury..

I have read and understand the above advisory

Special instructions

Perform operation.

- Loosen the drain plug.
- Remove the clutch valve assembly but let the air hose stay connected.

For more information, see Impact:

Reference to service information

Valve Assembly, Clutch Control Valve 4119-03-02-01 (41183-2)

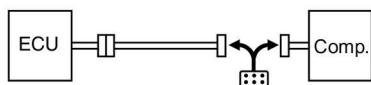
Connector check: B26B

Purpose:	Action:	Evaluation:
Check connector B26B.	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Test instruction

Purpose:	Components:	Action:	Evaluation:
• Visual inspection.	Clutch cylinder Magnet.	• Remove the clutch position sensor and inspect the magnet and magnet bracket on clutch cylinder assembly. • Inspect the orange highlighted area in the illustration.	If the magnet or bracket is damaged in any way the component (Clutch cylinder) must be replaced. Is the component free from fault?

Voltage measurement:

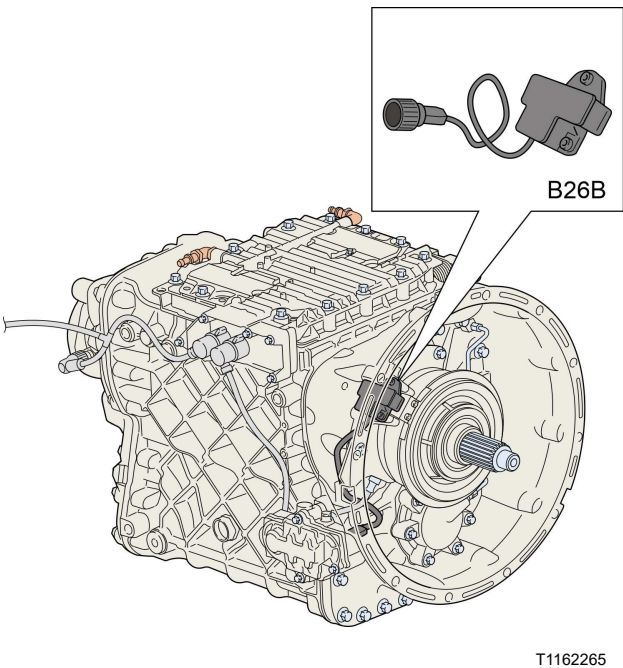


Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	4 — 2	B26B.4 — B26B.2	V= 2.7V– 2.8V		88890039

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs)	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1052 - 18, Clutch Cylinder Position

Component Location:	Schematics:
 T1162265	A13A TECU B16 — 0.75WH — B12 — 0.75WH — B11 — 0.75WH — B4 — 0.75WH — A42 3 2 4 1 B26B SECP A13:B:12 - B26B:2 Ground wire A13:B:4 - B26B:1 Supply wire A13:B:16 - B26B:3 Signal wire A13:B:11 - B26B:4 Inverted signal T1162266

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1052 FTB 18	Open circuit; Pin B:11, B:12, B:16.	- Uneven shifting at start and at slow speed. - Slow gear changes.	- Position sensor, clutch cylinder. - Transmission Control Module (TCM).

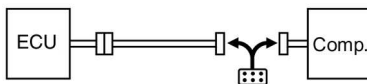
Connector check: A42

Purpose:	Action:	Evaluation:
Check connector A42 .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

 **DANGER**

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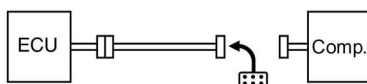
I have read and understand the above advisory

Voltage measurement:

Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	12 — 16	A13.B:12— A13. B:16	V= 0.5V – 4.7V		9990041, 9990061/62, 9998699

If the above test, fails:

Continue the next step



Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Note: Disconnect A42 connector						
Check of voltage level	ON	4 — 12	A13.B:4— A13.B:12	V= 4.75V– 5.25V		9990041, 9990061/62, 9998699

**DANGER**

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I have read and understand the above advisory

Special instructions

Perform operation.

- Loosen the drain plug.
- Remove the clutch valve assembly but let the air hose stay connected.

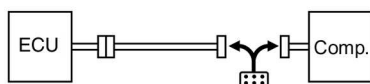
For more information, see Impact:

Reference to service information

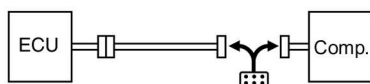
Valve Assembly, Clutch Control Valve 4119-03-02-01 (41183-2)

Connector check: B26B

Purpose:	Action:	Evaluation:
Check connector B26B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.



Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	3 — 2	B26B.3 — B26B.2	V= 0.5V – 4.7V		88890039

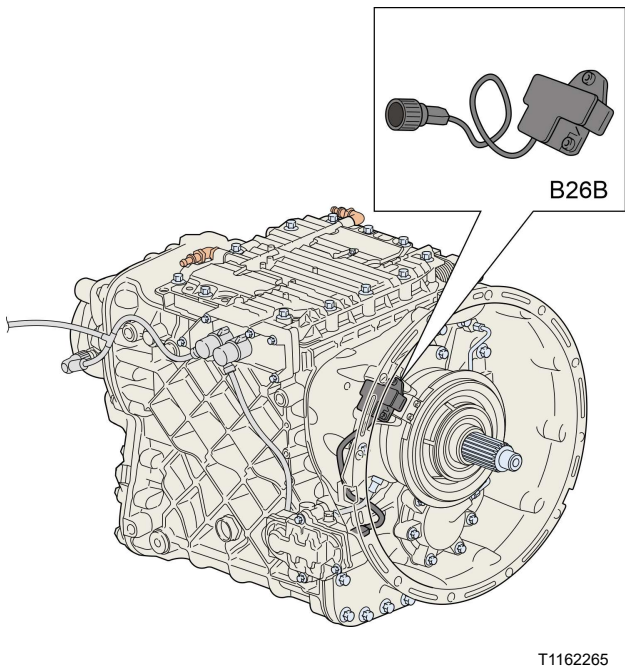


Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	11 — 12	A13.B:11— A13.B:12	V= 0.5V – 4.7V		9990041, 9990061/62, 9998699
Check of voltage level	ON	4 — 12	A13.B:4— A13.B:12	V= 4.75V – 5.25V		9990041, 9990061/62, 9998699

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs)	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1052 - 17, Clutch Cylinder Position

Component Location:	Schematics:
 T1162265	A13A TECU A42 B26B SECP B16 — 0.75WH — 3 B12 — 0.75WH — 2 B11 — 0.75WH — 4 B4 — 0.75WH — 1 A13:B:12 - B26B:2 Ground wire A13:B:4 - B26B:1 Supply wire A13:B:16 - B26B:3 Signal wire A13:B:11 - B26B:4 Inverted signal T1162266

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1052 FTB 17	- Higher voltage than normal on pin B:11. - Higher voltage than normal on pin B:16.	- Uneven shifting at start and at slow speed. - Slow gear changes.	- Position sensor. - Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A42

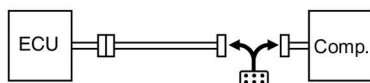
Purpose:	Action:	Evaluation:
Check connector A42 .	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.



DANGER

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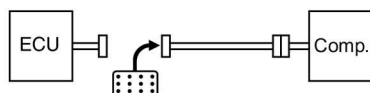
I have read and understand the above advisory

Voltage measurement:

Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	12 — 16	A13.B:12— A13. B:16	V= 0.5V – 4.7V		9990041, 9990061/62, 9998699

If the above test, fails:

Continue the next step

Resistance measurement:

Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit	OFF	4 — 16	A13.B:4— A13.B:16	R ≥ 500 KΩ		9990041, 9990061/62, 9998699

If the above test, fails:

Continue the next step

 DANGER

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I have read and understand the above advisory

Special instructions

Perform operation.

- Loosen the drain plug.
- Remove the clutch valve assembly but let the air hose stay connected.

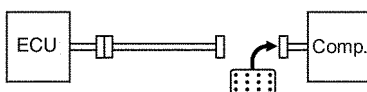
For more information, see Impact:

Reference to service information

Valve Assembly, Clutch Control Valve 4119-03-02-01 (41183-2)

Connector check: B26B

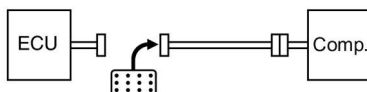
Purpose:	Action:	Evaluation:
Check connector B26B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement:

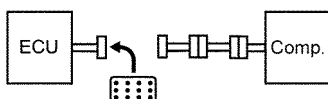
Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	OFF	1 — 3	B26B.1 — B26B.3	$R \geq 500 \text{ K}\Omega$		88890039

If the test between (A13.B:4 — A13.B:16), Pass:

Continue the next step



Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit	OFF	1 — 16	A13.B:1 — A13.B:16	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699
Check for short circuit	OFF	2 — 16	A13.B:2 — A13.B:16	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699
Check for short circuit	OFF	6 — 16	A13.B:6 — A13.B:16	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699
Check for short circuit	OFF	7 — 16	A13.B:7 — A13.B:16	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699

Voltage measurement:

Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit	ON	12 — 16	A13.B:12 — A13. B:16	$V \leq 0.2 \text{ V}$		9990041, 9990061/62, 9998699

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

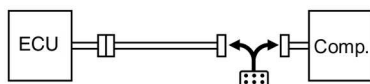
Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

If the test between (A13.B:12 — A13.B:16), Pass:

Continue the next step

Voltage measurement:

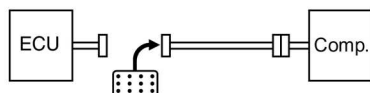


Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	ON	11 — 12	A13.B:11— A13. B:12	$V = 0.5\text{V} - 4.7\text{V}$		9990041, 9990061/62, 9998699

If the above test, Fails:

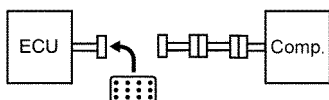
Continue the next step

Resistance measurement:

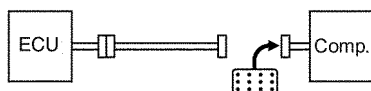


Measure- ment	Key position	Measurement points		Reference Value	Meas- ured value	Other (Spe- cial Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit	OFF	4 — 11	A13.B:4 — A13. B:11	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699
Check for short circuit	OFF	1 — 11	A13.B:1 — A13. B:11	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699
Check for short circuit	OFF	2 — 11	A13.B:2 — A13. B:11	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit	OFF	6 — 11	A13.B:6 — A13.B:11	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699
Check for short circuit	OFF	7 — 11	A13.B:7 — A13.B:11	$R \geq 500 \text{ K}\Omega$		9990041, 9990061/62, 9998699

Voltage measurement:

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit	ON	11 — 12	A13.B:11 — A13.B:12	$V \leq 0.2 \text{ V}$		9990041, 9990061/62, 9998699

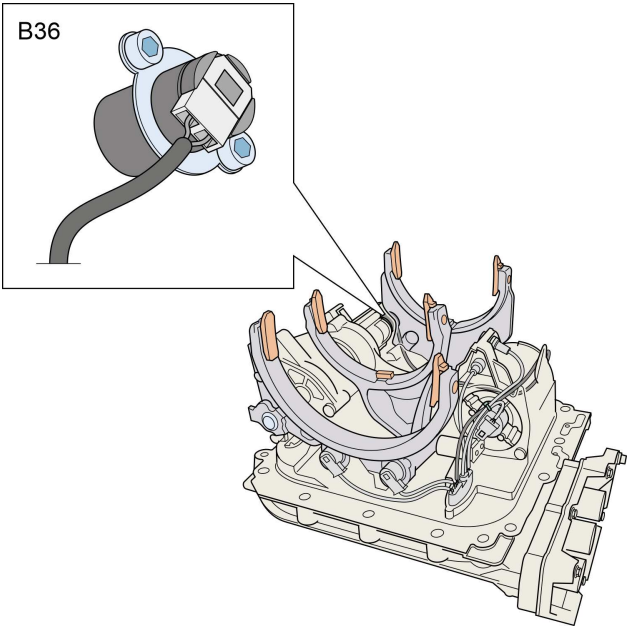
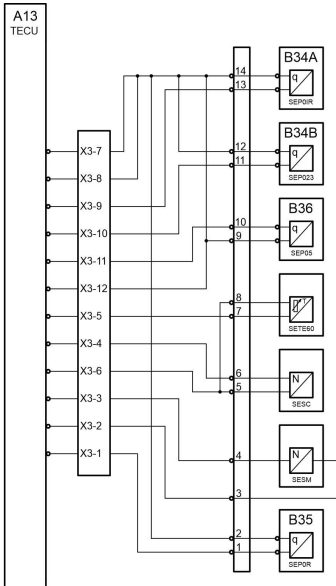
Resistance measurement:

Measurement	Key position	Measurement points		Reference Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check of voltage level	OFF	1 — 4	B26B.1 — B26B.4	$R \geq 500 \text{ K}\Omega$		88890039

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out diagnostic trouble codes (DTCs)	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1051 - 54, Split Position Sensor (SEPoS)

Component Location:	Schematics:
B36  T1162294	 X3:11 - B36:10 Signal wire X3:7 - B36:9 Ground wire X3:8 - B36:9 Ground wire X3:12 - B36:9 Ground wire T1162295

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1051 FTB 54	The position sensor is not calibrated.	Engine does not start.	Uncalibrated sensor.

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

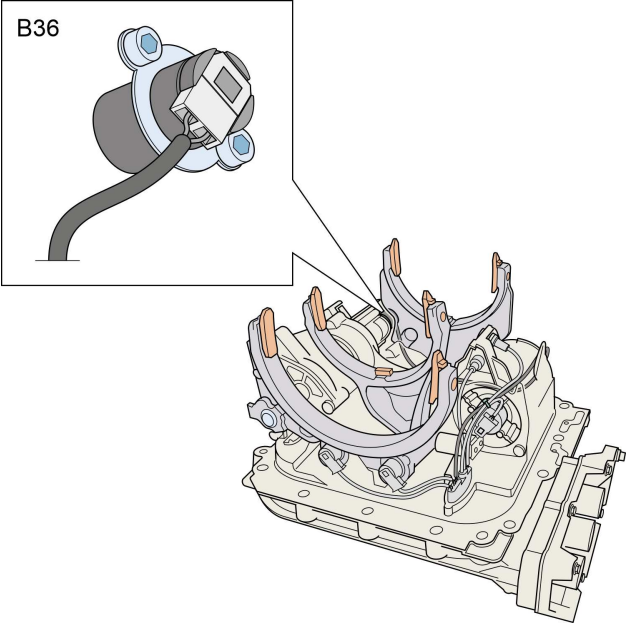
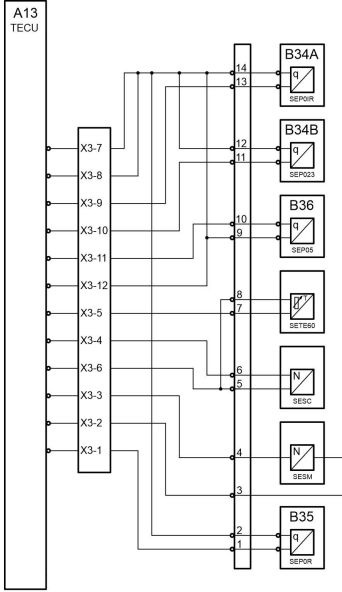
Action

For further guidance, choose symptom for Calibration.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1051 - 17, Split Position Sensor (SEPoS)

Component Location:	Schematics:
 T1162294	 T1162295 X3:11 - B36:10 Signal wire X3:7 - B36:9 Ground wire X3:8 - B36:9 Ground wire X3:12 - B36:9 Ground wire

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1051 FTB 17	Higher voltage than normal on pin X3:11.	Slow gear changes.	- Split Position Sensor (SEPoS). - Wiring harness - Transmission Control Module (TCM).

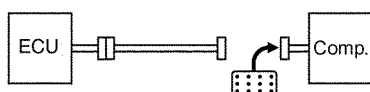
Important information:

The transmission must be removed from the vehicle before the control housing can be removed Remove the transmission For more information, see Impact: Reference to service information Transmission, remove (Impact operation: 4311-01-01-01(43170-01))
Remove the control housing: For more information, see Impact: Reference to service information Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B36

Purpose:	Action:	Evaluation:
Check connector B36.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, range cylinder).	OFF	1 — 2	B36.Pin 1— B36. Pin 2	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

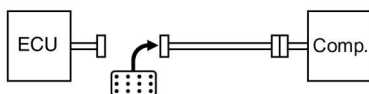
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

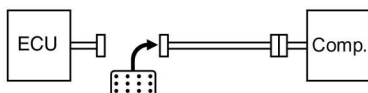


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for open-circuit (Wiring harness).	OFF	1 — 11	A13.X3 Pin 1 — A13.X3 Pin 11	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	2 — 11	A13.X3 Pin 2 — A13.X3 Pin 11	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	3 — 11	A13.X3 Pin 3 — A13.X3 Pin 11	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	4 — 11	A13.X3 Pin 4 — A13.X3 Pin 11	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	5 — 11	A13.X3 Pin 5 — A13.X3 Pin 11	$R \geq 500\ K\Omega$		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	9 — 11	A13.X3 Pin 9 — A13.X3 Pin 11	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	10 — 11	A13.X3 Pin 10 — A13.X3 Pin 11	$R = 128\ \Omega - 148\ \Omega$		9990008 (Grey test pins)

If the test (B36:1 – B36:2), Fails:

Continue the next step

Resistance measurement

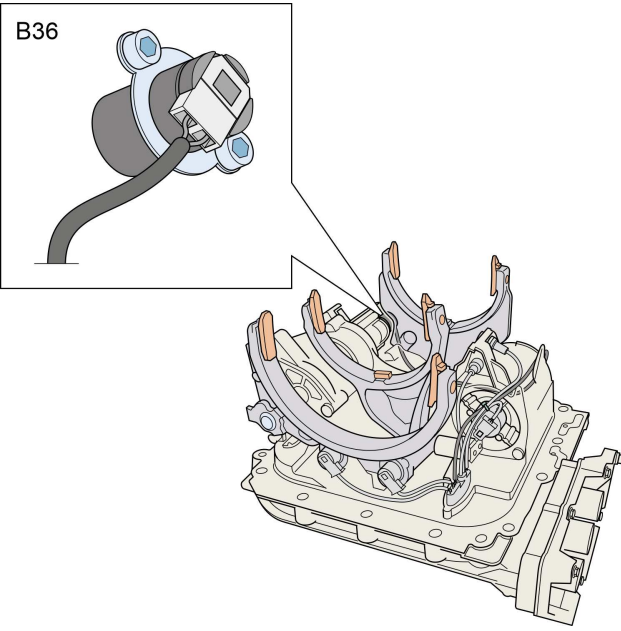
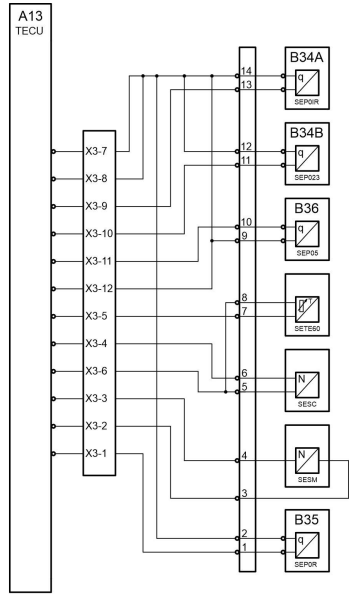


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Note: Disconnect B36 connector.						
Check for open-circuit (Wiring harness).	OFF	1 — 11	A13.X3 Pin 1 — A13.X3 Pin 11	R ≥ 500 KΩ		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	2 — 11	A13.X3 Pin 2 — A13.X3 Pin 11	R ≥ 500 KΩ		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	3 — 11	A13.X3 Pin 3 — A13.X3 Pin 11	R ≥ 500 KΩ		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	4 — 11	A13.X3 Pin 4 — A13.X3 Pin 11	R ≥ 500 KΩ		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	5 — 11	A13.X3 Pin 5 — A13.X3 Pin 11	R ≥ 500 KΩ		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	9 — 11	A13.X3 Pin 9 — A13.X3 Pin 11	R ≥ 500 KΩ		9990008 (Grey test pins)
Check for open-circuit (Wiring harness).	OFF	10 — 11	A13.X3 Pin 10 — A13.X3 Pin 11	R ≥ 500 KΩ		9990008 (Grey test pins)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1051 - 18, , Split Position Sensor (SEPoS)

Component Location:	Schematics:
B36  T1162294	 X3:11 - B36:10 Signal wire X3:7 - B36:9 Ground wire X3:8 - B36:9 Ground wire X3:12 - B36:9 Ground wire T1162295

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1051 FTB 18	Open circuit: Pin X3:11.	Slow gear changes.	- Split Position Sensor (SEPoS). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

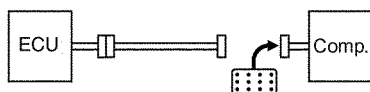
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B36

Purpose:	Action:	Evaluation:
Check connector B36.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, range cylinder).	OFF	1 — 2	B36.Pin 1— B36. Pin 2	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

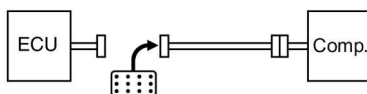
Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

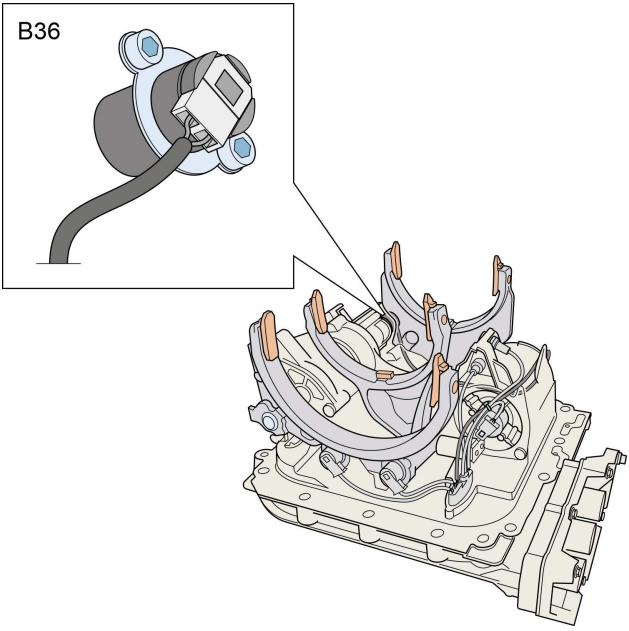
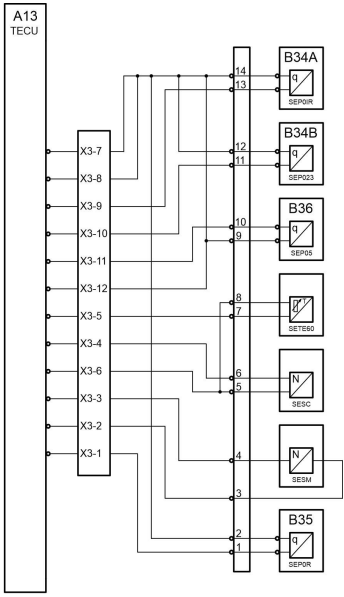


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for open-circuit (Wiring harness).	OFF	12 — 11	A13.X3 Pin 12 — A13.X3 Pin 11	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1051 - 19, Split Position Sensor (SEPoS)

Component Location:	Schematics:
B36  T1162294	A13 TECU  X3:11 - B36:10 Signal wire X3:7 - B36:9 Ground wire X3:8 - B36:9 Ground wire X3:12 - B36:9 Ground wire T1162295

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1051 FTB 19	Short circuit to ground: Pin X3:11.	Slow gear changes.	- Split Position Sensor (SEPoS). - Wiring harness - Transmission Control Module (TCM).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

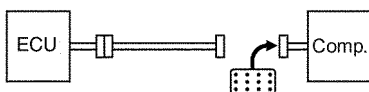
Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

Connector check: B36

Purpose:	Action:	Evaluation:
Check connector B36.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Position sensor, range cylinder).	OFF	1 — 2	B36.Pin 1— B36. Pin 2	R = 61 Ω — 77 Ω		9990008 (Grey test pins)

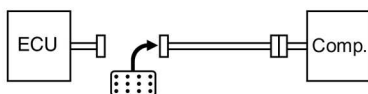
Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.	
For more information, see Impact:	
Reference to service information Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)	
 CAUTION Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.	
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

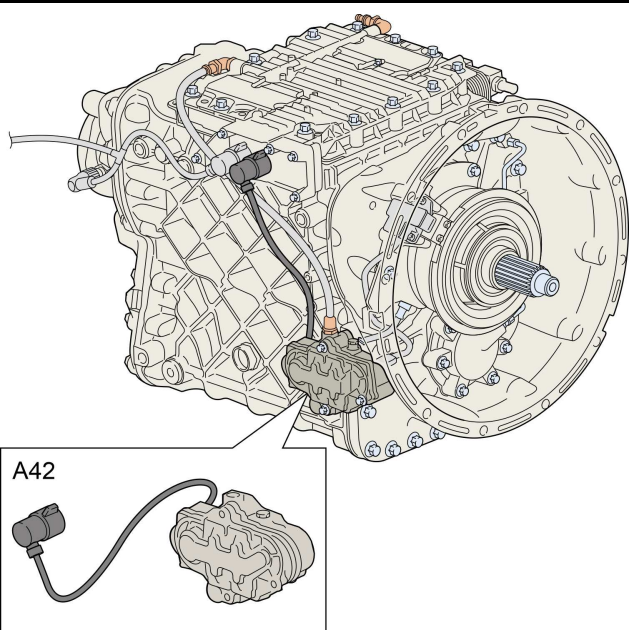
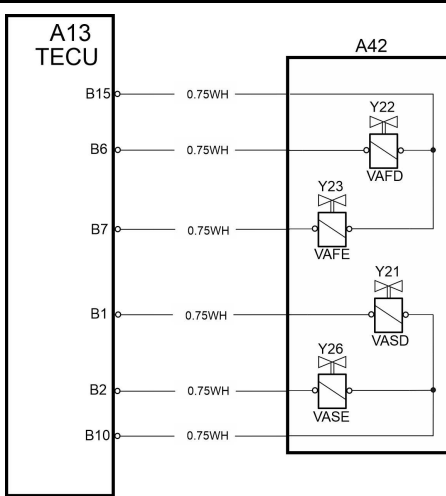


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check for short circuit.	OFF	6 — 11	A13.X3 Pin 6 — A13.X3 Pin 11	$R \geq 500 \text{ K}\Omega$		9990008 (Grey test pins)
Check for short circuit.	OFF	7 — 11	A13.X3 Pin 7 — A13.X3 Pin 11	$R = 61 \Omega - 77 \Omega$		9990008 (Grey test pins)
Check for short circuit.	OFF	8 — 11	A13.X3 Pin 8 — A13.X3 Pin 11	$R = 61 \Omega - 77 \Omega$		9990008 (Grey test pins)
Check for short circuit.	OFF	12 — 11	A13.X3 Pin 12 — A13.X3 Pin 11	$R = 61 \Omega - 77 \Omega$		9990008 (Grey test pins)

Verification:

CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1064 - 17, Clutch Fast Disengagement Valve (VAFD)

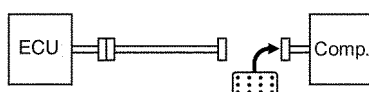
Component Location:	Schematics:
 T1162195	 A13.B:1 - Y21 Control wire A13.B:2 - Y26 Control wire A13.B:10 - Y21/Y26 Ground wire A13.B:6 - Y21:1 Control wire A13.B:7 - Y23 Control wire A13.B:15 - Y22/Y23 Ground wire T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1064 FTB 17	Higher voltage than normal on pin B:7.	Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

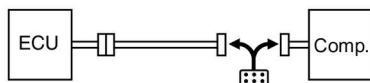
Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	7 — 15	A13.Pin B:67 — A13.Pin B:15	R = 3.2 Ω — 5.2 Ω		9990061/62, 9998699, 9990041

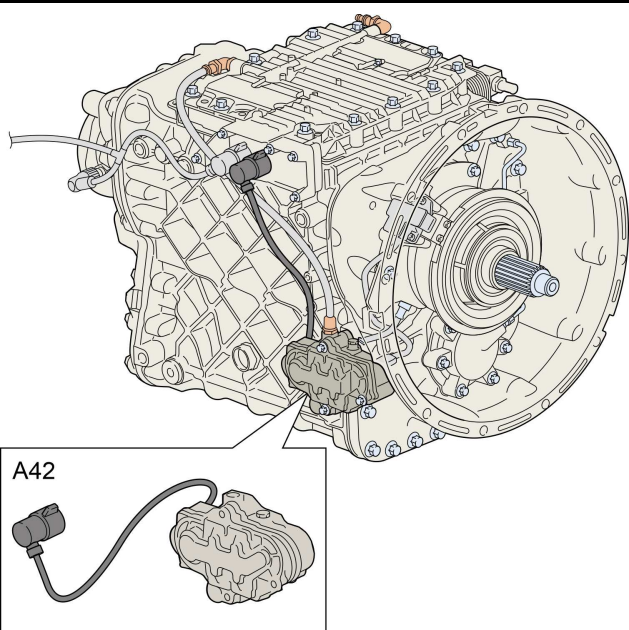
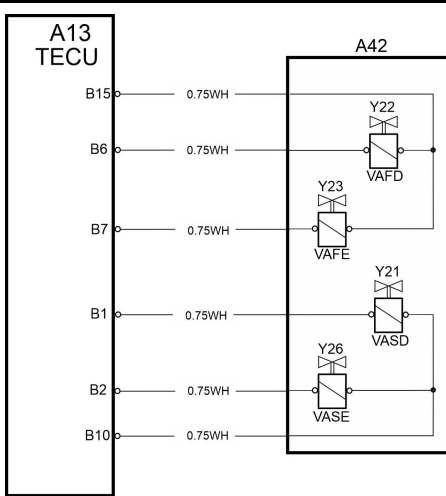
Voltage measurement

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	7 — 15	A13.Pin B:7 — A13.Pin B:15	V= 0 mV — 500 mV		9990061/62, 9998699, 9990041

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1064 - 18, Clutch Slow Disengagement Valve (VASD)

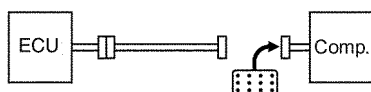
Component Location:	Schematics:
 T1162195	 A13.B:1 - Y21 Control wire A13.B:2 - Y26 Control wire A13.B:10 - Y21/Y26 Ground wire A13.B:6 - Y21:1 Control wire A13.B:7 - Y23 Control wire A13.B:15 - Y22/Y23 Ground wire T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1064 FTB 18	Open circuit, A13.B:7.	Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	7 — 15	A13.Pin B:7 — A13.Pin B:15	R = 3.2 Ω — 5.2 Ω		9990061/62, 9998699, 9990041

Connect TECHTOOL to the vehicle and run the **Clutch cylinder** Test operation.

Test instruction

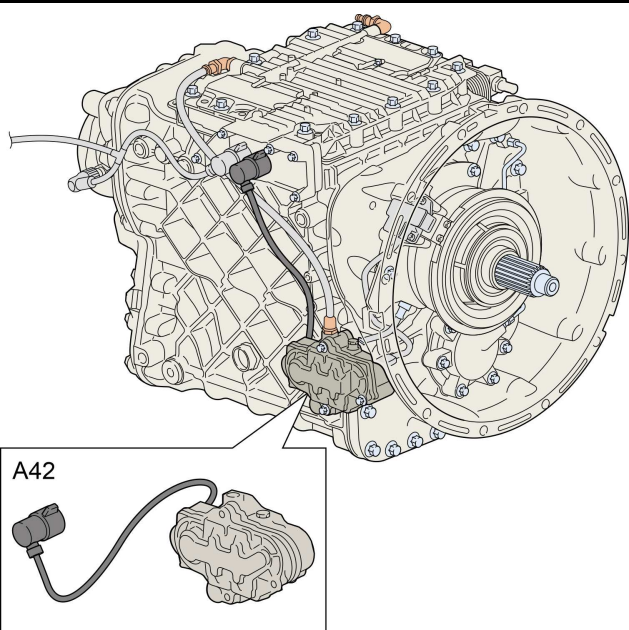
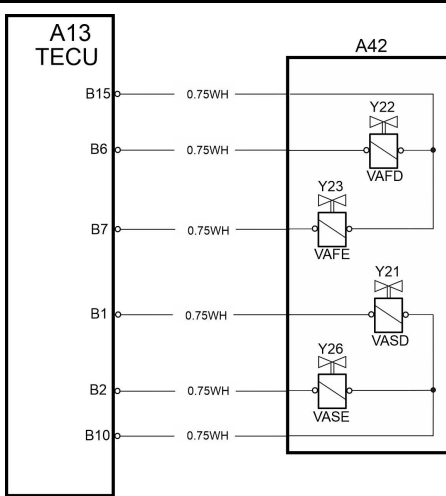
Purpose:	Component to be tested :	Action:	Evaluation:
This test determines if the diagnostic trouble code (DTC) status changes when the component connector is disconnected.	Clutch valve assembly.	- Ignition key in OFF position. - Disconnect A42 connector. - Ignition key in ON position.	None.

Note: Continue and read out the status of the diagnostic trouble code (DTC) in TECHTOOL.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1064 - 19, Clutch Fast Engagement Valve (VAFE)

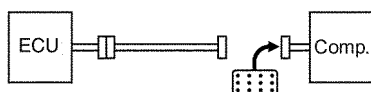
Component Location:	Schematics:
 T1162195	 T1162196 A13.B:1 - Y21 Control wire A13.B:2 - Y26 Control wire A13.B:10 - Y21/Y26 Ground wire A13.B:6 - Y21:1 Control wire A13.B:7 - Y23 Control wire A13.B:15 - Y22/Y23 Ground wire

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1064 FTB 19	Short circuit to ground on A13.B:7.	- Erratic clutch performance. - Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	7 — 15	A13.Pin B:7 — A13.Pin B:15	$R = 3.2 \Omega$ — 5.2Ω		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	7 — 7	A13.Pin B:7 — A13.Pin B:7	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	7 — 15	A13.Pin B:7 — A13.Pin B:12	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	7 — GND	A13.Pin B:7 — Chassis Ground	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

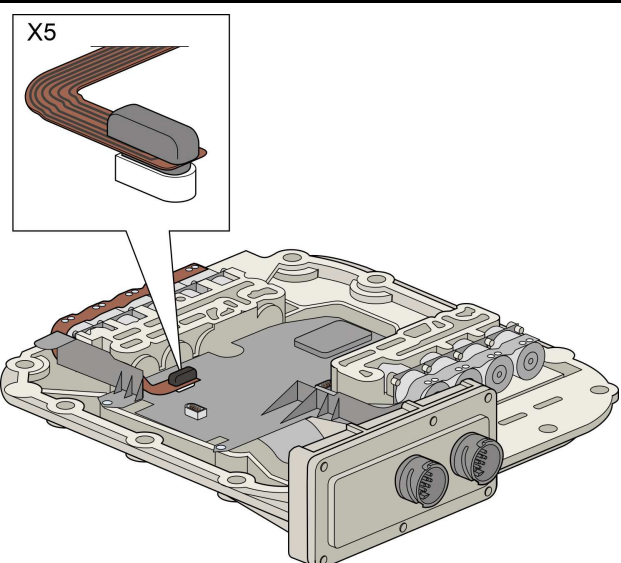
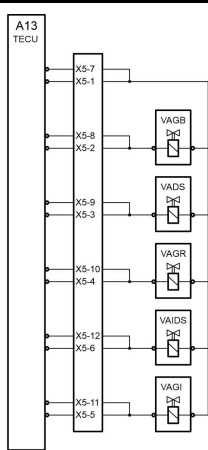
Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1070 - 19, Transmission Brake Valve (VAGB)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1070 FTB 19	Short circuit to battery voltage.	- The solenoid valve can not be activated. - Slow gear changes.	Solenoid valve assembly (VAGB).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

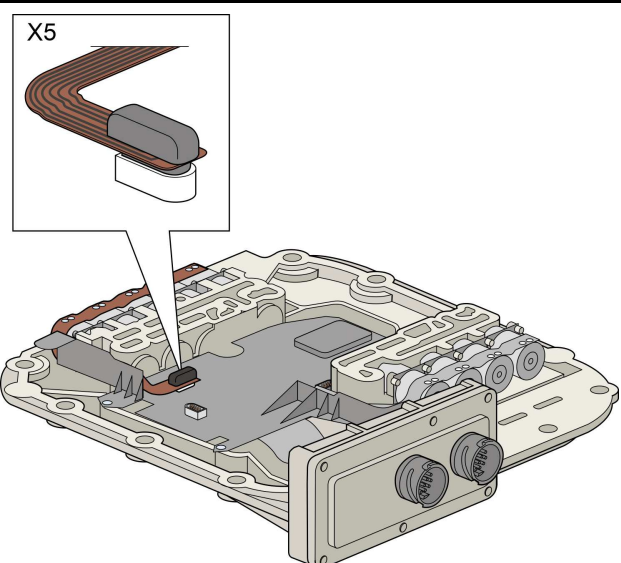
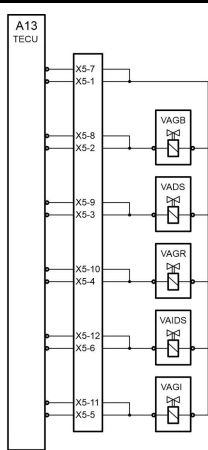
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1070 - 18, Gearbox Brake Valve (VAGB)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1070 FTB 18	Current below normal or open circuit.	- The solenoid valve can not be activated. - Slow gear changes.	Solenoid valve assembly (VAGB).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

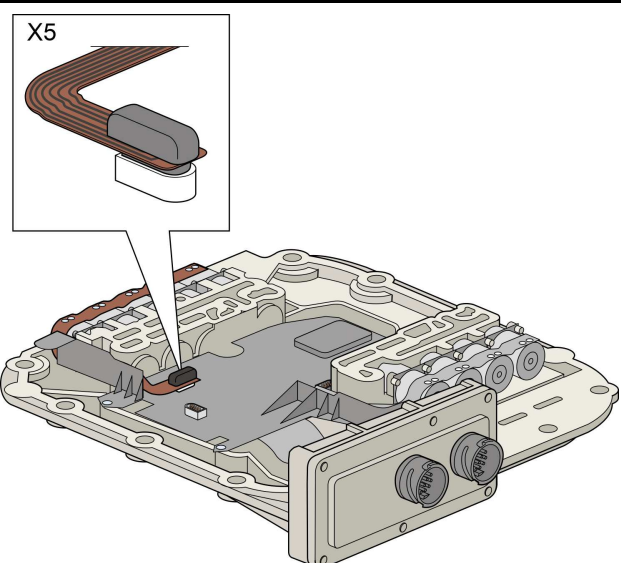
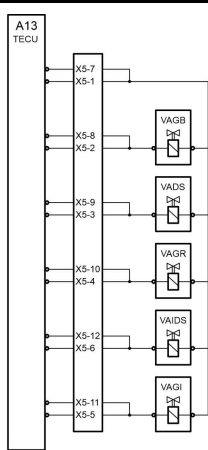
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position. • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition.	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1070 - 17, Gearbox Brake Valve (VAGB)

Component Location:	Schematics:
 T1162147	 X4:a1/X4:a10/X4:b1/X4:b10 - VAGB/VADS/VAGR/VAIDS/VAG1(High Side Circuit) X5:8/X5:2 - VAGB(Signal wire) X5:9/X5:3 - VADS(Signal wire) X5:10/X5:4 - VAGR(Signal wire) X5:12/X5:6 - VAIDS(Signal wire) X5:11/X5:5 - VAG1(Signal wire) T1162148

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1070 FTB 17	Short circuit to battery voltage.	- The solenoid valve and the brake are activated. - The transmission will be destroyed if you drive the vehicle. - The propeller shaft has to be removed to move the vehicle.	Solenoid valve assembly (VAGB).

Important information:

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Remove the control housing:

For more information, see Impact:

Reference to service information

Control housing, remove (Impact operation: 4329-01-01-01(43222-01))

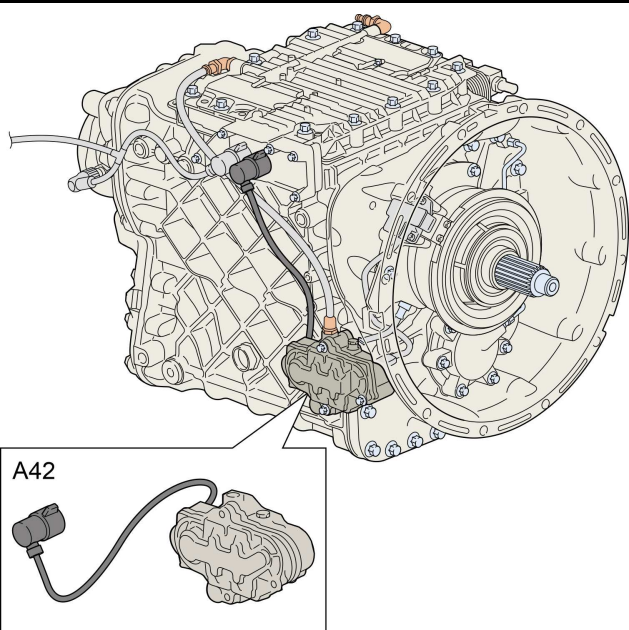
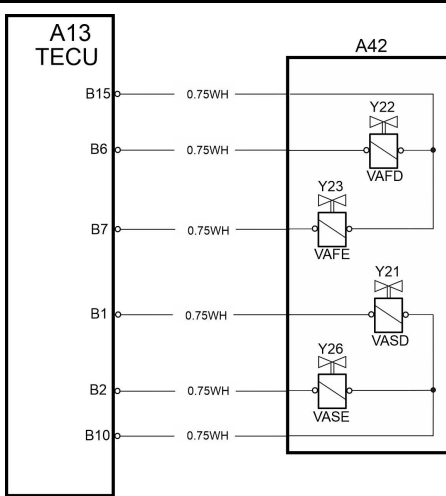
Connector check: X5

Purpose:	Action:	Evaluation:
Check connector X5 .	• Check that the connectors are properly connected and locked into position • Disconnect and check the component connector. • Inspect pins and terminals for oxidations or corrosion. • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. • Check the pins and terminal are not damaged (which can cause poor connection). • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

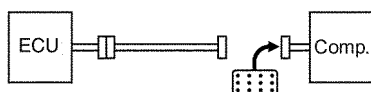
TECU - P1068 - 17, Fast Clutch Valves Low Side Circuit (VAF-)

Component Location:	Schematics:
 T1162195	 A13.B:1 - Y21 Control wire A13.B:2 - Y26 Control wire A13.B:10 - Y21/Y26 Ground wire A13.B:6 - Y21:1 Control wire A13.B:7 - Y23 Control wire A13.B:15 - Y22/Y23 Ground wire T1162196

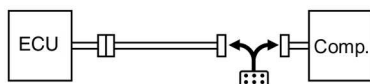
Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1068 FTB 17	The voltage at pin B:15 is more than 10 V.	Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

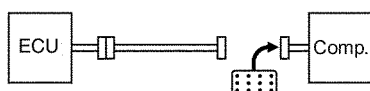
Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	7 — 15	A13.Pin B:7 — A13.Pin B:15	$R = 3.2 \Omega — 5.2 \Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	6 — 15	A13.Pin B:6 — A13.Pin B:15	$R = 3.2 \Omega — 5.2 \Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	1 — 15	A13.Pin B:1 — A13.Pin B:15	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	2 — 15	A13.Pin B:2 — A13.Pin B:15	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041

Voltage measurement

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	15 — GND	A13.Pin B:15 — Chassis Ground point	$V = 0 \text{ V} — 0.2 \text{ V}$		9990061/62, 9998699, 9990041



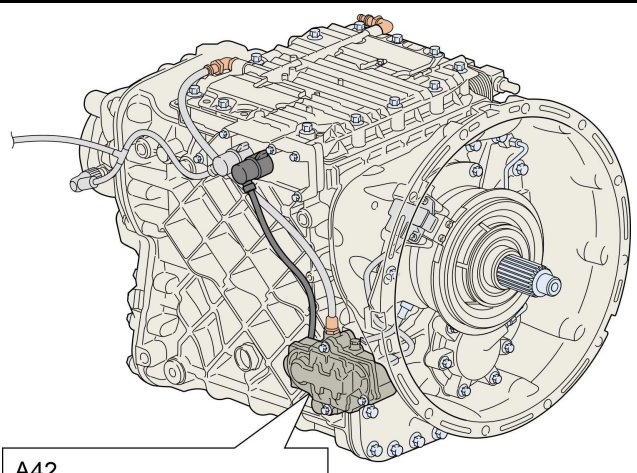
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Note: Disconnect A42						
Check Clutch valve assembly.	OFF	15 — GND	A13.Pin B:15 — Chassis Ground point	V= 0 V — 0.2V		9990061/62, 9998699, 9990041

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1068 - 19, Fast Clutch Valves Low Side Circuit (VAF-)

Component Location:



T1162195

Schematics:

A13
TECU

B15

B6

B7

B1

B2

B10

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

0.75WH

A42

Y22

VAFD

Y23

VAFE

Y21

VASD

Y26

VASE

A13.B:1 - Y21 Control wire

A13.B:2 - Y26 Control wire

A13.B:10 - Y21/Y26 Ground wire

A13.B:6 - Y21:1 Control wire

A13.B:7 - Y23 Control wire

A13.B:15 - Y22/Y23 Ground wire

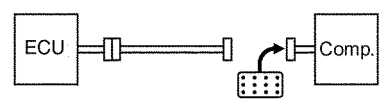
T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1068 FTB 19	Short Circuit to Ground on Pin B:15.	Slow gear shift.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

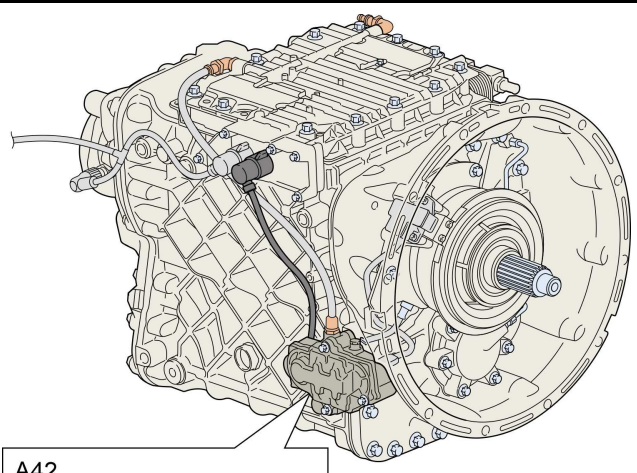
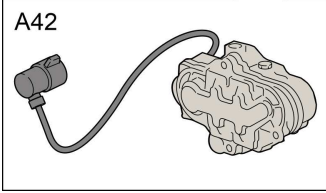


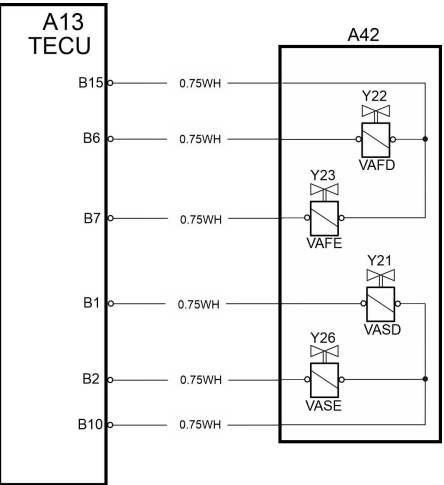
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	15 — GND	A13.Pin B:15 — Chassis Ground point	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1069 - 17, Slow Clutch Valves Low Side Circuit (VAS-)

Component Location:


T1162195

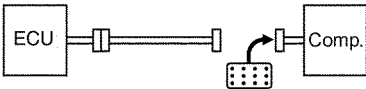
Schematics:

A13.B:1 - Y21 Control wire
A13.B:2 - Y26 Control wire
A13.B:10 - Y21/Y26 Ground wire
A13.B:6 - Y21:1 Control wire
A13.B:7 - Y23 Control wire
A13.B:15 - Y22/Y23 Ground wire
T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1069 FTB 17	The voltage at pin B:10 is more than 10 V.	Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

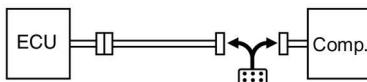
Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

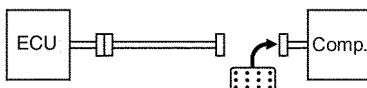
Resistance measurement



Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	1— 10	A13.Pin B:1 — A13.Pin B:10	$R = 3.2 \Omega - 5.2 \Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	2— 10	A13.Pin B:2 — A13.Pin B:10	$R = 3.2 \Omega - 5.2 \Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	7 — 10	A13.Pin B:7 — A13.Pin B:10	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041
Check Clutch valve assembly.	OFF	6— 10	A13.Pin B:2 — A13.Pin B:15	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041

Voltage measurement

Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	10 — GND	A13.Pin B:10 — Chassis Ground point	$V = 0 \text{ V} - 0.2 \text{ V}$		9990061/62, 9998699, 9990041

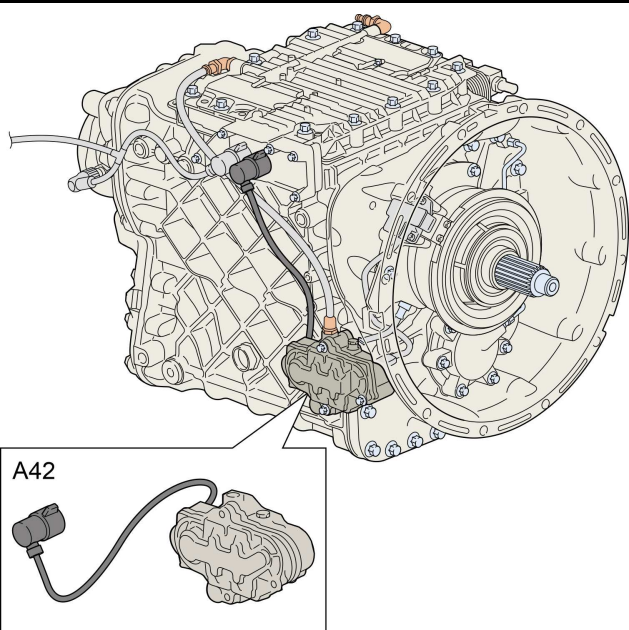
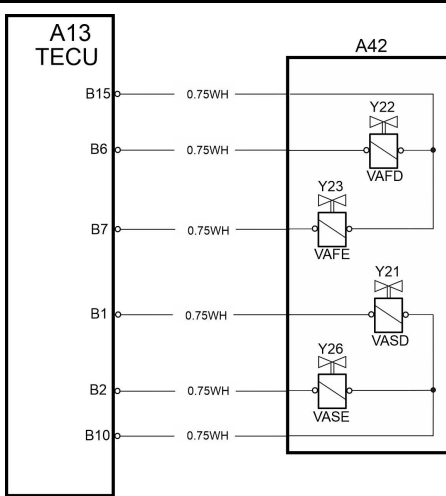


Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Note: Disconnect A42						
Check Clutch valve assembly.	OFF	10 — GND	A13.Pin B:10 — Chassis Ground point	V= 0 V — 0.2V		9990061/62, 9998699, 9990041

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1069 - 19, Slow Clutch Valves Low Side Circuit (VAS-)

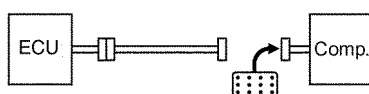
Component Location:	Schematics:
 T1162195	 A13.B:1 - Y21 Control wire A13.B:2 - Y26 Control wire A13.B:10 - Y21/Y26 Ground wire A13.B:6 - Y21:1 Control wire A13.B:7 - Y23 Control wire A13.B:15 - Y22/Y23 Ground wire T1162196

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1069 FTB 19	Short circuit to ground on B:1.	Slow gear changes.	- Clutch valve assembly. - Transmission Control Module (TCM).

Connector check: A13.B

Purpose:	Action:	Evaluation:
Check connector A13.B.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement



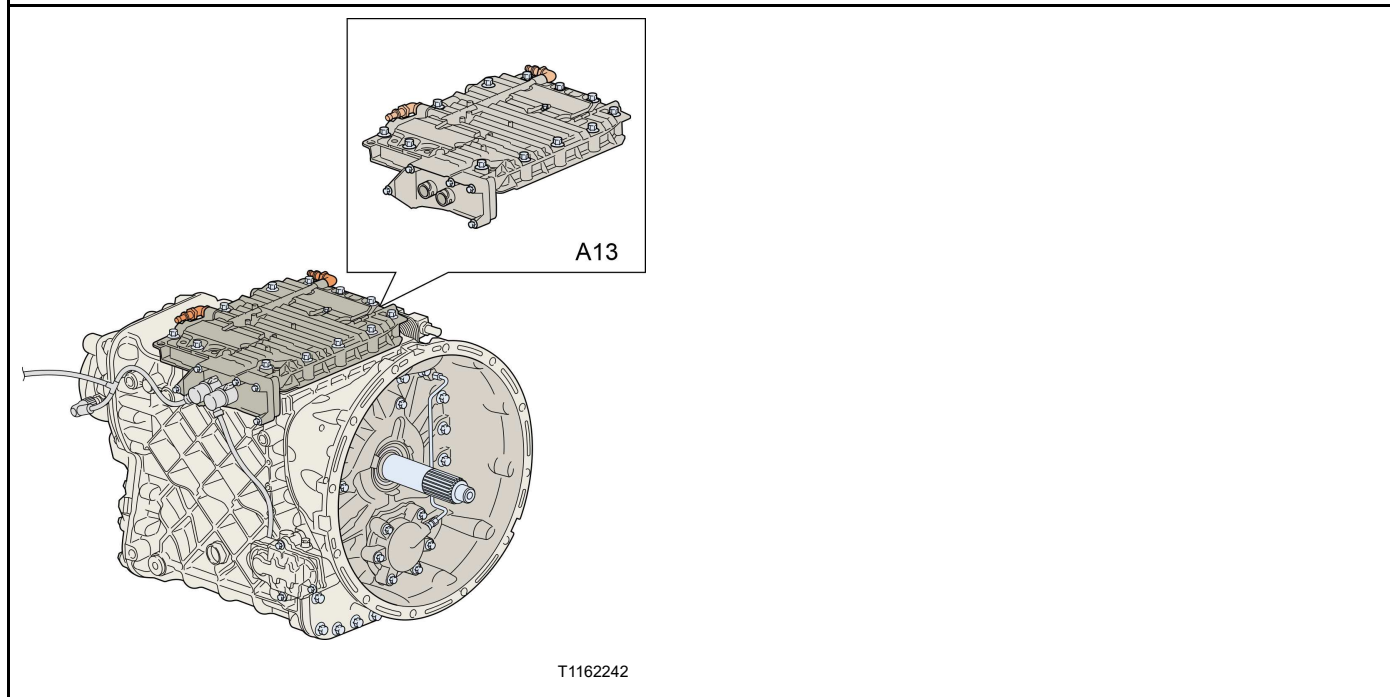
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Clutch valve assembly.	OFF	1 — GND	A13.Pin B:1 — Chassis Ground	$R \geq 500 \text{ K}\Omega$		9990061/62, 9998699, 9990041

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1063 - 29, Gearbox Inclination Sensor (SEIG)

Component Location:



Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1063 FTB 29	Higher voltage than normal on pin B:1.	- Wrong starting gear. - Wrong gear can be selected. - Downhill and uphill gear change performance may be reduced.	Transmission Control Module (TCM).

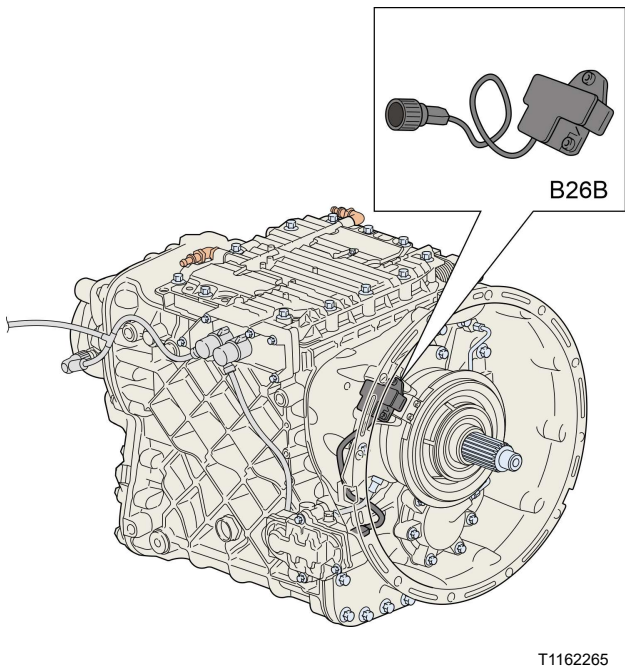
Test instruction

Purpose:	Component to be tested :	Action:	Evaluation:
Check Component.	Transmission vehicle Inclination Sensor.	- Read the Transmission vehicle Inclination Sensor reading. - Measure the angle of the service vehicle is parked on. - Compare the inclination sensor value from the readout to the physically measured value.	Do the values match?.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1062 - 16, Clutch Position Sensor Supply (SEPoC5V)

Component Location:	Schematics:
 T1162265	A13A TECU A42 B26B SECP B16 — 0.75WH — 3 B12 — 0.75WH — 2 B11 — 0.75WH — 4 B4 — 0.75WH — 1 A13:B:12 - B26B:2 Ground wire A13:B:4 - B26B:1 Supply wire A13:B:16 - B26B:3 Signal wire A13:B:11 - B26B:4 Inverted signal T1162266

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1062 FTB 16	The voltage at pin B:4 is more than 5.5 V.	- Uneven shifting at start and at slow speed. - Slow gear changes.	- Position sensor, clutch cylinder. - Clutch valve assembly. - Transmission Control Module (TCM).

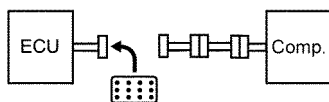
Connector check: A42

Purpose:	Action:	Evaluation:
Check connector A42.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

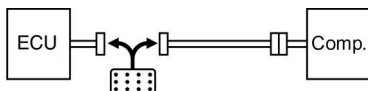
**DANGER**

Never work under a vehicle equipped with air suspension without the support of jack stands of an adequate rating under the vehicle. Failure to do so can cause serious personal injury or death..

I have read and understand the above advisory

Voltage measurement

Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Supply Voltage level .	ON	4 — 12	A13.Pin B:4 – A13. Pin B:12	V = 4.75 V to 5V		9990061/62, 9998699, 9998699



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Supply Voltage level .	ON	4 — 12	A13.Pin B:4 – A13. Pin B:12	V = 4.75 V to 5V		9990061/62, 9998699, 9998699

⚠ DANGER

The clutch valve contains air under high pressure. Do not remove the drain plug entirely because doing so may allow the plug to be fired with great force. Leave the drain plug slightly cracked to allow air pressure to be released. Failure to do so may result in serious personal injury.

I have read and understand the above advisory

Special instructions

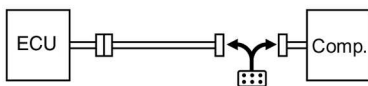
Perform operation.

- Loosen the drain plug.
- Remove the clutch valve assembly but let the air hose stay connected.

For more information, see Impact:

Reference to service information

Valve Assembly, Clutch Control Valve 4119-03-02-01 (41183-2)



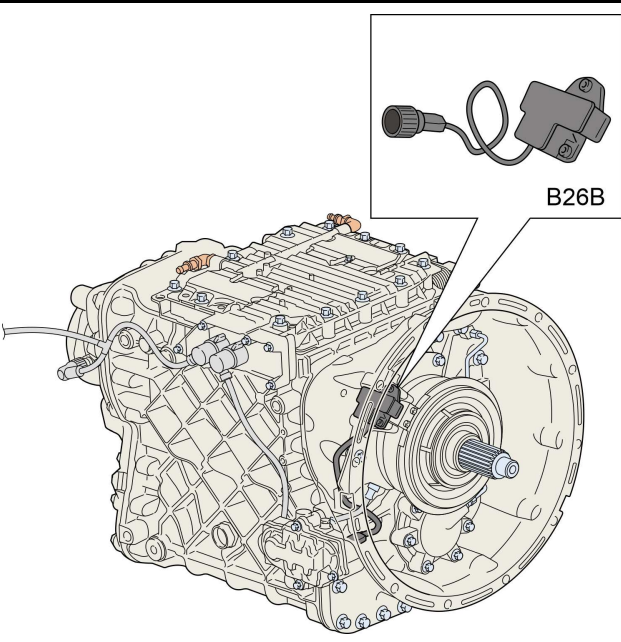
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Supply Voltage level .	ON	1 — 2	B26B.Pin 1 – B26B.Pin 2	V = 4.75 V to 5V		88890039

Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1062 - 18, Clutch Position Sensor Supply (SEPoc5V)

Component Location:	Schematics:
 T1162265	A13A TECU A42 B26B SECP B16 — 0.75WH — 3 B12 — 0.75WH — 2 B11 — 0.75WH — 4 B4 — 0.75WH — 1 A13:B:12 - B26B:2 Ground wire A13:B:4 - B26B:1 Supply wire A13:B:16 - B26B:3 Signal wire A13:B:11 - B26B:4 Inverted signal T1162266

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1062 FTB 18	The Voltage at Pin A13. B:4 is less than 4.5V .	- Uneven shifting at start and at slow speed. - Slow gear changes.	- Clutch Position sensorr. - Clutch valve assembly. - Transmission Control Module (TCM).

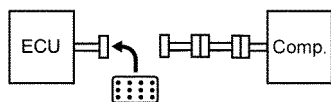
Connector check: A42

Purpose:	Action:	Evaluation:
Check connector A42.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

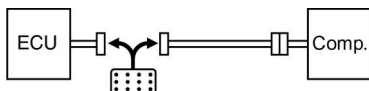
**DANGER**

Never work under a vehicle equipped with air suspension without the support of jack stands of an adequate rating under the vehicle. Failure to do so can cause serious personal injury or death..

I have read and understand the above advisory

Voltage measurement

Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Sup- ply Voltage level .	ON	4 — 12	A13.Pin B:4 – A13. Pin B:12	V = 4.75 V to 5V		9990061/62, 9998699, 9998699



Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Sup- ply Voltage level .	ON	4 — 12	A13.Pin B:4 – A13. Pin B:12	V = 4.75 V to 5V		9990061/62, 9998699, 9998699

**DANGER**

The clutch valve contains air under high pressure. Do not remove the drain plug entirely because doing so may allow the plug to be fired with great force. Leave the drain plug slightly cracked to allow air pressure to be released. Failure to do so may result in serious personal injury.

I have read and understand the above advisory

Special instructions

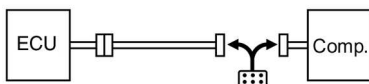
Perform operation.

- Loosen the drain plug.
- Remove the clutch valve assembly but let the air hose stay connected.

For more information, see Impact:

Reference to service information

Valve Assembly, Clutch Control Valve 4119-03-02-01 (41183-2)



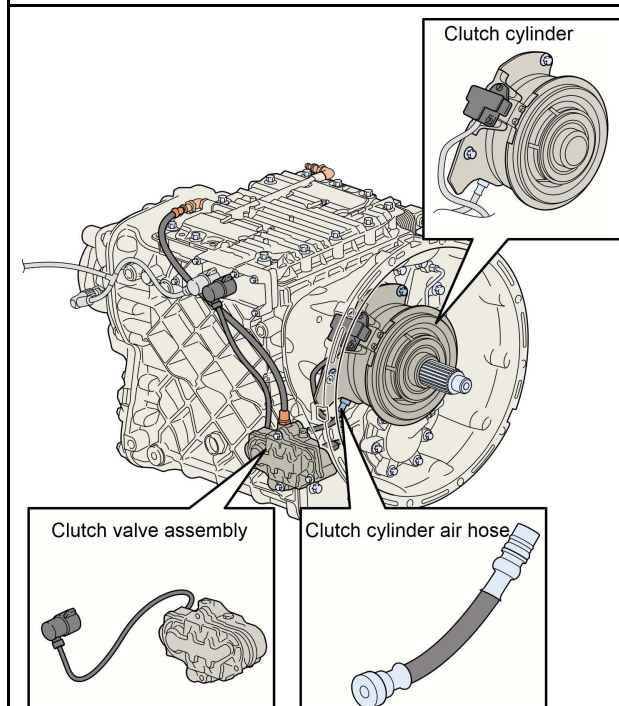
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Sup- ply Voltage level .	ON	1 — 2	B26B.Pin 1 – B26B.Pin 2	V = 4.75 V to 5V		88890039

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1061 - 54, Clutch Cylinder Slipping Point Position

Component Location:



T1162134

Fault type	Condition for Fault	Observable Symptoms	Possible cause
P1061 FTB 54	- Calibration has not been done. - Software error.	It is not possible to drive the vehicle.	- The clutch is not calibrated. - Software error.

Connect TECHTOOL to the vehicle and run the **4320-07-03-01 Transmission, clutch, engagement point** calibration operation.

The diagnostic trouble code (DTC) is still present, continue fault tracing the circuit

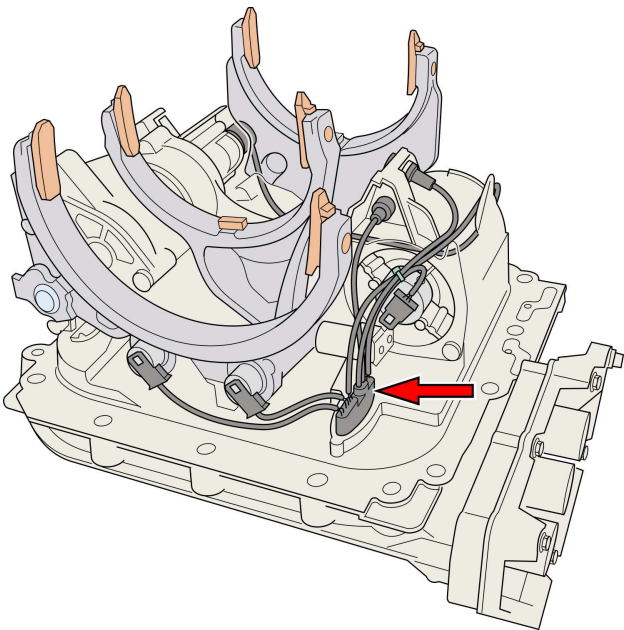
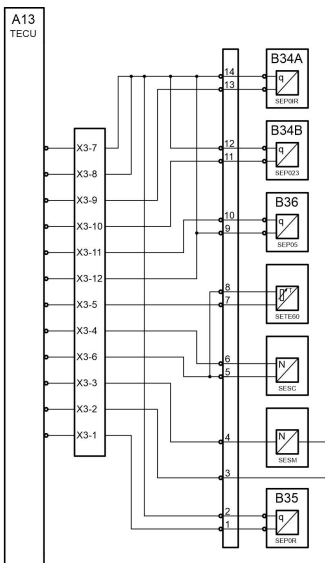
Note: The diagnostic trouble code (DTC) is still present, continue fault tracing the circuit.

Connect TECHTOOL to the vehicle and run the **1700-08-03-39 Program control unit - Reload software** programming operation.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1059 - 16, Gearbox Oil Temperature Sensor (SETeGO)

Component Location:	Schematics:
 T1162312	 X3:5 - SETe6O:7 (Signal) X3:6 - SETe6O:8 (Sensor ground) T1162313

Fault type	Condition for Fault	Observable Symptoms	Detailed Information
P1059 FTB 16	The Voltage at Pin X3:5 is less than Normal.	- Connector. - Control Housing wiring harness. - Transmission Control Unit (TECU).	The Transmission Oil Temperature sensor is an internal part of the Control housing wiring harness.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

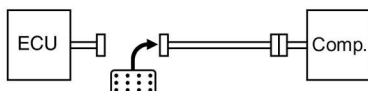
**CAUTION**

Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.



Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Component, Short Circuit between wires .	OFF	5 — 6	A13.X3 :5 – A13.X3:6	R = 3.6KΩ – 8.7KΩ		9990008
Check Component, Short Circuit between wires .	OFF	5 — 7	A13.X3 :5 – A13.X3:7	R ≥ 500 KΩ		9990008
Check Component, Short Circuit between wires .	OFF	5 — 8	A13.X3 :5 – A13.X3:8	R ≥ 500 KΩ		9990008
Check Component, Short Circuit between wires .	OFF	5 — 12	A13.X3 :5 – A13.X3:12	R ≥ 500 KΩ		9990008

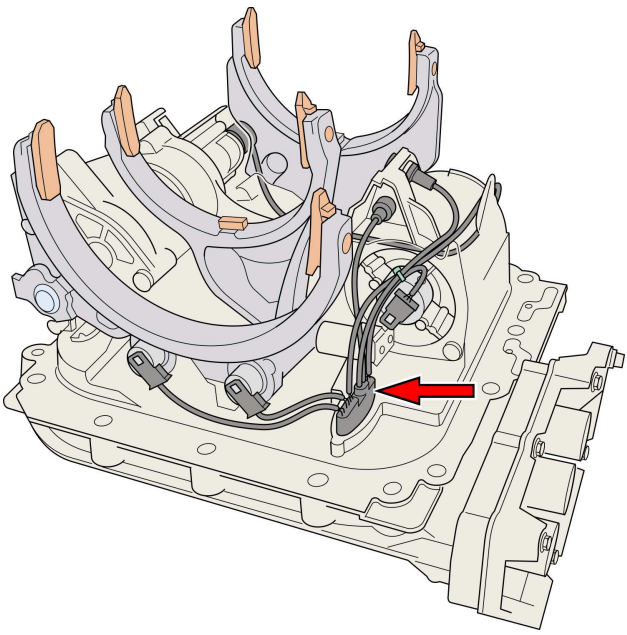
Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

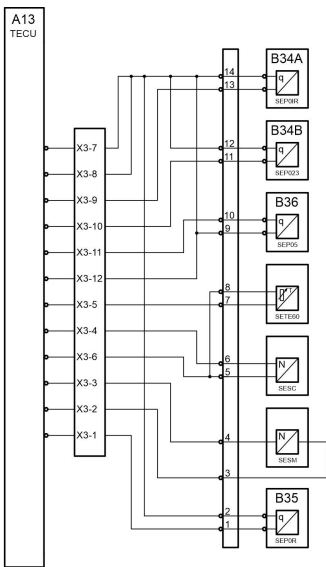
TECU - P1059 - 18, Gearbox Oil Temperature Sensor (SETeGO)

Component Location:



T1162312

Schematics:



X3:5 - SETeGO:7 (Signal)
X3:6 - SETeGO:8 (Sensor ground)

T1162313

Fault type	Condition for Fault	Probable cause	Detailed Information
P1059 FTB 18	Open circuit on Pin X3:5.	- Oil temperature sensor, transmission. - Transmission Control Unit (TECU).	The Sensor is an internal part of the Control Housing wiring harness.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

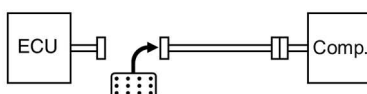
**CAUTION**

Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.



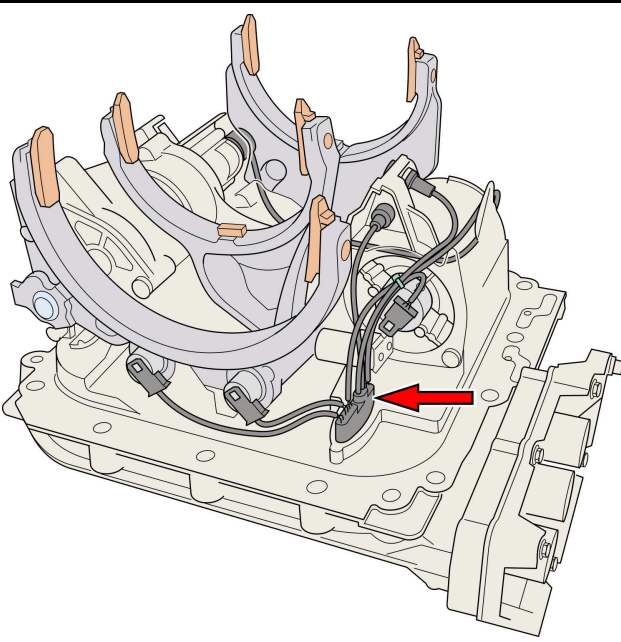
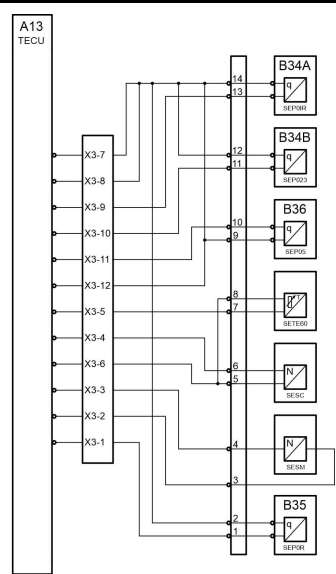
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check Component, Short Circuit between wires .	OFF	5 — 6	A13.X3 :5 – A13.X3:6	R = 3.6KΩ – 8.7KΩ		9990008

Verification:**CAUTION**

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1059 - 22, Gearbox Oil Temperature Sensor (SETeGO)

Component Location:	Schematics:
 T1162312	 X3:5 - SETe6O:7 (Signal) X3:6 - SETe6O:8 (Sensor ground) T1162313

Fault type	Condition for Fault	Observable symptoms	Probable cause
P1059 FTB 22	- Temperature above normal. - Condition 1: Temperature is more than 100 °C for at least 5 h.	Transmission high oil temperature warning.	- Poor cooling. - Lubrication and Oil System. - Low oil level. - Oil leakage.

Test instruction

Purpose:	Evaluation:
- Check engine coolant level. - Check transmission oil level.	Are the fluids at an acceptable level?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Transmission	- Check for oil leakage on the transmission. - Check for coolant leakage.	Is there leakage?

Test instruction

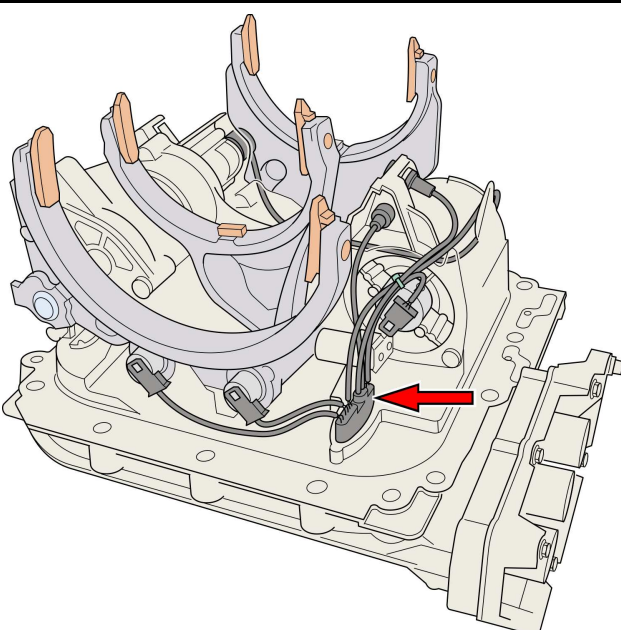
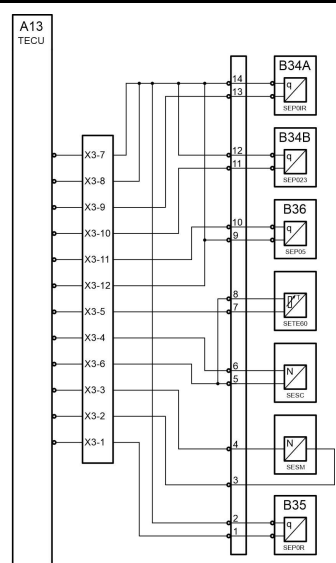
 CAUTION			
HOT TRANSMISSION! Use caution when installing test equipment and keep yourself away from hot transmission components. A hot transmission can damage test equipment and can cause personal injury due to burns.			
Purpose:	Components:	Action:	Evaluation:

Check engine oil temperature (EOT) sensor signal.	Oil temperature sensor.	- Special tools: Thermometer. - Point the thermometer in the area(s) as illustrated. - Compare sensor value with external thermometer value.	Does temperature sensor show correct temperature?
Check if any newly repaired, serviced or replaced parts in Transmission and oil cooler are fully functioning.	Transmission Oil Cooler.	Check if any additional equipment or installations are interfering with transmission cooling.	Are the installations correct?
Perform a visual check.	- Transmission Oil Cooler. - Coolant hose.	- Leakage from hoses or connections. - Check for cracks, cuts or chafe. - Restrictions.	Is the component free from faults?

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1059 - 92, Gearbox Oil Temperature Sensor (SETeGO)

Component Location:	Schematics:
 T1162312	 X3:5 - SETeGO:7 (Signal) X3:6 - SETeGO:8 (Sensor ground) T1162313

Fault type	Condition for Fault	Observable symptoms	Probable cause
P1059 FTB 92	- Temperature above normal. - Condition 2: Temperature is more than 120 °C for at least 10 min.	Transmission high oil temperature warning.	- Poor cooling. - Lubrication and Oil System. - Low oil level. - Oil leakage.

Test instruction

Purpose:	Evaluation:
- Check engine coolant level. - Check transmission oil level.	Are the fluids at an acceptable level?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Transmission	- Check for oil leakage on the transmission. - Check for coolant leakage.	Is there leakage?

Test instruction

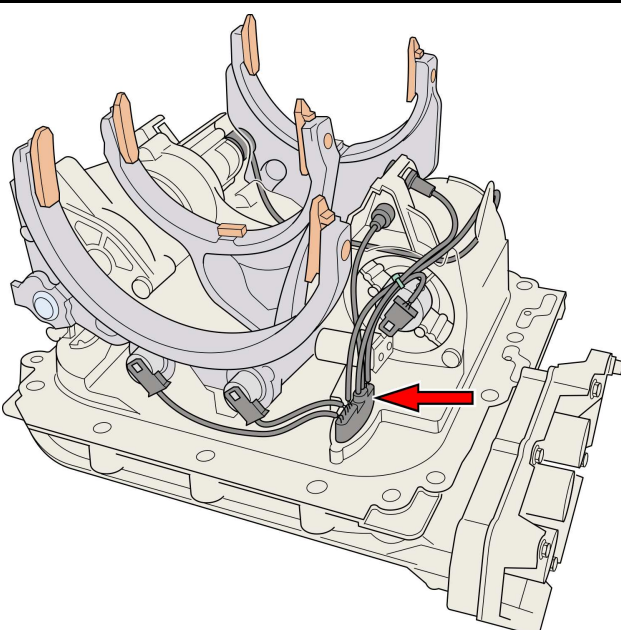
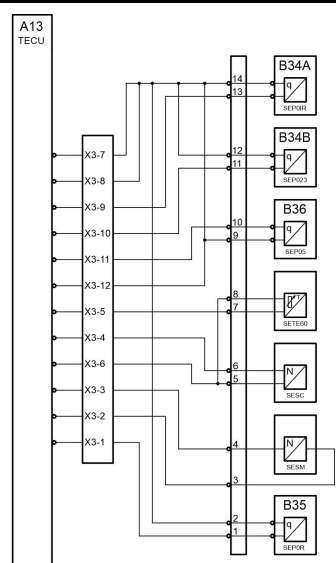
 CAUTION			
HOT TRANSMISSION! Use caution when installing test equipment and keep yourself away from hot transmission components. A hot transmission can damage test equipment and can cause personal injury due to burns.			
Purpose:	Components:	Action:	Evaluation:

Check engine oil temperature (EOT) sensor signal.	Oil temperature sensor.	- Special tools: Thermometer. - Point the thermometer in the area(s) as illustrated. - Compare sensor value with external thermometer value.	Does temperature sensor show correct temperature?
Check if any newly repaired, serviced or replaced parts in Transmission and oil cooler are fully functioning.	Transmission Oil Cooler.	Check if any additional equipment or installations are interfering with transmission cooling.	Are the installations correct?
Perform a visual check.	- Transmission Oil Cooler. - Coolant hose.	- Leakage from hoses or connections. - Check for cracks, cuts or chafe. - Restrictions.	Is the component free from faults?

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1059 - 98, Gearbox Oil Temperature Sensor (SETeGO)

Component Location:	Schematics:
 T1162312	 X3:5 - SETeGO:7 (Signal) X3:6 - SETeGO:8 (Sensor ground) T1162313

Fault type	Condition for Fault	Observable symptoms	Probable cause
P1059 FTB 22	- Temperature above normal. - Condition 3: Temperature is more than 140 °C for at least 30 s.	Transmission high oil temperature warning.	- Poor cooling. - Lubrication and Oil System. - Low oil level. - Oil leakage.

Test instruction

Purpose:	Evaluation:
- Check engine coolant level. - Check transmission oil level.	Are the fluids at an acceptable level?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Transmission	- Check for oil leakage on the transmission. - Check for coolant leakage.	Is there leakage?

Test instruction

 CAUTION			
HOT TRANSMISSION! Use caution when installing test equipment and keep yourself away from hot transmission components. A hot transmission can damage test equipment and can cause personal injury due to burns.			
Purpose:	Components:	Action:	Evaluation:

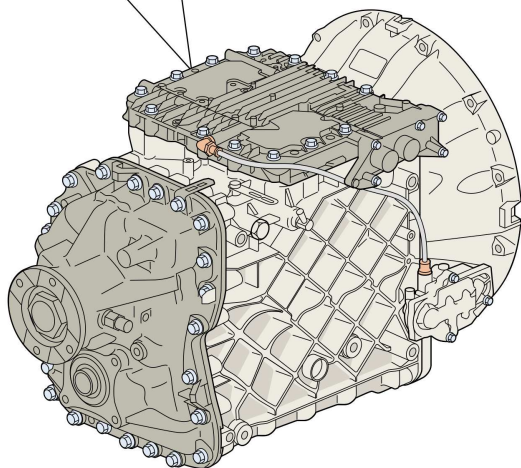
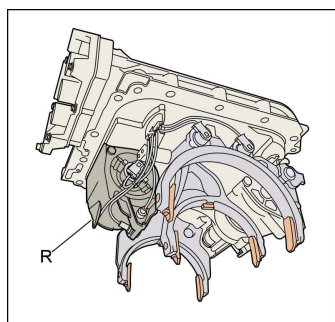
Check engine oil temperature (EOT) sensor signal.	Oil temperature sensor.	- Special tools: Thermometer. - Point the thermometer in the area(s) as illustrated. - Compare sensor value with external thermometer value.	Does temperature sensor show correct temperature?
Check if any newly repaired, serviced or replaced parts in Transmission and oil cooler are fully functioning.	Transmission Oil Cooler.	Check if any additional equipment or installations are interfering with transmission cooling.	Are the installations correct?
Perform a visual check.	- Transmission Oil Cooler. - Coolant hose.	- Leakage from hoses or connections. - Check for cracks, cuts or chafe. - Restrictions.	Is the component free from faults?

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1072 - 77, Range Engagement System

Component Location:



T1162314

Fault type	Condition for Fault	Observable symptoms	Probable cause
P1072 FTB 77	Not possible to engage low range gear.	• Loss of torque. • Slow gear changes. • Poor accelerator pedal (AP) response. • Incorrect gear selection.	• Gear and engaging clutch teeth. • Gear wheel. • Brass lugs. • Seals, solenoid valve. • Detent assembly. • Piston rod. • Transmission Control Module (TCM).

Test instruction

Precondition:	Action:	Evaluation:
• Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	• Listen for air leakage from the control housing. • Check that the connections do not leak. • Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-02 Range Cylinder** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Tests operation.

Test instruction

Purpose:	Components:	Action:	Evaluation:
Check detent assembly .	Detent assembly.	Check that the detent assembly is not damaged.	Is the detent assembly fault free?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	- Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Description:	Evaluation:
- Check that the gear and engaging sleeve clutch teeth are not damaged. - Check that the cylinder piston rod is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged. - Check the synchronizer ring for wear or damage.	Worn gear or engaging sleeve clutch teeth. Damaged cylinder piston rod. Damaged brass lugs. Faulty selector forks. Faulty Synchronizer components. No damaged component.

Repair instructions

For more information, see Impact:

Reference to service information

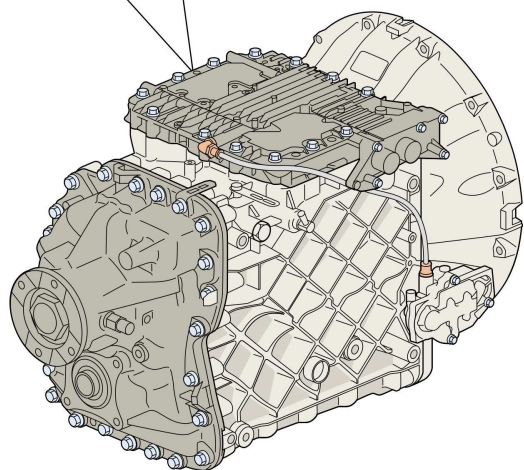
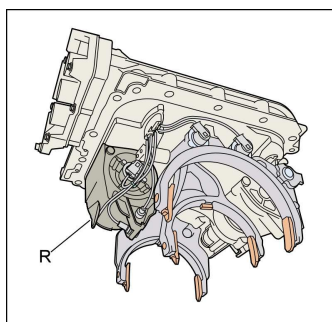
Range Sync. 4315-03-02-02 (43926-2)

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1072 - 92, Range Engagement System

Component Location:



T1162314

Fault type	Condition for Fault	Observable symptoms	Probable cause
P1072 FTB 92	High range gear jumps out.	Loss of torque.	- Gear and engaging sleeve back-taper. - Gear wheel. - Brass lugs. - Detent assembly. - Piston rod. - Transmission Control Module (TCM).

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Test instruction

Purpose:	Components:	Action:	Evaluation:
Check detent assembly .	Detent assembly.	Check that the detent assembly is not damaged.	Is the detent assembly fault free?

Connect TECHTOOL to the vehicle and run the **4320-08-03-02 Range Cylinder** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Purpose:	Components:	Action:	Evaluation:
Check Push rod.	Push rod.	Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Description:	Evaluation:
Proceed according to instructions in Impact - Check that the gear and engaging sleeve clutch teeth are not damaged. - Check that the cylinder piston rod is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged cylinder piston rod. Damaged brass lugs. Faulty selector forks. No damaged component.

Verification:



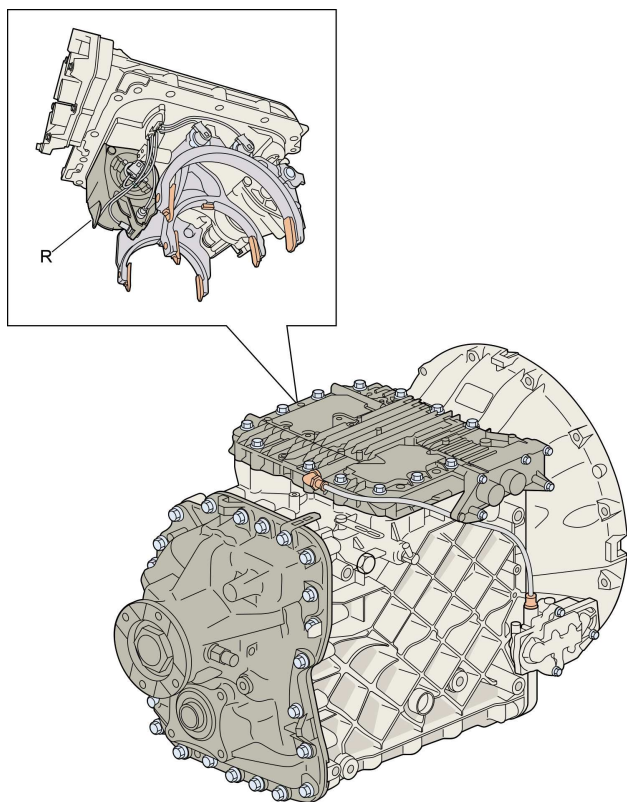
CAUTION

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Conditions:	Evaluation:
Verification.	• Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1072 - 94, Range Engagement System

Component Location:



T1162314

Fault type	Condition for Fault	Observable symptoms	Probable cause
P1072 FTB 94	Low range gear jumps out.	Loss of torque.	- Gear and engaging sleeve back-taper. - Gear wheel. - Brass lugs. - Detent assembly. - Piston rod. - Transmission Control Module (TCM).

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Test instruction

Purpose:	Components:	Action:	Evaluation:
Check detent assembly .	Detent assembly.	Check that the detent assembly is not damaged.	Is the detent assembly fault free?

Connect TECHTOOL to the vehicle and run the **4320-08-03-02 Range Cylinder Tests** operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Purpose:	Components:	Action:	Evaluation:
Check Push rod.	Push rod.	Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

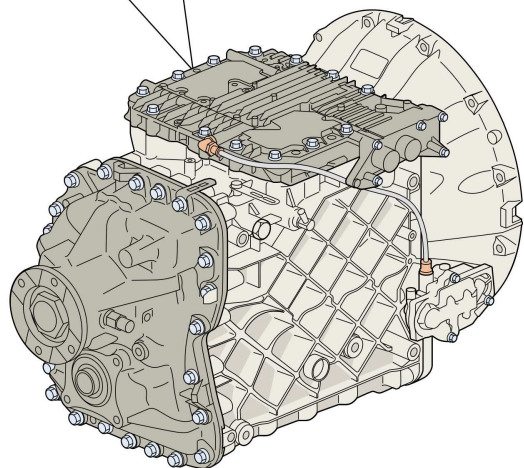
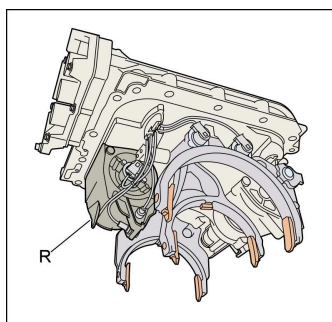
Description:	Evaluation:
Proceed according to instructions in Impact - Check that the gear and engaging sleeve clutch teeth are not damaged. - Check that the cylinder piston rod is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged cylinder piston rod. Damaged brass lugs. Faulty selector forks. No damaged component.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Conditions:	Evaluation:
Verification.	Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1072 - 97, Range Engagement System

Component Location:



T1162314

Fault type	Condition for Fault	Observable symptoms	Probable cause
P1072 FTB 97	Not possible to engage high range gear.	• Loss of torque. • Slow gear changes. • Poor accelerator pedal (AP) response. • Incorrect gear selection.	• Gear and engaging sleeve back-taper. • Gear wheel. • Brass lugs. • Seals, solenoid valve. • Detent assembly. • Piston rod. • Transmission Control Module (TCM).

Test instruction

Precondition:	Action:	Evaluation:
• Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	• Listen for air leakage from the control housing. • Check that the connections do not leak. • Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-02 Range Cylinder Tests** operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Tests operation.

Test instruction

Purpose:	Components:	Action:	Evaluation:
Check detent assembly .	Detent assembly.	Check that the detent assembly is not damaged.	Is the detent assembly fault free?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	- Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Check Push rod.	Push rod.	Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Description:	Evaluation:
- Check that the gear and engaging sleeve clutch teeth are not damaged. - Check that the cylinder piston rod is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged. - Check the synchronizer ring for wear or damage.	Worn gear or engaging sleeve clutch teeth. Damaged cylinder piston rod. Damaged brass lugs. Faulty selector forks. Faulty Synchronizer components No damaged component.

Verification:



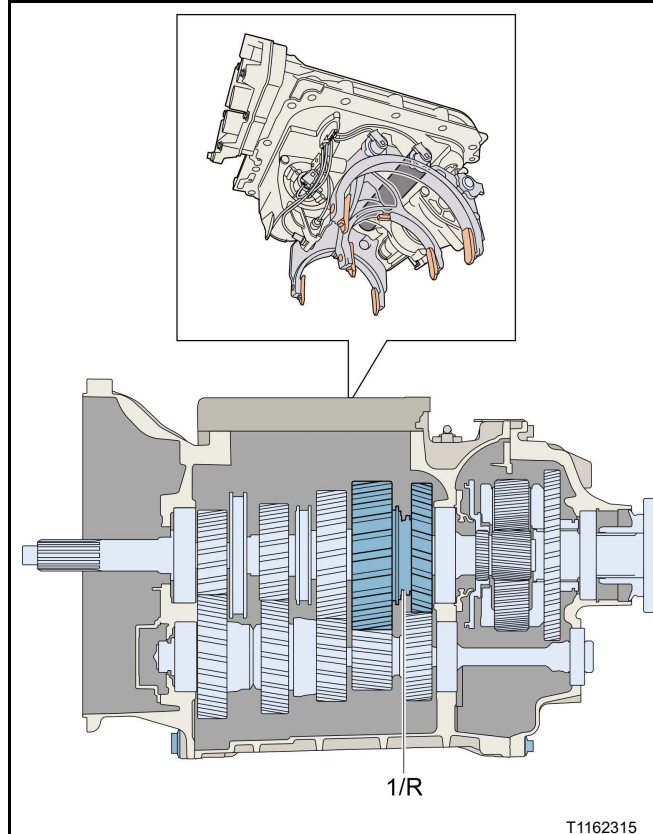
CAUTION

There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.

Purpose:	Conditions:	Evaluation:
Verification.	• Start the engine and let it idle.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1073 - 71, Gears 1 and R Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1073 FTB 71	Not possible to engage neutral gear.	Slow gear changes.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Seals, solenoid valve. - Piston rod. - Engaging sleeve.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Restore after the performed procedure

- Restore all connectors, wires and covers.

Continue.

Connect TECHTOOL to the vehicle and run the **4320-08-03-24 Gear Selector Cylinder 1/Reverse** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Tests operation.

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

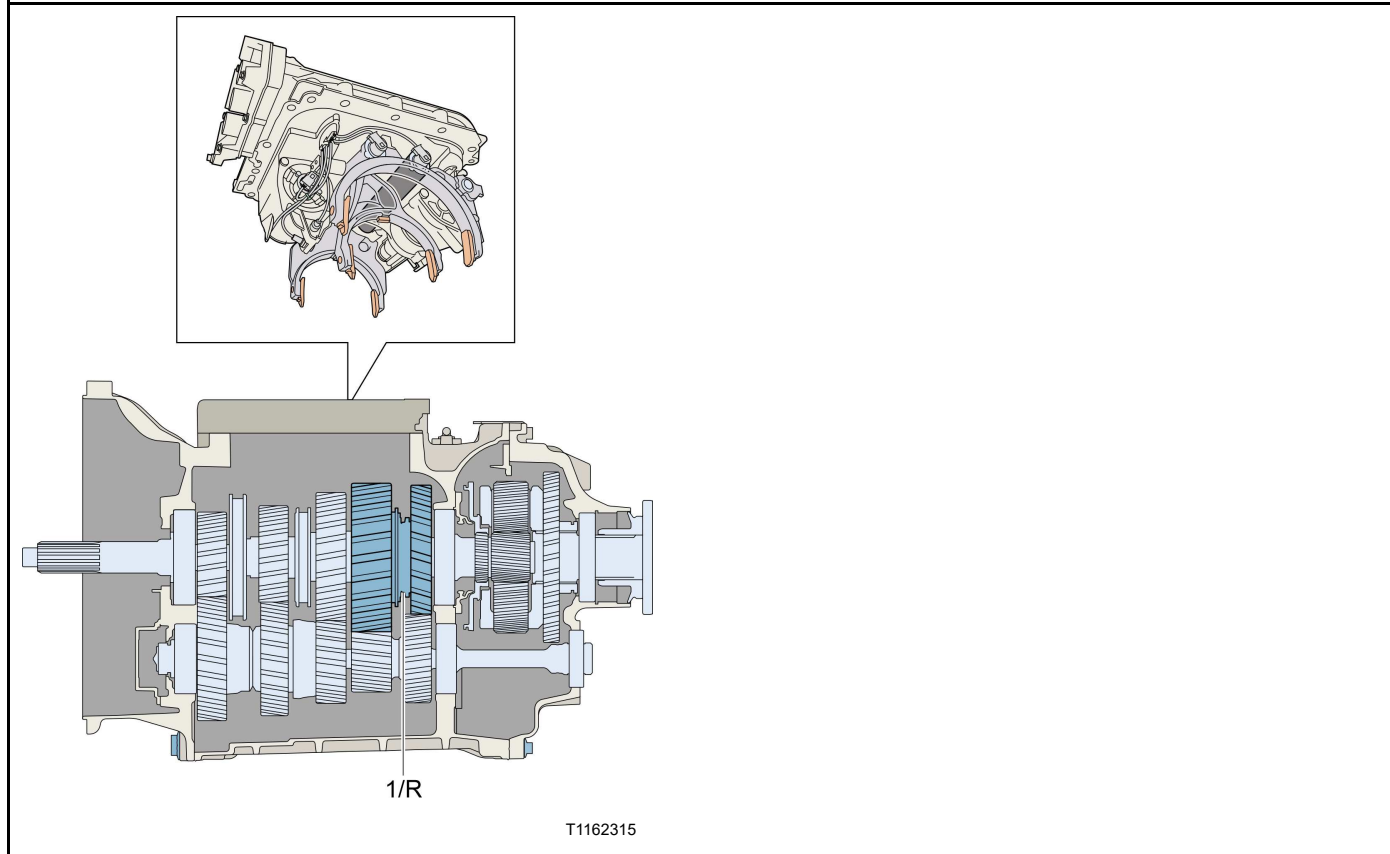
Description:	Evaluation:
• Check that the detent assembly is not damaged. • Check if any of the brass lugs are damaged. • Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
• Check that the engaging sleeve can move back and forth.	Is it possible to move the engaging sleeve?

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Start the engine and let it idle.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1073 - 77, Gears 1 and R Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1073 FTB 77	Not possible to engage reverse gear.	Slow gear changes.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Seals, solenoid valve. - Gear and engaging clutch teeth. - Piston rod. - Gear wheel.

Detailed information

The reverse gear cannot engage but the system will try to engage it as long as the gear shift lever is in the reverse position

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-24 Gear Selector Cylinder 1/Reverse** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Tests operation.

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

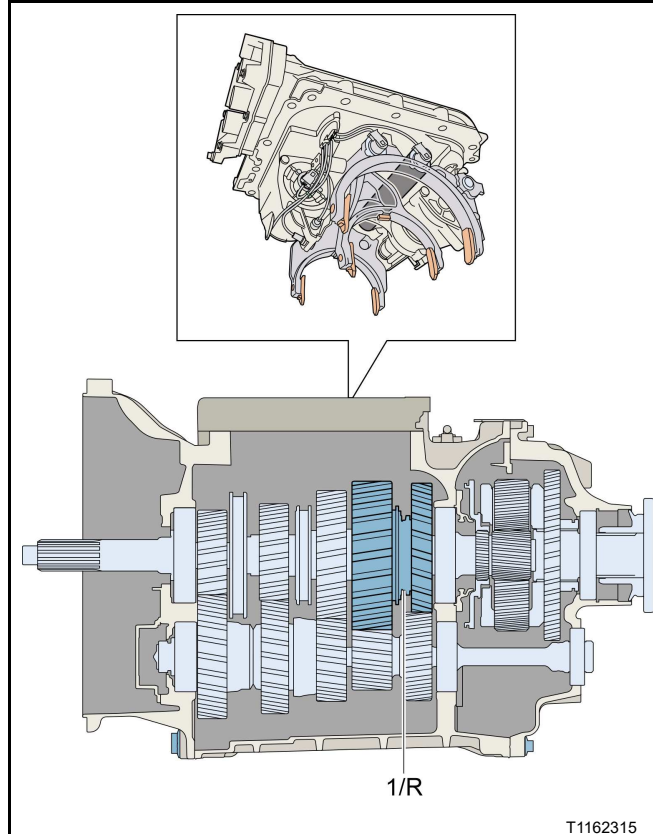
Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
- Check that engaging sleeve clutch teeth are not damaged. - Check that the gear wheels are undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged gear wheel. No damaged component.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Start the engine and let it idle.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1073 - 92, Gears 1 and R Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1073 FTB 92	Reverse gear jumps out.	Reverse gear jumps out.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Clutch teeth, engaging sleeve. - Piston rod. - Main shaft hub. - Gear wheel.
Detailed information Activation - Wiring harness between component connector and electronic control unit (ECU) connector. - Position sensor, gear selector cylinder for gear 1 and reverse.			

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-24 Gear Selector Cylinder 1/Reverse** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

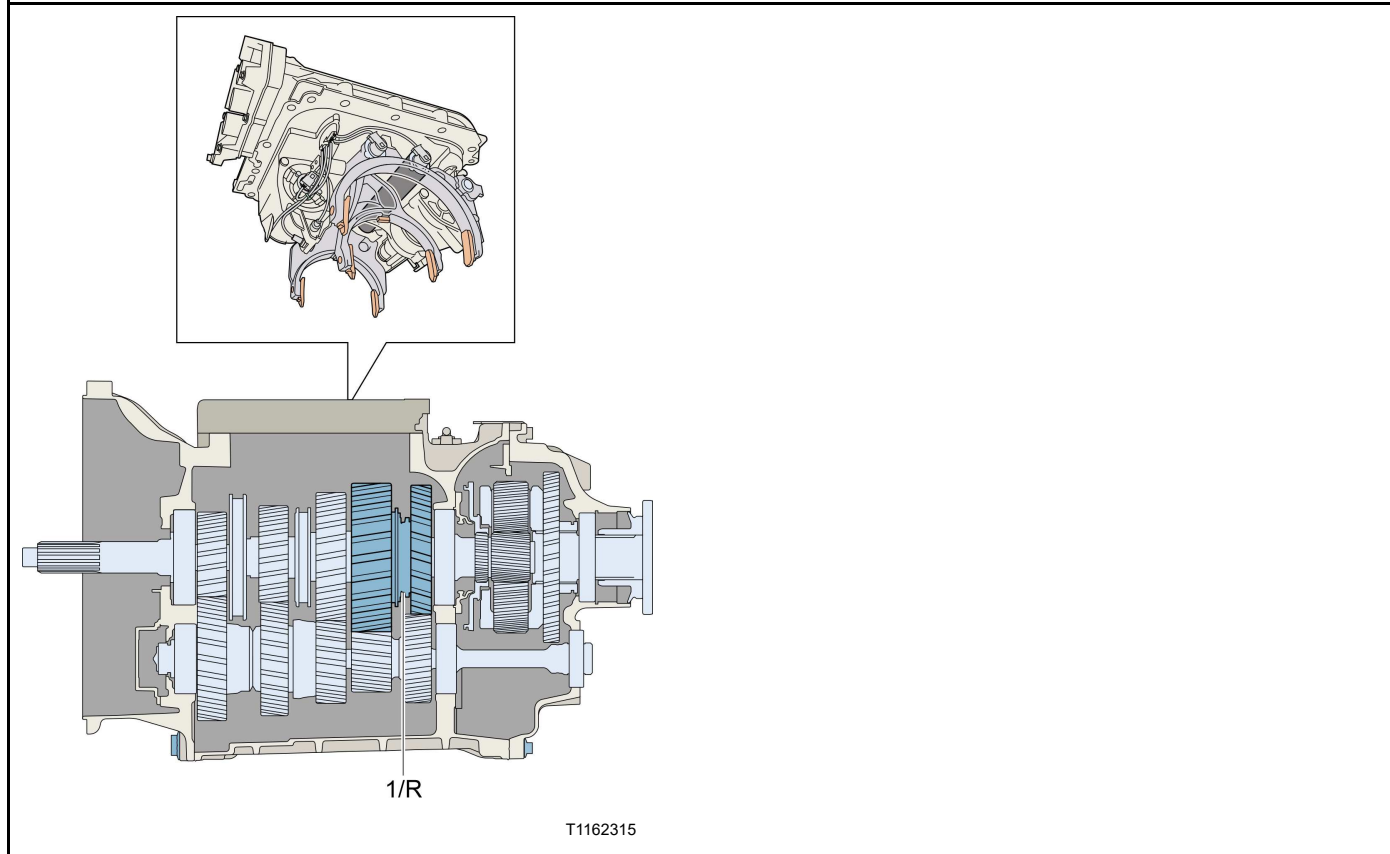
Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
- Check that engaging sleeve clutch teeth are not damaged. - Check that the gear wheels are undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged gear wheel. No damaged component.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1073 - 94, Gears 1 and R Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1073 FTB 94	Unintentional gear engagement.	- Loss of torque. - Slow gear changes.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Piston rod.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

**CAUTION**

Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Restore after the performed procedure

- Restore all connectors, wires and covers.

Continue.

Connect TECHTOOL to the vehicle and run the **4320-08-03-24 Gear Selector Cylinder 1/Reverse** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

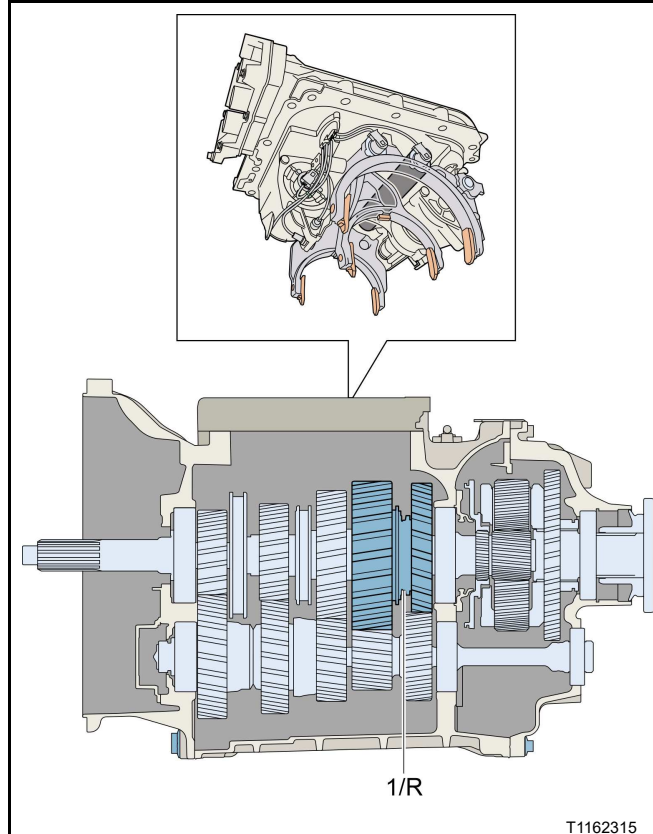
Description:	Evaluation:
• Check that the detent assembly is not damaged. • Check if any of the brass lugs are damaged. • Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1073 - 96, Gears 1 and R Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1073 FTB 96	- First gear jumps out. - The condition(s) must be fulfilled 3 times in order for the DTC to set.	Loss of torque.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Clutch teeth, engaging sleeve. - Piston rod. - Main shaft hub. - Gear wheel.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Restore after the performed procedure

- Restore all connectors, wires and covers.

Continue.

Connect TECHTOOL to the vehicle and run the **4320-08-03-24 Gear Selector Cylinder 1/Reverse** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)



CAUTION

Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

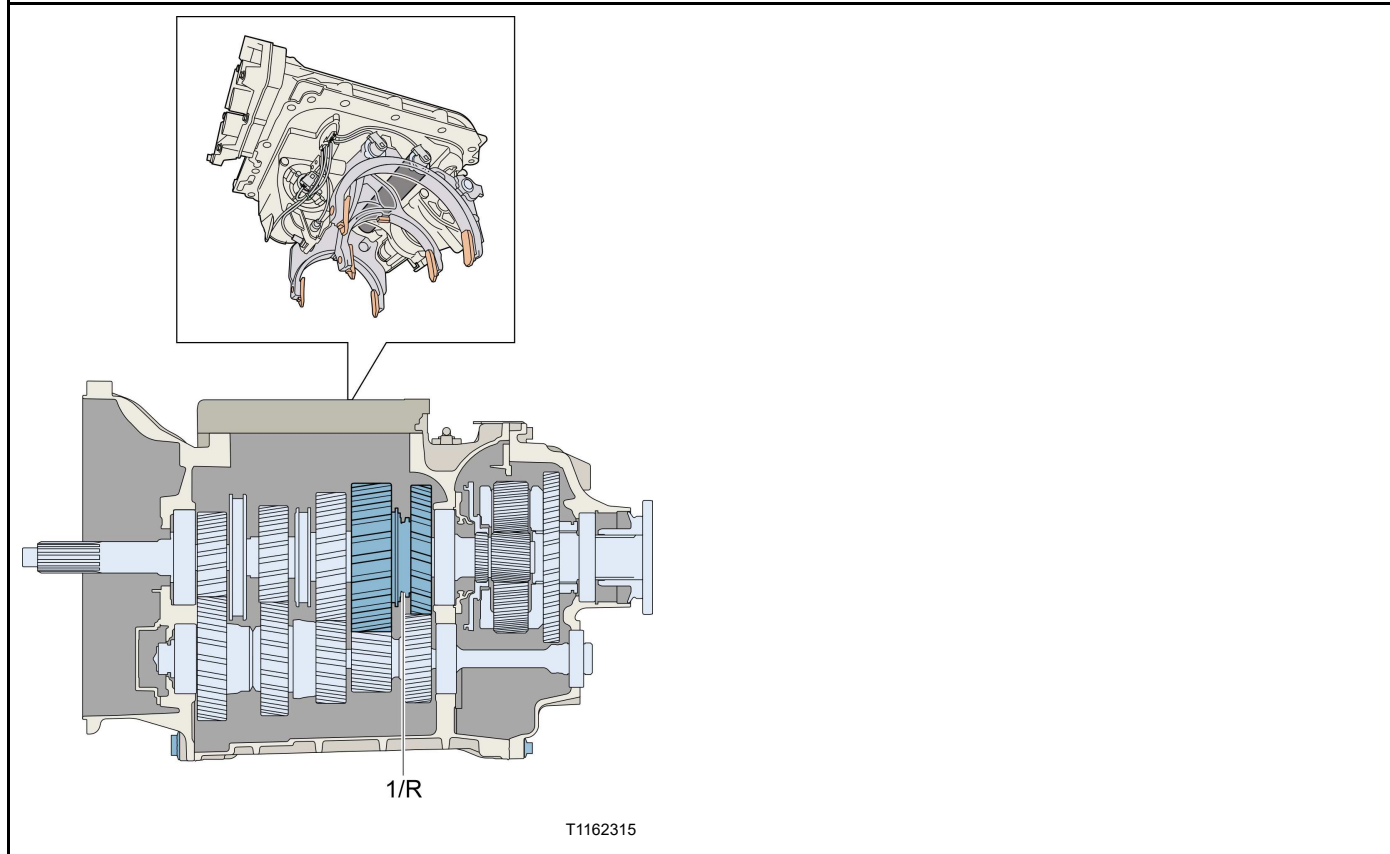
Description:	Evaluation:
• Check that the detent assembly is not damaged. • Check if any of the brass lugs are damaged. • Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
• Check that engaging sleeve clutch teeth are not damaged. • Check that the gear wheels are undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged gear wheel. No damaged component.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1073 - 97, Gears 1 and R Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1073 FTB 97	Not possible to engage first gear.	- Loss of torque. - Slow gear changes. - Poor accelerator pedal (AP) response. - Incorrect gear selection.	- Loss of torque. - Brass lugs. - Transmission Control Module (TCM). - Seals, solenoid valve. - Gear and engaging clutch teeth. - Piston rod. - Gear wheel.

Detailed information

- The first gear will not be selected by the system for a short while. After five successful gearshifts a new attempt to use the gear may be made.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-24 Gear Selector Cylinder 1/Reverse** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Tests operation.

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

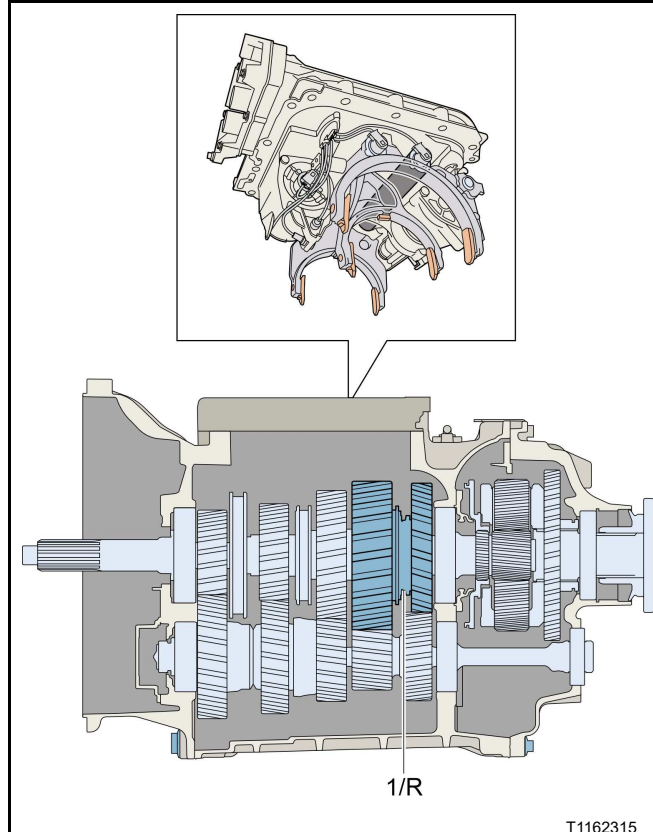
Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
- Check that engaging sleeve clutch teeth are not damaged. - Check that the gear wheels are undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged gear wheel. No damaged component.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Start the engine and let it idle.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1074 - 71, Gears 2 and 3 Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1074 FTB 71	Not possible to engage neutral gear.	Slow gear changes.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Seals, solenoid valve. - Piston rod. - Engaging sleeve.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-05 Gear Selector Cylinder 2/3 Tests** operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Tests operation.

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

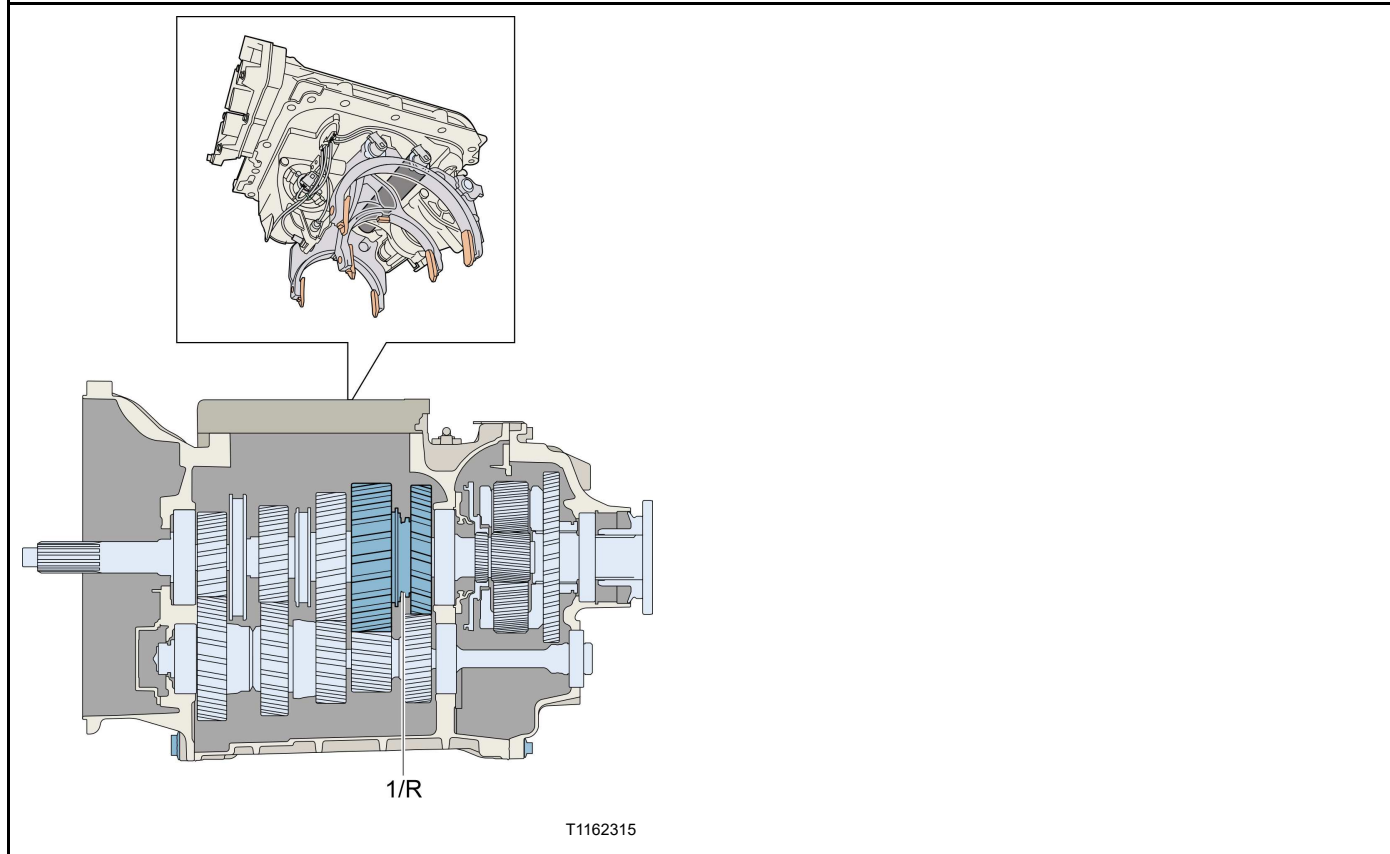
Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
Check that the engaging sleeve can move back and forth.	Is it possible to move the engaging sleeve?

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Start the engine and let it idle.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1074 - 77, Gears 2 and 3 Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1074 FTB 77	Not possible to engage third gear.	- Loss of torque. - Slow gear changes. - Poor accelerator pedal (AP) response. - Incorrect gear selection.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Seals, solenoid valve. - Gear and engaging clutch teeth. - Piston rod. - Gear wheel.

Detailed information

The first gear will not be selected by the system for a short while. After five successful gearshifts a new attempt to use the gear may be made.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-05 Gear Selector Cylinder 2/3** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Tests operation.

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

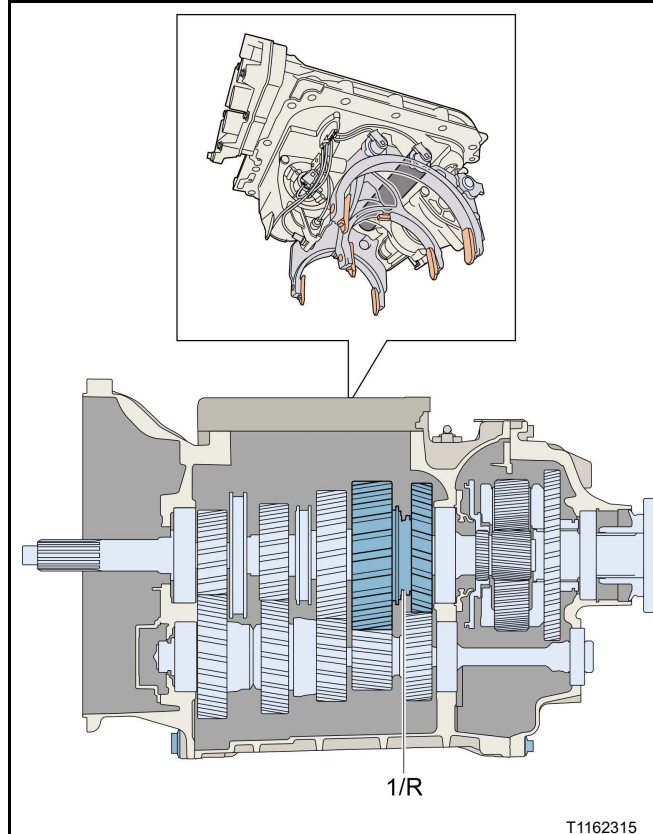
Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
- Check that engaging sleeve clutch teeth are not damaged. - Check that the gear wheels are undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged gear wheel. No damaged component.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Start the engine and let it idle.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1074 - 92, Gears 2 and 3 Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1074 FTB 92	Third gear jumps out.	Loss of torque.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Clutch teeth, engaging sleeve. - Piston rod. - Main shaft hub. - Gear wheel.
Detailed information Activation - Wiring harness between component connector and electronic control unit (ECU) connector. - Position sensor, gear selector cylinder for gear 2 and 3.			

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-05 Gear Selector Cylinder 2/3** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

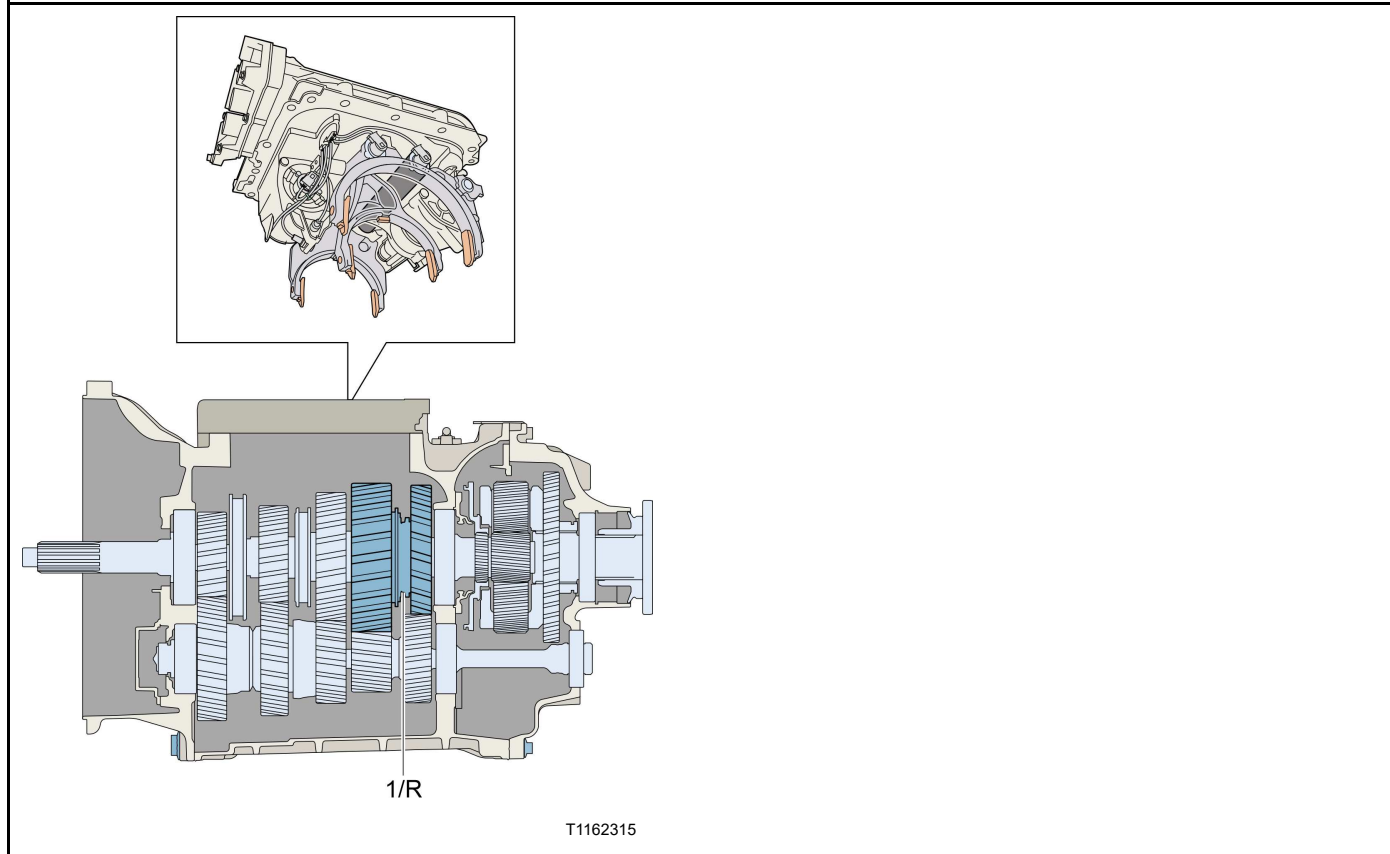
Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
- Check that engaging sleeve clutch teeth are not damaged. - Check that the gear wheels are undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged gear wheel. No damaged component.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1074 - 94, Gears 2 and 3 Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1074 FTB 94	Unintentional gear engagement.	Slow gear changes.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Piston rod.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Test instruction

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

**CAUTION**

Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Restore after the performed procedure

- Restore all connectors, wires and covers.

Continue.

Connect TECHTOOL to the vehicle and run the **4320-08-03-05 Gear Selector Cylinder 2/3** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

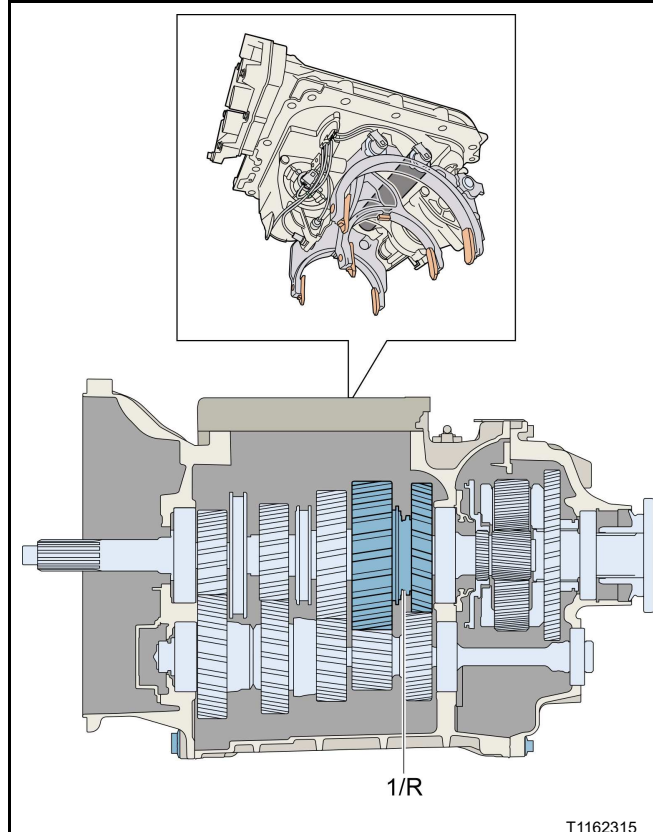
Description:	Evaluation:
• Check that the detent assembly is not damaged. • Check if any of the brass lugs are damaged. • Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1074 - 96, Gears 2 and 3 Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1074 FTB 96	- Second gear jumps out. - The condition(s) must be fulfilled 3 times in order for the DTC to set.	Loss of torque.	- Control housing detent assembly. - Brass lugs. - Transmission Control Module (TCM). - Cylinder stroke. - Clutch teeth, engaging sleeve. - Piston rod. - Main shaft hub. - Gear wheel.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	- Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-05 Gear Selector Cylinder 2/3** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Action:	Evaluation:
Check that the components (Push rod) move freely by moving them back and forth.	Is the piston moving?

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

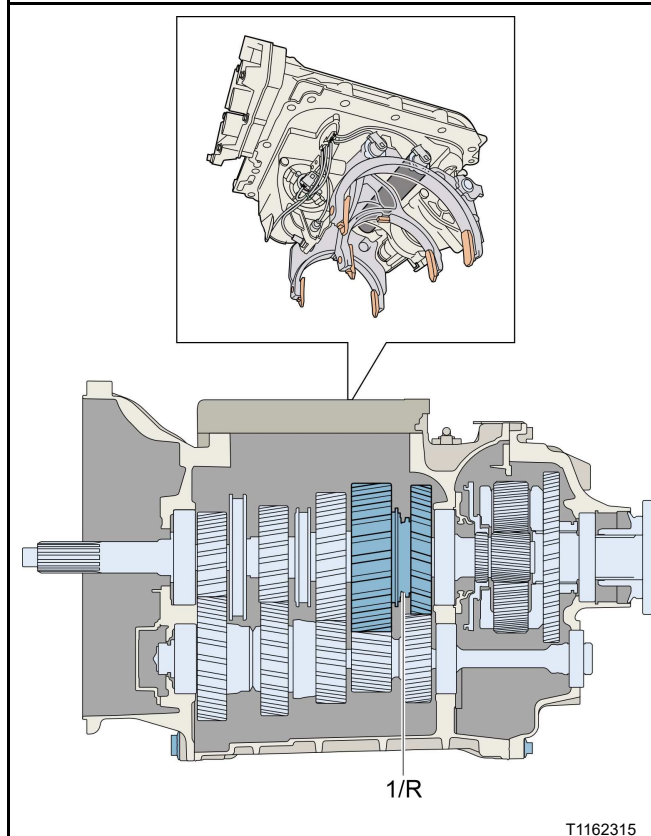
Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
- Check that engaging sleeve clutch teeth are not damaged. - Check that the gear wheels are undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged gear wheel. No damaged component.

Verification:

 CAUTION		
There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	Drive in typical city conditions (several 45 s - 120 s periods of idling, accelerations and low speed driving around 30 kph) with the conditions fulfilled for at least 30 min.	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P1074 - 97, Gears 2 and 3 Engagement System

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P1074 FTB 97	Not possible to engage second gear.	• Loss of torque. • Slow gear changes. • Poor accelerator pedal (AP) response. • Incorrect gear selection.	• Control housing detent assembly. • Brass lugs. • Transmission Control Module (TCM). • Seals, solenoid valve. • Gear and engaging clutch teeth. • Piston rod. • Gear wheel.

Detailed information

- The second gear will not be selected by the system for a short while. After five successful gearshifts a new attempt to use the gear may be made.

Test instruction

Precondition:	Action:	Evaluation:
• Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	• Listen for air leakage from the control housing. • Check that the connections do not leak. • Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

Connect TECHTOOL to the vehicle and run the **4320-08-03-05 Gear Selector Cylinder 2/3** Tests operation.

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Connect TECHTOOL to the vehicle and run the **4320-08-03-40 Gears** Tests operation.

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Position sensor, gear selector cylinder for gear 1 and reverse.	1 - Inspect Position sensor, gear selector cylinder for gear 1 and reverse. - Inspect Bracket. 2 - Check that the component is correctly installed. - Check for damage.	Is the sensor correctly installed?

Test instruction

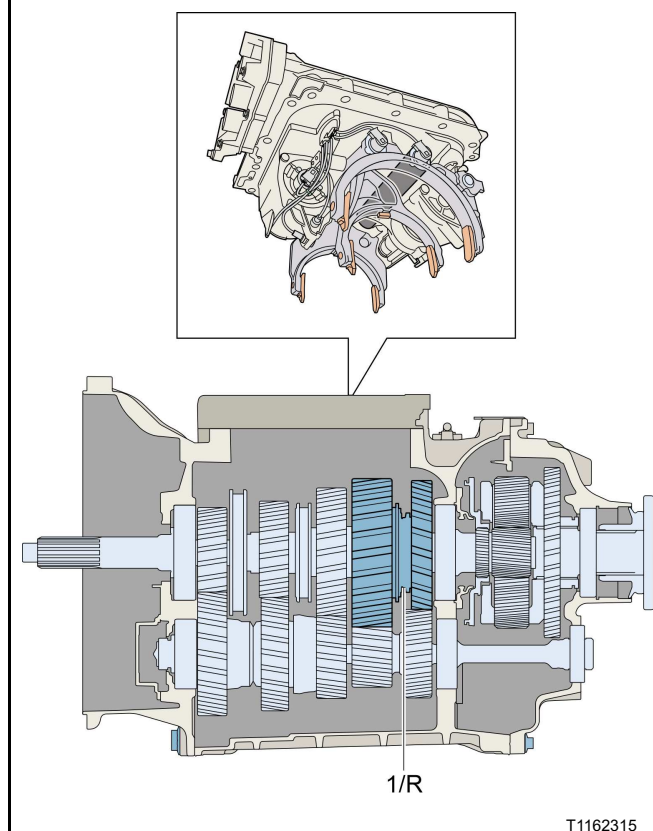
Description:	Evaluation:
- Check that the detent assembly is not damaged. - Check if any of the brass lugs are damaged. - Check if the shift fork is secured onto the rod and is undamaged.	Damaged detent assembly. Damaged brass lugs. Faulty selector forks. No damaged component.
- Check that engaging sleeve clutch teeth are not damaged. - Check that the gear wheels are undamaged.	Worn gear or engaging sleeve clutch teeth. Damaged gear wheel. No damaged component.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Start the engine and let it idle.	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P1076 - 94, Transmission Brake (Countershaft Brake / Input Shaft Brake)

Component Location:



T1162315

Fault type	Condition for Fault	Observable symptoms	Probable cause
P1076 FTB 94	The transmission brake (countershaft brake / input shaft brake) does not brake when the valve is activated.	• Slow gear changes.	• Clutch plate package. • Seal, brake cylinder. • Air line. • Gasket between control housing and transmission housing. • O-ring between upper cover and control housing. • Transmission brake (countershaft brake / input shaft brake) cover. • Clutch. • Transmission Control Module (TCM).

Connect TECHTOOL to the vehicle and run the **4313-08-03-01 Solenoid valve, Transmission brake (Input shaft brake/ Countershaft brake)** Tests operation.

Test instruction

Precondition:	Action:	Evaluation:
Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle.	Listen for air leakage from the control housing. - Check that the connections do not leak. - Check if the upper cover is leaking air	Is the control housing free from leakage?
Note: The control housing must be in the vehicle when performing the check.		

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Connect TECHTOOL to the vehicle and run the **4313-08-04-01 Solenoid valve, Transmission brake (Input shaft brake/ Countershaft brake)(Transmission removed)Check the system for air leakage** Tests operation.

If the above operation result is NO:

Continue the next step and Evaluate

- The air line is leaking.
- Damaged gasket between control housing and transmission housing.
- The O-ring leaks.

If the above operation result is YES:

Continue the next step

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Test instruction

Purpose:	Action:	Evaluation:
Visual inspection.	Check that the transmission housing air line is not clogged.	Is the air line fault free?

Purpose:	Components:	Action:	Evaluation:
Transmission brake (Countershaft brake / Input shaft brake), check.	Transmission brake (countershaft brake / input shaft brake) cover.	Inspect transmission brake (countershaft brake / input shaft brake) cover for excessive wear grooves.	Was the cover free from excessive wear?

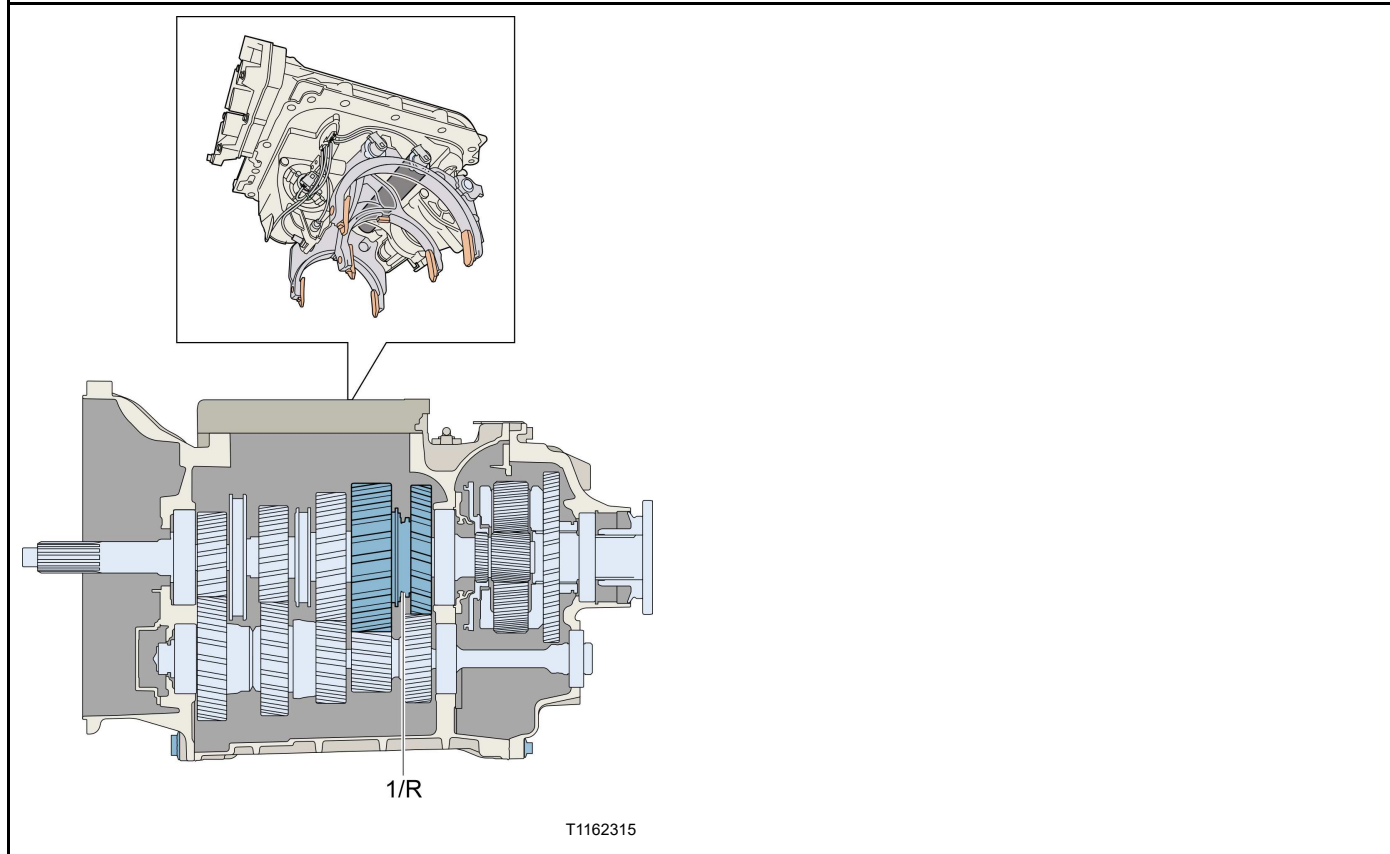
Purpose:	Components:	Action:	Evaluation:
- Perform a visual check. - Check for damage.	- Clutch plate. - Pressure plate. - Flywheel.	Clutch plate - Check that the spring is undamaged. - Check the clutch plate for wear. Pressure plate - Check for signs of excessive heat. - Check the surface for signs of damage and/or signs of foreign debris. Flywheel - Check if there are signs of blue annealing on the flywheel. - Check the surface for signs of damage and/or signs of foreign debris.	Choose one of the following reasons for fault. - Clutch plate. - Pressure plate. - Flywheel. - No fault.

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	- Ignition key in OFF position. - Wait 5 seconds. - Ignition key in ON position. - Wait 1 minute(s) and continue verification by reading out fault codes..	- If the DTC is not set during the verification the fault may be corrected - The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. - The DTC may appear later when the vehicle has been returned to service.

TECU - P10AE - 81, Engaged Gear in Neutral

Component Location:



Fault type	Condition for Fault	Observable symptoms	Probable cause
P10AE FTB 81	Gear engaged with cylinder position sensor indicating neutral position. Gear engaged with cylinder position sensor indicating neutral position.	Gear shifting inoperative.	- Countershaft speed sensor. - Selector forks. - Transmission oil level. - Piston rod.

Test instruction

Purpose:	Action:	Evaluation:
Oil level, check.	Check transmission oil level.	Is the oil level above the low limit for correct level?

If the above test result is No:

Continue the next step

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Transmission.	Check for oil leakage on the transmission.	Is the component free from leakage?

If the previous test result is Yes:

Continue the next step

Test instruction

Purpose:	Components:	Action:	Evaluation:
Visual inspection.	Propeller shaft.	Propeller shaft, check.	Is the propeller shaft removed from the transmission?
Note: If the propeller shaft is dismantled (this is necessary for towing the vehicle to the workshop), there are some checks that should be performed first.			

Test instruction

Purpose:	Action:	Evaluation:
Transmission in neutral position, check.	- The gear selector must be in position N (Neutral). - Turn the ignition key to ON position. - Check that neutral gear is indicated on the Instrument Cluster. - Turn the ignition key to OFF position. - Check if the transmission is in neutral by turning its output shaft.	Is it possible to turn the output shaft by hand?

Action: Mount the propeller shaft on the gearbox output shaft Continue fault tracing

Test instruction

Purpose:	Action:	Evaluation:
Make the Transmission control unit (TECU) perform a second check on the fault.	- Turn the ignition key to ON position. - Make sure that the air pressure is at least 650 kPa (94.2745 psi) in the vehicle. - The gear selector must be in position N (Neutral). - Apply the parking brake. - Keep a foot on the service brake. - Start the engine. - Wait 30 seconds.	The Transmission control unit (TECU) will perform an additional check to see if the transmission can be put in neutral

Note: Continue and the system will read out the status of the diagnostic trouble code (DTC)

The transmission must be removed from the vehicle before the control housing can be removed

Remove the transmission

For more information, see Impact:

Reference to service information

Transmission, remove (Impact operation: 4311-01-01-01(43170-01))

Repair instructions

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Removal 4329-01-01-01 (43222-1)

Note: Damages can be difficult to detect, sufficient light and a magnifying glass are recommended.

For more information, see Impact:

Reference to service information

Upper Cover, Control Housing, Replace 4329-03-04-05 (43271-4)

**CAUTION**

Electrical components, including the wiring harness inside the transmission control housing, are delicate. Handle with extreme care. Failure to do so may result in damage to components.

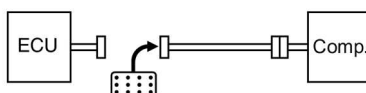
Action:	Evaluation:
- Remove component, Upper cover. - Visually check that X3 wiring harness is not damaged. - Visually check soldering points.	Is the wiring harness free from obvious faults?

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Countershaft speed sensor, check.	Speed sensor, counter shaft.	Check that the sensor is correctly installed.	Is the sensor correctly installed?

Connector check: X3

Purpose:	Action:	Evaluation:
Check connector X3.	- Check that the connectors are properly connected and locked into position - Disconnect and check the component connector. - Inspect pins and terminals for oxidations or corrosion. - Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets. - Check the pins and terminal are not damaged (which can cause poor connection). - Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition	None.

Resistance measurement

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Check component (Speed sensor, counter shaft).	OFF	6 — 4	A13.X3 Pin 6 — A13.X3 Pin 4	R = 950Ω — 1150KΩ		9990008 (Grey test pins)

Test instruction

Description:	Evaluation:
- Check if the shift fork's physical attachment to the actuator is adequate. - Check if any of the brass lugs are damaged. - Check the position of the selector forks in the transmission.	Faulty selector forks. Damaged brass lugs. Damaged, Spring Pin. No damaged component

Test instruction

Purpose:	Component to be tested:	Action:	Evaluation:
Visual inspection.	Piston rod.	Visually check that component is not damaged.	Is the component free from faults?
Visual inspection.	Engaging sleeve.	Visually check that component is not damaged.	Is the component free from faults?

Test instruction

Purpose:	Evaluation:
Check that the engaging sleeve can move back and forth.	Is it possible to move the engaging sleeve?

Test instruction

Purpose:	Repair instructions:	Evaluation:
- Move the engaging sleeves to the neutral position. - Rotate the output shaft and check that the main shaft rotates independently of the gears.	For more information, see Impact: Reference to service information Transmission, disassemble-inspect-assemble (Transmission removed) 4311-06-04-01 (43187-4)	Does the main shaft rotate independently of the gears?
- Visual inspection, Main shaft. - Check the component for faults.	For more information, see Impact: Reference to service information Main shaft, overhaul 4313-04-05-01 (43173-5)	Check that the component free from faults?

Verification:

 CAUTION There is no communication with the vehicle. This is not the actual verification procedure. Information shown is the condition(s) how to verify the repair when connected to the vehicle.		
Purpose:	Action:	Evaluation:
Verification.	• Ignition key in OFF position. • Wait 5 seconds. • Ignition key in ON position. • Wait 1 minute(s) and continue verification by reading out fault codes..	• If the DTC is not set during the verification the fault may be corrected • The status of the diagnostic process in the control unit can not be tested without communication with the vehicle. • The DTC may appear later when the vehicle has been returned to service.

TECU - P107B- 86, Accelerator Pedal Position / Brake Switch Signal Performance

Component Location:

T1162852

Schematics:

T1162853

Fault type	Area	Condition for fault	DL
P107B FTB 86	Accelerator Pedal Position / Brake Switch Signal Performance.	Signal Invalid.	Backbone 1.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
- ECU hardware

Erroneous DTCs:

Some DTCs are considered erroneous or erratic. Inactive DTCs that cannot be duplicated under normal vehicle operation, may be erroneous and diagnostics are not always necessary. Erroneous data link DTCs can be caused by programming an ECU, low system voltage, poor ground connections, etc..

Non-responding Electronic Control Units:

Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

Third party Electronic Control Units (ECUs):

Some vehicles have customer added Electronic Control Units (ECUs) such as Qualcomm and PeopleNet PC If not connected correctly to the data link network, these Electronic Control Units (ECUs) can cause communication faults. If suspected, the recommendation is to disconnect the ECUs from the data link network.

Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

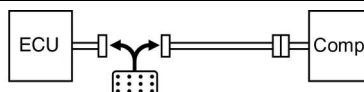
Select a data link and click **Update view**

Check for the following:

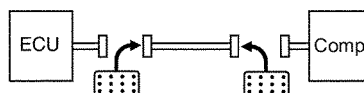
- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

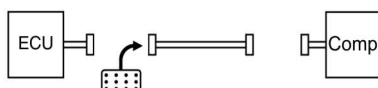
Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage signal check:

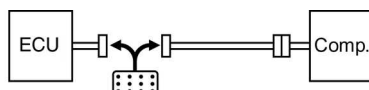
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Volt-age check	ON	8 — GND	A13.A Pin 8 — Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Volt-age check	ON	4 — GND	A13.A Pin 4 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 51	A13.A Pin 8 — A14.EB:51	R=0 Ω		88890195, 9990014, 9998699
Wiring harness check	OFF	4 — 55	A13.A Pin 4 — A14.EB:55	R=0 Ω		88890195, 9990014, 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — GND	A13.A Pin 8 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Wiring harness check	OFF	4 — GND	A13.A Pin 4 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 4	A13.A Pin 8 — A13.A Pin 4	R = 50 Ω — 70 Ω (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors.

A test drive may also be needed to recreate the conditions when the fault occurred

- 1 Set the multimeter to appropriate setting
- 2 Connect the tools according to the information in the choosen data link schematics
- 3 Once reading the values, press the MIN/MAX button
- 4 Wiggle the wires or perform a test drive while notifying the minimum and maximum values on the multimeter to find a bad contact

Control Unit:

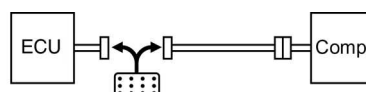
Select an Electronic Control unit (ECU) and then click "Update View" to display relevant information

Connector check:

Check for the following:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage supply check:



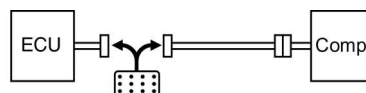
- Check fuses
- Check all relevant connectors for voltage supply and ground connection
- Check that correct voltage reaches the component
- Check ground wire for open circuit

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Ground check	OFF	15 — GND	A13.A Pin 15 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status						
Record the measured value						

System Reset:

A control unit may have been locked at start up and will need to be restarted Perform a refresh using the Function status below to attempt to get a response from a missing ECU If an ECU does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and re-connect before performing a second function status refresh Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery:

Note: If the battery readout value is 12 V or more, there is no need to perform a battery status check It is recommended to connect a battery charger during the fault tracing session

Battery cable connections:

• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:

 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

Out-of-vehicle

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

1700-21-03-04 Oscilloscope

The button will open the program in a new window outside of Tech Tool

After the program has been opened, Tech Tool can be viewed by minimizing the window

There are 2 type of tests

- **Standard:** Used for active faults
- **Wiggle wire:** Used for intermittent faults

Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

To evaluate if an action has solved the problem, either confirm that the DTC icon has disappeared from the ECU box in the image or click on the box to see if the DTC has changed status to inactive

Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U2005 - 08, CAN Communication Trailer Proprietary Net

Component Location:

T1162852

Schematics:

T1162853

Fault type	Area	Condition for fault	DL
U2005 FTB 08	CAN Communication Trailer Proprietary Net.	Bus Signal / Message Failures .	Backbone 1.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
- ECU hardware

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Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

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Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

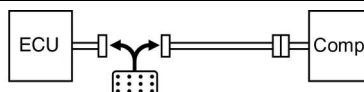
Select a data link and click **Update view**

Check for the following:

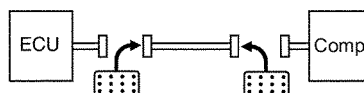
- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

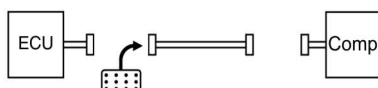
Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage signal check:

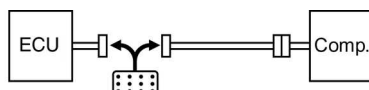
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Volt-age check	ON	8 — GND	A13.A Pin 8 — Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Volt-age check	ON	4 — GND	A13.A Pin 4 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 51	A13.A Pin 8 — A14.EB:51	$R=0\ \Omega$		88890195, 9990014, 9998699
Wiring harness check	OFF	4 — 55	A13.A Pin 4 — A14.EB:55	$R=0\ \Omega$		88890195, 9990014, 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — GND	A13.A Pin 8 — Chassis Ground	$R \geq 500\ K\Omega$		88890195, , 9998699
Wiring harness check	OFF	4 — GND	A13.A Pin 4 — Chassis Ground	$R \geq 500\ K\Omega$		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 4	A13.A Pin 8 — A13.A Pin 4	$R = 50\ \Omega - 70\ \Omega$ (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors.

A test drive may also be needed to recreate the conditions when the fault occurred

- 1 Set the multimeter to appropriate setting
- 2 Connect the tools according to the information in the choosen data link schematics
- 3 Once reading the values, press the MIN/MAX button
- 4 Wiggle the wires or perform a test drive while notifying the minimum and maximum values on the multimeter to find a bad contact

Control Unit:

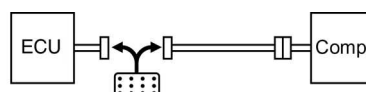
Select an Electronic Control unit (ECU) and then click "Update View" to display relevant information

Connector check:

Check for the following:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage supply check:



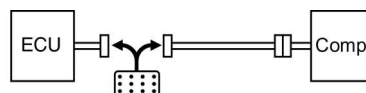
- Check fuses
- Check all relevant connectors for voltage supply and ground connection
- Check that correct voltage reaches the component
- Check ground wire for open circuit

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Ground check	OFF	15 — GND	A13.A Pin 15 — Chassis Ground	R = 0 Ω		88890195, , 9998699
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Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery:

Note: If the battery readout value is 12 V or more, there is no need to perform a battery status check It is recommended to connect a battery charger during the fault tracing session

Battery cable connections:

• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:

 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

Out-of-vehicle

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

1700-21-03-04 Oscilloscope

The button will open the program in a new window outside of Tech Tool

After the program has been opened, Tech Tool can be viewed by minimizing the window

There are 2 type of tests

- **Standard:** Used for active faults
- **Wiggle wire:** Used for intermittent faults

Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

To evaluate if an action has solved the problem, either confirm that the DTC icon has disappeared from the ECU box in the image or click on the box to see if the DTC has changed status to inactive

Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U0103- 00, Lost Communication With Gear Shift Control Module A

Component Location:

T1162852

Schematics:

T1162853

Fault type	Area	Condition for fault	DL
U0103 FTB 00	Lost Communication With Gear Shift Control Module A.	Signal Failure.	Backbone 1.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
- ECU hardware

Erroneous DTCs:

Some DTCs are considered erroneous or erratic. Inactive DTCs that cannot be duplicated under normal vehicle operation, may be erroneous and diagnostics are not always necessary. Erroneous data link DTCs can be caused by programming an ECU, low system voltage, poor ground connections, etc..

Non-responding Electronic Control Units:

Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

Third party Electronic Control Units (ECUs):

Some vehicles have customer added Electronic Control Units (ECUs) such as Qualcomm and PeopleNet PC If not connected correctly to the data link network, these Electronic Control Units (ECUs) can cause communication faults. If suspected, the recommendation is to disconnect the ECUs from the data link network.

Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

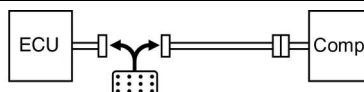
Select a data link and click **Update view**

Check for the following:

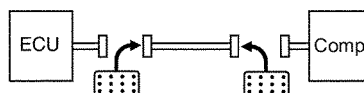
- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

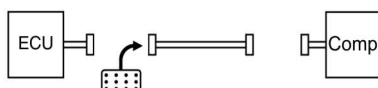
Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage signal check:

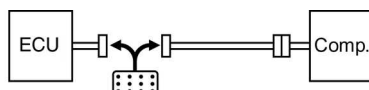
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Volt-age check	ON	8 — GND	A13.A Pin 8 — Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Volt-age check	ON	4 — GND	A13.A Pin 4 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 51	A13.A Pin 8 — A14.EB:51	R=0 Ω		88890195, 9990014, 9998699
Wiring harness check	OFF	4 — 55	A13.A Pin 4 — A14.EB:55	R=0 Ω		88890195, 9990014, 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — GND	A13.A Pin 8 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Wiring harness check	OFF	4 — GND	A13.A Pin 4 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 4	A13.A Pin 8 — A13.A Pin 4	R = 50 Ω — 70 Ω (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors.

A test drive may also be needed to recreate the conditions when the fault occurred

- 1 Set the multimeter to appropriate setting
- 2 Connect the tools according to the information in the choosen data link schematics
- 3 Once reading the values, press the MIN/MAX button
- 4 Wiggle the wires or perform a test drive while notifying the minimum and maximum values on the multimeter to find a bad contact

Control Unit:

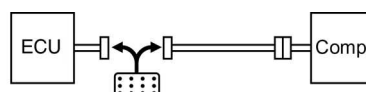
Select an Electronic Control unit (ECU) and then click "Update View" to display relevant information

Connector check:

Check for the following:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage supply check:



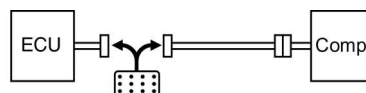
- Check fuses
- Check all relevant connectors for voltage supply and ground connection
- Check that correct voltage reaches the component
- Check ground wire for open circuit

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Ground check	OFF	15 — GND	A13.A Pin 15 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status Record the measured value						

System Reset:

A control unit may have been locked at start up and will need to be restarted Perform a refresh using the Function status below to attempt to get a response from a missing ECU If an ECU does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and re-connect before performing a second function status refresh Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery:

Note: If the battery readout value is 12 V or more, there is no need to perform a battery status check It is recommended to connect a battery charger during the fault tracing session

Battery cable connections:

• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:

 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

Out-of-vehicle

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

1700-21-03-04 Oscilloscope

The button will open the program in a new window outside of Tech Tool

After the program has been opened, Tech Tool can be viewed by minimizing the window

There are 2 type of tests

- **Standard:** Used for active faults
- **Wiggle wire:** Used for intermittent faults

Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

To evaluate if an action has solved the problem, either confirm that the DTC icon has disappeared from the ECU box in the image or click on the box to see if the DTC has changed status to inactive

Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U0001- 88, CAN Communication Backbone 2 Net

Component Location:

T1162852

Schematics:

T1162854

Fault type	Area	Condition for fault	DL
U0001 FTB 88	CAN Communication Backbone 2 Net.	Bus off.	Backbone 2.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
- ECU hardware

Erroneous DTCs:

Some DTCs are considered erroneous or erratic. Inactive DTCs that cannot be duplicated under normal vehicle operation, may be erroneous and diagnostics are not always necessary. Erroneous data link DTCs can be caused by programming an ECU, low system voltage, poor ground connections, etc..

Non-responding Electronic Control Units:

Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

Third party Electronic Control Units (ECUs):

Some vehicles have customer added Electronic Control Units (ECUs) such as Qualcomm and PeopleNet PC If not connected correctly to the data link network, these Electronic Control Units (ECUs) can cause communication faults. If suspected, the recommendation is to disconnect the ECUs from the data link network.

Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

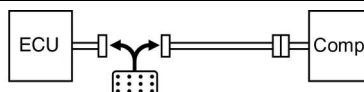
Select a data link and click **Update view**

Check for the following:

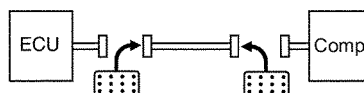
- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

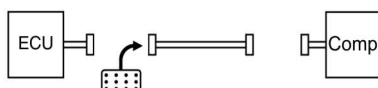
Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage signal check:

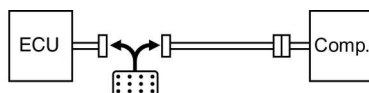
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Voltage check	ON	14 — GND	A13.A Pin 14 — Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Voltage check	ON	11 — GND	A13.A Pin 11 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	11 — 21	A13.A Pin 11 — A14.EB:21	$R=0\ \Omega$		88890195, 9990014, 9998699
Wiring harness check	OFF	14 — 22	A13.A Pin 14 — A14.EB:22	$R=0\ \Omega$		88890195, 9990014, 9998699
Note: See schematics for connector pins Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	11 — GND	A13.A Pin 11 — Chassis Ground	$R \geq 500\ K\Omega$		88890195, , 9998699
Wiring harness check	OFF	14 — GND	A13.A Pin 14 — Chassis Ground	$R \geq 500\ K\Omega$		88890195, , 9998699
Note: See schematics for connector pins Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	11 — 14	A13.A Pin 11 — A13.A Pin 14	$R = 50\ \Omega - 70\ \Omega$ (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors.

A test drive may also be needed to recreate the conditions when the fault occurred

- 1 Set the multimeter to appropriate setting
- 2 Connect the tools according to the information in the choosen data link schematics
- 3 Once reading the values, press the MIN/MAX button
- 4 Wiggle the wires or perform a test drive while notifying the minimum and maximum values on the multimeter to find a bad contact

Control Unit:

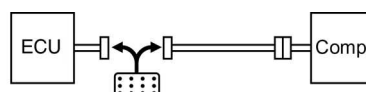
Select an Electronic Control unit (ECU) and then click "Update View" to display relevant information

Connector check:

Check for the following:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage supply check:



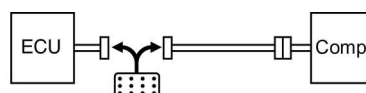
- Check fuses
- Check all relevant connectors for voltage supply and ground connection
- Check that correct voltage reaches the component
- Check ground wire for open circuit

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Ground check	OFF	15 — GND	A13.A Pin 15 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						

System Reset:

A control unit may have been locked at start up and will need to be restarted Perform a refresh using the Function status below to attempt to get a response from a missing ECU If an ECU does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and re-connect before performing a second function status refresh Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery:

Note: If the battery readout value is 12 V or more, there is no need to perform a battery status check It is recommended to connect a battery charger during the fault tracing session

Battery cable connections:

• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:

 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

Out-of-vehicle

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

1700-21-03-04 Oscilloscope

The button will open the program in a new window outside of Tech Tool

After the program has been opened, Tech Tool can be viewed by minimizing the window

There are 2 type of tests

- **Standard:** Used for active faults
- **Wiggle wire:** Used for intermittent faults

Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

To evaluate if an action has solved the problem, either confirm that the DTC icon has disappeared from the ECU box in the image or click on the box to see if the DTC has changed status to inactive

Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U0010- 88, CAN Communication Backbone 1 Net

Component Location:

T1162852

Schematics:

T1162853

Fault type	Area	Condition for fault	DL
U0010 FTB 88	CAN Communication Backbone 1 Net.	Bus off.	Backbone 1.

372

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
- ECU hardware

Erroneous DTCs:

Some DTCs are considered erroneous or erratic. Inactive DTCs that cannot be duplicated under normal vehicle operation, may be erroneous and diagnostics are not always necessary. Erroneous data link DTCs can be caused by programming an ECU, low system voltage, poor ground connections, etc..

Non-responding Electronic Control Units:

Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

Third party Electronic Control Units (ECUs):

Some vehicles have customer added Electronic Control Units (ECUs) such as Qualcomm and PeopleNet PC If not connected correctly to the data link network, these Electronic Control Units (ECUs) can cause communication faults. If suspected, the recommendation is to disconnect the ECUs from the data link network.

Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

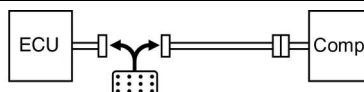
Select a data link and click **Update view**

Check for the following:

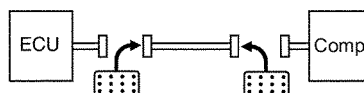
- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

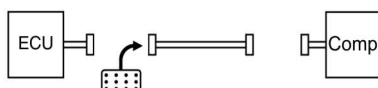
Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage signal check:

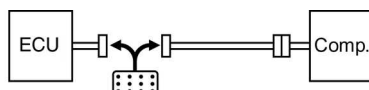
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Volt-age check	ON	8 — GND	A13.A Pin 8— Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Volt-age check	ON	4 — GND	A13.A Pin 4 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 51	A13.A:8 — A14. EB:51	R=0 Ω		88890195, 9990014, 9998699
Wiring harness check	OFF	4 — 55	A13.A:4 — A14. EB:55	R=0 Ω		88890195, 9990014, 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — GND	A13.A:8 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Wiring harness check	OFF	4 — GND	A13.A:4 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 4	A13.A:8 — A13.A:4	R = 50 Ω — 70 Ω (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors.

A test drive may also be needed to recreate the conditions when the fault occurred

- 1 Set the multimeter to appropriate setting
- 2 Connect the tools according to the information in the choosen data link schematics
- 3 Once reading the values, press the MIN/MAX button
- 4 Wiggle the wires or perform a test drive while notifying the minimum and maximum values on the multimeter to find a bad contact

Control Unit:

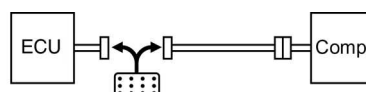
Select an Electronic Control unit (ECU) and then click "Update View" to display relevant information

Connector check:

Check for the following:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage supply check:



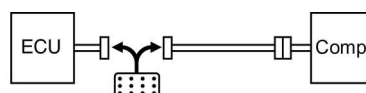
- Check fuses
- Check all relevant connectors for voltage supply and ground connection
- Check that correct voltage reaches the component
- Check ground wire for open circuit

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Ground check	OFF	15 — GND	A13.A Pin 15 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						

System Reset:

A control unit may have been locked at start up and will need to be restarted Perform a refresh using the Function status below to attempt to get a response from a missing ECU If an ECU does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and re-connect before performing a second function status refresh Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery:

Note: If the battery readout value is 12 V or more, there is no need to perform a battery status check It is recommended to connect a battery charger during the fault tracing session

Battery cable connections:

• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:

 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

Out-of-vehicle

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

1700-21-03-04 Oscilloscope

The button will open the program in a new window outside of Tech Tool

After the program has been opened, Tech Tool can be viewed by minimizing the window

There are 2 type of tests

- **Standard:** Used for active faults
- **Wiggle wire:** Used for intermittent faults

Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

To evaluate if an action has solved the problem, either confirm that the DTC icon has disappeared from the ECU box in the image or click on the box to see if the DTC has changed status to inactive

Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U0100- 00, Lost Communication with EMS

Component Location:

T1162852

Schematics:

T1162853

Fault type	Area	Condition for fault	Data Link
U0100 FTB 00	Lost Communication with EMS.	No engine speed signal from EMS.	Backbone 1.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
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Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

Third party Electronic Control Units (ECUs):

Some vehicles have customer added Electronic Control Units (ECUs) such as Qualcomm and PeopleNet PC If not connected correctly to the data link network, these Electronic Control Units (ECUs) can cause communication faults. If suspected, the recommendation is to disconnect the ECUs from the data link network.

Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

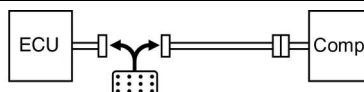
Select a data link and click **Update view**

Check for the following:

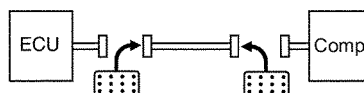
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Connector check:

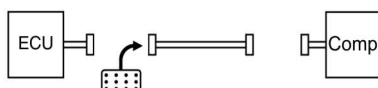
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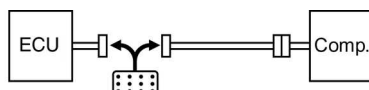
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
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Signal Volt-age check	ON	4 — GND	A13.A Pin 4 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 51	A13.A:8— A14. EB:51	R=0 Ω		88890195, 9990014, 9998699
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Note: See schematics for connector pins						
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Note: Remove the voltage by disconnecting the negative wire from the battery						
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		Breakout box	Wiring diagram			
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Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors.

A test drive may also be needed to recreate the conditions when the fault occurred

- 1 Set the multimeter to appropriate setting
- 2 Connect the tools according to the information in the choosen data link schematics
- 3 Once reading the values, press the MIN/MAX button
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Control Unit:

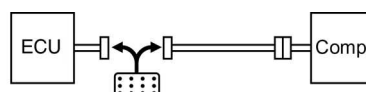
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Connector check:

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Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

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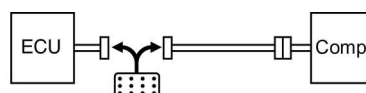
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Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
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System Reset:

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Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

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• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:

 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

Out-of-vehicle

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

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There are 2 type of tests

- **Standard:** Used for active faults
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Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

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Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U0140- 00, Lost Communication with VMCU

Component Location:

T1162852

Schematics:

T1162853

Fault type	Area	Condition for fault	Data Link
U0140 FTB 00	Lost Communication with VMCU.	No accelerator pedal signal from VMCU.	Backbone 1.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
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To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

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- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

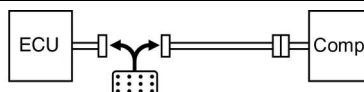
Select a data link and click **Update view**

Check for the following:

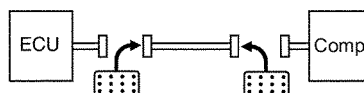
- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

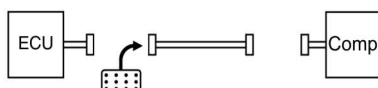
Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage signal check:

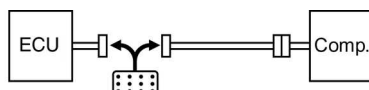
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Volt-age check	ON	8 — GND	A13.A Pin 8— Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Volt-age check	ON	4 — GND	A13.A Pin 4 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 51	A13.A:8— A14. EB:51	R=0 Ω		88890195, 9990014, 9998699
Wiring harness check	OFF	4 — 55	A13.A:4 — A14. EB:55	R=0 Ω		88890195, 9990014, 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — GND	A13.A:8 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Wiring harness check	OFF	4 — GND	A13.A:4 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 4	A13.A:8— A13.A:4	R = 50 Ω — 70 Ω (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors.

A test drive may also be needed to recreate the conditions when the fault occurred

- 1 Set the multimeter to appropriate setting
- 2 Connect the tools according to the information in the choosen data link schematics
- 3 Once reading the values, press the MIN/MAX button
- 4 Wiggle the wires or perform a test drive while notifying the minimum and maximum values on the multimeter to find a bad contact

Control Unit:

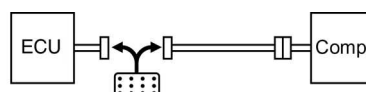
Select an Electronic Control unit (ECU) and then click "Update View" to display relevant information

Connector check:

Check for the following:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage supply check:



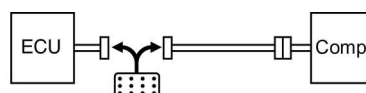
- Check fuses
- Check all relevant connectors for voltage supply and ground connection
- Check that correct voltage reaches the component
- Check ground wire for open circuit

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Ground check	OFF	15 — GND	A13.A Pin 15 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						

System Reset:

A control unit may have been locked at start up and will need to be restarted Perform a refresh using the Function status below to attempt to get a response from a missing ECU If an ECU does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and re-connect before performing a second function status refresh Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery:

Note: If the battery readout value is 12 V or more, there is no need to perform a battery status check It is recommended to connect a battery charger during the fault tracing session

Battery cable connections:

• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:

 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

Out-of-vehicle

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

1700-21-03-04 Oscilloscope

The button will open the program in a new window outside of Tech Tool

After the program has been opened, Tech Tool can be viewed by minimizing the window

There are 2 type of tests

- **Standard:** Used for active faults
- **Wiggle wire:** Used for intermittent faults

Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

To evaluate if an action has solved the problem, either confirm that the DTC icon has disappeared from the ECU box in the image or click on the box to see if the DTC has changed status to inactive

Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U3003- 17, Battery Power

Component Location:

T1162852

Schematics:

T1162856

Fault type	Area	Condition for fault	Data Link
U3003 FTB 17	Battery Power.	System Voltage 19V.	Backbone 1.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
- ECU hardware

Erroneous DTCs:

Some DTCs are considered erroneous or erratic. Inactive DTCs that cannot be duplicated under normal vehicle operation, may be erroneous and diagnostics are not always necessary. Erroneous data link DTCs can be caused by programming an ECU, low system voltage, poor ground connections, etc..

Non-responding Electronic Control Units:

Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

Third party Electronic Control Units (ECUs):

Some vehicles have customer added Electronic Control Units (ECUs) such as Qualcomm and PeopleNet PC If not connected correctly to the data link network, these Electronic Control Units (ECUs) can cause communication faults. If suspected, the recommendation is to disconnect the ECUs from the data link network.

Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

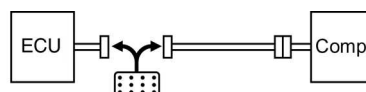
Select a data link and click **Update view**

Check for the following:

- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

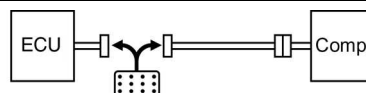
Voltage supply check:

- Check fuses
- Check all relevant connectors for voltage supply and ground connection
- Check that correct voltage reaches the component
- Check ground wire for open circuit

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

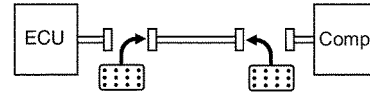
Voltage signal check:

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Voltage check	ON	8 — GND	A13.A Pin 8— Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Voltage check	ON	4 — GND	A13.A Pin 4 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:

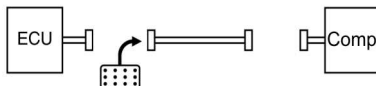


Note: Remove the voltage by disconnecting the negative wire from the battery

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — 51	A13.A:8— A14. EB:51	R=0 Ω		88890195, 9990014, 9998699
Wiring harness check	OFF	4 — 55	A13.A:4 — A14. EB:55	R=0 Ω		88890195, 9990014, 9998699

Note: See schematics for connector pins

Record the measured value

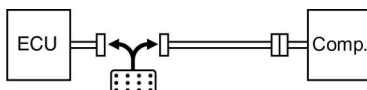


Note: Remove the voltage by disconnecting the negative wire from the battery

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	8 — GND	A13.A:8 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Wiring harness check	OFF	4 — GND	A13.A:4 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699

Note: See schematics for connector pins

Record the measured value



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring har- ness check	OFF	8 — 4	A13.A:8— A13.A:4	R = 50 Ω — 70 Ω (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors. A test drive may also be needed to recreate the conditions when the fault occurred 1 Set the multimeter to appropriate setting 2 Connect the tools according to the information in the choosen data link schematics 3 Once reading the values, press the MIN/MAX button 4 Wiggle the wires or perform a test drive while notifying the minimum and maximum values on the multimeter to find a bad contact

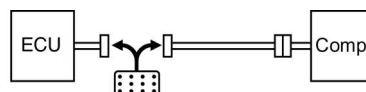
Control Unit:

Select an Electronic Control unit (ECU) and then click "Up-
date View" to display relevant information

Connector check:

Check for the following:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Ground check	OFF	15 — GND	A13.A Pin 15 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						

System Reset:

A control unit may have been locked at start up and will need to be restarted Perform a refresh using the Function status below to attempt to get a response from a missing ECU If an ECU does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and re-connect before performing a second function status refresh Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery:

Note: If the battery readout value is 12 V or more, there is no need to perform a battery status check It is recommended to connect a battery charger during the fault tracing session

Battery cable connections:

• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:

 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

Out-of-vehicle

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

1700-21-03-04 Oscilloscope

The button will open the program in a new window outside of Tech Tool

After the program has been opened, Tech Tool can be viewed by minimizing the window

There are 2 type of tests

- **Standard:** Used for active faults
- **Wiggle wire:** Used for intermittent faults

Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

To evaluate if an action has solved the problem, either confirm that the DTC icon has disappeared from the ECU box in the image or click on the box to see if the DTC has changed status to inactive

Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U0073- 87, CAN Communication Powertrain Subnet

Component Location:

T1162852

Schematics:

Powertrain Net (DL9)

H L
YE GN

T1162855

Fault type	Area	Condition for fault	Data Link
U0073 FTB 87	CAN Communication Powertrain Subnet.	Engine speed signal missing from EECU.	DL9.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
- ECU hardware

Erroneous DTCs:

Some DTCs are considered erroneous or erratic. Inactive DTCs that cannot be duplicated under normal vehicle operation, may be erroneous and diagnostics are not always necessary. Erroneous data link DTCs can be caused by programming an ECU, low system voltage, poor ground connections, etc..

Non-responding Electronic Control Units:

Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

Third party Electronic Control Units (ECUs):

Some vehicles have customer added Electronic Control Units (ECUs) such as Qualcomm and PeopleNet PC If not connected correctly to the data link network, these Electronic Control Units (ECUs) can cause communication faults. If suspected, the recommendation is to disconnect the ECUs from the data link network.

Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

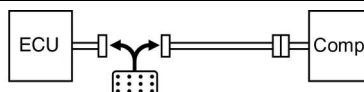
Select a data link and click **Update view**

Check for the following:

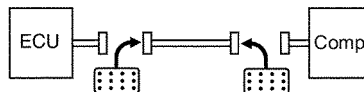
- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

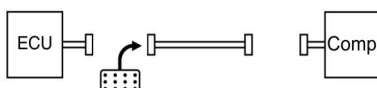
Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage signal check:

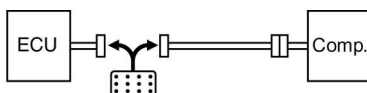
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Volt-age check	ON	2— GND	A13.A Pin 2 — Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Volt-age check	ON	1— GND	A13.A Pin 1 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	2— 51	A13.A:2 — A14. EB:52	R=0 Ω		88890195, 9990014, 9998699
Wiring harness check	OFF	1— 55	A13.A:41 — A14. EB:56	R=0 Ω		88890195, 9990014, 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	2 — GND	A13.A:2 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Wiring harness check	OFF	1 — GND	A13.A:1 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	2 — 1	A13.A:2 — A13. A:1	R = 50 Ω — 70 Ω (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

Intermittent faults, test:

Intermittent faults might be found by connecting a multimeter into the circuit and then wiggle the wires and connectors.

A test drive may also be needed to recreate the conditions when the fault occurred

- 1 Set the multimeter to appropriate setting
- 2 Connect the tools according to the information in the choosen data link schematics
- 3 Once reading the values, press the MIN/MAX button
- 4 Wiggle the wires or perform a test drive while notifying the minimum and maximum values on the multimeter to find a bad contact

Control Unit:

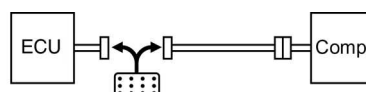
Select an Electronic Control unit (ECU) and then click "Update View" to display relevant information

Connector check:

Check for the following:

Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage supply check:



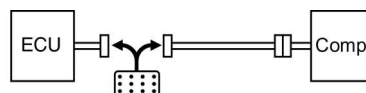
- Check fuses
- Check all relevant connectors for voltage supply and ground connection
- Check that correct voltage reaches the component
- Check ground wire for open circuit

Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Ground check	OFF	15 — GND	A13.A Pin 15 — Chassis Ground	R = 0 Ω		88890195, , 9998699
Note: See schematics for connector pins						
Record the measured value						

System Reset:

A control unit may have been locked at start up and will need to be restarted Perform a refresh using the Function status below to attempt to get a response from a missing ECU If an ECU does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and re-connect before performing a second function status refresh Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Update software:

Update Electronic Control Unit with latest software Suggested actions • Check for software updates • Reload Electronic Control Unit with existing software • Perform a refresh using the Function status below to attempt to get a response from a missing ECU Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery:

Note: If the battery readout value is 12 V or more, there is no need to perform a battery status check. It is recommended to connect a battery charger during the fault tracing session

Battery cable connections:

• Check the cable terminals and the battery terminals for any corrosion or dirt • Loose or poor connection • Ground wire between battery terminal connection and chassis connection Test result Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Battery status:

Check the battery status and charge voltage

Battery check:
 DANGER

Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

 CAUTION

The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:**Out-of-vehicle**

Clean the battery terminals using a wire brush before the test

In-vehicle

Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
- 2 Connect the black clamp to the negative (-) terminal

Note: For satisfactory results, connect the battery analyzer to the battery terminals as close to the poles as possible

Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing**Operations:**

Running operations require good knowledge of the function to be able to evaluate any test data

3711-08-03-02 Wiggle wire

Follow the instructions in the relevant operation

Note: No product is connected

This test can only be started when connected to a product

1700-21-03-04 Oscilloscope

The button will open the program in a new window outside of Tech Tool

After the program has been opened, Tech Tool can be viewed by minimizing the window

There are 2 type of tests

- **Standard:** Used for active faults
- **Wiggle wire:** Used for intermittent faults

Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

To evaluate if an action has solved the problem, either confirm that the DTC icon has disappeared from the ECU box in the image or click on the box to see if the DTC has changed status to inactive

Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service

TECU - U0073- 88, CAN Communication Powertrain Subnet

Component Location:

T1162852

Schematics:

Powertrain Net (DL9)

H L
YE GN

T1162855

Fault type	Area	Condition for fault	Data Link
U0073 FTB 88	CAN Communication Powertrain Subnet.	Bus off.	DL9.

Information:

Tech tip:

Description, Design and Function:

To fully understand the system and be able to fault trace, it is recommended to read the Description, Design and Function in IMPACT.

Common data link faults:

- Rubbed wires
- Pushed-back pins
- Connectors not fully connected
- Corrosion in connectors
- Control unit not powered up
- Missing or defective terminating resistor
- ECU software
- ECU hardware

Erroneous DTCs:

Some DTCs are considered erroneous or erratic. Inactive DTCs that cannot be duplicated under normal vehicle operation, may be erroneous and diagnostics are not always necessary. Erroneous data link DTCs can be caused by programming an ECU, low system voltage, poor ground connections, etc..

Non-responding Electronic Control Units:

Perform a refresh using the **Function status** below to attempt to get a response from a missing **ECU** . If an **ECU** does not respond after a function status refresh it might help to disconnect the batteries. Wait for 5 minutes and reconnect before performing a second function status refresh.

Third party Electronic Control Units (ECUs):

Some vehicles have customer added Electronic Control Units (ECUs) such as Qualcomm and PeopleNet PC If not connected correctly to the data link network, these Electronic Control Units (ECUs) can cause communication faults. If suspected, the recommendation is to disconnect the ECUs from the data link network.

Intermittent fault:

To find intermittent faults, the recommendation is to use a multimeter to check for faulty connections. For detailed information, see: Data link wires.

How to start fault tracing

Analyze the system from the Product status view to determine in which area to start the fault tracing.

- Non-responding Electronic Control Units
- Electronic Control Units (ECUs) with set DTCs, click on the ECUs for DTC details

Fault Tracing Area:

Click on the schematic button and select the data link to be fault traced in Techtool

Click on the battery button to select the control unit or component to fault trace in Techtool.

Data link Wires:

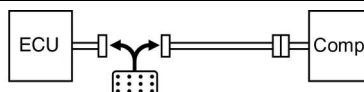
Select a data link and click **Update view**

Check for the following:

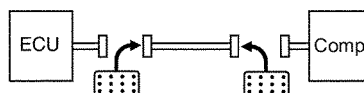
- Connectors not fully connected
- Pushed-back pins
- Corrosion in connectors
- Rubbed wires
- Polarization error

Connector check:

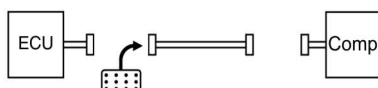
Purpose:	Action:	Test result:
The purpose of this test is to quickly identify obvious damage to the wiring harness, without removing anything that may take a lot of time Note: Before breaking any circuits or connecting measurement tools: Ignition key in OFF position	View Schematic to identify relevant pins to check • Visually check that wiring harness is not damaged • Check that the connectors are properly connected and locked into position • Disconnect and check the component connector • Inspect pins and terminals for oxidation or corrosion • Ensure that the pins and terminals are locked into the connectors and that they are not pushed back out of the sockets • Check that the pins and terminal are not damaged (which can cause poor connection) • Carefully insert the correct test pin from special tool 9990008 and verify that pin connections are in good condition Note: After completed procedure, reconnect all connectors	Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Voltage signal check:

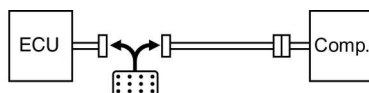
Measure-ment	Key position	Measurement points		Expected Value	Meas-ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Signal Volt-age check	ON	2— GND	A13.A Pin 2 — Chassis Ground	V= 2.5 V — 4.0 V		88890195, 9998699
Signal Volt-age check	ON	1— GND	A13.A Pin 1 — Chassis Ground	V= 1.0 V — 2.5 V		88890195, 9998699
Note: See schematics for connector pins Record the measured value						

Resistance check:

Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	2— 51	A13.A:2 — A14. EB:52	R=0 Ω		88890195, 9990014, 9998699
Wiring harness check	OFF	1— 55	A13.A:41 — A14. EB:56	R=0 Ω		88890195, 9990014, 9998699
Note: See schematics for connector pins						
Record the measured value						



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	2 — GND	A13.A:2 — Chassis Ground	R ≥ 500 KΩ		88890195, , 9998699
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Note: See schematics for connector pins						
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Note: Remove the voltage by disconnecting the negative wire from the battery						
Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Wiring harness check	OFF	2 — 1	A13.A:2 — A13. A:1	R = 50 Ω — 70 Ω (* Terminating)		88890195, , 9998699
*Terminating resistor The resistance when measuring the CAN circuit (two terminating resistors in parallel) should be approximately 50 - 70 Ohm The resistance when measuring towards only one terminating resistor should be approximately 120 Ohm Note: See schematics for connector pins Record the measured value						

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Control Unit:

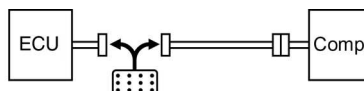
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Check for the following:

Connector check:

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Voltage supply check:



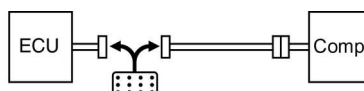
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- Check all relevant connectors for voltage supply and ground connection
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Measurement	Key position	Measurement points		Expected Value	Measured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Supply voltage check	ON	18 — GND	A13.A Pin 18 — Chassis Ground	$V \geq 12V$		88890195, 9998699
Supply voltage check	ON	19 — GND	A13.A Pin 19 — Chassis Ground	$V \geq 12V$		88890195, 9998699

Note: See schematics for connector pins

Record the measured value

Resistance check:



Note: Remove the voltage by disconnecting the negative wire from the battery						
Measure- ment	Key position	Measurement points		Expected Value	Meas- ured value	Other (Special Tool PN)
		Breakout box	Wiring diagram			
Ground check	OFF	10 — GND	A13.A Pin 10 — Chassis Ground	R = 0 Ω		88890195, , 9998699
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Battery status:

Check the battery status and charge voltage

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Great care is required when working with batteries due to the risk of personal injury. Watch out for static electricity when working with batteries.

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The maximum voltage is 30 Volts. Higher voltages may damage the battery analyzer.

Does this vehicle have an anti sulphation unit fitted? If yes, the anti sulphation unit must be disconnected before testing

Before connecting the battery analyzer:

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Clean the battery terminals using a wire brush before the test

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Check that all power consuming components in the vehicle are switched off

Connecting the battery analyzer

- 1 Connect the red clamp to the positive (+) terminal
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Note: It is important that both sides of the clamp make good contact with the poles, both prior to and while testing. If the contact is poor CHECK CONNECTION will be displayed. Clean the poles and then connect the clamps again. If necessary, work the clamps forwards and backwards.

I have read and understand the above advisory

Test instruction

Purpose:	Component:	Action:	Evaluation:
Check battery status and charge voltage.	- Battery. - Alternator.	- Connect special tool 88890203 Battery Analyzer. - Follow the instructions in the user manual for a Full system check.	Is the component free from faults?

Test result

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status

Operations relevant for fault tracing

Operations:

Running operations require good knowledge of the function to be able to evaluate any test data

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Follow the instructions in the relevant operation

Note: No product is connected

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There are 2 type of tests

- **Standard:** Used for active faults
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Note: A battery charger can create measurement disturbances. Turn off the battery charger during the test

Tool instructions:

Oscilloscope:	Red probe:	Black Probe:	Special tools:
• Channel 1	• Can L*	• Ground point	88890040
• Channel 2	• Can H*	• Ground point	88890040

Test result:

Note: After any performed action, it is recommended to refresh the Function status in order to re-evaluate the product status.

Function status:

Refresh status:

This will reset all control units, re-identify the vehicle and perform a new **DTC** read out

Note: Set the **DTC** filter to only show active DTCs to improve evaluation

Evaluation

The Product status image and the DTC lists are updated after clicking Refresh DTC status.

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Set the **DTC** filter to only show active DTCs to improve evaluation

Note: To ensure the problem is corrected, the recommendation is to recreate the conditions (if known) when the DTC was set during the repair verification

Fault corrected?

Note: Clear DTCs before returning the vehicle to service



Mack Trucks, Inc.
Greensboro, NC USA