GENERAL SERVICE BULLETIN **24-7032**
03 April 2024

Diagnostic hints for 3rd and 4th Generation Selective Catalytic Reduction (SCR) of the Level, Quality and Temperature (LQT) sensor, reductant pump, reductant tank heater and heated reductant supply line

This bulletin supersedes 21-7036. Only refer to the electronic version of this GSB. Reason for update: Addition of 4th Generation Selective Catalytic Reduction (SCR) and vehicles

Model:

2020 Puma - with 1.5L EcoBlue	
Transit/Tourneo Courier 2014.5 (07/2013–) - with 1.5L EcoBlue	
Transit Courier/Tourneo Courier - with 1.5L EcoBlue	Year: 2023-2024 Assembly Plant: Craiova
2019 Focus - with 1.5L EcoBlue and 2.0L EcoBlue	
2020 Kuga - with 1.5L EcoBlue and 2.0L EcoBlue	
Mondeo 2014.75 (10/2014–) - with 2.0L EcoBlue	
S-MAX/Galaxy 2015.0 (03/2015–) - with 2.0L EcoBlue	
Transit/Tourneo Connect 2013.75 (02/2013–) - with 1.5L EcoBlue	
2019 Transit Custom - with 2.0L EcoBlue	
Transit Custom/Tourneo Custom - with 2.0L EcoBlue	Year: 2023-2024 Assembly Plant: Yeniköy
2019.75 Transit - with 2.0L EcoBlue	
Ranger 2012 (04/2011-) - with 2.0L EcoBlue	
Ranger - with 2.0L EcoBlue and 3.0L Power Stroke Diesel	Year: 2022-2024 Assembly Plant: SILVERTON(S.AFRICA)PLANT BLD
Ranger - Raptor with 2.0L EcoBlue	Year: 2022-2024 Assembly Plant: THAILAND LTD PLANT BUILD (AAGB7)

Markets: All European markets

Summary

This General Service Bulletin give insight into the diagnosing methods related to the 3rd and 4th generation Selective Catalytic Reduction (SCR) of:

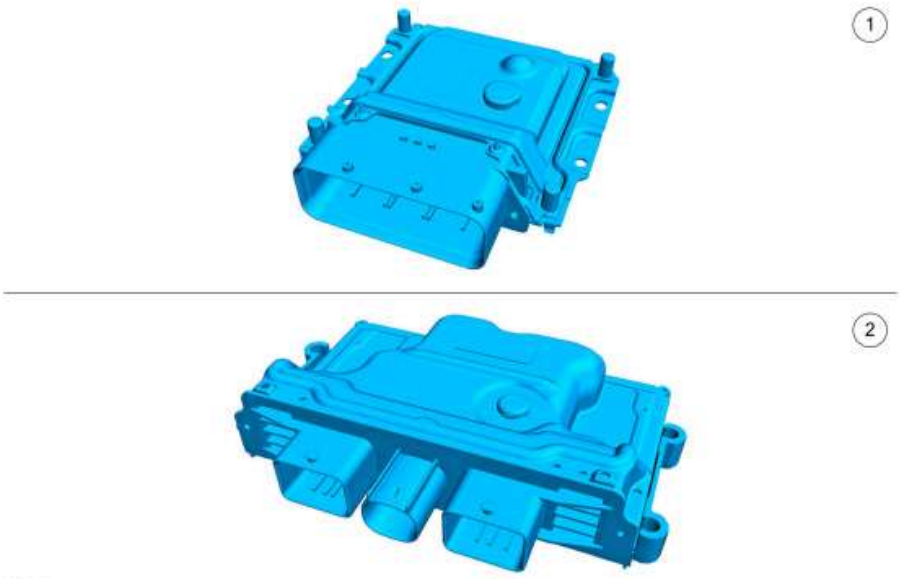
- Level, Quality and Temperature (LQT) sensor
- Reductant pump and backflow pump (purge pump)
- Reductant tank heater and heated reductant supply line

Service Information

Ford Motor Company employs differing Selective Catalytic Reduction (SCR) versions, this builds on technology from generation to generation.

It is important that you can identify the version of Selective Catalytic Reduction (SCR) you are working on. The systems look typically the same but there are subtle differences.

Selective Catalytic Reduction (SCR) modules



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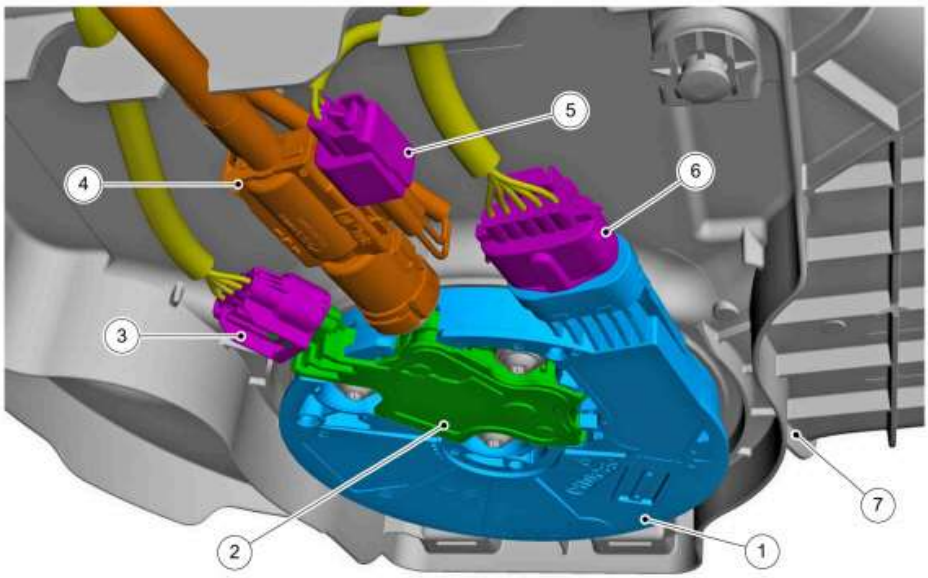
Item	Description
1	3rd Generation Selective Catalytic Reduction (SCR) module
2	4th Generation Selective Catalytic Reduction (SCR) module

Reductant pump module

The reductant pump module is plastic welded to the reductant tank. The reductant pump module is a part of the reductant tank assembly and cannot be changed separately.

Reductant pump module (3rd Generation shown, 4th Generation similar)



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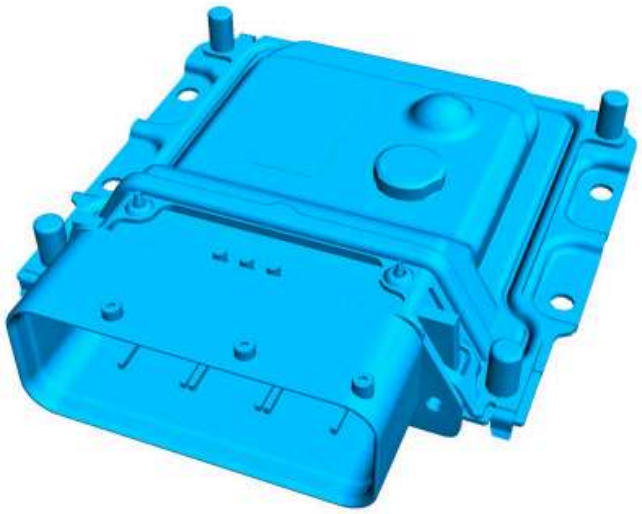
Item	Description
1	Reductant pump module
2	Reductant pump
3	4-pin electrical connector - reductant pump (7-pin electrical connector on 4th Generation)
4	Heated reductant supply line
5	2-pin electrical connector - heated reductant supply line
6	5-pin electrical connector - reductant tank

7	Reductant tank

3rd Generation Selective Catalytic Reduction (SCR)



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Item	Description
-	3rd Generation Selective Catalytic Reduction (SCR) module

The 3rd Generation Selective Catalytic Reduction (SCR) is a single dose injection system.

It consists two separate modules:

1. Dosing Control Unit (DCU)
2. Glow Plug Module (GPM)

The Dosing Control Unit (DCU) is a single connector module that contains the dosing wiring and urea heating wiring.

3rd Generation Selective Catalytic Reduction (SCR) Applicable Diagnostic Trouble Codes (DTCs) for Level, Quality and Temperature (LQT) sensor

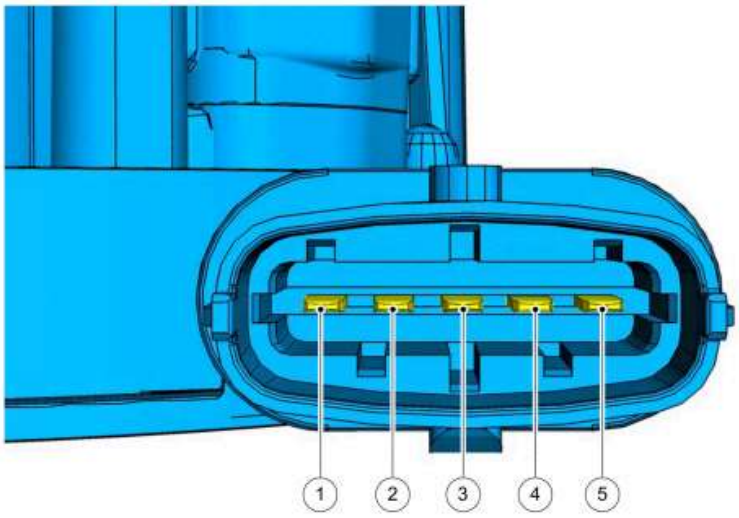
No.	Diagnostic Trouble Code	DTC Description	Slow/Fast	Actual Fault	Bit
1.	P206B-86	Reductant Quality Sensor Range/Performance	Fast	Reductant Agent Quality Fault	9
2.	P206D-00	Reductant Quality Sensor High	Fast	Reductant Agent Quality Fault	9
3.	P206C-00	Reductant Quality Sensor Low	Fast	Reductant Agent Quality Fault	9
4.	P206B-08	Reductant Quality Sensor Range/Performance	Fast	Reductant Agent Quality Fault	9
5.	P206B-64	Reductant Quality Sensor Range/Performance	Fast	Reductant Agent Quality Fault	9
6.	P206B-8F	Reductant Quality Sensor Range/Performance	Fast	Reductant Agent Quality Fault	9
7.	P206C-84	Reductant Quality Sensor Low	Fast	Reductant Level Sensor Fault	10
8.	P2044-11	Reductant Temperature Sensor "A" Circuit Low	Fast	Reductant Level Sensor Fault	10
9.	P203D-00	Reductant Level Sensor "A" Circuit High	Fast	Reductant Level Sensor Fault	10
10.	P203C-00	Reductant Level Sensor "A" Circuit Low	Fast	Reductant Level Sensor Fault	10
11.	P203B-81	Reductant Level Sensor "A" Circuit Range/Performance	Fast	Reductant Level Sensor Fault	10
12.	P206D-85	Reductant Quality Sensor High	Fast	Reductant Level Sensor Fault	10
13.	P205D-85	Reductant Tank Temperature Sensor "A" Circuit High	Fast	Reductant Level Sensor Fault	10
14.	P205C-84	Reductant Tank Temperature Sensor "A" Circuit Low	Fast	Reductant Level Sensor Fault	10
15.	P2045-24	Reductant Temperature Sensor "A" Circuit High	Fast	Reductant Level Sensor Fault	10
16.	P2044-00	Reductant Temperature Sensor "A" Circuit Low	Fast	Reductant Level Sensor Fault	10
17.	P2043-92	Reductant Temperature Sensor "A" Circuit Range/Performance	Fast	Reductant Level Sensor Fault	10

3rd Generation Selective Catalytic Reduction (SCR) Information and operation

The Level, Quality and Temperature (LQT) sensor is a Single Edge Nibble Transmission (SENT) based sensor.

The LQT sensor is connected via the 5-pin electrical connector at the reductant tank, the connection is linked to the Dosing Control Unit (DCU).

On all 3rd Generation equipped vehicles they are connected to the following Pins:



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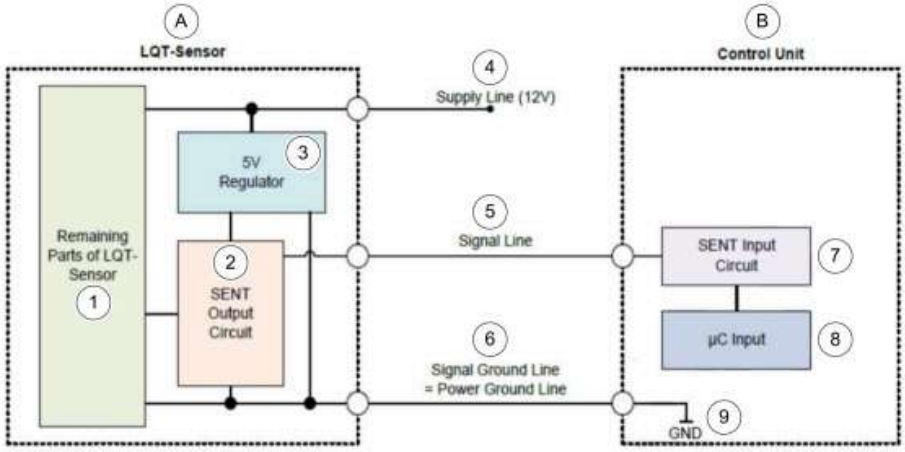
Reductant tank connector	Signal	DCU (SOBDMC) connector
1	LQT Heater	2
2	Ground	Goes to Ground point
3	LQT Power	32
4	LQT Ground	63
5	LQT Signal	62



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Item	Description
A	LQT sensor
B	Dosing Control Unit (DCU)
1	Remaining Parts of LQT sensor
2	SENT Output Circuit
3	5 V Regulator

4	Supply Line (12 V)
5	Signal Line
6	Signal Ground Line = Power Ground Line
7	SENT Input Circuit
8	µC Input
9	GND

The Level, Quality and Temperature (LQT) sensor cannot be changed as it is plastic welded to the tank.

If the LQT sensor is deemed to be inoperative it will involve a complete reductant tank change. This should **ONLY** be done when all diagnostic methods have been exhausted.

NOTE: Disconnecting the Level, Quality and Temperature (LQT) sensor whilst the vehicle is powered on or whilst the PCM (powertrain control module) has not fully power latched can and will trigger Diagnostic Trouble Codes (DTCs) that will cause confusion and will require further diagnostics.

It is only possible within the dealerships to check the continuity of the DCU (Secondary On-Board Diagnostic Control Module C (SOBDMC)) wiring to tank and LQT Power (Pin 3 to Pin 32 of DCU (SOBDMC)) and to make sure that Pin 3 of the Level, Quality and Temperature (LQT) sensor is receiving 12 volts.

NOTE: If you disconnect the Level, Quality and Temperature (LQT) sensor with the ignition ON you WILL set DTCs in the PCM for reductant level and reductant quality.

The Level, Quality and Temperature (LQT) sensor sends data to the DCU (SOBDMC) via SENT, the DCU (SOBDMC) then sends information about the level and quality via private CAN to the PCM.

The PCM then acts upon that information, if the readings are within a specific set of ranges no DTCs are set relating to UREA LEVEL and UREA QUALITY.

If there is an issue with the UREA TEMPERATURE, the DCU (SOBDMC) requests the PCM to trigger a DTC for UREA TEMPERATURE.

Simply put, the PCM controls DTC setting for reductant level and quality, the DCU (SOBDMC) has internal limits for reductant temperature and will request the PCM to set DTCs for reductant temperature.

Why is this important information?

The DCU (SOBDMC) does not support reading of DTCs, it does however support On Demand Self Test, also the Data Identifiers (DIDS) for Level, Quality and Temperature are readable in both the PCM and DCU (SOBDMC) – this can either aid you if you understand the above passage or cause you to misdiagnose if you are unaware of how the system functions – the latter leads to the unnecessary replacement of the reductant tank.

The following Data Identifiers (DIDS) can be read from the PCM:

- DID $0683 – Reductant Level Sensor - Level Height Measured – Unfiltered (REDUCT_HIGT_UNFIL)
- DID $0684 – Reductant Level Sensor - Concentration Measured – Unfiltered. (REDUCT_CON_UNFIL)
- DID $0685 – Reductant Level Sensor - Temperature Measured – Unfiltered. (REDUCT_TMP_UNFIL)

The following Data Identifiers (DIDS) can be read from the DCU (SOBDMC):

- DID $015F - Reductant Temperature Measurement Value from Sensor (REDUCT_TMP_MES)
- DID $0160 - Reductant Level Measurement Value from Sensor (REDUCT_LVL_MES)
- DID $0161 - Reductant Concentration Measurement Value from Sensor (REDUCT_CON_MES)

The PCM will set DTCs for reductant quality when DCU (SOBDMC) tells the PCM there are no valid reflections or no data at all, this is performed over the private CAN, in this instance the DID $0684 – Reductant Level Sensor - Concentration Measured – Unfiltered (REDUCT_CON_UNFIL) will read 63.5% constantly, the Data Identifier (DID) can also read 63.5% if the Level, Quality and Temperature (LQT) sensor is initialising so do not take a single read of the Data Identifier (DID) as there being an issue.

The PCM will set DTCs for reductant level when DCU (SOBDCM) tells the PCM there is no valid level or no data at all, this is performed over the private CAN, in this instance the DID $0683 – Reductant Level Sensor - Level Height Measured – Unfiltered (REDUCT_HIGT_UNFIL) will read 126% constantly.

Currently the Ranger and Transit with 2.0L EcoBlue engine later calibrations will inhibit P206B, P206C and P206D from setting when the DCU (SOBDCM) is disconnected (U010E).

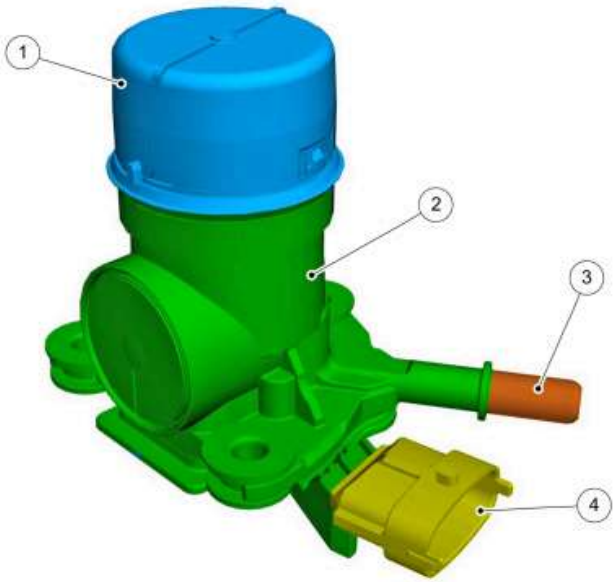
Engineering are in the process of releasing calibrations on other vehicle lines to also incorporate the inhibiting function of these DTCs when the DCU (SOBDCM) is disconnected (U010E).

If P206D, P206C or P206B are set, and you have determined the correct repair and you are certain that the fault is repaired, the monitor completion time for these faults is over 300 seconds with the key on, which means that this fault will only test and pass when the DCU (SOBDCM) has tested – circa 5 seconds to complete, In total the ignition on time will need to be on for 320 seconds to ensure that the vehicle comes out of inducement.

NOTE: If the monitor has not run within the 10 minutes it will require the ignition OFF for 10 minutes before trying again.

3rd Generation Selective Catalytic Reduction (SCR) Reductant pump and backflow pump (purge pump)

The reductant pump is the only component that can be replaced independently of the complete reductant tank assembly.



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Reductant pump

Item	Description
1	Main pump
2	Backflow pump (purge pump)
3	Connection heated reductant supply line
4	4-pin electrical connector

The DTCs below are related to the reductant pump and purge pump, you will notice that they are all electrical based meaning open circuit/short circuit.

Diagnostic Trouble Codes (DTCs) reductant pump and backflow pump (purge pump)

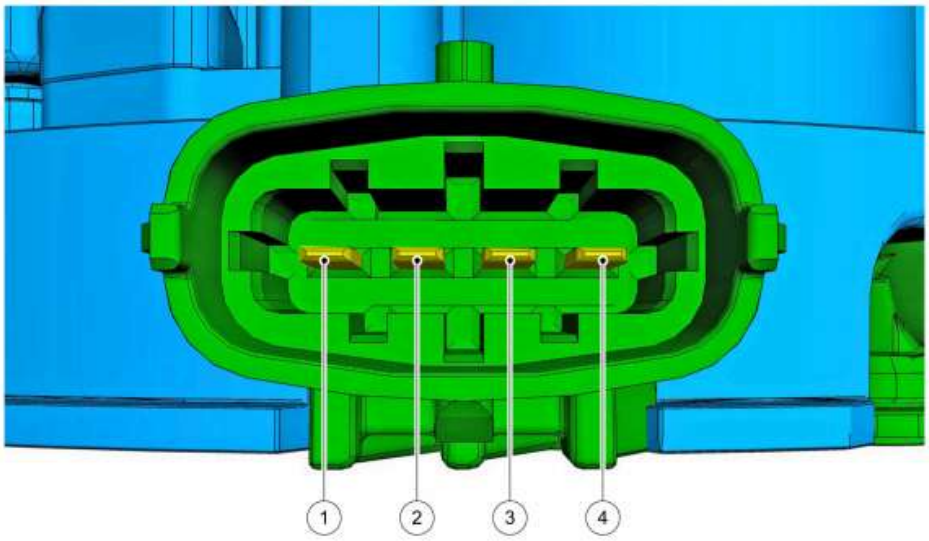
No.	Diagnostic Trouble Code	DTC Description	Slow/Fast	Actual Fault	Bit
1.	P20A0-11	Reductant Purge Control Valve "A" Circuit/Open	Fast	Reductant Pump Assembly Fault	18
2.	P20A2-A2	Reductant Purge Control Valve "A" Circuit Low			
3.	P208A-13	Reductant Pump "A" Control Circuit/Open			
4.	P208D-4B	Reductant Pump "A" Control Circuit High			
5.	P208D-12	Reductant Pump "A" Control Circuit High			
6.	P208C-12	Reductant Pump "A" Control Circuit Low			
7.	P20A2-11	Reductant Purge Control Valve "A" Circuit Low	Fast	Urea Pump Motor Control	1
8.	P208C-11	Reductant Pump "A" Control Circuit Low	Fast		
9.	P20A5-00	Reductant Purge Control Valve "A" Stuck Closed	Slow		
10.	P20A3-A2	Reductant Purge Control Valve "A" Circuit High	Slow		
11.	P208D-A3	Reductant Pump "A" Control Circuit High	Slow		

NOTE: The bit assignment in the table does not mean that it is the actual component at fault, it is merely a bit assignment to point you into the fault area. This is particularly useful if DTC's have been cleared.

In much the same manner as the Level, Quality and Temperature (LQT) sensor, if the ignition is on or the vehicle has not power latched you will trigger DTCs if the connector or the DCU (SOBDCM) is disconnected.

3rd Generation Selective Catalytic Reduction (SCR) 4-pin electrical connector - reductant pump

The electrical connector at the reductant pump is the 4-pin connector:



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Reductant pump connector	Signal	DCU (SOBDMC) connector
1	Purge Pump Power	55
2	Purge Pump Ground	56
3	Main Pump Ground	29
4	Main Pump Power	51

NOTE: Before replacement of the reductant tank test the reductant pump for Open circuits/short circuits.

Below are the Pins to check and the acceptable resistance readings:

Measurement with Ohmmeter:

- Resistance main pump Pin 3 to 4 = 4.13 Ohms
- Resistance purge pump Pin 1 to 2 = 4.12 Ohms
- Pin 1 to 3, Pin 1 to 4, Pin 2 to 3, Pin 2 to 4 = (open load)

Diagnostic Trouble Codes (DTCs) reductant pump pressure

No.	Diagnostic Trouble Code	DTC Description	Slow/Fast	Actual Fault	Bit
1.	P20E8-85	Reductant Pressure Too Low	Slow	Reductant Pump Assembly Fault	18
2.	P20E8-84	Reductant Pressure Too Low			
3.	P20E9-85	Reductant Pressure Too High			
4.	P20E9-84	Reductant Pressure Too High			
5.	P20E8-92	Reductant Pressure Too Low			
6.	P208B-00	Reductant Pump "A" Performance/Stuck Off			

The reductant system does not contain a pressure sensor.

The pressure is calculated based off a calibrated number of pump strokes, the reductant pump is not a rotary pump. The modelled pressure can be read by the diagnostic tool from the DCU (SOBDCM) via DID $0166 (REDUCT_LINP_CLC). The Data Identifier (DID) is not IO controllable. If you have the ignition on only the chances are that you will show no pressure, the reductant pump only provides pressure when conditions are met.

These conditions are:

- Engine running
- Engine coolant at 65°C
- Exhaust gas temperature sensor 1 above 160°C.

When you turn off the engine the purge pump operates and will empty the reductant line. In some scenarios if monitoring the pressure pump and the purge pump whilst driving it may appear that the purge pump is emptying the reductant line, this is no cause for concern.

Most faults attributed to pressure are due to reductant leaks primarily at the reductant injector or the reductant pump connector, it can be of the smallest amount, not necessarily flowing out. It is not uncommon that if there is a significant leak the system will trigger an under pressure and an over pressure DTC, this is because the reductant pump detects a leak, tries to overcome by reacting and applying more pump strokes which invariably leads to an over pressure event.

One main factor of reductant pump failures and the under pressure issues is the fact that fluid other than Urea has been placed in the reductant tank, this should be investigated when you are checking for leaks and ensuring reductant flow via the service tools, running the dosing measurement test should be your second choice after checking for visible leaks.

Over pressure DTCs can be caused by kinks in the reductant line or blockages in the reductant line, a physical blockage in the line or a blocked injector. In order to determine if a blockage is present perform the dosing measurement test, as this will dispense a specific volume of reductant over time.

Once the fault has been identified and resolved it is advisable to run the complete static healing process, bit 1 (SCR_F_SLW_B01) in the datalogger group is one of the last monitors to test and requires the system to have dosed, ignition off for around 30 seconds to activate the purge pump. When bit one (SCR_F_SLW_B01) goes to false it indicates that the monitor has completed and passed.

The Healing process is outlined below:

1. Start the engine.

2. Get the Engine coolant temp up to 65°C.

3. Once at 65°C hold the RPM at 2000 RPM for 5 minutes.

4. After 5 minutes return to idle.

5. Start datalogger and look at DID $06AD BIT one (SCR_F_SLW_B01) in datalogger for PCM – it should be set true – keep datalogger active.

6. Turn the ignition OFF read DID $06AD BIT one (SCR_F_SLW_B01) and wait until it sets to false, circa 35 seconds. Once set to false go to step 7.

7. Turn Ignition ON.

8. Turn the ignition OFF for at least 3 minutes. **DO NOT** open the doors (this is to make sure a power latch of the PCM) – once datalogger shows a comms error the vehicle has power latched.

9. After the Power latch turn the ignition ON and start engine.

3rd Generation Selective Catalytic Reduction (SCR) Reductant tank heater and heated reductant supply line

The reductant tank heater and heated reductant supply line are **not** inducement, however they will put a MIL on.

The reductant tank heater and the heated reductant supply line operate at 4°C when the ignition is on, the circuit checks are monitored at every key on to determine Open circuit/Short circuit.

The reductant tank heater and heated reductant supply line can be tested after repair by running the On Demand Selftest , NOT CMDTCS from the DCU (SOBDCM), Routine $0202.

3rd Generation Selective Catalytic Reduction (SCR) Diagnostic Trouble Codes (DTCs) reductant tank LQT heater and heated reductant supply line

No.	Diagnostic Trouble Code	DTC Description
1.	0x20B9	Reductant Heater "A" Control Circuit/Open
2.	0x20BA	Reductant Heater "A" Control Performance
3.	0x20BB	Reductant Heater "A" Control Circuit Low
4.	0x20BC	Reductant Heater "A" Control Circuit High
5.	0x20BD	Reductant Heater "B" Control Circuit/Open
6.	0x20BE	Reductant Heater "B" Control Performance
7.	0x20BF	Reductant Heater "B" Control Circuit Low
8.	0x20C0	Reductant Heater "B" Control Circuit High

NOTE: Reductant tank Heater DTCs reference Reductant Heater A.

The reductant tank heater can be measured.

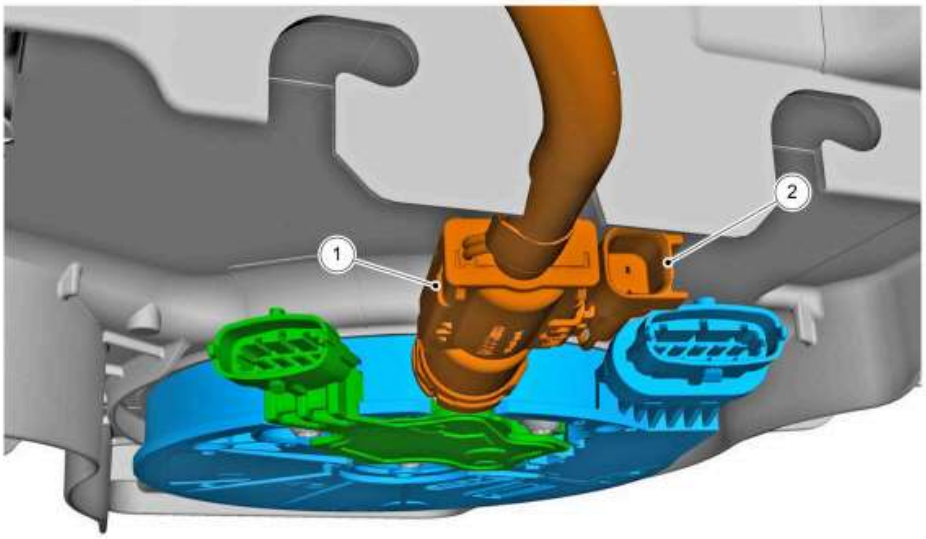
The permissible acceptable ranges in Ohms are:

- 1.2 Ohms – 1.9 Ohms from Pin 1 to Pin 2 of the 5-pin electrical connector on the reductant tank LQT connector.

NOTE: Disconnecting the Level, Quality and Temperature (LQT) sensor whilst the vehicle is powered on or whilst the PCM (powertrain control module) has not fully power latched can and will trigger Diagnostic Trouble Codes (DTCs) that will cause confusion and will require further diagnostics.

NOTE: Heated reductant supply line DTCs reference Reductant Heater B.

The heated reductant supply line has a 2-pin electrical connector near the base of the reductant pump line.



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Heated reductant supply line

Item	Description
1	Heated reductant supply line
2	2-pin electrical connector - heated reductant supply line

The heated reductant supply line is fed by a separate fuse from the PDB, the 12 V power is fed into the DCU at Pin 1, the 12 V power is outputted from the DCU at Pin 6, this is then fed to the heated reductant supply line Pin 2 runs through the line heater resistor and grounds directly to the body on Pin 1.

3rd Generation Selective Catalytic Reduction (SCR) Part number and resistances heated reductant supply line

The resistance of the heated reductant supply line is unique per vehicle line, below is a chart detailing the part number and resistances:

No.	Vehicle line	Part number	Resistance (Ohm)
1.	Puma	N1T1-5J249-AA	2.35 ± 0.25
2.	Puma	N1T1-5J249-AB	2.35 ± 0.25
3.	Transit Courier/Tourneo Courier	MT76-5J249-AA	2.16 ± 0.32
4.	Focus with 1.5L EcoBlue	JX61-5J249-A	2.12 ± 0.32
5.	Focus with 2.0L EcoBlue	JX61-5J249-A	1.6 ± 0.24
6.	Kuga with 1.5L EcoBlue	LX61-5J249-A	1.5 ± 0.23
7.	Kuga with 2.0L EcoBlue	LX61-5J249-C	1.6 ± 0.24
8.	Mondeo with manual transmission	KG93-5J249-AA	1.6 ± 0.24
9.	Mondeo with automatic transmission	KG93-5J249-BA	1.6 ± 0.24
10.	S-MAX/Galaxy with twin turbocharger	J1G3-5J249-AA	1.6 ± 0.24
11.	S-MAX/Galaxy with manual transmission	J1G3-5J249-BA	1.6 ± 0.24
12.	S-MAX/Galaxy with automatic transmission	J1G3-5J249-CA	1.6 ± 0.24
13.	Edge with twin turbocharger	K2G3-5J249-AB	2.05 ± 0.35
14.	Edge with manual transmission	K2G3-5J249-BB	2.05 ± 0.35
15.	Edge with automatic transmission	K2G3-5J249-CA	2.05 ± 0.35
16.	Transit Connect/Tourneo Connect with short wheelbase	KV61-5J249-A	2.05 ± 0.28
17.	Transit Connect/Tourneo Connect with short wheelbase	KV61-5J249-C	2.05 ± 0.28
18.	Transit Connect/Tourneo Connect with long wheelbase	KV61-5J249-B	2.06 ± 0.28
19.	Transit Connect/Tourneo Connect with long wheelbase	KV61-5J249-C	2.06 ± 0.28
20.	Tourneo Custom	KK21-5J249-A	6.54 ± 0.98
21.	Transit with front wheel drive	KK21-5J249-A	6.54 ± 0.98
22.	Transit with rear wheel drive	KK31-5J249-A	4.98 ± 0.75
23.	Transit with hydraulic power assist steering	KK31-5J249-C	4.72 ± 0.71
24.	Ranger	JB3G-5J249-B	1.5 ± 0.23

No.	Vehicle line	Part number	Resistance (Ohm)
25.	Ranger with twin turbocharger	JB3G-5J249-D	(1.3 + 0.2) ± 0.23
26.	Ranger with twin turbocharger	JB3G-5J249-E	(1.3 + 0.2) ± 0.23

4th Generation Selective Catalytic Reduction (SCR)

E429741

Item	Description
-	4th Generation Selective Catalytic Reduction (SCR) module

The 4th Generation Selective Catalytic Reduction (SCR) system is a combination of dual dosing applications **and** single dosing applications.

Dual dosing has a single pump and two reductant injectors in the exhaust system.

The single dosing applications have a single reductant injector.

The easiest way of determining the SCR generation is to identify the Glow Dosing Control Module (GDCM) – this module controls the dosing and the glow functions in a single ECU.

It can be easily identified as it is a 3 connector ECU.

NOTE: Sometimes the combination of the Reductant Dosage Control Module (RDCM) with the Glow Plug Module (GPM) is referred to as Glow Dosing Control Module (GDCM).

The left-hand pocket is for the dosing functions, the middle pocket is the Live for Glow plugs, the right hand pocket is for the Glow plug functions, so to reiterate:

- Grey multiplug is for dosing wiring (including urea heating)
- Black multiplug is Glow wiring

4th Generation Selective Catalytic Reduction (SCR) Applicable Diagnostic Trouble Codes (DTCs) for Level, Quality and Temperature (LQT) sensor

No.	Diagnostic Trouble Code			DTC Description		Slow/Fast	Bit	Actual Fault
1.	P205C	0x84	Signal Below Allowable Range	Reductant Tank Temperature Sensor "A" Circuit Low	Inducement	Fast	10	Reductant Level Sensor Fault
2.	P206D	0x00	No Sub Type Information	Reductant Quality Sensor High	Inducement	Slow	10	Reductant Level Sensor Fault
3.	P206C	0x00	No Sub Type Information	Reductant Quality Sensor Low	Inducement	Slow	10	Reductant Level Sensor Fault
4.	P206B	0x00	No Sub Type Information	Reductant Quality Sensor Range/Performance	Inducement	Slow	9	Reductant Agent Quality Fault
5.	P2BA9	0x00	No Sub Type Information	NOx Exceedance - Insufficient Reductant Quality	Inducement	Slow	9	Reductant Agent Quality Fault
6.	P206B	0x81	Invalid Serial Data Received	Reductant Quality Sensor Range/Performance	Inducement	Slow	10	Reductant Level Sensor Fault
7.	P203D	0x00	No Sub Type Information	Reductant Level Sensor "A" Circuit High	Inducement	Slow	10	Reductant Level Sensor Fault

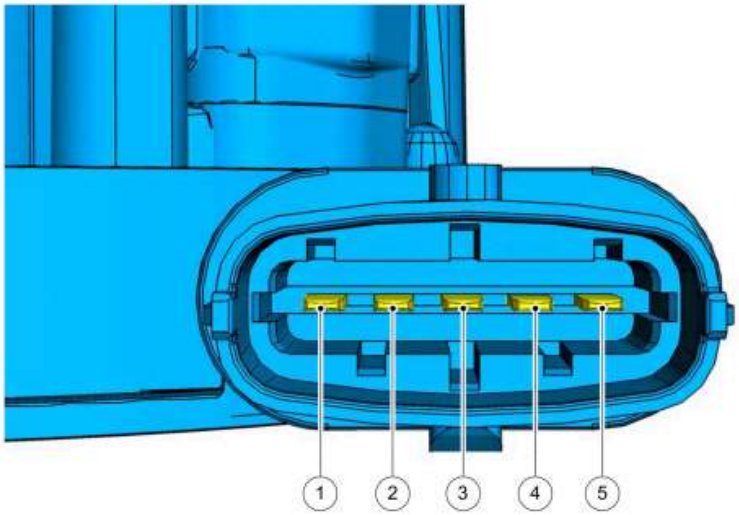
No.	Diagnostic Trouble Code			DTC Description		Slow/Fast	Bit	Actual Fault
8.	P203C	0x00	No Sub Type Information	Reductant Level Sensor "A" Circuit Low	Inducement	Slow	10	Reductant Level Sensor Fault
9.	P203B	0x81	Invalid Serial Data Received	Reductant Level Sensor "A" Circuit Range/Performance	Inducement	Slow	10	Reductant Level Sensor Fault
10.	U0619	0x31	No Signal	Lost Communication With Reductant Level Sensor "A"	Inducement	Fast	10	Reductant Level Sensor Fault
11.	U0619	0x00	No Sub Type Information	Lost Communication With Reductant Level Sensor "A"	Inducement	Fast	10	Reductant Level Sensor Fault
12.	P206B	0x8F	Erratic	Reductant Quality Sensor Range/Performance	Inducement	Fast	10	Reductant Level Sensor Fault
13.	P206D	0x85	Signal Above Allowable Range	Reductant Quality Sensor High	Inducement	Fast	10	Reductant Level Sensor Fault
14.	P206C	0x84	Signal Below Allowable Range	Reductant Quality Sensor Low	Inducement	Fast	10	Reductant Level Sensor Fault
15.	P206B	0x64	Signal Plausibility Failure	Reductant Quality Sensor Range/Performance	Inducement	Fast	10	Reductant Level Sensor Fault
16.	P206B	0x00	No Sub Type Information	Reductant Quality Sensor Range/Performance	Inducement	Slow	9	Reductant Agent Quality Fault
17.	P2BA9	0x00	No Sub Type Information	NOx Exceedance - Insufficient Reductant Quality	Inducement	Slow	9	Reductant Agent Quality Fault
18.	P2045	0x00	No Sub Type Information	Reductant Temperature Sensor "A" Circuit High	Inducement	Slow	10	Reductant Level Sensor Fault
19.	P2044	0x11	Circuit Short To Ground	Reductant Temperature Sensor "A" Circuit Low	Inducement	Fast	10	Reductant Level Sensor Fault

4th Generation Selective Catalytic Reduction (SCR) Information and operation

The Level, Quality and Temperature (LQT) sensor is a Single Edge Nibble Transmission (SENT) based sensor.

The LQT sensor is connected via the 5-pin electrical connector at the reductant tank, the connection is linked to the Dosing Control Unit (DCU).

On all 4th Generation equipped vehicles they are connected to the following Pins:



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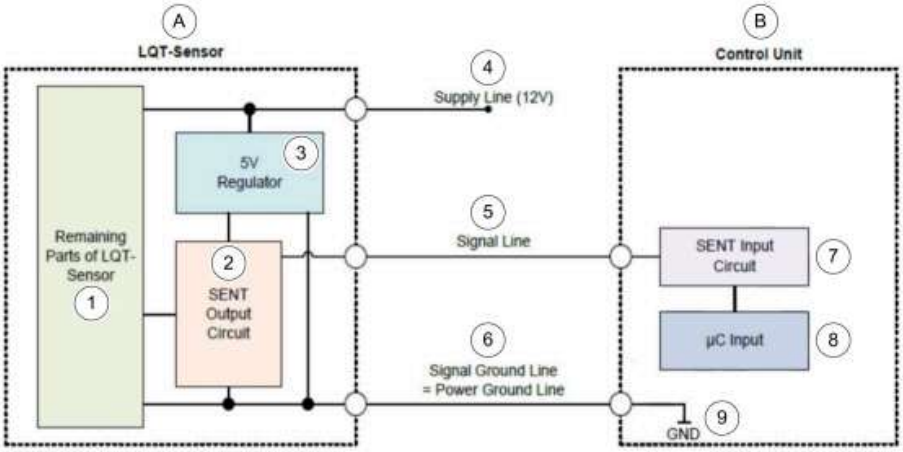
Reductant tank connector	Signal	Glow Dosing Control Module (GDCM) Pin
5	LQT Heater	H4
4	Ground	
3	LQT Ground	C2
2	LQT Signal	D3
1	LQT Power	E2



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Item	Description
A	LQT sensor
B	Glow Dosing Control Module (GDCM)
1	Remaining Parts of LQT sensor
2	SENT Output Circuit
3	5 V Regulator
4	Supply Line (12 V)
5	Signal Line
6	Signal Ground Line = Power Ground Line
7	SENT Input Circuit
8	µC Input
9	GND

The LQT sensor cannot be changed as it is plastic welded to the tank. If the sensor is deemed to be defective it will involve a complete urea tank change. This should ONLY be done when all diagnostic methods have been exhausted.

Disconnecting the sensor whilst the vehicle is powered on or whilst the PCM has not fully power latched can and will trigger DTC's that will cause confusion and will require further diagnostics.

It is only possible within the dealerships to check the continuity of the Glow Dosing Control Module (GDCM) wiring to tank and LQT Power (PIN2>PIN D3of GDCM and to ensure that PIN 1 of the QLT sensor is receiving 12 volts – NOTE if you disconnect the LQT sensor with the ignition ON you WILL set DTCs in the PCM for urea level and urea quality.

The LQT sends data to the Glow Dosing Control Module (GDCM) via SENT, the GDCM then sends information about the level and quality via private CAN to the PCM, the PCM then acts upon that information, if the readings are within a specific set of ranges no DTCs are set relating to UREA LEVEL and UREA QUALITY.

If there is an issue with the UREA TEMPERATURE, the Glow Dosing Control Module (GDCM) requests the PCM to trigger a DTC for UREA TEMPERATURE.

Simply put, the PCM controls DTC setting for urea level and quality, the Glow Dosing Control Module (GDCM) has internal limits for urea temperature and will request the PCM to set DTC's for urea temperature.

Why is this important information?

Well, as we know the Glow Dosing Control Module (GDCM) does not support reading of DTC's, it does however support On Demand Self Test, also the DIDS for Level, Quality and Temperature are readable in both the PCM and GDCM – this can either aid you if you understand the above passage or cause you to misdiagnose if you are unaware of how the system functions – the latter leads to the unnecessary replacement of the urea tank.

The following DIDS can be read from the PCM:

DID $0683 – Reductant Level Sensor - Level Height Measured – Unfiltered (REDUCT_HIGT_UNFIL)

DID $0684 – Reductant Level Sensor - Concentration Measured – Unfiltered. (REDUCT_CON_UNFIL)

DID $0685 – Reductant Level Sensor - Temperature Measured – Unfiltered. (REDUCT_TMP_UNFIL)

The following DIDS can be read from the Glow Dosing Control Module (GDCM):

DID $015F - Reductant Temperature Measurement Value from Sensor (REDUCT_TMP_MES)

DID $0160 - Reductant Level Measurement Value from Sensor (REDUCT_LVL_MES)

DID $0161 - Reductant Concentration Measurement Value from Sensor (REDUCT_CON_MES)

The PCM will set DTC's for urea quality when Glow Dosing Control Module (GDCM) tells the PCM there are no valid reflections or no data at all, this is performed over the private CAN network, in this instance the DID $0684 – Reductant Level Sensor - Concentration Measured – Unfiltered(REDUCT_CON_UNFIL) will read 63.5% constantly, the DID can also read 63.5% if the LQT sensor is initialising so do not take a single read of the DID as there being an issue.

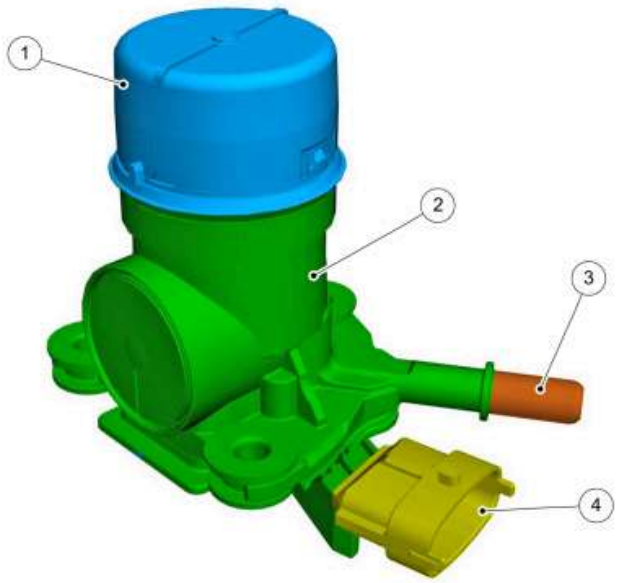
The PCM will set DTC's for urea level when Glow Dosing Control Module (GDCM) tells the PCM there is no valid level or no data at all, this is performed over the private CAN network, in this instance the DID $0683 – Reductant Level Sensor - Level Height Measured – Unfiltered (REDUCT_HIGT_UNFIL) will read 126% constantly.

If P206D, P206C or P206B are set, and you have determined the correct repair and you are certain that the fault is repaired, the monitor completion time for these faults is over 300 seconds with the key on, which means that this fault will only test and pass when the DCU(SOBDCM) has tested – circa 5 seconds to complete, In total the ignition on time will need to be on for 320 seconds to ensure that the vehicle comes out of inducement.

NOTE: If the monitor has not run within the 10 minutes it will require the ignition OFF for 10 minutes before trying again.

4th Generation Selective Catalytic Reduction (SCR) Pump and Backflow Pump (Purge Pump)

The pump assembly is the only component that can be replaced independently of the complete tank assembly.



Reductant pump

Item	Description
1	Main pump
2	Backflow pump (purge pump)
3	Connection heated reductant supply line
4	7-pin electrical connector

The DTC's below are related to the pump and purge pump, you will notice that they are all electrical based meaning open circuit/short circuit.

No.	Diagnostic Trouble Code			DTC Description		Slow/Fast	Bit	Actual Fault
1.	P208D	0x01	General Electrical Failure	Reductant Pump "A" Control Circuit High	Inducement	Fast	1	Urea Pump Motor Control Fault
2.	P208D	0x00	No Sub Type Information	Reductant Pump "A" Control Circuit High	Inducement	Fast	1	Urea Pump Motor Control Fault
3.	P208B	0x90	Stuck On	Reductant Pump "A" Performance/Stuck Off				
4.	P208C	0x00	No Sub Type Information	Reductant Pump "A" Control Circuit Low	Inducement	Fast	1	Urea Pump Motor Control Fault

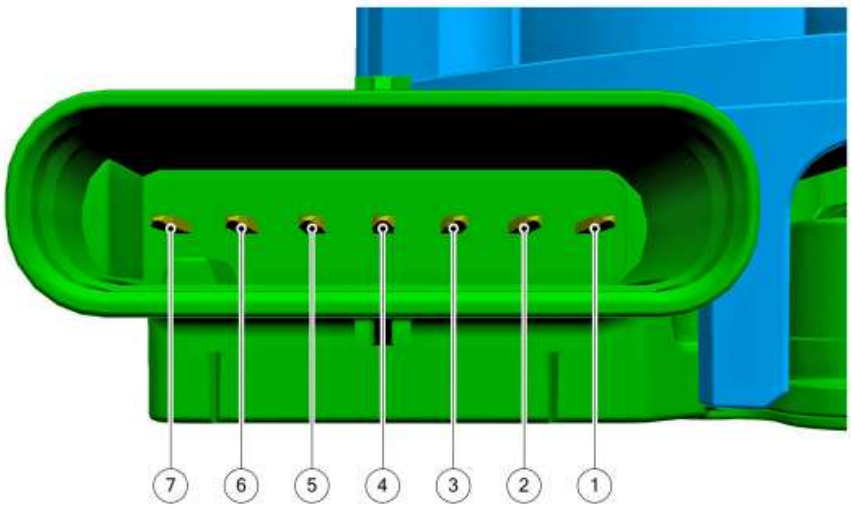
No.	Diagnostic Trouble Code			DTC Description		Slow/Fast	Bit	Actual Fault
5.	P20FD	0x01	General Electrical Failure	Reductant Pump "B" Control Circuit High	Inducement	Fast	1	Urea Pump Motor Control Fault
6.	P20FD	0x00	No Sub Type Information	Reductant Pump "B" Control Circuit High	Inducement	Fast	1	Urea Pump Motor Control Fault
7.	P20FC	0x00	No Sub Type Information	Reductant Pump "B" Control Circuit Low	Inducement	Fast	1	Urea Pump Motor Control Fault
8.	P208B	0x00	No Sub Type Information	Reductant Pump "A" Performance/Stuck Off	Inducement	Slow	18	Reductant Pump Assembly
9.	P208A	0x00	No Sub Type Information	Reductant Pump "A" Control Circuit/Open	Inducement	Fast	18	Reductant Pump Assembly
10.	P20FB	0x00	No Sub Type Information	Reductant Pump "B" Performance/Stuck Off	Inducement	Fast	18	Reductant Pump Assembly
11.	P20FA	0x00	No Sub Type Information	Reductant Pump "B" Control Circuit/Open	Inducement	Fast	18	Reductant Pump Assembly

NOTE: The bit assignment in the table does not mean that it is the actual component at fault, it is merely a bit assignment to point you into the fault area. This is particularly useful if DTC's have been cleared.

In much the same manner as the LQT sensor, if the ignition is on or the vehicle has not power latched you will trigger DTC's if the connector or the Glow Dosing Control Module (GDCM) is disconnected.

4th Generation Selective Catalytic Reduction (SCR) 7-pin electrical connector - reductant pump

The electrical connector at the reductant pump is the 7-pin connector:



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Reductant tank connector	Signal	Glow Dosing Control Module (GDCM) Pin
1	PIN Not used	
2	PIN Not used	
3	PIN Not used	
4	Supply pump -	B4
5	Supply pump +	A4
6	Backflow Pump +	C4
7	Backflow Pump -	D4

NOTE: Before replacement of the reductant tank test the reductant pump for Open circuits/short circuits.

Below are the Pins to check and the acceptable resistance readings:

Measurement with Ohmmeter:

- Resistance main pump Pin 4 to 5 = 4.13 Ohms
- Resistance Backflow pump (purge pump) Pin 6 to 7 = 4.12 Ohms
- Pin 6 to 4, Pin 6 to 5, Pin 7 to 4, Pin 7 to 5 = (open load)

DTCs relating to Urea pump pressure:

No.	Diagnostic Trouble Code			DTC Description		Slow/Fast	Bit	Actual Fault
1.	P208B	0x90	Stuck On	Reductant Pump "A" Performance/Stuck Off				
2.	P249E	0x00	No Sub Type Information	Closed Loop Reductant Injection Control At Limit - Flow Too High				
3.	P249E	0x9B	High/Excessive Flow	Closed Loop Reductant Injection Control At Limit - Flow Too High				
4.	P249D	0x9C	Low/Insufficient Flow	Closed Loop Reductant Injection Control At Limit - Flow Too Low				
5.	P2D1D	0x00	No Sub Type Information	Reductant System Leak Detected - Small Leak	Inducement	Slow	18	Reductant Pump Assembly
6.	P20E9	0x00	No Sub Type Information	Reductant Pressure Too High	Inducement	Slow	18	Reductant Pump Assembly
7.	P20E8	0x92	Performance or Incorrect Operation	Reductant Pressure Too Low	Inducement	Slow	18	Reductant Pump Assembly
8.	P208B	0x00	No Sub Type Information	Reductant Pump "A" Performance/Stuck Off	Inducement	Slow	18	Reductant Pump Assembly
9.	P20E8	0x84	Signal Below Allowable Range	Reductant Pressure Too Low	Inducement	Slow	18	Reductant Pump Assembly

The urea system does not contain a pressure sensor, the pressure is calculated based off a calibrated number of pump strokes, the pump is not a rotary pump. The modelled pressure can be read by the diagnostic tool from the GDCM via DID $0166 (REDUCT_LINP_CLC). The DID is not IO controllable. If you have the ignition on only the chances are that you will show no pressure, the pump only provides pressure when conditions are met, these conditions are:

- Engine running
- Engine coolant at 65°C
- Exhaust gas temperature sensor 1 above 160°C

When you turn off the engine the purge pump operates and will empty the urea line. In some scenarios if monitoring the pressure pump and the purge pump whilst driving it may appear that the purge pump is emptying the urea line, this is no cause for concern.

When you turn off the engine the purge pump operates and will empty the urea line. In some scenarios if monitoring the pressure pump and the purge pump whilst driving it may appear that the purge pump is emptying the urea line, this is no cause for concern.

One main factor of pump failures and the under pressure issues is the fact that fluid other than Urea has been placed in the urea tank, this should be investigated when you are checking for leaks and ensuring urea flow via the service tools, running the dosing measurement test should be your second choice after checking for visible leaks.

Over pressure DTC's can be caused by kinks in the urea line or blockages in the urea line, a physical blockage in the line or a blocked injector. In order to determine if a blockage is present perform the dosing measurement test, as this will dispense a specific volume of urea over time.

Once the fault has been identified and resolved it is advisable to run the complete static healing process, you will be required to get the system to be dosing, then ignition off for around 30 seconds to activate the purge pump.

The Healing process is outlined below.

Nearly all monitors can be completed statically, in most instances there is no need to drive the vehicle to get out of inducement.

If executing an entry condition that requires dosing, it is recommended that you continue to dose for at least 5 minutes.

The complete process is below for Bit 1 monitors in the slow group, however following this will ensure all monitors complete.

1. Start the engine
2. Get the Engine coolant temp up to 65°C
3. Once at 65°C hold the RPM at 2000 RPM for 10 minutes
4. Increase and decrease throttle for a further 5 minutes
5. After 5 mins return to idle
6. Start datalogger and look at SCR_F_SLW_B18 in datalogger for PCM– it should be set true – keep datalogger active
7. Turn the ignition off read DID $06AD BIT 18 (SCR_F_SLW_B18) and wait until it sets to false, circa 35 seconds. Once set to false go to step 8
8. Turn Ignition on
9. Turn ignition off for at least 3 minutes – DO NOT open the doors (this is to ensure a power latch of the PCM) – once datalogger shows a comms error the vehicle has power latched
10. After the Power latch turn the ignition on and start engine

The exception to static testing is the urea quality DTC's (Bit 10 Slow calculated), these may require the vehicle to be driven. The urea concentration is checked after 10 minutes, this requires the tank to slosh to mix the urea in the case of the urea being frozen.

If the vehicle does not come out of inducement, the ignition will need to be turned of for at least 11 minutes to try again.

If it is not possible to run statically a sedate drive for at least 15 minutes will provide the same outcome.

4th Generation Selective Catalytic Reduction (SCR) Tank and Line Heaters

The reductant tank heater and heated reductant supply line are **not** inducement, however they will put a MIL on.

The heaters operate at 4°C when the ignition is on, the circuit checks are monitored at every key on to determine Open circuit/Short circuit.

The Tank and Line heaters can be tested after repair by running the On Demand Selftest , NOT CMDTCS from the Glow Dosing Control Module (GDCM), Routine $0202.

No.	Diagnostic Trouble Code			DTC Description
1.	P20BD	0x13	Circuit Open	Reductant Heater "B" Control Circuit/Open
2.	P20BE	0x00	No Sub Type Information	Reductant Heater "B" Control Performance
3.	P20C0	0x12	Circuit Short To Battery	Reductant Heater "B" Control Circuit High
4.	P20BF	0x12	Circuit Short To Battery	Reductant Heater "B" Control Circuit Low
5.	P20B9	0x13	Circuit Open	Reductant Heater "A" Control Circuit/Open
6.	P20BA	0x00	No Sub Type Information	Reductant Heater "A" Control Performance
7.	P20BC	0x12	Circuit Short To Battery	Reductant Heater "A" Control Circuit High
8.	P20BB	0x00	No Sub Type Information	Reductant Heater "A" Control Circuit Low
9.	P221D	0x00	No Sub Type Information	Reductant Heater "B" Current Too High
10.	P221C	0x00	No Sub Type Information	Reductant Heater "B" Current Too Low
11.	P214F	0x00	No Sub Type Information	Reductant Heater "A" Current Too High
12.	P21DD	0x00	No Sub Type Information	Reductant Heater "A" Current Too Low
13.	P209F	0x00	No Sub Type Information	Reductant Tank Heater Control Performance

NOTE: Tank Heater DTCs reference Reductant Heater A. Line heater DTC's are referenced as line heater B.

The Tank heater can be measured, the permissible acceptable ranges in Ohms are:

1.07 Ohms – 2.25 Ohms From PIN 5 to PIN 4 of the 5 PIN connector on the tank.

Remember - Disconnecting the sensor whilst the vehicle is powered on or whilst the PCM has not fully power latched can and will trigger DTC's that will cause confusion and will require further diagnostics.

4th Generation Selective Catalytic Reduction (SCR) Part number and resistances heated reductant supply line

The resistance of the heated reductant supply line is unique per vehicle line, below is a chart detailing the part number and resistances:

No.	Vehicle line	Reductant tank part number	Pressure line part number	Line length (mm) Circuit 1	Line length (mm) Circuit 2	Line length (mm) Circuit 3	Pressure line resistance in Ohm	Tolerance Pressure line resistance (Ohm)	Minimum resistance (Ohm)	Maximum resistance (Ohm)	Minimum conductance	Maximum conductance
				1.	L2 Cold	L3 Pump						
1.	2022 Ranger with single turbocharger (Dual Dose)	MB3Q-5J228-C*	MB3Q-5J253-K*	2148	1424	1989	2.14	± 0.32	1.73	2.58	0.39	0.58
2.	2022 Ranger with twin turbocharger (Dual Dose)	MB3Q-5J228-C*	MB3Q-5J253-L*	1853	1424	1989	2.12	± 0.32	1.71	2.56	0.39	0.58
3.	2022 Ranger with twin turbocharger (Dual Dose) - Redback	MB3Q-5J228-CC	MB3Q-5J253-L	2034	1411	1880	2.13	± 0.32	1.81	2.45	0.41	0.55
4.	2024 Transit / Tourneo Custom	PZ31-5J228-A*	PZ31-5J249-C*	1898	1044	862	2.90	± 0.43	2.34	3.50	0.29	0.43
5.	2024 Transit / Tourneo Custom	PZ31-5J228-A*	PZ31-5J249-D*	1846	1044	862	2.87	± 0.43	2.32	3.47	0.29	0.43
6.	2019 - 2024 Transit FWD with single turbocharger		RK31-5J249-CA				6.19 ± 15%		4.95	7.43	0.13	0.20

No.	Vehicle line	Reductant tank part number	Pressure line part number	Line length (mm) Circuit 1	Line length (mm) Circuit 2	Line length (mm) Circuit 3	Pressure line resistance in Ohm	Tolerance Pressure line resistance (Ohm)	Minimum resistance (Ohm)	Maximum resistance (Ohm)	Minimum conductance	Maximum conductance
				1.	L2 Cold	L3 Pump						
7.	2024.0 Tourneo Courier/Transit Courier		R2X6-5J249-AA				2.29 ± 0.36		1.85	2.77	0.36	0.54
8.	2019 - 2024 Transit RWD with single turbocharger		RK31-5J249-DA				4.96 ± 15%		3.97	5.95	0.17	0.25
9.	2022 Ranger with 3.0L Power Stroke Diesel	MB3Q-5J228-CC	MB3Q-5J253-M; +MB3Q-5J253-	2034	927	1959	2.12	0.39	1.74	2.51	0.40	0.576