Preview Solution CBR-2107-22

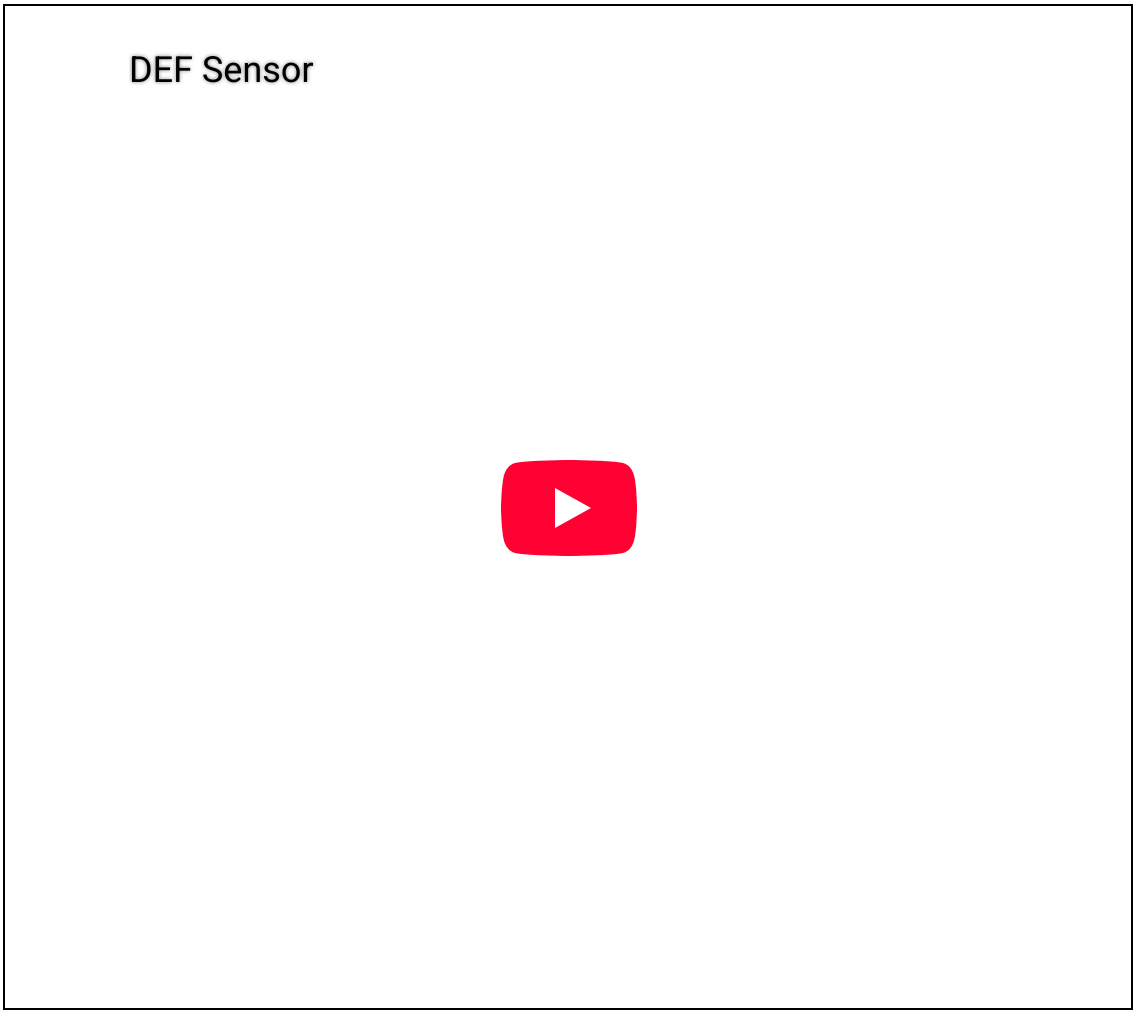
Mack DEF Level (UQLS) Sensor Troubleshooting Guide - US17+OBD16 Emissions to US22+OBD2023 (DOES NOT APPLY TO AN(4) and PR(4))

Published 7 January 2026

Valid For
All Mack models 2017 to 2024

Note: This CBR does not apply to PR(4) and AN(4)

Overview



Live UI

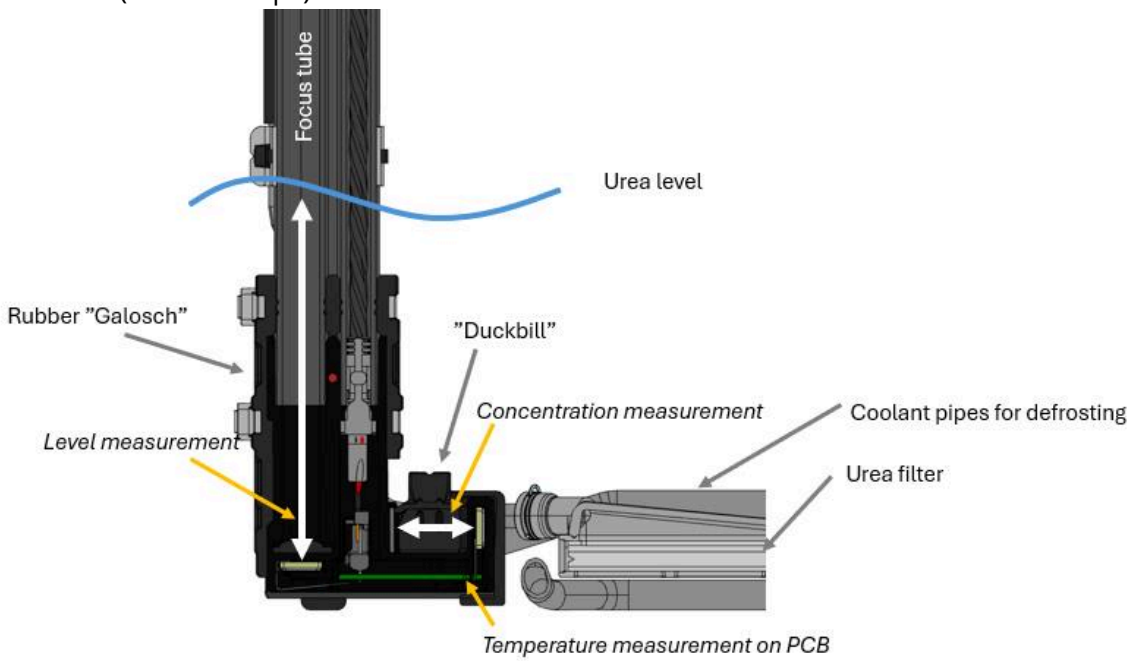
The Urea Quality Level Sensor (UQLS) is a smart sensor that is located in the top of the Urea (DEF) Tank, commonly referred to as the DEF Level Sensor or Combined Tank Unit.

This smart sensor has Urea Quality, Level, and Temperature all integrated into it as one unit and reports on the DL7 (J1939-7) Datalink. This sensor is responsible for sending all the urea information to the Aftertreatment Control Module (ACM) and Engine Control Module (ECM).

Updated UQLS Functions

Basic definition

The SSI sensor measures level as well as concentration by means of ultrasonic waves. The **Urea Quality Level Sensor (UQLS)** communicates on **Controller Area Network (CAN)** and is connected to EngineSubnet. The sensor will support automatic baud rate detection (250/500 kbps).

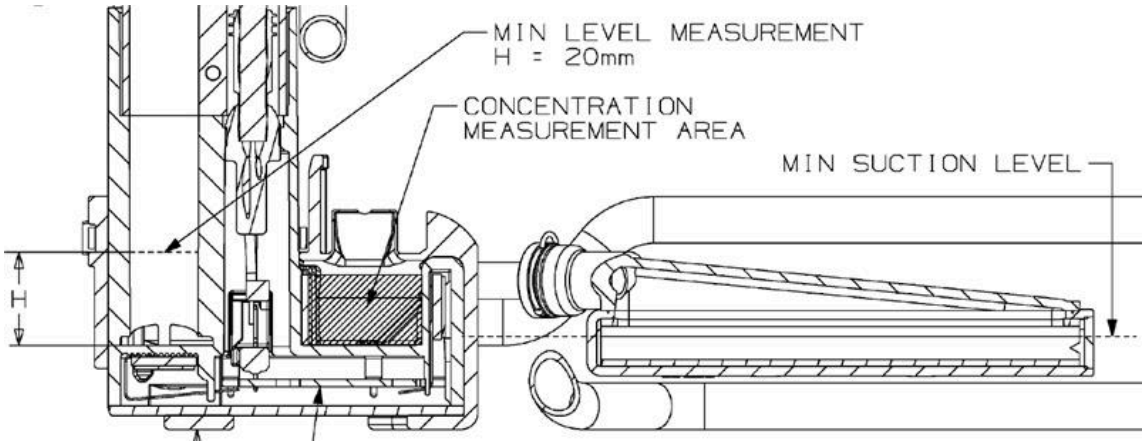


Level measurement

Level measurement works by bouncing ultrasonic waves towards the liquid level. The sensors report level in mm where 0 is defined as bottom of the focus tube (offset values can be used for specific part number, e.g NA aftermarket sensors). However, some urea above the **piezoelectric sensor technology (PZT)** is needed in order for the sensor to detect a level, definition is therefore that 20 mm is the lowest level where the sensor can reliably measure. If the sensor can't detect urea level it will output an error.

Based on tank geometry and dataset steered by vehicle variant specification, the mm value from the sensor is converted to urea mass and tank fill percentage.

Live UI



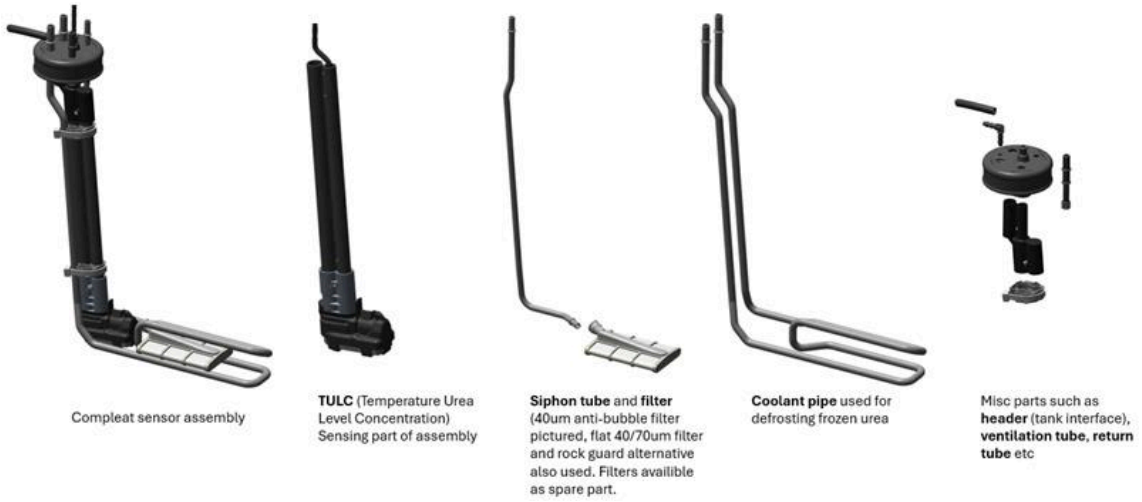
Quality measurement

Urea quality (concentration) is measured by bouncing ultrasonic waves between the **PZT** in the toe of the sensor towards a reflector. By knowing the distance and temperature the urea concentration is derived from the speed of sound waves in the liquid.

Temperature measurement

Temperature is measured on two locations on the **Printed Circuit Board (PCB)**.

Component list



NOTE: The UQLS cannot be ordered in separate parts; it must be purchased as a complete sensor. Refer to impact for details.

Diagnosis and Repair

Perform a DTC Readout and Review Codes

If any of the codes in yellow below appear on the Readout in Active or Confirmed status: Continue to the diagnostic steps in the following section.

DTC	DTC Description
P205B64	Reductant Tank Temperature Sensor, Circuit Range/Performance
P203A13	Reductant Level Sensor "A", Open Circuit

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P203C00	Aftertreatment Reagent Level, Short Circuit Low
P206A13	Reductant Quality Sensor, Open Circuit
P206C00	Reductant Quality Sensor, Short Circuit Low
P206B64	Reductant Quality Sensor Range/Performance
P205A13	Reductant Tank Temperature Sensor, Open Circuit
P205C00	Aftertreatment Reagent Tank Temperature, Short Circuit Low
P204364	Aftertreatment Reagent Tank Temperature Sensor Stuck, Signal plausibility failure

DO NOT REPLACE the DEF Level Sensor for any of the codes in green below: DO NOT proceed with the diagnostics steps in this solution. None of these codes immediately indicate a failed DEF Level Sensor. Use the table in conjunction with PTT's Guided Diagnostics to find the root cause.

DTC	DTC Description	Probable Source
P203F00	Reductant Level Low	Commonly low DEF quantity or level sensor float in DEF tank stuck
P203B00	Aftertreatment Reagent Level Warning	System fault. Follow Guided Diagnostics.
U02A200	Lost Communication with Reductant Quality Module	Commonly a wiring harness or connection issue.
P24FF00	Reductant Temperature Too High	DEF tank temp above 70°C (160°F). Commonly the coolant line to the DEF tank are swapped.
P207F00	Reductant Quality	DEF quality low and SCR efficiency low. Commonly a DEF quality issue.

Diagnostic Steps For Yellow Codes

1. Check the sensor wiring harness connection.

• Disconnect the harness and make sure there is no damage to the wires or pins, corrosion, or water ingress in either of the connectors. If damage is found replace in accordance with Technical Service Bulletin (only if applicable) 258-040 - Aftertreatment Diesel Exhaust Fluid (DEF) Tank, Level Sensor, Replacement. Located in Impact.

1. Navigate to the Service tab.

2. In the Info Type box, make sure Technical Service Bulletins is selected.

3. In the Additional search values box select Keyword

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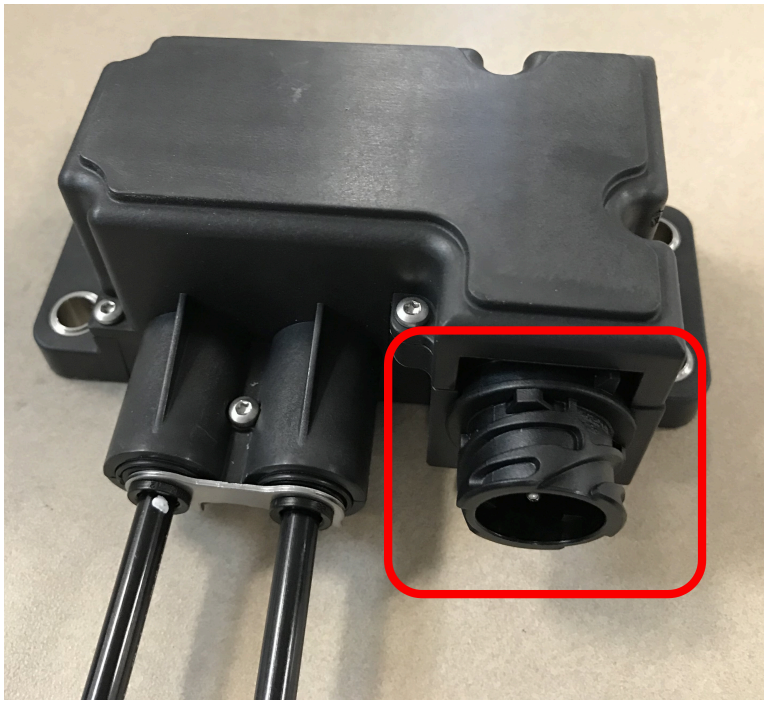
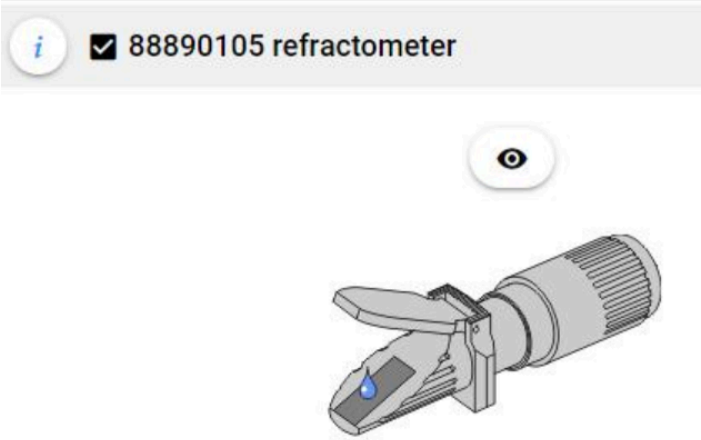
4. Enter 258-040 into the text entry box, press the Search button.

5. A link for the article will be shown in the results. Click on the title, then choose one of the options from the window that opens.



2. Verify the DEF quality is at an acceptable value.

- Use refractometer part number 88890105 to verify the DEF quality. See illustration below.



3. Verify that the DEF tank is not frozen.

4. Ensure that the DEF tank is adequately filled.

5. Clear the Fault Codes.

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6. Start the engine. Run the engine on high idle for 2 minutes at 1000 rpm or higher.

7. Turn the Engine Off, Key Off for 15 seconds.

8. Start the engine. Run the engine on high idle for 2 minutes a second time.

Evaluate the Results

If any of the faults shown in the yellow chart above return active: Replace the DEF Level Sensor in accordance with Impact instructions and the wires routed as shown in Technical Service Bulletin 258-040.
If none of the faults in the yellow chart above return: No troubleshooting or replacement of the DEF Level Sensor is necessary.

Rules for Replacement

• In order for a repair to be eligible for warranty coverage, one of the diagnostic trouble codes (DTCs) listed above must be present. However, in rare cases where there is a potential failure but no DTCs are detected, please provide supporting evidence of the failure. This can be in the form of a photo or video, along with an explanation for the need of replacement. This evidence will be used to determine if the repair qualifies for warranty coverage. For any additional support with diagnostics, open an e-Service case.
• Standard Diagnostic Time for a DEF Level Sensor is 0.6 hrs.

Related links and attachments

FSB 258-040