



Diesel Exhaust Fluid (DEF) Quality Test

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. The purpose of this test is to determine:

- Diesel Exhaust Fluid (DEF) urea concentration, as indicated by quality sensor reading versus actual DEF urea concentration in the DEF tank.
- If low DEF quality warning strategy performs as described in GM8775.
- If long term dosing adaptation engages.

1.2 Applicability. All vehicles with DEF systems.

1.3 Remarks. This procedure is intended to be used as a vehicle level assessment of the DEF fluid quality vehicle interaction. This procedure studies the accuracy of the quality sensor as well as the vehicle level interactions that occur when DEF urea concentration differs from the standard value.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- CG5088 Diesel Exhaust Fluid (DEF) Quality Test Tables
- GM8775 (ID)

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions.

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Tank Drain.

3.2.1.1 In-Tank DEF Pump. Equipment to activate DEF pump using device control capabilities through vehicle service tool interface.

3.2.1.2 Remote DEF Pump. Equipment to drain DEF tank through the DEF fill spud.

3.2.2 Equipment for measuring DEF added and removed from the tank with an accuracy of ± 50 mL

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3.2.3 A laptop computer or equivalent device to read the vehicle and DEF quality information. A NeoVI/Vehicle Spy software will be needed or similar for data capture.

3.2.4 A vehicle hoist may be necessary.

3.2.5 Refractometer. Refractometer or equivalent device used to measure DEF urea concentration with an accuracy of $\pm 0.2\%$.

3.3 Test Vehicle/Test Piece. Program specific vehicle with instrumented Engine Control Module (ECM) and DEF system, and equipment for interfacing with laptop used for data capture. The vehicle should include production representative:

- DEF tank assembly with controller.
- Instrument cluster.

3.4 Test Time. The following is an estimate on the amount of time (work hours) needed to perform this procedure. Preparation, other downtime, actual test, and analysis of data are considered in capturing a total calendar time.

Calendar time: 5 days

Test time: 24 hours

Coordination time: 16 hours

3.5 Test Required Information.

- DEF Rated Capacity.
- DEF Unusable Capacity.

3.6 Personnel/Skills. Skilled performance or test engineer needs to be present.

4 Procedure

4.1 Preparation.

4.1.1 The engineer shall use the V-Spy Auto Part Number program to identify what controllers are on the vehicle and request part numbers from those controllers.

4.1.2 The engineer shall print a copy of the readout and record test and vehicle information on Appendix A, Data Sheet A1.

4.1.3 The engineer shall prepare 20 L of DEF with an urea concentration of at least 45% (aged DEF).

4.1.4 The engineer shall ensure DEF tank is empty of useable DEF (un-useable DEF remains).

4.2 Conditions.

4.2.1 Environmental Conditions. Run at ambient temperatures above 5 °C and ensure the DEF tank has no frozen fluid.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Measurement conditions. The engine must be running for each DEF quality sensor reading recorded during the test. Measurements must be made prior to and following the addition of water or aged DEF.

4.3.1.1 Start of Test (SOT) Measurements. After adding fluid, record the following:

- Volume and type of fluid added.
- In tank urea concentration as measured by quality sensor (DEF calibration engineer should provide variable name).
- Value of DEF quality flag (DEF calibration engineer should provide variable name).
- Value of long term dosing adaptation parameter EeSCRR_K_LongTermAdapFx.
- Any Driver Information Center (DIC) messages present.

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4.3.1.2 End Of Test (EOT) Measurements. EOT measurements shall include:

- Kilometers driven since last fluid addition.
- Actual urea concentration of DEF sample taken from tank (sample should not exceed 5 mL).
- In tank urea concentration, as measured by quality sensor (DEF calibration engineer should provide variable name).
- Value of DEF quality flag (DEF calibration engineer should provide variable name).
- Value of long term dosing adaptation parameter EeSCRR_K_LongTermAdapFx.
- Any DIC messages present.

4.3.2 If the tank reaches rated capacity and will not accept additional fluid, that test will be considered complete when the subsequent EOT measurements are made.

4.3.3 Diluted DEF Testing.

4.3.3.1 Fill DEF tank to 15% of rated capacity or 3.5 L useable volume (whichever is greater) with new DEF. Check that urea concentration of fluid being added is between 31% and 34% prior to filling. Note concentration on data sheet.

4.3.3.2 Record SOT measurements described in 4.3.1.1.

4.3.3.3 Drive vehicle at least 30 km. The driving should include a mix of City and highway.

4.3.3.4 Record EOT measurements described in 4.3.1.2.

4.3.3.5 If no flags indicating low DEF quality are active or have been recorded during test procedure, add water equal to 2.5% of tank rated capacity and return to step 4.3.3.2.

4.3.3.6 If flags indicating low DEF quality are still active, add new DEF equal to 1 gal and return to step 4.3.3.2.

4.3.4 Aged DEF Testing

4.3.4.1 Ensure tank is empty of useable DEF (unusable remains), and that the vehicle is not in any low quality inducement state.

4.3.4.2 Fill DEF tank to 15% of rated capacity or 3.5 L useable volume (whichever is greater) with new DEF. Check that urea concentration of fluid being added is between 31% and 34% prior to filling. Note concentration on Appendix A, Data Sheet A1 and record value of long term dosing adaptation parameter EeSCRR_K_LongTermAdapFx.

4.3.4.3 Measure urea concentration of aged DEF; record on Appendix A, Data Sheet A1.

4.3.4.4 Record SOT measurements described in 4.3.1.1

4.3.4.5 Drive vehicle at least 30 km. The drive conditions used should include 40 mph 60 mph sections with semi frequent traffic stops in order to increase the likelihood of dosing adaptation learning.

4.3.4.6 Record EOT measurements described in 4.3.1.2.

4.3.4.7 If long term dosing adaptation parameter EeSCRR_K_LongTermAdapFx still has a value within 0.1 of the value recorded at the beginning of the Aged DEF Testing, add aged DEF equal to 5% of tank rated capacity and return to step 4.3.4.4.

4.3.4.8 If long term dosing adaptation parameter EeSCRR_K_LongTermAdapFx does not have a value within 0.1 of the value recorded at the beginning of the Aged DEF Testing, add water equal to 5% of tank rated capacity and return to step 4.3.4.4.

5 Data

5.1 Calculations. Calculate the percent of error as indicated on Appendix A, Data Sheet A1.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. Record data on Appendix A, Data Sheet A1 and CG5088. See example in Appendix A, Data Sheet A2.

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