



Driver Information Center (DIC) Fuel Economy Validation

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 document is to define the procedure for validating the Driver Information Center (DIC) indicated fuel economy over a range of vehicle driving. The schedule developed consists of segments of the Federal Test Procedure (FTP) City and Highway Fuel Economy Test (HWFET) cycles - which are mandated by the Environmental Protection Agency (EPA) for emissions and fuel economy certification in many regions. Appendix A, Figure A1 documents the driving cycle developed to evaluate DIC accuracy. It is a full FTP City cycle (bags 1, 2, and 3) followed immediately by a HWFET test - which provides for a good mix of idle time, stop and go driving, as well as some higher speed steady state driving.

1.2 Applicability. This procedure applies to vehicles designed for sale in any region. The procedure is applicable to vehicles equipped with either automatic or manual transmissions.

1.3 Remarks. It is important that fuel consumption/economy is accurately measured and displayed in the DIC. There are multiple reasons for this - the two most important being to accurately reflect the customer's true fuel economy and to allow for precise range measurements.

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.

- Component Technical Specification (CTS) 9116 Combo-1 Drive Schedule for GMNA. **Note:** Optional for other regions.
- Global Energy Library (<https://share.gm.com/sites/GEAETL/Pages/Home.aspx>).
- GM Best Practice Energy-10: Driver Information Center - Fuel Consumed Validation.
- Intrepid Control Systems, Madison Heights, MI.
- Vehicle Technical Specification (VTS).

3 Resources

3.1 Facilities. This procedure is written for testing a full vehicle on a spindle coupled or chassis roll type dynamometer (dyno), but can also be performed on-road. The capability to accurately simulate the vehicle loading via 3-term road load coefficients (F0, F1, and F2) is required.

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.

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3.2 Equipment. Dyno testing will be conducted with an external (test cell) cooling fan placed in front of vehicle. The larger the cooling fan, the better for maintaining stable engine operating temperatures during testing.

A method for measuring fuel consumed is required. This can either be done via an in-line fuel flowmeter (preferred method), or by using an emissions bench and sampling bags.

3.2.1 A neoVI device (a product of Intrepid Control Systems) or equivalent instrument for recording data from the vehicle Controller Area Network (CAN) interface.

3.3 Test Vehicle/Test Piece. The test vehicle shall be supplied by the requestor in excellent operating condition. There shall be no performance or cooling system deficiencies.

3.4 Test Time.

Calendar time: 0 days

Test hours: 1 h

Coordination hours: 0 h

3.5 Test Required Information. The following information shall be supplied by the test requestor, using the units specified in the following list.

- Program designation
- Region of sale
- Vehicle number
- Model year
- Model number
- Model name
- Regular Production Options (RPO) (engine, transmission, axle)
- Engine controller calibration
- Instrument panel cluster and body controller calibrations
- Tire size (revolutions per kilometer (rpk) or revolutions per mile)
- EPA Test Weight class
- Road Load Coefficients
 - a. F0 (N)
 - b. F1 (N/(km/h))
 - c. F2 (N/(km/h)²)

3.6 Personnel/Skills. Qualified dyno operator.

4 Procedure

4.1 Preparation.

4.1.1 Dyno Preparation. Input to the dyno for inertia simulation shall be the regional Certification Test Weight (EPA Test Weight Class for GMNA). If the content of the actual vehicle chosen for test exceeds the regional Certification Test Weight due to option content, the dyno-simulated inertia input shall be adjusted upwards to reflect the true mass of the vehicle (including driver and fluids).

4.1.2 Vehicle Preparation. Ensure that the vehicle is fueled with the correct/recommended fuel for the region. The objective is to use fuels that are representative of what the customers will use. See the Global Energy Library for information regarding standard fuels for each region. These fuels are defined by standard density and Lower Heating Values (LHV). For testing in GMNA, the recommended fuel is Tier III certification fuel. This fuel has 10% ethanol content, which is similar to the commercially available pump fuel in the region. It is permissible to use pump fuel if the density has been measured (as is the case for the fuel used at the GM Milford Proving Grounds).

Preparations are also required to allow for the measurement of fuel flow/consumption. This can be done either by using a fuel flowmeter (preferred) or by sampling exhaust emissions.

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It is highly recommended that a properly calibrated in-line fuel flowmeter be used because of its consistent repeatability. The meter can be installed at either of two locations as follows:

- The fuel line connections at the fuel tank
- The top of the engine

If the exhaust sampling method must be used, it may be necessary to modify the tailpipe to ensure that the connection to the sampling hose can be made easily and is free of leaks. Ensure there are no exhaust leaks.

Ensure that there are adequate vehicle tie-downs (to the frame) when a dyno is being used.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Ideally this test is run in an indoor dynamometer facility where ambient temperature is to be controlled between 20 °C and 25 °C (68 °F and 77 °F). Humidity and barometric pressure control is not a requirement.

4.2.1.2 Dyno testing requires an external vehicle cooling fan to properly cool the engine. The fan should be sized to properly cool the vehicle during testing.

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. The signals in the following list must be recorded by the instrumentation during the testing, using the units specified.

- Vehicle speed (km/h)
- Distance (km)
- Fuel flow rate (cm³/s)
- Fuel accumulation (cm³ or liter)

In addition, it is recommended that the channels in the following list be monitored via vehicle serial data interface.

- Engine speed (revolutions per minute (rpm))
- Fuel Injected Rolling Counts (2 counts = 2 L fuel consumed, then resets.)
- Distance Rolling Count Average Driven (1024 counts = 1024 m distance travelled, then resets)
- Battery Voltage (V)
- Battery Current (A)
- Battery State of Charge (%)
- Regulated Voltage Control (RVC) Mode (Mode Number)
- Engine Cooling Fan Speed (rpm or %)
- Spark Advance (degrees)
- Throttle Position (%)
- Accelerator Pedal Position (%)
- Oil Temperature (degree C)
- Transmission Fluid Temperature (degree C)
- Coolant Temperature (degree C)
- Manifold Pressure (kPa)
- Regeneration Mode (**Note:** Diesel engine only)

4.4 Preconditioning. No vehicle preconditioning or warm-up is required to run this test.

4.5 Test Instructions.

4.5.1 For dynamometer testing, run the test per the steps as follows.

- a. The test requires a dyno operator and possibly an assisting person in vehicle depending on the sophistication of the Assembly Line Diagnostic Link (ALDL) neoVI scan file used.
- b. Some neoVI scan files will zero out all the DIC measurements at start of test and start recording the accumulated fuel used. With this type of file, the dyno operator can start the vehicle, and then initiate the

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