



Fuel Pump Module Durability Test Procedures

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. This document contains guidance toward the writing and execution of supplier Fuel Pump Module (FPM) performance test procedures. This document is only to be used in conjunction with GMW14081 to provide a complete set of technical requirements for the FPM.

1.2 Applicability. This document applies to all hardware described in GMW14081.

2 References

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

2.1 External Standards/Specifications.

ASTM 4057	ASTM D2274	ASTM D4814	ISO 12156
ASTM D445	ASTM D2622	ASTM D6079	ISO 12205
ASTM D525	ASTM D3120	ASTM D6423	ISO 20846
ASTM D664	ASTM D3703	EN 15751	ISO 20884
ASTM D1125	ASTM D4308	ISO 7536	

2.2 GM Standards/Specifications.

GMW14081

2.3 Additional References.

CG2021 Fuel Pump and Sender Module Validation Cross Reference Index (VCRI) (ID)

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

3 Resources

3.1 Facilities. This procedure is facility independent, but does require a suitable lab area capable of safely handling the test fuels specified by GMW14081. Reference schematics (see Appendix A, Figure A1) and procedural information are provided as guidance for test execution. A supplier test procedure for each test shall be provided to GM Validation for final approval.

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. Recommended equipment is listed in Table 1 and a recommended schematic can be found in Appendix A.

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Table 1: Recommended Equipment

Item	Description	System
1	Stainless Steel Durability Tester	All
	a. Pressure Relief to Ambient Atmosphere	--
	b. Ground Strap	--
	c. Heater/Chiller Coils	--
2	Power Supplies capable of 13.5 Vdc, 35 A	All
3a	Fuel System Control Module (FSCM), if applicable	ERFS DC
3b	Chassis Control Module (CCM), if applicable	ERFS DC
3c	Fuel Pump Power Module (FPPM), if applicable	ERFS DC
3d	Fuel Tank Zone Module (FTZM), if applicable	ERFS DC or EC
4	Electromagnetic Compatibility (EMC) Diode	MRFS
5	Oscilloscope	All
6	Orifice Calibrated to 15% to 20% WOT	ERFS/RFS
7	Pressure Regulator Gage	All
8	External Filter	Export/Diesel
9	Return Line Heater	Diesel

Note: DC = Direct Current; EC = Electronically Commutated; ERFS = Electronically Regulated Fuel System; MRFS = Mechanically Regulated Fuel System; RFS = Return Fuel System; WOT = Wide Open Throttle

3.3 Test Vehicle/Test Piece. Sample size shall be at the discretion of the FPM Product Development Team (PDT) based upon examination of hardware design, processes, and related variation (potential bandwidth and quantities). Samples sizes shall be documented in the VCRI (CG2021) and shall be approved by GM Validation.

3.4 Test Time.

Calendar time: Up to 333 d
 Test time: Up to 8000 h
 Coordination time: Up to 500 h

3.5 Test Required Information. See specific procedures.

3.6 Personnel/Skills. Laboratory technicians skilled in safe fuel handling and data acquisition.

4 Procedure

4.1 Preparation.

4.1.1 Test Fuels. Test fuels shall be purchased from a GM approved fuel supplier (using the GMPT number) to ensure correct formulation. Fuel purchase documentation including quality control analysis data shall be included in each test report.

4.1.2 Fuel Storage. Barrels of biodiesel fuel shall be stored in a temperature controlled environment ($< 0^{\circ}\text{C}$) or shall be nitrogen purged.

4.1.3 Test Fuels Analysis. Fuel shall be analyzed to understand fuel quality as it affects test part performance. Table 2 defines minimum fuels analysis to be performed for each test and sampling schedule. Fuel sampling shall be per ASTM 4057. Analysis shall be completed and reported at time of sampling (prior to final test report).

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Table 2: Fuel Analysis

Reference Paragraph (GMW14081, Tables 22 & 23)	Description	Analysis	ASTM Standard	Sampling Schedule
3.2.1.80.1	E25 General Purpose	Electrical Conductivity	ASTM D4308 or ASTM D1125	1
3.2.1.80.2	M15 General Purpose	Electrical Conductivity	ASTM D4308 or ASTM D1125	1
3.2.1.80.3	E85 General Purpose	Electrical Conductivity	ASTM D1125	1, 2, 3
3.2.1.80.4	Brazil E100 Cert Fuel	Electrical Conductivity	ASTM D1125	1, 2, 3
3.2.1.80.5	B20 Biodiesel	Hydroperoxide Number	ASTM D3703	1, 2, 3, 4
		Oxidation Stability	EN 15751	1, 2, 3
		Acid Number	ASTM D664	1, 2, 3, 4
3.2.1.81.1	Corrosive E22	Electrical Conductivity	ASTM D4308 or ASTM D1125	1, 2, 3
3.2.1.81.2	Low Lubricity	Lubricity	ASTM D6079	1
3.2.1.81.3	Oxidized Gasoline	Hydroperoxide Number	ASTM D3703	1, 2, 3
		Oxidation Stability	ASTM D525 or EN ISO 7536	1, 2, 3
3.2.1.81.4	Conductive E85	Electrical Conductivity	ASTM D1125	1, 2, 3
		pHe Determination	ASTM D6423	1, 2, 3
3.2.1.81.5	Conductive E100	Electrical Conductivity	ASTM D1125	1, 2, 3
		pHe Determination	ASTM D6423	1, 2, 3
3.2.1.81.6	Elemental Sulfur Gas	Silver Strip Corrosion	ASTM D4814	1
3.2.1.81.7	Deposit Forming and Peroxide B20	Hydroperoxide Number	ASTM D3703	1, 2, 3, 4
		Oxidation Stability	EN 15751	1, 2, 3
		Acid Number	ASTM D664	1, 2, 3, 4
		Gum Content	ASTM D2274 or EN ISO 12205	1, 2, 3
3.2.1.81.8	Bad Euro 3 Diesel	Total Sulfur	ASTM D2622	1
			ASTM D3120	--
			ISO 20846	--
			ISO 20884	--
3.2.1.81.9	Poor Lubricity and Low Viscosity Diesel	Silver Strip Corrosion	ASTM D4814	1
		Lubricity	ASTM D6079	1
		Viscosity	ISO 12156 ASTM D445	-- 1

Key, Sampling Schedule:

- 1: As received (immediately prior to testing).
- 2: Prior to 2nd fuel change.
- 3: Prior to final fuel change.
- 4: Diesel systems: anticipate additional testing to ensure peroxide and acid level performance (estimate 3 additional sampling events depending upon analysis findings).

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4.1.4 Test Required Information. The following information shall be provided with test report:

4.1.4.1 Test fuels certification and quality control analysis from GM approved fuel supplier.

4.1.4.2 Test fuel analysis provided as completed and included in each test report.

4.1.4.3 Pretest and posttest data, per GMW14081 shall be included in each test report.

4.2 Conditions.

4.2.1 Environmental Conditions. Temperature and humidity fluctuations in the laboratory should not affect the fuel temperature, vapor generation, test stand pressure or venting.

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.

4.2.3 Fuels. Fuels are defined by GMW14081.

4.2.4 FPM to be fixed at nominal installed height.

4.2.5 FPM lower module, including level sensor, fuel pump and level sensor wiring, tubing, and flange connections shall be completely submerged in the test fluid for the duration of the test.

4.2.6 Duration. Test durations are defined by GMW14081.

4.2.7 Temperature. Bulk fuel temperature shall be maintained per Table 3.

Table 3: Temperature Definition

Reference Paragraph (GMW14081, Tables 22 & 23)	Description	Temperature
3.2.1.80.x (1, 2, 3, 4)	Standard Gasoline Fuel Tests (Various)	40 °C
3.2.1.80.5	Standard Diesel Fuel Test	Per Appendix B, Table B1
3.2.1.81.x (1, 3, 4, 6)	Aggressive Gasoline Fuel Tests (Various)	40 °C
3.2.1.81.2	Low Lubricity Gasoline Fuel Test	65 °C
3.2.1.81.5	Conductive E100	55 °C
3.2.1.81.x (7, 8, 9)	Aggressive Diesel Fuel Tests (Various)	Per Appendix B, Table B2

4.2.8 Flow Rate.

- **MRFS:** FPM output flow shall be restricted to 15% to 20% WOT by a jet orifice in the feed line.
- **RFS:** Flow is dependent on applied pressure and voltage. All flow shall recirculate through the FPM return port.
- **ERFS:** Flow is dependent on applied pressure and voltage. For diesel applications, all flow shall recirculate through the FPM return port.
- **ERFS EC:** Flow is dependent on applied pressure and commanded RPM. For diesel applications, all flow shall recirculate through the FPM return port.

4.2.9 Feed Line Pressure.

- **MRFS:** FPM feed line pressure shall be controlled by the module mounted fuel pressure regulator and is dependent on applied voltage and flow.
- **RFS:** FPM feed line pressure shall be set to Nominal Operating Pressure (NOP) using an external regulator.
- **ERFS:** Fuel feed line pressure shall be set to NOP using an external regulator except for standard fuel resistance tests, which shall follow the pressure cycle detailed in Table 4 and Table 5.

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