



Test Fluids for Fuel Resistant Testing

1 Scope

This specification describes the preparation and chemical composition of standardized test fluids for material fuel resistance in gasoline and diesel engine application. These test fuels are intended to simulate the worst case fuels in regards of material testing. Standardized test fluids will promote consistent test results for materials testing.

The test fluids specified in this document are only used for material tests. They are identified per GM global and regional applications.

Note: If this specification is referenced with no identification of the region(s), the tested material is expected to pass GM global test fuels.

1.1 Material Description. Depending on the representation of fuel chemistry, fuel resistance test fluids can contain petroleum derived aliphatic and aromatic hydrocarbons, i.e., 2,2,4-trimethylpentane, toluene, oxygen containing fluids, i.e., alcohols, and bio compounds fluids, i.e., Fatty Acids of Methyl Ester (FAME). Other components like acids, salts, peroxides, etc., may add to base fluids to increase fluids corrosiveness, permeation, and/or oxidation potential to the materials to simulate the fuel chemistry as found in the market places, see Tables 1, A1 and A2.

1.2 Symbols. Not applicable.

1.3 Applicability. For testing the fuel resistance of metals, plastics, elastomers, inorganic and organic coatings, self-adhesive films etc., which in service, are likely to come into contact with fuels. The test fluids are designed to have similar effects on these materials as service fluids. The test fluid shall be used in accordance with the relevant material specification, test specification, engineering drawing, etc.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified. Test standards are in Table B1.

2.1 External Standards/Specifications.

ASTM D93	ASTM D4951	DIN EN 14105	DIN EN ISO 3987
ASTM D130	ASTM D5052	DIN EN 14107	DIN EN ISO 10370
ASTM D445	ASTM D5453	DIN EN 14110	DIN EN ISO 12185
ASTM D471	ASTM D6584	DIN EN 14112	DIN EN ISO 12937
ASTM D613	ASTM D6751	DIN EN 14214	DIN EN ISO 20884
ASTM D664	ASTM D7111	DIN EN 14538	EPA 40 CFR 86.113-07
ASTM D874	DIN 51604-2	DIN EN 15195	ISO 10336
ASTM D975	DIN 51777-1	DIN EN 15779	ISO 1817
ASTM D1160	DIN EN 116	DIN EN 23015	SAE J1681
ASTM D1744	DIN EN 590	DIN EN ISO 2160	
ASTM D2500	DIN EN 14103	DIN EN ISO 3104	
ASTM D4530	DIN EN 14104	DIN EN ISO 3679	

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2.2 GM Standards/Specifications.

GMW3059 GMW14270

2.3 Additional References.

GM Fuels Handbook	GMPT-5-031	GMPT-6-030
GMPT-5-019	GMPT-5-032	GMPT-6-031
GMPT-5-020	GMPT-6-029	GMPT-6-037

- Component Technical Specifications (CTS)
- Safety and Industrial Hygiene (S&IH) Technical Standard (TS), S&IH TS 3.4-160-02 (available at www.gmsupplypower.covisint.com)
- Vehicle Technical Specifications (VTS)

3 Requirements

3.1 All materials supplied to this standard must comply with GMW3059, **Restricted and Reportable Substances**, including the requirement to submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

3.2 Fluids Compositions. The fluids compositions for **global applications** are listed in Table 1. The fluids for regional applications are listed in Tables A1 and A2. The fluids compositions are designed for materials testing with fuels for both Spark Ignition (SI) and Compression Ignition (CI) engine applications.

The coding on drawings, Vehicle Technical Specifications (VTS), Component Technical Specifications (CTS), etc., refers, which test fluid should be used (see Section 8).

It is recommended to purchase the test fluids from approved suppliers as listed in Appendix C Table C1 or as listed in the GM Fuels Handbook.

3.3 Compositions for Global Applications. See Table 1.

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Table 1: Test Fuels for Global Applications

Global Applications	Recommended Specifications	Alternative Reference	Reference Composition ^{Note 1}	
Conventional Gasoline	GMPT-6-030	ISO 1817 Liquid 2 DIN 51604-2 FAM B	25.35% 42.25% 12.68% 4.22% 15.00% 0.50%	2,2,4-trimethylpentane toluene di-isobutylene ethanol methanol water
High Level Ethanol Blends ^{Note 2} (E85 and E100)	E85: GMPT-6-031		15% 84% 1%, (0.5 g NaCl/100 mL de-ionized water)	Fuel Tier 2 gasoline Ed100 Corrosive water as:
	E100: GMPT-6-037 (Final conductivity about 1000 μ S/m)		89.3% 4.7% 6% 5 mL 4 mL 1 mL 0.1 g 0.1 g 300 mL	E100 Fuel Tier 2 gasoline Corrosive water as: ethyl acetate, acetaldehyde, glacial acetic acid, sodium sulphate, sodium chloride in distilled water
Diesel	GMPT-5-020 (US Ultra Low Sulfur B20 Biodiesel)	80% Diesel fuel as per ASTM D975 – S15 (15 ppm maximum Sulfur content; <u>without BIODIESEL</u>) + 20% Soy Methyl Ester Biodiesel per ASTM D6751 ^{Note 3}	80% 20% Biodiesel OR 80% 20% Biodiesel	EPA 40 CFR 86.113-07 + Soy Methyl Ester per ASTM D6751 ^{Note 3} ISO 1817 Liquid F (Straight chain C12-C18 Paraffin) + Soy Methyl Ester per ASTM D6751 ^{Note 3}

Note 1: Reference composition is for engineering assessment only; **not** as guideline for making of the fuels. It is recommended acquiring fuels from approved suppliers. The unit is percent volume if not otherwise noted.

Note 2: Mandatory for metal alloys compatibility testing (optional for plastics and elastomer with prior agreement from Material Engineering).

Note 3: Biodiesel fuel shall be soy methyl ester and should not contain any antioxidant additives. The biodiesel shall meet the requirements in Appendix B.

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3.4 Compositions for Regional Applications. See Appendix A, Table A1.

3.5 Additional Recommendations for Testing.

3.5.1 Diesel Fuel.

3.5.1.1 Use of a Reflux Condenser. For diesel immersion, the storage vessel must be used with a reflux condenser which is open to the atmosphere. A drying unit is not utilized.

3.5.1.2 Usage of an Autoclave. If stored without atmospheric exchange, an addition of 1% water to the testing fuels must be provided.

3.5.2 Gasoline Fuel. As storage vessel for petrol immersion standard laboratory vessels have to be used.

3.6 Preparation of Fuel Test Fluid (Gasoline Fuels). This section of preparation of test fluid is for reference only. It provides general guideline on how the fuels should be prepared. It is recommend acquiring testing fuels from GM approved suppliers.

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