



Designation: D8639/D8639M – 26

Standard Test Method for the Effect of Fuel on Asphalt Mixtures¹

This standard is issued under the fixed designation D8639/D8639M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the procedures for conditioning asphalt mixtures in fuel and measuring their resistance to fuel degradation. The method describes the determination of fuel-induced mass loss (FML) using cylindrical laboratory-compacted asphalt mixture specimens. Fuel-conditioned mixtures may be further evaluated for mechanical properties; the measurement of fuel-induced tensile strength ratio (TSR_F) and Cantabro mass loss (CML) are described in [Appendix X1](#) and [Appendix X2](#), respectively.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.3 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those used in tables and figures) shall not be considered requirements of the standard.

1.4 Since a complete precision and bias statement for this standard has not been developed, the test method is to be used for research and informational purposes only. Therefore, this standard should not be used for acceptance or rejection of a material for purchasing purposes.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- [D8 Terminology Relating to Materials for Roads and Pavements](#)
 - [D910 Specification for Leaded Aviation Gasolines](#)
 - [D1655 Specification for Aviation Turbine Fuels](#)
 - [D2041/D2041M Test Method for Theoretical Maximum Specific Gravity and Density of Asphalt Mixtures](#)
 - [D2726/D2726M Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures](#)
 - [D3203 Test Method for Percent Air Voids in Compacted Asphalt Mixtures](#)
 - [D3549/D3549M Test Method for Thickness or Height of Compacted Asphalt Mixture Specimens](#)
 - [D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials](#)
 - [D3699 Specification for Kerosine](#)
 - [D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing](#)
 - [D4867/D4867M Test Method for Effect of Moisture on Asphalt Mixtures](#)
 - [D6925 Test Method for Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyratory Compactor](#)
 - [D6926 Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus](#)
 - [D6931 Test Method for Indirect Tensile \(IDT\) Strength of Asphalt Mixtures](#)
 - [D7227/D7227M Practice for Rapid Drying of Compacted Asphalt Mixture Specimens Using Vacuum Drying Apparatus](#)
- #### 2.2 AASHTO Standards:³
- [R 30 Practice for Short-Term Laboratory Conditioning of Asphalt Mixtures](#)
 - [T 401 Test for Cantabro Abrasion Loss of Asphalt Mixture Specimens](#)

¹ This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.22 on Effect of Water and Other Elements on Asphalt Coated Aggregates.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American Association of State Highway and Transportation Officials (AASHTO), 555 12th St., NW, Suite 1000, Washington, DC 20004, <http://www.transportation.org>.



3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this standard, refer to Terminology D8.

3.1.2 *aviation gasoline, avgas, n*—gasoline possessing specific properties suitable for fueling aircraft powered by reciprocating spark ignition engines.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *fuel-induced mass loss, FML, n*—mass loss in an asphalt mixture specimen due to degradation by fuel immersion, expressed as a percentage of the original specimen mass.

3.2.2 *fuel-induced indirect tensile strength ratio, TSR_f, n*—ratio of the indirect tensile strength of an asphalt mixture after fuel immersion to the indirect tensile strength of an unconditioned asphalt mixture.

4. Summary of Test Method

4.1 The effect of fuel is determined by fully immersing a set of asphalt mixture specimens in a bath of fuel at room temperature for a prescribed duration, typically 24 h, and then drying under a fan for 24 h. The change in specimen mass following immersion and drying is expressed as a percentage of the original specimen mass and reported as FML. Following fuel conditioning and determination of FML, mechanical properties may be determined by supplementary procedures that are non-mandatory to this standard and are described in the appendixes.

5. Significance and Use

5.1 This test method can be used to test asphalt mixtures in conjunction with mixture design testing to determine the potential for fuel spill damage. This assessment is particularly important for airfield pavements that are subject to fuel spills where fuel damage could lead to surface degradation and the generation of foreign object debris (FOD). This test method can also be used to evaluate and design asphalt mixtures used in other pavement applications that frequently suffer from oil and fuel spill distresses (for example, bus lanes, truck stops, fueling centers).

5.2 This test method is used to measure the fuel resistance of asphalt mixtures through FML as a result of fuel conditioning. Because damage to asphalt mixtures may present itself in forms that do not result in a direct loss of material (for example, reduction in adhesion quality between aggregate and asphalt binder), some specifying agencies may also wish to determine mechanical properties of fuel-conditioned mixtures. Appendix X1 and Appendix X2 provide information on how to modify Test Methods D4867/D4867M and D6931 to measure TSR_f or AASHTO T 401 to measure CML.

NOTE 1—The quality of the results produced by this standard is dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of Specification D3666 are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this standard are cautioned that compliance with Specification D3666 alone does not completely ensure reliable results. Reliable results depend on many factors; following the suggestions of

Specification D3666 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.

6. Apparatus

6.1 *Balance*, capable of being read to the nearest 0.1 g and conforming to the requirements of Guide D4753, Class GP2.

6.2 *Immersion Container or Pan*—A container or pan of sufficient size to allow for complete immersion of test specimens in fuel while being seated on the specimen support grate.

6.3 *Specimen Support Grate*—A flat grate used to support specimens in the immersion container and allow for all specimen surfaces to be exposed to fuel during immersion. The grate shall be made of aluminum, stainless steel, or other durable material.

NOTE 2—McMaster-Carr Part Number 9232T335 has been found suitable for fabricating specimen support grates. This part number is a 14 gauge [0.063 in.] perforated aluminum sheet with 51 % perforated area.

7. Reagents and Materials

7.1 *Kerosene*, meeting Specification D3699.

7.2 *Jet A or Jet A-1*, meeting Specification D1655.

NOTE 3—Kerosene and Jet A or Jet A-1 may be used interchangeably. Other fuels such as avgas grade 100LL meeting Specification D910 may be utilized if of interest for a specific application. Avgas typically induces greater fuel damage; therefore, the temporary precision statement would not be applicable to avgas.

8. Hazards

8.1 **Warning**—The fuels listed in Section 7 should be used under a hood or with an effective surface exhaust system in a well-ventilated area to avoid high vapor levels. Consult the current Threshold Limit Concentration Committee of the American Conference of Governmental Industrial Hygienists⁴ for the current threshold limit values.

8.2 **Warning**—The fuels listed in Section 7 are flammable substances; avoid exposure to open flames and sources of ignition. Store containers in a cool, dry location that is well ventilated. Keep container closed and sealed until ready for use. Refer to the manufacturer's safety data sheet (SDS) for more detailed information.

8.3 Standard laboratory caution should be exercised when handling, compacting, and fabricating test specimens and asphalt mixtures.

9. Standardization

9.1 *Balance*—Standardize at least once each twelve months.

NOTE 4—The terms of standardization, verification, calibration, and check are defined in Section 3 of Specification D3666.

10. Sampling, Test Specimens, and Test Units

10.1 *Laboratory-Compacted Asphalt Mixture Specimens*—Prepare three laboratory-compacted specimens in accordance with one of the following standards: Test Method D6925 or Practice D6926.

⁴ Available from American Conference of Governmental Industrial Hygienists (ACGIH), 1130 Kemper Meadow Dr., Cincinnati, OH 45240, <http://www.acgih.org>.