



Standard Test Method for Insolubles in Used Lubricating Oils by Paper Filtration (LMOA Method)¹

This standard is issued under the fixed designation D 7317; 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 determination of coagulated pentane insolubles in used lubricating oils by a paper filtration method.

1.2 This test method was originally developed by the Fuels, Lubricants, and Environmental Committee (FL&E) of the Locomotive Maintenance Officer's Association (LMOA).²

1.3 This test method is used primary for testing used diesel engine oils from railroad locomotive service. It may be applied to other samples types but precision, bias, and significance have not been determined for samples other than used railroad locomotive diesel engine oils.

1.4 This test method, in general, does not correlate with Test Method D 893 on Insolubles in Lubricating Oils, since it uses separation by centrifugation and a more concentrated solution of anti-coagulant.

1.5 The correlation between this test method and Appendix A4 (Enhanced Thermal Gravimetric Analysis (TGA) Procedure) in Test Method D 5967 has not been investigated.

1.6 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.7 *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 and health practices and determine the applicability of regulatory limitations prior to use.* For specific warning statements, see 7.2, 7.3, and 7.4.

2. Referenced Documents

2.1 ASTM Standards:³

D 893 Test Method for Insolubles in Used Lubricating Oils

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D 5967 Test Method for Evaluation of Diesel Engine Oils in T-8 Diesel Engine

3. Terminology

3.1 Definitions:

3.1.1 *coagulate, v*—to cause to become viscous or thickened into a coherent mass.

3.1.2 *coagulated pentane insolubles, n*—in used oil analysis, separated matter that results when a coagulant is added to a solution of used oil in pentane.

3.1.2.1 *Discussion*—The addition of a coagulant will aid in separating finely divided materials that may have been held in suspension because of the dispersant characteristics of the oil.

3.1.3 *pentane insolubles, n*—in used oil analysis, separated matter resulting when a used oil is mixed with pentane.

3.1.3.1 *Discussion*—In this test method, the separation is effected by paper filtration.

3.1.4 *used oil, n*—any oil that has been in a piece of equipment (for example, an engine, gearbox, transformer, or turbine), whether operated or not.

3.1.4.1 *Discussion*—In this test method, the oil can be any oil that has been used for lubrication of a locomotive diesel engine, whether engaged in railroad or other service.

4. Summary of Test Method

4.1 A representative sample of used lubricating oil is mixed with pentane-coagulant solution and filtered under vacuum. The filter is washed with pentane, dried, and weighed to give coagulated pentane insolubles.

5. Significance and Use

5.1 Coagulated pentane insolubles can include oil-insoluble materials, some oil-insoluble resinous matter originating from oil or additive degradation, soot from incomplete diesel fuel combustion, or a combination of all three.

5.2 A significant change in coagulated pentane insolubles indicates a change in oil, and this could lead to lubrication system problems.

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.06.0B on Physical Testing.

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³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

5.3 Coagulated pentane insolubles measurements can also assist in evaluating the performance characteristics of a used oil or in determining the cause of equipment failure.

6. Apparatus (see Fig. 1)

6.1 *Smooth-tip Forceps.*

6.2 *Graduated Cylinder, 50 mL with stopper.*

6.3 *Oven, explosion-proof, capable of maintaining a temperature of $50 \pm 3^\circ\text{C}$.*

6.4 *Oven, explosion-proof, capable of maintaining a temperature of $100 \pm 3^\circ\text{C}$.*

6.5 *Filtering Flask, 1 L.*

6.6 *Filter Holders, borosilicate glass.*

6.7 *Filter Membrane, 0.45 μm .*



FIG. 1 Paper Filtration Apparatus