



Designation: D 4870 – 99

An American National Standard



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Standard Test Method for Determination of Total Sediment in Residual Fuels¹

This standard is issued under the fixed designation D 4870; 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.

This test method has been approved by the sponsoring committees and accepted by the cooperating societies in accordance with established procedures.

1. Scope

1.1 This test method covers the determination of total sediment up to 0.40 % m/m for distillate fuel oils containing residual components and to 0.50 % m/m in residual fuel oils having a maximum viscosity of 55 cSt (mm²/s) at 100°C. Some fuels can exceed the maximum filtration time specified in this test method due to factors other than the presence of significant quantities of insoluble organic or inorganic material. This test method can be used for the assessment of total sediment after regimes of fuel pretreatment designed to accelerate the aging process.

1.2 The values stated in acceptable SI units are to be regarded as the standard.

1.3 *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 hazard statements see Note 1, Note 2, and Annex A1.

2. Referenced Documents

2.1 ASTM Standards:

D 362 Specification for Industrial Grade Toluene²

D 2880 Specification for Gas Turbine Fuel Oils³

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products³

D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products³

E 1 Specification for ASTM Thermometers⁴

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.14 on Stability and Cleanliness of Liquid Fuels.

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² *Annual Book of ASTM Standards*, Vol 06.03.

³ *Annual Book of ASTM Standards*, Vol 05.02.

⁴ *Annual Book of ASTM Standards*, Vol 14.03.

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *total sediment*—the sum of the insoluble organic and inorganic material that is separated from the bulk of the residual fuel oil by filtration through a Whatman GF/A filter medium, and that is also insoluble in a predominantly paraffinic solvent.

4. Summary of Test Method

4.1 A weighed quantity (10 g) of the oil sample is filtered through the prescribed apparatus at 100°C. After solvent washing and drying the total sediment on the filter medium is weighed. The test is to be carried out in duplicate.

5. Significance and Use

5.1 Appreciable amounts of sediment in a residual fuel oil can cause fouling of facilities for handling, and give problems in burner mechanisms. Sediment can accumulate in storage tanks, on filter screens, or on burner parts, resulting in obstruction of the flow of oil from the tank to the burner.

6. Apparatus

6.1 *Filtration Apparatus*, constructed of brass, with copper steam coils attached, suitably supported above a vacuum flask appropriately protected against the effects of implosion. See Figs. 1 and 2.

6.2 *Thermometer*, partial immersion type ranging from approximately 95 to 103°C. Maximum length 220 mm. Maximum graduation interval 0.5°C.

6.3 *Oven*, electric, capable of maintaining a temperature of 110 ± 1°C. The oven should be capable of safely evaporating the solvent without risk of fire.

6.4 *Stirring Rod*, glass or PTFE approximately 150 by 3 mm diameter.

6.5 *Beaker*, glass, 30 mL capacity, either squat form with lip or conical.

6.6 *Weighing Bottles*, with ground glass stoppers, numbered, 80 mm diameter by 40 mm.

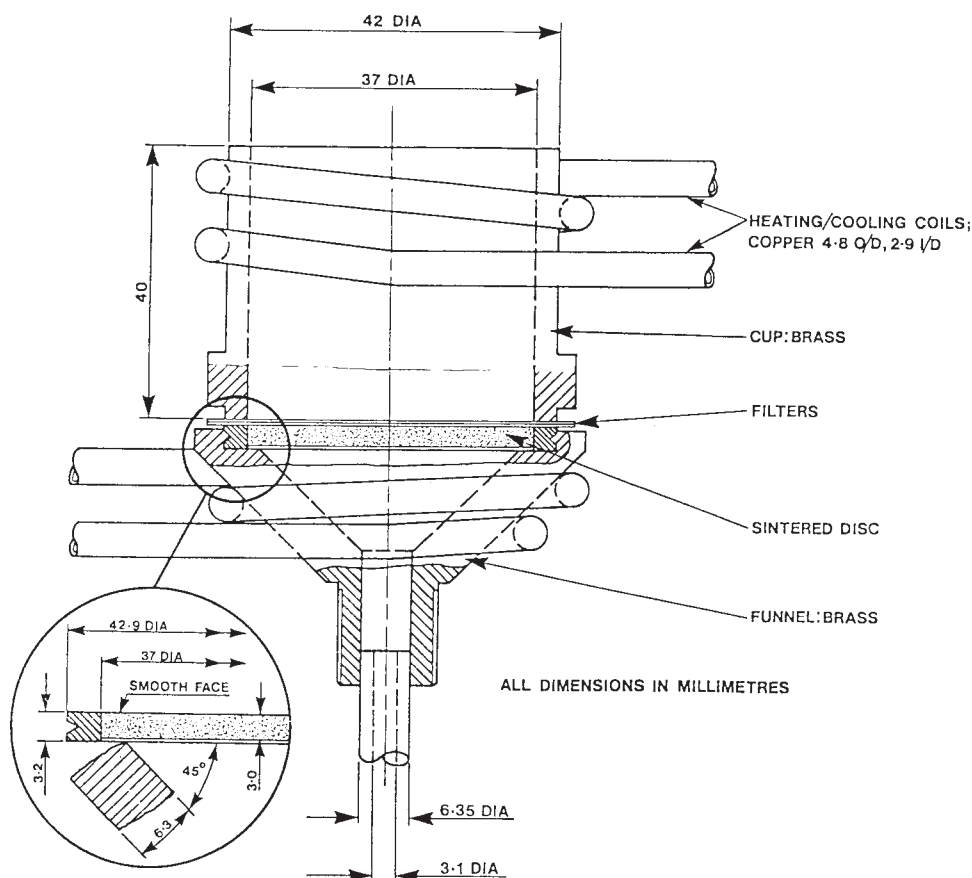
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FIG. 1 Detail of Filtration Cell

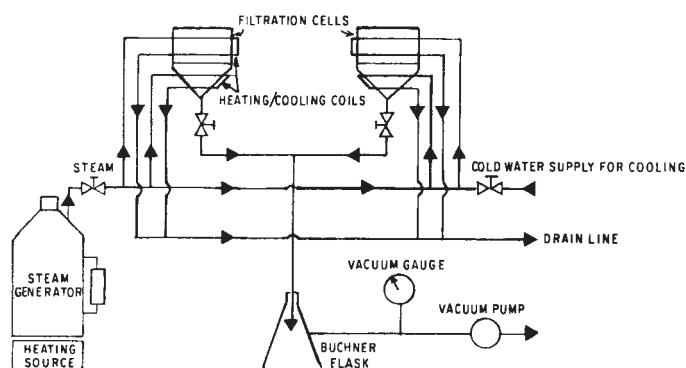


FIG. 2 Arrangement of Filtration Apparatus

6.7 *Hotplate*, electric.

6.8 *Steam Generator*, to provide steam at $100 \pm 1^\circ\text{C}$.

6.9 *Vacuum Source*, capable of providing the specified vacuum.

6.10 *Vacuum Gage*, capable of measuring the specified vacuum.

6.11 *Filter Medium*, Whatman glass fiber filter medium, Grade GF/A, 47 mm diameter.

6.12 *High Speed Mixer*, any convenient type, minimum speed 400 rpm.

6.13 *Desiccator*.

6.14 *Cooling Vessel*, a desiccator or other type of tightly covered vessel for cooling the filter media before weighing. The use of a drying agent is not recommended.

6.15 *Syringe or Graduated Wash Bottle*, minimum capacity 25 mL, graduated in 0.5 mL increments.

6.16 *Forceps*, spade-ended.

7. Reagents and Materials

7.1 *Normal Heptane*, ASTM knock test grade, conforming to the requirements of Specification D 2880.

NOTE 1—**Warning:** Flammable, vapor harmful if inhaled. See A1.1.

7.2 *Toluene*, conforming to Specification D 362.

NOTE 2—**Warning:** Flammable, vapor harmful. See A1.2.

7.3 *Wash Solvent*, consisting of 85 volume % *n*-heptane (7.1) and 15 volume % toluene (see 7.2).

8. Sampling

8.1 Sample in accordance with Practice D 4057 or Practice D 4177.

9. Procedure

9.1 *Sample Preparation*—Mix the whole sample, as received, thoroughly using a high speed mixer when practicable, for 30 s. In all cases a sample taken on a glass or PTFE rod dipped to the bottom of the container must show a homogeneous appearance. For fuels with a high wax content (high pour point), or of very high viscosity, the sample must be heated before stirring. The temperature must be either 15°C above the pour point in the case of low viscosity fuels, or at the required