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Standard Test Method for INORGANIC PARTICLES IN MARINE RESIDUAL FUEL OILS BY SELECTIVE CENTRIFUGAL SEPARATION¹

This standard is issued under the fixed designation D 4484; 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 inorganic particles, excluding those containing iron, in marine residual fuel oils. In the absence of other contaminants, such as sand and dirt, this test method provides a gravimetric determination of FCC catalyst fines in residual fuel oils.

1.2 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statement, see 6.3, 6.4, 6.5, 6.6, and 6.7.

2. Applicable Documents

2.1 ASTM Standards:

D 1193 Specification for Reagent Water²

D 4057 Practice for Manual Sampling of Petroleum Products³

3. Summary of Method

3.1 A centrifuge is employed to transfer the particles from the diluted fuel to a non-fuel phase. During the transfer, the particles pass through an aqueous phase where rust particles are removed by a reaction with oxalic acid solution. The remaining particles are then collected in an *o*-dichlorobenzene layer, a liquid heavier than water. Subsequently, the separated particles are transferred to a crucible where they are ashed and weighed.

NOTE 1—In order to achieve best possible precision, the operator is encouraged to read the following instructions carefully and to adhere to them strictly. It is

believed that the critical steps in this test are: (1) Obtaining a representative fuel sample, (2) treatment of centrifuge tube wall with surfactant, (3) transfer of deposits from centrifuge tube to ashing crucible, and (4) ashing and subsequent weighing of deposits. The instructions for these steps have been underlined to draw operator special attention.

4. Significance and Use

4.1 Certain inorganic particles present in residual fuel oils have been shown to cause excessive wear in diesel engines, when present in excessively high concentrations. This test method provides a means to determine the level of inorganic particles, excluding those containing iron, in residual fuel oils.

5. Apparatus

5.1 *Centrifuge*, capable of whirling two or more filled centrifuge tubes at a speed which can be adjusted to give a relative centrifugal force (rcf) of about 1500 at the tip of the tubes. [where $rcf = (RPM/1335)^2 d$ and d is diameter of swing of two opposite tubes in millimetres.] The revolving head, trunnion rings and trunnion cups, including the cushions, shall be soundly constructed to withstand the maximum centrifugal force capable of being delivered by the power source. The trunnion cups and cushions shall firmly support the tubes when the centrifuge is in motion. The centrifuge shall be enclosed by a

¹ This test method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.E on Burner, Diesel, and Turbine Fuel Oils.

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² *Annual Book of ASTM Standards*, Vol 11.01.

³ *Annual Book of ASTM Standards*, Vol 05.03.