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Standard Test Method for Measuring the Merit of Dispersancy of In-Service Engine Oils with Blotter Spot Method[1]

This standard is issued under the fixed designation D7899; 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 a procedure for determination of the merit of dispersancy of diesel crankcase engine oils as well as other types of engine oils where pollutants of diverse sources such as soot from combustion, metallic particles from wear, corrosion of mechanical parts, and insoluble products resulting from the oxidation of the oil may contaminate the lubricant.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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.*

NOTE 1—It is not the intent of this test method to establish or recommend normal, cautionary, warning, or alert limits for any machinery. Such limits should be established in conjunction with advice and guidance from the machinery manufacturer and maintenance group.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D7418 Practice for Set-Up and Operation of Fourier Transform Infrared (FT-IR) Spectrometers for In-Service Oil Condition Monitoring

3. Terminology

3.1 *Definitions:*

3.1.1 *diesel crankcase engine oils, n*—an engine oil used in the crankcase of the internal combustion diesel engine.

3.1.1.1 *Discussion*—It may contain additives to enhance certain properties. Inhibition of engine rusting, deposit formation, valve train wear, oil oxidation, and foaming are examples.

3.1.2 *diesel engine, n*—a reciprocating or rotary engine in which ignition of the main fuel charge, as it is introduced to the combustion chamber, shall be by the heat of compression of the charge of combustion air, during regular operation of the engine from idle speeds up to full speed, regardless of whether miscellaneous methods to augment such heat of compression are used to facilitate starting of the engine under normal conditions or under low ambient temperature conditions or low intake air temperature conditions.

3.1.2.1 *Discussion*—Engines that are designed to operate with a continuously hot spot or bulb or other device to facilitate ignition or combustion, or both, of low cetane fuels, or any fuels slow to ignite or to burn, or both, shall be considered to be diesel engines for purposes of this test method.

3.1.3 *engine oil, n*—a liquid that reduces friction or wear, or both, between the moving parts within an engine; removes heat, particularly from the underside of pistons; and serves as a combustion gas sealant for piston rings.

3.1.3.1 *Discussion*—It may contain additives to enhance certain properties. Inhibition of engine rusting, deposit formation, valve train wear, oil oxidation, and foaming are examples.

3.1.4 *oxidation, n*—of engine oil, the reaction of the oil with an electron acceptor, generally oxygen, which can produce deleterious acidic or resinous materials often manifested as sludge formation, varnish formation, viscosity increase, or corrosion, or a combination thereof.

3.1.5 *sludge, n*—in internal combustion engines, a deposit, principally composed of insoluble resins and oxidation products from fuel combustion and the lubricant that does not drain from engine parts but can be removed by wiping with a cloth.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *dispersancy*—the property that allows oil to suspend and carry away pollutants of diverse sources such as soot from combustion, metallic particles from wear, corrosion of mechanical parts, and insoluble products resulting from the aging of the oil.

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.96.02 on Chemistry for the Evaluation of In-Service Lubricants.

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[2] 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.

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4. Summary of Test Method

4.1 A drop of oil is deposited on a piece of specific filter paper held level and not resting on a surface. The filter paper is placed in an oven set at 80 °C for 1 h. The oil wicks across the paper. The oil spot is illuminated with a constant and homogenous LED (light emitting diodes) backlight. A CCD (charge-coupled device) camera positioned on the other side of the paper takes a picture of the spot in black and white mode. The software analyzes each pixel of the picture. Dispersancy characteristics of the oil are judged by how far the oil drop spreads, how large the central sooty area is, and how homogeneous the opacity of the spot is in comparison with a theoretical reference diameter of 32 mm.

5. Significance and Use

5.1 Dispersancy is the property that allows oil to suspend and carry away pollutants of diverse sources such as soot from combustion, metallic particles from wear, corrosion of mechanical parts, and insoluble products resulting from the aging of the oil.

5.2 When poured on a specific filter paper, oil that is properly dispersing soot and other insolubles produces an evenly graduated spot. The distribution of the different zones (Fig. 1) will reflect the status of oil dispersancy.

5.3 While the oil spreads out on the filter paper, the oil carries contaminants, and due to the lamination phenomenon of the oil film, the particles of same size deposit on the paper on the same concentric zones.

5.4 This test method provides a simple technique for condition monitoring of the dispersancy property of in-service lubricants.

5.5 An oil that is properly dispersing soot and other insolubles produces an evenly graduated blotter (see Fig. 2—Spot 1). A ring of light debris on the outer circumference of the circular spot also indicates that the oil has retained its dispersancy properties.

5.6 A blotter indicating a high soot load, but even graduation, suggests the oil is still fit for service, but should be watched closely for degradation (see Fig. 2—Spot 2).

5.7 When dispersancy begins to fail, the insolubles begin to form a dense ring on the exterior of the absorbing oil drop as in Fig. 2—Spot 3. A brown or yellow stain on the blotter spot indicates oxidation.

5.8 Fig. 2—Spot 4 indicates the characteristic dense black dot and sharp periphery that indicates sludge and the loss of dispersancy as the particles have settled in the center and the oil has wicked outward.

5.9 From a maintenance perspective, when the ring begins to form around the exterior of the oil blotter, it is time to look at scheduling a drain. If the black dot is allowed to form, the situation is problematic because the undispersed portion of soot

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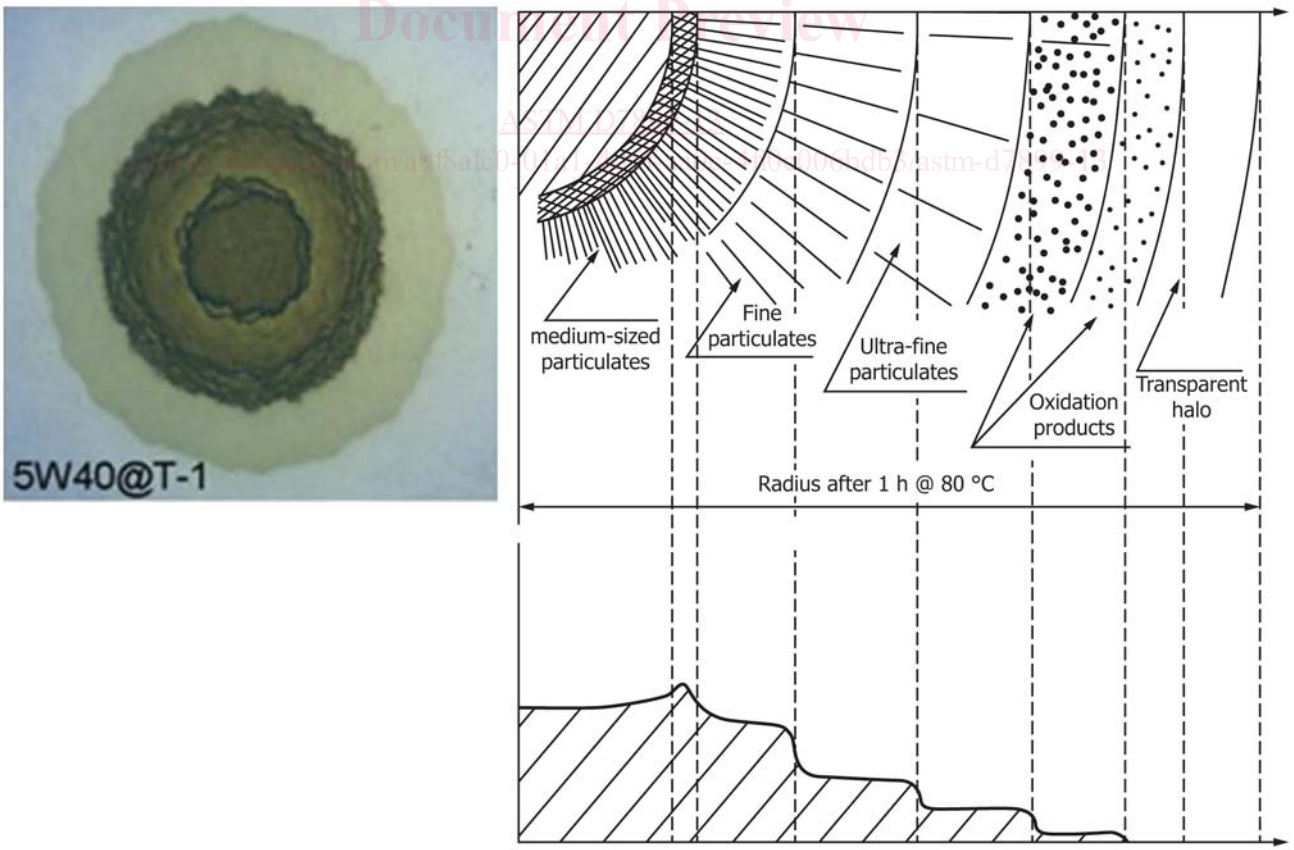

FIG. 1 Oil Spot Example and Scheme of the Distribution of the Different Zones