



Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field¹

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1. Scope

1.1 This test method for visual examination is applicable to mineral oils of petroleum origin that have been used in transformers, oil circuit breakers, or other electrical apparatus as insulating or cooling media, or both.

1.2 *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.*

2. Referenced Documents

2.1 ASTM Standards:

D 1500 Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)²

3. Summary of Test Method

3.1 The color of the test specimen is estimated by visually comparing the color of a specified thickness of the sample with a series of artificial standard color disk filters in a specified comparator.

3.2 The condition of the test specimen is estimated by observation of cloudiness, foreign particles, or suspended matter in the sample by reflected light.

4. Significance and Use

4.1 By use of this test method the color and condition of a test specimen of oil may be estimated during a field inspection, thus assisting in the decision as to whether or not the sample should be sent to a central laboratory for full evaluation. Cloudiness, particles of insulation, products of metal corrosion, or other undesirable suspended materials, as well as any unusual change in color may be detected. For precise determination of color in the laboratory, Test Method D 1500 should be used.

5. Apparatus

5.1 *Color Comparator*³—A color comparator suitable for estimating the color of petroleum products on the ASTM Color Scale, and for the examination of the test specimen by reflected light (Tyndall beam effect).

5.2 *Light*—A light source such as a pen light with a No. 222 bulb.

5.3 *Cloth*—Photographer's focusing cloth.

6. Preparation of Apparatus

6.1 Open the front cover of the comparator housing, and place the center of the color disk on the ring with the number plates facing the operator. Close the cover. As the disk is rotated, the number plates representing ASTM Color Numbers can be read through the upper opening on the right-hand side of the front cover. The alignment is such that only one figure is visible when a glass color standard is completely in the field of view.

6.2 The observation fields for colorimetric comparison can be seen through the two central openings. Through the prism attachment, they are seen as half-fields. The right-hand field is produced by the test specimen in a tube which is placed in the opening at the right of the instrument, while the left-hand field is formed by one of the glass color standards.

7. Procedure

7.1 *Color Determinations*—Fill a tube with the test specimen to a height convenient for full exposure in the observation field and place it in the right-hand opening of the apparatus. Quickly make the color comparison by revolving the color disk so that one standard after another is brought into the observation field. When using the comparator with the prism attachment, view the color fields with the eye in line with the center of the fields. The half-fields should be free of shadow effect which can be caused by off-center or oblique observation. For

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² *Annual Book of ASTM Standards*, Vol 05.01.

³ The Hellige Oil Comparator, catalog No. 605-HT, with catalog No. 620C-55 color disk, available from OrbcO Hellige, 185 T Marine St., Farmingdale, NY 11735, has been found to be suitable. This equipment may be modified to accommodate a Tyndall Beam Accessory. A prism magnifier attachment, Catalog No. 600-PA, is also available if desired. A Hellige Comparator, catalog No. 607-OC, has also been found suitable but is less convenient for field use.

normal eyesight, the preferred viewing distance is approximately 10 in. (25 cm). **Caution:** Do not place the eye close to the comparator housing. Do not prolong the observation for more than 10 to 15 s. For very accurate readings, let the eyes rest between such intervals, preferably by viewing a gray or green surface. When a color match is obtained between the test specimen and one of the glass standards, the figure seen in the upper opening in the front cover gives the direct reading. If the color of the test specimen is intermediate between those of two glass standards, the result to be reported will be intermediate between their corresponding values and may be estimated by interpolation. While taking readings, face the opal glass plate at the back of the comparator directly toward the light. Take care that pronounced shadows do not cause uneven illumination of the comparator fields. Northern exposure provides the best daylight for colorimetric determination, but any indirect light from outdoors usually will be satisfactory. Avoid direct sunlight, even in the early morning or late afternoon.

7.2 Tyndall Beam Examination—Project a narrow focused light beam from the pen light upward through the test specimen tube, using the photographic focusing cloth to exclude extraneous light. Carefully examine the test specimen by means of this light. A test specimen of good oil will appear clean and sparkling. Haziness or cloudiness usually denotes moisture in suspension or sludge. If the dielectric strength is satisfactory, the cloudiness may be caused by oxidation products, in which case the neutralization number will probably be high and the interfacial tension low. Particles of metals, insulation, carbon, and other matter will show up very markedly by reflected light. Report the oil as failing the test if the appearance of any

condition other than sparkling is observed. Open the comparator case and examine for sediment (sludge, metal particles, etc.)

8. Report

8.1 Report the following information:

8.1.1 Color number,

8.1.2 Description of any deviation from perfectly clear and sparkling, and any evidence of sediment,

8.1.3 Approximate temperature of the oil at the time the test specimen was taken, and

8.1.4 Approximate temperature of the oil at time of observation.

9. Precision and Bias

9.1 It is not practical to specify the precision and bias of this test method because this is a rapid field examination to screen test specimens for further testing. If Test Method D 1500 is used in order to obtain precise determination of color in the laboratory, the precision and bias are as specified in that method.

9.2 An interlaboratory investigation was conducted in 1968 to support this test method. The results of this investigation were first reported as RR 185: D97 D27 in January 1969.⁴

10. Keywords

10.1 color; comparator; mineral oil; Tyndell beam effect; visual examination

⁴ For citation purposes, this report has now been designated as RR: D27-1008.

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