Designation: ~~D3427 – 14a~~ D3427 – 14a$^{\varepsilon 1}$

Designation 313–01

Standard Test Method for Air Release Properties of Petroleum Oils[1]

This standard is issued under the fixed designation D3427; 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.

ε[1] NOTE—Subsection 10.9 was corrected editorially in February 2015.

1. Scope*

1.1 This test method covers the ability of turbine, hydraulic, and gear oils to separate entrained air.

NOTE 1—This test method was developed for mineral based oils. It may be used for some synthetic fluids; however, the precision statement applies only to petroleum oils.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
D1193 Specification for Reagent Water
D1401 Test Method for Water Separability of Petroleum Oils and Synthetic Fluids
D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
E1 Specification for ASTM Liquid-in-Glass Thermometers
2.2 *DIN Standard:*[3]
DIN 51 381

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*
3.1.1 *air release time, n*—the number of minutes needed for air entrained in the oil to reduce in volume to 0.2 % under the conditions of this test and at the specified temperature.

4. Summary of Test Method

4.1 Compressed air is blown through the test oil, which has been heated to a temperature of (25, 50, 75) °C. After the air flow is stopped, the time required for the air entrained in the oil to reduce in volume to 0.2 % is recorded as the air release time.

NOTE 2—By agreement between the customer and the laboratory, the oil may be heated at other temperatures. However, the precision at these different temperatures is not known at present.

[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.C0.02 on Corrosion and Water/Air Separability.

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This standard has been developed through the cooperative effort between ASTM International and the Energy Institute, London. The EI and ASTM International logos imply that the ASTM International and EI standards are technically equivalent, but does not imply that both standards are editorially identical. Adopted as a joint ASTM/IP standard in 2006.

[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.

[3] Available from Beuth Verlag GmbH, Burggrafenstrasse 6, 1000 Berlin 30, Germany.

***A Summary of Changes section appears at the end of this standard**

5. Significance and Use

5.1 Agitation of lubricating oil with air in equipment, such as bearings, couplings, gears, pumps, and oil return lines, may produce a dispersion of finely divided air bubbles in the oil. If the residence time in the reservoir is too short to allow the air bubbles to rise to the oil surface, a mixture of air and oil will circulate through the lubricating oil system. This may result in an inability to maintain oil pressure (particularly with centrifugal pumps), incomplete oil films in bearings and gears, and poor hydraulic system performance or failure.

5.2 This test method measures the time for the entrained air content to fall to the relatively low value of 0.2 % volume under a standardized set of test conditions and hence permits the comparison of the ability of oils to separate entrained air under conditions where a separation time is available. The significance of this test method has not been fully established. However, entrained air can cause sponginess and lack of sensitivity of the control of turbine and hydraulic systems. This test may not be suitable for ranking oils in applications where residence times are short and gas contents are high.

6. Apparatus

6.1 A schematic diagram of the apparatus is shown in Fig. 1. The component parts are described as follows:

6.1.1 *Test Vessel,* made of borosilicate glass as shown in Fig. 2, consisting of a jacketed sample tube fitted with an air inlet capillary, baffle plate, and air outlet tube. The two parts of each test vessel should be marked and preferably used as a pair. Interchanged parts may be used so long as the resultant test vessel conforms to the stated dimensions.

6.1.2 *Pressure Gage,* covering the range from 0 kPa to 35 kPa, with divisions at least every 2 kPa, and an accuracy of 1.5 kPa.

6.1.3 *Thermometers:*

6.1.3.1 *Air Thermometer,* for measuring compressed air temperature. ASTM Precision Thermometer having a range from –20 °C to 102 °C, graduated in 0.2 °C and conforming to the requirements for Thermometer 12C as prescribed in Specification E1 is suitable. A temperature sensor of at least equivalent performance is also suitable. Care shall be taken to avoid restricting the air path with the thermometer bulb or any adapter used.

6.1.3.2 *Sample Thermometer,* for measuring the temperature of the sample during preparation and trial runs. ASTM Precision Thermometer having a range from –20 °C to 102 °C, graduated in 0.2 °C and conforming to the requirements for Thermometer 12C as prescribed in Specification E1 is suitable. A temperature sensor of at least equivalent performance is also suitable.

6.1.4 *Heater,* to bring the compressed air up to measurement temperature. A coil of copper tubing immersed in the circulating bath (see 6.1.5) is suitable at 25 °C, but additional heating is necessary at 50 °C and 75 °C. This can be obtained by an additional bath, or by using a separate steam or electric heat exchanger. The temperature of the air shall be measured by a thermometer located as close as possible to the testing vessel and meeting the specifications shown in 6.1.3.

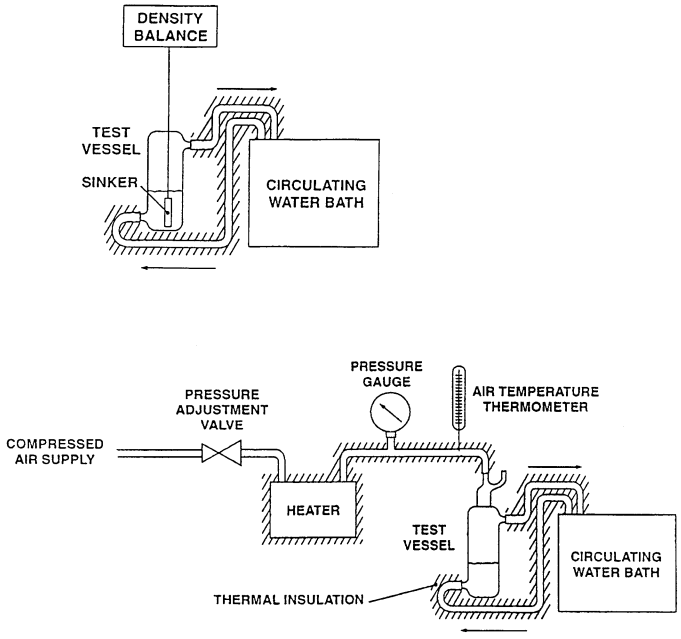

FIG. 1 Apparatus for the Determination of Air Release Time

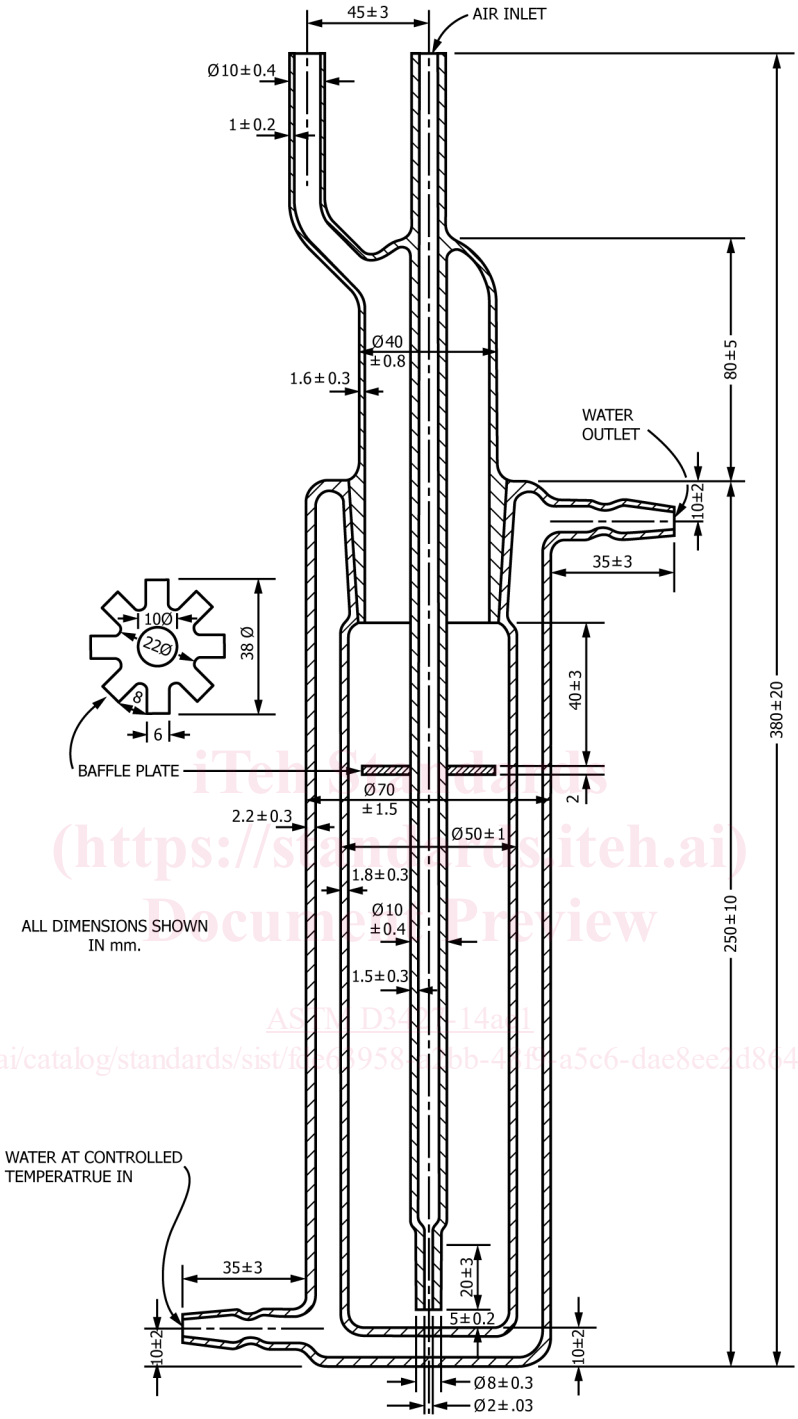

FIG. 2 Test Vessel

NOTE 3—The application of thermal insulation to the pipework carrying the heated compressed air is recommended.

6.1.5 *Circulating Bath,* approximately 10 L capacity with a rate of flow of 10 L/min and capable of maintaining the test cell at a temperature of (25, 50, 75) °C within ±0.1 °C.

NOTE 4—Use of water in the bath has been found to minimize electrostatic effects.
NOTE 5—The application of thermal insulation to the pipework carrying the heated bath fluid is recommended.

(**Warning—**The use of glass vessels with glass hose fittings for circulating 75 °C bath medium is potentially dangerous. Back pressure in excess of a gage pressure of 70 kPa can be generated when the bath medium is pumped at the required rate; this can cause fracture of the glass or slippage of the hose connections. Use of a pressure relief valve set at 70 kPa is recommended. In addition, use of a safety shield is recommended.)