Designation: ~~D2155 – 12~~ D2155 – 18

Standard Test Method for Determination of Fire Resistance of Aircraft Hydraulic Fluids by Autoignition Temperature[1]

This standard is issued under the fixed designation D2155; 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~~ Scope*

1.1 This test method is used for assessing the fire resistance of hydraulic fluids used for aircraft applications by determination of the autoignition temperature of the hydraulic fluid in air at one atmosphere pressure using hypodermic syringe injection.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products, or assemblies under actual fire conditions.*

1.4 *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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Terminology

2.1 *Definitions:*

2.1.1 *autoignition, n*—the ignition of a material commonly in air as the result of heat liberation due to the exothermic oxidation reaction in the absence of an external ignition source such as a spark or flame.

2.1.2 *autoignition temperature, n*—the minimum temperature at which autoignition occurs under the specified conditions of the test.

2.1.3 *ignition, n*—the initiation of combustion.

2.1.4 *ignition time lag, n*—the time lapse between application of the heat to a material and its ignition; it is the time in seconds between the insertion of the sample into the flask and ignition.

3. Summary of Test Method

3.1 A small metered sample of the fluid to be tested is injected with a hypodermic syringe into a heated ~~200-mL~~200 mL Erlenmeyer borosilicate glass flask containing air. The contents of the flask are observed in a darkened room for ~~5 min~~ 5 min following injection of the sample or until autoignition occurs; autoignition is evidenced by the sudden appearance of a flame inside the flask. The lowest flask temperature at which autoignition occurs for a series of prescribed sample volumes is taken to be the autoignition temperature of the fluid in air at one atmosphere pressure.

4. Significance and Use

4.1 Autoignition is dependent on the chemical and physical properties of the material and the method and apparatus employed for its determination. The autoignition temperature by a given method does not necessarily represent the minimum temperature at which a given material will self-ignite in air. The volume of the vessel used is particularly important since lower autoignition temperatures will be achieved in larger vessels. Vessel material can also be an important factor.

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[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum ~~Products~~ Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.N0 on Hydraulic Fluids.

Current edition approved ~~July 1, 2012~~Dec. 1, 2018. Published ~~November 2012~~February 2019. Originally approved in 1966. Last previous edition approved in ~~1976~~2012 as ~~D2155-66(1976)~~D2155 – 12. ~~which was withdrawn August 1980 and reinstated in July 2012. DOI: 10.1520/D2155-12~~DOI: 10.1520/D2155-18.

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

4.2 The temperatures determined by this test method are those at which air oxidation leads to ignition. These temperatures can be expected to vary with the test pressure and oxygen concentration.

4.3 This test method is not designed for evaluating materials which are capable of exothermic decomposition. For such materials, ignition is dependent upon the thermal and kinetic properties of the decomposition, the mass of the sample, and the heat transfer characteristics of the system.

4.4 This test method is not designed for evaluating for solid chemicals which melt and vaporize or which readily sublime at the test temperature.

4.5 This test method is not designed to measure the autoignition temperature of materials which are solids or liquids at the test temperature (for example, wood, paper, cotton, plastics, and high-boiling point chemicals). Such materials will thermally degrade in the flask and the accumulated degradation products may ignite.

4.6 This test method is not designed to measure the autoignition temperature of chemicals that are gaseous at atmospheric temperature and pressure.

5. Apparatus

5.1 The apparatus, shown schematically in Figs. 1 and 2, shall conform to the requirements prescribed in ~~3.2~~5.2 to ~~3.6~~5.6.

5.2 *Furnace*—The furnace shall consist of a ~~5-in. (127-mm)~~5 in. (127 mm) internal diameter alundum cylinder, ~~5 in.~~ 5 in. long, circumferentially wound with an electric heater, a Transite cover ring neck heater, three-neck heater supports, Transite flask guide ring, base heater, and suitable refractory insulating material and retaining shell. Temperature control shall be achieved by the use of suitable autotransformers or rheostats, thermocouples, and a suitable potentiometer.

5.3 *Hypodermic Syringe*—A ~~0.25~~0.25 cm^3 or ~~1-cm~~1 cm^3 hypodermic syringe equipped with a ~~2-in. (50.8-mm)~~2 in. (50.8 mm) No. 18 stainless steel needle and calibrated in units of ~~0.01 cm~~0.01 cm^3 should be used to inject the sample into the heated test flask.

5.4 *Test Flask*—The test flask in Fig. 3 shall be a commercial ~~200-mL~~200 mL Erlenmeyer borosilicate glass flask.[2] A new flask shall be used for tests on each product; should the flask become visibly coated with residue before the completion of tests on each product, the final series of tests should be conducted with a new flask.

5.5 *Thermocouples*—Three calibrated ~~20-gage~~20 gauge iron-constantan thermocouples shall be used in determining the flask temperature. These shall be mounted in the furnace so as to contact the walls of the flask ~~1 and 2 in. (25 to 51 mm)~~ 1 in. and 2 in. (25 mm to 51 mm) below the bottom of the neck heater and under the base of the flask near its center.

5.6 *Timer*—An electric timer or stopwatch calibrated in ~~0.1~~0.1 s or ~~0.2-s~~0.2 s intervals shall be used to determine the time lag before ignition (time interval between the instant of sample injection and that of ignition as evidenced by the appearance of the flame).

6. Procedure

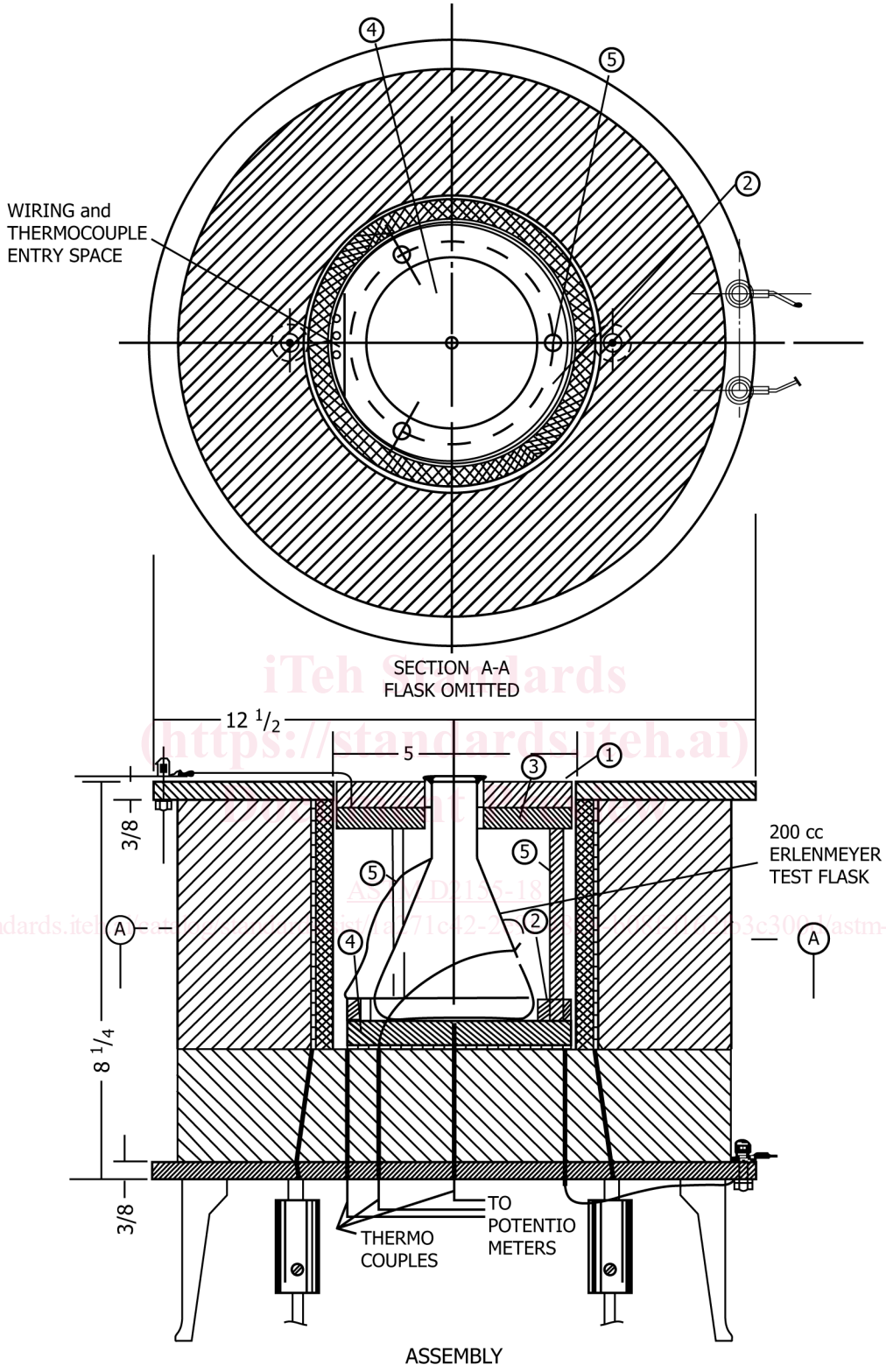
6.1 *Temperature Control*—Adjust the temperature of the furnace so that the temperatures at the top, center, and bottom of the ~~200-mL~~200 mL Erlenmeyer test flask are within ~~2°F (1.1°C)~~2 °F (1.1 °C) of the desired test temperature.

6.2 *Sample Injection*—Inject ~~0.07 cm~~0.07 cm^3 of the sample to be tested into the test flask with the hypodermic syringe; quickly withdraw the syringe.

6.3 *Time Measurement*—Start the timer as the sample is injected into the test flask.

6.4 *Observations*—Observe the inside of the test flask in a darkened room by means of a mirror placed at an appropriate angle above the flask. If a flame is not observed in ~~5 min,~~ 5 min, the volume of the sample tested is considered nonflammable at the temperature of the test flask. Completely flush the flask with clean dry air and stop the timer. Then repeat the test at a higher (about ~~50°F~~50 °F or ~~30°C)~~30 °C) temperature. Allow at least ~~15 min~~ 15 min to elapse between tests. If a flame is observed, stop the timer and record the time interval between the sample injection and the appearance of the flame to the nearest ~~0.2 s~~ 0.2 s as the time lag. Lower the test temperature by ~~5°F (3°C)~~5 °F (3 °C) and repeat the entire procedure until autoignition is no longer obtained. Then raise the test temperature about ~~50°F~~50 °F and repeat the above procedure using ~~0.10 cm~~0.10 cm^3 of the sample. If the lowest temperature at which autoignition is obtained with this quantity of sample ~~(0.10 cm~~(0.10 cm^3) is lower than that found in the previous test, repeat the procedure again using ~~0.12,~~0.12 cm^3, then ~~0.15 cm~~0.15 cm^3, etc., of the sample in ~~0.02~~0.02 cm^3 to ~~0.03 cm~~0.03 cm^3 steps until the minimum autoignition temperature is obtained. If the lowest temperature at which autoignition is obtained with ~~0.10 cm~~0.10 cm^3 of the sample is greater than that obtained with ~~0.07 cm~~0.07 cm^3 of the sample, repeat the above procedure with ~~0.05~~0.05 cm^3 then ~~0.03 cm~~0.03 cm^3 instead of ~~0.12,~~0.12 cm^3, 0.15 cm^3, etc.

[2] The sole source of supply of the apparatus known to the committee at this time is Schott of North America Inc., 555 Taxter Road, Elmsford, NY. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.



(1) Cover Ring.
(2) Flask Guide Ring.
(3) Neck Heater.
(4) Base Heater.
(5) Neck Heater Support.

FIG. 1 Furnace Details