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An American National Standard

Standard Test Method for Simulative Recirculating System Testing of Aerospace Hydraulic Fluids¹

This standard is issued under the fixed designation D 2428; 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 system evaluation of aerospace hydraulic fluids. The test method recommends control of test variables, a typical test system geometry, data to be obtained, and procedures which will assure a uniform approach to fluid screening and evaluation. Recommendations concerning specific hardware and rigid techniques have been avoided where possible to allow the test method to be used as the state-of-the-art advances.

1.2 Each agency using the test method can simulate a specific system, thus fluids can be qualified for use in applications having unique hardware and design concepts. This approach provides the test flexibility needed to meet the rapid changes in fluid requirements and also provide valuable comparative data for both users and developers of hydraulic fluids.

1.3 Since the test system was purposely generalized, it is important that the specified data be obtained in order that fluid flow dynamics can be defined. Such factors as shear rate, mass flow rate, temperature gradients, etc., must be defined for valid comparisons.

1.4 *This standard does not purport to address all of the safety problems, 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.*

1.5 The values stated in metric units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 ASTM Standards:

D 88 Test Method for Saybolt Viscosity²D 92 Test Method for Flash and Fire Points by Cleveland Open Cup³D 97 Test Method for Pour Point of Petroleum Oils³D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)³D 664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration³D 941 Test Method for Density and Relative Density (Specific Gravity) of Liquids by Lipkin Bicapillary Pycnometer³D 974 Test Method for Acid and Base Number by Color-Indicator Titration³D 1298 Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method³D 1480 Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Bingham Pycnometer³D 1481 Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Lipkin Bicapillary Pycnometer³D 1533 Test Method for Water in Insulating Liquids (Karl Fischer Method)⁴D 2155 Test Method for Autoignition Temperature of Liquid Petroleum Products⁵F 303 Practices for Sampling Aerospace Fluids from Components⁶F 313 Test Method for Insoluble Contamination of Hydraulic Fluids by Gravimetric Analysis⁷

3. Summary of Test Method

3.1 Hydraulic fluids are evaluated in a system which simulates as closely as practical that in which the fluid is to operate. System variables and test procedures have been purposely generalized while system description and data to be obtained have been rigidly defined.

4. Significance and Use

4.1 The usefulness of this test method is related directly to the ability to correlate valid test results from different laboratories. Results validity and correlativity are related directly to the care with which data is obtained and reported as well as instrumentation accuracy and test concept.

4.2 Instrumentation accuracy is a function not only of resolution but also placement in the system.

4.2.1 Pressure piezometer rings are fabricated and placed in accordance with "Fluid Meters, Their Theory and Applications," ASME, 1959, p. 18.⁸ Thermocouple probes are placed in the line to read the maximum fluid temperature. For inside-out heat flow this is generally at the tube

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 D 02.11 on Engineering Science of High Performance Fluids and Solids.

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² Annual Book of ASTM Standards, Vol 04.04.

³ Annual Book of ASTM Standards, Vol 05.01.

⁴ Annual Book of ASTM Standards, Vol 10.03.

⁵ Discontinued 1980—Replaced by E 659.

⁶ Annual Book of ASTM Standards, Vol 10.05.

⁷ Annual Book of ASTM Standards, Vol 15.03.

⁸ Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.