Designation: D4054 – 22

An American National Standard

Standard Practice for Evaluation of New Aviation Turbine Fuels and Fuel Additives[1]

This standard is issued under the fixed designation D4054; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This standard practice provides procedures to develop data for use in research reports for new aviation turbine fuels, changes to existing aviation turbine fuels, or new aviation turbine fuel additives. These research reports are intended to support the development and issuance of new specifications or specification revisions for these products. This standard practice has also been used to evaluate the effect of incidental materials on jet fuel properties and performance.

1.2 The procedures, tests, and selection of materials detailed in this practice are based on industry expertise to provide the necessary data to determine if the new or changed fuel or additive is suitable for use on existing aircraft and engines and for use in the current aviation operational and supply infrastructure. As such, it is primarily intended for the evaluation of drop-in fuels, but it can also be used for the evaluation of other fuels.

1.3 Because of the diversity of aviation hardware and potential variation in fuel/additive formulations, not every aspect may be fully covered and further work may be required. Therefore, additional data beyond that described in this practice may be requested by the ASTM task force, Subcommittee J, or Committee D02 upon review of the specific composition, performance, or other characteristics of the candidate fuel or additive.

1.4 Units of measure throughout this practice are stated in International System of Units (SI) unless the test method specifies non-SI units.

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

1.6 *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. Referenced Documents

2.1 *ASTM Standards:*[2]

A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

B36/B36M Specification for Brass Plate, Sheet, Strip, And Rolled Bar

B93/B93M Specification for Magnesium Alloys in Ingot Form for Sand Castings, Permanent Mold Castings, and Die Castings

D56 Test Method for Flash Point by Tag Closed Cup Tester

D86 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure

D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

D257 Test Methods for DC Resistance or Conductance of Insulating Materials

D395 Test Methods for Rubber Property—Compression Set

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D471 Test Method for Rubber Property—Effect of Liquids

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D924 Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids

[1] This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.J0.04 on Additives and Electrical Properties.

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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.

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

D1002 Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
D1319 Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
D1331 Test Methods for Surface and Interfacial Tension of Solutions of Paints, Solvents, Solutions of Surface-Active Agents, and Related Materials
D1405 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
D1414 Test Methods for Rubber O-Rings
D1655 Specification for Aviation Turbine Fuels
D2240 Test Method for Rubber Property—Durometer Hardness
D2386 Test Method for Freezing Point of Aviation Fuels
D2425 Test Method for Hydrocarbon Types in Middle Distillates by Mass Spectrometry
D2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
D2624 Test Methods for Electrical Conductivity of Aviation and Distillate Fuels
D2717 Test Method for Thermal Conductivity of Liquids (Withdrawn 2018)[3]
D2887 Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography
D3114 Method of Test for D-C Electrical Conductivity of Hydrocarbon Fuels (Withdrawn 1985)[3]
D3241 Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels
D3242 Test Method for Acidity in Aviation Turbine Fuel
D3338 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
D3359 Test Methods for Rating Adhesion by Tape Test
D3363 Test Method for Film Hardness by Pencil Test
D3701 Test Method for Hydrogen Content of Aviation Turbine Fuels by Low Resolution Nuclear Magnetic Resonance Spectrometry
D3703 Test Method for Hydroperoxide Number of Aviation Turbine Fuels, Gasoline and Diesel Fuels
D3828 Test Methods for Flash Point by Small Scale Closed Cup Tester
D3948 Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer
D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
D4066 Classification System for Nylon Injection and Extrusion Materials (PA)
D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
D4529 Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
D4629 Test Method for Trace Nitrogen in Liquid Hydrocarbons by Syringe/Inlet Oxidative Combustion and Chemiluminescence Detection
D4809 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)
D5001 Test Method for Measurement of Lubricity of Aviation Turbine Fuels by the Ball-on-Cylinder Lubricity Evaluator (BOCLE)
D5291 Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants
D5304 Test Method for Assessing Middle Distillate Fuel Storage Stability by Oxygen Overpressure
D5363 Specification for Anaerobic Single-Component Adhesives (AN)
D5453 Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
D5972 Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)
D6304 Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration
D6378 Test Method for Determination of Vapor Pressure (VP_X) of Petroleum Products, Hydrocarbons, and Hydrocarbon-Oxygenate Mixtures (Triple Expansion Method)
D6379 Test Method for Determination of Aromatic Hydrocarbon Types in Aviation Fuels and Petroleum Distillates—High Performance Liquid Chromatography Method with Refractive Index Detection
D6732 Test Method for Determination of Copper in Jet Fuels by Graphite Furnace Atomic Absorption Spectrometry
D6793 Test Method for Determination of Isothermal Secant and Tangent Bulk Modulus (Withdrawn 2021)[3]
D6890 Test Method for Determination of Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuel Oils by Combustion in a Constant Volume Chamber
D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
D7111 Test Method for Determination of Trace Elements in Middle Distillate Fuels by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)
D7153 Test Method for Freezing Point of Aviation Fuels (Automatic Laser Method)
D7154 Test Method for Freezing Point of Aviation Fuels (Automatic Fiber Optical Method)
D7171 Test Method for Hydrogen Content of Middle Distillate Petroleum Products by Low-Resolution Pulsed Nuclear Magnetic Resonance Spectroscopy
D7359 Test Method for Total Fluorine, Chlorine and Sulfur in Aromatic Hydrocarbons and Their Mixtures by Oxidative Pyrohydrolytic Combustion followed by Ion Chromatography Detection (Combustion Ion Chromatography-CIC)

[3] The last approved version of this historical standard is referenced on www.astm.org.

D7566 Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons
D7945 Test Method for Determination of Dynamic Viscosity and Derived Kinematic Viscosity of Liquids by Constant Pressure Viscometer
E411 Test Method for Trace Quantities of Carbonyl Compounds with 2,4-Dinitrophenylhydrazine
E659 Test Method for Autoignition Temperature of Chemicals
E681 Test Method for Concentration Limits of Flammability of Chemicals (Vapors and Gases)
E1269 Test Method for Determining Specific Heat Capacity by Differential Scanning Calorimetry

2.2 *Federal Specifications:*[4]

FED-STD-791 Testing Method of Lubricants, Liquid Fuels, and Related Products

2.3 *Department of Defense Specifications:*[4]

DOD-L-85645 Lubricant, Dry Film, Molecular Bonded
MIL-A-8625 Anodic Coatings for Aluminum and Aluminum Alloys
MIL-C-83019 Coating, Polyurethane, for Protection of Integral Fuel Tank Sealing Compound
MIL-DTL-5541 Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-DTL-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-24441 Paint, Epoxy-Polyamide, General Specification for
MIL-PRF-25017 Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (NATO S-1747)
MIL-DTL-25988 Rubber, Fluorosilicone Elastomer, Oil- and Fuel-Resistant, Sheets, Strips, Molded Parts, and Extruded Shapes
MIL-DTL-26521 Hose Assembly, Nonmetallic, Fuel, Collapsible, Low Temperature with Non-Reusable Couplings
MIL-DTL-83054 Baffle and Inerting Material, Aircraft Fuel Tank
MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)
MIL-H-4495 Hose Assembly, Rubber, Aerial Refueling
MIL-DTL-17902 Hose, End Fittings and Hose Assemblies, Synthetic Rubber, Aircraft Fuels
MIL-HDBK-510 Aerospace Fuels Certification
MIL-P-25732 Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Limited Service at 275 °F (135 °C)
MIL-PRF-370 Hose and Hose Assemblies, Nonmetallic: Elastomeric, Liquid Fuel
MIL-PRF-6855 Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes, General Specification for
MIL-PRF-8516 Sealing Compound, Synthetic Rubber, Electric Connectors and Electric Systems, Chemically Cured
MIL-PRF-46010 Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting, NATO Code S-1738
MIL-PRF-81298 Dye, Liquid for the Detection of Leaks in Aircraft Fuel Systems
MIL-PRF-81733 Sealing and Coating Compound, Corrosion Inhibitive
MIL-PRF-87260 Foam Material, Explosion Suppression, Inherently Electrostatically Conductive, for Aircraft Fuel Tanks
MIL-S-85334 Sealing Compound, Noncuring, Low Consistency, Silicone, Groove Injection, for Integral Fuel Tanks
MIL-DTL-5578 Tanks, Fuel, Aircraft, Self-Sealing
MMM-A-132 Adhesives, Heat Resistant, Airframe Structural, Metal to Metal
QPL-25017 Qualified Products List for MIL-PRF-25017 (Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble) (NATO S-1747)

2.4 *SAE International:*[5]

SAE-AMS-2410 Plating, Silver Nickel Strike, High Bake
SAE-AMS-2427 Aluminum Coating, Ion Vapor Deposition
SAE-AMS-3215 Acrylonitrile Butadiene (NBR) Rubber Aromatic Fuel Resistant 65–75
SAE-AMS-3265 Sealing Compound, Polysulfide (T) Rubber, Fuel Resistant, Non-Chromated Corrosion Inhibiting for Intermittent Use to 360 °F (182 °C)
SAE-AMS-3276 Sealing Compound, Integral Fuel Tanks and General Purpose, Intermittent Use to 360 °F (182 °C)
SAE-AMS-3277 Sealing Compound, Polythioether Rubber Fast Curing Integral Fuel Tanks and General Purpose, Intermittent Use to 360 °F (182 °C)
SAE-AMS-3278 Sealing and Coating Compound: Polyurethane (PUR) Fuel Resistant High Tensile Strength/Elongation for Integral Fuel Tanks/Fuel Cavities/General Purpose
SAE-AMS-3279 Sealing Compound, Sprayable, for Integral Fuel Tanks and Fuel Cell Cavities, for Intermittent Use to 350 °F (177 °C)
SAE-AMS-3281 Sealing Compound, Polysulfide (T) Synthetic Rubber for Integral Fuel Tank and Fuel Cell Cavities Low Density for Intermittent Use to 360 °F (182 °C)
SAE-AMS-3283 Sealing Compound, Polysulfide Non-Curing, Groove Injection Temperature and Fuel Resistant
SAE-AMS-3361 Silicone Potting Compound, Elastomeric, Two-Part, General Purpose, 150 to 400 Poise (15 to 40 Pa·s) Viscosity
SAE-AMS-3375 Adhesive/Sealant, Fluorosilicone, Aromatic Fuel Resistant, One-Part Room Temperature Vulcanizing
SAE-AMS-3376 Sealing Compound, Non-Curing, Groove Injection Temperature and Fuel Resistant
SAE-AMS-4017 Aluminum Alloy Sheet and Plate, 2.5Mg – 0.25Cr (5052–H34) Strain-Hardened, Half-Hard, and Stabilized
SAE-AMS-4027 Aluminum Alloy, Sheet and Plate 1.0Mg – 0.60Si – 0.28Cu – 0.20Cr (6061; –T6 Sheet, –T651 Plate)

[4] Copies of these documents are available online at http://quicksearch.dla.mil/ or http://assist.dla.mil.

[5] Available from SAE International, 400 Commonwealth Dr., Warrendale, Pennsylvania 15096, http://www.sae.org/servlets/index