

Standard Guide for Evaluation of New Aviation Gasolines and New Aviation Gasoline Additives¹

This standard is issued under the fixed designation D7826; 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 guide covers and provides procedures to develop data for use in research reports for new aviation gasolines or new aviation gasoline additives.

1.2 These research reports are intended to support the development and issuance of new specifications or specification revisions for these products. Guidance to develop ASTM International standard specifications for aviation gasoline is provided in Subcommittee J on Aviation Fuels Operating Procedures, Annex A6, “Guidelines for the Development and Acceptance of a New Aviation Fuel Specification for Spark-Ignition Reciprocating Engines.”

1.3 The procedures, tests, selection of materials, engines, and aircraft detailed in this guide are based on industry expertise to give appropriate data for review. Because of the diversity of aviation hardware and potential variation in fuel/additive formulations, not every aspect may be encompassed and further work may be required. Therefore, additional data beyond that described in this guide 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 While it is beyond the scope of this guide, investigation of the future health and environmental impacts of the new aviation gasoline or new aviation gasoline additive and the requirements of environmental agencies is recommended.

1.5 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.6 *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

- D86 Test Method for Distillation of Petroleum Products at Atmospheric Pressure
- D97 Test Method for Pour Point of Petroleum Products
- D156 Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
- D323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)
- D381 Test Method for Gum Content in Fuels by Jet Evaporation
- 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
- D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration
- D873 Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method)
- D892 Test Method for Foaming Characteristics of Lubricating Oils
- D909 Test Method for Supercharge Rating of Spark-Ignition Aviation Gasoline
- D910 Specification for Leaded Aviation Gasolines
- D924 Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids
- D943 Test Method for Oxidation Characteristics of Inhibited Mineral Oils
- D1002 Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
- D1056 Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

¹ This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.J0.02 on Spark and Compression Ignition Aviation Engine Fuels.

Current edition approved Oct. 15, 2013. Published November 2013. DOI: 10.1520/D7826-13.

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.

D1094 Test Method for Water Reaction of Aviation Fuels
D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
D2240 Test Method for Rubber Property—Durometer Hardness
D2344/D2344M Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
D2386 Test Method for Freezing Point of Aviation Fuels
D2500 Test Method for Cloud Point of Petroleum Products
D2533 Test Method for Vapor-Liquid Ratio of Spark-Ignition Engine Fuels (Withdrawn 2008)³
D2583 Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
D2624 Test Methods for Electrical Conductivity of Aviation and Distillate Fuels
D2700 Test Method for Motor Octane Number of Spark-Ignition Engine Fuel
D2887 Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography
D2896 Test Method for Base Number of Petroleum Products by Potentiometric Perchloric Acid Titration
D3339 Test Method for Acid Number of Petroleum Products by Semi-Micro Color Indicator Titration
D3359 Test Methods for Measuring Adhesion by Tape Test
D3525 Test Method for Gasoline Diluent in Used Gasoline Engine Oils by Gas Chromatography
D3652 Test Method for Thickness of Pressure-Sensitive Tapes
D3762 Test Method for Adhesive-Bonded Surface Durability of Aluminum (Wedge Test)
D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
D4057 Practice for Manual Sampling of Petroleum and Petroleum Products
D4308 Test Method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter
D4809 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)
D4865 Guide for Generation and Dissipation of Static Electricity in Petroleum Fuel Systems
D5188 Test Method for Vapor-Liquid Ratio Temperature Determination of Fuels (Evacuated Chamber and Piston Based Method)
D5190 Test Method for Vapor Pressure of Petroleum Products (Automatic Method) (Withdrawn 2012)³
D5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)
D5304 Test Method for Assessing Middle Distillate Fuel Storage Stability by Oxygen Overpressure
D5762 Test Method for Nitrogen in Petroleum and Petroleum Products by Boat-Inlet Chemiluminescence

D6053 Test Method for Determination of Volatile Organic Compound (VOC) Content of Electrical Insulating Varnishes
D6227 Specification for Unleaded Aviation Gasoline Containing a Non-hydrocarbon Component
D6304 Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration
D6424 Practice for Octane Rating Naturally Aspirated Spark Ignition Aircraft Engines
D6469 Guide for Microbial Contamination in Fuels and Fuel Systems
D6812 Practice for Ground-Based Octane Rating Procedures for Turbocharged/Supercharged Spark Ignition Aircraft Engines
D7547 Specification for Hydrocarbon Unleaded Aviation Gasoline
E659 Test Method for Autoignition Temperature of Liquid Chemicals

2.2 *EI Standards:*⁴

EI 1529 Aviation fuelling hose and hose assemblies
EI 1581 Specification and qualification procedures for aviation jet fuel filter/separators
EI 1583 Laboratory tests and minimum performance levels for aviation fuel filter monitors
EI 1590 Specifications and qualification procedures for aviation fuel microfilters

2.3 *MODUK Standard:*⁵

MODUK DEF STAN 80-97 Paint System, for the Interior of Bulk Fuel Tank and Fittings, Multi-Pack

2.4 *ISO Standards:*⁶

ISO 1825 Rubber hoses and hose assemblies for aircraft ground fuelling and defuelling—Specification
ISO 20823 Determination of the flammability characteristics of fluids in contact with hot surfaces—Manifold ignition test

2.5 *UL Standard:*⁷

UL 94 Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing

2.6 *Federal Standards:*⁸

DOT/FAA/AR-03/21 Characterization of In-Plane, Shear-Loaded Adhesive Lap Joints: Experiments and Analysis
DOT/FAA/AR-06/10 Guidelines and Recommended Criteria for the Development of a Material Specification for Carbon Fiber/Epoxy Fabric Prepregs
14 CFR Part 33:49 Block Tests; Reciprocating Aircraft Engines—Endurance Test

⁴ Available from Publications Team, Energy Institute, 61 New Cavendish St., London W1G 7AR, UK, <http://www.energyinst.org>.

⁵ Available from UK Defence Standardization, Kentigern House, Rm. 1138, 65 Brown St., Glasgow G2 8EX.

⁶ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁷ Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, <http://www.ul.com>.

⁸ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

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

Fed-Std-791 Testing Method of Lubricants, Liquid Fuels, and Related Products

MIL-C-6183 Cork and Rubber Composition Sheet, for Aromatic Fuel and Oil Resistant Gaskets

MIL-F-5509 Fittings, Flared Tube, Fluid Connection

MIL-R-83248 Rubber: Fluorocarbon Elastomer, High Temperature, Fluid and Compression Set Resistant

MIL-S-8802 Sealing Compound, Temperature-Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High-Adhesion

3. Terminology

3.1 Definitions:

3.1.1 *additive*, *n*—substance added to a base aviation gasoline in relatively small amounts that either enables that base aviation gasoline to meet the applicable specification properties or does not alter the applicable specification properties of that base aviation gasoline beyond allowable limits.

3.1.2 *aviation gasoline*, *n*—fuel possessing specific properties suitable for operating aircraft powered by spark-ignition piston engines.

3.1.2.1 *Discussion*—Principal properties include combustion, fluidity, volatility corrosion, stability, water shedding, and detonation-free performance in the engine (or engines) for which it is intended. In the context of this guide, the terms fuel and gasoline are interchangeable.

3.1.3 *production specification*, *n*—ASTM International aviation gasoline standard that specifies the properties, performance, and composition necessary to provide a level of control to support large-scale production, distribution, and the conduct of commerce.

3.1.4 *test specification*, *n*—ASTM International aviation gasoline standard specifying the properties, performance, and composition necessary to provide a level of control to support the conduct of testing and analysis for development of an ASTM International aviation gasoline production specification.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *critical altitude*, *n*—maximum altitude at which, in standard atmosphere, it is possible to maintain at a specific engine revolutions per minute (RPM), a specified power, or a specified manifold pressure.

3.2.1.1 *Discussion*—Unless otherwise stated, the critical altitude is the maximum altitude at which it is possible to maintain, at the maximum engine RPM, one of the following:

(1) The maximum continuous power, in the case of engines for which this power rating is the same, at sea level and at the rated altitude or

(2) The maximum continuous rated manifold pressure, in the case of engines, the maximum continuous power of which is governed by a constant manifold pressure.

3.2.2 *fit-for-purpose*, *adj*—describes a condition of acceptance of an aviation fuel or aviation fuel additive that signifies acceptable performance in aircraft and aircraft engines.

3.2.3 *fit-for-purpose properties*, *n*—characteristics of an aviation fuel or aviation fuel additive in the fuel that are not controlled by the fuel specification or specification properties but that are specified for evaluation in addition to the speci-

cation properties to provide a comprehensive assessment of the suitability of an aviation fuel for use on aircraft and aircraft engines.

3.2.4 *production specification research report*, *n*—compilation of the technical data describing the composition, properties, and performance of an aviation gasoline used to support development and issuance of a production specification.

3.2.5 *sponsor*, *n*—entity submitting a new fuel or new fuel additive for review.

3.2.6 *test specification research report*, *n*—compilation of the technical data describing the composition, properties, and performance of an aviation gasoline used to support development and issuance of a test specification.

4. Summary of Practice

4.1 This guide gives laboratory and aircraft equipment test guidance to evaluate a new aviation gasoline or aviation gasoline additive. This guide includes requirements that address the following subjects:

4.1.1 Basic specification properties;

4.1.2 Fit-for-purpose properties, including compatibility with other aviation gasolines and aviation piston-engine lubricants;

4.1.3 Materials compatibility;

4.1.4 Aircraft component bench or rig testing;

4.1.5 Engine test cell evaluation; and

4.1.6 Aircraft flight test evaluation.

4.2 The procedure for new aviation gasolines is organized into Phase 1 and Phase 2. Details of the two phases:

4.2.1 Phase 1 is a test specification phase structured to produce data to support the development and review of an ASTM International Aviation Gasoline Test Specification (see 6.2). The process to develop, review, and issue an ASTM International aviation gasoline test specification is not addressed in this guide.

4.2.2 Phase 2 is a production specification phase structured to produce data to support the development and review of an ASTM International aviation gasoline production specification (see 6.3). The process to develop, review, and issue an ASTM International aviation gasoline production specification is not addressed in this guide.

4.3 The procedure for new aviation gasoline additives consists of only one phase.

4.4 The procedure to evaluate new aviation gasolines is progressive and iterative in nature with the extent of continued testing determined by the fuel properties, characteristics, and test results revealed at each successive stage. The extent of testing can be expected to grow with increasing degree of divergence from the properties, performance, and experience with existing aviation gasolines. This degree of divergence and its consequences are evaluated during the analysis of data provided in the research reports.

4.5 The procedure to evaluate new aviation gasoline additives is also progressive and iterative in nature with the extent of continued testing determined by the fuel properties,

characteristics, and test results revealed at each successive stage. The extent of testing can be expected to grow with increasing effect on the properties and performance of the base aviation gasoline. This effect on the base aviation gasoline is evaluated during the analysis of data provided in the research reports.

5. Significance and Use

5.1 This guide is intended for the developers or sponsors of new aviation gasolines or additives to describe the data requirements necessary to support the review of these new products by ASTM members.

5.2 This guide is not an approval process. It is intended to describe test and analysis requirements necessary to generate data to support specification development. This guide does not address the approval process for ASTM International standards.

5.3 This guide will reduce the uncertainty and risk to developers or sponsors of new aviation gasolines or additives by describing the test and analysis requirements necessary to proceed with the development of an ASTM International specification for aviation gasoline or specification revision for an aviation gasoline additive.

5.4 This guide does not purport to specify an all-inclusive listing of test and analysis requirements to achieve ASTM International approval of a specification or specification revision. The final requirements will be dependent upon the specific formulation and performance of the candidate fuel and be determined by the ASTM International task forces and committees charged with overseeing the specification development.

5.5 This guide does not describe data requirements of other approving authorities, such as national aviation regulatory authorities, or of other organizations or industry associations. However, the data generated in the conduct of the procedure may be useful for other purposes or other organizations.

5.6 Over 200 000 piston-engine aircraft rely on Specification **D910** lead-containing aviation gasoline (avgas) for safe operation. There has been an increase in the research and development of alternatives to Specification **D910** gasolines as a result of environmental and economic concerns.

6. Procedure

6.1 *Special Considerations for Additives*—The following procedure is applicable to both aviation gasolines and aviation gasoline additives. Therefore, the terms “aviation gasoline,” “gasoline,” and “fuel” will only be used to describe the test product unless special considerations exist for additives. When these special considerations for additives exist, they will be specified in the appropriate section of the procedure.

6.1.1 The additive’s final chemistry, carrier solvent, recommended treatment level, location in the production or supply chain for treatment, and conditions for retreatment should be identified.

6.1.2 Complete information on the base fuel into which the additive is to be added should be provided. If the base fuel is fuel approved to current major aviation gasoline specifications

such as Specifications **D910**, **D7547**, or **D6227**, this shall be noted and all further testing shall be done on fuel samples blended with locally available fuel.

6.1.3 All testing of additives, unless otherwise noted, should be conducted with base fuel containing 400 % (4×) of the maximum additive dosage.

6.2 *Test Specification Phase*—The tests and analysis in **Table 1** should be conducted and the resulting data should be compiled in a test specification research report.

6.2.1 *Pilot Production Report*—A report describing the simulated production, pilot plant ramp up, and/or production capability to confirm that adequate production capacity is available to support the test and analyses of this procedure. Ideally, several batches of fuel should be produced to reflect a range of specification properties to support “worst-case” testing of fuel for the below requirements.

6.2.2 *Basic Specification Properties*—These should be based on, but not be limited to Specification **D910** Table 1 properties. The basic specification property results for evaluation of additives should be compared to the corresponding data for the base fuel. Special focus should be provided for the following properties:

6.2.2.1 *Octane*—This requirement should consider the variations in the correlation between the motor octane test (Test Method **D2700**) and the rich rating test (Test Method **D909**) with actual engine anti-knock capability for unleaded fuels.

6.2.2.2 *Freezing Point*—Critical for flight safety (Test Method **D2386**).

6.2.2.3 *Distillation Curve*—Critical for adequate engine performance throughout the entire operability range, including engine starting. Provide distillation points of Specification **D910**, Table 1 (Test Method **D86**).

6.2.2.4 *Vapor Pressure*—Important for vapor lock and engine starting. Test at 38°C (Test Method **D5191**).

6.2.2.5 *Net Heat of Combustion*—Determines aircraft range (Test Method **D4809**).

6.2.2.6 *Density*—Determines aircraft range, possible impact on structure, weight, and balance and its impact under different flight attitudes. Test at 15°C (Test Method **D4052**).

6.2.2.7 *Water Reaction and Separation*—Important for control of water in fuel and confirm the absence of significant quantities of alcohol (Test Method **D1094**).

6.2.2.8 *Electrical Conductivity*—Fire safety (Test Methods **D2624**).

6.2.3 *Fuel Composition*—Detailed chemical analysis of hydrocarbons and trace materials. The composition of additives should be defined to the extent necessary to establish conformance of the products used for testing (GC X GC).

6.2.4 *Fit-For-Purpose Properties, Part 1 (FFP-1)*—The following FFP-1 tests should be performed to evaluate the fuel properties. The test results should be compared to the corresponding data for Specification **D910** 100LL fuels. The FFP-1 results for evaluation of additives should be compared to the corresponding data for the base fuel.

6.2.4.1 *Distillation Characteristics*—A complete boiling point distribution and comparison of the test and base fuel.

TABLE 1 Test Specification Phase—Summary of the Testing Required for the ASTM Test Specification Research Report

Manufacturing Documentation		
Documentation covering manufacture, pilot plant or full scale, quality control, typical and “worst case” analysis.		
<i>Laboratory Tests – Basic Specification Properties</i>		
Test	Premise	ASTM Test Method
MON	Combustion anti-detonation quality	D2700/IP256
Supercharge	Combustion anti-detonation quality	D909/IP119
Freeze Point	Fluidity at low temperature/altitude	D2386/IP16
Distillation	Specified distillation points	D86/IP123
Vapor Pressure	Combustion performance	D5191/IP394
Net Heat of Combustion	Determines aircraft range	D4809/IP12
Density	Aircraft range and structural considerations	D4052/IP365
Water Reaction	Control of water in fuel	D1094
Electrical Conductivity	Fire safety	D2624/IP274
Fuel Composition	Describes fuel composition	GC X GC
<i>Laboratory Tests – Fit For Purpose Properties – Part 1</i>		
Test	Premise	ASTM Test Method
Distillation Curve	Engine operability	D86/IP123 and D2887/IP406
Liquid/Vapor Ratio	Fuel vaporization characteristics	D2533 or D5188
Vapor Pressure	Fuel vaporization characteristics	D323/IP69, D5190, or D5191
Viscosity	Fluidity at low temperature/altitude	D445/IP71
Density	Aircraft range and structural considerations	D1298 or D4052
Water Solubility	Control of water in fuel	D6304/IP160
Cloud Point	Fluidity at low temperature/altitude	D2500/IP219
Pour Point	Fluidity at low temperature/altitude	D97/IP15
Additional Tests		
Test	Premise	Refer to Sections
Preliminary Materials Compatibility	To ensure compatibility with aviation fuel handling, aircraft and engine components.	6.2.5
Optional Tests^A		
Engine test ^A	To support laboratory data and demonstrate fuel performance in full size engine.	6.2.6
Flight test ^A	To support operational performance.	6.2.7

^A These tests are not mandatory but may offer useful supporting data.

residue, and loss with Specification D910 100LL per Test Method D86. Include simulated distillation to Test Method D2887.

6.2.4.2 *Fuel Vaporization Properties*—Liquid/vapor ratio per Test Methods D2533 or D5188 and vapor pressure per Test Methods D323, D5190, or D5191.

6.2.4.3 *Viscosity*—Measure from freezing point to room temperature per Test Method D445.

6.2.4.4 *Density*—Measure over operating temperature range per Test Methods D1298 or D4052.

6.2.4.5 *Water Solubility*—Measure over operating temperature range per Test Method D6304.

6.2.4.6 *Low-Temperature Fuel Characterization*—Phase transition to freezing as compared to Specification D910 100LL freeze point per Test Method D2386 (IP16), cloud point per Test Method D2500 (IP219), and pour point per Test Method D97 (IP15).

6.2.5 *Preliminary Materials Compatibility*—Perform soak testing of two metallic materials from Table A3.1 (5052-0 aluminum, tube and AMS 4505 brass) and three nonmetallic materials from Table A3.2 (Buna – N (nitrile), fluorosilicone, and MIL-R-83248 Viton) in accordance with the procedures described in Annex A2 to measure property changes such as % volume change, hardness, tensile strength, and so forth.

6.2.6 *Engine Testing*—The basic specification property data and FFP-1 data should be compared to similar data for known aviation gasolines such as Specification D910 100LL. This analysis should be used to determine the engine model to be used for these tests.

6.2.6.1 New production or newly overhauled engines that have not been operated on any fuel other than the test fuel should be used for this testing. The engine should be broken in and exclusively operated on only the test fuel. Limited operation with other fuels may be permitted under controlled conditions if accompanied by purging run periods of acceptable duration.

6.2.6.2 *Performance and Operability Testing*—Engine-rated power, steady-state performance, transient performance, and starting should be evaluated on a dynamometer-equipped engine test stand that meets industry standards for facility configuration and instrumentation calibration. Performance data should be compared to the engine manufacturer’s published performance data.

6.2.6.3 *Detonation Testing*—Detonation testing should be conducted in accordance with the procedures described in ASTM International Specifications D6424 and D6812. A detonation measurement system that uses piezoelectric sensors that are flush mounted in the combustion chamber, or a system found to be equivalent, should be used for this testing. Detonation threshold levels and measurement accuracy and sensitivity should be correlated to known systems.

6.2.7 *Test Specification Research Report and Draft ASTM Test Specification*—The test specification research report should provide data and summarize results of above fuel and engine testing. The draft test specification should be sufficient to control the performance of the fuel for testing in the next phase of this procedure. Both the test specification research

report and test specification should be balloted to ASTM and approved before proceeding with the next phase of this procedure.

6.3 Production Specification Phase—Upon issuance of the ASTM International test specification, the following tests and analysis should be conducted and the resulting data should be compiled in a production specification research report (see [Table 2](#)).

6.3.1 Production Report—A report describing the pilot plant or, preferably, a refinery/chemical plant production process. The fuel used in the following testing should be produced from representative production processes, including the fuel's blending components. Fuel produced for this phase should be derived from an integrated process from feedstock to finished fuel. Chemical facsimiles of production fuel or fuel produced in a manner not representative of finished production routes are not acceptable for development of an ASTM production specification.

6.3.2 Fit-For-Purpose Properties, Part 2 (FFP-2)—FFP-2 includes additional properties relating to engine and aircraft operability and performance and also includes properties relating to fuel handling and distribution. The data generated during this testing should be compared to corresponding data for Specification [D910](#) 100LL fuel properties. Differences from Specification [D910](#) FFPs should be reconciled in the research

report. The FFP-2 results for evaluation of additives should be compared to the corresponding data for the base fuel.

6.3.2.1 Carburetor Icing—A simulated or actual flight test evaluation of carburetor icing propensity of the candidate fuel.

6.3.2.2 Fuel Gauging and Capacitance—Comparative analysis to 100LL per Test Methods [D2624](#) or [D4308](#).

6.3.2.3 Conductivity and Static Charge Dissipation—Comparative analysis to 100LL over the operating temperature range per Guide [D4865](#).

6.3.2.4 Surface tension versus temperature compared to baseline test fluid.

6.3.2.5 Thermal conductivity versus temperature compared to baseline test fluid.

6.3.2.6 Dielectric constant versus density compared to baseline test fluid.

6.3.2.7 Hot surface ignition temperature compared to baseline test fluid using FED-STD-791, Method [D6053](#) Manifold Ignition Test, or ISO 20823.

6.3.2.8 Gum formation per Test Method [D873](#).

6.3.2.9 Potential Gums—Test Method [D5304](#).

6.3.2.10 Water reaction per Test Method [D1094](#).

6.3.2.11 Microbial Contamination Susceptibility per Guide [D6469](#)—Microbial growth should be compared with Specification [D910](#) fuels or suitably identified test fluid over ambient operating range and fuel compositional range.

TABLE 2 Production Specification Phase—Summary of the Testing Required for the ASTM Production Specification Research Report

Manufacturing Documentation

Documentation covering manufacture, pilot plant or full scale, quality control, typical and "worst case" analysis.

Laboratory Tests – Fit For Purpose Properties – Part 2

Test	Premise	ASTM Test Method
Carburetor Icing	Cold weather fuel system operation	TBD
Fuel Gauging and Capacitance	Aircraft range measurement	D2624 / IP274 or D4308
Conductivity and Static Charge Dissipation	Fire safety	D4865
Surface Tension	Fuel system operation	
Thermal Conductivity	Engine cooling	
Dielectric Constant	Aircraft range measurement	
Hot Surface Ignition Temp	Engine durability	FED-STD-791 or ISO 20823
Gum Formation	Storage stability	D873 / IP138
Potential Gums	Storage stability	ASTM D5304
Water Reaction	Water control	D1094
Microbial Contamination	Contamination control	D6469
Electrical Conductivity	Fire safety	D2624
Fuel Weathering	Long-term fuel performance	
Test Method Validation	Fuel performance control	
Additive Response and Compatibility	Fuel property control	
100LL Fuel Compatibility	Fuel property control	
Lube Oil Compatibility	Engine durability	
Fuel Coloration	Mis-fueling control	
Health, Safety, and Environmental	Personnel health	
Toxicity		
Long Term Fuel Storage Stability	Storage stability	D873 / IP138
Laboratory Tests	Fuel property control	
Fuel Distribution System	Fuel quality control	
Component Compatibility		
Emissions	Environmental impact	
Additional Tests		
Test Premise	Refer to Sections	
Final Materials Compatibility	To ensure compatibility with aviation fuel handling, aircraft and engine components.	6.3.3
Component Testing		6.3.4
Aircraft Operation and Safety Tests		
Engine Test	To support laboratory data and demonstrate fuel performance in full size engine.	6.3.5
Flight Test	To support operational performance.	6.3.6