AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
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AVIATION FUEL
Grade 122/145

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. GRADE: The fuel shall be the one grade known as Aviation Grade 122/145. Fuel consisting of a blend of refined hydrocarbons derived from crude petroleum, natural gasoline, or blends thereof with synthetic hudrocarbons and/or aromatic hydrocarbons will be considered.

3. APPLICATION: The finished fuel is intended for use in aircraft engines requiring Grade 122/145 fuel.

4. REQUIREMENTS: The fuel shall conform to the following requirements when tested in accordance with the methods specified:

(a) Knock Rating.-

(1) Knock Rating (Lean).- Thelean mixture knock rating of the fuel shall be not less than that of iso-octane (or approved reference fuel) to which has been added 0.80 ml. tetraethyl lead per U. S. gallon when determined in accordance with the CRC F-3-645 Lean Mixture Procedure for Determining Knock Characteristics of Aviation Fuels.

(2) Knock Rating (Rich).- The rich mixture knock rating of the fuel shall be not less than that of iso-octane (or approved reference fuel) to which has been added 2.80 ml. Tetraethyl lead per U. S. gallon when determined in accordance with the CRC F-4-443 Supercharge Test Procedure for Determining Knock Characteristics of Aviation Fuels. The rich mixture knock rating of the fuel shall be determined at the fuel-air ratio at which the maximum indicated mean effective pressure for iso-octane (or approved reference fuel) plus 2.80 ml. tetraethyl lead per U. S. gallon is obtained. The mixture response curve for the test fuel shall not be below a curve determined by the minimum values shown at the following listed fuel-air-ratios:

Fuel-Air Ratio	Iso-octane plus TEL ml. per gal.
Peak	2.80
.100	2.80
.090	2.65
.080	2.25
.070	1.75
Min. Boost Pt.	1.00

NOTE: The knock ratings prescribed above shall be defined as the quantity of tetraethyl lead in iso-octane which precisely matches the fuel, and not specified values within the tolerance of the test methods.

(b) Color.- The color shall be purple. The color of the fuel before addition of any dye should be not darker than +21 Saybolt when tested in accordance with ASTM D156-38.

(c) Lead Content.- The lead content shall not exceed 4.5 ml. of tetraethyl lead in the form of 1-T Ethyl Fluid, per U. S. gallon. Tests shall be in accordance with ASTM D526-42.

(d) Distillation.- The limits of the distillation range of the fuel shall be as follows when tested in accordance with ASTM D86-45:

10% evaporated	140 - 158 F
50% evaporated	221 F max
90% evaporated	212 - 257 F
End Point	338 F max
Sum of 10% and 50% evaporated temperatures	307 F min
Distillate Recovery	97.5% min
Distillation Residue	1.5% max
Distillation Loss	1.0% max

(e) Acidity.- The aqueous extract of the distillation residue, using three volumes of distilled water, shall show no pink or red color when one drop of a 0.1% solution of methyl orange is added to it.

(f) Sulphur.- The sulphur content shall not exceed 0.05% by weight when tested in accordance with ASTM D90-41T.

(g) Corrosion (Copper Strip).- No gray or black discoloration shall be apparent on a copper strip when tested in accordance with ASTM D130-30.

(h) Gum Content and Corrosion (Copper Dish).- The residue from 100 ml. of the fuel shall not exceed 5 mg. after evaporating that volume of fuel to dryness in a freshly polished and weighed, 3.5 in. diameter hemispherical copper dish on a steam bath at 212 F (100 C), drying the dish in an electric oven at 212-221 F (100 C - 105 C) for 30 minutes, cooling in a desiccator and weighing. No gray or black corrosion of the inside of the dish shall be apparent.

(i) Vapor Pressure (Reid Method).- The vapor pressure shall not exceed 7.0 psi when tested in accordance with ASTM D323-43.

(j) Freezing Point.- The freezing point shall be not higher than -76 F (-60 C).

(k) Water Tolerance.- The volume of the aqueous layer shall not increase or decrease by more than 2 ml. after 80 ml. of the fuel and 20 ml. of distilled water at room temperature have been shaken vigorously in a glass-stoppered graduated cylinder for at least 2 minutes and allowed to settle.

(l) Gum Content (Accelerated Aging).- The accelerated aging test with 16 hr. induction time at 212 F (100 C), starting with 100 lb. oxygen pressure, shall be conducted in the ASTM bomb according to the ASTM "Proposed Method of Test for Potential Gum in Aviation Gasoline" as described in the 1944 Committee D-2 Report, Appendix IV (pages 393 - 397 inclusive ASTM Proceedings, Volume 44, 1944). The gum residue after the foregoing accelerated aging test shall not exceed 10 mg. per 100 ml. and the total weight of visible lead precipitate shall not exceed 4 mg. An acceptable alternative accelerated aging test conducted as above may be employed with 5 hr. induction time at 212 F (100 C) provided the gasoline contains no inhibitor. For this 5-hr. accelerated aging test, the gum residue shall not exceed 6 mg. per 100 ml. and the total weight of visible lead precipitate shall not exceed 3 mg.

(m) Net Calorific or Lower Heat Value.- The net calorific or lower heat value shall be not less than 18,800 Btu per lb. when tested in accordance with the following procedure:

(1) Determine the heat of combustion (higher or gross value) in an oxygen bomb calorimeter and make suitable correction for the latent heat of vaporization of water formed during the combustion of the fuel to obtain the heat of combustion (lower or net value). For reference tests use an oxygen-bomb calorimeter and the procedure described in the Method of Test for Thermal Value of Fuel Oil (ASTM D240-39), modified for volatile fuel as follows:

(2) Preparation of Sample.- Fill a dry, weighed, gelatin capsule of suitable size with dry cotton fiber, weigh the capsule again and record the weight of gelatin and cotton. Fill the capsule by immersing it in the fuel and closing it under the surface. Dry the outside of the capsule, weigh the capsule immediately, and record the weight of the fuel. Wrap the ignition wire around the capsule three or four times and place the capsule immediately in the bomb.

(3) Procedure.- Fill the bomb with oxygen at 30 atmospheres pressure. Repeat the test, if traces of sooty deposit or odor of unburned fuel are noticed when the bomb is opened after combustion. Deduct the heat of combustion of the gelatin and cotton from the total heat developed.

(4) Calculation of Lower or Net Heat Value.- Any suitable method may be used for determining the water formed during the combustion for correcting the heat of combustion for the latent heat of vaporization of the water. However, for any referee tests use the method described in the paper on "Determination of Carbon and Hydrogen in Gasoline and Other Volatile Liquids." (A. Levin and C. Uhrig, Industrial and Engineering Chemistry, Analytical Edition, Volume 9, 326 (1937), or any other mutually satisfactory method to determine the weight of water formed by combustion of each pound of fuel. The heat of combustion (lower or net value) per pound of fuel shall be condisered as equal to the heat of combustion (higher or gross value) minus the weight, in pounds, of water per pound of fuel multiplied by 1050.

NOTE: Aviation fuel having a net heat of combustion (according to Tables 6 and 7 of Miscellaneous Publication No. 97 of the National Bureau of Standards, "Thermal Properties of Petroleum Production") more than 100 Btu higher than that specified, meets the requirements and the actual tests for gross calorific value and hydrogen content are unnecessary.