Product specifications
Turbine Fuel, Kerosene Type, JP-8

Table 1. Test Requirements

CARACTERÍSTICA	UNIDADES	LÍMITES	MÉTODOS DE ENSAYO	
			NORMAS ASTM	NORMAS IP
Visual Appearance	-	Clear, bright and visually free from solid matter and undissolved water at ambient fuel temperature.	Visual	
			D6986	
Saybolt colour	-	Report	D156 (1) D6045	
Total acidity	mg KOH/g	Max 0.015	D3242	IP 354
Aromatics content or Total aromatics content	% v/v % v/v	Max 25.0 Max 26.5	D1319 (1) D6379	IP 156 IP 436
Sulfur, Total	% m/m	Max 0.30	D129 D1266 D2622 D3120 (2) D4294 (1) D5453	IP 336
Sulfur, Mercaptan or Doctor Test (3)	% m/m	Max 0.0030 Doctor Negative	D3227 D4952	IP 342 IP 30
Refining components, at point of manufacture (4) Non-Hydroprocessed Components Severely Hydroprocessed Components Synthetic Components	 % v/v % v/v % v/v	 Report Report Report		
Distillation (7) Initial Boiling Point 10 % Recovery 50 % Recovery 90 % Recovery End Point Residue Loss	 ºC ºC ºC ºC ºC % v/v % v/v	 Report Max 205.0 Report Report Max 300.0 Max 1.5 Max 1.5	D86 (1) (5) D2887 D7345 (6)	IP 123 IP 406
Flash Point (8)	ºC	Min 38.0	D56 D93 D3828	IP 170 (1)
Density at 15 ºC	kg/m³	Min 775.0; Máximo 840.0	D1298 D4052 (1) D7777	IP 160 IP 365
Freezing Point (9)	ºC	Max minus 47.0	D2386 (1) D5972 D7153 D7154	IP 16 IP 435 IP 529 IP 528
Viscosity at minus 20 ºC	mm²/s	Max 8.000	D445 (1) D7042 (10) D7945	IP 71
Specific Energy	MJ/kg	Min 42.80	D3338 D4529 D4809 (1)	IP 12
Hydrogen Content	% m/m	Min 13.4	D3343 D3701 D5291 D7171 (1)	

Tabla 1: Test Requirements

CARACTERÍSTICA	UNIDADES	LÍMITES		MÉTODOS DE ENSAYO	
				NORMAS ASTM	NORMAS IP
Smoke Point or Smoke Point and Naphthalenes	mm mm % v/v	Min 25.0 Min 18.0 Max 3.00		D1322 (11) D1322 D1840	IP 598 IP 598
Calculated Cetane Index	-	Report		D976 D4737	
Copper Strip, 2 h at 100 ºC	Class	Max 1		D130	IP 154
Thermal Stability (2,5 h at 260ºC): Tube Rating (12)(13) (one of the following requirements shall be met) 1) VTR 2) ITR or ETR, average over area of 2.5 mm^2 Pressure Differential	 Rating nm mm Hg	 Less than 3. No Peacock (P) or Abnormal (A) (14) Max 85 (15) Max 25		D3241	IP 323
Existent Gum (16)	mg/100 ml	Max 7		D381 (1)	IP 540
Water separation Characteristics (17) MSEP Without SDA MSEP With SDA MSEP	 Rating Rating Rating	 Min 85 Min 70 Min 70 (17)		 D3948 D3948 D7224	
Contamination (18)	mg/l	Max 1.0		D2276 D5452 (1)	IP 423
Filtration Time (18)	minutes	Max 15		MIL-DTL-83133K Appendix A (1)	
Cumulative channel particle counts (19) ≥ 4 µm ≥ 6 µm ≥ 14 µm ≥ 30 µm	Individual channel counts & ISO code	Channel counts Report Report Report Report	ISO Code 19 17 14 13	D8166 D7619 (1)	IP 564 IP 565 IP 577
FAME Content (20)	mg/kg	Less than 5.0			IP 585 (1) IP 590 IP 599
FSII Additive Content (21)	% v/v	Min 0.07; Max 0.10		D5006 (1)	IP 424
Electrical Conductivity	pS/m	Min 150; Max 600		D2624	IP 274
Wear Scar Diameter (22)	mm	Max 0.85		D5001	
Components and additives	-	(23)			

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THE TEST METHODS TO BE APPLIED WILL BE THOSE CORRESPONDING TO THE LATEST PUBLISHED VERSION. IF THERE IS A MODIFICATION ON THE OFFICIAL SPECIFICATION THIS DOCUMENT WILL BE REVIEWED TO UPDATE IT.	

NOTES

(1) Referee test method.

(2) The sulfur content detection range for ASTM D3120 is 3.0 to 1000 mg/kg.

(3) If Doctor Test result is positive then mercaptan sulfur content shall be determined by the referee test method ASTM D3227.

(4) Blend components used in the make-up of the batch shall be reported on the Certificate of Quality as a percentage by volume of the total fuel in the batch. Severely hydroprocessed components are defined as those petroleum derived hydrocarbons that have been subjected to a hydrogen partial pressure of greater than 7000 kPa (70 bar or 1015 psi) during manufacture.

(5) Group 4 test conditions, except for the temperature of the cooling bath, which must be between 0ºC and 5ºC.

(6) ASTM D7345 results shall be corrected to bias-free distillation results by the application of the correction factors included in the D7345 “Precision and Bias” section.

(7) Distillation property criteria are specified in ASTM D86 scale units. ASTM D2887 results shall be converted to estimated D86 results by the application of the correlation included in appendix X4 "Correlation for Jet and Diesel Fuel (Procedures A and B)" of D2887 to compare them with the specified property criteria. Distillation residue and loss limits provide a control of the distillation process during the D86 test method and do not apply to D2887.

(8) ASTM D56 may give results up to 1 °C below the ASTM D93 results. ASTM D3828 may give results up to 1.7 °C below the ASTM D93 results. IP 170 may give results up to 2.2 °C below the ASTM D93 results.

(9) During downstream distribution if the freezing point of the fuel is very low and cannot be determined within the IP 16 lowest achievable temperature of minus 65 degrees C, if no crystals appear during cooling of the fuel and when the thermometer indicates a temperature of minus 65°C, the freezing point shall be recorded as below minus 65°C. This limit is not applicable if the freezing point is determined by ASTM D5972 / IP 435, ASTM D7153 / IP 529 o ASTM D7154 / IP 528 methods.

(10) ASTM D7042 results shall be corrected to bias-free viscosity results by the application of the correction factor included in the Precision and Bias section of the standard.

(11) ASTM D1322 includes both a manual and an automated method. The automated method is the referee method.

(12) Heater tubes other than those supplied by the original equipment manufacturer shall not be used. Technically suitable heater tubes are PAC – Alcor or Falex.

(13) Determination of tube appearance by visual procedure (VTR) or deposit thickness by ETR or ITR shall be performed within 120 minutes of the end of the test.

(14) The appearance of abnormal colours (A) or iridescent colours (P) of the deposits imply a non-compliant result.

(15) ETR is the referee thermal stability method, when available; otherwise, ITR, when available. Tube deposit failures by ETR or ITR shall be reported as ">85 nm”. If test results by either ETR or ITR are reported, then results by D3241 Visual Tube Rater (VTR) are not required.

(16) The preferred vaporizing medium for aviation turbine fuel is steam; however, the existent gum test IP 540 may be performed using air as the vaporizing medium. If air is used instead of steam, it shall be recorded.

(17) Although the presence or absence of AO and MDA does not change these limits, samples submitted for compliance or specification analysis must contain the same additives as the refinery batch. Regardless of which minimums the refinery selects to meet, the refinery must report the water separation rate evaluated on a fuel sample with all additives required by the specification prepared in the laboratory.

Limit applicable to JP-8 containing FSII, LIA and SDA, which may or may not contain AO and MDA.

(18) A minimum sample size of 3.785 liters (1 gallon) shall be filtered. Filtration time will be determined in accordance with procedure included in appendix A of MIL-DTL-83133K. This procedure may also be used for the determination of particulate matter as an alternative to ASTM D2276 or ASTM D5452.

(19) Alternate to the gravimetric particulate matter test method where equipment and laboratory capability exist. In case of failure in this test, gravimetric particulate matter shall be the referee method. ISO Codes are included in table 1 of ISO 4406. The instrument must be calibrated in accordance with ISO 11171. If limits are exceeded annex B of IP 565 or IP 577 may be applied to eliminate trace free water, and cleanliness re-determined. In such cases, results before and after application of the annex shall be reported.

(20) Meeting the requirements of ASTM D6751 or EN 14214.

(21) This additive will be mandatory in the case of JP-8. In deliveries to the EXOLUM system, the FSII additive will not be incorporated into the fuel and, therefore, will not have to meet this specification.

(22) The requirement to determine lubricity applies only to fuels whose composition is made up of:

- less than 5% non-hydroprocessed components and at least 20% severely hydroprocessed components.
- includes synthesised fuel components.

(23) **Components**

The percentage by volume of the refinery components used in the manufacture of the batch must be shown in the Quality Certificate of that batch.

The fuel can contain up to 5% co-processing from esters and fatty acids or Fischer-Tropsch hydrocarbons.

In the specific case of co-processing, the CoQ Refinery Quality Certificate (RCQ) must report that the batch can incorporate up to 5%V/V of co-hydroprocessed synthetic kerosene.

For compliance, table 2 includes the additional properties and their limits:

Table 2. Extended Requirements of Aviation Turbine Fuels Containing Co-hydroprocessed Fatty Acid Esters and Fatty Acids or Fisher-Tropsch hydrocarbons (a)(b)

PROPERTY	UNITS	LIMITS	TEST METHODS	
			ASTM STANDARDS	IP STANDARDS
Thermal stability (JFTOT) Test temperature for 2.5hr (c) Tube Rating (one of the following requirements shall be met): 1) VTR 2) ITR or ETR, average over area of 2.5 mm^2 Pressure differential	 ºC - nm mm Hg	 Min 280 Less than 3. No Peacock (P) or Abnormal (A) Max 85 Max 25	D3241	IP 323
Freezing Point	ºC	Max minus 47.0	D5972 (d) D7153 D7154	IP 435 (d) IP529 IP 528
Viscosity at minus 40ºC (e)	mm^2/s	Max. 12.0	D445 (f) D7945	IP 71 (f)
Unconverted fatty acid esters and fatty acids	mg/kg	Max 15	D7797 (g)	IP 583 (g)

(a) Applies at the point of manufacture only.

(b) Applies for the finished batch of jet fuel.

(c) An IP323 / ASTM D3241 test temperature of 280°C has been selected to help ensure that reactive compounds introduced through co-hydroprocessing of fatty acid esters and fatty acids are limited. Metal Deactivator (MDA), as described in annex A of DEF STAN 91-091 Issue 16, may not be used to meet this requirement.

(d) IP 435 / ASTM D 5972 is the referee method.

(e) The kinematic viscosity specification of 12.0 mm^2 /s at minus 40°C maximum mitigates the potential risk of increased viscosity due to n-paraffin enrichment. Compared to conventional hydrocarbons, a co-hydroprocessed esters and fatty acids stream may contain a higher concentration of n-paraffins.

(f) IP 71 / ASTM D445 allows measuring the viscosity at minus 40°C, however, the precision values were determined down to minus 20°C. A revision to test method IP 71 and ASTM D445 to specify measurement precision at minus 40°C is in process.

(g) Applies only to co-processing esters and fatty acids. The ability of IP 583 / D7797 to identify carbonyl containing compounds in addition to FAMEs is acknowledged. The reported value may be corrected for a local sample-specific bias related to trace carbonyl species inherent in aviation turbine fuel derived from conventional sources. Corrected values shall be identified as such.

Additives

Antioxidants

Immediately after manufacturing and before the fuel is exposed to the atmosphere, an approved antioxidant additive or a mixture of them may be added to prevent peroxidation and gum formation. The addition in the supply chain will also be permitted subject to prior agreement between supplier and contractor or user. The final concentration of antioxidant, in either case, will be included in the corresponding certificate and will not exceed 24.0 mg/l of active material.

Metal Deactivator Additive (MDA)

MDA may be added to fuel by prior written agreement between supplier and user under the following conditions:

- At Point of Manufacture

    a) No more than 5 % of the jet fuel batches produced in a 12-month period may be treated with MDA to meet table 1 thermal oxidative stability requirements (260 °C test temperature).

    b) The batch of fuel shall pass table 1 thermal oxidative stability requirements at a test temperature of 245 °C prior to any MDA addition.

    c) The fuel batch after MDA addition (2.0 mg/L maximum MDA) shall pass table 1 thermal oxidative stability requirements at a test temperature of 275 °C.

    d) The thermal oxidative stability test result at 245 °C prior to MDA addition, the original test result at 260 °C and the test result at 275 °C (post MDA addition) and the concentration of MDA added shall be reported on the Refinery Certificate of Quality.

- During Distribution

    a) MDA may be added to jet fuel in the distribution system to recover thermal oxidative stability performance lost during distribution (after release from point of manufacture). The Certificate of Analysis shall show the initial thermal oxidative stability test result, the result after the addition of the MDA and the concentration of MDA added.

Initial addition of more than 2 mg/l MDA, to jet fuel that meets table 1 thermal oxidative stability requirements (260ºC test temperature) prior to MDA addition is permitted when fuel will be transported in supply chains where copper contamination can occur: the maximum cumulative addition still applies.

Qualified material is detailed in point 6.3.2 of NME-3004. The concentration of active material used on initial doping of the fuel shall not exceed 2.0 mg/l. Cumulative addition of MDA when redoping the fuel shall not exceed 5.7 mg/l.

Static Dissipator Additive (SDA)

Where necessary to meet the conductivity requirements an SDA shall be added to the fuel to impart electrical conductivity in accordance with Table 1.

Qualified materials are detailed in point 6.3.2 of NME-3004.

The concentration of SDA to be used in newly manufactured, or on first doping of fuel, is 3.0 mg/l maximum. It is permitted to add additional SDA downstream of the point of manufacture. In such circumstances the maximum total SDA concentration, including initial doping, shall not exceed 5.0 mg/l.

In deliveries to the EXOLUM system this additive shall not be incorporated.

Lubricity Improver Additive (LIA)

A LIA of the type and concentration indicated in STANAG / AFPL 3390 will be added. In deliveries to the EXOLUM system this additive shall not be incorporated.

Antifreeze additive (FSII)

The additive approved as FSII is diethylene glycol monomethyl ether and will meet the requirements established in the MIL-DTL-85470 standard. Its use is mandatory in the JP-8. In deliveries to the EXOLUM system this additive shall not be incorporated.