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## Product specifications Aviation Kerosene JP8

PROPERTY	UNITS	LIMITS	TEST METHODS (1)	
			ASTM STANDARDS	IP STANDARDS
Appearance		Clear, bright and visually free from solid matter and undissolved water at ambient temperature. In case of dispute it shall be evaluated at 21° C.	Visual	
Saybolt color	standard scale	infam	D 156 (2) D 6045	
Total acidity	mg KOH/g	maximum 0,015	D 3242	IP 354
Aromatics	% V/V	maximum 25,0 maximum 26,5	D 1319 (2) D 6379	IP 156 IP 436
Sulfur, Total	% m/m	maximum 0,30	D 129 D 1266 D 2622 D 3120 (3) D 4294 (2) D 5453	IP 336
Sulfur, Mercaptan or Doctar Test (4)	% m/m	maximum 0,002 Doctar Negative	D 3227 (2) D 4952	IP 342
Distillation(5): Initial boiling point 1 0 % V/V recovered 2 0 % V/V recovered 5 0 % V/V recovered 90 % V/V recovered End point Residue Loss	°C °C °C °C °C % V/V % V/V	report maximum 205 report report report maximum 300 maximum 1,5 maximum 1,5	D 86 (2) (6) D 2887 D 7345 (7)	IP 123 IP 406
Flash point (8)	°C	minimum 38	D 56 D 93 (2) D 3828	IP 170
Density at 15 °C or Density °API at 60 °F	kg/m³ °API	775,0 a 840,0 37,0 a 51,0	D 1298 D 4052 (2) D 7777	IP 160 IP 365
Freezing point	°C	maximum -47,0	D 2386 (2) D 5972 D 7153 D 7154	IP 16 IP 435 IP 529 IP 528
Viscosity at -20 °C	mm²/s	maximum 8,000	D 445 (2) D 7042 (9) D 7945	IP 71 Section 1
Specific energy	MJ/kg	minimum 42,80	D 3338 D 4529 D 4809 (2)	IP 12
Hydrogen content	% m/m	minimum 13,4	D 3343 D 3701 D 5291 D 7171 (2)	
Smoke point or Smoke point and Naphthalenes	mm mm % V/V	minimum 25,0 minimum 19,0 maximum 3,0	D 1322 D 1322 D 1840	IP 598 IP 598
Calculated cetane index		report	D 976 D 4737	
Copper corrosion, 2 h at 100 °C (212 °F)	Class	maximum 1b	D 130	IP 154

PROPERTY	UNITS	LIMITS		TEST METHODS (1)	
				ASTM STANDARDS	IP STANDARDS
Thermal stability (JFTOT) (15): Test temperature tube rating Tube evaluation, one of the following requirements shall be met (16) (17): 1) VTR or  2) ITR or ETR, average over area of 2,5 mm <sup>2</sup>	°C	minimum 260		D 3241	IP 323
Pressure differential	mm Hg	maximum 85			
Existent gum(11)	mg/100 ml	maximum 7		D381 (2)	IP 540
Particulate contamination(12)	mg/l	maximum 1,0		D 2276 D 5452 (2)	IP 423
Filtration time (12)	min	maximum 15			(12)
Particles per channel (13) ≥ 4 μm(c) (15) ≥ 6 μm(c) (15) ≥ 14 μm(c) (15) ≥ 30 μm(c) (15)	Particles per channel & ISO code	Channel count report report report report	ISO Code (14) 1 9 1 7 1 4 1 3	ASTM D 8 166 ASTM D 7 619 (2)	IP 564 IP 565 IP 577
FAME content (16)	mg/kg	Less than 5,0			IP 585 IP 590 IP 599
Microseparaterrating(17):		(17)		D 3948 D 7224 (2)	
Fuel system icing inhibitor(18)	% V/V	0,07 a 0,10		D 5006 (2)	IP 424
Electrical conductivity (19)	pS/m	1 50 a 600		D 2624	IP 274
Refining components, at point of manufacture (20) Non-hydroprocessed components Severely hydroprocessed components Synthetic components(20)	% V/V % V/V % V/V	report report report			
Components and additives (20)		(18)			

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NOTES:

- (1) The test methods to be applied shall be those corresponding to the last published version.
  - (2) Referee test method.
  - (3) The sulfur content detection range for ASTM D 3120 is 3.0 to 1000 mg/kg.
  - (4) If the Doctor Test results in a failure ('positive' result), then mercaptan sulfur content shall be determined by the referee test method ASTM D3227.
  - (5) Distillation property criteria are specified in ASTM D86 scale units. ASTM D2887 results shall be converted to estimated D86 results by application of the correlation in Appendix X4 "Correlation for Jet and Diesel Fuel (Procedures A and B)" of D2887 for comparison with the specified property criteria. Distillation residue and loss limits provide control of the distillation process during the D86 test method and do not apply to D2887.
  - (6) ASTM D86 distillation is run at Group 4 conditions except that Group 3 condenser temperatures are used.
  - (7) ASTM D7345 results shall be corrected to bias-free distillation results by the application of the correction factors in the D7345 Precision and Bias section.
  - (8) ASTM D56 may give results up to 1 °C (2 °F) below the ASTM D93 results. ASTM D3828 may give results up to 1.7 °C (3 °F) below the ASTM D93 results. IP 170 is also permitted; may give results up to 2.2 °C (4 °F) below the ASTM D93 results.
  - (9) ASTM D7042 results shall be corrected to bias-free viscosity results by the application of the correction factor in the Precision and Bias section.
  - (10) Thermal stability shall be conducted using ASTM D3241 at 260°C. ASTM D3241 Ellipsometric Tube Rater (ETR) is the referee thermal stability method, when available; otherwise, Annex A2 Interferometric Tube Rater (ITR), when available. Tube deposit failures by ETR or ITR shall be reported as ">85 nm." If the ITR reports "N/A" for the tube's volume measurement, the result constitutes a failure and the result 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.
  - (11) 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. Test Method ASTM D381, using steam jet operating conditions, shall be the referee test method.
  - (12) A minimum sample size of 3.785 liters (1 gallon) shall be filtered. Filtration time will be determined in accordance with procedure in Appendix A of MIL-DTL-83133K. This procedure may also be used for the determination of particulate matter as an alternate to ASTM D2276 or ASTM D5452.
  - (13) Alternate to the gravimetric particulate matter test method where equipment and laboratory capability exist. Should particulate counting result in failure, gravimetric particulate matter shall be the referee.
  - (14) ISO 4406 scale numbers.
  - (15) The notation (c) indicates that the equipment has been calibrated in accordance with ISO 11171.
  - (16) Meeting the requirements of ASTM D6751 or EN 14214.
  - (17) The determination of which Micro-Separator (MSEP) test method is to be run – D3948 or D7224 – will depend on which fuel additives are in the jet fuel. If the jet fuel is fully additized with all the approved fuel additives including SDA, then ASTM D7224 is to be run; otherwise, D3948 is to be run.
- (a) The minimum microseparator rating at point of manufacture using an ASTM D3948 MSEP shall be as follows:

JP -8 A Additives	ASTM D 3948 MSEP Rating minimum
Antioxidant (AO) *, Metal Deactivator (MDA) *	90
AO*, MDA* and Fuel System Icing Inhibitor (FSII)	85
AO*, MDA* and Corrosion Inhibitor /Lubricity Improver (CI/LI)	80
AO*, MDA*, FSII and CI/LI	70

\* Even though the presence or absence of AO and MDA do not change these limits, samples submitted for specification or conformance testing shall contain the same additives present in the refinery batch. Regardless of which minimum the refiner selects to meet, the refiner shall report the MSEP rating on a laboratory hand blend of the fuel with all additives required by the specification.

(b) The MSEP rating requirement by ASTM D7224 is minimum 70. This rating solely applies to a fully additized JP-8 (containing FSII, CI/LI, and SDA; the fuel may also contain AO and MDA).

JP -8 Additives	ASTM D 7224 MSEP Rating, minimum
FSII, CI/LI and SDA (may contain AO, MDA)	70

(18) In deliveries to the EXOLUM System the anti-icing additive shall not be incorporated into the fuel and therefore shall not have to meet this specification.

(19) In deliveries to the EXOLUM System, SDA shall not be incorporated into the kerosene and therefore shall not have to comply with this specification. In these cases, two liters of SDA per thousand cubic meters of kerosene shall be given by refineries (or plants).

(20) Components:

Refinery components used in the make-up of the batch shall be reported on the Refinery Certificate of Quality as a percentage by volume of the total fuel in the batch.

The finished fuel could contain up to 5% of co-hydroprocessed esters and fatty acids or Fischer-Tropsch Hydrocarbons

The refinery certificate of quality (RCQ) shall include wording to reflect that the batch may contain up to 5 % by volume co-hydroprocessed synthesized kerosene.

Table 2: Additional requirements for fuels incorporating co-hydroprocessed fatty acids and fatty acid esters.

CHARACTERISTICS (I)(II)	UNITS	LIMITS	TEST METHODS	
			ASTM STANDARDS	IP STANDARDS
Thermal stability (JFTOT): Test temperature (III) Tube assessment, one of the following requirements has to be fulfilled (IV): 1) VTR or 2) RTI or RTE, average over 2.5 mm <sup>2</sup> area Differential pressure	°C  standard scale  nm  mm Hg	minimum 280  maximum 3. No peacock (P) or abnormal deposits (A)  maximum 85  maximum 25	D 3241	IP 323
Freezing point	°C	maximum -47.0	D 5972 (V) D 7153 D 7154	IP 435 (V) IP 529 IP 528
Viscosity at -40 °C (VI)	mm <sup>2</sup> /s	maximum 12.0	D 445 (VII) D 7945	IP 71 (VII)
Unconverted fatty acids and esters	mg/kg	maximum 15	D 7797 (VIII)	IP 583 (VIII)

(I) Applies only at the point of manufacture.

(II) Applies to the finished batch of aviation fuel.

(III) A temperature of 280°C has been selected in IP323/ASTM D 3241 methods to ensure that reactive components introduced in the co-processing of fatty acids and fatty acid esters and fatty acids are limited. Metal deactivator (MDA), as described in Annex A of DEF STAN 91-091 Issue 14, cannot be used to meet this requirement.

(IV) Visual assessment of the tube using the VTR or measurement of the thickness of the deposits using the ETR or ITR shall be performed within 120 minutes of the completion of the test.

- (V ) IP 435/ASTM D 5972 are the reference methods.
- (VI) The upper limit of 12.0 mm<sup>2</sup>/s at -40°C mitigates the potential risk of viscosity increase due to increased n-paraffins. Compared to conventional hydrocarbons, the processed co-hydro stream of esters and fatty acids may contain a higher concentration of n-paraffins.
- (VII) IP 71/ASTM D 445 allow viscosity measurements down to -40°C, however, the accuracy values were established down to -20°C. Their determination is in progress.
- (VIII) The ability of IP 583 / D7797 to identify carbonyl containing compounds in addition to FAME is recognised. The reported value may be corrected with a bias specific to the analysis of a conventional fuel sample to detect traces of carbonyl species inherent to conventional fuels (according to paragraph 4 of DEF STAN 91-091 Issue 14). The corrected values shall be identified as such.

Additives:

Antioxidants :

Immediately after processing and before the fuel is exposed to the atmosphere (such as during rundown into feed/batch tankage), could be added an approved antioxidant formulation or combination of approved antioxidant formulations in order to prevent the formation of gums and peroxides after manufacture. The concentration of antioxidant to be added shall be maximum 24.0 mg/l active component.

Metal Deactivator (MDA) :

Shall not be used unless the supplier has obtained written consent from the procuring activity and user. The concentration of the active component used shall be:

First Addition of MDA maximum 2.0 mg/l

MDA re-doping , cumulative concentration maximum 5.7 mg/l

Anti-static dissipater (SDA) :

SDAs shall be blended into the fuel in sufficient concentration to increase the conductivity of the fuel to the specified limits. This additive shall not be incorporated in deliveries to the EXOLUM System.

Corrosion Inhibitor/Lubricity Enhancer (CI/LI) :

CI/LI additive shall be blended in accordance with MIL-PRF-25017. The amount added shall be equal to or greater than the minimum effective concentration and shall not exceed the maximum allowable concentration listed in QPL-25017. This additive shall not be incorporated in deliveries to the EXOLUM System.

Antifreeze additive (FSII) :

FSII additive shall be incorporated according to MIL-DTL-85470. Its use is mandatory in the JP-8. In deliveries to the EXOLUM System this additive shall not be incorporated.

IF THERE IS A MODIFICATION OF THE OFFICIAL SPECIFICATIONS IN FORCE IN SPAIN, THIS TABLE WILL BE REVISED TO ADAPT IT TO THE NEW SITUATION.