



# PRODUCT SPECIFICATION SHEET

## JET A-1



1. PRODUCT DETAILS	
<b>Product:</b>	Aviation Turbine Fuel
<b>Applicable Standards:</b>	MoD DEF STAN 91-091
<b>Use:</b>	Aviation Turbines
<b>Notes:</b>	<ol style="list-style-type: none"> <li>1. The requirement to report Saybolt Colour shall apply at point of manufacture, thus enabling a colour change during distribution to be quantified. Where the colour of the fuel precludes the use of the Saybolt colour test method, then the visual colour shall be reported. Unusual or atypical colours should also be noted.</li> <li>2. Refer to the information on particulate contamination at Annex F.1 of DEF Stan 91-091</li> <li>3. Both the number of particles and the number of particles as a scale number as defined by table 1 of ISO 4406 shall be reported</li> <li>4. It is the Technical Authority's intention to replace Test 1.3 with Test 1.4 at the earliest opportunity</li> <li>5. Inter laboratory studies have demonstrated the correlation between total aromatics content measured by IP 156/ASTM D1319 and IP 436/ASTM D6379. Bias between the two methods necessitates different equivalent limits as shown. Testing laboratories are encouraged to measure, and dispute IP 156 will be the referee method. It is the intention of the Technical Authority to change the referee method to IP 436 at a later date</li> <li>6. The alternative requirement 2.5 is a secondary requirement to 2.4 of DEF Stan 91-091. In the event of a conflict between Sulfur Mercaptan (2.4) and Doctor Test (2.5) results, requirement 2.4 shall prevail</li> <li>7. Each refinery component 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. Mildly hydro processed components are defined as those petroleum derived hydrocarbons that have been subjected to a hydrogen partial pressure of less than 7000 kPa (70 bar or 1015 psi) during manufacture. Severely hydro processed 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. The total of non-hydro processed plus mildly hydro processed plus severely hydro processed plus synthetic components shall equal 100%</li> <li>8. The volume percentage of each synthetic blending components type shall be recorded along with its corresponding release specification and ASTM D7566 Annex number, product originator and originator's certificate of quality number</li> <li>9. In methods IP123 and ASTM D86 all fuels certified to this standard shall be classed as group 4, with a condenser temperature of zero to 40C</li> <li>10. During downstream distribution if the freezing point of the fuel is very low and cannot be determined within the IP16 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 degrees C, the freezing point shall be recorded as below minus 65 degrees C. This limit does not apply if the freezing point is measured by IP435/ASTM D5972, IP529/ASTM D7153, IP528 or ASTM D7154</li> <li>11. Alternative test requirements identified in table 1 of DEF STAN 91-091; test requirements 5.1 or 5.2 are equal primary requirements. IP598 includes both a manual and an automated method. The automated method in IP 598 is the referee method</li> <li>12. Specific Energy by one of the calculation methods listed in Annex E of DEF Stan 91-091 is acceptable. Where a measurement of specific energy is deemed necessary, the method to be used shall be agreed between the purchaser and supplier</li> <li>13. The sample shall be tested in a pressure vessel at 100+10C for 2 hours + 5 minutes</li> <li>14. Thermal stability is a critical aviation fuel test and while competition among equipment manufacturers/suppliers is to be encouraged, aircraft safety must remain paramount. It is known that there are heater tubes being supplied by sources other than the original OEM. Until the alternative manufacturer's tubes have been demonstrated to be equivalent to the OEM's test pieces, to the satisfaction of the AFC, they shall not be used. A list of manufacturers whose heater tubes have been found to be technically suitable is as follows (a, PAC – Alcor, b, Falex)</li> <li>15. The annexes referred to in Table 1 of DEF STAN 91-091 and this note correspond to those in IP323. If the technically equivalent ASTM D3241 test method is used, the same protocol shall be followed using the appropriate annex that corresponds to the visual (VTR), interferometric (ITR) or Annex D ETR, when available. If the Annex C ITR device reports "N/A" for a tubes volume measurement, the test shall be a failure and the value reported as &gt;85 nm. Visual rating of the heater tube shall be by the method in IP 323</li> <li>16. Examination of the heater tube to determine the visual tube rating using the visual tube rater or deposit thickness by ETR or ITR shall be carried out within 120 minutes of completion of the test</li> <li>17. Where SDA is added at point of manufacture the MSEP limit of 70 shall apply. No precision data are available for fuels containing SDA; if MSEP testing is carried out during downstream distribution no specification limits apply and the results are not to be used as the sole reason for rejection of a fuel. A protocol giving guidelines on possible actions to be taken following failed MSEP testing can be found in the</li> </ol>

	<p>joint inspection groups bulletin number 65, MSEP protocol at <a href="http://www.jigonline.com">www.jigonline.com</a> under 'fuel quality'. Where SDA is added downstream of point of manufacture, it is acknowledged that MSEP results may be less than 70</p> <p>18. The conductivity limits are mandatory for product to meet this standard. However, it is acknowledged that in some manufacturing and distribution systems it is more practical to inject SDA further downstream. In such cases the certificate of quality for the batch should be annotated thus: "Product meets requirements of Defence Standard 91-091 except for electrical conductivity". The technical authority is also aware of situation where conductivity can decrease rapidly, and the fuel can fail to respond to additional dosing of SDA (See Annex F.2 of DEF STAN 91-091 for more information)</p> <p>19. The requirement to determine lubricity applies to only fuels whose composition is made up of a less than 5% non-hydro processed components and at least 20% severely hydro processed components (see note 7) or b) includes synthesised fuel components. The limit applied only at the point of manufacture (see note 8)</p>
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## 2. SPECIFICATION

PROPERTY	UNIT	LIMITS		TEST METHOD
		MINIMUM	MAXIMUM	
Visual appearance	-	Clear, bright and visually free from solid matter and undissolved water at ambient fuel temperature		Visual
Colour	-	Report		ASTM D156 or ASTM D6045 (See Note 1)
Particulate contamination, at point of manufacture	mg/l	-	1.0	IP423 / ASTM D5452 (See Note 2)
Particulate, at point of manufacture, cumulative channel particle counts	Individual channel counts & ISO code	Channel Counts	ISO Code (See Note 3)	IP 564 or IP 577 (See Note 4)
≥ 4 µm(c)	-	Report	Report	-
≥ 6 µm(c)	-	Report	Report	-
≥ 14 µm(c)	-	Report	Report	-
≥ 21 µm(c)	-	Report	Report	-
≥ 25 µm(c)	-	Report	Report	-
≥ 30 µm(c)	-	Report	Report	-
<b>Composition</b>				
Total acidity	mg KOH/g	-	0.015	IP354 / ASTM D3242
<b>Aromatic hydrocarbon types:</b>				
Aromatics	% v/v	-	25.0	IP 156 / ASTM D1319
Total Aromatics	% v/v	-	26.5	IP436 / ASTM D6379 (See Note 5)
Sulfur, Total	% m/m	-	0.30	IP 336
Sulfur, Mercaptan	% m/m	-	0.0030	IP342 / ASTM D3227 (See Note 6)
Doctor test	-	Doctor Negative		IP30
Refining components, at point of manufacture	-	-	-	See Note 7
Non-Hydro processed components	% v/v	Report		
Mildly Hydro processed components	% v/v	Report		
Severely Hydro processed components	% v/v	Report		
Synthetic components	% v/v	Report, for limits see Annex B of DEF STAN 91-091		See Note 8 and Annex B, Note B1)
<b>Volatility:</b>				
<b>Distillation:</b>				
Initial boiling point	oC	Report		IP 123 / ASTM D86 (See Note 9)

PROPERTY	UNIT	LIMITS		TEST METHOD
		MINIMUM	MAXIMUM	
10% Recovery	oC	-	205.0	
50 % Recovery	oC	Report		
90 % Recovery	oC	Report		
End Point	oC	-	300.0	
Residue	% v/v	-	1.5	
Loss	% v/v	-	1.5	
Flash Point	oC	38.0	-	IP170
Density at 15oC	kg/m3	775.0	840.0	IP365 / ASTM D4052
<b>Fluidity:</b>				
Freezing point	OC	-	-47.0	IP16 / ASTM D2386 (See Note 10)
Viscosity at minus 20oC	mm2/s	-	8.00	IP71 / ASTM D445
<b>Combustion</b>				
Smoke point	mm	25.0	-	IP598 / ASTM D1322 (See Note 11)
Smoke point and	mm	18.0	-	IP598 / ASTM D1322
Naphthalene's	% v/v	-	3.00	ASTM D1840
Specific energy	MJ/kg	42.80	-	See Note 12
<b>Corrosion:</b>				
Copper strip	Class	-	1.0	IP154 / ASTM D130 (See Note 13)
<b>Thermal Stability, JFTOT</b>	IP323 / ASTM D3241 (See Note 14)			
Test temperature tube rating	oC	260	-	
One of the following requirements shall be met:	-	-	-	See Note 15
1. Annex B VTR		Less than 3. No peacock (P) or Abnormal (A)		See Note 16
2. Annex C ITR of Annex D ETR, average over area of 2.5mm2	Nm	-	85	
Pressure differential	mm Hg	-	25	
<b>Contaminants:</b>				
Existent gum	mg/100ml	-	7	IP 540
<b>Water Separation Characteristics:</b>				
Microseparometer, at Point of Manufacture:	ASTM D3948 (See Note 17)			
MSEP without SDA	Rating	85	-	
MSEP with SDA	Rating	70	-	
<b>Conductivity:</b>				
Electrical conductivity	pS/m	50	600	IP274/ASTM D2624 (See Note 18)
Lubricity: Wear scar diameter	Mm	-	0.85	ASTN D5001 (See Note 19)