Aviation Fuel Quality Requirements for Joint Operations Systems (AFQRJOS) Checklist - Issue 36

BULLETIN NO. 156 **AFQRJOS CHECKLIST ISSUE 36 (Supersedes Issue 35)** **21 02 2025**

1. INTRODUCTION

1.1 This document defines the fuel quality requirements for supply into Jointly Operated Fueling Systems operated to JIG Standards. The Aviation Fuel Quality Requirements for Jointly Operated Systems (AFQRJOS) for Jet A-1 embodies the requirements of the following two specifications:

(a) Ministry of Defence, Defence Standard 91-091 Issue 18 December 2024 for Turbine Fuel, Kerosene Type, Jet A-1, NATO Code F-35, Joint Service Designation: AVTUR.

(b) ASTM Standard Specification D1655 for Aviation Turbine Fuels "Jet A-1" (Latest issue).

1.2 Jet fuel that meets the AFQRJOS is usually referred to as "Jet A-1 to Checklist" or "Checklist Jet A-1" and, by definition, allows custodians of the fuel to supply against either of these specifications.

1.3 Test certificates shall state conformance to either of the two reference specifications. The Checklist is not a specification and manufacturing, and supply locations shall not release fuel only to the Checklist. If reference to the Checklist is to be made, the following statement should be used if the fuel meets the requirements of this Bulletin.

"It is certified that the samples have been tested using the Test Methods stated and that the Batch represented by the samples conforms with DEF STAN 91-091 Issue 18 and AFQRJOS Checklist Issue 36".

Or

"It is certified that the samples have been tested using the Test Methods stated and that the Batch represented by the samples conforms with ASTM D1655 latest issue and AFQRJOS Checklist Issue 36".

The minimum requirements of information to be included on the fuel's point of manufacture batch certificate of quality shall be:

- Specification name, issue and any amendment number;
- Name, telephone number, email address and postal address of testing laboratory;
- Tank Number;
- Batch number or unique identifier;
- Quantity of fuel in the batch;
- Properties tested and including specification limit, test method and result of test;
- Additives, including qualification reference and quantity added;
- Name and position of authorised test certificate signatory or an electronic signature;
- Date of certification.

1.4 AFQRJOS is normally revised and published annually but if urgent issues need to be addressed it may be revised more frequently.

1.5 The Aviation Fuel Quality Requirements for Jointly Operated Systems for Jet A-1 are defined in the following Table 1, which should be read in conjunction with the Notes that follow the table. The Notes highlight some of the main issues concerning the specification parameters and the changes from Issue 35 are as follows:

1.5.1 30 % Coprocessing has been added to Table 1 as it is only approved in Defence Standard 91 –091 Issue 18.

1.6 Conformance to AFQRJOS requires conformance to the details of both specifications listed in **1.1** above, not just the following table. Clarification on the statements to be used when certifying fuel is detailed in **1.3,** and it provides further guidance on statements declaring conformance to these specifications. Airports operated to JIG Standards may supply jet fuel to either of the primary specifications listed above provided the participants agree.

1.7 It should be specifically noted that DEF STAN 91-091/18 requires traceability of product to point of manufacture. See Annexes D of DEF STAN 91-091/18 respectively for more information. For fuel to comply with this Checklist, traceability to point of manufacture is required. Additional guidance on traceability in fungible transport systems is detailed in EI/JIG 1530.

1.8 Attention is drawn to the guidance in DEF STAN 91-091/18 and ASTM D1655 latest edition concerning the need for appropriate management of change measures at the point of manufacture of both jet fuel and its constituent components. The implications of any changes to feedstock, processing conditions or process additives on finished product quality and performance shall be considered (for example, experience has shown that some process additives might be carried over in trace quantities into aviation fuels).

Aviation Fuel Quality Requirements for Joint Operations Systems (AFQRJOS) Checklist - Issue 36

2. CHECKLIST REQUIREMENTS

JOINT FUELLING SYSTEM CHECKLIST FOR JET A-1

Issue 36– Feb 2025
Supersedes Issue 35- August 2024

Table 1 – Requirements

Tests and other requirements that are unique to the following specifications for the product shown: (a) Ministry of Defence, DEF STAN 91-091 Issue 18, dated 28th December Jet A-1 (b) ASTM D1655 – Jet A-1 Latest Issue					
In conjunction with the following test requirements					
PROPERTY	**LIMITS**	**TEST METHOD Note 1**		**REMARKS**	**Source of Requirement**
		IP	**ASTM**		
APPEARANCE - Visual appearance	Clear, bright and visually free from solid matter and un-dissolved water at ambient fuel temperature			See Note 2	Defence Standard 91 – 091 Issue 18
Colour	Report		D156 or D6045	See Note 3	
- Particulate contamination mg/L max	1.0	423	D5452	See Note 4	
Or					
- Particulate, cumulative channel particle counts	Channel counts / ISO code	565 or 577	D7619	See Note 4	
ISO Code & Individual Channel Counts ≥ 4 µm(c) ≥ 6 µm(c) ≥ 14 µm(c) ≥ 21 µm(c) ≥ 25 µm(c) ≥ 30 µm(c)	 Report / Max 19 Report / Max 17 Report / Max 14 Report Report Report / Max 13			 See Note 5	
COMPOSITION Total Acidity, mg KOH/g Max	0.015	354	D3242		Defence Standard 91 - 091 Issue 18

Aviation Fuel Quality Requirements for Joint Operations Systems (AFQRJOS) Checklist - Issue 36

Components at point of manufacture: Non Hydroprocessed Components, %v/v Severely Hydroprocessed Components, % v/v Synthetic Components, %v/v Co-processed Components, %v/v	Report (incl. 'nil' or '100%') Report (incl. 'nil' or '100%') Report (incl. 'nil' or '50%') 15% max			See Note 6 See Note 6 See Note 6-7-8,9 Note 10	Defence Standard 91 - 091 Issue 18
VOLATILITY Distillation Initial Boiling Point, °C	Report	123	D86	D7345, See Note 11 Or IP 406 or D2887 Note 11	Defence Standard 91 - 091 Issue 18
Thermal Stability Tube rating: One of the following requirements shall be met: (1) Annex A1 VTR, VTR Color Code (2) Annex A2 ITR or Annex A3 ETR, or **Annex A4** MWETR, nm average over area of 2.5 mm2	<3 Max (No peacock or abnormal color deposits) 85 nm max	323	D3241	Note 12	ASTM D1655-24
Water Separation Characteristics Without approved Static Dissipator Additive (SDA) With approved SDA **With or without approved SDA**	85 min 70 min 88 min		D3948 D8073	See Note 13	Defence Standard 91 - 091 Issue 18
CONDUCTIVITY Electrical Conductivity, pS/m	50 min to 600 max	274	D2624	See Note 14	Defence Standard 91 - 091 Issue 18
LUBRICITY BOCLE wear scar diameter, mm max	0.85		D5001	See Note 15	Defence Standard 91 - 091 Issue 18
ADDITIVES	**Refer to relevant sections of the primary specifications.** The types and concentrations of **all** additives used shall be shown on the original Certificates of Quality and on all other quality documents when they are added downstream of the point of manufacture. Names, qualification reference and quantity from DEF STAN 91-091/18 shall be quoted on quality certificates. When the original dosage of additives is unknown, it has to be assumed that first doping was applied at maximum dose rate. When additives are diluted (with hydrocarbon solvent only) to improve handling properties prior to addition, it is the concentration of active ingredient that shall be reported. See Annex A of DEF STAN 91-091 for detailed advice. See **1.8** about requirements for management of change in refineries.				

Aviation Fuel Quality Requirements for Joint Operations Systems (AFQRJOS) Checklist - Issue 36

Notes and Comments

1. Alternative test methods are approved for a number of properties (specific energy and naphthalenes). Reference to the primary specifications shall be made to identify which methods are permitted.

2. The method for Visual Appearance in DEF STAN 91-091 is Visual (assessment). Alternative methods are D4176 Procedure 1 and D6986 Procedure A, Section 8.1.1.1.

3. The requirement to report Saybolt Colour shall apply at the point of manufacture. Unusual colours should also be noted and investigated. For further information on the significance of colour, see Annex F in DEF STAN 91-091 Issue 18.

4. The limits of either particulate contamination or particulate counts shall be met, and it is only necessary to report whichever property is being used to support release of the fuel. These limits shall apply at point of manufacture only. It is the Specification Authority's intention to replace gravimetric filter membrane test with particle counting from April 2025. For more information on particulate contamination refer to Annex F of DEF STAN 91-091 Issue 18. For guidance on contamination limits for into-plane fueling, refer to 9th Edition IATA Guidance Material (Part III).

5. The number of particles and, the number of particles as a scale number as defined by Table 1 of ISO 4406, shall be reported where this method is being used to release the fuel (see also Note 4). If limits are exceeded, Annex B of IP 565 or IP 577 or Annex A2 of D7619 may be applied to eliminate trace free water, and cleanliness re-determined. In such cases, results before and after application of annex shall be reported.

6. The need to report the %v/v of non-hydroprocessed, severely hydroprocessed and synthetic components (including "nil", "50%" or "100%" as appropriate) on Point of Manufacture Certificates of Quality for Jet A-1 to Checklist derives from DEF STAN 91-091/18. Each of the defined 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. See Note 10.

7. Attention is drawn to DEF STAN 91-091/18 which approves both Semi-Synthetic and Fully Synthetic Jet Fuel produced by SASOL.

8. DEF STAN 91-091/18 also approves all the generic components listed in the Annexes of ASTM D7566. For these fuels, additional testing requirements detailed in ASTM D7566 apply, and reference should be made to DEF STAN 91-091 Issue 18 Annex B.2.

9. The semi-synthetic jet fuel (SSJF) CoQ at point of batch origination shall include a listing of the quality documents relating to the conventional and synthetic blend component (SBC) batches in the blend and their respective volumes to show compliance with the blending limits set out in the Annexes to ASTM D7566. The SBC producer's CoQ, COA or RT number shall be available for each SBC at the point of batch origination including number, anti-oxidant concentration (as the concentration of active material reported on originator's CoQ) and corresponding formulation qualification reference per DEF STAN Annex A.2.4. The use of anti-oxidant is optional for jet fuels containing only conventional components. Anti-oxidant continues to be mandatory as part of the production process for synthetic components (see ASTM D7566 or Annex B.2 of Def Stan 91-091/18).

10. Defence Standard 91-091 Issues 18 approves the coprocessing of 30% HEFA feedstocks and the following requirements detailed in B.4.1.1.2 and Table 3 shall be met:
    a. In the case of hydrocracking, a hydrogen partial pressure of greater than 7000 kPa (70 bar or 1015 psi) shall be present. The feed into the final hydrocracking unit, where process streams are used for jet production, shall not exceed 30% by volume in approved feedstock with the balance (≥ 70% by volume) being conventional sources as described in Clause 4.1.1. The resultant stream shall:
        i. not exceed 30 % by volume of co-hydroprocessed synthesized kerosene derived from mono-, di-, and triglycerides, free fatty acids, and fatty acid esters.
        ii. be blended at 50 % by volume maximum with conventional kerosene derived from sources as described in Clause 4.1.1 when more than 5 % by volume of co-hydroprocessed synthesized kerosene derived from co-hydrocracked mono-, di-, and triglycerides, free fatty acids, and fatty acid

ester feedstock is present, and in such cases, the finished blend shall include antioxidant of the type specified in A.2.4 at a concentration of 17.0 to 24.0 mg/l.

iii. The final jet batch is limited to 15% by volume of co-hydroprocessed synthesized kerosene derived from co-hydrocracked mono-, di-, and triglycerides, free fatty acids and fatty acid esters.

b. For fuel approved in accordance with clause B.4.1.1.2 b) the finished blend shall include antioxidant of the type specified in A.2.4 at a concentration of 17.0 to 24.0 mg/l.

11. In methods IP 123 and ASTM D86 all fuels certified to DEF STAN 91-091 Issue 18 or ASTM D1655 latest edition, shall be classed as group 4, with a condenser temperature of zero to 4°C. Where ASTM D7345 is used, results shall be corrected for relative bias as described in the test method.

12. When using either D3241 or IP 323, users shall not report results obtained using a 230 Mk IV instrument containing an inline internal non-consumable fuel filter located upstream of the 0.45 µm pre-filter.

13. Water separation property testing is a mandatory requirement at point of manufacture only. In ASTM D1655 the only approved method is ASTM D3948. However, Defence Standard 91-091 Issue 18 lists ASTM D8073 as an alternative method with a minimum limit of 88. Note that neither of the primary Standards mandate the testing of water separation properties downstream of the point of manufacture. Where it is required by JIG Standards for the purposes of product quality management, the following methods and limits shall apply:

Table 2 -. Water Separation Limits Downstream of Point of Manufacture

Test Method	Limits
ASTM D7224	85 min
ASTM D8073	88 min

Alternatively, testing may also be conducted using ASTM D3948 (still the intent of JIG to withdraw this method in the future). For further information on water separation testing refers to JIG Bulletins 129, 142 and 150 -Testing Water Separation Properties of Jet Fuel (Revised MSEP Protocol).

This protocol is also referenced in Note 17 of Def Stan 91-091/18.

14. The conductivity limits are mandatory for product to meet the requirements of DEF STAN 91-091 Issue 18. 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 the requirements of DEF STAN 91-091 Issue 18 except for electrical conductivity”. In some situations, the conductivity can decrease rapidly, and the fuel can fail to respond to additional dosing with approved Static Dissipator Additive(s). In such cases, fuel may be released with conductivity down to a minimum of 25pS/m provided that the fuel is fully tested against the specification and the Tank Release Note is annotated with the explanation “Product released below 50pS/m due to conductivity loss as per Annex F of DEF STAN 91-091 Issue 18”. For further guidance see JIG 2, 4.8 (Low conductivity fuelling protocol).

15. This requirement comes from DEF STAN 91-091 Issue 18. The requirement to determine lubricity applies only to fuels whose composition is made up of a) less than 5% non-hydroprocessed components and at least 20% of severely hydroprocessed components or b) includes synthetic fuel components. See Note 6.
The limit applies at the point of manufacture only. For important advisory information on the lubricity of aviation turbine fuels see Annex F of DEF STAN 91-091 Issue 18.
Lubricity Improver Additive (also known as LIA) may be used to improve lubricity. It may be added to the fuel without prior consent of the joint system participants. However, only those additives listed in Table 2 of ASTM D1655 / Annex A of DEF STAN 91-091 Issue 18 are permitted (only 2 additives; Innospec DCI-4A and Nalco 5403, are listed in both ASTM D1655 and DEF STAN 91-091, even if there is no BOCLE requirement for D1655). Refer also to Appendix A.5 of DEF STAN 91-091 Issue 18 for advice on point of addition. When injecting LIA downstream of point of manufacture, care shall be taken to ensure that maximum dose rates are not exceeded.

Aviation Fuel Quality Requirements for Joint Operations Systems (AFQRJOS) Checklist - Issue 36

Actions to Implement this Bulletin (See Table below for Action Type Codes)

In-scope Operations, testing laboratories and other entities using or referring to JIG AFQRJOS Checklist shall implement JIG AFQRJOS Issue 36, with an implementation date no later than **28/03/2025.**	JS	**28/03/2025**

Action Type Codes Table

Action Types	JIG Bulletin Action Type Definition
JS	Change to JIG Standard – to be adopted by JV and/or Operator to continue to meet the JIG Standard(s) (JIG 1, 2, 4, EI/JIG 1530 and the JIG HSSE Management System).
RA	Required Action to implement one off verification or checks outlined in the table of actions.
RP	JIG Recommended Practice which the JV should consider adopting as its own practice (**).
I	Issued for information purposes only.
Note (**) - If the JV agreements require any of the JIG Standards and/or any of the JIG Common Processes as the governing operational standard then adoption of changes to applicable JIG Standards and/or Common Processes should not be considered optional by the JV Board.	