BULLETIN NO. 150 | **TESTING WATER SEPARATION PROPERTIES OF JET FUEL** | 12/02/2024

TESTING WATER SEPARATION PROPERTIES OF JET FUEL DOWNSTREAM OF POINT OF MANUFACTURE (REVISED MSEP PROTOCOL) - This protocol supersedes JIG Bulletin 142

SUMMARY

THIS DOCUMENT SUMMARISES THE LATEST UPDATES TO WORK BEING UNDERTAKEN ON THE RELIABILITY AND PERFORMANCE OF THE APPROVED ASTM TESTS FOR WATER SEPARATION PROPERTIES OF JET FUEL.

1) **The preferred method for testing fuels containing a Static Dissipator Additive [SDA] downstream of the Point of Manufacture is ASTM D8073**

2) **ASTM D8073 has been approved as alternative method for measuring Water Separation at the point of manufacture in Defence Standard 91-091 Issue 16**

3) **ASTM D3948 can continue to be used as part of JIG Standards (for example as part of Recertification testing and Certificate of Analysis)**

Background

The term “surfactants” is a technical term for surface active agents and describes a class of chemicals that may be present dissolved in jet fuel. These can be present due to:

- The intentional addition of permitted performance additive materials (such as lubricity improvers, corrosion inhibitors and static dissipator additives (SDA).
- Trace materials from the crude oil that distil in the Jet fuel boiling cut.
- Unintended incidental contamination that occurs during fuel distribution, especially in multi-product transportation systems.

Not all surfactants are a concern, but they need to be controlled in jet fuel, as their presence may cause disarming of filtration systems that are designed to coalesce and remove water from onward transfer of the fuel. Surfactants can also act to disperse particles (or in extreme cases act as detergents to mobilise otherwise stable particles) which can result in fuel that is difficult to settle or filter.

Water separation property testing of fuel is conducted for two main reasons with jet fuel:

1. To limit the level of harmful surfactants which could be carried over from the crude oil at the point of manufacture. For this purpose, the industry currently approves ASTM D3948 in ASTM D1655, and ASTM D3948 and ASTM D8073 in Defence Standard 91-091.
2. To indicate the potential impact of a fuel on the performance of filters downstream of the point of manufacture. (For this purpose, either ASTM D3948, ASTM D7224 or ASTM D8073 may be used).

Testing at Point of Manufacture

Both Defence Standard 91-091 and ASTM D-1655 (the prime fuel specifications that make up the latest edition of AFQRJOS 'Checklist' Issue 34) require testing of water separation properties by Microseparometer (MSEP by ASTM D3948) and describe test limits with, and without, the addition of SDA. Defence Standard 91-091 also lists D8073 as the alternative method with a limit that applies whether an SDA is present in the fuel or not. At this point in time, ASTM D3948 remains the referee method. A high rating number suggests a fuel free of harmful surfactants; a low rating number indicates that harmful surfactants may be present. The reason that two limits are specified for ASTM D3948 is that the test method (D3948) is sensitive to the presence of SDA, but the surfactant effects of this additive are not deemed as harmful to operations as they have a negligible impact on both filtration efficiency, particulate mobilisation and settling and this has been demonstrated in both filter element qualification testing and empirically in aviation fuel handling over several decades.

Testing downstream of the Point of Manufacture

Both primary specifications contain a statement indicating that results from water separation property testing downstream of the point of manufacture are not to be used as the sole reason for rejection of fuel, but they can indicate a mandatory need for further diligent investigation. This statement is based on significant historical information where failing water separation property results (by ASTM D3948) downstream of the manufacturing location have been found to be due to either poor test method precision, or presence of surfactants that do not affect filtration performance. Due to multiple occurrences of unnecessary supply disruption, a protocol for handling failing water separation property (by ASTM D3948) results was introduced by JIG initially in Bulletin 14 (2007) and this was updated by various Bulletins since that time: Bulletin 65 (2013), 121 (2019), 129 (2020) and 142 (2022).

Revised status of available testing methods

ASTM D3948

JIG Bulletin 121 indicated that method ASTM D3948 shall only be used for testing the water separation property downstream of point of manufacture until the end of May 2020. In order to avoid unnecessary supply disruption, the previous restriction in the use of this test method for the testing of water separation property downstream of point of manufacture was withdrawn until further notice in JIG Bulletin 129. This method is used at the point of manufacture and may still be used downstream for CoAs and Recertification Testing.

ASTM D7224

Experience with this method in a small number of circumstances has shown sensitivity with some fuels, as detailed in Bulletin 121. There has been continuing concern with the results from use of ASTM D7224 - being less than 85, particularly with fuels containing an SDA. This sensitivity can produce a failing result, whereas the other two permitted methods produce a passing result. Additional industry research work has been initiated to investigate these anomalies. JIG intends to issue further Bulletins once this work is completed, and a clear understanding is available.

ASTM D8073

This method has not shown the same sensitivity to the presence of SDA noted for the other test methods. It is currently identified as the preferred method for water separation testing for fuels containing SDA downstream of the point of manufacture.

Revised JIG Protocol for Water Separation Testing Downstream of Point of Manufacture Effective February 2024

Where water separation performance testing is conducted downstream of point of manufacture in facilities operating to the JIG Standards, the following protocols shall apply.

1) **Testing should be done using either**
   a. **ASTM D7224 with a minimum limit of 85, (*fuels without SDA) or**
   b. **ASTM D8073 (IP624) with a minimum limit of 88.**

*Note that for fuels containing an SDA the preferred method is ASTM D8073, and ASTM D7224 is not recommended. Despite this uncertainty with some fuels containing SDA as explained above, both of these methods are the preferred methods for testing downstream of the point of manufacture, as they have improved precision relative to MSEP (ASTM D3948).

2) **Alternatively, testing may continue to be conducted using ASTM D3948 (it is noted that JIG still intends to withdraw this method in the future).**
   a. If the results are between 60 and 70, a confirmation test shall be run of the original sample. Provided the two test results are within the repeatability of the ASTM D3948 method, enter the average MSEP result from the two tests onto the test certificate. Subject to all other properties meeting specification requirements the certificate can be issued. The batch may be released without recourse to other fuel suppliers involved at the location concerned, subject to local procedures. The local re-certifying Authority shall endorse the certificate, adding the following statement: "MSEP result within precision limits of the test method". All fuel suppliers at the location shall be advised of this occurrence retrospectively.
   b. If the result of ASTM D3948 testing is less than 60, a test shall be run on the original sample using either ASTM D7224 or ASTM D8073 (IP624). If the result of the test is greater than 85 for ASTM D7224 or 88 for ASTM D8073 (IP624), this result shall be entered onto the test certificate. Subject to all other properties meeting specification requirements, the certificate may be issued. The batch may be released without recourse to other fuel suppliers involved at the location concerned, subject to local procedures.
3) If the initial result for ASTM D7224 or ASTM D8073 (IP624) is below the stated minimum limit for these tests shown under item 1 or 2b above, the protocols detailed in EI/JIG 1530 Annex E should be followed, to establish the final result before quarantining the fuel, pending an investigation to determine the source of the failure.
4) Part of the investigation should be to carry out a test on the same sample with the alternative test method listed in 1 above, before quarantining the fuel. Results for a sample, which has a "pass" result for one method, but a "fail" result by the other, should be reported to the JIG Product Quality Committee.
5) Where the source of failure cannot be identified after investigation, remediation actions such as, but not limited to, clay treating or dilution may be used to achieve the required passing result for ASTM D7224 or ASTM D8073 (IP624). (Note that clay treatment and/or dilution may result in loss of electrical conductivity in the fuel batch, which may need subsequent correction by redosing SDA.)
6) Where remediation is not feasible the product shall be downgraded to non-aviation fuel use.

Throughout transfers of fuel associated with batches released under this protocol, particular care shall be taken to ensure that water draining is done in accordance with the operating standards in effect at the location, either JIG 1/2 or EI/JIG 1530 (latest editions), to ensure that the fuel is free of excess water and dirt when delivered into aircraft.

Subject to the endorsement of all fuel suppliers at a specific location, the above protocol shall be advised to their recertification laboratory(s) for automatic implementation. However, ensuring the integrity of Jet Fuel product quality for use in aircraft is at all times the paramount consideration. Nothing in this protocol shall be deemed to override this principle. Fuel suppliers shall retain the right, in the absence of positive evidence of an investigation and any subsequent suitable corrective/preventative action, to ultimately withdraw their support for the use of this protocol.

Although the use of ASTM D3948 to evaluate water separation properties continues to be permissible as a product quality control method downstream of refineries, it is the intention of JIG, at some future date, to withdraw the use of this method. The withdrawal will be the subject of a future Bulletin, which will be published in due course.

Actions to Implement this Bulletin (See Table 2 for Action Type Codes)

Action Description	Action Type	Target Completion Date
Where water separation performance testing is conducted downstream of point of manufacture in facilities operating to the JIG Standards, the revised protocol defined in this Bulletin shall apply	JS	Immediate effect

Table 2 Action Type Codes

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.	