

INDEX 1 EUROPEAN TECHNICAL STANDARD ORDERS

ETSO-C55a A1

ED Decision 2022/018/R

FUEL AND OIL QUANTITY INSTRUMENTS

1 Applicability

This ETSO provides the requirements that fuel and oil quantity instruments that are designed and manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 Procedures

2.1 General

The applicable procedures are detailed in CS-ETSO [Subpart A](#).

2.2 Specific

None.

3 Technical Conditions

3.1 Basic

3.1.1 Minimum Performance Standard

The applicable standards are those provided in:

- SAE Aerospace Standard (AS) 405C 'Fuel and oil quantity Instruments', dated July 2001; or
- SAE Aerospace Standard (AS) 405D 'Fuel and oil quantity Instruments', dated August 2012,

both modified by Appendix 1 to this ETSO.

3.1.2 Environmental Standard

See CS-ETSO, [Subpart A](#), paragraph 2.1.

As specified in SAE Aerospace Standard AS405C or AS405D.

3.1.3 Software

See CS-ETSO, [Subpart A](#), paragraph 2.2.

3.1.4 Airborne Electronic Hardware

See CS-ETSO, [Subpart A](#), paragraph 2.3.

3.2 Specific

3.2.1 Failure Condition Classification

See CS-ETSO, [Subpart A](#), paragraph 2.4.

The failure condition classification will depend on the system on which the fuel and oil quantity instrument is installed. The classification must be determined by the safety assessment conducted as part of the installation approval. Each fuel and oil quantity instrument shall be developed to at least the design assurance level

assumed to be assigned to the system on which the fuel and oil quantity instrument will be installed.

4 Marking

4.1 General

See CS-ETSO, [Subpart A](#), paragraph 1.2.

4.2 Specific

At least one major component must be permanently and legibly marked with all the information in SAE AS405C or AS405D, Section 3.2 (except paragraph 3.2.b). Also, the component must be marked with the following information:

- (1) The basic type and accuracy classification, and
- (2) The fluids for which the instrument is substantiated.

5 Availability of Referenced Documents

See CS-ETSO, [Subpart A](#), paragraph 3.

[Amdt ETSO/7]

[Amdt ETSO/17]

APPENDIX 1 TO ETSO-C55a A1 — FUEL AND OIL QUANTITY INSTRUMENTS

ED Decision 2022/018/R

This Appendix prescribes the minimum performance standard for fuel and oil quantity instruments, as modified by EASA.

The applicable standard is:

- SAE AS405C Fuel and Oil Quantity Instruments', dated July 2001; or
- SAE AS405D 'Fuel and oil quantity Instruments', dated August 2012.

Conformance with the following paragraphs of SAE AS405C or AS405D is not required: 3.1, 3.1.1, 3.1.2, 3.2 and 4.2.1.

A.1. ADDITIONS TO SAE AS405C or AS405D, PARAGRAPH 5

Paragraph 5.7, Instrument Setup

- a. Before starting tests, set up the instrument as follows:
 - (1) place the sensor component in a simulated fuel or oil tank, and the indicator and other components in a convenient location; and
 - (2) connect all the components using the same means as is required when the instrument is in service.
- b. You may choose to test individual components. When testing components individually, provide proper inputs or outputs for the components being tested.

Paragraph 5.8, Accuracy Tolerances

All accuracy tolerances are for the complete system. Before testing components individually, connect the components per the manufacturer's instructions. The complete system must meet the tolerances of Table 1 (see SAE AS8029, 'Minimum Performance Standard for Fuel and Oil Quantity Indicating System Components', dated June 1983):

Table 1 — Accuracy tolerances for the complete system

Class	Accuracy tolerance
1	± 0.75 % full scale
2	± 2 % of full scale
3	± 3 % of full scale

Paragraph 5.9, Ambient Room Conditions

At ambient room conditions, test the instrument for scale errors, hysteresis errors, friction errors, and position errors. The resulting total error must not exceed the values in the applicable listing in Table 1 of this Appendix.

Paragraph 5.10, Applicable Environmental Conditions

Test the instrument under the applicable environmental conditions. The resulting total error must not exceed the values in the applicable listing in Table 1 of this Appendix.

A.2. MODIFICATIONS TO SAE AS405C or AS405D, PARAGRAPH 6

Replace all the wording in:	With:
Paragraph 6.1, Scale Error	Adjust the tank unit and all the components before the test. You cannot adjust anything during the test. Immerse the tank unit, and compensators when used, in the test fluid. Calculate the percentage of errors by comparing the readings taken from the design calibration of the system or component you are testing.
Paragraph 6.2, Friction	Test all the components with moving parts for friction errors at several points. Test the components by applying the needed inputs to bring the output to a desired test point. Hold the input constant while taking the two output readings. Take the first reading before vibrating the indicator. Take the second reading after vibrating the indicator.
Paragraph 6.4, Position Error	To obtain a reading near mid-scale, the fluid tank should be about half-full, or have the equivalent electrical input. Hold each component (except the tank unit) in several different positions and record any change in output. Test the instrument for position errors in several positions.

A.3. ADDITIONS TO SAE AS405C or AS405D, PARAGRAPH 6.
Paragraph 6.8, Hysteresis Error

Test the instrument for hysteresis at several points. Increase the test fluid level or apply equal inputs to each selected test point and hold them while taking a reading.

Paragraph 6.9, Speed of Response

At ambient room conditions, the indicator must register from empty to full or vice versa in less than 30 seconds, but more than 5 seconds. When testing at any environmental extremes, the speed of response must not exceed 3 times the time measured at ambient room conditions.

A.4. MODIFICATIONS TO SAE AS405C or AS405D, PARAGRAPH 7
Replace:

‘As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer’s recommendation.’

with the following:

‘Performance tests: The following tests, in addition to any others deemed necessary by the manufacturer, shall be the basis for determining compliance with the performance requirements of this standard.’

A.5. ADDITIONS TO SAE AS405C or AS405D, PARAGRAPH 7

Add the following new paragraphs:

Paragraph 7.7, Operational Shock Tests

Use the test requirements in Section 7 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.8, Explosion Proof Test

Use the test requirements in Section 9 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.9, Power Input Test

Use the test requirements in Section 16 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.10, Voltage Spike Test

Use the test requirements in Section 17 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.11, Audio Frequency Conducted Susceptibility Test

Use the test requirements in Section 18 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.12, Induced Signal Susceptibility Test

Use the test requirements in Section 19 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.13, Radio Frequency Susceptibility Test

Use the test requirements in Section 20 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.14, Emission of Radio Frequency Energy Test

Use the test requirements in Section 21 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.15, Lightning Induced Transient Susceptibility Test

Use the test requirements in Section 22 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.16, Lightning Direct Effects Test

Use the test requirements in Section 23 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.17, Electrostatic Discharge Test

Use the test requirements in Section 25 of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A, paragraph 2.1.

Paragraph 7.18, Flammability Test

All the materials used must be self-extinguishing when tested in accordance with the applicable requirements of RTCA/DO-160E or later version as defined in CS-ETSO, Subpart A,

paragraph 2.1, Section 26, Category C, Flammability Test. This requirement does not apply to small parts (where the greatest equipment dimension is less than 50 mm, such as knobs, fasteners, seals, grommets and small electrical parts) that do not contribute significantly to fire propagation.

[Amdt ETSO/17]