
**Aerospace — Clamps for fluid systems —
Test methods**

*Aéronautique et espace — Colliers pour systèmes de fluides —
Méthodes d'essai*

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 9679 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

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Aerospace — Clamps for fluid systems — Test methods

1 Scope

This International Standard specifies the test methods and procedures to be used for the qualification and comparison of support or retention devices used in the installation of aerospace fluid systems.

It is applicable when reference is made to parts standards, procurement specifications, or other definition documents.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1431-1:2004, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 2951, *Vulcanized rubber — Determination of insulation resistance*

ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

3 General requirements

3.1 The tests required by this specification relate only to the qualification of the device. They do not infer qualification of the service, installation or techniques used. All devices tested shall be in conformance with the applicable parts standard or development criteria.

3.2 Unless otherwise specified, all tests should be conducted at room temperature (25 ± 10) °C.

4 Material tests

4.1 General

All materials used shall be in conformance with the specifications specified in the applicable parts standard. In addition, the following tests may be required by the parts standard, procurement specification or contract.

4.2 Ozone resistance

All non-metallic materials, vulcanized or thermoplastic, shall be free of cracking when tested in accordance with ISO 1431-1:2004, procurement B, at a volume fraction of ozone of 6×10^{-6} , under an 80 % strain for 6 h, and at a temperature of (40 ± 2) °C.

4.3 Flame resistance

4.3.1 General

All non-metallic materials shall be tested for flammability by means of a vertical burn test, as specified in this subclause. The flame source shall be a Bunsen Burner or a similar burner, having a normal diameter of 10 mm (0,40 in). The burner shall be adjusted to provide a 38 mm (1,52 in) high flame of blue intensity. Verify flame temperature to be minimum of 849 °C at the centre of the flame, by use of thermocouple.

4.3.2 Test specimens

Specimens shall be actual components mounted in an "as used" condition as close as possible to their use in an aircraft. All test specimens shall include the necessary mounting hardware and tubing. See Figure 1 for examples.

4.3.3 Preconditioning

All specimens shall be preconditioned at 20 °C to 25 °C at (50 ± 5) % relative humidity for a period of 24 h prior to testing.

4.3.4 Test

Remove specimens, one at a time, from the preconditioning chamber immediately before performing the test. Position the specimens 19 mm above the burner so the flame strikes the specimen at approximately 90°. Apply the flame for 12 s and remove. The average burn time of three specimens after removal of the flame shall not exceed 15 s. Dripping from the burning specimens shall not burn for more than 5 s after dropping.

4.4 Insulation properties

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If necessary for a particular installation, the insulation value of vulcanized rubber shall be determined by referring to ISO 2951.

4.5 Ultraviolet resistance

Various plastic and organic elastomer materials exposed to sunlight and some electrical applications can be susceptible to ultraviolet attack. When these types of material are used on exterior applications, they should be tested in accordance with ISO 4892-3.

4.6 Titanium compatibility

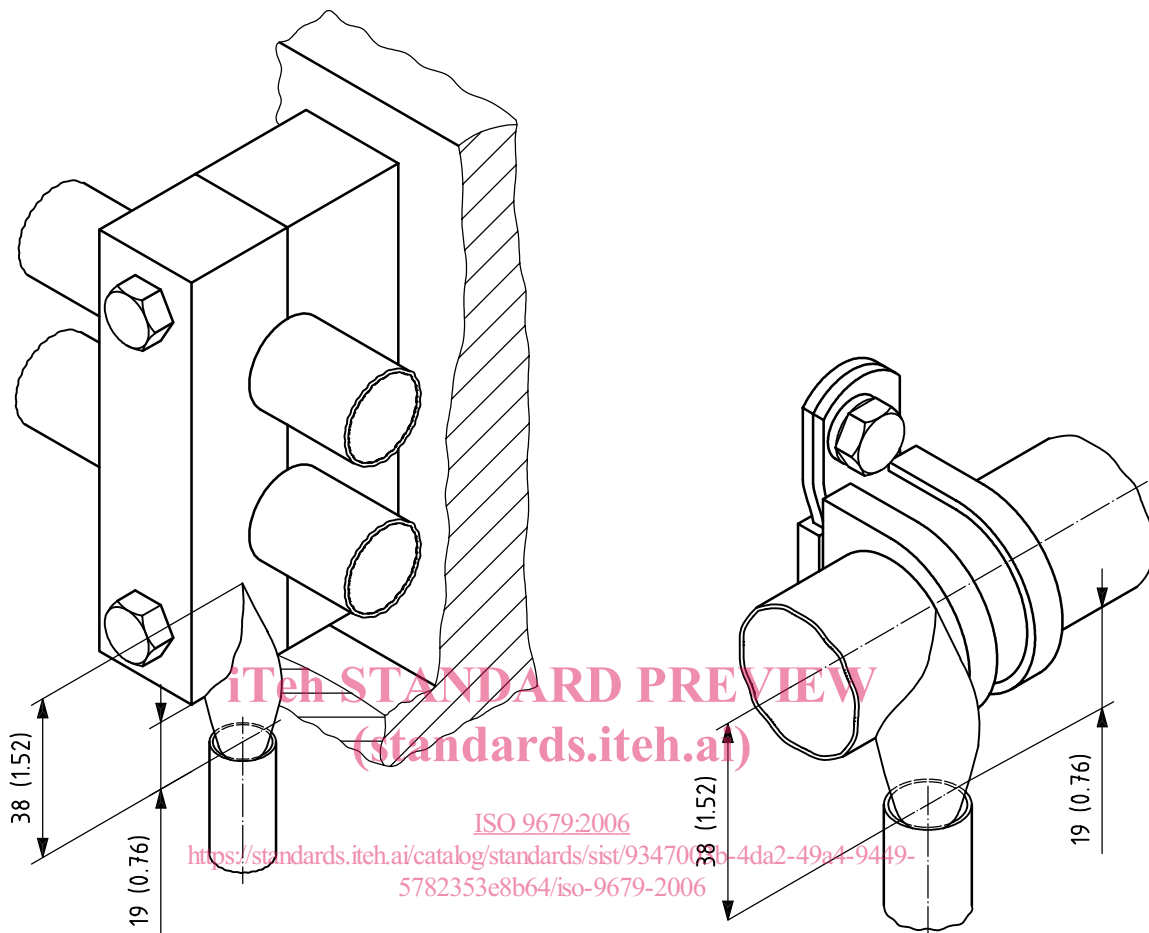
4.6.1 Principle

Where clamping devices are employed to support titanium tube installations, the sheathing or other materials in direct contact with the tubing shall be tested to determine if they have any chemical effect on the tubing.

4.6.2 Test methods

Mount five size-25 (1 in) clamps on a length of titanium alloy tubing, material type Ti-3Al2,5V, with no spacers between the test samples. The tubing, with the clamps mounted, shall be filled with hydraulic fluid and exposed to the clamping device's maximum rated service temperature for 12 d. Pressure in the tube shall be maintained at 21 000 kPa (3 000 psi) during the 12 d exposure. The test apparatus shall be removed and placed in an atmosphere of 70 °C and 95 % relative humidity for 20 d. There shall be no evidence of cracking or pitting of the titanium tube specimen when observed with a five to ten power magnifying glass.

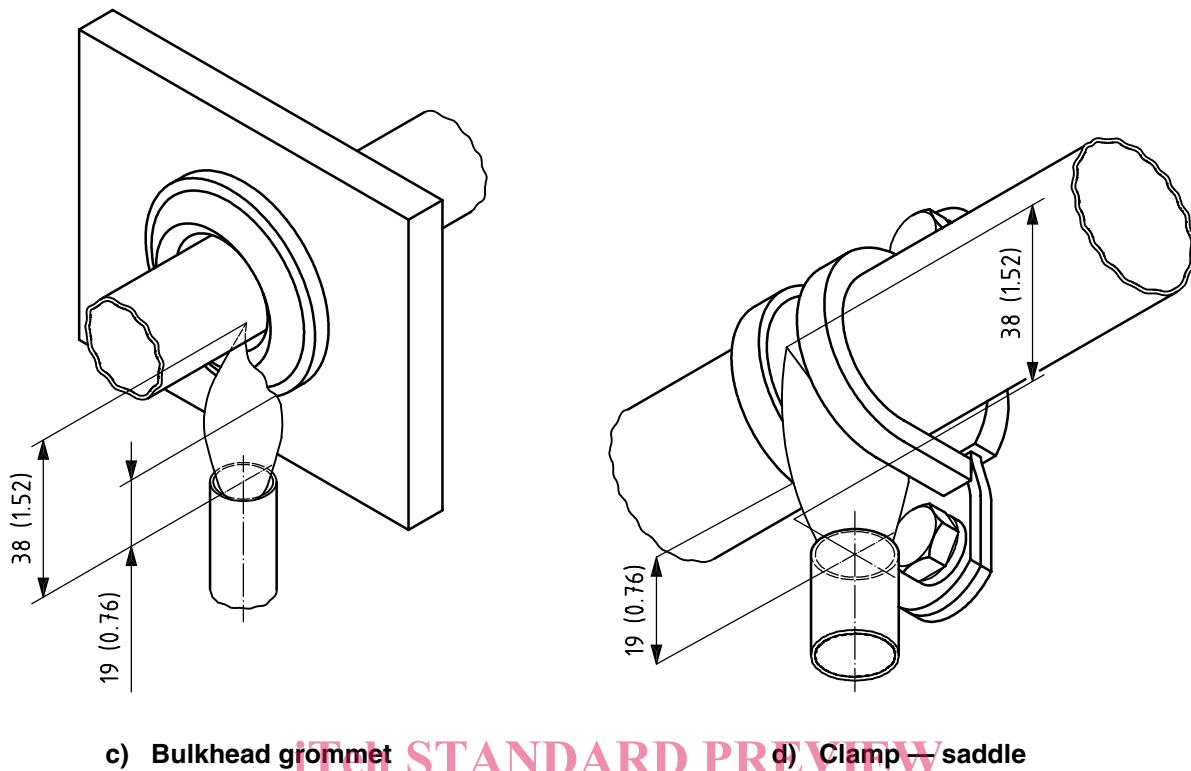
Dimensions in millimetres
(Dimensions in inches)



a) Clamp block

b) Clamp, loop style

Figure 1 — Flame resistance test set-up



c) Bulkhead grommet d) Clamp — saddle

Figure 1 — Flame resistance test set-up (Continued)

5 Tube support assembly tests

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5.1 Preparation for tests

5.1.1 Principle

This series of tests is intended to control the durability of the support device and provide a method of comparing the vibration dampening and wear characteristics of tubing supports.

5.1.2 Test assemblies

All test specimens and assemblies, clamps, blocks, and grommets used shall be for the tube sizes 12 mm (0,5 in), 19 mm (0,75 in) and 25 mm (1 in). Tubing shall be titanium alloy Ti-3Al2,5V or equivalent.

5.1.3 Preconditioning

All test specimens shall be preconditioned at 20 °C to 50 °C and (50 ± 5) % relative humidity for a period of 24 h prior to testing.

5.1.4 Test sequence

Testing shall be conducted in the following sequence using the same specimens throughout:

- retention test;
- vibration and transmissibility test;
- test specimen inspection.

If a failure occurs, the entire sequence shall be repeated using new specimens and tubes.

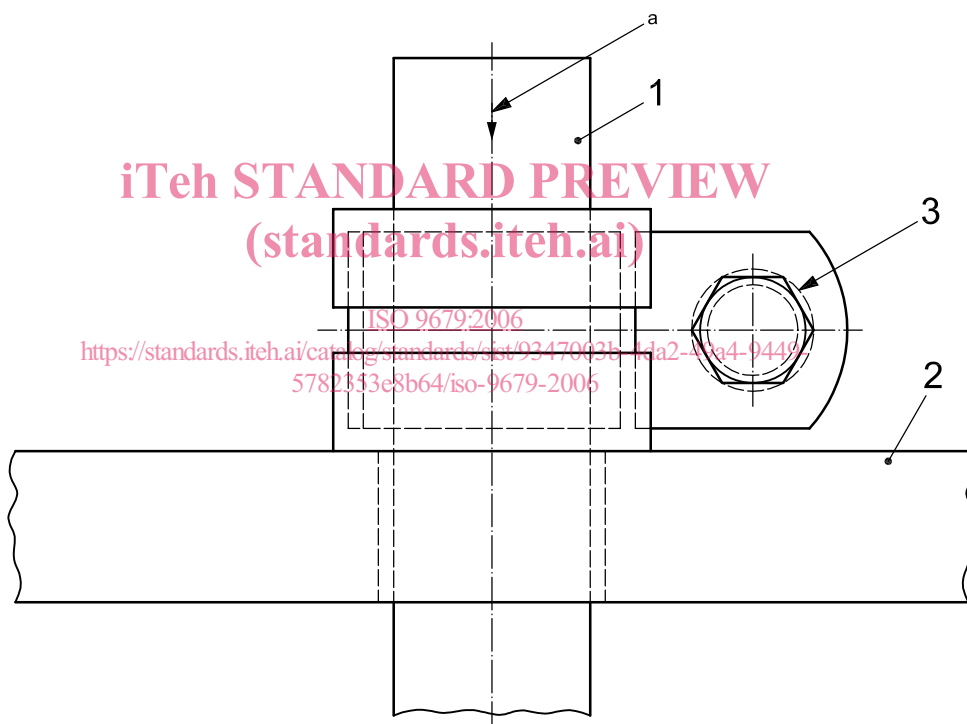
5.2 Retention test

5.2.1 Principle

This test is intended to verify the retention value of the tube support device before and after the assembly is subject to vibration and thereby determine any resulting degradation.

5.2.2 Procedure

Each assembly specimen shall be mounted on a clean dry tube as shown in Figure 2 using a stainless-steel bolt MJ5 (0,1 900 in thread), free-running nut and a 1,6 mm (0,064 in) spacer, applicable for the device. The tube shall be slowly forced longitudinally through the device to a distance of 25 mm (1 in) and the force recorded. Specimens shall not exhibit any separation or delamination. Forces shall exceed those listed in the applicable procurement specification.



Key

- 1 mandrel
- 2 base with hole equal to mandrel diameter plus 1 mm (0,040 in)
- 3 shim or spacer between clamp feet

^a Axial mandrel or tube force.

Figure 2 — Retention test