INTERNATIONAL STANDARD

ISO 9679

First edition
2006-08-15

Aerospace — Clamps for fluid systems — Test methods

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

Reference number
ISO 9679:2006(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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*.

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 $\pm$ 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 $\pm$ 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

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

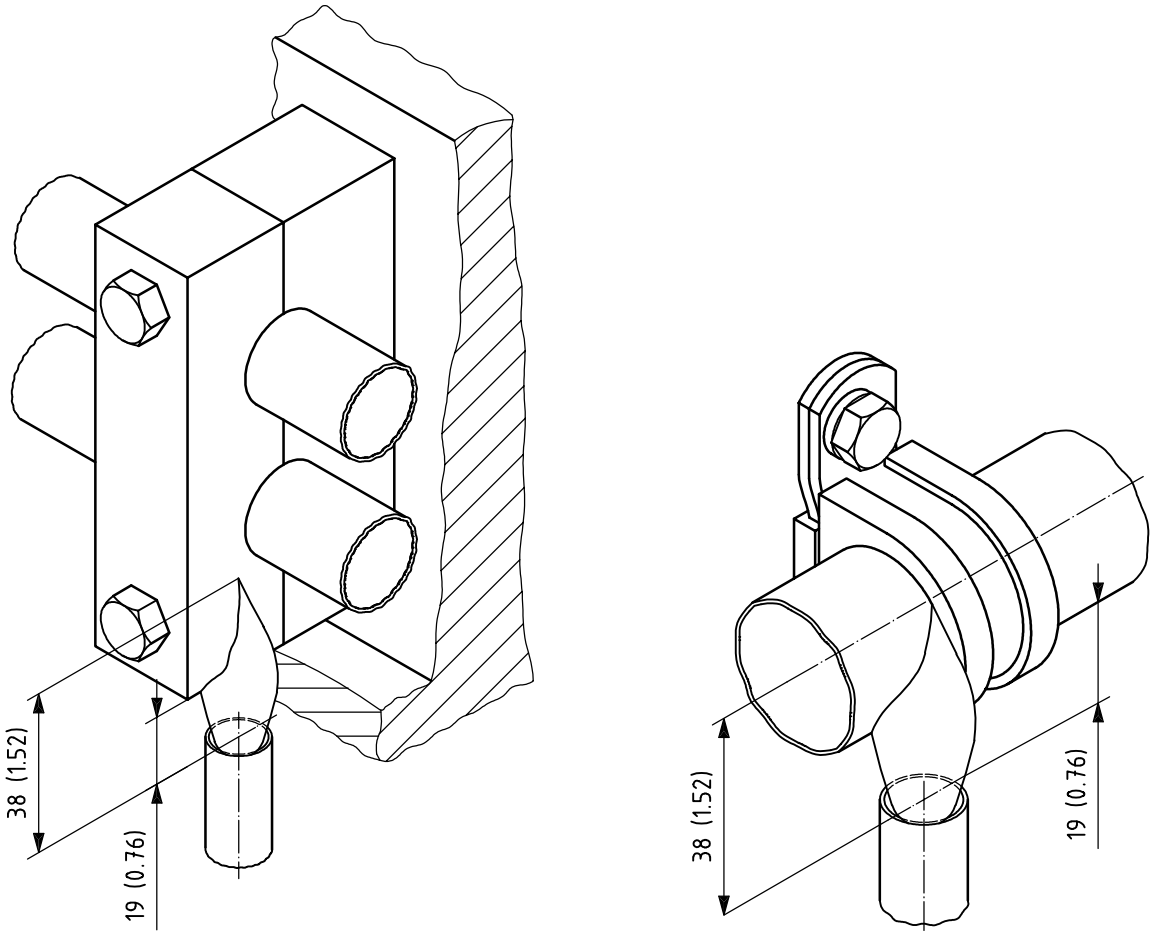
4.6.1 Principle

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

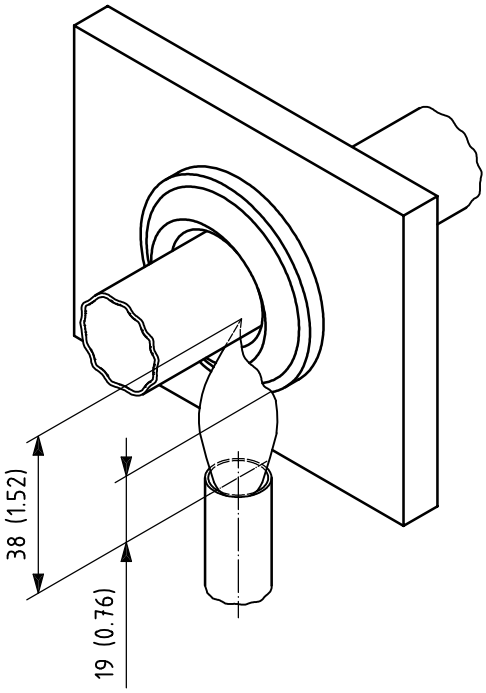
Mount five size-25 (1 in) clamps on a length of titanium alloy tubing, material type Ti-3Al2,5V, with no spacers between the test samples. The tubing, with the clamps mounted, shall be filled with hydraulic fluid and exposed to the clamping device's maximum rated service temperature for 12 d. Pressure 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)

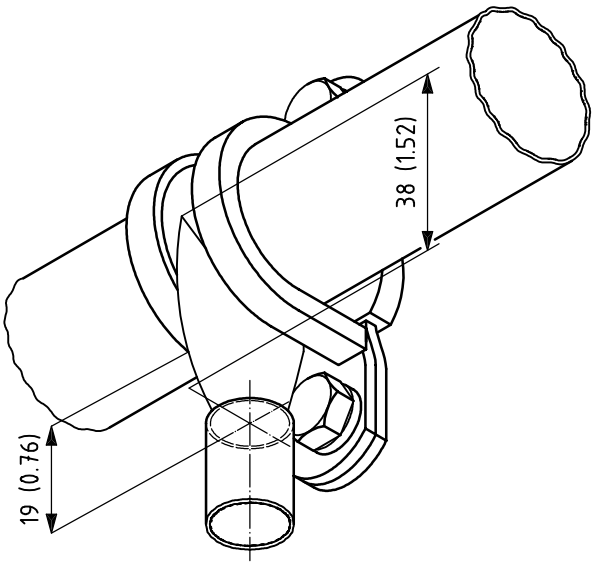


a) Clamp block **b) Clamp, loop style**

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

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.

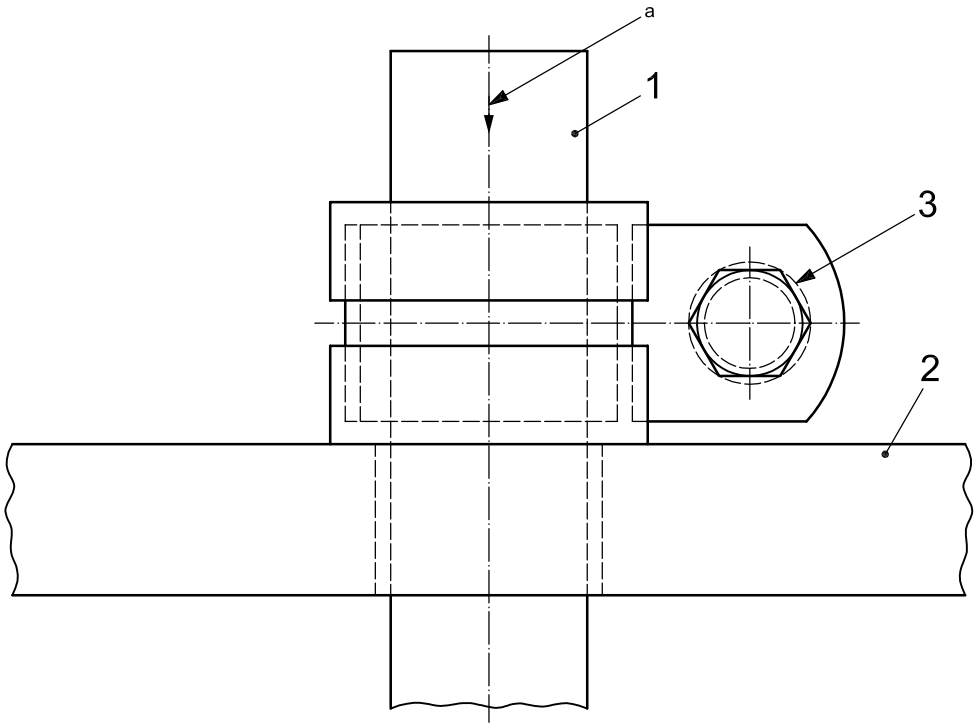
5.2 Retention test

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

5.3 Vibration and transmissibility test

5.3.1 Principle

This test is intended to establish the integrity of the device under vibration and reveal its transmission of vibration between the structure and tubing. After testing various devices, a comparison of performance can be established.

5.3.2 Procedure

Tube sizes 12 mm (0,5 in), 19 mm (0,75 in) and 25 mm (1 in) shall be used. Three specimens of each size shall be tested, using tubing filled with hydraulic fluid. The overall length of the tubes shall be 737 mm (29 in), spacing between supports 305 mm (12 in), with 64 mm (2,5 in) overhang each end. The tube assembly shall be installed on a vibration fixture and vibration table as shown in Figure 3. Specimens shall be mounted on the vibration fixture using bolts MJ5 (0,190 0 in thread) with 1 000 MPa or higher strength. A flat washer shall be used beneath the head of the mounting bolt with the smooth edge against the clamp foot. An input measuring accelerometer shall be mounted on the vibration fixture, adjacent to but not touching the centre clamp specimen. A second output accelerometer shall be mounted on the tube adjacent to, but not touching, the centre clamp (see Figure 3). The test specimen shall be subjected to a simple harmonic motion having a vibration acceleration of $2g$ through a frequency range of 50 Hz to 500 Hz. The sweep rate shall be logarithmic, requiring 5 min per cycle. One frequency cycle shall consist of 50 Hz to 500 Hz to 50 Hz. A resonance search shall be made and each resonance peak recorded (frequency and acceleration peak).

5.3.3 Transmissibility

The transmissibility ratio [TR $= (g - \text{output}) / (g - \text{input})$] shall be calculated for each resonance peak and recorded. The test specimens shall then be subjected to a dwell at the most severe resonance peak for 30 min at a constant sinusoidal vibratory acceleration of $10g$. The vibration test shall be repeated with three new test specimens of the same size as specified.

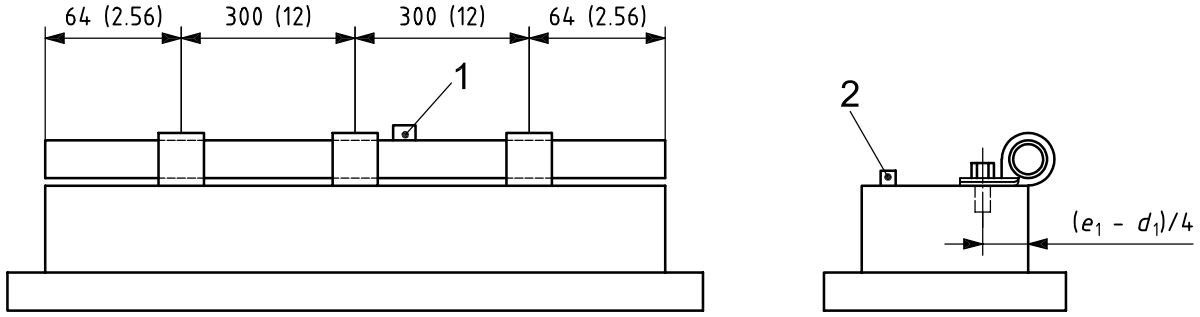
5.4 Test specimen inspection

5.4.1 All specimens tested shall be subjected to the retention test specified in 5.2. All results shall meet the maximum axial force requirements specified in 5.2.2.

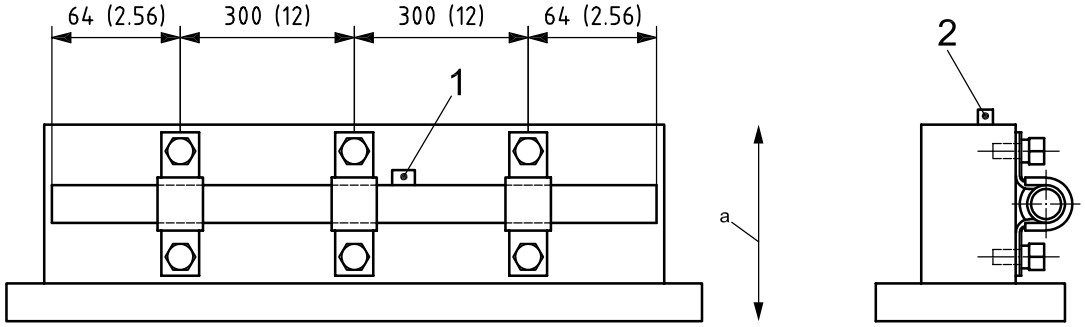
5.4.2 All test specimens shall be thoroughly examined for integrity and degradation, such as cracks, separation of components, excessive wear and degradation of materials which would impair their intended use.

5.4.3 All tubing used in the vibration and transmissibility testing shall be examined under a five to ten power magnifying glass for evidence of cracking, abrasion or other deterioration which would impair its intended use. Any tube wear should not exceed 5 % of the tubing wall thickness.

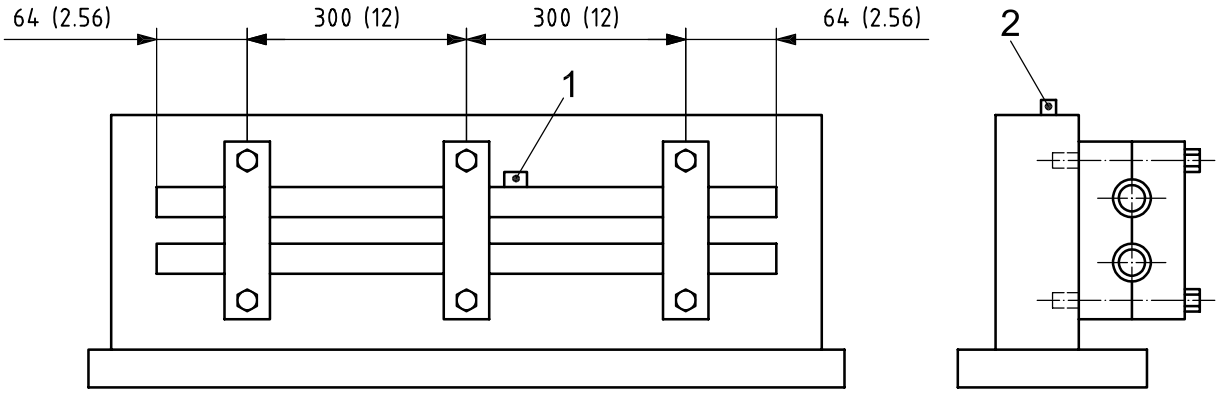
Dimensions in millimetres
(Dimensions in inches)



a) Clamp, loop style



b) Clamp — saddle



c) Clamp block

Key

1 output accelerometer

2 input accelerometer

[a] Axis of vibration.

Figure 3 — Vibration set-up

ICS 49.080

Price based on 7 pages