International Standard 7661

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Aerospace — Fluid systems — Clamp blocks for tube lines having axial alignment — Design standard and qualification testing — Metric series

Aéronautique et espace — Systèmes de fluides — Peignes supports de tuyauteries à alignement axial — Conception et essais de qualification — Série métrique

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7661 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*.

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1 Scope and field of application

This International Standard gives definitions for clamp blocks for tube lines having axial alignment, with or without electrical grounding, designed for a range of tube outside diameters from 4 to 32 mm selected from ISO 2964, and it lays down the dimensions of clamp blocks and specifies the test methods for qualification testing.

These clamp blocks permit the fastening of tubes, used for different purposes in fluid systems.

2 References

ISO/TR 2685, *Aircraft — Environmental conditions and test procedures for airborne equipment — Resistance to fire in designated fire zones.*

ISO 2964, *Aircraft — Tubing outside diameters and thicknesses — Metric dimensions.*

ISO 5855, *Aerospace construction — MJ threads —*

Part 1 : Basic profile.

Part 2 : Dimensions for bolts and nuts.

ISO 6771, *Aerospace construction — Fluid systems and components — Pressure and temperature classifications.*

ISO 7137, *Aircraft — Environmental conditions and test procedures for airborne equipment.*[1)]

3 Definitions

3.1 axial alignment : A clamp is said to have an "axial alignment" when the axes of supported tubings are located in the same plane.

3.2 clamp block for tubing : A device used on aerospace vehicles for fixing tubings the dimensions of which may be different and which are constituted from materials that may be different.

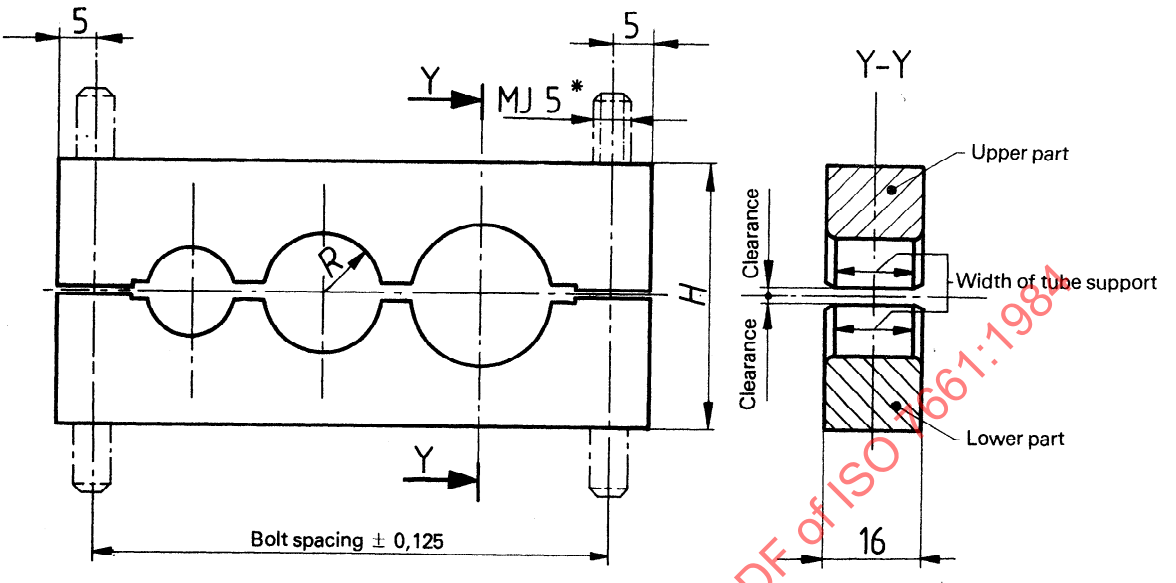
3.2.1 monobloc clamp block : A clamp block for tubing (3.2) consisting of two monobloc parts. (See figure 1.)

3.2.2 modular clamp block : A clamp block for tubing (3.2) consisting of removable parts (3.4), with or without insert(s) (3.5). (See figure 2.)

3.3 clamp block with intermediate mounting hole : A monobloc clamp block (3.2.1) or a modular clamp block (3.2.2), having one or more intermediate mounting hole(s). (See figure 3.)

1) Endorsement, in part, of the publication EUROCAE ED-14A/RTCA DO-160A (a document published jointly by the European Organisation for Civil Aviation Electronics and the Radio Technical Commission for Aeronautics).

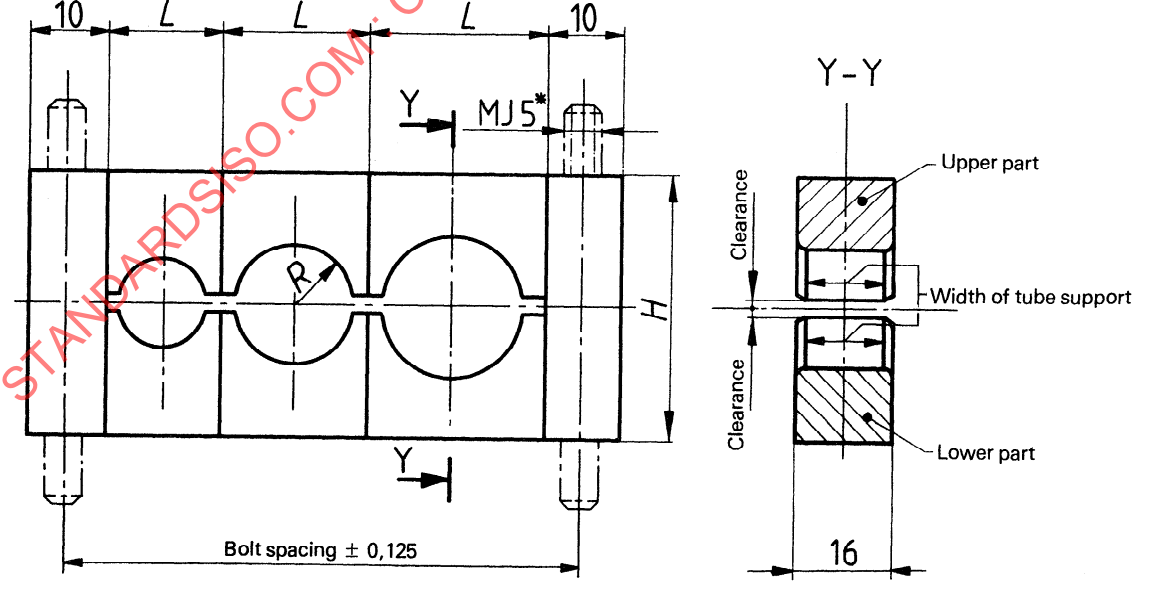
Dimensions in millimetres



* See ISO 5855.

Figure 1 — Monobloc clamp block

Dimensions in millimetres



* See ISO 5855.

Figure 2 — Modular clamp block (without insert)

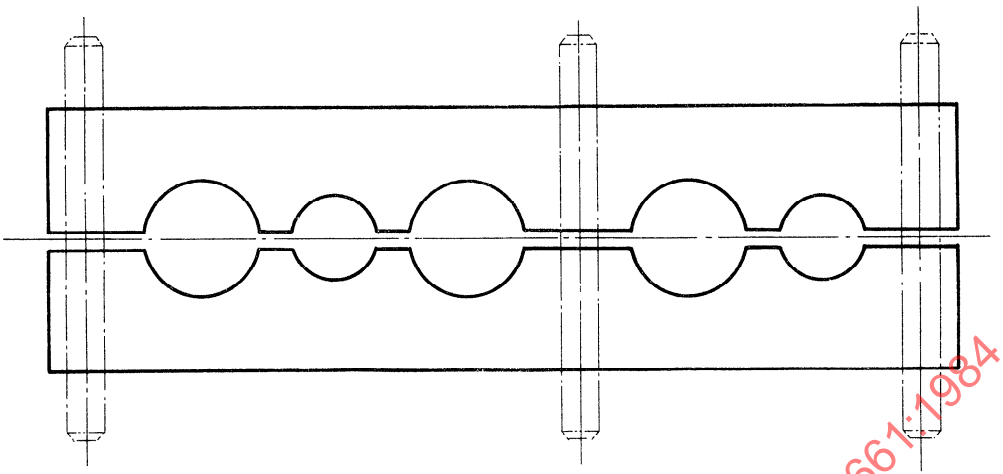


Figure 3 — Clamp block with intermediate mounting hole

3.4 removable part : A part of a modular clamp block (3.2.2) which ensures a standardized clearance between two adjacent tubings.

3.5 insert : A part that can be assembled between two removable parts (3.4) in order to obtain the required centre-to-centre distance, standardized or not, between tubes.

4 Classification of clamp blocks

The clamp blocks are divided into three classes, A, B and C, each corresponding to a range of tube outside diameters and to a maximum clamp block height (see table 1), as follows :

Class A : Tube outside diameters from 4 to 12 mm

Class B : Tube outside diameters from 4 to 20 mm

Class C : Tube outside diameters from 4 to 32 mm

5 Dimensions of clamp blocks

5.1 Maximum height

Table 1 gives, for each clamp block class and for each tube outside diameter, the maximum height, H, of the clamp block (see figures 1 and 2).

5.2 Nominal radius

Table 2 gives, for each tube outside diameter, the nominal radius R, of the clamp block (see figures 1 and 2).

Table 1 — Maximum height of the clamp block

Dimensions in millimetres

Identification class of the clamp block	Tube outside diameter										
	04	05	06	08	10	12	14	16	20	25	32
	Maximum height of the clamp block, H										
A	27	27	27	27	27	27					
B	35	35	35	35	35	35	35	35	35		
C	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5

Table 2 — Nominal radius of the clamp block

Dimensions in millimetres

Tube outside diameter	04	05	06	08	10	12	14	16	20	25	32
Nominal radius, R	2	2,5	3	4	5	6	7	8	10	12,5	16

5.3 Width of removable parts

Two models of removable parts for modular clamp blocks are standardized, as follows :

— model 1 allows a clearance of 3 mm between adjacent tubes;

— model 2 allows a clearance of 5 mm between adjacent tubes.

NOTE — Model 2 may be composed of a removable part and an insert.

Table 3 gives, for each tube outside diameter, the width L (L_1 for model 1 and L_2 for model 2) of removable parts for modular clamp blocks.

Table 3 — Width of removable parts

Dimensions in millimetres

Tube outside diameter	Width of removable parts, L	
	Model 1	Model 2
	$L_1 \begin{smallmatrix}0\\-0,1\end{smallmatrix}$	$L_2 \begin{smallmatrix}0\\-0,1\end{smallmatrix}$
04	—	9
05	8	10
06	9	11
08	11	13
10	13	15
12	15	17
14	17	19
16	19	21
20	23	25
25	28	30
32	35	37

5.4 Clamp block bolt spacing

5.4.1 Modular clamp block

The bolt spacing for modular clamp blocks is equal to the sum of the widths of removable parts (see figure 2 and table 3) and the widths of inserts, if any, increased by 10 mm.

5.4.2 Monobloc clamp block

The bolt spacing for monobloc clamp blocks is equal to that of a modular clamp block designed for supporting the same tubes.

6 Temperature conditions

The clamp blocks are designed for service within the following types of operating temperature ranges, in accordance with ISO 6771 :

Type I : − 55 to + 70 °C

Type II : − 55 to + 135 °C

Type III : − 55 to + 200 °C

7 Qualification tests

7.1 Electrical tests (for clamp blocks with electrical grounding)

7.1.1 Measurement of the electrical contact resistance

NOTE — This measurement shall be carried out before and after the mechanical tests (7.2) and climatic tests (7.3).

Measure the potential drop between one of the fastening screws of the clamp block and each one of the test tubes, using a direct current power source (1 to 4 A) and a millivoltmeter.

Before carrying out any test, the contact resistance shall be less than or equal to 150 mΩ. In order to obtain a contact resistance with a lower value, a different electrical continuity procedure shall be considered.

7.2 Mechanical tests

7.2.1 Sliding test under temperature

NOTE — The following test does not apply in the case of clamp blocks where there is no possibility of retention on the tubes they support.

7.2.1.1 Samples

Three samples shall be provided for this test and shall consist of clamp blocks for three parallel tubes, of length 50 mm, of the same material (aluminium alloy, stainless steel or titanium) and with the same diameter : 4, 12 and 20 mm respectively.

7.2.1.2 Test apparatus

A suitable device, in conformity with figure 4, shall allow the sliding of the tubing in a clamp block with a displacement of 6 mm (i.e. ± 3 mm). The displacement shall be effected at a frequency of 1 cycle/s.

7.2.1.3 Test conditions

The sliding test under temperature shall be carried out at the following temperatures :

+ 55 ± 3 °C

+ 110 ± 3 °C

+ 160 ± 3 °C

The tightening torque for the fastening screw shall be 2 N.m.

The number of cycles performed under these conditions shall be 50 000.

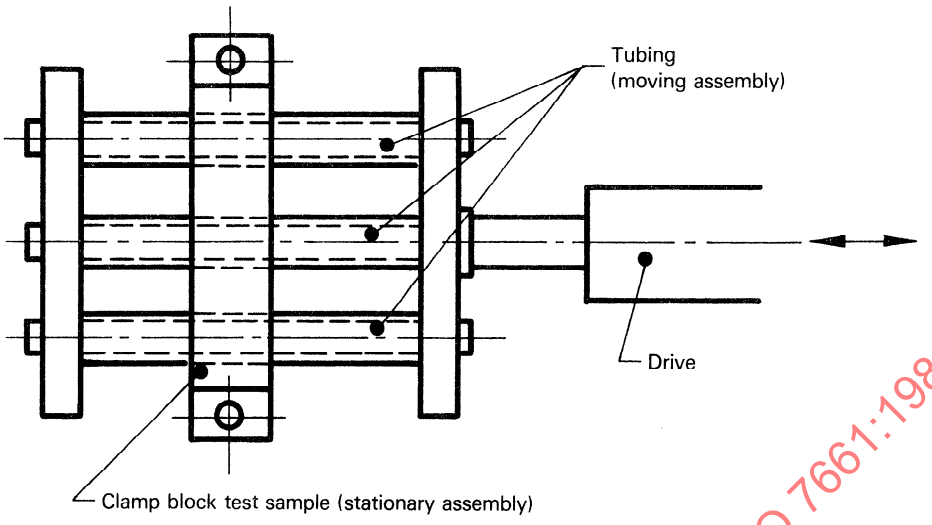


Figure 4 — Apparatus for sliding test

7.2.1.4 Initial measurements

Before mounting each tube in the device, take the following initial measurements at room temperature :

a) the sliding force, F, for each tube :
$15\ N < F < 30\ N$, according to the service temperature range of the clamp block, the nature and the area of the tube;

b) the electrical contact resistance : see 7.1.1.

7.2.1.5 Final measurements

After dismantling each tube from the test device, take the following final measurements at room temperature :

a) the sliding force for the tubes;

b) the electrical contact resistance (see 7.1.1) : the measurement of the electrical resistance shall be made before the tubes are dismantled;

c) examination and measurement of the tube and clamp contact areas for grooves and wear marks, after the clamp block has been dismantled.

7.2.1.6 Acceptance criteria

After the test, the following requirements shall be met :

a) the sliding force for each tube shall remain greater than 5 N;

b) the electrical contact resistance shall remain less than 150 mΩ;

c) the wear marks on the tubes after slide testing shall not exceed the following values :

— aluminium alloy tubes : 40 µm

— stainless steel tubes : 15 µm

— titanium tubes : 15 µm

d) whatever the material, the allowable wear on the diameter of the tubes shall remain lower than or equal to the following values :

— tube outside diameters from 4 to 10 mm : wear less than or equal to 0,05 mm relative to the nominal diameter

— tube outside diameters from 12 to 32 mm : wear less than or equal to 0,08 mm relative to the nominal diameter

7.2.2 Sliding test combined with contamination

7.2.2.1 Samples

Three samples shall be provided for this test and shall consist of clamp blocks for three parallel tubes, of length 50 mm, of the same material (aluminium alloy, stainless steel or titanium) and with the same diameter : 4, 12 and 20 mm respectively.

7.2.2.2 Aim of the test

This sliding test is intended to determine the consequences on the behaviour of a clamp block and of its tube when exposed to certain fluids used in aerospace vehicles, in a sand- and dust-laden atmosphere with a definite saturation concentration.

The fluids to be considered for this test shall be as follows :

— fuel;

— phosphate ester based hydraulic fluid;

— ester silicate;

— de-icing fluid;