
**Refrigerating systems and heat
pumps — Qualification of tightness of
components and joints**

*Systèmes de réfrigération et pompes à chaleur — Qualification de
l'étanchéité des composants et des joints*

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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. 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 14903 was prepared by Technical Committee ISO/TC 86, *Refrigeration and air conditioning*, Subcommittee SC 1, *Safety and environmental requirements for refrigerating systems*.

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Introduction

This International Standard is intended to describe the qualification procedure for type approval of the tightness of hermetically sealed and closed components, joints and parts used in refrigerating systems and heat pumps as described in ISO 5149. The sealed and closed components, joints and parts concerned are, in particular, fittings, bursting discs, flanged or fitted assemblies.

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Refrigerating systems and heat pumps — Qualification of tightness of components and joints

1 Scope

The requirements contained in this International Standard are applicable to joints of maximum DN 50 and components of maximum 5 l and maximum mass of 50 kg.

This International Standard is intended to describe the qualification procedure for type approval of the tightness of components, joints and parts used in refrigerating systems and heat pumps as described in ISO 5149. It characterizes the joint tightness and stresses met when operating, following the fitting procedure specified by the manufacturer, and to specify the minimal list of necessary information to be provided by the supplier of a component to the person in charge of carrying out this procedure.

This International Standard specifies the level of tightness of the component, as a whole, and its assembly as specified by the manufacturer.

This International Standard applies to the hermetically sealed and closed components, joints and parts used in refrigerating installations, including those with seals, whatever their material and their design are.

This International Standard specifies additional requirements for mechanical joints that can be recognized as hermetically sealed joints.

2 Normative references

The following documents in whole or in part are normatively referenced in this document and are indispensable for its application. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5149-1:—¹, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Definitions, classification and selection criteria*

ISO 5149-2:—², *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

EN 13134, *Brazing — Procedure approval*

ISO 13971:2012, *Refrigerating systems and heat pumps — Flexible pipe elements, vibration isolators, expansion joints and non-metallic tubes — Requirements, design and installation*

EN 12693, *Refrigerating systems and heat pumps — Safety and environmental requirements — Positive displacement refrigerant compressors*

ISO 175, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals*

IEC 60068-2-64:1993, *Environmental testing — Part 2: Test methods — Test Fh: Vibration, broad-band random (digital control) and guidance*

IEC 60335-2-34, *Household and similar electrical appliances — Safety — Part 2-34: Particular requirements for motor-compressors*

1) To be published.

2) To be published.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5149-1:— and the following apply.

3.1 mass flow per year

q_m
value of the leak mass flow rate

NOTE It is expressed in grams per year.

3.2 volume flow rate

Q
value of the leak volume flow rate

NOTE It is expressed in pascal cubic metres per second.

3.3 hermetically sealed system

system in which all refrigerant containing parts are made tight by welding, brazing or a similar permanent connection which may include capped valves and capped service ports that allow proper repair or disposal and which have a tested tightness control level of less than 3 grams per year under a pressure of at least a quarter of the maximum allowable pressure

NOTE Sealed systems as defined in ISO 5149-1:— are equal to hermetically sealed systems.

3.4 product family

group of products that have the same function, same technology, and same material for each functional part and sealing materials, produced according to the same specification but of a different size

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3.5 permanent joints

means joints which cannot be disconnected except by destructive methods

3.6 reusable joint

joint other than permanent joint that can be disconnected without destructive manner

NOTE In some cases the tube is used as sealing material (e.g. flared joint). Sealing component may be replaced.

3.7 same base material

material belonging to the same group as follows:

- steel group
- aluminium and aluminium alloy group, and
- copper group

NOTE Subgroups of these material groups are considered to be same base materials (see EN 14276-2).

4 Symbols and units

The symbols and units used in this International Standard are given in Table 1.

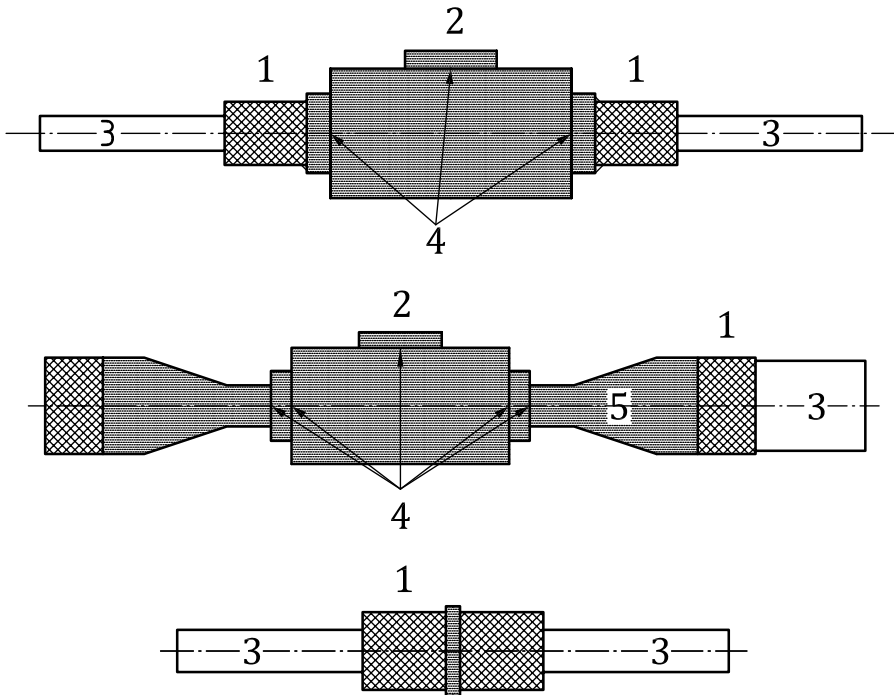
Table 1 — Symbols and units

Symbol	Description	Unit
DK_{rel}	Percentage deviation of the minimum and maximum torque from the average of the minimum and maximum torque, $(K_{o,max} - K_{o,min}) / (K_{o,min} + K_{o,max})$	
f	Frequency of vibrations	Hz
$K_{o,ave}$	Average torques of the respective joint standard	
$K_{o,max}$	Required maximum torques of the respective joint standard, if specified. Otherwise, the maximum torque values supplied by the manufacturer	
$K_{o,min}$	Required minimum torques of the respective joint standard, if specified. Otherwise, the minimum torque values supplied by the manufacturer	
L	Length of tube	mm
n	Number of cycles in temperature and in pressure (method 1)	
n_1	Number of cycles in temperature and in pressure (method 2)	
n_2	Number of cycles in pressure	
n_3	Number of cycles in vibration	
n_{total}	Total number of cycles in temperature and in pressure	
N	Number of samples	
P	Tightness test pressure	bar
P_{max}	Maximal pressure of cycle	bar
P_{min}	Minimal pressure of cycle	bar
PS	Maximal allowable pressure	bar
P_{set}	Nominal set pressure of the device	bar
Q	volume flow rate	Pa m ³ /s
q_m	mass flow per year	g/year
s	Vibration displacement (peak to peak value)	mm
T_{max}	Maximal temperature of cycle	°C
T_{min}	Minimal temperature of cycle	°C
θ	Mass flow rate	kg/s

5 Test requirements

The required tests to be applied to the body of the component and to the joint used in refrigerating systems and heat pumps are given in Tables 2 and 3.

Figure 1 illustrates the principle of a component and a joint and the corresponding requirements shall conform to Table 2 or Table 3.



According to Table 2

According to Table 2

According to Table 3

Key

- 1 joint
- 2 component body
- 3 pipe
- 4 component body joint
- 5 extension pipe

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Figure 1 — Principle: component body-joint

All component types and joints types shall be tested.

When a component is connected with different types of joints, one of these joints shall be tested with the component according to Table 2. The other possible types of joints shall be tested independently according to Table 3.

Table 2 — Requirements for the body of the component

Description of the components (including valves)	Tests to be carried out							
	Tightness test 7.4	PTV test (pressure temperature vibration) 7.6	Operation simu- lation 7.7	Freezing test 7.8	Chemical com- patibility with materials 7.11	Vacuum test 7.10	Additional test for hermetically sealed joints	
							Pressure test 7.9	Fatigue test 7.12
Component bodies having only permanent body joints: brazing and welding Identical base materials	YES	NO	NO	NO	NO	NO	NO	NO
Components having permanent body joints : brazing and welding Different base materials	YES	YES ^a	NO	NO	NO	NO	NO	NO
Component bodies having other permanent body joints: e.g. glue, permanent compression fittings, expansion joints	YES	YES	NO	YES if operating temperature below 0 °C	YES if non-metallic parts	YES	YES	YES
Component bodies with non-permanent body joints	YES	YES	YES if any external stems/shaft seals or removable or replaceable parts	YES if operating temperature below 0 °C	YES if non-metallic parts	YES	Not applicable	Not applicable
Capped valves and capped service ports for hermetically sealed systems	YES	YES	YES	YES if operating temperature below 0 °C	YES if non-metallic parts	YES	YES	YES
Safety valves	YES	YES	NO	NO	YES if non-metallic parts	Not applicable	Not applicable	Not applicable
Flexible piping	Test according to ISO 13971:2012							
As an exception compressors that comply with the requirements of EN 12693 or IEC 60335-2-34 only need to be subjected to the following test: — joints connecting to other parts of the refrigerating systems; — chemical compatibility test for all gaskets (sight glass, etc.). NOTE Another qualification for this chemical compatibility done according to another standard is equivalent.								
a PTV tests are not required if the destructive and non-destructive tests in EN 13134 are carried out.								

Table 3 — Requirements for the joining of components

Description of the joints and parts	Requirements							
	Tightness test 7.4	PTV test (pressure temperature vibration) 7.6	Operation simulation 7.7	Freezing test 7.8	Chemical compatibility with materials 7.11	Vacuum test 7.10	Additional test for hermetically sealed joints	
							Pressure test 7.9	Fatigue test 7.12
Permanent piping joints: brazing and welding Identical base materials	YES	NO	NO	NO	NO	NO	NO	NO
Permanent piping joints: brazing and welding Different base materials	YES	YES	NO	NO	NO	NO	NO	NO
Other permanent piping joints: e.g. glue, permanent compression fittings, expansion joints	YES	YES	NO	YES	YES	YES	YES	YES
Non-permanent piping joints	YES	YES	YES	YES	YES, if sealing material	YES	Not applicable	Not applicable
Gaskets and sealing	NO	NO	NO	NO	YES	NO	Not applicable	Not applicable

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6 Requirements for hermetically sealed systems

Hermetically sealed systems shall be constructed with components that have a tightness control level qualified according to A.1 or A.2, or that comply with Table 3. These components and joints shall be submitted to the relevant tests as specified in Tables 2 and 3.

7 Test procedures

7.1 General

The test characteristics to be applied to the components, joints and parts shall pass the qualification test for type approval of the tightness. The test procedures are shown in Figure 2.

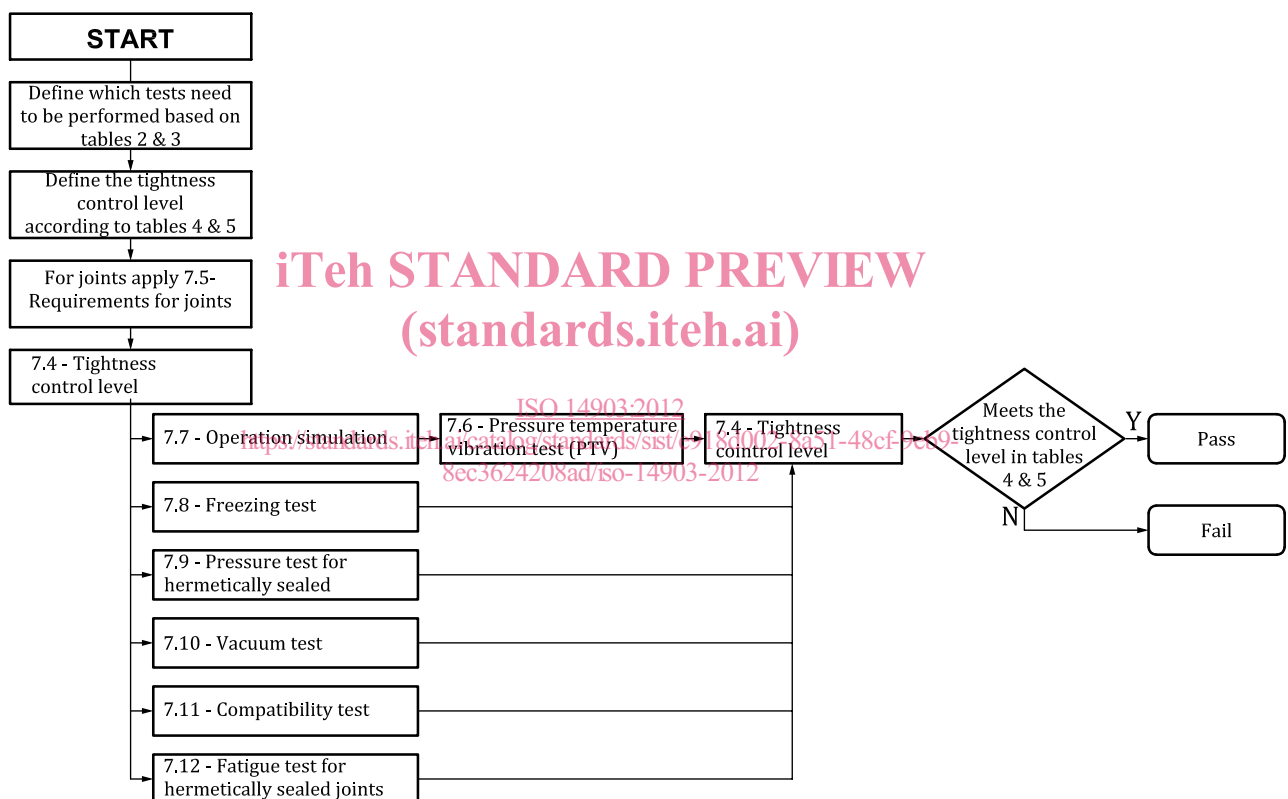


Figure 2 — Test procedure

7.2 Sampling

The largest, the smallest and any random samples in between of the product family shall be submitted to the test as required in Table 2 or Table 3. The samples used for pressure temperature vibration test (7.6) and for operation simulation (7.7) shall be the same. For each of the tests described in 7.8, 7.9, 7.10, 7.11, 7.12, different samples may be used.

7.3 Test temperature

The test temperature (ambient and gas) shall be between 15 °C and 35 °C, unless otherwise specified as the test conditions.