International Standard

ISO 14903

# 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*

Third edition
2025-01



Reference number
ISO 14903:2025(en)



ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

# Contents

Page

# 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 182, *Refrigerating systems, safety and environmental requirements*, in collaboration with ISO Technical Committee TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 1, *Safety and environmental requirements for refrigerating systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 14903:2017), which has been technically revised.

The main changes are as follows:

— update of the test procedure:

  — PTV test:

    — deletion of previous method 1 "Combined pressure-temperature cycle test with integrated vibration test";

    — update of previous method 2 "Combined pressure-temperature cycle test with a separate vibration test".

  — pressure test: modification of the test pressure specification;

— modification of Figure 2 "Test procedure": the compatibility test is moved out of the tightness test;

— deletion of previous Annex B "Test arrangements".

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

# Introduction

This document is intended to characterize the tightness stresses of joints of maximum DN 50 and components of internal volume of maximum 5 l and maximum weight of 50 kg met during their operations, following the fitting procedure specified by the manufacturer. This document is also intended 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.

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

## 1 Scope

This document specifies 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 relevant parts of the ISO 5149 series, including metal flexible piping. It specifies the level of tightness of the component as a whole and its assembly as specified by the manufacturer. It specifies additional requirements for mechanical joints that can be recognized as hermetically sealed joints.

This document is applicable to joints of maximum DN 50 and components of internal volume of maximum 5 l and maximum weight of 50 kg.

It is applicable to the hermetically sealed and closed components, joints and parts (e.g. fittings, bursting discs, flanged or fitted assemblies) used in the refrigerating installations, including those with seals, whatever their material and design are.

This document does not apply to the tightness of flexible piping made from non-metallic material. This is covered in ISO 13971.

Components tested before the date of publication of this document and found to comply with ISO 14903:2017 are considered to comply with this document.



## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 175, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

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

ISO 20485:2017, *Non-destructive testing — Leak testing — Tracer gas method*

## 3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

**3.1**
**mass flow rate**
$Q_m$
value of the leak mass flow rate at any point of the component

Note 1 to entry: The mass flow rate is expressed in grams per year (g/a).

**3.2**
**volume flow rate**
$Q$
value of the leak volume flow rate at any point of the component

Note 1 to entry: The volume flow rate is expressed in Pascal cubic metres per second ($Pa \cdot m^3/s$).

**3.3**
**product family**
group of products that have the same function, technology and material for each functional part and sealing materials

**3.4**
**closed joint**
joint other than hermetically sealed joints where there is no movement between the sealing surfaces except for service purposes

EXAMPLE Flanged joints.

**3.5**
**closed component**
component other than hermetically sealed components where there is no movement between the sealing surfaces except for service purpose

EXAMPLE Stop valves, service ports, pressure-relief valves.



**3.6**
**hermetically sealed joint**
joint that is made tight by welding, brazing or a similar permanent connection



**3.7**
**hermetically sealed component**
component that is made tight by welding, brazing or a similar permanent connection

**3.8**
**permanent joint**
joint which cannot be disconnected except by destructive methods

[SOURCE: Pressure Equipment Directive 2014/68/EU]

**3.9**
**reusable joint**
joint made without replacing the sealing material in general procedure

Note 1 to entry: In some cases, the tube is used as sealing material (e.g. flared joint).

**3.10**
**same base material**
material belonging to the same group

EXAMPLE Steel group, aluminium and aluminium alloy group, or copper group.

Note 1 to entry: Subgroups of these material groups are considered to be same base materials (refer to EN 14276-1 and EN 14276-2).

## 4 Symbols

| Symbol | Denomination | Unit |
|---|---|---|
| $D_K$ | percentage deviation of the minimum and maximum torque from the average of the minimum and maximum torque, $(K_{max} - K_{min})/(K_{min} + K_{max})$ | — |
| $f$ | frequency of vibrations | Hz |
| $K_{ave}$ | average torques of the respective joint standard, if specified. Otherwise, average of $K_{min}$ and $K_{max}$ | Nm |
| $K_{test\_max}$ | maximum torque used for testing a joint | Nm |
| $K_{test\_min}$ | minimum torque used for testing a joint | Nm |
| $K_{max}$ | required maximum torques of the respective joint standard if specified; otherwise, the maximum torque values supplied by the manufacturer | Nm |
| $K_{min}$ | required minimum torques of the respective joint standard if specified; otherwise, the minimum torque values supplied by the manufacturer | Nm |
| $L$ | length of tube | mm |
| $n_1$ | number of cycles in temperature and in pressure | — |
| $n_2$ | 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 | $Pa \cdot m^3/s$ |
| $Q_m$ | mass flow rate | g/a |
| $s$ | vibration displacement (peak to peak value) | mm |
| $T_{max}$ | maximal temperature of cycle | °C |
| $T_{min}$ | minimal temperature of cycle | °C |

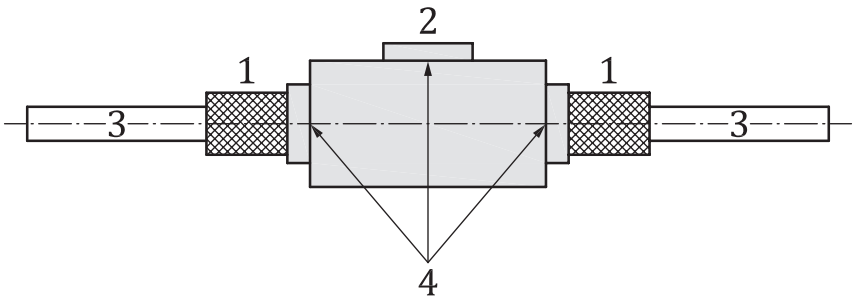


## 5 Test requirements

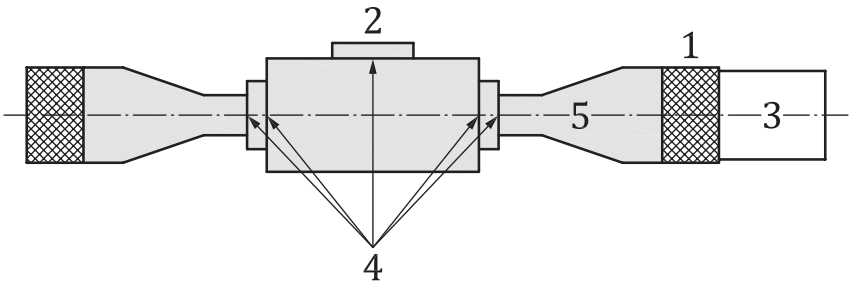
The tests that shall be applied to component bodies and joints used in refrigerating systems and heat pumps are given in Table 1 and in Table 2.

When a component can be connected with different types of joints, one of these joints shall be tested with the component according to Table 1. The other possible types of joints shall be tested independently according to Table 2.

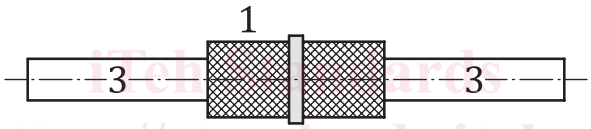
Figure 1 illustrates the principle of a component and a joint.




**a) According to Table 1**




**b) According to Table 1**




**c) According to Table 2**



**Key**

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



**Figure 1 — Principle of component body joint and joining of components**

**Table 1 — Requirements for component bodies**

| **Components** (including valves) | **Requirements** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Tightness test** | **PTV test** (pressure-temperature-vibration) | **Operation simulation** | **Freezing test** | **Chemical compatibility with materials** | **Vacuum test** | **Additional test for hermetically sealed components** | |
| | | | | | | | **Pressure test** | **Fatigue test** |
| **Subclause** | 7.4 | 7.6 | 7.7 | 7.8 | 7.11 | 7.10 | 7.9 | 7.12 |
| Component bodies having only permanent joints: brazing and welding<br>Same base materials | YES | NO | NO | NO | NO | NO | NO | NO |
| Components having permanent joints: brazing and welding<br>Not same base materials | YES | YES [a] | NO | NO | NO | NO | NO | NO |
| Component bodies having other permanent joints (e.g. glue, permanent compression fittings, expansion joints) | YES | YES | NO | YES<br>if operating temperature below 0 °C | YES<br>if non-metallic parts | YES | YES | YES |
| Component bodies with non-permanent joints | YES | YES | YES<br>if any external stems, shaft seals or removable or replaceable parts | YES<br>if operating temperature below 0 °C | YES<br>if non-metallic parts | YES | Not applicable | Not applicable |
| Capped valves and capped service ports for sealed systems | YES | YES | YES | YES<br>if operating temperature below 0 °C | YES<br>if non-metallic parts | YES | YES | YES |
| Safety valves | YES | YES | NO | NO | YES<br>if non-metallic parts | Not applicable | Not applicable | Not applicable |
| Flexible piping | Test according to ISO 13971 | | | | | | | |

By exception, compressors that conform to 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.).

[a] PTV tests are not required if destructive and non-destructive tests of EN 13134 are carried out.

NOTE Other qualifications for this chemical compatibility done according to other standards are equivalent.