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Gas welding equipment — Safety devices —

Part 1: Devices incorporating a flame (flashback) arrestor

Matériel de soudage au gaz — Dispositifs de sécurité — Partie 1: Dispositifs avec arrêt de flamme

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Foreword

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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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 8, *Equipment for gas welding, cutting and allied processes*.

This first edition of ISO 5175-1, together with ISO 5175-2, cancels and replaces ISO 5175:1987, which has been technically revised. It also incorporates the Amendment ISO 5175:1987/Amd 1:2015.

A list of all parts in the ISO 5175 series can be found on the ISO website.

Requests for official interpretations of any aspect of this document should be directed to the Secretariat of ISO/TC 44/SC 8 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

Gas welding equipment — Safety devices —

Part 1:
Devices incorporating a flame (flashback) arrestor

1 Scope

This document specifies the general requirements and tests for safety devices for fuel gases and oxygen or compressed air incorporating a flame (flashback) arrestor used downstream of manifold, cylinder and/or pipeline outlet regulators, and upstream of blowpipes for welding, cutting and allied processes.

This document does not specify the location of these devices in the gas system.

This document is not applicable to safety devices not incorporating a flame arrestor, covered by ISO 5175-2.

This document does not apply to the use of safety devices incorporating flame arrestors for applications with premixed oxy/fuel or air/fuel gas supply systems, e.g. downstream of gas mixers or a generator to produce hydrogen/oxygen mixture by electrolytic decomposition of water.

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 554, *Standard atmospheres for conditioning and/or testing — Specifications*

ISO 5175-2, *Gas welding equipment — Safety devices — Part 2: Not incorporating a flame (flashback) arrestor*

ISO 7289, *Gas welding equipment — Quick-action couplings with shut-off valves for welding, cutting and allied processes*

ISO 9090, *Gas tightness of equipment for gas welding and allied processes*

ISO 9539, *Gas welding equipment — Materials for equipment used in gas welding, cutting and allied processes*

ISO 10225, *Gas welding equipment — Marking for equipment used for gas welding, cutting and allied processes*

ISO 15296, *Gas welding equipment —Vocabulary*

EN 560, *Gas welding equipment — Hose connections for equipment for welding, cutting and allied processes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15296 and the following apply.

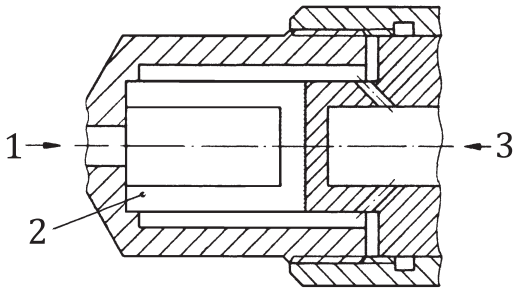
ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

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

3.1
flame arrestor
device which arrests a flame front

EXAMPLE The good thermal conductivity, high porosity and small pore size (larger surface) of sintered metal elements lead to flame quenching. An example is given in Figure 1.



Key

1 normal direction of gas flow
2 e.g. sintered metal element
3 flame

Figure 1 — Flame arrestor (example)

3.2
maximum operating pressure
maximum pressure to which the equipment may be subjected in service

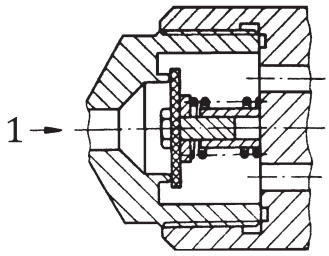
3.3
multifunctional safety device
device that incorporates two or more of the safety functions

EXAMPLE *Flame arrestor* (3.1) with *non-return valve* (3.4) and cut-off valve.

Note 1 to entry: The *temperature-sensitive cut-off valve* (3.6) is normally used in combination with a flame arrestor as its purpose is to cut-off the gas flow before the temperature at the flame arrestor reaches a point where flame transmission across the flame arrestor takes place. It is normal for pressure and or temperature cut-off valves only to be used in combination with flame arrestors. Due to the burning characteristics of hydrogen, it is recommended that all flame arrestors for hydrogen incorporate a temperature-sensitive cut-off valve.

3.4
non-return valve
device that prevents passage of gas in the direction opposite to the intended flow

EXAMPLE Valve is held open by energy in gas stream and closes when downstream pressure is approximately equal to or greater than that in normal direction of flow. An example is given in Figure 2.



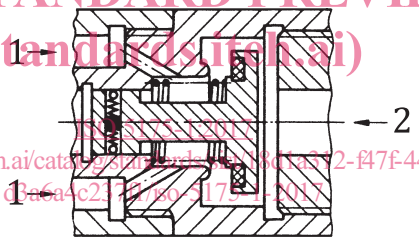
Key

1 normal direction of gas flow

Figure 2 — Non-return valve (example)

3.5
pressure-sensitive cut-off valve
device that stops the gas flow when the downstream pressure is higher than the upstream pressure by more than a predetermined value

EXAMPLE Valve is held open, e.g. by a spring; it is actuated by a pressure wave from downstream and is then automatically held closed by a special device. An example is given in Figure 3.



Key

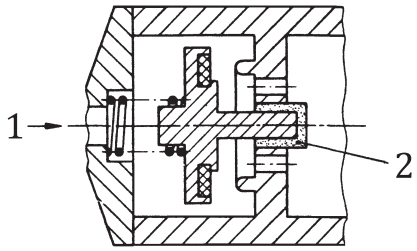
1 normal direction of gas flow

2 back-pressure wave

Figure 3 — Pressure-sensitive cut-off valve (example)

3.6
temperature-sensitive cut-off valve
device which stops the gas flow when a predetermined temperature is exceeded

EXAMPLE Valve is held open, e.g. by a fusible metal, and actuated by sustained temperature rise. An example is given in Figure 4.



Key

1 normal direction of gas flow

2 e.g. fusible metal

Figure 4 — Temperature-sensitive cut-off valve (example)

3.7
safety device
device which prevents the damage resulting from misuse or malfunction of gas equipment and gas installations

4 Design and materials

4.1 Connection

Threaded connections up to G1 shall be in accordance with EN 560. Quick release connections shall be in accordance with ISO 7289.

4.2 Materials

Materials used for safety devices shall conform to the requirements laid down in ISO 9539.

5 Requirements

5.1 General

Requirements for each safety device vary depending upon the device and combination of functions in the device. A summary of the requirements and test sequence is given in Table 1.

Table 1 — Summary of requirements and test sequence for the most commonly available safety devices

Safety device function(s)	Requirements (Subclause no.)	Tests (in test order) (Subclause no.)	Number of devices required for each test	Total number of devices required
Flame arrestor	5.2.1 5.3 5.4	6.4 External gas tightness 6.5 Pressure resistance 6.7 Flashback resistance	5 1[a] 5	6
Flame arrestor + non-return valve	5.2.1 5.2.2 5.3 5.5	6.4 External gas tightness 6.5 Pressure resistance 6.6 Reverse flow 6.7 Flashback resistance 6.6 Reverse flow	5 1[a] 5 5 5	6
Flame arrestor + temperature-sensitive cut-off valve	5.2.1 5.2.2 5.3 5.6	6.4 External gas tightness 6.5 Pressure resistance 6.7 Flashback resistance 6.8 Temperature cut-off 6.10 Internal leakage	5 1[a] 5 1[a] 5	7
Flame arrestor + non-return valve + temperature-sensitive cut-off valve	5.2.1 5.2.2 5.3 5.5 5.6	6.4 External gas tightness 6.5 Pressure resistance 6.6 Reverse flow 6.7 Flashback resistance 6.6 Reverse flow 6.8 Temperature cut-off 6.10 Internal leakage	5 1[a] 5 5 5 1[a] 5	7
Flame arrestor + non-return valve + pressure-sensitive cut-off valve	5.2.1 5.2.2 5.3 5.5 5.7	6.4 External gas tightness 6.5 Pressure resistance 6.6 Reverse flow 6.7 Flashback resistance 6.9 Pressure cut-off 6.10 Internal leakage	5 1[a] 5 5 5 5	6
Flame arrestor + non-return valve + temperature-sensitive cut-off valve + pressure-sensitive cut-off valve	5.2.1 5.2.2 5.3 5.5 5.6 5.7	6.4 External gas tightness 6.5 Pressure resistance 6.6 Reverse flow 6.7 Flashback resistance 6.8 Temperature cut-off 6.9 Pressure cut-off 6.10 Internal leakage	5 1[a] 5 5 1[a] 5 5	7

[a] Use a new device for this test. Do not use for any other test.

NOTE In the following subclauses, the terms “upstream” and “downstream” refer to the normal direction of gas flow in the device.

5.2 Gas tightness

5.2.1 External gas tightness

The general requirements on external gas tightness and the test procedures shall be in accordance with ISO 9090.

5.2.2 Internal gas tightness

Where internal gas tightness is required in this document, the leakage rate shall not exceed 50 cm^3/h for devices with a connection internal bore (diameter) less than 11 mm or 0,41 d^2 for larger diameters (see 6.6 and/or 6.10 for tests).

NOTE The value 0,41 d^2 is the flow in cm^3/h where d is the internal bore (diameter) in mm of the largest connection of the device.

5.3 Pressure resistance

The housings of the safety devices shall resist a pressure equal to ten times the maximum operating pressure, with the test pressure in all cases not less than 6 MPa (60 bar).

NOTE 1 bar = 0,1 MPa = 10^5 Pa. 1 Pa = 1 N/m^2. All pressures are gauge pressure.

When the device is tested in accordance with 6.5, no permanent deformation of the pressure retaining components shall occur after a test duration of at least 5 min.

5.4 Flame arrestor

Flame arrestors shall quench flashbacks when tested in accordance with 6.7.

5.5 Flame arrestor with non-return valve

Flame arrestor with non-return valve shall quench flashbacks when tested in accordance with 6.7 and shall not allow the reverse flow of gases when tested in accordance with 6.6 both before and after the flashback test in 6.7.

5.6 Flame arrestor with temperature-sensitive cut-off valve

Flame arrestor with temperature-sensitive cut-off valve shall quench flashbacks when tested in accordance with 6.7 and shall stop the gas flow before the upstream gas is ignited when tested in accordance with 6.8.

It shall not be possible to reset the temperature-sensitive cut-off valve.

If the temperature-sensitive cut-off valve operates before the fifth flashback in the test in 6.7 and the flame is not transmitted upstream, the unit shall be considered to meet the flashback test requirement, but the test in 6.8 shall still be carried out on a new unit.

5.7 Flame arrestor with pressure-sensitive cut-off valve

Flame arrestor with pressure-sensitive cut-off valve shall quench flashbacks when tested in accordance with 6.7 and the pressure-sensitive cut-off function shall activate at each flashback. The pressure-sensitive cut-off valve shall remain closed until it is manually reset.

The pressure-sensitive cut-off valve shall be reset after each flashback during the test in 6.7.

Flame arrestor with pressure-sensitive cut-off valve shall also stop the gas flow when tested in accordance with 6.9, both before and after completing the flashback test in 6.7.

5.8 Other multifunctional safety devices

Multifunctional safety devices not included in Table 1, but incorporating functions described in this document or in ISO 5175-2, shall be tested according to the relevant requirements. Functions in this document shall be tested before the functions in ISO 5175-2.

6 Methods for type testing

6.1 General

The test methods in this clause are not intended as production inspection tests, but are to be applied to sample devices to be tested for compliance with this document. Tests shall be carried out on new devices with all safety functions operational as designed.

Third party conformity testing is not a requirement of this document. See Annex B for information relating to third party conformity testing if required.

6.2 Accuracy of pressure and flow measurements

The allowable total error of the measured values are as follows:

— flow: ±10 %;

— pressure: ±3 %.

All flows and pressures shall be expressed in standard atmospheric conditions in accordance with ISO 554. All pressure values are given as gauge pressure, expressed in bars.

6.3 Test gases

Unless otherwise stated, tests shall be carried out at ambient pressure conditions and at (20 ± 5) °C with air or nitrogen free from oil and grease.

Air is considered as oil-free if it comprises

— a mass fraction of oil vapour of less than 5×10^{-6}, and

— less than 1 mg/m^3 of suspended droplets.

In all cases, tests shall be carried out with dry gas with a maximum moisture content corresponding to a dew point of 0 °C.

Safety devices for hydrogen shall be tested with hydrogen or helium for the gas tightness test only.

6.4 Gas tightness test

Conformity with the requirements of 5.2.1 shall be checked on five samples in accordance with ISO 9090.

6.5 Pressure resistance test

Conformity with the requirements of 5.3 shall be checked by means of a hydraulic pressure test on one sample. No other tests shall be carried out on the sample either before or after this test nor shall the sample tested be used for any other purposes.

6.6 Non-return valve test

6.6.1 General

Conformity with the requirements of 5.5 shall be checked on five samples as follows. Before proceeding with this test, pass the test gas through the device in the normal direction of flow for 5 s to operate the valve. Connect the downstream side of the device under test to a gas source, with the upstream side at atmospheric pressure and connected to a leak detection device. Proceed to pressurize in the reverse direction according to 6.6.2. For the tests, the samples shall be installed in the most disadvantageous position (gravity acting to open the valve).

6.6.2 Tests with reverse flow of gas

Pressurize the device in the reverse direction as follows:

a) increase the back-pressure at a rate of 600 Pa/min (6 mbar/min) up to 3 000 Pa (30 mbar);

b) increase the back-pressure within 1 s from 0 to maximum operating pressure.