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ISO 5172

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Gas welding equipment — Blowpipes for gas welding, heating and cutting — Specifications and tests

Matériel de soudage aux gaz — Chalumeaux pour soudage aux gaz, chauffage et coupage — Spécifications et essais

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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 5172 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 8, *Equipment for gas welding, cutting and allied processes*.

This third edition of ISO 5172 cancels and replaces ISO 5172:1995, ISO 5172:1995/Amd.1:1995 and ISO 5186:1995, of which it constitutes a technical revision.

Introduction

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

Gas welding equipment — Blowpipes for gas welding, heating and cutting — Specifications and tests

1 Scope

This International Standard specifies specifications and tests for blowpipes for gas welding, heating and cutting of metals. It applies to manual blowpipes for welding and heating with a nominal thermal power up to 32 000 kcal/h, and manual and machine cutting blowpipes with a cutting range up to 300 mm.

This International Standard does not apply to air-aspirated blowpipes which are covered in ISO 9012.

NOTE 1 Blowpipes with greater nominal thermal power or cutting range can also be tested in accordance with this International Standard if the test requirements are suitable.

NOTE 2 For the most common fuel gases, the corresponding flow rates are given in Table A.1.

NOTE 3 Examples of blowpipes are shown in Annex B, which also gives the terminology concerning these blowpipes.

In addition to terms used in two of the three official ISO languages (English and French), this annex gives the equivalent terms in German; these are published under the responsibility of the member body for Germany (DIN) and are given for information only. Only the terms and definitions given in the official languages can be considered as ISO terms.

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

ISO 5175, *Equipment used in gas welding, cutting and allied processes — Safety devices for fuel gases and oxygen or compressed air — General specifications, requirements and tests*

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

ISO 15296, *Gas welding equipment — Vocabulary — Terms used for gas welding equipment*

3 Terms and definitions

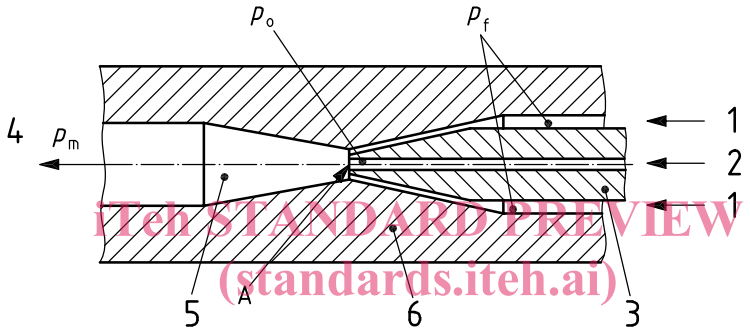
For the purposes of this document, the terms and definitions given in ISO 15296 and the following apply.

3.1 Mixing system

3.1.1
low-pressure blowpipe
blowpipe, in which the fuel gas pressure, measured immediately before the mixing chamber, is lower than the pressure of the gas mixture, measured between the mixing chamber and the welding nozzle

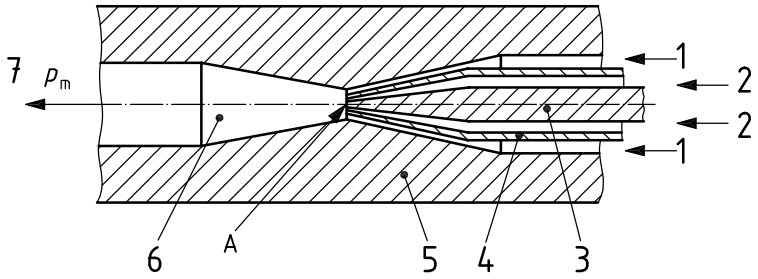
$$p_f < p_m$$

NOTE 1 Fuel gas and oxygen/compressed air are mixed by the action of oxygen/compressed air which, being discharged from the orifice of the injector generates suction at point “A” of the mixing system, thus entraining the fuel gas. See examples of injector-mixer, fixed or adjustable, in Figure 1 and Figure 2.



Key
1 fuel gas
2 oxygen/compressed air
3 pressure nozzle
4 mixture
5 mixing chamber
6 mixing nozzle
A point A
p_f pressure of fuel gas
p_o pressure of oxygen (or compressed air)
p_m pressure of mixture
$p_f < p_m$ low pressure
$p_f > p_m$ high pressure
$p_o > p_m$

Figure 1 — Injector-mixer for low-pressure and high-pressure blowpipes



Key

1 fuel gas
2 oxygen/compressed air
3 needle
4 pressure nozzle
5 mixing nozzle
6 mixing chamber
7 mixture
A point A

NOTE The control of the flow of oxygen/compressed air is effected by means of a needle valve inside the pressure nozzle.

Figure 2 — Mixer with adjustable injector

NOTE 2 The pressure in the fuel gas channel is below the atmospheric pressure during discharge of oxygen/compressed air when the fuel gas valve between valve and mixing chamber is closed. If the fuel gas valve is open during discharge of oxygen/compressed air and the fuel gas hose connection is exposed to the atmosphere, air will be entrained (suction test, see instruction for use).

3.1.2
high-pressure injector blowpipe
blowpipe in which the pressure of both the fuel gas and the oxygen/compressed air, measured immediately before the point of mixing, is higher than the pressure of the mixture, measured between the point of mixing and welding nozzle

$$p_m < p_f$$

$$p_f < p_0$$

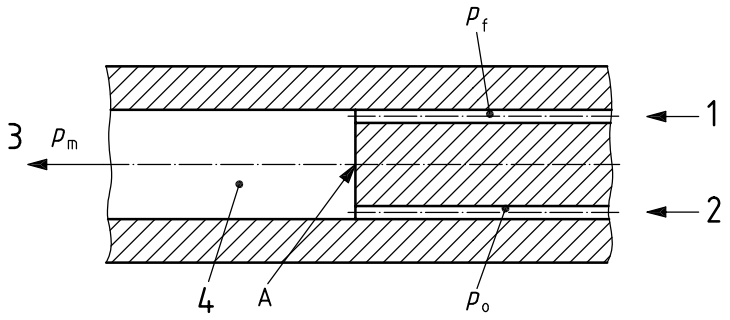
NOTE Fuel gas and oxygen/compressed air are mixed when both gases meet at pressures greater than that of the resulting mixture but with the oxygen/compressed air pressure higher than the fuel gas pressure. When the valve in the fuel gas channel is closed while oxygen/compressed air is discharged, the pressure in this channel is higher than the atmospheric pressure. If the fuel gas valve is open and the fuel gas hose connection is exposed to the atmosphere, oxygen/compressed air will be discharged (fuel gas valve open), see Figure 1.

3.1.3
equal-pressure blowpipe
blowpipe, where the pressures of fuel gas and oxygen/compressed air are identical, measured immediately before the point of mixing “A”, but are higher than the pressure of the mixture, measured between the point of mixing and welding nozzle

$$p_m < p_f$$

$$p_f = p_0$$

NOTE See Figure 3.



Key

1 fuel gas
2 oxygen/compressed air
3 mixture
4 mixing chamber
A point A

p_f pressure of fuel gas
p_o pressure of oxygen (or compressed air)
p_m pressure of mixture

Figure 3 — Mixer for equal-pressure blowpipes

3.2 Blowpipes classified according to the possibility of varying the gas flow rate

3.2.1
blowpipe with a single flow rate
blowpipe which, due to design, gives a single nominal gas flow rate which can only be varied within narrow limits

3.2.2
blowpipe with multiple flow rates
blowpipe giving a range of flow rates corresponding to a series of nozzles

3.2.2.1
blowpipe with multiple gas flow rates adjusted by means of the injector
blowpipe with multiple gas flow rates which are varied by means of a device for adjustment of the injector cross-section (blowpipe with variable injector)

3.2.2.2
blowpipe with multiple gas flow rates, adjusted by the pressure
blowpipe with multiple gas flow rates, which are varied by adjusting the pressures (blowpipe with fixed mixer), e.g. welding blowpipe attachments and manual cutting blowpipes

NOTE See Figure 1.

3.2.2.3
blowpipe with multiple gas flow rates adjusted by changing the welding, heating or cutting attachments (combination blowpipes)
blowpipe with multiple gas flow rates which are varied by changing the welding or cutting attachment with injector, e.g. welding, heating and cutting attachments

NOTE See Figure 1.

3.2.2.4
blowpipe with multiple gas flow rates adjusted by means of gas control valves
blowpipe with multiple gas flow rates, which are varied by means of the adjustment valves

3.3 Cutting and heating blowpipes classified according to the mixing position

3.3.1
blowpipe with preliminary mixer
blowpipe in which the mixture of heating oxygen and fuel gas is ensured by the mixer before the welding, heating or cutting nozzle

3.3.2
blowpipe with nozzle mixing
blowpipe in which the heating oxygen and fuel gas are mixed in the cutting or heating nozzle (nozzle mixing)

3.4 Operational incidents

3.4.1
backfire
momentary return of the flame into the blowpipe

NOTE This return of the flame generates a popping sound, the flame being either extinguished or re-ignited at the nozzle.

3.4.2
sustained backfire
return of the flame into the blowpipe with continued burning within the mixer

NOTE This is accompanied by an initial popping sound followed by a hissing sound caused by continued burning within the blowpipe.

3.4.3
flashback
return of the flame into the blowpipe and possibly extending into the hoses and the upstream equipment

3.4.4
gas backflow
flowing back of gas from one blowpipe passage at higher pressure into the other gas passage at lower pressure and possibly into the hose

NOTE This can have the effect that oxygen (or compressed air) and fuel can form a mixture capable of being ignited in the blowpipe passages and possibly in the hoses.

3.5 Flame specifications (reference values)

3.5.1
nominal thermal power
thermal power obtained by the product of the nominal fuel gas flow and the lower heat of combustion of the fuel gas at 15 °C and 101,3 kPa

3.5.2
neutral flame
⟨for acetylene only⟩ acetylene flame obtained with a mixing ratio of approximately 1 part acetylene to 1,1 parts oxygen by volume under standard conditions

NOTE It is a flame which is neither reducing (carburising) nor oxidising.

3.5.3
normal flame
〈for all fuel gases〉 flame obtained with the practical mixing ratio (in normal volumes) used in normal operation and which gives approximately the maximum flame temperature

NOTE 1 For type testing, the mixing ratios are indicated in Table C.1.

NOTE 2 The normal acetylene flame is used in heating operations only.

3.5.4
neutral mixture
acetylene/oxygen mixture necessary to obtain a neutral flame (see 3.5.2)

3.5.5
normal mixture
fuel gas/oxygen or fuel gas/compressed air mixture necessary to obtain a normal flame (see 3.5.3)

4 Hose connections

The hose connections shall be either detachable or integral to the shank (see Figure 4). Inlet connections of blowpipes shall comply with the national standard or regulatory requirements of the country where they are used. If no national standard is enforced, it is recommended that the connection comply with ISO 3253.

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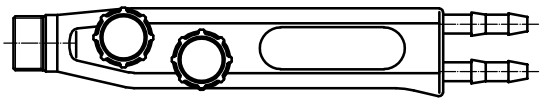

2

Key
1 detachable hose connection
2 integral hose connection

Figure 4 — Examples of hose connections — detachable — integral

5 Material

The material requirements according to ISO 9539 shall be fulfilled. Components in contact with oxygen shall be free from oil, grease or other contaminants.

6 Marking

6.1 General

The marking shall be legible and durable and shall be in accordance with 6.2 to 6.7. Table D.1 gives an overview for preferred marking of the components of a blowpipe.

6.2 Marking of the blowpipe

The blowpipe shank shall carry the name or registered trade mark of the manufacturer (the term “manufacturer” includes distributors, suppliers or importers) and the reference number of this International Standard. The marking should be according to 6.7 and 6.8. The connection adjacent to the oxygen inlet of blowpipes with fixed hose-connecting nipples shall be identified by the letter “O” and the connection adjacent to the fuel gas inlet shall be identified with the appropriate letter from Table 1.

6.3 Marking of oxygen and fuel gas valves

The heating oxygen valves (body or knob) shall be identified by the letter “O”, or the colour blue, or both the letter “O” and the colour blue. In the case where a country has a colour identification other than blue in their national requirements, then the colours detailed in Annex I shall apply.

The fuel gas control valve (body or knob) shall be identified by the appropriate letter in Table 1, or the colour red, or both the appropriate letter in Table 1 and the colour red.

The cutting oxygen valve, if fitted, shall be identified in a similar manner.

6.4 Marking of nozzles

All nozzles shall be marked with the name, registered trade mark or identifying mark of the manufacturer, the symbol identifying the fuel gas and a code to allow easy reference to the manufacturer's operating data.

6.5 Marking of interchangeable components

Where mismatching of interchangeable components (e.g. mixer and injector) could occur, an identifying code, the manufacturer's trade mark and the symbol identifying the fuel gas shall be marked and shown in the operating data.

6.6 Marking of cutting attachment

If it is separable, the cutting attachment shall be marked with the name, the registered trade mark or the identifying mark of the manufacturer (the term “manufacturer” includes distributors, suppliers or importers).

6.7 Marking of mixing systems

The user is advised to refer to the operating instructions provided by the manufacturer (see Clause 10). If operating pressures are marked on any part of the blowpipe, they shall be indicated in kilopascals (kPa).

If the mixing device is symbolically marked, indicating the blowpipe type, the marking should conform to the symbols shown in Figure 5.

a) Fuel gas injector-mixer b) Mixer without injector action c) Fuel gas injector-mixer with backflow resistance

Figure 5 — Marking of mixing systems

6.8 Gases to be used, symbols for gases

Where the marking requires the identification of the gas, either the full name of the gas or the symbols given in Table 1 shall be used.

Table 1 — Designations and symbols for the gases

Designations	Symbols
Oxygen	O
Acetylene	A
Propane, butane or LPG (Liquefied petroleum gas)	P
Natural gas, methane	M
Hydrogen	H
Ethane	E
MPS (methylacetylene-propadiene mixtures) and other fuel gas mixtures	Y
Compressed air	AIR
For more than one fuel gas (if required)	F

For blowpipes, nozzles and interchangeable components capable of use with more than one fuel gas, the abbreviation F shall be used. Operating data shall give details on fuel gases for which these components are suitable.

7 Safety and operational requirements

7.1 Safety requirements

7.1.1 Gas tightness

The gas-tightness test shall be according to 8.2 as follows:

a) on new blowpipes;

b) after the valve endurance test according to 8.5;

c) after the sustained backfire test according to 8.3.4 or 8.3.5;

d) after the overheating test according to 8.3.2 or 8.3.3.

7.1.2 Valves

Each gas line shall be separately closed with a valve. Internal and external gas tightness shall be achieved in the closed position. Valve elements shall remain captive in all positions.

7.1.3 Resistance of blowpipes to sustained backfire

7.1.3.1 Resistance to overheating

The blowpipe shall be tested in accordance with 8.3.2 and/or 8.3.3.

7.1.3.2 Resistance to occlusion of the nozzle outlet

The blowpipe and nozzle shall be resistant to sustained backfire when the nozzle outlet(s) is (are) partially and totally closed (see test conditions according to 8.3.4 and 8.3.6 for welding and heating blowpipes and to 8.3.5 for cutting blowpipes). An alternative test (simple brick test) is given in Annex G. Heating nozzles without a flat front shall be tested in accordance with Annex G.

7.1.4 Protection against backflow

For mixers marked with the symbol shown in Figure 5 c), backflow shall not occur at 0,5 to 2 times the nominal gas operating pressures (see 8.6 for test conditions).

If a non-return valve is incorporated in the blowpipe, it shall conform to ISO 5175.

7.2 Operational requirements

7.2.1 General

The following operational requirements shall be fulfilled for the gas flow rates and pressures specified by the manufacturer in the operating instructions.

7.2.2 Flow rate

Gas flow rates and gas pressures shall be as specified by the manufacturer in the operating instructions. It shall be verified that the gas flows and pressures are achieved.

7.2.3 Adjustment of flame

It shall be possible to adjust the flame continuously from the flows stated by the manufacturer to a reducing state obtained by increasing the fuel flow by 10 % and to an oxidising state obtained by increasing the oxygen flow by 10 %.

7.2.4 Turn-down ratio

It shall be possible to obtain a stable flame at flow rates which are 25 % below the stated nominal flow rates.

7.2.5 Stability in wind

It shall be possible to maintain the flame in a wind transverse to the axis of the emergent gas stream at the orifice. Test conditions are according to 8.4.

8 Tests

8.1 General

The accuracy of the measuring and test equipment used shall be stated in the test report. All tests are type tests and are not intended to be production tests.

The test devices shall be subjected to the tests specified in Table 2.