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Gas welding equipment — Rubber and plastics hose and hose assemblies for use with industrial gases up to 450 bar (45 MPa)

Matériel de soudage aux gaz — Tuyaux souples et flexibles en caoutchouc et en plastique pour des gaz industriels jusqu'à 450 bar (45 MPa)

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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. www.iso.org/directives

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The committee responsible for this document is ISO/TC 44, *Welding and allied processes*, Subcommittee SC 8, *Equipment for gas welding, cutting and allied processes*.

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This third edition cancels and replaces the second edition (ISO 14113:2007), of which it constitutes a minor revision with the following changes:

— correction of temperature value in 7.5;

— editorial revision.

Requests for official interpretations of any aspect of this International Standard 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.

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Gas welding equipment — Rubber and plastics hose and hose assemblies for use with industrial gases up to 450 bar (45 MPa)

1 Scope

This International Standard specifies requirements for rubber and plastics hose and hose assemblies for use with compressed, liquefied, and dissolved gases up to a maximum working pressure of 450 bar (45 MPa), within the ambient temperature range of −20 °C to +60 °C.

This International Standard applies to hose assemblies used to connect industrial gas cylinders to manifolds or bundles prior to any pressure reduction stage.

This International Standard does not cover rubber or thermoplastic hoses for welding, cutting, and allied processes (see ISO 3821 and ISO 12170).

This International Standard does not apply to refrigerated liquefied gases or to liquefied petroleum gases (LPG).

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2 Normative references

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

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ISO 105-A02:1993, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 1307:2006, *Rubber and plastics hoses — Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses*

ISO 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 1746:1998, *Rubber or plastics hoses and tubing — Bending tests*

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

ISO 4080:1991, *Rubber and plastic hoses and hose assemblies — Determination of permeability to gas*

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 4672:1997, *Rubber and plastics hoses — Sub-ambient temperature flexibility tests*

ISO 7326:2006, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8031, *Rubber and plastics hoses and hose assemblies — Determination of electrical properties*

ISO 8033:2006, *Rubber and plastics hoses — Determination of adhesion between components*

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

ISO 11114-3, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 3: Autogenous ignition test in oxygen atmosphere*

ISO 30013:2011, *Rubber and plastics hoses — Methods of exposure to laboratory light sources — Determination of changes in colour, appearance and other physical properties*

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ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Terms and definitions

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

3.1
autogenous ignition temperature
temperature at which ignition of a sample occurs when subjected to oxygen pressure and heating and in the absence of a source of ignition other than the applied temperature

Note 1 to entry: The autogenous ignition temperature depends on the sample preparation, test apparatus, and test procedure employed.

3.2
burst pressure
pressure at which rupture of the hose occurs when tested to the relevant standard

[SOURCE: ISO 8330:2007, definition 2.1.21]

3.3
distance piece
length of metallic tubing at the end of a hose or hose assembly that serves to contain and cool the highest temperature gas that is formed by the effect of adiabatic compression, e.g. by the rapid opening of a cylinder valve

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3.4
end fitting
sub-assembly of components enabling the hose to be safely connected to other pressurized equipment

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3.5
hose assembly
length of hose with suitably attached end fittings

3.6
maximum working pressure
pressure to which a hose is designed to be subjected during service, including expected momentary surges

Note 1 to entry: This definition is consistent with that for a gas cylinder in ISO 10286:2007, A.2.4 maximum permissible operating pressure (the highest pressure permitted to be developed during service). ISO 10286:2007 defines “working pressure” as the “settled pressure ... at a uniform ... temperature of 15 °C in a full gas cylinder”.

Note 2 to entry: Due to the peculiar characteristics of the acetylene cylinder, there is no clearly defined maximum working pressure for acetylene service. Applicable requirements for acetylene service are given in relevant clauses.

3.7
proof pressure
pressure applied during a non-destructive test and held for a specified period of time to prove the integrity of the construction

Note 1 to entry: It is expressed in bars.

[SOURCE: ISO 8330:2007, definition 2.1.104]

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4 Construction

4.1 Hose

The hose should consist of either

— a rubber or plastics lining,

— reinforcement consisting of one or more layers, and

— an outer protective cover of permeable material or perforated rubber or plastics,

for flammable gas service, the hose shall also incorporate bonding wires to provide the electrical conductivity (see 7.8);

or

— a rubber or plastics lining, and

— reinforcement consisting of one or more layers of stainless steel wire braid and/or other corrosion and abrasion resistant material, which is also designed to act as an outer protective cover and provide electrical conductivity (see 7.8).

4.2 End fittings

Fittings shall be of permanent, swage, or crimp design.

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The fitting design shall enable the hose assembly to attain its burst pressure without fitting pullout or separation from the hose.

End fittings shall be manufactured from materials that are compatible with the gases and the environment to which they will be subjected, e.g. according to ISO 9539.

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4.3 Hose assemblies

Assemblies shall consist of a length of hose and permanently attached end fittings. Field-attachable or reusable-type fittings shall not be used. Distance pieces, when used as heat sinks as part of hose assemblies for oxygen service (see 7.1.3), shall not be readily detachable by the user.

For maximum working pressures in excess of 40 bar (4 MPa), hoses assembled should be provided with a suitable restraining cable or device, properly fitted to an anchor point to restrain the hose in the event of a hose assembly failure.

5 Dimensions and tolerances

5.1 Bore size

The bore of the hoses shall be in accordance with the nominal bore sizes and permitted ranges given in Table 1, except that the effective maximum bore of hoses for acetylene shall not exceed 25 mm.

NOTE In some countries, local regulations can restrict bores of acetylene hoses to less than 25 mm.

5.2 Concentricity

The internal diameter and concentricity of the hose, measured according to ISO 4671, shall be in accordance with the values given in Table 1.

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Table 1 — Nominal bore size, internal diameter permitted range, and concentricity

Nominal bore size	Internal diameter permitted range mm	Concentricity mm
3,2	3,0 to 3,6	± 0,6
4	3,8 to 4,4	
5	4,5 to 5,4	
6,3	6,1 to 6,9	
8	7,7 to 8,5	
10	9,3 to 10,1	
11	10,8 to 11,6	
12,5	12,3 to 13,5	
13	12,8 to 14,0	
16	15,4 to 16,7	± 0,7
19	18,6 to 19,8	
20	19,6 to 20,8	
22	21,8 to 23,0	
25	25,0 to 26,4	
31,5	31,3 to 33,0	
32	31,7 to 33,4	
38	37,7 to 39,3	± 0,8
50	49,7 to 51,4	
51	50,4 to 52,0	

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5.3 Cut lengths and tolerances

The tolerances for cut lengths of hoses shall be in accordance with ISO 1307:2006, Clause 3 (±1 % or ±3 mm, whichever is the greater).

5.4 Length of hoses assemblies

The tolerances for lengths of hose assemblies shall be +2 % of the specified length or +6 mm, whichever is the greater. The length shall be measured when the hose assembly is in the unpressurized state.

6 Physical properties of lining and cover — Type tests

6.1 General

The lining material shall be compatible with the gas or gases with which the hose is specified for use, under normal operating conditions. See ISO 11114-2 for guidance.

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6.2 Resistance to ignition requirement for oxygen hose lining

The autogenous ignition temperature of the lining shall be according to Table 2 when tested at a minimum pressure of 130 bar (13 MPa) by the method of ISO 11114-3.

NOTE Suitable grades of fluorinated polymers and copolymers, e.g. polytetrafluoroethylene and polytetrafluoroethylene/perfluorinated vinyl ethers, normally meet this requirement, but some oil-treated grades may not.

Table 2 — Minimum autogenous ignition temperature

Maximum working pressure bar (gauge)	**Minimum autogenous ignition temperature** °C
40	300
100	350
150	375
207	400
Above 207 up to 450	400

6.3 Resistance to acetone (acetylene hose only)

A sample of the lining when immersed in the test solvents of acetone and dimethylformamide at standard laboratory temperature as defined in ISO 23529 for 70 h shall not increase in mass by more than 8 % for each test solvent when calculated by the method specified in ISO 1817.

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7 Performance requirements — Type tests

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7.1 Pressure resistance requirements

7.1.1 Hydrostatic testing

Hose and hose assemblies shall be tested for proof pressure at twice the maximum working pressure according to the test method specified in ISO 1402.

Hose and hose assemblies shall be tested for burst pressure at four times the maximum working pressure according to the test method specified in ISO 1402. The end fittings shall remain attached to the hose up to the burst pressure. Hoses and hose assemblies for acetylene shall have a minimum burst pressure of 1 000 bar (100 MPa).

NOTE The requirement for acetylene service is based on the extremely high pressures that could be generated in the case of an acetylene decomposition.

7.1.2 Special requirements for acetylene hose assemblies

Hose assemblies for acetylene service in direct contact with the contents of an acetylene cylinder shall resist an acetylene decomposition at an initial pressure of 26 bar (25 bar gauge), according to the test method in Annex A.

NOTE It is known that the decomposition of acetylene takes place as a reaction starting as deflagration and changing to stable detonation. The transition area is located at a distance of about 1 000 mm to 2 000 mm from the starting point of the deflagration (in general, the beginning of the hose) and depends on the diameter. This length is called critical length. In addition, there are other influencing factors (e.g. connector design).

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