INTERNATIONAL STANDARD

ISO 3821

Third edition
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Gas welding equipment — Rubber hoses for welding, cutting and allied processes

Matériel de soudage au gaz — Tuyaux souples en caoutchouc pour le soudage, le coupage et les techniques connexes

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.

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.

International Standard ISO 3821 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 cancels and replaces the second edition (ISO 3821:1992) which has been technically revised.

Annexes A, B and C form an integral part of this International Standard.

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Gas welding equipment – Rubber hoses for welding, cutting and allied processes

1 Scope

This International Standard specifies requirements for rubber hoses (including twin hoses) for welding, cutting and allied processes. The term "allied processes" means, in particular, heating, brazing and metallization.

This International Standard specifies requirements for rubber hoses for normal duty up to 2 MPa (20 bar) and light duty [limited to hoses for maximum working pressure up to 1 MPa (10 bar) and with nominal bore less than or equal to 6,3].

This International Standard pertains to hoses operated at temperatures – 20 °C to + 60 °C.

Plastic hoses are excluded from this International Standard.

Different colours and markings are specified for identification of the gas.

NOTES

1 If hoses for liquefied petrol gases are used without regulators the use of light duty hoses is not allowed.

2 In the case of hoses for use with liquid flux dispensers fitted in the fuel gas supply line, the manufacturer should be consulted on the suitability of the hose for this application.

This International Standard applies to hoses used in:

— gas welding and cutting;

— arc welding under the protection of an inert or active gas;

— processes allied to welding and cutting.

This International Standard does not apply to hoses used for high pressure acetylene [more than 0,15 MPa (1,5 bar)].

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All Standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 37:1994, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties.*

ISO 188:1998, *Rubber, vulcanized or thermoplastic – Accelerated ageing and heat-resistance tests.*

ISO 471:1995, *Rubber – Temperatures, humidities and times for conditioning and testing.*

ISO 1307:1992, *Rubber and plastics hoses for general-purpose industrial applications – Bore diameters and tolerances, and tolerances on length.*

ISO 1402:1994, *Rubber and plastics hoses and hose assemblies – Hydrostatic testing.*

ISO 1746:—[1], *Rubber or plastics hoses and tubing – Bending tests.*

ISO 1817:—[2], *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:—[3], *Rubber and plastics hose and hose assemblies – Methods of measurement of dimensions.*

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

ISO 7326:1991, *Rubber and plastics hoses – Assessment of ozone resistance under static conditions.*

ISO 8033:1991, *Rubber and plastics hose – Determination of adhesion between components.*

ISO 11114-3:1997, *Transportable gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 3: Autogenous ignition test in oxygen atmosphere.*

3 Materials

3.1 Construction

The hose shall consist of:

– a rubber lining of a minimum thickness of 1,5 mm;

– reinforcement applied by any suitable technique;

– a rubber cover of a minimum thickness of 1 mm.

3.2 Manufacture

The lining and cover shall be of uniform thickness and free from holes, porosity and other defects.

4 Dimensions and tolerances

4.1 Internal diameter

The internal diameter of the hoses shall be in accordance with the dimensions shown in table 1.

4.2 Concentricity (total indicated reading)

The concentricity of the hose, measured in accordance with ISO 4671, shall be in accordance with the values given in table 1.

4.3 Cut lengths and tolerances

The tolerances for cut lengths shall be in accordance with ISO 1307.

1) To be published. (Revision of ISO 1746:1983)
2) To be published. (Revision of ISO 1817:1985)
3) To be published. (Revision of ISO 4671:1984)

Table 1 — Nominal bores, internal diameters, tolerances and concentricity

Nominal bore	Internal diameter (mm)	Tolerance (mm)	Concentricity max. (mm)
4	4	± 0,55	1
5	5		
6,3	6,3		
8	8	± 0,65	1,25
10	10		
12,5	12,5	± 0,7	
16	16		
20	20	± 0,75	1,5
25	25		
32	32	± 1	
40	40	± 1,25	
50	50		

NOTES

1 The tolerances and internal diameters (excluding nominal bore of 20) do not comply with table 1 of ISO 1307:1992.

2 For intermediate dimensions, numbers should be chosen from the R20 series of preferred numbers with tolerances as for the next larger internal diameter shown in table 1.

5 Physical properties of lining and cover

5.1 Tensile strength and elongation at break

The rubber used in the lining and cover shall, when tested in accordance with ISO 37, have a tensile strength and elongation at rupture not less than the values given in table 2.

Table 2 — Tensile strength and elongation at rupture

Rating	Tensile strength MPa	Elongation at break %
lining	5	200
cover	7	250

5.2 Accelerated ageing

After ageing for 7 days at a temperature of 70 °C as described in ISO 188 (air oven), the tensile strength and elongation at rupture of the lining and cover shall not decrease from the values given in table 2 by more than 25 % for the tensile strength and 50 % for elongation at rupture.

5.3 Non-ignition requirement for oxygen hoses

Non-ignition test shall be carried out either according to ISO 11114-3 or annex A. When tested according to ISO 11114-3 the initial conditions should be set at 2 MPa (20 bar) (ambient temperature) and the autogenous ignition temperature should be higher than 150 °C.

When tested by the method described in annex A, three samples of the lining shall remain in the apparatus at a constant temperature of 360 °C to 365 °C for 2 min without ignition.

If more than one of the samples show evidence of ignition in less than 2 min, the hose shall be considered not to comply. If only one sample shows evidence of ignition in less than 2 min, three further samples shall be prepared and tested. If any of the three samples in this second series shows evidence of ignition in less than 2 min, the hose shall be deemed not to comply.

5.4 Resistance to liquids

5.4.1 Resistance to acetone and dimethylformamide (DMF) for acetylene hoses and all fuel gas hoses

A sample of the lining, when immersed in the test solvent at standard laboratory temperature as defined in ISO 471 for 70 h, shall not increase in mass by more than 8 % when calculated in accordance with the method in ISO 1817.

5.4.2 Resistance to -pentane for LPG[4] hoses, MPS[5] hoses and all fuel gas hoses

A sample of the hose lining, when tested as described in annex B, shall show *n*-pentane absorbed not exceeding 15 % and *n*-pentane extractable matter not exceeding 10 %.

4) LPG: Liquefied petroleum gases
5) MPS: Methylacetylene-propadiene-mixtures

6 Requirements

6.1 Hydrostatic requirements

The hose, when tested in accordance with ISO 1402, shall meet the requirements of table 3.

Table 3 — Hydrostatic requirements

Rating	Light duty	Normal duty
nominal bore	⩽ 6,3	all sizes
maximum design working pressure	1 MPa (10 bar)	2 MPa (20 bar)
proof pressure	2 MPa (20 bar)	4 MPa (40 bar)
minimum burst pressure	3 MPa (30 bar)	6 MPa (60 bar)
change in length at maximum design working pressure	± 5 %	
change in diameter at maximum design working pressure	± 10 %	

6.2 Adhesion

When tested in accordance with ISO 8033 using the type 2 or type 4 test piece, the minimum adhesion between adjacent components shall be 1,5 kN/m.

6.3 Flexibility

When tested in accordance with ISO 1746 at standard laboratory temperature as defined in ISO 471 using a diameter of curvature, C, of ten times the internal diameter (with a minimum of 80 mm), and a coefficient of deformation, K, of not less than 0,8, there shall be no kink in the curved portion of the hose.

6.4 Low-temperature flexibility

When tested in accordance with ISO 4672:1997, method B, at (– 25 ± 2) °C, using a diameter of curvature of ten times the internal diameter (with a minimum of 80 mm), the hose shall show no signs of leaks when subjected to the proof pressure (carried out at ambient temperature) stated in table 3.

6.5 Resistance to incandescent particles and hot surfaces

The cover of the hose shall have sufficient resistance to contact with incandescent particles and hot surfaces. To meet this requirement, the test piece shall resist for 60 s the test conditions given in annex C, without leaking.

6.6 Ozone resistance

When tested in accordance with ISO 7326:1991, method 1, the cover, under two times magnification, shall show no evidence of cracking.

6.7 Permeability to gas for LPG hoses, MPS hoses and all fuel gas hoses

When tested in accordance with ISO 4080 using a test gas of 95 % propylene at cylinder pressure [approximately 0,6 MPa (6 bar)] and standard laboratory temperature of 23 °C as defined in ISO 471 the gas permeance shall not exceed 25 cm^3/m/h, irrespective of internal diameter.

6.8 Requirements for twin hoses

When using twin hoses, each, or both, of the hoses shall, after separation, conform to this International Standard.

The separation of the hoses shall be commenced by means of a knife. The hoses shall be manually dissociated (with a force between 5 daN and 10 daN) over a length of about 1 000 mm. The starting zone shall be discarded and then each of the hoses thus obtained, shall be submitted to the relevant tests in accordance with this International Standard and shall meet its requirements.

7 Colour identification and marking

7.1 General

The hose cover material shall be coloured throughout and marked as follows.

7.2 Colour identification

In order to identify the gas for which the hose is to be used the hose cover shall be coloured as given in table 4.

Hoses which comply with the requirements given in 5.4.1, 5.4.2 and 6.7 shall be coloured half red and half orange (one side red and one side orange) and can be used with all fuel gases given in table 4.

In the case of twin hoses, each of the individual hoses shall be coloured and marked in accordance with this International Standard.

Table 4 — Colour coding and marking

Gas	Colour of cover
acetylene and other combustible gases [a] (except LPG, MPS, natural gas, methane)	red
oxygen	blue
air, nitrogen, argon, CO_2	black
LPG, MPS, natural gas, methane	orange
all fuel gases (included in this table)	red-orange
[a] The manufacturer shall be consulted on the suitability of the hose for use with hydrogen.	

7.3 Marking

The hose cover shall be continuously and durably marked at least every 1 000 mm with the following information:

– the number of this International Standard, i.e. ISO 3821;

– the maximum design working pressure in MPa and between parentheses in bar;

– the nominal bore;

– the manufacturer's or supplier's mark (in the example given as XYZ);

– the year of manufacture.

EXAMPLE:

ISO 3821 – 2 MPa (20 bar) – 10 – XYZ – 96

Annex A
(normative)

Method of test for non-ignition

A.1 Apparatus

The apparatus shown in figure A.1 is required together with the following.

A.1.1 heating furnace: 350 W, internal dimensions: 150 mm deep by 50 mm diameter.

A.1.2 tubular sliding resistance: 190 Ω to 200 Ω , with screw movement or an auto-transformer with continuously variable output voltage.

A.1.3 calibrated flowmeter for oxygen: 0 to 5 l/min at atmospheric pressure and 15 °C.

A.1.4 nitrogen-filled mercury-in-glass thermometer: suitable for use at 150 mm immersion, graduated from approximately 300 °C to 400 °C in intervals of not more than 5 °C, the graduations to start not less than 200 mm above the bulb.

A.2 Procedure

Insert the ignition test apparatus, in its aluminium foil wrapping, into the electric furnace (A.1.1). The purpose of the aluminium foil is to minimize radiant heat and to obtain a more uniform temperature distribution. Adjust the energy supply to the electric furnace with the variable resistance (A.1.2) or auto-transformer so that a constant temperature of 300 °C to 365 °C is maintained with the oxygen flowing at (2 ± 0,1) l/min.

After cleaning by buffing, cut the sample of rubber lining for test into blocks of 8 mm^3 to 10 mm^3 of which no side shall be less than 1,3 mm nor greater than 2,5 mm.

When the furnace is at constant temperature, remove the sample holder, impale a sample block of the rubber lining under test on the tungsten point and replace the sample holder in the apparatus. It is necessary for this operation to be carried out quickly, so that cooling is reduced to a minimum. The tungsten point should be kept clean and sharp.

Retain the sample in the apparatus for at least 2 min and observe it carefully during this period, for evidence of ignition. Fumes may be observed but this shall not constitute evidence of ignition, which is normally accompanied by a flash and sometimes by a small explosion. When ignition of a sample occurs, the temperature of the apparatus can rise and it is then essential that time be allowed in oreder to permit the temperature to return to the appropriate testing temperature.

Test three samples consecutively.