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

*Matériel de soudage aux gaz — Matériaux utilisés pour le matériel de
soudage aux gaz, coupage et techniques connexes*

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Foreword

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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 9539 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 8, *Equipment for gas welding, cutting and allied processes*.

This second edition cancels and replaces the first edition (ISO 9539:1988) which has been technically revised.

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 which can be found at <http://www.iso.org>.

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1 Scope

This International Standard specifies the general, and some of the special, requirements on materials used for the construction of equipment used in gas welding, cutting and allied processes.

Additional requirements on materials for some equipment are given in other standards. This International Standard is not applicable to materials used for the construction of welding hoses which are specified in ISO 3821.

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

3 General requirements

Materials liable to come into contact with the process gases shall be resistant to the chemical, mechanical and thermal action of these gases under all operating conditions (see for example ISO 11114-1 and ISO 11114-2).

The properties of the materials shall be such that the function for which they are intended can be performed correctly within the temperature range of -20 °C to $+60\text{ °C}$.

Where dissimilar materials are in direct contact, steps shall be taken to prevent corrosion.

4 Specific requirements

4.1 Metallic materials

4.1.1 For use with acetylene and gases with similar chemical properties

Because of the risk of forming explosive acetylides, the copper content of materials liable to come into contact with such gases shall not exceed 70 % (mass fraction). The manufacturer shall not use any procedure resulting in copper enrichment of the surface. Nozzles and necks of blowpipes are an exception to this requirement.

NOTE International and national regulations may require different maximum copper contents than those specified here, but these remain generally within this range. The likelihood of the formation of copper acetylides depends on metallic corrosion and contamination which can be caused by many factors, e.g. moisture.

Metal flame-arresting elements (including sintered metal elements) shall be manufactured from copper-free materials.

Where brazing alloys containing silver and copper are used, the silver content shall not exceed 46 % (mass fraction) and the copper content shall not exceed 37 % (mass fraction). The brazing connection shall be designed and completed in such a way that, as far as practicable, the area where acetylene is liable to come into contact with the brazing alloy will be small and all residues of flux will be removed.

4.1.2 For use with oxygen

Metallic materials for components intended to be used with oxygen shall be selected according to their resistance to ignition and the release of ignition energy.

NOTE 1 Materials that burn in air will burn violently in pure oxygen, and many materials that do not burn in air will do so in pure oxygen, particularly under pressure. Similarly, materials that can be ignited in air require less energy to ignite in oxygen. Many such materials can be ignited by friction at a valve seat or stem packing or by adiabatic compression produced when oxygen at high pressure is rapidly introduced into a system initially at low pressure.

Aluminium or aluminium alloys shall not be used for components whose surfaces come into contact with oxygen at a working pressure greater than 30 bar, except aluminium sealing washers for pressure gauges.

Materials for filters whose surfaces come into contact with gas at cylinder pressure shall be non-inflammable under the conditions of use. The selection of the material of the filter is particularly important to reduce the probability of ignition.

Springs and other moving parts liable to come into contact with oxygen shall be made of materials that resist oxidation and they shall not be coated.

NOTE 2 Plating could come off.

All components in contact with oxygen shall be subjected to appropriate cleaning procedures so that their surfaces do not exceed the following hydrocarbon contamination levels:

- a) for applications in the pressure range of 50 kPa to 3 000 kPa: no greater than 550 mg/m²;
- b) for applications at a pressure greater than 3 000 kPa: no greater than 220 mg/m² and no particles of size > 100 µm.

These requirements shall be met by using either an appropriate method of manufacture or an appropriate cleaning procedure. Compliance shall be checked either by verification of the cleanliness of the components or by validation of the cleaning procedure or the manufacturing process.

NOTE 3 ISO 15001 provides guidance on suitable cleaning procedures.

4.2 Non-metallic materials

4.2.1 Resistance to solvents for non-metallic materials in contact with fuel gases

Non-metallic materials (e.g. those used for seals and lubricants) liable to come into contact with acetylene shall be adequately resistant to the solvents acetone and dimethylformamide (DMF).

Non-metallic materials (e.g. those used for seals and lubricants) liable to come into contact with propane, butane and methylacetylene-propadiene mixtures shall be adequately resistant to *n*-pentane.

For the purposes of this International Standard, the term “adequate resistance” (to solvents) will be taken to mean that the material shall fulfil the following conditions.

- a) The change in mass (resistance to swelling) shall not exceed 15 % and the change in hardness shall not exceed ± 15 IRHD after the material has been stored under the following conditions: (168 ± 2) h (i.e. 7 d) in an atmosphere saturated with solvent vapour (acetone and DMF) or in liquid (*n*-pentane) at (23 ± 2) °C.
- b) A subsequent period in air for (70 ± 2) h at (40 ± 2) °C.
- c) (24 ± 2) h at standard atmosphere 23/50 as specified in ISO 554.

These tests shall be carried out in accordance with ISO 1817.

4.2.2 Resistance to oxygen

4.2.2.1 Resistance to ignition

Ignition resistance in oxygen of non-metallic materials and lubricants shall have been established by an appropriate test procedure.

NOTE This test is described in several standards, e.g. ISO 11114-3.

4.2.2.2 Resistance to ageing

Non-metallic sealing materials for use with air and oxygen shall be capable of withstanding an ageing sensitivity test (e.g. ISO 2440).

4.2.2.3 Cleanliness and lubricants

All components in contact with oxygen shall be free from substances that may react violently with oxygen under normal operating conditions, e.g. hydrocarbon-based solvents, oils, greases and detergents.

Only lubricants suitable for use in oxygen at maximum operating pressure and temperature shall be used.

Bibliography

- [1] ISO 2440, *Flexible and rigid cellular polymeric materials — Accelerated ageing tests*
- [2] ISO 3821, *Gas welding equipment — Rubber hoses for welding, cutting and allied processes*
- [3] ISO 11114-1, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials*
- [4] ISO 11114-2, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials*
- [5] ISO 11114-3, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 3: Autogenous ignition test in oxygen atmosphere*
- [6] ISO 15001, *Anaesthetic and respiratory equipment — Compatibility with oxygen*

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