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Steel sheet and strip for welded gas cylinders

Produit en acier laminé à plat pour bouteilles à gaz soudées

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Contents

Page

Foreword ..... **iv**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **1**

4 Information to be supplied by the purchaser **2**

5 Manufacturing process **2**
5.1 Steelmaking 2
5.2 Delivery condition 2

6 Technical requirements **3**
6.1 Chemical composition 3
6.2 Mechanical properties 4
6.3 Grain size 4
6.4 Weldability 4
6.5 Surface condition and soundness 4
6.6 Dimensions and tolerances 5
6.7 Other requirements 5

7 Inspection **5**
7.1 Types of inspection and inspection documents 5
7.2 Test frequency 6
7.3 Visual inspection 6

8 Sampling **6**

9 Test methods **7**
9.1 Chemical analysis 7
9.2 Tensile test 7
9.3 Impact test 7
9.4 Bend test 7
9.5 Grain size 7
9.6 Non-metallic inclusion 7
9.7 Retests 7

10 Marking **7**

Bibliography **8**

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.

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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, SC 10, *Steel for pressure purposes*.

This second edition cancels and replaces the first edition ISO 4978:1983, which has been technically revised. The following main changes have been made:

- the title has been changed from "flat rolled steel products" to "steel sheet and strip";
- the Scope has been changed from "flat rolled steel products with a thickness up to 6 mm" to "hot-rolled steel sheet and strip with a thickness up to 12 mm";
- the normative references have been updated;
- a new option c) for maximum carbon equivalent value has been added to the list of options for the purchaser in 4.2;
- statements concerning the surface condition under 6.5.1 and internal quality under 6.5.3 have been revised;
- the tables and statements concerning chemical composition, mechanical properties, testing and assessment of non-metallic inclusions have been completely revised or added;
- the Bibliography has been added.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Steel sheet and strip for welded gas cylinders

1 Scope

This document specifies the characteristics of hot-rolled steel sheet and strip with a thickness up to 12 mm inclusive of the non-alloyed steels listed in Table 1, which are intended for welded gas cylinders in accordance with ISO 4706.

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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 404, *Steel and steel products — General technical delivery requirements*

ISO 643, *Steels — Micrographic determination of the apparent grain size*

ISO 4706, *Gas cylinders — Refillable welded steel cylinders — Test pressure 60 bar and below*

ISO 4967:2013, *Steel — Determination of content of non-metallic inclusions — Micrographic method using standard diagrams*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 7438, *Metallic materials — Bend test*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 16160, *Hot-rolled steel sheet products — Dimensional and shape tolerances*

3 Terms and definitions

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

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

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

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

3.1
normalizing rolling
rolling process in which the final deformation process is carried out in a certain temperature range, leading to a material condition equivalent to that obtained after normalizing so that the specified values of the mechanical properties are retained even after normalizing

4 Information to be supplied by the purchaser

4.1 The following information shall be supplied by the purchaser at the time of enquiry and order:

a) the dimensions and tolerances of the product (see 6.6);

b) the steel grade (see Table 1);

c) the inspection procedures and type of the documents required.

4.2 A number of options are specified in this document and are listed below. If the purchaser does not indicate any of these options at the time of enquiry and order, products shall be supplied at the discretion of the manufacturer:

a) heat treatment condition of supply (see 5.2);

b) if a product analysis is required (see 6.1.2 and 9.1.2);

c) maximum carbon equivalent value (see 6.1.3);

d) surface condition of supply (see 6.5);

e) others (see 6.7).

5 Manufacturing process

5.1 Steelmaking

5.1.1 Unless otherwise stated at the time of enquiry and order, the steelmaking process and the deoxidation practice within the provisions of 5.1.2 and 5.1.3 shall be left to the discretion of the manufacturer.

5.1.2 The steel shall be produced by electric or one of the basic oxygen processes. Other steelmaking processes may be used by agreement between the parties concerned. On request, the purchaser shall be informed of the steelmaking process used.

NOTE Other parties include the user, purchaser and manufacturer of the equipment, the producer of the material supplied and the inspection and/or certifying authority.

5.1.3 The deoxidation procedure shall ensure that the steel has acceptable non-aging properties. The steel shall therefore be killed with aluminium so that Al_{sol} is equal to or greater than 0,015 %. However, other elements which, by binding the nitrogen, have a similar effect may also be used instead of, or in addition to, aluminium (see also Table 1).

If the manufacturer intends, however, to supply steels with such additions in contents higher than 0,05 %, this addition shall conform to the restriction given in ISO 4706 for the niobium, titanium and vanadium content.

5.2 Delivery condition

5.2.1 The delivery condition shall be agreed at the time of enquiry and order.

5.2.2 The most usual delivery condition is “hot rolled”. The product may, however, also be delivered in other conditions such as:

— hot rolled and normalized;