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Hot-rolled twin-roll cast steel sheet of commercial quality

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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.

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).

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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*, Subcommittee SC 12, *Continuous mill flat rolled products*.

This second edition cancels and replaces the first edition (ISO 15177:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

- complete editorial revision.

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.

Hot-rolled twin-roll cast steel sheet of commercial quality

1 Scope

This document specifies the requirements for hot-rolled twin-roll cast steel sheet of commercial quality.

The product is intended for applications where the presence of oxide or scale or normal surface imperfections disclosed after removal of oxide or scale are not objectionable. It is not suitable for applications where the surface is of prime importance.

This document does not cover steel sheet that is subjected to subsequent rolling.

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

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

hot-rolled twin-roll cast steel sheet

product resulting from the twin-roll process to obtain the required sheet thickness and tolerances

3.2

hot-rolled descaled steel sheet

hot-rolled steel sheet from which oxide or scale has been removed, commonly by pickling in an acid solution

Note 1 to entry: Descaling can also be performed by mechanical methods, such as grit blasting. Some change in properties can result from descaling.

3.3

skin pass

light cold rolling of the product

Note 1 to entry: The purpose of the skin passing is one or more of the following: to minimize the appearance of coil breaks, stretcher strains and fluting; to control the shape; and to obtain the required surface finish.

Note 2 to entry: Some increase in hardness and some loss in ductility will result from skin passing.

**3.4
mill edge**

normal side edge without any definite contour produced in hot rolling

Note 1 to entry: Mill edges can contain some irregularities, such as cracked or torn edges or thin (feathered) edges.

**3.5
sheared edge**

normal edge obtained by shearing, slitting, or trimming a mill edge product

Note 1 to entry: Normal processing does not necessarily provide a definite position of the slitting burr.

**3.6
twin-roll cast steel sheet**

steel sheet produced by casting to near final thickness directly from the liquid metal with minimal hot rolling to achieve the final thickness

**3.7
lot**

up to a specified quantity of steel sheet of the same designation rolled to the same thickness and condition

4 Dimensions

4.1 Hot-rolled twin-roll cast steel sheet is commonly produced in thicknesses from 0,7 mm to 2,0 mm inclusive and in widths of up to 2 000 mm in coils and cut lengths

4.2 Hot-rolled twin-roll cast steel sheet less than 600 mm wide, slit from wide sheet, is considered as sheet.

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5 Conditions of manufacture

5.1 Steelmaking

Unless otherwise agreed by the interested parties, the processes used in making the steel and in manufacturing hot-rolled twin-roll cast steel sheet are left to the discretion of the manufacturer. On request, the purchaser shall be informed of the steelmaking process being used.

5.2 Chemical composition

The chemical composition (heat analysis) shall conform to the requirements given in [Tables 1](#) and [2](#).

5.3 Chemical analysis

5.3.1 Heat analysis

An analysis of each heat shall be made by the manufacturer in order to determine conformity with the requirements given in [Tables 1](#) and [2](#). On request, a report of the heat analysis shall be made available to the purchaser or the purchaser's representative. Each of the elements listed in [Tables 1](#) and [2](#) shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium or molybdenum present is less than 0,02 %, the analysis may be reported as "<0,02 %".

5.3.2 Product analysis

A product analysis may be made by the purchaser in order to verify the specified analysis of the product and shall take into consideration any normal heterogeneity. The product analysis tolerances shall be in accordance with [Tables 2](#) and [3](#).

Table 1 — Chemical composition (heat analysis)

Mass fractions, in percent

Base-metal quality		C	Mn	P	S	Si
Designation	Name	max.	max.	max.	max.	
HRA	Commercial	0,15	0,70	0,045	0,035	— ^a

^a "—" indicates that there is no requirement, but the analysis shall be reported.

Table 2 — Limits on additional chemical elements

Mass fractions, in percent

Element	Cu	Ni	Cr	Mo	Nb	V	Ti
	max.	max.	max.	max.	max.	max.	max.
Heat analysis	0,50	0,30	0,30	0,15	0,008	0,008	0,008
Product analysis	0,53	0,33	0,34	0,16	0,018	0,018	0,018

Table 3 — Product analysis tolerances
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Mass fractions, in percent

Element	Maximum of specified element ISO/FDIS 15177	Tolerance over the maximum specified
C	0,15	0,03
Mn	0,70	0,04
P	0,045	0,01
S	0,035	0,01

NOTE The above maximum tolerance is the allowable excess over the requirements of the heat analysis specified in [Table 1](#).

5.4 Mechanical properties

Except where ordered according to an identified part as explained in [5.5](#), the mechanical properties of commercial quality shall be as given in [Table 4](#), where they are determined on test pieces obtained in accordance with the requirements of [Clause 7](#).

Prolonged storage of the sheet can cause a change in the mechanical properties (increase in hardness and a decrease in elongation), leading to a decrease in formability.

Table 4 — Mechanical properties

Base-metal quality		R_m max. MPa	A min. %	
			$e \leq 2$ mm	
Designation	Name		$L_o = 50$ mm	$L_o = 80$ mm
HRA	Commercial	470	20	19

R_m : tensile strength
 A : percentage elongation after fracture
 L_o : gauge length on original test piece
 e : thickness of steel sheet, in millimetre(s)
 NOTE MPa = 1 N/mm²

5.5 Application

Hot-rolled twin-roll cast steel sheet should be identified for fabrication by the name of the part or by the intended application. Proper identification of the part may include visual examination, prints or description, or a combination of these.

5.6 Weldability

This product is normally suitable for welding if appropriate welding conditions are selected. For non-descaled steel, it can be necessary to remove the scale or oxide depending upon the welding method.

5.7 Surface condition

Oxide or scale on hot-rolled twin-rolled cast steel sheet is subject to variations in thickness, adherence and colour. Removal of the oxide or scale by pickling or grit blasting can disclose surface imperfections not readily visible to this operation.

5.8 Oiling

As a deterrent to rusting, a coating of rust preventive oil is usually applied to hot-rolled descaled steel sheet but sheet may be furnished not oiled if required. This oil is not intended as a drawing or forming lubricant and should be easily removable with degreasing chemicals. Upon request, the manufacturer shall advise the purchaser of which type of oil has been used. Hot-rolled descaled steel sheet may be ordered not oiled, if required, in which case the supplier has limited responsibility if oxidation occurs.

5.9 Skin passing

The purchaser shall state whether skin passing is required.

6 Dimensional and shape tolerances

Dimensional and shape tolerances applicable to hot-rolled twin-cast steel sheet shall be as given in ISO 16160. These tolerances also apply to descaled product.

7 Tensile test sampling

One representative sample for the tensile test required in [Tables 4](#) shall be taken from each lot of 50 t or less for shipment.

8 Tensile test

The tensile test shall be carried out in accordance with ISO 6892-1. Transverse test pieces shall be taken midway between the centre and the edge of the sheet as rolled.

9 Retests

9.1 Machining and flaws

If a test piece shows defective machining or develops flaws, it shall be discarded and another test piece shall be substituted.

9.2 Elongation

If the percentage elongation of any test piece is less than that specified in [Table 4](#) and if any part of the fracture is outside the middle half of the gauge length as scribed before the test, the test shall be discarded and a retest shall be carried out.

9.3 Additional tests

If a test does not give the specified results, two additional tests shall be conducted on samples selected at random from the same lot. Both retests shall conform to the requirements of this document; otherwise the lot shall be rejected.

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10 Resubmission

10.1 The manufacturer has the right to resubmit, for acceptance, the products that have been rejected during earlier inspection because of unsatisfactory properties after the rejected products have been subjected to a suitable treatment (e.g. selection, heat treatment, etc.) which, on request, will be indicated to the purchaser. In this case, the tests shall be carried out as if they applied to a new lot.

10.2 The manufacturer shall have the right to subject the rejected products to a new examination for conformity with the requirements for another quality.

11 Workmanship

11.1 The surface condition shall be that normally obtained on a hot-rolled twin-roll cast product or hot-rolled descaled product.

11.2 The steel sheet in cut lengths shall be free from amounts of laminations, surface flaws and other imperfections that are detrimental to subsequent appropriate processing.

11.3 Processing for shipment in coils does not afford the manufacturer an opportunity to observe readily, or to remove, defective portions; however, this is possible with the cut-length product. However, this does not relieve the manufacturer of responsibility to provide a product that meets the requirement for surface condition that is normally obtained on a hot-rolled twin-roll cast product or hot-rolled twin-roll cast descaled product.

12 Inspection and acceptance

12.1 Although not usually required for products covered by this document, when the purchaser specifies that inspection and tests for acceptance shall be observed prior to shipment from the manufacturer's

works, the manufacturer shall afford the purchaser's inspector all reasonable facilities to determine that the steel is being furnished in accordance with this document.

12.2 Steel that is reported to be defective after arrival at the user's works shall be set aside, properly and correctly identified and adequately protected. The supplier shall be notified in order that the reported nonconforming material can be properly investigated.

13 Coil size

When steel sheet in accordance with this document is ordered in coils, a minimum or range of acceptable inside diameter(s) (ID) shall be specified. In addition, the maximum outside diameter (OD) and the maximum acceptable coil mass shall be specified.

14 Marking

Unless otherwise stated, the following minimum requirements for identifying the steel sheet shall be legibly stencilled on the top of each lift or shown on a tag attached to each coil or shipping unit:

- a) the manufacturer's name or identifying brand;
- b) a reference to this document, i.e. ISO 15177:—;
- c) the quality (designation and name);
- d) the order number;
- e) the product dimensions;
- f) the lot number;
- g) the mass;
- h) the coil or bundle number.

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15 Information to be supplied by the purchaser

To specify requirements adequately according to this document, enquiries and orders shall include the following information:

- a) a reference to this document, i.e. ISO 15177:—;
- b) the name and quality of the material (e.g. steel sheet, hot-rolled twin-roll cast, of commercial quality);
- c) dimensions:
 - for cut lengths, thickness width, length and bundle mass and the total quantity required;
 - for coils, thickness width, minimum or range of inside diameter, outside diameter, and the maximum acceptable coil mass, and the quantity required.
- d) the application (name of part), if possible (see [5.5](#));
- e) whether pickling or descaling by grit or shot blasting is required (see [3.2](#)); material so specified shall be oiled, unless upon ordering it is specified as not oiled) (see [5.8](#));
- f) the type of edge (mill edge or sheared edge);
- g) whether or not crop ends are required;