BS ISO 15177:2012

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of ISO 15177:2012.

The UK participation in its preparation was entrusted to Technical Committee ISE/109, Coated and Uncoated Flat Products to be Used for Cold Forming.

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISBN 978 0 580 72827 3

ICS 77.140.50

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2012.

Amendments issued since publication

Date	Text affected

BS ISO 15177:2012

INTERNATIONAL STANDARD

ISO 15177

First edition
2012-03-15

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

Tôles en acier de qualité commerciale laminées à chaud par coulée entre cylindres

Reference number
ISO 15177:2012(E)

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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Published in Switzerland

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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.

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 15177 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

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

1 Scope

This International Standard specifies the characteristics of hot-rolled twin-roll cast carbon steel sheet of commercial quality produced by the twin-roll cast process. Hot-rolled twin-roll cast steel sheet is suitable for many 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.

NOTE A steel sheet that is subjected to subsequent re-rolling is not covered by this International Standard.

Commercial quality twin-roll cast steel sheet is intended for general fabrication purposes where sheet is used in the flat condition or for bending, moderate forming and welding operations.

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 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.

3.1
hot-rolled descaled steel sheet
hot-rolled steel sheet from which oxide or scale has been removed, commonly by pickling in an acid solution or by appropriate mechanical means such as grit blasting

NOTE Some changes in properties can result from descaling.

3.2
skin pass
light cold rolling of hot-rolled steel sheet or hot-rolled descaled steel sheet

3.3
mill edge
normal side edge without any definite contour produced in hot rolling

NOTE Mill edges may contain some irregularities, such as cracked or torn edges or thin (feathered) edges.

3.4
sheared edge
normal edge obtained by shearing, slitting or trimming a mill edge product

NOTE Normal processing does not necessarily provide a definite positioning of the slitting.

3.5
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

3.6
breakage allowance
agreed-upon level of acceptable breakage not subject to claim

4 Thickness

4.1 Hot-rolled twin-roll cast sheet of commercial quality sheet is produced in thicknesses of 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 sheets less than 600 mm wide may be slit from wide sheets and may be considered sheets.

5 Other information

5.1 Some increase in hardness and some loss of ductility may result from descaling if mechanical means, such as grit blasting are used.

5.2 The purchaser should state whether descaling is required.

6 Surface characteristics

6.1 Surface condition

The sheets shall not have slivers, seams, cracks or scratches, which can adversely affect their use. Also, oxide or scale on hot-rolled steel sheet is subject to variations in thickness, adherence and colour. Removal of the oxide or scale by pickling or blast cleaning can disclose surface imperfections not readily visible prior to this operation. Furthermore, after drawing, imperfections, which were not apparent in the flat sheet, can be visible.

Pores, small pits, small marks, scratches, kinks from pay-off reels and slight coloration are permitted. Defects shall not be of such an extent that they run the risk of causing failure or damage to tooling or of creating welding difficulties.

In the case of delivery of coil and slit coil, the percentage of defects can be greater than in the case of delivery in sheet or cut lengths. The purchaser should take this into account and the percentage of admissible surface defects may be agreed upon at the time of the enquiry and order. Unless otherwise agreed, a single surface of the product shall comply with the specified requirements. The other surface shall be such that, during subsequent treatment, it does not have a deleterious effect on the better surface.

6.2 Skin passing

The purpose of skin passing is one or more of the following:

a) to minimize, temporarily, the appearance of coil breaks, stretcher strains (Luder's lines) or fluting during the fabrication of finished parts;

b) to obtain the required surface finish suitable for ordinary decorative painting;

c) to control the shape.

NOTE Some increase in hardness and some loss in ductility can result from skin passing. It is the responsibility of the purchaser to state whether or not skin passing is required.

6.3 Oiling

As a deterrent to rusting, a coating of rust-preventative oil is usually applied to hot-rolled descaled twin-roll cast steel sheet, but 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. On request, the manufacturer shall advise the purchaser which type of oil has been used. Hot-rolled-descaled twin-roll cast steel sheet may be ordered not oiled, if required; in which case, the supplier has limited responsibility if oxidation occurs.

7 Conditions of manufacture

7.1 Steelmaking

The processes used in making the steel are left to the discretion of the manufacturer. On request, the purchaser shall be informed of the steel-making process being used.

7.2 Chemical composition

The chemical composition (heat analysis) shall not exceed the values given in Tables 1 and 2.

Table 1 — Chemical composition — Heat analysis

Mass fractions in per cent

Desig-nation	Quality	C max.	Mn max.	P max.	S max.	Si[a]
HRA	Commercial	0,15	0,70	0,045	0,035	–
[a] In this table, "–" indicates that there is no requirement, but the analysis shall be reported.						

Table 2 — Limits on additional chemical elements

Mass fractions in per cent

Element	Cu max.	Ni max.	Cr max.	Mo max.	Nb max.	V max.	Ti 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
NOTE Each of the elements listed in this table shall be included in the report of the heat analysis. Where the amount of copper, nickel, chromium or molybdenum present is less than 0,02 %, the analysis shall be reported as < 0,02 %.							

7.3 Chemical analysis

7.3.1 Heat analysis

An analysis of each heat of steel shall be made by the manufacturer to determine compliance with the requirements of Tables 1 and 2. If requested, this analysis shall be reported to the purchaser or his/her representative.

7.3.2 Product analysis

A product analysis may be made by the purchaser to verify the specified analysis of the semi-finished or finished steel. The product analysis tolerances shall be in accordance with Table 3.

Table 3 — Product analysis tolerances

Element	Maximum of specified element %	Tolerance over the maximum specified %
Carbon	≤ 0,15	0,03
Manganese	≤ 0,70	0,04
Phosphorus	≤ 0,045	0,01
Sulfur	≤ 0,035	0,01
NOTE The maximum tolerance in this table is the allowable excess over the specified requirement and not the heat analysis.		

7.4 Weldability

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

7.5 Application

It is desirable that hot-rolled twin-roll cast steel sheet be identified for fabrication by the name of the part or by the intended application. Hot-rolled twin-roll cast commercial quality steel sheet (HRA) may be produced to make an identified part within a properly established breakage allowance, which shall be previously agreed between the manufacturer and the purchaser. In this case, the part name, the details of fabrication and special requirements shall be specified, and the mechanical properties in Table 4 do not apply.

7.6 Mechanical properties

Except where ordered according to an identified part as explained in 7.5, 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 9. 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 property requirements for hot-rolled twin-roll cast commercial-quality carbon steel sheet

Designation	Name	R_m max.	A min., % $e \leq 2$	
		MPa	$L_o = 50$ mm	$L_o = 80$ mm
HRA	Commercial	470	20	19
R_m tensile strength				
a percentage elongation after fracture				
L_o gauge length of original test piece				
e thickness of steel sheet, in millimetres				
1 MPa = 1 N/mm^2.				

8 Dimensional tolerances

Dimensional and shape tolerances applicable to hot-rolled steel sheet shall be as given in ISO 16160.

Restricted thickness tolerances are given in ISO 16160.

9 Tensile test sampling

One representative sample for the tensile test in Table 4, where specified, shall be taken from each lot of sheet for shipment. A lot consists of 50 t, or less, of sheet of the same designation rolled to the same thickness and condition.

10 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.

11 Retests

11.1 Machining and flaws

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

11.2 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.

11.3 Additional tests

If a test does not give the specified results, two additional tests shall be carried out at random on the same lot. Both retests shall conform to the requirements of this International Standard; otherwise, the lot may be rejected.

12 Resubmission

The manufacturer may resubmit, for acceptance, the products that have been rejected during earlier inspection because of unsatisfactory properties after he/she has subjected them to a suitable treatment, for example selection and heat treatment, which, on request, shall be indicated to the purchaser. In this case, the tests shall be carried out as if they applied to a new batch.

The manufacturer has the right to subject the rejected products to a new examination for compliance with the requirements for another grade.

13 Workmanship

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

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

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; quality shall be approved by the manufacturer.

14 Inspection and acceptance

While not usually required for products covered by this International Standard, if the purchaser specifies that inspection and tests for acceptance be observed prior to shipment from the manufacturer's works, the manufacturer shall provide the purchaser's inspector with all reasonable facilities to determine that the steel is being furnished in accordance with this International Standard.

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 he/she may properly investigate.

15 Coil size

Where hot-rolled twin-roll cast steel sheet is ordered in coils, a minimum inside diameter (ID) or a range of acceptable inside diameters shall be specified. In addition, the maximum outside diameter (OD) and maximum acceptable coil mass shall be specified.

16 Marking

Unless otherwise stated, the following minimum requirements for identifying the steel 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 International Standard, i.e. ISO 15177:2012;

c) the quality designation (commercial);

d) the order number;

e) the product dimensions;

f) the lot number;

g) the mass;

h) the bundle/coil number;

i) the heat/lot number;

j) the production date.

17 Information to be supplied by the purchaser

The following information shall be supplied by the purchaser:

a) a reference to this International Standard, i.e. ISO 15177:2012;

b) the name and quality of the material, for example hot-rolled twin-roll cast steel sheet, commercial quality, designation HRA;

c) the dimensions of the product and the quantity required;

d) the application (name of part), if possible (see 7.5);

e) whether pickling or descaling by grit or shot blasting is required (material so specified shall be oiled, unless ordered not oiled) (see 5.1);

f) the type of edge (see 3.3 or 3.4);

g) whether or not skin passing is required (see 6.2);

h) the type of oil for descaled steel, if required;

i) the report of heat analysis and/or mechanical properties, if required (see 7.3.1);

j) limitations on mass and dimensions of individual coils and bundles, if applicable (see Clause 15);

k) inspection and tests for acceptance prior to shipment from the manufacturer's works, if required (see Clause 14).

NOTE The following is a typical ordering description:

ISO 15177:2012, hot-rolled twin-roll cast steel sheet, commercial quality, designation HRA, 1.5 mm × 1 200 mm × 2 440 mm, 10 000 kg, to be used for warehouse resale, edge trimmed, report of heat analysis required, maximum lift mass 4 000 kg.

Bibliography

[1] ASTM A1039/A1039M-10, *Standard Specification for Steel, Sheet, Hot-Rolled, Carbon, Commercial, Structural, and High-Strength Low-Alloy, Produced by the Twin-Roll Casting Process*[1)]

1) This document is recognized by ISO/TC 17/SC 12 to cover a subject similar to that of this International Standard. This information is given for the convenience of users of this International Standard and constitutes neither an endorsement of the document by ISO/TC 17/SC 12 or ISO, nor a statement regarding its degree of equivalence with this International Standard.

ICS 77.140.50

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

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