

DRAFT INTERNATIONAL STANDARD

ISO/DIS 15177

ISO/TC 17/SC 12

Secretariat: ANSI

Voting begins on:
2019-12-24

Voting terminates on:
2020-03-17

Steel sheet, hot-rolled twin-roll cast, of commercial quality

ICS: 77.140.50

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Reference number
ISO/DIS 15177:2019(E)

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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.

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

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Steel sheet, hot-rolled twin-roll cast, 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 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 This document does not cover steel sheet that is to be 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 terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

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 may 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 hot-rolled steel sheet or hot-rolled descaled steel sheet.

Note 1 to entry: The purpose of the skin pass is to produce a higher degree of surface smoothness and thereby improve the surface appearance. The skin pass also temporarily minimizes the occurrence of a surface condition known as stretcher strain (Lüder's Lines) or fluting during the fabrication of finished parts. The skin pass also controls and improves flatness. Some increase in hardness and loss of 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: to entry: Mill edges may 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 coating 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 widths of up to 2 000 mm maximum in coils and cut lengths.

4.2 Hot-rolled twin-roll cast steel sheet less than 600 mm wide may be slit from wide sheets and may be 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 sheet are left to the discretion of the manufacturer. On request, the purchaser shall be informed of the steel-making 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 compliance 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 normal heterogeneity. The product analysis tolerances shall be in accordance with [Tables 2](#) and [3](#).

Table 1 — Chemical composition — Heat analysis

Mass fractions in per cent

Base-metal quality		C	Mn	P	S	Si ^a
Designation	Name	max	max	max	max	
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	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

Each of the elements listed in this table shall be included in the report of the heat analysis.

Table 3 — Product analysis tolerances
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Mass fractions in per cent

Element	Maximum of specified element	Tolerance over 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 in this table is the allowable excess over the specified requirement and not the heat analysis.

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 property requirements for hot-rolled twin-roll cast carbon steel sheet

Base-metal quality		R_m max MPa	A min, % $e \leq 2$	
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 of original test piece
 e = thickness of steel sheet, in millimetres
 1 MPa = 1 N/mm²

5.5 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. 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 may be necessary to remove the scale or oxide depending upon the welding method. As the carbon increases above 0,15%, spot welding becomes increasingly difficult.

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 might 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 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 [Table 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 any test piece shows defective machining or develop flaws, it shall be discarded and another rest piece substituted.

9.2 Elongation

If the percentage elongation of any test piece is less than that specified in [Tables 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 any 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 International Standard; otherwise the lot shall be rejected.

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10 Resubmission

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10.1 The manufacturer may 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 and heat treatment) which, on request, shall be indicated to the purchaser. In this case, 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 compliance with the requirements for another grade.

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