

INTERNATIONAL
STANDARD

ISO
13887

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**Cold-reduced steel sheet of higher strength
with improved formability**

iTeh STANDARD PREVIEW

*Tôles laminées à froid en acier à limite d'élasticité et aptitude au formage
accrues*
(standards.iteh.ai)

ISO 13887:1995

<https://standards.iteh.ai/catalog/standards/sist/0b9a715c-2bbe-4c24-ab41-30f3d69e594a/iso-13887-1995>



Reference number
ISO 13887:1995(E)

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.

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.

International Standard ISO 13887 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 12, *Continuous mill flat rolled products*.

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Cold-reduced steel sheet of higher strength with improved formability

1 Scope

1.1 This International Standard applies to cold-reduced steel sheet of higher strength in the seven grades listed in table 2. The steel is killed, made according to a fine grain practice and may contain phosphorus up to 0,12 % (*m/m*) maximum in place of microalloying elements. The product is intended for applications where parts are to be fabricated requiring better formability than is provided by normal high yield strength steel sheet. It is suitable for applications where the surface of the sheet is of prime importance. Because of the combination of higher strength and improved formability, it is possible to obtain savings in mass along with better weldability.

1.2 Cold-reduced sheet less than 600 mm wide may be slit from wide sheet and will be considered as sheet.

1.3 This International Standard does not cover steels designated as commercial quality or drawing qualities [covered in ISO 3574¹⁾], or steels of structural quality [covered in ISO 4997²⁾].

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

- 1) ISO 3574:1986, *Cold-reduced carbon steel sheet of commercial and drawing qualities*.
- 2) ISO 4997:1991, *Cold-reduced steel sheet of structural quality*.

Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6892:1984, *Metallic materials — Tensile testing*.

ISO 7438:1985, *Metallic materials — Bend test*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 cold-reduced steel sheet: A product obtained from hot-rolled descaled steel sheet by cold reducing to the required thickness followed by annealing to recrystallize the grain structure.

3.2 microalloying elements: Elements, such as niobium, vanadium, titanium, etc., added singly or in combination to obtain higher strength levels.

4 General information

4.1 Skin pass

A light cold rolling of the product. The purpose of the skin passing is one or more of the following:

- a) to minimize the appearance of coil breaks, stretcher strains and fluting;
- b) to control the shape;
- c) to obtain the required surface finish.

Some increase in hardness and some loss in ductility will result from skin passing.

4.2 Oiling

As a deterrent to rusting, a coating of oil is usually applied to cold-reduced steel sheet but sheet may be furnished not oiled if required. The oil is not intended as a drawing or forming lubricant and should be easily removable with degreasing chemicals.

5 Conditions of manufacture

5.1 Steelmaking

Unless otherwise agreed by the interested parties, the processes used in making the steel and in manufacturing cold-reduced 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 (cast analysis) shall be in accordance with table 1.

Table 1 — Chemical composition (cast analysis), %

Grade	C max.	Mn max.	S max.	Si max.
260Y	0,08	0,60	0,025	0,50
300Y	0,10	0,90	0,025	0,50
340Y	0,11	1,20	0,025	0,50
380Y	0,11	1,20	0,025	0,50
420Y	0,11	1,40	0,025	0,50
490Y	0,16	1,65	0,025	0,60
550Y	0,16	1,65	0,025	0,60

NOTE — These steels may contain one or more micro-alloying elements (such as niobium, titanium, and vanadium) up to a total of 0,22 % (*m/m*) maximum, or phosphorus up to 0,12 % (*m/m*) maximum.

5.3 Chemical analysis

5.3.1 Cast analysis

A cast analysis of each cast of steel shall be made by the manufacturer to determine compliance with the requirements of table 1. When requested at the time of ordering, this analysis shall be reported to the purchaser or his representative.

5.3.2 Verification analysis

A verification analysis may be made by the purchaser to verify the specified analysis of the semi-finished or finished steel and shall take into consideration any normal heterogeneity. The sampling method and deviation limits shall be agreed upon between the interested parties at the time of ordering.

5.4 Weldability

This product is normally suitable for welding if appropriate welding conditions are selected.

5.5 Application

It is desirable that cold-reduced steel sheet be identified for fabrication by the name of the part or by the intended application, which shall be compatible with the grade specified. Proper identification of the part may include visual examination, prints or a description, or a combination of these.

5.6 Mechanical properties

At the time that the steel is made available for shipment, the mechanical properties shall be as stated in table 2, when they are determined on test pieces obtained in accordance with the requirements of clause 8.

5.7 Surface condition

The condition of the surface of cold-reduced steel sheet is not required to be the same for unexposed parts as it is for exposed parts.

Surface condition of sheet for unexposed parts may contain pores, some slight pitting, small markings, light scratches, and a light discoloration. The surface of sheet for exposed parts shall be reasonably free of these conditions. Unless otherwise agreed, only one side is inspected.

5.8 Surface finish

Cold-reduced steel sheet is normally produced in a matt finish, dull in appearance, which is suitable for ordinary decorative painting but is not recommended for electroplating.

NOTE 1 When cold-reduced steel sheet is deformed during fabrication, localized areas may roughen to some degree and such affected portions of the part may require hand finishing to prepare the surface for the intended application.

Table 2 — Mechanical properties

Grade	R_{eL}	R_m	A min. 1)		180° bend mandrel diameter ²⁾
	min. N/mm ²	min. N/mm ²	%		
			$L_o = 50$	$L_o = 80$	
260Y	260	350	28	26	Flat
300Y	300	380	26	24	Flat
340Y	340	410	24	22	Flat
380Y	380	450	22	20	Flat
420Y	420	490	20	18	0,5a
490Y	490	550	16	14	1a
550Y	550	620	12	10	1a

R_{eL} = lower yield strength
 R_m = tensile strength
A = percentage elongation after fracture
 L_o = gauge length on test piece
 a = thickness of bend test piece, in millimetres
1 N/mm² = 1 MPa

1) Use either $L_o = 50$ mm or $L_o = 80$ mm.
2) The bend test is performed only when specified (see 8.2). The bend test radii in this table are for test pieces prepared for laboratory testing. Conditions during fabrication may be more severe and not simulate those during laboratory testing.

6 Dimensional tolerances

Dimensional tolerances applicable to cold-reduced steel sheet of higher strength with improved formability shall be as given in tables 3 to 9.

7 Sampling

7.1 Tensile test

One representative sample for the tensile test required in table 2 shall be taken from each lot of sheet for shipment. A lot consists of 50 tonnes or less of sheet of the same grade rolled to the same thickness and condition.

7.2 Bend test (when specified)

One representative sample for the bend test shall be taken from each lot of sheet for shipment. A lot con-

sists of all sheet of the same grade rolled to the same thickness and condition.

8 Mechanical property tests

8.1 Tensile test

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

8.2 Bend test (when specified)

The bend test piece shall withstand being bent as specified in table 2 and figure 1, without cracking on the outside of the bent portion. The bend test shall be carried out at ambient temperature and as specified in ISO 7438.

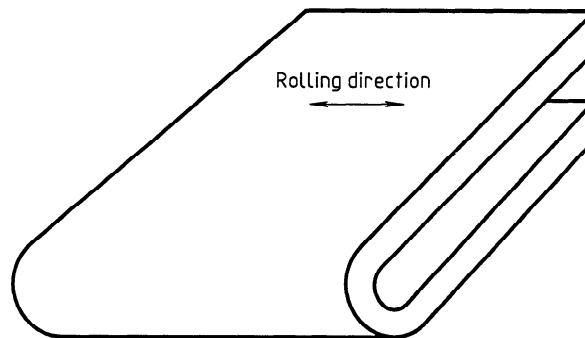


Figure 1 — Transverse bend test piece (after bending)

Table 3 — Thickness tolerances for coils and cut lengths

Values in millimetres

Specified widths	Thickness tolerances ^{1) 2)} over and under, for specified thicknesses								
	up to and including 0,4	over 0,4 up to and including 0,6	over 0,6 up to and including 0,8	over 0,8 up to and including 1,0	over 1,0 up to and including 1,2	over 1,2 up to and including 1,6	over 1,6 up to and including 2,0	over 2,0 up to and including 2,5	over 2,5 up to and including 3,0
600 up to and including 1 200	0,05	0,06	0,08	0,09	0,10	0,12	0,14	0,17	0,20
Over 1 200 up to and including 1 500	0,06	0,07	0,09	0,10	0,11	0,13	0,15	0,18	0,21
Over 1 500	—	0,09	0,10	0,11	0,13	0,15	0,18	0,20	0,23

NOTE — The thickness tolerances for sheets in coil form are the same as for sheets supplied in cut lengths but, in cases where welds are present, the tolerances shall be double those given over a length of 15 m in the vicinity of the weld.

1) Thickness is measured at any point on the sheet not less than 25 mm from a side edge.
 2) For grades 340Y, 380Y, 420Y, 490Y and 550Y, increase the thickness tolerances by 10 % by applying normal rounding-off procedures.

Table 4 — Width tolerances for coils and cut lengths, not required

Values in millimetres

Specified widths	Tolerance ¹⁾
Up to and including 1 200	+5 0
Over 1 200 up to and including 1 500	+7 0
Over 1 500	+9 0

1) Tolerances for sheet over 4 mm thick shall be the subject of agreement.

Table 5 — Length tolerances for cut lengths, not required

Values in millimetres

Specified lengths	Tolerance
Up to and including 3 000	+20 0
Over 3 000 up to and including 6 000	+30 0
Over 6 000	+ 0,5 % × length 0

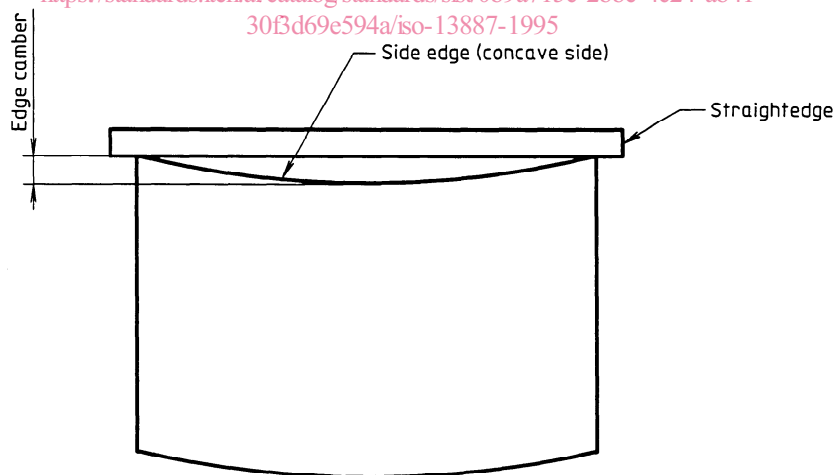
Table 6 — Camber tolerances for coils and cut lengths, not required
(see figure 2)

Form	Camber tolerance
Coils	20 mm in any 5 000 mm length
Cut lengths	0,4 % × length

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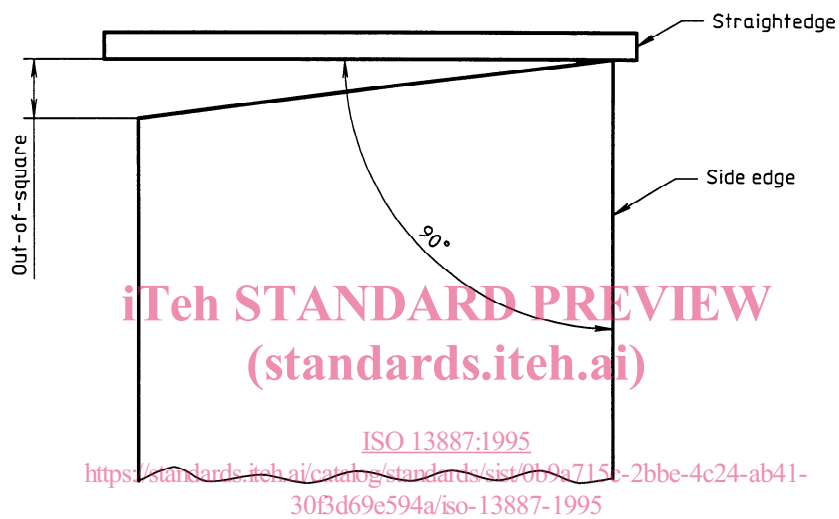


NOTE — Camber is the greatest deviation of a side edge from a straight line, the measurement being taken on the concave side with a straightedge.

Figure 2 — Measurement of camber

Table 7 — Out-of-square tolerance for cut lengths, not resquared
(see figure 3)

Dimensions	Out-of-square tolerance
All thicknesses and all sizes	1,0 % × width



NOTE — Out-of-square is the greatest deviation of an end edge from a straight line at right angles to a side and touching one corner, the measurement being taken as shown in this figure. It can also be measured as one-half the difference between the diagonals of the cut-length sheet.

Figure 3 — Measurement of out-of-square

Table 8 — Out-of-square tolerances for resquared sheet

Values in millimetres

Specified lengths	Specified widths	Out-of-square tolerance
Up to and including 3 000	Up to and including 1 200	+2 0
	Over 1 200	+3 0
Over 3 200	All widths	+3 0

NOTE — When measuring material ordered to resquared tolerances, consideration may have to be given to extreme variations in temperature.

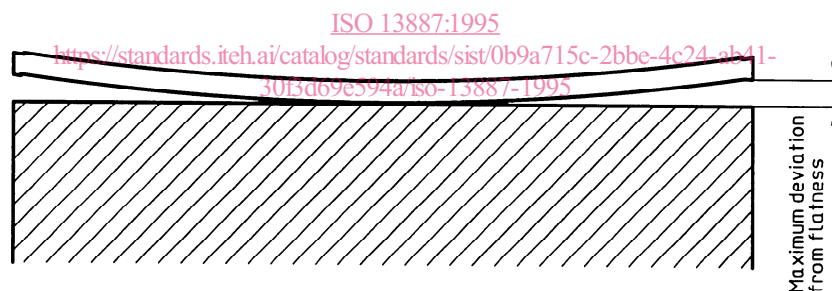
Table 9 — Standard flatness tolerances for cut lengths

Values in millimetres

Specified thicknesses	Specified widths	Flatness tolerance ¹⁾
Up to and including 0,7	Up to and including 1 200	23
	Over 1 200 up to and including 1 500	27
	Over 1 500	33
Over 0,7 up to and including 1,2	Up to and including 1 200	18
	Over 1 200 up to and including 1 500	23
	Over 1 500	29
Over 1,2	Up to and including 1 200	15
	Over 1 200 up to and including 1 500	19
	Over 1 500	26

NOTE — This table also applies to sheet cut to length from coils by the customer when adequate flattening procedures are performed. For grades 340Y, 380Y, 420Y, 490Y and 550, increases the flatness tolerances by 25 %.

1) Maximum deviation from a flat horizontal surface. With the sheet lying under its own weight on a flat surface, the maximum distance between the lower surface of the sheet and the flat horizontal surface is the maximum deviation from flatness (see figure 4).

**Figure 4 — Measurement of flatness**

9 Retests

If a test does not give the specified results, two or more pieces shall be taken at random from the same lot. Both retests shall conform to the requirements of this International Standard; otherwise, the lot shall be rejected.

9.1 Machining and flaws

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

9.2 Additional tests

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

10 Resubmission

10.1 The manufacturer may resubmit for acceptance the products that have been rejected during earlier inspection because of unsatisfactory properties, after he has subjected them to a suitable treat-