INTERNATIONAL STANDARD

ISO 13887

Third edition
2011-11-15

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

Tôles laminées à froid en acier à limite d'élasticité et aptitude au formage accrues

Reference number
ISO 13887:2011(E)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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

This third edition cancels and replaces the second edition (ISO 13887:2004), which has been technically revised.

Introduction

With the combination of higher strength and improved formability derived from the tests outlined in this International Standard, it is possible to obtain savings in mass along with better weldability.

The last two standards listed in the Bibliography may be reviewed for comparison with this International Standard. The relationship between the standards might only be approximate; therefore, the respective standards should be consulted for actual requirements. Those who use these documents will need to determine which specifications address their needs.

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

1 Scope

This International Standard applies to all grades of cold-rolled steel sheet of higher yield strength with improved formability. The steel is made according to fine-grain practice and has a suitable chemical composition, including microalloying elements, to provide improved formability. The product is intended for the fabrication of parts requiring better formability. It is generally used in the delivered condition.

This International Standard is not applicable to steels designated as commercial quality or drawing quality (see ISO 3574), steels of structural quality (see ISO 4997) or steels of high tensile strength and low yield point with improved formability (see ISO 14590).

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 16162, *Continuously cold-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
cold-reduced steel sheet
product obtained from hot-rolled descaled steel sheet by cold-reducing to the required sheet thickness followed by annealing to recrystallize the grain structure

3.2
skin pass
light cold-rolling of the product

NOTE 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 a required surface finish suitable for ordering decorative painting.

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

4 Conditions of manufacture

4.1 Steelmaking

Unless otherwise agreed, 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.

4.2 Chemical composition

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

Table 1 — Chemical analysis (*heat analysis*)

Values expressed as a mass fraction

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 microalloying elements (such as niobium, titanium and vanadium) up to a total of 0,22 % (mass fraction) maximum, or phosphorus up to 0,30 % maximum.				

Table 2 — Limits on additional chemical elements

Values expressed as a mass fraction

Element	Cu[a] % max.	Ni[a] % max.	Cr[ab] % max.	Mo[ab] % max.
Heat analysis	0,20	0,20	0,15	0,06
Product analysis	0,23	0,23	0,19	0,07
Each of the elements listed in this table 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 $< 0{,}02$ %.				
[a] The sum of copper, nickel, chromium and molybdenum shall not exceed 0,50 % on the heat analysis. When one or more of these elements are specified, the sum does not apply, in which case, only the individual limits on the remaining elements will apply.				
[b] The sum of chromium and molybdenum shall not exceed 0,16 % on heat analysis. When one or more of these elements are specified, the sum does not apply, in which case, only the individual limits on the remaining elements will apply.				

4.3 Chemical analysis

4.3.1 General

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

4.3.2 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. When requested at the time of ordering, this analysis shall be reported to the purchaser or his representative.

4.3.3 Product analysis

A product analysis may be made by the purchaser to verify the specified analysis of the product and shall take into consideration any normal heterogeneity. The sampling method shall be agreed upon between the interested parties at the time of ordering. The product analysis tolerances shall be in accordance with Table 3.

Table 3 — Product analysis tolerances

Values expressed as a mass fraction

Element	Content of specified element % max.	Tolerance over maximum specified % max.
C	≤ 0,15	0,03
	> 0,15 to ≤ 0,16	0,04
Mn	≤ 0,60	0,03
	> 0,60 to ≤ 1,15	0,04
	> 1,15 to ≤ 1,65	0,05
S	≤ 0,025	0,01
Si	≤ 0,60	0,05

NOTE The above maximum tolerance is the allowable excess over the specified requirement and not the heat analysis. For example, for Grade 300Y the following product analysis values are within these tolerances: C 0,13 %; Mn 0,94 %; S 0,035 %; and Si 0,55 %.

4.4 Weldability

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

4.5 Application

It is desirable that the specified product 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.

4.6 Mechanical properties

At the time that the steel is made available for shipment, the mechanical properties shall be as stated in Table 4 when they are determined on test pieces obtained in accordance with the requirements of Clause 6.

NOTE Prolonged storage of the sheet can cause a change in the mechanical properties (increase in hardness and a decrease in elongation) leading to an adverse effect on formability.

Table 4 — Mechanical properties

Grade	Yield stress σ_{eL} min. MPa	Tensile strength σ_m min. MPa	Percentage elongation at fracture E % min.	
			Gauge length on test piece $L_0 = 50$ mm	Gauge length on test piece $L_0 = 80$ mm
260Y	260	350	28	26
300Y	300	380	26	24
340Y	340	410	24	22
380Y	380	450	22	20
420Y	420	490	20	18
490Y	490	550	16	14
550Y	550	620	12	10

NOTE 1 MPa = 1 N/mm^2.

4.7 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.

The 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.

4.8 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.

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

4.9 Oiling

As a deterrent to rusting, a coating of oil is usually applied to cold-reduced steel sheet. The oil is not intended as a drawing or forming lubricant and should be easily removable with degreasing chemicals. Cold-reduced steel sheet may be ordered not oiled, if required, in which case the supplier has limited responsibility if oxidation occurs.

5 Dimensional and shape tolerances

Dimensional and shape tolerances shall be as in ISO 16162.

6 Sampling

6.1 Chemical composition

Each heat of steel shall be tested by the manufacturer to determine compliance with the requirements of Tables 1 and 2.

6.2 Tensile test

One representative sample for the tensile test required in Table 1 or 2 shall be taken from each lot of sheet for shipment. A lot consists of 50 t or less of sheet of the same grade rolled to the same thickness and condition.

7 Mechanical property tests — Tensile test

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

8 Retests

8.1 Machining and flaws

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

8.2 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 shall be rejected (see Clause 9).

9 Resubmission

The manufacturer may resubmit for acceptance the products that have been rejected during earlier inspection due to unsatisfactory properties, after the manufacturer has subjected them to suitable treatment (for example, selection or heat treatment). On request, any such treatment shall be indicated to the purchaser. In this case, the tests shall be carried out as if they applied to a new lot.

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

10 Workmanship

The surface condition shall be that normally obtained for this product. The material in cut lengths shall be free from amounts of lamination, surface flaws and other imperfections that are detrimental to the final product or to subsequent appropriate processing. Processing for shipment in coils does not afford the manufacturer the opportunity to observe readily or to remove imperfect portions, as can be done with the cut-length product.

11 Inspection and acceptance

While not usually required for products covered by this International Standard, when the purchaser specifies that inspection and testing for acceptance 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 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 may properly investigate.

12 Coil size

When the product is ordered in coils, a minimum or range of acceptable inside diameter (ID) shall be specified. In addition, the maximum outside diameter (OD) and the maximum acceptable coil mass shall be specified.

13 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 number of this International Standard (i.e. ISO 13887:2011);

b) manufacturer's name or identifying brand;

c) the grade designation number;

d) the purchaser's order number;

e) the product dimensions;

f) the lot number;

g) the mass.

14 Information to be supplied by the purchaser

To meet the requirements of this International Standard, enquiries and orders shall include the following information:

a) the number of this International Standard (i.e. ISO 13887:2011);

b) the grade;

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

d) whether skin passing is required (see 3.2);

e) whether the sheet is to be furnished oiled or not oiled (see 4.9);

f) the report of the heat analysis, if required for Tables 1 and 2 (see 4.3.1);

g) the application (name of part), if possible (see 4.5);

h) the report of the mechanical properties, if required (see 4.6);

i) the type of surface finish (see 4.8);

j) inspection and tests for acceptance prior to shipment from the manufacturer's works, if required (see Clause 11);

k) limitations on mass and dimensions of individual coils and bundles, if applicable (see Clause 12);

l) restricted thickness tolerances, if required (see Clause 5).

A typical ordering description is as follows:

> ISO 13887:2011 cold-reduced steel sheet grade 420Y, 1 mm × 800 mm × 1 800 mm, 40 000 kg, restricted thickness tolerances apply, for part No. 654, Automobile bumper bracket, oiled, furnish report of heat analysis and tensile test, maximum lift mass 4 000 kg.

Bibliography

[1] ISO 3574, *Cold-reduced carbon steel sheet of commercial and drawing qualities*

[2] ISO 4997, *Cold-reduced carbon steel sheet of structural quality*

[3] ISO 14590, *Cold-reduced steel sheet of high tensile strength and low yield point with improved formability*

[4] EN 10149 (all parts), *Hot-rolled flat products made of high yield strength steels for cold forming*

[5] A1008/A1008M[1)], *Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake-Hardenable*

1) This document is recognized by ISO/TC17/SC12 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 TC17/SC12 or ISO, nor a statement regarding its degree of equivalence with this International Standard.

ICS 77.140.50

Price based on 7 pages