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Steel sheet, cold-reduced, 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 13887:2017(E)

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Foreword

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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).

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For an explanation on 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 the following URL: 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 fourth edition cancels and replaces the third edition (ISO 13887:2011), which has been technically revised.

Introduction

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

References [4] and [5] may be reviewed for comparison with this document. 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.

Steel sheet, cold-reduced, of higher yield strength with improved formability

1 Scope

This document is applicable to all grades of cold-reduced steel sheet of higher yield strength with improved formability. The steel is made according to fine-grain practice and has a suitable chemical composition 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 document does not apply 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 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 16162, *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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

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

4 Dimensions

Cold-reduced steel sheet of higher yield strength with improved formability is produced in thicknesses from 0,25 mm to 3,2 mm and in widths of 600 mm and over in coils and cut lengths. Product less than 600 mm wide, slit from wide sheet, will be considered as sheet not strip.

5 Conditions of manufacture

5.1 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.

5.2 Chemical composition

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

Table 1 — Chemical analysis (heat analysis)

Mass fractions in percent

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 of the elements niobium, titanium and vanadium up to a total of 0,22 % maximum, or phosphorus up to 0,30 % maximum.				

Table 2 — Limits on additional chemical elements

Mass fractions in percent

Element	Cu[a] max.	Ni[a] max.	Cr[ab] max.	Mo[ab] max.	Nb[c] max.	V[cd] max.	Ti[c] max.
Heat analysis	0,20	0,20	0,15	0,06	0,008	0,008	0,008
Product analysis	0,23	0,23	0,19	0,07	0,018	0,018	0,018

[a] The sum of copper, nickel, chromium and molybdenum shall not exceed 0,50 % 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 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 apply.

[c] For interstitial free steels only, the value of 0,15 % titanium, and 0,10 % maximum for niobium and vanadium are acceptable to ensure that the carbon and nitrogen are fully stabilized.

[d] Heat analysis greater than 0,008 % may be supplied after agreement between the manufacturer and purchaser.

5.3 Chemical analysis

5.3.1 Heat analysis

An analysis of each heat of steel shall be made by the manufacturer to determine conformity with the requirements of 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 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 3 — Product analysis tolerances

Mass fractions in percent

Element	Maximum of specified element	Tolerance over maximum specified max.
C	C ≤ 0,15	0,03
	0,15 < C ≤ 0,16	0,04
Mn	Mn ≤ 0,60	0,03
	> 0,60 < Mn ≤ 1,15	0,04
	> 1,15 < Mn ≤ 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 %.

5.4 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 Clauses 6 and 7. On request, a report of the mechanical properties shall be made to the purchaser.

NOTE Prolonged storage of the sheet can cause a change in the mechanical properties leading to an adverse effect on formability.

Table 4 — Mechanical properties

Grade	$R_{eL\ min}$ MPa	$R_{m\ min}$ MPa	A min % L_0 = 50 mm	 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

R_{eL} = lower yield strength

R_m = tensile strength

A = percentage elongation after fracture

Lo = gage length of original test piece

NOTE 1 MPa = 1 N/mm²