

Cold rolled steel flat products with high yield strength for cold forming — Technical delivery conditions

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National foreword

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Foreword

This document (EN 10268:2006) has been prepared by Technical Committee ECISS/TC 13 “Flat products for cold working - Qualities, dimensions, tolerances and specific tests”, the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2007, and conflicting national standards shall be withdrawn at the latest by January 2007.

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1 Scope

This European Standard applies to cold rolled uncoated steel flat products for cold forming with high yield strength. The thickness is equal to or less than 3 mm.

These products are delivered in sheet, wide strip, slit wide strip, narrow strip or cut lengths obtained from slit wide strip, narrow strip or sheet.

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.

EN 10002-1, *Metallic materials - Tensile testing - Part 1: Method of test at ambient temperature*

EN 10020:2000, *Definition and classification of grades of steel*

EN 10021:1993, *General technical delivery requirements for steel and iron products*

EN 10027-1, *Designation systems for steels - Part 1: Steel names*

EN 10027-2, *Designation systems for steels - Part 2: Numerical system*

EN 10079:1992, *Definition of steel products*

EN 10130, *Cold rolled low carbon steel flat products for cold forming - Technical delivery conditions*

EN 10131, *Cold rolled uncoated low carbon and high yield strength steel flat products for cold forming - Tolerances on dimensions and shape*

EN 10139, *Cold rolled uncoated mild steel narrow strip for cold forming - Technical delivery conditions*

EN 10140, *Cold rolled narrow steel strip - Tolerances on dimensions and shape*

EN 10204:2004, *Metallic products - Types of inspection documents*

prEN 10325, *Steel - Determination of yield strength increase by the effect of heat treatment (Bake-Hardening-Index)*

EN ISO 377, *Steel and steel products - Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997)*

EN ISO 14284, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*

ISO 10113, *Metallic materials - Sheet and strip - Determination of plastic strain ratio*

ISO 10275, *Metallic materials - Sheet and strip - Determination of tensile strain hardening exponent*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 10020:2000, EN 10021:1993, EN 10079:1992 and EN 10204:2004 and the following apply.

3.1

bake-hardening steels (B)

steels that demonstrate a defined increase in proof strength following heating in the region of 170 °C for 20 minutes

NOTE These steels have a good suitability for cold forming and present a high resistance to plastic straining which is increased on finished parts during the heat treatment. Dent resistance is improved. These steels are often used in car body outer parts.

3.2

rephosphorized steels (P)

steels that contain up to 0,12% P and achieve the required proof strength levels

NOTE These steels present a high mechanical resistance and a good suitability for cold forming due to solid solution hardening by phosphorus. They are used in car body panels and structural components due to their good impact and fatigue resistance properties.

3.3

low alloy / micro-alloyed steels (LA)

steels containing one or more of alloys Nb, Ti and V to achieve required proof strength levels

NOTE Combined precipitation and grain refinement hardening modes allow reaching a high mechanical resistance while reducing the content of alloying elements. Suitability for welding is improved and cold forming is limited. These steels are used in reinforcing structural parts and have good impact and fatigue strengths.

3.4

high strength interstitial free steels (Y)

steels whose composition is controlled to achieve improved plastic strain ratio (r) and strain hardening exponent (n) values

NOTE These steels have both a high mechanical strength and an excellent suitability for cold forming due to their solid solution hardening and interstitial free microstructure. They are used for complex components involving deep drawing processes.

3.5

isotropic steels (I)

steels with limited plastic strain ratio (r) value

NOTE These steels have excellent stretch formability due to their isotropic behaviour. They are used in the automotive industry for bonnets and doors.

4 Designation

The steel names are in compliance with EN 10027-1; the steel numbers with EN 10027-2.

The designation consists of the word "sheet", "cold rolled wide strip", "cold rolled narrow strip", "slit cold rolled wide strip" or "cut length" followed in order by:

- reference to this European Standard EN 10268;
- steel name or the steel number (see Table 1 or Table 2);
- symbol concerning the surface quality (A or B);
- if applicable, the symbol relating to the surface finish.

EXAMPLE 1 Designation of sheet made of steel grade HC260P (1.0417), surface quality A, surface finish normal (m):

Sheet EN 10268-HC260P-A-m
or
Sheet EN 10268-1.0417-A-m.

EXAMPLE 2 Designation of coil made of steel grade HC220B (1.0396), surface quality B, surface finish normal (m):

Coil EN 10268-HC220B-B-m
or
Coil EN 10268-1.0396-B-m.

5 Requirements

5.1 Steelmaking and manufacturing processes

Unless otherwise agreed at the time of enquiry or order, the steelmaking and manufacturing processes are left to the discretion of the manufacturer.

If specified by the purchaser, he or she will be informed of these processes.

5.2 Chemical composition

The chemical composition based on the ladle analysis shall be as given in Table 1.

5.3 Delivery conditions

5.3.1 The products are supplied in the skin-passed condition only.

5.3.2 Usually the products are supplied oiled. In this case, both sides are corrosion protected by a layer of neutral non-drying oil, free of impurities and uniformly spread so that under the normal packing, transportation, loading and storage conditions, there will be no corrosion for up to three months.

The layer of oils shall be capable of being removed by alkaline solutions or usual solvents.

The choice of protective oils may be subject to a special agreement.

If the purchaser does not require the surfaces to be oiled, this shall be clearly indicated at the time of order.

If the conditions of transportation or storage are such that special protection against corrosion is required, the purchaser shall inform the manufacturer at the time of enquiry and order.

NOTE If the order is for un-oiled products, the manufacturer is not responsible for the risk of corrosion. The purchaser is also advised that there is a greater risk of the appearance of light scratches during handling, transportation and application.

Table 1 — Ladle analysis chemical composition

Steel name	Steel number	C max %	Si max %	Mn max %	P max %	S max %	Al min %	Ti max a b %	Nb max a b %
HC180Y	1.0922	0,01	0,3	0,7	0,06	0,025	0,01	0,12	
HC180P	1.0342	0,05	0,4	0,6	0,08	0,025	0,015		
HC180B	1.0395	0,05	0,5	0,7	0,06	0,025	0,015		
HC220Y	1.0925	0,01	0,3	0,9	0,08	0,025	0,01	0,12	
HC220I	1.0346	0,07	0,5	0,5	0,05	0,025	0,015	0,05	
HC220P	1.0397	0,07	0,5	0,7	0,08	0,025	0,015		
HC220B	1.0396	0,06	0,5	0,7	0,08	0,025	0,015		
HC260Y	1.0928	0,01	0,3	1,6	0,1	0,025	0,01	0,12	
HC260I	1.0349	0,07	0,5	0,5	0,05	0,025	0,015	0,05	
HC260P	1.0417	0,08	0,5	0,7	0,1	0,025	0,015		
HC260B	1.0400	0,08	0,5	0,7	0,1	0,025	0,015		
HC260LA	1.0480	0,1	0,5	0,6	0,025	0,025	0,015	0,15	
HC300I	1.0447	0,08	0,5	0,7	0,08	0,025	0,015	0,05	
HC300P	1.0448	0,1	0,5	0,7	0,12	0,025	0,015		
HC300B	1.0444	0,1	0,5	0,7	0,12	0,025	0,015		
HC300LA	1.0489	0,1	0,5	1,0	0,025	0,025	0,015	0,15	0,09
HC340LA	1.0548	0,1	0,5	1,1	0,025	0,025	0,015	0,15	0,09
HC380LA	1.0550	0,1	0,5	1,6	0,025	0,025	0,015	0,15	0,09
HC420LA	1.0556	0,1	0,5	1,6	0,025	0,025	0,015	0,15	0,09
^a These additional elements may be used individually or in combination where they appear in the definition of the steel within the composition limits indicated. Vanadium and boron may also be added. However, the sum of the contents of these four dispersoidal elements shall not exceed 0,22 %.									
^b For all interstitial free (Y) grades, Nb may be added alternatively or in combination with Ti. For all grades containing "I" in its designation, Ti can be substituted by Nb or B.									

5.4 Mechanical properties

The products shall comply with the requirements for transverse test pieces given in Table 2. By agreement, they may be delivered as suitable for making a particular part; in this case a maximum percentage of scrap may be agreed and acceptance on the basis of mechanical properties is not applicable.

The mechanical properties given in Table 2 and Table 3 are valid for a period of at least 6 months from the date on which the products are made available.

By agreement, special formability criteria can be defined between producer and purchaser.

Table 2 — Mechanical properties of transverse test pieces

Steel name	Steel number	0,2% proof strength a	Increase in proof strength after heating b	Tensile strength	Elongation c	Plastic strain ratio	Plastic strain ratio b d e	Strain hardening exponent d
		$R_{p0,2}$ trans. MPa	BH_2 min. trans. MPa	R_m trans. MPa	A_{80} min. trans. %	r max. trans.	r min. trans.	n min. trans.
HC180Y	1.0922	180-230		340-400	36		1,7	0,19
HC180P	1.0342	180-230		280-360	34		1,6	0,17
HC180B	1.0395	180-230	35	300-360	34		1,6	0,17
HC220Y	1.0925	220-270		350-420	34		1,6	0,18
HC220I	1.0346	220-270		300-380	34	1,4		0,18
HC220P	1.0397	220-270		320-400	32		1,3	0,16
HC220B	1.0396	220-270	35	320-400	32		1,5	0,16
HC260Y	1.0928	260-320		380-440	32		1,4	0,17
HC260I	1.0349	260-310		320-400	32	1,4		0,17
HC260P	1.0417	260-320		360-440	29			
HC260B	1.0400	260-320	35	360-440	29			
HC260LA	1.0480	260-330		350-430	26			
HC300I	1.0447	300-350		340-440	30	1,4		0,16
HC300P	1.0448	300-360		400-480	26			
HC300B	1.0444	300-360	35	400-480	26			
HC300LA	1.0489	300-380		380-480	23			
HC340LA	1.0548	340-420		410-510	21			
HC380LA	1.0550	380-480		440-560	19			
HC420LA	1.0556	420-520		470-590	17			
NOTE 1 MPa = 1 N/mm ² .								
a If the yield strength is pronounced, the values apply to the lower yield point (R_{eL}).								
b For thicknesses > 1,2 mm special agreements must be made.								
c When the thickness is less than or equal to 0,7 mm and greater than 0,5 mm, the minimum value for elongation is reduced by 2 units.								
d The minimum values for r (trans.) and n (trans.) only apply to products of thickness equal to or greater than 0,5 mm.								
e For products with thickness over 2 mm the minimum r (trans.) value is reduced by 0,2.								

For the LA grades it may be agreed that the requirements given in Table 3 for longitudinal test pieces shall apply instead of those for transverse test pieces.

Table 3 — Mechanical properties of longitudinal test pieces

Steel name	Steel number	0,2% proof strength ^a $R_{p0,2}$ long. MPa	Tensile strength R_m long. MPa	Elongation ^b A_{80} min. long. %
HC260LA	1.0480	240-310	340-420	27
HC300LA	1.0489	280-360	370-470	24
HC340LA	1.0548	320-410	400-500	22
HC380LA	1.0550	360-460	430-550	20
HC420LA	1.0556	400-500	460-580	18
NOTE 1 MPa = 1 N/mm ² .				
^a If the yield strength is pronounced, the values apply to the lower yield point (R_{eL}).				
^b When the thickness is less than or equal to 0,7 mm and greater than 0,5 mm, the minimum value for elongation is reduced by 2 units.				

5.5 Surface characteristics

5.5.1 General

The surface properties cover surface quality and surface finish.

5.5.2 Surface quality

5.5.2.1 Products of rolled width ≥ 600 mm

The products are supplied with one of the surface qualities A or B as defined in EN 10130 except for LA grades for which only surface quality A applies.

5.5.2.2 Products of rolled width < 600 mm

The requirements of EN 10139 apply.

5.5.3 Surface finish

5.5.3.1 Products of rolled width ≥ 600 mm

The requirements of EN 10130 apply.

5.5.3.2 Products of rolled width < 600 mm

The requirements of EN 10139 apply.

5.6 Suitability for surface coating

The products may be intended for metallic coating applied by hot dipping or electrodeposition and/or organic or other coatings. When such a coating is required, this shall be specified at the time of enquiry and order.

5.7 Weldability

The products are suitable for standard welding processes. However, the welding process should be specified at the time of enquiry and order, especially in the case of gas welding.

5.8 Tolerances on dimensions and shape

The tolerances on dimensions and shape of products in rolled widths ≥ 600 mm are those given in EN 10131; those of products in rolled widths < 600 mm are given in EN 10140.

6 Tests

6.1 General

The purchaser shall specify at the time of enquiry and order his or her requirements for:

- type of inspection and testing, specific or non specific: see EN 10021;
- type of inspection document: see EN 10204.

Specific inspection and testing shall be carried out in accordance with 6.2 to 6.7.

Specific inspection and testing may not be specified either for the product analysis or for the surface finish.

6.2 Inspection units

6.2.1 Products of rolled width ≥ 600 mm

The inspection unit is 30 t or fraction of 30 t for products of the same quality and nominal thickness. When a coil exceeds 30 t, it constitutes a single inspection unit, as does its products.

6.2.2 Products of rolled width < 600 mm

The inspection unit is 5 t or a fraction of 5 t of product of the same steel grade, same heat treatment with the same surface properties and same nominal thickness. Coils of mass exceeding 5 t shall be considered as comprising a single inspection unit.

6.3 Number of tests

For each inspection unit, a tensile test and where appropriate, a determination of the plastic strain ratio r and the tensile strain hardening exponent n (see Table 2) in the as-delivered state shall be carried out. In the case of bake hardening steels, further tensile tests shall be carried out (see 6.5.3).

6.4 Sampling

The requirements of EN ISO 377 and EN 10021 are supplemented by the following specific requirements:

- for sheet and cut lengths the selection of products to be tested and the position of the samples in the products is left to the discretion of the inspection representative;
- in the case of wide strip and slit wide strip, the sample should preferably be taken from the outer end.

If the width of the product permits, the test pieces for the tensile test shall be taken transverse to the direction of rolling.

For LA grades, longitudinal tensile test pieces may be agreed on.

6.5 Test methods

6.5.1 The tensile test shall be carried out according EN 10002-1 using type 2 test pieces (initial gauge length $L_0 = 80$ mm, width $b = 20$ mm).

6.5.2 The determination of the plastic strain ratio r and the strain hardening exponent n shall be carried out in accordance with ISO 10113 and ISO 10275.

The strain ratio r and the strain hardening exponent n are determined within the strain range 10% to 20%. As the determination shall be carried out in the range of homogeneous deformation, then if the uniform elongation of the tested material is lower than 20%, values for the upper limit of the strain range of 15% to 20% can be applied.

6.5.3 The determination of the yield strength increase by the effect of heat treatment (Bake-Hardening-Index) shall be carried out in accordance with prEN 10325.

6.6 Chemical analysis

For the determination of the chemical composition, EN ISO 14284 and the corresponding European Standards shall apply.

6.7 Retests

The requirement of EN 10021 shall apply.

6.8 Inspection document

By agreement at the time of enquiry and order an inspection document chosen from those given in European Standard EN 10204 shall be supplied.

7 Marking

7.1 Products of rolled width ≥ 600 mm

Unless otherwise agreed at the time of enquiry and order, marking shall be carried out on the inspected surface by means of easy removable non-corrosive ink. Slit wide strip products are not marked unless otherwise agreed at the time of enquiry and order.

7.2 Products of rolled width < 600 mm

Marking of the products in line with the specifications of EN 10021 may be agreed at the time of enquiry and order.

8 Packing

The packing requirements shall be agreed at the time of enquiry and order.

9 Disputes

With regard to any claims and any action arising, EN 10021 shall apply.

10 Information to be supplied by the purchaser at the time of enquiry and order

In order to allow the manufacturer to supply products conforming to this European Standard, the following information shall be provided by the purchaser at the time of enquiry and order:

- a) full designation as given in clause 4;
- b) nominal dimensions, the tolerances according to the dimensional standard and the ordered quantities;
- c) limits on the mass and the sizes of the coils and the individual bundles;
- d) intended application of the products, including surface coatings;
- e) if the products are to be welded, the indication of the method to be used;
- f) if the products are to be supplied as suitable for making a specific part;
- g) if inspection documents are required and their type;
- h) if an external inspection is to be carried out at the manufacturer's works;
- i) if oiling is not required;
- j) if other protective coatings are required;
- k) detailed description of all other special requirements;
- l) any special requirements for packing and marking (e. g. bar coding, see EN 606);
- m) position of the surface of better surface quality.

Bibliography

EN 606, *Bar coding – Transport and handling labels for steel products*

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