BRITISH STANDARD

BS EN
10113-2 : 1993

Incorporating
Corrigendum No. 1

Hot-rolled products in weldable fine grain structural steels

Part 2. Delivery conditions for normalized/normalized rolled steels

The European Standard EN 10113-2:1993 has the status of a British Standard

ICS 77.140.10

Cooperating organizations

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Contents

National foreword

This British Standard has been prepared under the direction of the Iron and Steel Standards Policy Committee and is the English language version of EN 10113-2 : 1993 *Hot-rolled products in weldable fine grain structural steels — Part 2 : Delivery conditions for normalized/normalized rolled steels*, published by the European Committee for Standardization (CEN).

Together with BS EN 10113-1, BS EN 10113-3 and BS EN 10155, it partially supersedes BS 4360 : 1990 which will be withdrawn in due course.

The other Parts of BS EN 10113 are as follows:

BS EN 10113-1 *Hot-rolled products in weldable fine grain structural steels Part 1 : General delivery conditions*

BS EN 10113-3 *Hot rolled products in weldable fine grain structural steels Part 3 : Delivery conditions for thermomechanical rolled steels*

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Summary of pages

This document comprises of a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 8, an inside back cover and a back cover.

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EUROPEAN STANDARD

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EN 10113-2

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Descriptors: Iron and steel products, hot rolled products, structural steels, welded construction, delivery conditions, designation, quality classes, chemical composition, grades : quality, mechanical properties, inspection, tests

Hot-rolled products in weldable fine grain structural steels — Part 2: Delivery conditions for normalized/normalized rolled steels

Produits laminés à chaud en aciers de construction soudable á grains fins
Partie 2: Conditions de livraison des aciers á l'état normalisé/laminage normalisé

Warmgewalzte Erzeugnisse aus schweissgeeigneten Feinkornbaustählen
Teil 2: Lieferbedingungen für normalgeglühte/normalisierend gewalzte Stähle

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been drawn up by ECISS/TC 10 'Structural steel — qualities' whose Secretariat is held by NNI.

This European Standard replaces EURONORM 113-72 *Special quality weldable structural steel grades and quality — General provisions.*

The Technical Committee ECISS/TC 10 met in June 1991 in Brussels and agreed on the text for circulation for formal vote within CEN. The following countries were represented in that meeting: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Spain, Sweden and UK.

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 September 1993, and conflicting national standards shall be withdrawn at the latest by September 1993.

This European Standard has been adopted and in accordance with the CEN/CENELEC Rules, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

Contents

1 Scope

Part 2 of this European Standard, in addition to Part 1, specifies requirements for flat and long products of hot-rolled weldable fine grain structural steel in the normalized delivery condition in the grades and qualities given in table 1 (chemical composition) and tables 3, 4 and 5 (mechanical properties), in thickness $\leq$ 150 mm for grades S275, S355 and S420 and in thickness $\leq$ 100 mm for grade S460.

2 Normative references

The normative references as given in EN 10113 Part 1 shall apply.

3 Definitions

The definitions given in EN 10113 Part 1 shall apply.

4 Information to be supplied by the purchaser

4.1 General

The following information shall be supplied by the purchaser at the time of enquiry and order:

a) details of the product form and relevant quantities;

b) reference to this European Standard;

c) nominal dimensions and tolerances (see **5.1**);

d) the grade and quality of the steel (see tables 1 to 5);

e) the type of inspection document (see **8.8**).

Where no specific choice is made by the purchaser concerning points a), b), c), d) and e) the supplier shall refer back to the purchaser.

4.2 Options

A number of options is specified in clause **11**. In the event that the purchaser does not indicate his wish to implement any of these options, the supplier shall supply in accordance with the basic specification.

5 Dimensions, mass and tolerances

5.1 Dimensions and tolerances

The dimensions and tolerances shall be in accordance with the relevant European Standards and EURONORMS (see **2.2** of EN 10113 Part 1).

5.2 Mass of steel

The mass of steel shall comply with EN 10113 Part 1.

6 Classification of qualities; designation

6.1 Classification of qualities

The steel grades S275 and S355 of Part 2 of this European Standard are non-alloy quality steels and the steel grades S420 and S460 of Part 2 of this European Standard are alloy special steels according to EN 10020.

6.2 Designation

The designation shall be in accordance with EN 10113 Part 1.

Example: Normalized steel with a specified minimum yield strength at ambient temperature of 355 N/mm^2, and with a specified minimum impact value at -50 °C:

Steel EN 10113-2 S355NL

7 Technical requirements

7.1 Steel manufacturing process

The steel manufacturing process shall be in accordance with EN 10113 Part 1.

Option 1.

7.2 Delivery condition

The products shall be supplied normalized or in an equivalent condition obtained by normalizing rolling as defined in clause **3.**

7.3 Chemical composition

7.3.1 The chemical composition determined by ladle analysis shall comply with the specified values of table 1.

7.3.2 The values for permissible deviations of the product analysis from the specified limits of the ladle analysis are as specified in table 1 of EN 10113 Part 1. The manufacturer shall inform the purchaser at the time of the enquiry and order which of the alloying elements appropriate to the steel grade required will be deliberately added to the material to be delivered.

7.3.3 If agreed at the time of the enquiry and order the maximum carbon equivalent values, based on the ladle analysis, given in table 2 shall apply.

Option 2.

7.4 Mechanical properties

7.4.1 *General*

Under the inspection and testing conditions as specified in clause **8** and in the delivery condition as specified in **7.2** as well as after normalizing by heat treatment after delivery the mechanical properties shall comply with the values given in tables 3 and 4.

Table 1. Chemical composition of the ladle analysis for normalized steel

Designation		C max. %	Si max. %	Mn %	P max. %	S max.[1] %	Nb max. %	V max. %	Al total min.[2] %	Ti max. %	Cr max. %	Ni max. %	Mo max. %	Cu max. %	N max. %
According to EN 10027-1 and ECISS IC 10	According to EN 10027-2														
S275N	1.0490	0,18	0,40	0,50 – 1,40	0,035	0,030	0,05	0,05	0,02	0,03	0,30	0,30	0,10	0,35	0,015
S275NL	1.0491	0,16			0,030	0,025									
S355N	1.0545	0,20	0,50	0,90 – 1,65	0,035	0,030	0,05	0,12	0,02	0,03	0,30	0,50	0,10	0,35	0,015
S355NL	1.0546	0,18			0,030	0,025									
S420N	1.8902	0,20	0,60	1,00 – 1,70	0,035	0,030	0,05	0,20	0,02	0,03	0,30	0,80	0,10	0,70[3]	0,025
S420NL	1.8912				0,030	0,025									
S460N	1.8901	0,20	0,60	1,00 – 1,70	0,035	0,030	0,05	0,20	0,02	0,03	0,30	0,80	0,10	0,70[3]	0,025
S460NL	1.8903				0,030	0,025									

[1] For railway applications a maximum S content of 0,007 % may be agreed at the time of enquiry and order for all products with a thickness of ≤ 16 mm. Option 18.
[2] If sufficient N-binding elements are present the minimum total Al content does not apply.
[3] If the Cu content is greater than 0,35 %, then the Ni content shall be at least half the Cu content.

Table 2. Maximum CEV based on the ladle analysis, if agreed at the time of the enquiry and order
Option 2.

Designation		Maximum CEV for nominal product thickness in mm		
According to EN 10027-1 and ECISS IC 10	According to EN 10027-2	≤ 63	> 63 ≤ 100	> 100 ≤ 150
S275N	1.0490	0,40	0,40	0,42
S275NL	1.0491			
S355N	1.0545	0,43	0,45	0,45
S355NL	1.0546			
S420N	1.8902	0,48	0,50	0,52
S420NL	1.8912			
S460N[1)]	1.8901	—	—	—
S460NL[1)]	1.8903			

[1)] At the time of the enquiry and order it may be agreed to use V + Nb + Ti ≤ 0,22 % and Mo + Cr ≤ 0,30 %.

7.4.2 ***Impact test***

The verification of the impact energy value shall be carried out in accordance with EN 10113 Part 1.

Option 4.

Option 5.

7.5 Technological properties

7.5.1 ***Weldability***

Weldability shall be in accordance with EN 10113 Part 1.

7.5.2 ***Formability***

NOTE. Recommendations regarding hot and cold forming are laid down in ECCS IC 2.

7.5.2.1 *Hot forming*

The products shall comply with tables 3 and 4 if hot forming is carried out after delivery (see **7.4.1**).

7.5.2.2 *Cold forming*

7.5.2.2.1 *Flangeability*

If specified at the time of the enquiry and order plate, sheet, strip and wide flats ordered and supplied in the normalized condition with a nominal thickness ≤ 16 mm shall be suitable for flanging without cracking with the following minimum bend radii:

— 2 times the nominal thickness with the axis of the bend in transverse direction and 2,5 times the nominal thickness in longitudinal direction for the steel grades S275 and S355;

— 4 times the nominal thickness with the axis of the bend in transverse direction and 5 times the nominal thickness in longitudinal direction for the steel grades S420 and S460.

Option 11.

7.5.2.2.2 *Roll forming*

If specified at the time of the enquiry and order plate and strip with a nominal thickness ≤ 8 mm shall be suitable for the production of sections through cold rolling (for example according to EURONORM 162), with the same minimum bend radii as given in **7.5.2.2.1**.

Option 12.

NOTE. The products suitable for roll forming are also suitable for the manufacture of cold-finished square and rectangular hollow sections.

7.5.3 ***Other requirements***

7.5.3.1 If specified at the time of the enquiry and order the grades S275 and S355 shall be suitable for hot-dip zinc coating and shall comply with the relevant product quality requirements.

Option 7.

7.5.3.2 If agreed at the time of the enquiry and order the material shall be suitable for slitting of heavy sections.

Option 15.

7.6 Surface finish

The surface finish shall be in accordance with EN 10113 Part 1.

Option 8.

7.7 Internal defects

The internal defects shall be in accordance with EN 10113 Part 1.

Option 13 (for flat products).

Option 16 (for long products).

8 Inspection and testing

8.1 General

The products shall be supplied in accordance with **8.1** of EN 10113 Part 1.

Option 9.

8.2 Sampling

Sampling shall be in accordance with EN 10113 Part 1.

8.3 Test units

8.3.1 The test unit shall contain products of the same form and grade and of the same thickness range as specified in table 3 for the yield strength. For verifying the mechanical properties the following test unit shall apply:

— 40 t or part thereof

8.3.2 If specified at the time of the enquiry and order for flat products the impact test only or the impact test and the tensile test shall be carried out on each parent plate or coil.

Option 19a and 19b.

Table 3. Mechanical properties at ambient temperature for normalized steel

Designation		Mechanical properties[1]								
		Tensile strength R_m for nominal product thickness, in mm		Upper yield strength R_{eH} for nominal product thickness, in mm						Elongation after fracture[2] ($L_o = 5{,}65\sqrt{S_o}$)
According to EN 10027-1 and ECISS IC 10	According to EN 10027-2	≤ 100	> 100 ≤ 150	≤ 16	> 16 ≤ 40	> 40 ≤ 63	> 63 ≤ 80	> 80 ≤ 100	> 100 ≤ 150	
		N/mm²		N/mm² min.						% min.
S275N	1.0490	370 to 510	350 to 480	275	265	255	245	235	225	24
S275NL	1.0491									
S355N	1.0545	470 to 630	450 to 600	355	345	335	325	315	295	22
S355NL	1.0546									
S 420N	1.8902	520 to 680	500 to 660	420	400	390	370	360	340	19
S420NL	1.8912									
S460N	1.8901	550 to 720	—	460	440	430	410	400	—	17
S460NL	1.8903									

[1] For thickness > 100 mm for grade S460 and for thickness > 150 mm for the grades S275, S355 and S420 the values shall be agreed at the time of the enquiry and order. Option 17 (part 2).

[2] For product thickness < 3 mm for which test pieces with a gauge length of $L_o = 80$ mm shall be tested, the values shall be agreed at the time of the enquiry and order.

Table 4. Minimum values of impact energy for impact tests on longitudinal V-notch test pieces for normalized steel

Designation		Minimum values of impact energy in J[1] at test temperature, in °C						
According to EN 10027-1 and ECISS IC 10	According to EN 10027-2	+ 20	0	− 10	− 20	− 30	− 40	− 50
S275N	1.0490							
S355N	1.0545							
S420N	1.8902	55	47	43	40	—	—	—
S460N	1.8901							
S275NL	1.0488							
S355NL	1.0566							
S420NL	1.8912	63	55	51	47	40	31	27
S460NL	1.8903							

[1] For thickness > 100 mm for grade S460 and for thickness > 150 mm for the grades S275, S355 and S420 the values shall be agreed at the time of the enquiry and order.
Option 17 (part 2).

Table 5. Minimum values of impact energy for impact tests on transverse V-notch test pieces for normalized steel, when the impact test on transverse test pieces is agreed at the time of the enquiry and order
Option 5.

Designation		Minimum values of impact energy in J[1] at test temperature, in °C						
According to EN 10027-1 and ECISS IC 10	According to EN 10027-2	+ 20	0	− 10	− 20	− 30	− 40	− 50
S275N	1.0490							
S355N	1.0545							
S420N	1.8902	31	27	24	20	—	—	—
S460N	1.8901							
S275NL	1.0491							
S355NL	1.0546							
S420NL	1.8912	40	34	30	27	23	20	16
S460NL	1.8903							

[1] For thickness > 100 mm for grade S460 and for thickness > 150 mm for the grades S275, S355 and S420 the values shall be agreed at the time of the enquiry and order.
Option 17 (part 2).

8.4 Verification of chemical composition

The verification of the chemical composition shall be in accordance with EN 10113 Part 1.

Option 3.

8.5 Mechanical tests

The mechanical tests shall be in accordance with EN 10113 Part 1.

8.6 Test methods

The test methods shall be in accordance with EN 10113 Part 1.

8.7 Retests and resubmission for testing

The retests and resubmission for testing shall be in accordance with EN 10113 Part 1.

8.8 Inspection documents

The inspection documents shall comply with EN 10113 Part 1.

9 Marking for flat and long products

The marking for flat and long products shall comply with EN 10113 Part 1.

Option 10.

10 Complaints after delivery

The complaints after delivery shall be in accordance with EN 10113 Part 1.

11 Options

11.1 All products

See options 1 to 10 of EN 10113 Part 1.

17) Whether mechanical properties should be specified for thickness > 100 mm for grade S460 and > 150 mm for the grades S275, S355 and S420 (see tables 3, 4 and 5).

18) Whether for railway applications a maximum S content of 0,007 % is required for products with thickness ≤ 16 mm (see table 1).

11.2 Flat products

See options 11 to 14 of EN 10113 Part 1.

19a) Whether the impact test should be carried out on each parent plate or coil (see **8.3.2**).

19b) Whether the impact test and the tensile test should be carried out on each parent plate or coil (see **8.3.2**).

11.3 Long products

See options 15 to 16 of EN 10113 Part 1.

National annex NA (informative)

Committees responsible

The United Kingdom participation in the preparation of this European Standard was entrusted by the Iron and Steel Standards Policy Committee (ISM/-) to Technical Committee ISM/12 upon which the following bodies were represented:

BEAMA Ltd.
British Constructional Steelwork Association Ltd.
British Railways Board
British Steel Industry
Department of Transport
Institution of Structural Engineers
Lloyd's Register of Shipping
National Association of Steel Stockholders
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