



SLOVENSKI STANDARD

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Hladno oblikovani varjeni votli konstrukcijski profili iz nelegiranih in drobnnozrnatih jekel - 1. del: Tehnični dobavni pogoji

Cold formed welded structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions

Kaltgefertigte geschweißte Hohlprofile für den Stahlbau aus unlegierten Baustählen und aus Feinkornbaustählen - Teil 1: Technische Lieferbedingungen

Profils creux de construction soudés formés à froid en aciers non alliés et à grains fins - Partie 1 : Conditions techniques de livraison

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Cold formed welded structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions

Profils creux pour la construction soudés, formés à froid en aciers non alliés et à grains fins - Partie 1 : Conditions techniques de livraison

Kaltgefertigte geschweißte Hohlprofile für den Stahlbau aus unlegierten Baustählen und aus Feinkornbaustählen - Teil 1: Technische Lieferbedingungen

This European Standard was approved by CEN on 16 March 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. 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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Foreword

This European Standard (EN 10219-1:2006) has been prepared by Technical Committee ECISS/TC 10 "Structural steels - Grades and qualities", the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by October 2006, and conflicting national standards shall be withdrawn at the latest by October 2006.

This European Standard supersedes EN 10219-1:1997.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this European Standard.

This standard consists of the following parts under the general title 'Cold formed welded structural hollow sections of non-alloy and fine grain steels':

- Part 1: Technical delivery conditions
- Part 2: Tolerances, dimensions and sectional properties

It forms part of a series of standards on hollow sections together with EN 10210-1 and 2, which are also under revision.

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According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EN 10219-1:2006 (E)**1 Scope**

This part of this European Standard specifies the technical delivery conditions for cold formed welded structural hollow sections of circular, square or rectangular forms and applies to structural hollow sections formed cold without subsequent heat treatment.

Requirements for tolerances, dimensions and sectional properties are contained in EN 10219-2.

NOTE A range of steel grades is specified in this European Standard and the user should select the grade appropriate to the intended use and service conditions. The grades and mechanical properties of the finished hollow sections are compatible with those in EN 10025-2 and EN 10025-3.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 287-1, *Qualification test of welders - Fusion welding - Part 1: Steels*

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 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*

EN 10052:1993, *Vocabulary of heat treatment terms for ferrous products*

EN 10168, *Steel products - Inspection documents - List of information and description*

EN 10204, *Metallic products — Types of inspection documents*

EN 10219-2:2006, *Cold formed welded structural hollow sections of non-alloy and fine grain steels — Part 2: Tolerances, dimensions and sectional properties*

EN 10246-3, *Non-destructive testing of steel tubes — Part 3: Automatic eddy current testing of seamless and welded (except submerged arc welded) steel tubes for the detection of imperfections*

EN 10246-5, *Non-destructive testing of steel tubes — Part 5: Automatic full peripheral magnetic transducer/flux leakage testing of seamless and welded (except submerged arc welded) ferromagnetic steel tubes for the detection of longitudinal imperfections*

EN 10246-8, *Non-destructive testing of steel tubes — Part 8: Automatic ultrasonic testing of the weld seam of electric welded steel tubes for the detection of longitudinal imperfections*

EN 10246-9, *Non-destructive testing of steel tubes — Part 9: Automatic ultrasonic testing of the weld seam of submerged arc-welded steel tubes for the detection of longitudinal and/or transverse imperfections*

EN 10246-10, *Non-destructive testing of steel tubes — Part 10: Radiographic testing of the weld seam of automatic fusion arc welded steel tubes for the detection of imperfections*

EN 10256, *Non-destructive testing of steel tubes - Qualification and competence of level 1 and 2 non-destructive testing personnel*

CR 10261, *ECISS Information Circular 11 – Iron and steel – Review of available methods of chemical analysis*

EN 10266:2003, *Steel tubes, fittings and steel structural hollow sections — Symbols and definitions of terms for use in product standards*

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

EN ISO 643, *Steels — Micrographic determination of the apparent grain size (ISO 643:2003)*

EN ISO 2566-1, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels (ISO 2566-1:1984)*

EN ISO 9001:2000, *Quality management systems — Requirements (ISO 9001:2000)*

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

EN ISO 15607, *Specification and qualification of welding procedures for metallic materials - General rules (ISO 15607:2003)*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials - Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

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3 Terms, definitions and symbols SIST EN 10219-1:2006

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3.1 Terms and definitions

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For the purpose of this European Standard, the following terms and definitions apply in addition to or where different from those in EN 10020:2000, EN 10021:1993, EN 10052:1993 and EN 10266:2003.

3.1.1

cold forming

process where the main forming is done at ambient temperature

3.1.2

normalizing rolling

rolling process in which the final deformation is carried out in a certain temperature range leading to a material condition equivalent to that obtained after normalizing so that the specified values of the mechanical properties are retained even after subsequent normalizing

3.1.3

thermomechanical rolling

rolling process in which the final deformation is carried out in a certain temperature range leading to a material condition with certain properties which cannot be achieved or repeated by heat treatment alone

NOTE 1 Subsequent heating above 580 °C may lower the strength values.

NOTE 2 Thermomechanical rolling, leading to the delivery condition M, can include processes with an accelerated cooling rate, with or without tempering including self-tempering, but excluding direct quenching and quenching and tempering.

3.2 Symbols

For the purposes of this European Standard, the symbols defined in EN 10266:2003 apply.

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4 Classification and designation

4.1 Classification

4.1.1 Within the strength grades of the non-alloy steels given in Annex A, four qualities JR, J0, J2 and K2 are specified. These differ in respect of specified impact requirements, limits on values of various elements, with particular reference to sulfur and phosphorus, and the inspection and testing requirements.

In accordance with the classification system in EN 10020, all steel grades in Annex A are non-alloy quality steels.

4.1.2 Within the strength grades of the fine grain steels given in Annex B, four qualities N, NL, M and ML are specified. These differ in respect of the carbon, sulfur and phosphorus content and low temperature impact properties.

In accordance with the classification system in EN 10020, steel grades S275NH, S275NLH, S355NH and S355NLH are non-alloy quality steels, S460NH, S460NLH, S275MH to S460MH and S275MLH to S460MLH are alloy special steels.

4.2 Designation

4.2.1 For the products covered by this European Standard the steel names are allocated in accordance with EN 10027-1; the steel numbers are allocated in accordance with EN 10027-2.

4.2.2 For non-alloy steel hollow sections the steel designation consists of:

- the number of this European Standard (EN 10219-1);
- the capital letter S for structural steel;
- the indication of the minimum specified yield strength for thicknesses ≤ 16 mm expressed in MPa¹);
- the capital letters JR for the qualities with specified impact properties at room temperature, the characters J0 for the qualities with specified impact properties at 0 °C and the characters J2 or K2 for the qualities with specified impact properties at -20 °C;
- the capital letter H to indicate hollow sections.

EXAMPLE Structural steel (S) with a specified minimum yield strength for thickness not greater than 16 mm of 275 MPa, with a minimum impact energy value of 27 J at 0 °C (J0), hollow section (H):

EN 10219-S275J0H

4.2.3 For fine grain steel structural hollow sections the steel designation consists of:

- the number of this European Standard (EN 10219-1);
- the capital letter S for structural steel;
- the indication of the minimum specified yield strength for thicknesses ≤ 16 mm expressed in MPa;
- the capital letter N to indicate normalized or normalized rolled feedstock material or the capital letter M to indicate thermomechanically rolled feedstock material (see 6.3);
- the capital letter L for the qualities with specified impact properties at -50 °C;
- the capital letter H to indicate hollow sections.

1) 1 MPa = 1 N/mm²

EXAMPLE Structural steel (S) with a specified minimum yield strength for thickness not greater than 16 mm of 355 MPa, normalized fine grain steel feedstock (N), with a minimum impact energy value of 27 J at -50 °C (L), hollow section (H):

EN 10219-S355NLH

5 Information to be obtained by the manufacturer

5.1 Mandatory information

The following information shall be obtained by the manufacturer at the time of enquiry and order:

- a) the quantity (mass or total length);
- b) the type of length, length range or length (see EN 10219-2);
- c) details of the product form:
 - CFCHS = cold formed circular hollow section;
 - CFRHS = cold formed square or rectangular hollow section;
- d) the steel designation (see 4.2);
- e) the dimensions (see EN 10219-2).

5.2 Options

A number of options are specified in this part of this European Standard. These are listed below with appropriate clause references. In the event that the purchaser does not indicate a wish to implement any of these options at the time of enquiry and order, the hollow sections shall be supplied in accordance with the basic specification.

- 1.1 Product analysis (see 6.6.1).
- 1.2 Cr, Cu, Mo, Ni, Ti and V cast analysis contents to be reported (see 6.6.2).
- 1.3 Verification of impact properties for qualities J0 and JR (see 6.7.4).
- 1.4 Suitability for hot dip galvanizing (see 6.8.2).
- 1.5 Weld repairs to the body of non-alloy structural steel hollow sections not permitted (see 6.9.4).
- 1.6 Specific inspection and testing for non-alloy quality grades JR and J0 (see 7.1.1).
- 1.7 Inspection document other than the standard document (see 7.2.2).

5.3 Example of an order

10 t of 8 m to 10 m random length cold finished square hollow sections in accordance with EN 10219, made from non-alloy quality structural steel S355NH, with specified outside dimensions 100 mm × 100 mm and wall thickness of 8 mm, supplied with product analysis (Option 1.1) and suitable for hot dip galvanising (Option 1.4).

10 t, 8-10m Random lengths – CFRHS – EN 10219 – S355NH – 100 x 100 x 8 – Options 1.1, 1.4

6 Requirements

6.1 General

Structural hollow sections of non-alloy steels shall conform to the requirements of Annex A. Structural hollow sections of fine grain steels shall conform to the requirements of Annex B.

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In addition, the general technical delivery requirements specified in EN 10021 shall apply.

6.2 Steel manufacturing process

6.2.1 The steel manufacturing process shall be at the discretion of the steel producer.

6.2.2 For the non-alloy steels given in Annex A, the method of deoxidation shall be as specified in Table A.1.

6.2.3 For the fine grain steels given in Annex B the method of deoxidation shall be as specified in Table B.1 or Table B.2.

6.2.4 The fine grain steels given in Annex B shall have a ferritic grain size equal to or finer than 6 when measured in accordance with EN ISO 643 (see 6.7.3).

6.3 Condition of feedstock material

According to the designation given in the order the following delivery conditions apply for the feedstock material used for the manufacture of cold formed hollow sections:

- as rolled or normalized/normalized rolled (N) for steels of qualities JR, J0, J2 and K2 according to Annex A;
- normalized/normalized rolled (N) for steels of qualities N and NL according to Annex B;
- thermomechanically rolled (M) for steels of quality M and ML according to Annex B.

6.4 Structural hollow section manufacturing process

6.4.1 Structural hollow sections shall be manufactured by electric welding or submerged arc welding without subsequent heat treatment (see 6.5). Hollow sections manufactured by a continuous process shall not include the welds used to join the lengths of strip prior to forming the hollow section, except that for helically welded submerged arc-welded (SAW) hollow sections, such welds shall be permitted when tested in accordance with 9.4.3.

6.4.2 Electric welded hollow sections are normally supplied without trimming the internal weld bead.

6.4.3 All NDT activities shall be carried out by qualified and competent level 1, 2 and/or 3 personnel authorised to operate by the employer.

The qualification shall be in accordance with EN 10256 or, at least, an equivalent to it.

It is recommended that the level 3 personnel be certified in accordance with EN 473 or, at least, an equivalent to it.

The operating authorisation issued by the employer shall be in accordance with a written procedure.

NDT operations shall be authorised by a level 3 NDT individual approved by the employer.

NOTE The definition of levels 1, 2 and 3 can be found in the appropriate standards, e.g. EN 473 and EN 10256.

6.5 Delivery condition

The hollow sections shall be delivered cold formed without subsequent heat treatment except that the weld seam may be in the as welded or heat treated condition.

NOTE For SAW hollow sections above 508 mm outside diameter it may be necessary to perform a warm shaping operation, which does not affect the mechanical properties, in order to meet the out-of-roundness tolerance requirements.

6.6 Chemical composition

6.6.1 The cast analysis reported by the steel producer shall apply and shall conform to the requirements given in Table A.1, Table B.1 or Table B.2.

The maximum carbon equivalent value (CEV) for all grades, based on the cast analyses, given in Table A.2 or Table B.3, shall apply. When determining the CEV the following formula shall be used.

$$CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

Option 1.1 for products supplied with specific inspection and testing, a product analysis shall be reported.

Deviations of the product analysis from the specified limits of the cast analysis shall be in accordance with Table 1.

Table 1 — Permissible deviations of the product analysis from the specified limits of the cast analysis given in Tables A.1, B.1 and B.2

Element	Permissible maximum content in the cast analysis		Permissible deviation of the product analysis from specified limits for the cast analysis	
	% by mass		% by mass	
C ^a	≤ 0,20		+ 0,02	
	> 0,20		+ 0,03	
Si	≤ 0,60		+ 0,05	
Mn	non-alloy	≤ 1,60	+ 0,10	
	fine grain	≤ 1,70	- 0,05 + 0,10	
P	non-alloy	≤ 0,040	+ 0,010	
	fine grain	≤ 0,035	+ 0,005	
S	non-alloy	≤ 0,040	+ 0,010	
	fine grain	≤ 0,030	+ 0,005	
Nb	≤ 0,050		+ 0,010	
V	≤ 0,20		+ 0,02	
Ti	≤ 0,05		+ 0,01	
Cr	≤ 0,30		+ 0,05	
Ni	≤ 0,80		+ 0,05	
Mo	≤ 0,20		+ 0,03	
Cu	≤ 0,35		+ 0,04	
	0,35 < Cu ≤ 0,70		+ 0,07	
N	≤ 0,025		+ 0,002	
Al _{Total}	≥ 0,020		- 0,005	

^a For S235JRH in thicknesses ≤ 16 mm, the permissible deviation = 0,4 % C, and for thicknesses >16 mm and ≤ 40 mm the permissible deviation = 0,05 % C.

6.6.2 For non-alloy steel products supplied with specific inspection and testing the following option may be specified (see 7.1):

Option 1.2 the recording on the inspection certificate of the Cr, Cu, Mo, Ni, Ti and V content (cast analysis).

6.7 Mechanical properties

6.7.1 Under the inspection and testing conditions as specified in Clause 7 and in the delivery condition specified in 6.5, the mechanical properties shall conform to the relevant requirements of Tables A.3, B.4 or B.5.

NOTE Stress relief annealing at more than 580 °C or for over one hour may lead to deterioration of the mechanical properties.

6.7.2 For impact tests, standard V-notch test pieces in accordance with EN 10045-1 shall be used. If the nominal product thickness is not sufficient for the preparation of standard test pieces, the test shall be carried out using test pieces of width less than 10 mm, but not less than 5 mm. The minimum average values given in Tables A.3, B.4 and B.5 shall be reduced in direct proportion of the actual width of the test piece compared to that of the standard test piece.

Impact tests are not required for specified thicknesses < 6 mm.

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6.7.3 For fine grain steel hollow sections in thicknesses which do not permit impact test pieces of width ≥ 5 mm to be taken, the ferritic grain size (see 6.2.4) shall be verified by the method as described in EN ISO 643.

When aluminium is used as the grain refining element, the grain size requirement shall be deemed to be fulfilled if the cast analysis shows the aluminium content to be not less than 0,020 % total aluminium or alternatively 0,015 % soluble aluminium. In these cases, verification of the grain size is not required.

6.7.4 Subject to the limitations of 6.7.2

- a) the impact properties of structural hollow sections of steel qualities J2, K2, M, N, ML and NL shall be verified;
- b) the impact properties of structural hollow sections of steel qualities JR and J0 are not verified unless otherwise specified by the purchaser at the time of enquiry and order.

Option 1.3 for products in qualities JR and J0 supplied with specific inspection and testing (see Option 1.6), the verification of the impact properties is specified.

6.8 Technological properties**6.8.1 Weldability**

The steels specified in this European Standard are weldable. General requirements for welding the products in accordance with this European Standard are given in EN 1011-1 and EN 1011-2.

NOTE 1 When welding these products, as product thickness, strength level and CEV increase, the occurrence of cold cracking in the welded zone forms the main risk. Cold cracking is caused by a combination of the following factors:

- high levels of diffusible hydrogen in the weld metal;
- a brittle structure in the heat affected zone;
- significant tensile stress concentrations in the welded joint.

NOTE 2 By using guidelines, specified for example in EN 1011-1, EN 1011-2 or any other relevant standard, the recommended welding conditions and the various welding ranges for the steel grades can be determined. These will vary depending on the product thickness, the applied welding energy, the design requirements, the electrode efficiency, the welding process and the weld metal properties.

6.8.2 Suitability for hot dip galvanizing

Option 1.4 the products shall be suitable for hot dip galvanizing.

6.9 Surface condition

6.9.1 The hollow sections shall have a smooth surface corresponding to the manufacturing method used; bumps, cavities or shallow longitudinal grooves resulting from the manufacturing process are permissible, provided the remaining thickness is within tolerance.

Surface defects may be removed by the manufacturer by grinding, provided that the thickness of the hollow section after the repair is not less than the minimum permissible thickness in accordance with EN 10219-2.

6.9.2 The ends of the hollow section shall be cut nominally square to the axis of the product.

6.9.3 For both non-alloy and fine grain hollow sections, repair of the weld shall be permitted.

6.9.4 For non-alloy hollow sections, repair of the body by welding shall be permitted unless otherwise specified. The conditions under which, and the extent to which, welding repair to the body may be carried out shall be agreed between the manufacturer and the purchaser.

Option 1.5 repair of the body by welding shall not be carried out.