



# SLOVENSKI STANDARD

## SIST EN 10210-1:2006

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**Vročje izdelani votli profili iz nelegiranih in drobnozrnatih konstrukcijskih jekel - 1. del: Tehnični dobavni pogoji**

Hot finished structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions

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

Profils creux de construction finis a chaud en aciers non alliés et a grains fins - Partie 1 : Conditions techniques de livraison

**Ta slovenski standard je istoveten z: EN 10210-1:2006**

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NORME EUROPÉENNE  
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**EN 10210-1**

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## Hot finished structural hollow sections of non-alloy and fine grain steels - Part 1: Technical delivery conditions

Profils creux pour la construction finis à chaud en aciers non alliés et à grains fins - Partie 1 : Conditions techniques de livraison

Warmgefertigte 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.

CEN members are the national standards bodies of 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.

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## Foreword

This European Standard (EN 10210-1:2006) 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 10210-1:1994.

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 'Hot finished 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 10219-1 and 2, which are also under revision.

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 10210-1:2006 (E)****1 Scope**

This part of this European Standard specifies technical delivery conditions for hot finished hollow sections of circular, square, rectangular or elliptical forms and applies to hollow sections formed hot, with or without subsequent heat treatment, or formed cold with subsequent heat treatment to obtain equivalent metallurgical conditions to those obtained in the hot formed product.

Requirements for tolerances, dimensions and sectional properties are contained in EN 10210-2.

NOTE A range of material grades is specified in this 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 10210-2:2006, *Hot finished 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 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)*

### 3 Terms, definitions and symbols

#### 3.1 Terms and definitions

For the purposes 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

**EN 10210-1:2006 (E)****3.2 Symbols**

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

**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, method of deoxidation, 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, two qualities N and NL 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 and steel grades S420NH, S420NLH, S460NH and S460NLH are alloy special steels.

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**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 10210-1);
- the capital letter S for structural steel;
- the indication of the minimum specified yield strength for thicknesses  $\leq 16$  mm expressed in MPa<sup>1</sup>;
- 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 a 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 10210-S275J0H

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

- number of this European Standard (EN 10210-1);

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<sup>1)</sup> 1 MPa = 1 N/mm<sup>2</sup>



- capital letter S for structural steel;
- indication of the minimum specified yield strength for thicknesses  $\leq 16$  mm expressed in MPa;
- capital letter N to indicate normalized or normalized rolled (see 6.4);
- capital letter L for the qualities with specified impact properties at  $-50$  °C;
- capital letter H to indicate hollow sections.

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

EN 10210-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 10210-2);
- c) details of the product form:

HFCHS = hot finished circular hollow sections  
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HFRRHS = hot finished square or rectangular hollow sections

HFEHS = hot finished elliptical hollow sections;

- d) the steel designation (see 4.2);
- e) the dimensions (see EN 10210-2).

### 5.2 Options

A number of options are specified in Parts 1 and 2 of this European Standard. Those relevant to this part 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 6.5.1).
- 1.2 Cr, Cu, Mo, Ni, Ti and V cast analysis contents to be reported (see 6.5.2).
- 1.3 Verification of impact properties for qualities J0 and JR (see 6.6.4).
- 1.4 Suitability for hot dip galvanizing (see 6.7.2).
- 1.5 Weld repairs to the body of non-alloy structural steel hollow sections not permitted (see 6.8.4).
- 1.6 Specific inspection and testing for non-alloy quality grades JR and J0 (see 7.1.1).

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1.7 Inspection document other than the standard document (see 7.2.2).

1.8 Tensile test in corner region (see 8.2.3.1).

1.9 Impact test in corner region (see 8.2.3.2).

**5.3 Example of an order**

100 t of 12 m exact length hot finished square hollow section in accordance with EN 10210, made from non-alloy quality structural steel S355J0H, with specified outside dimensions 100 mm × 100 mm and wall thickness of 8 mm, supplied with specific inspection and testing (Option 1.6), verified impact properties at 0 °C (Option 1.3):

100 t 12 m Exact length – HFRHS – EN 10210– S355J0H – 100 × 100 × 8 – Options 1.3, 1.6

**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.

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.

**6.3 Structural hollow section manufacturing process**

**6.3.1** Structural hollow sections shall be manufactured by a seamless or by a welding process. Welded 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 as permitted in 9.4.3.

**6.3.2** 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 6.6.3).

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

**6.3.4** 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.

#### 6.4 Delivery condition

The products shall be delivered in the conditions indicated below:

Qualities JR, J0, J2 and K2 — hot finished,

Qualities N and NL — normalized. Normalized includes normalized rolled.

It may be necessary for seamless hollow sections with a wall thickness above 10 mm, or when  $T/D$  is greater than 0,1, to apply accelerated cooling after austenitizing to achieve the intended structure, or liquid quenching and tempering to achieve the specified mechanical properties. The decision shall be left to the discretion of the manufacturer, but shall be stated to the purchaser at the time of enquiry and order. Hollow sections treated in such a way shall be designated:

— for accelerated cooling: by the steel name supplemented by the symbol "+DC";

— for quenching and tempering:

- a) by the steel name supplemented by the symbol "+QT" in the case of non alloy steels;
- b) by a modified steel name for which the letter N is replaced by Q in the case of fine grain steels e.g. S460QLH.

NOTE Cold formed hollow sections with subsequent heat treatment to obtain properties equivalent to those obtained by normalizing rolling are deemed to meet the requirements of this standard.

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#### 6.5 Chemical composition

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

The maximum carbon equivalent value (CEV) for all grades, based on the cast analyses, given in Table A.2 or Table B.2, 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.

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

Element	Permissible maximum content in the cast analysis % by mass	Permissible deviation of the product analysis from specified limits for the cast analysis % by mass
C <sup>a</sup>	≤ 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	≤ 0,060	+ 0,010
V	≤ 0,20	+ 0,02
Ti	≤ 0,03	+ 0,01
Cr	≤ 0,30	+ 0,05
Ni	≤ 0,80	+ 0,05
Mo	≤ 0,10	+ 0,03
Cu	≤ 0,35	+ 0,04
	0,35 < Cu ≤ 0,70	+ 0,07
N	≤ 0,025	+ 0,002
Al <sub>total</sub>	≥ 0,020	− 0,005
<sup>a</sup> For S235JRH in thicknesses ≤ 16 mm, the permissible deviation = 0,04 % C, and for thicknesses > 16 mm and ≤ 40 mm the permissible deviation = 0,05 % C.		

**6.5.2** 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).

## 6.6 Mechanical properties

**6.6.1** Under the inspection and testing conditions as specified in Clause 7 and in the delivery condition as specified in 6.4, the mechanical properties shall conform to the relevant requirements of Table A.3 or Table B.3.

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

**6.6.2** 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 Table A.3 and Table B.3 shall be reduced in direct proportion to 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.

**6.6.3** For fine grain steel hollow sections in thicknesses which do not permit impact test pieces of width  $\geq 5$  mm to be taken, the ferritic grain size (see 6.3.2) 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.

**6.6.4** Subject to the limitations of 6.6.2

a) the impact properties of structural hollow sections of steel qualities J2, K2, N, NL, Q and QL 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.

## 6.7 Technological properties

### 6.7.1 Weldability

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The steels specified in this European Standard are weldable. General requirements for welding of 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.

### 6.7.2 Suitability for hot dip galvanizing

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