



SLOVENSKI STANDARD

oSIST prEN 10210-1:2016

01-februar-2016

Vročje izdelani votli konstrukcijski profili iz jekla - 1. del: Splošno

Hot finished structural steel hollow sections - Part 1: General

Warmgefertigte Hohlprofile für den Stahlbau - Teil 1: Allgemeines

Profils creux de construction finis à chaud en aciers - Partie 1: Généralités

Ta slovenski standard je istoveten z: **prEN 10210-1**

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ICS:

77.140.45	Nelegirana jekla	Non-alloyed steels
77.140.70	Jekleni profili	Steel profiles

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en,fr,de

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 10210-1

January 2016

ICS 77.140.75

Will supersede EN 10210-1:2006

English Version

Hot finished structural steel hollow sections - Part 1: General

Profils creux de construction finis à chaud en aciers -
Partie 1 : Généralités

Warmgefertigte Hohlprofile für den Stahlbau - Teil 1:
Allgemeines

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee ECISS/TC 103.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 10210-1:2016) has been prepared by Technical Committee ECISS/TC 103 “Structural steels other than reinforcements”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 10210-1:2006.

This document 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 Regulation 305/2011.

For relationship with EU Regulation 305/2011, see informative Annex ZA, which is an integral part of this document.

This standard consists of the following parts under the general title 'Hot finished structural steel hollow sections':

- *Part 1: General*
- *Part 2: Technical delivery conditions*
- *Part 3: Tolerances, dimensions and sectional properties*

It forms part of a series of standards on hollow sections together with prEN 10219-1 to prEN 10219-3.

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prEN 10210-1:2016 (E)**1 Scope**

This part of prEN 10210 specifies the product characteristics, test methods and performance criteria for hot-finished seamless, electric welded and submerged arc welded steel structural hollow sections of circular, square, rectangular or elliptical forms.

It applies to hollow sections formed hot, with or without subsequent heat treatment, or formed cold with subsequent heat treatment above 580 °C to obtain equivalent mechanical conditions to those obtained in the hot formed product.

Requirements for the technical delivery conditions are specified in prEN 10210-2 and for tolerances, dimensions and sectional properties in prEN 10210-3.

NOTE 1 prEN 10210-1 covers provision of the Construction Products Regulations (CPR) to fulfil European law for construction products. The technical delivery conditions are described within prEN 10210-2 in combination with Clauses 2, 3, 4, 5, 7 and 8 of prEN 10210-1.

NOTE 2 Seamless and welded hollow sections for offshore structures are covered in EN 10225.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1011-1, *Welding - Recommendations for welding of metallic materials - Part 1: General guidance for arc welding*

EN 1011-2, *Welding - Recommendations for welding of metallic materials - Part 2: Arc welding of ferritic steels*

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

EN 10021:2006, *General technical delivery conditions for steel products*

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

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

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

prEN 10210-2:2016, *Hot finished structural steel hollow sections - Part 2: Technical delivery condition*

prEN 10210-3:2016, *Hot finished structural steel hollow sections - Part 3: Tolerances, dimensions and sectional properties*

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

EN ISO 148-1, *Metallic materials - Charpy pendulum impact test - Part 1: Test method (ISO 148-1)*

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

EN ISO 6892-1, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1)*

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

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply in addition to, or where different, from those in EN 10020:2000, EN 10021:2006, EN 10052:1993 and EN 10266:2003.

3.1.1

hot finished

hollow sections formed hot, with or without subsequent heat treatment, or formed cold with subsequent heat treatment above 580 °C to obtain equivalent metallurgical conditions to those obtained in the hot formed product

3.1.2

cold forming

process where the forming to final shape of the welded hollow section is carried out at ambient temperature

Note 1 to entry: Circular hollow sections produced from normalized strip with a normalized weld seam and with a cold forming ratio of $D/T \geq 20$ may be classified as hot-finished hollow sections.

3.1.3

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

3.1.4

thermomechanical rolling

simultaneously performed forming process and heat treatment in which the final deformation from round to rectangular/square/elliptical hollow sections is carried out in a certain temperature range above 580 °C leading to a material condition with certain properties which cannot be achieved or repeated by heat treatment alone

Note 1 to entry: Thermomechanical rolling leading to the delivery condition M can include processes with an increasing cooling rate with or without tempering including self-tempering but excluding direct quenching and quenching and tempering.

Note 2 to entry: In some publications the word TMCP (Thermomechanical Control Process) is also used.

3.1.5

steel with improved atmospheric corrosion resistance

steel in which a certain number of alloying elements has been added in order to increase its resistance to atmospheric corrosion, by forming an auto-protective oxide layer on the base metal under the influence of weather conditions

Note 1 to entry: Steel with improved atmospheric corrosion resistance is often called weathering steel.

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Note 2 to entry: Additional information for the use of steel with improved atmospheric corrosion resistance is given in prEN 10210-2:2016, Annex E.

3.1.6**quenching and tempering**

process which consists of the following two steps:

- first quenching, where the steel is heated up above AC3 temperature and then rapidly cooled down in liquids to create a process specific grain structure;
- afterwards tempering, during which the steel is heated up to a certain temperature to adjust the desired properties and cooled down in air afterwards

3.1.7**fine grain steel**

steels with fine grain structure with an equivalent index of ferritic grain size ≥ 6

Note 1 to entry: For the determination of grain sizes except for +QT steels, see EN ISO 643.

3.2 Symbols

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

4 Product characteristics

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4.1 Chemical composition (durability)

The chemical composition determined by the cast analysis and reported by the steel producer shall comply to the requirements given in prEN 10210-2:2016, Tables A.1, B.1, C.1, D.1 or E.1.

4.2 Mechanical properties (yield strength, tensile strength, elongation and impact strength)

4.2.1 Under the inspection and testing conditions as specified in prEN 10210-2:2016, Clause 8 and in the delivery condition as specified in prEN 10210-2:2016, 6.5 the mechanical properties of the finished hollow section shall conform to the relevant requirements of prEN 10210-2:2016, Tables A.3, B.3, B.4, C.3, C.4, D.3, D.4 and E.3.

NOTE Any heat treatment at more than 580 °C may lead to a reduction in the mechanical properties of TMCR sections and also hot finished sections not processed in the normalizing temperature range.

4.2.2 For impact tests, standard Charpy-V-notch test pieces in accordance with EN ISO 148-1 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 prEN 10210-2:2016, Tables A.3, B.4, C.4, D.4 and E.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 $\leq 6,3$ mm.

NOTE If a Charpy test is performed at a lower temperature than specified in the standard and the impact energy values obtained meet the requirements at the higher temperature, then the material is deemed to conform to the standard and the test need not be repeated at the higher temperature.

4.3 Weldability

The steels specified in this European Standard are weldable as given in prEN 10210-2:2016, Annexes A to E. General requirements for welding of the products in accordance with this European Standard are given in EN 1011-1 and EN 1011-2.

The maximum carbon equivalent value (CEV) for all grades, based on the cast analyses, given in prEN 10210-2:2016, Tables A.2, B.2, C.2, D.2 and E.2 shall apply.

When determining the CEV, the following formula of the International Institute of Welding (IIW) shall be used:

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

NOTE 1 When welding hollow sections, 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 welding 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.

4.4 Tolerances on dimensions and shape

Tolerances of dimensions and shape shall be as specified in prEN 10210-3.

4.5 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets. In the absence of European harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: <http://ec.europa.eu/enterprise/construction/cpd-ds/>.

5 Testing, assessment and sampling methods

5.1 Chemical composition (durability)

5.1.1 Frequency of tests

For the purpose of FPC (factory production control) the test frequency shall be up to 100 casts per steel grade.

prEN 10210-1:2016 (E)**5.1.2 Selection and preparation of samples for chemical analysis**

The selection and preparation of samples shall be in accordance with EN ISO 14284.

5.1.3 Test method

The elements to be determined and reported shall be those given in prEN 10210-2:2016, Tables A.1, B.1, C.1, D.1 or E.1 for the cast analysis as applicable and those for determining the carbon equivalent value. The choice of a suitable physical or chemical analytical method for the analysis shall be at the discretion of the manufacturer.

5.2 Mechanical properties**5.2.1 Frequency of tests for the mechanical properties**

Mechanical properties are determined by tensile testing (yield strength, tensile strength and elongation) and by impact testing (impact energy).

For the purpose of FPC the test frequency shall be up to 1 000 t per steel grade.

5.2.2 Location and orientation of samples for mechanical tests**5.2.2.1 Tensile test pieces**

The test pieces for tensile testing shall conform to the following:

- a) the test piece may be the full section of the product;
- b) for circular or elliptical sections, not tested in full section, the test pieces shall be taken either longitudinally or transversely, at the discretion of the manufacturer, and, for welded sections, at a point remote from the weld (see Annex A);
- c) for square or rectangular sections, not tested in full section, the test pieces shall be taken either longitudinally or transversely, at the discretion of the manufacturer, midway between the corners, and, for welded sections, from one of the sides not containing the weld (see Annex A).

5.2.2.2 Impact test pieces

Test pieces for impact testing shall conform to the following:

- a) for circular or elliptical sections the test pieces shall be taken either longitudinally or transversely, at the discretion of the manufacturer, and, for welded sections, at a point remote from the weld (see Annex A);
- b) for square or rectangular sections the test pieces shall be taken either longitudinally or transversely, at the discretion of the manufacturer, midway between the corners, and, for welded sections, from one of the sides not containing the weld (see Annex A).

5.2.3 Preparation of test pieces for mechanical tests**5.2.3.1 General**

The requirements of EN ISO 377 shall apply in conjunction with the test piece location specified in 5.2.2.

5.2.3.2 Tensile test pieces

The requirements of EN ISO 6892-1 as appropriate shall apply.

Test pieces may be non-proportional, but in cases of dispute proportional test pieces having a gauge length $L_0 = 5,65 \sqrt{S_0}$ shall be used (see 5.2.4). For thicknesses less than 3 mm, a gauge length of $L_0 = 80$ mm shall be used, provided a test piece width of 20 mm can be achieved, otherwise a gauge length of 50 mm shall be used with a test piece width of 12,5 mm.

5.2.3.3 Impact test pieces

Impact Charpy-V-notch test pieces shall be machined and prepared in accordance with EN ISO 148-1 with the exception that 10 x 2,5 mm test pieces shall not be used. In addition, the following requirements shall apply:

- a) the orientation of the notch is perpendicular to the wall thickness;
- b) for specified thicknesses > 12 mm, standard test pieces shall be machined in such a way that one side is not further away than 2 mm from the outside surface;
- c) for specified thicknesses ≤ 12 mm, when test pieces with reduced sections are used, the width shall be ≥ 5 mm; the largest obtainable width shall be used. If test pieces of width 5 mm cannot be obtained than the material need not be submitted to impact testing.

NOTE Test piece size is dependent on the actual thickness of the sample and, for circular or elliptical hollow sections; allowance also needs to be made for the curvature of the section.

5.2.4 Test methods for mechanical tests

5.2.4.1 Test temperature

Tensile tests shall be carried out in the temperature range 10 °C to 35 °C. Impact tests shall be carried out at the temperatures specified in prEN 10210-2:2016, Table A.3 for non-alloy steels and Tables B.4, C.4, D.4 or E.3 for the other steel grades.

5.2.4.2 Tensile tests

The tensile test shall be carried out in accordance with EN ISO 6892-1.

For the specified yield strengths in prEN 10210-2:2016, Tables A.3, B.3, C.3, D.3 and E.3, the upper yield strength (R_{eH}) shall be determined.

If a distinct yield phenomenon is not present, either the 0,2 % proof strength non-proportional extension ($R_{p0,2}$) or the 0,5 % proof strength total extension ($R_{t0,5}$) shall be determined at the discretion of the manufacturer. In cases of dispute, the 0,2 % proof strength ($R_{p0,2}$) shall apply.

If a non-proportional test piece is used, the percentage elongation value obtained after fracture (A) shall be converted to the value for a gauge length $L_0 = 5,65 \sqrt{S_0}$ using the conversion tables given in EN ISO 2566-1.

For thicknesses less than 3 mm, the percentage elongation may be reported for a gauge length of 80 mm or 50 mm (see 5.2.3.2).

5.2.4.3 Impact tests

The impact test shall be carried out in accordance with EN ISO 148-1 on Charpy-V-notch specimens using the 2 mm striker. In addition, the following requirements shall apply:

- a) The average value of a set of three test pieces shall be equal to or greater than the specified value. One individual value may be below the specified value, provided that it is not less than 70 % of that value;