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Nederlandse norm

NEN-EN 10219-1

(en)

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

Vervangt NEN-EN 10219-1:1998;
NEN-EN 10219-1:2003 Ontw.

ICS 77.140.75; 91.080.10-10

mei 2006

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Nederlands voorwoord

Voor de in deze norm vermelde normatieve verwijzingen bestaan in Nederland de volgende equivalenten:

vermelde norm	Nederlandse norm	titel
EN 287-1	NEN-EN 287-1	Het kwalificeren van lassers - Smeltlassen - Deel 1: Staal (en)
EN 10002-1	NEN-EN 10002-1	Metalen - Trekproef - Deel 1: Beproevingsmethode bij omgevingstemperatuur (en)
EN 10020:2000	NEN-EN 10020:2000	Definitie en indeling van staalsoorten (en,nl)
EN 10021:1993	NEN-EN 10021:1994	Algemene technische leveringsvoorwaarden voor staal en staalprodukten (en,nl)
EN 10027-1	NEN-EN 10027-1	Systemen voor het aanduiden van staalsoorten - Deel 1: Aanduiding met symbolen (en)
EN 10027-2	NEN-EN 10027-2	Systemen voor het aanduiden van staalsoorten - Deel 2: Numeriek systeem (en,nl)
EN 10045-1	NEN-EN 10045-1	Metalen - Kerfslagproef volgens Charpy - Deel 1: Beproevingsmethode (en,nl)
EN 10052:1993	NEN-EN 10052:1994	Termen en definities van de warmtebehandeling van ijzer- en staalprodukten (en,nl)
EN 10168	NEN-EN 10168	Producten van staal - Keuringsdocumenten - Lijst van informatie en omschrijving (en,nl)
EN 10204	NEN-EN 10204	Producten van metaal - Soorten keuringsdocumenten (en)
EN 10219-2:2006	NEN-EN 10219-2	Koudvervaardigde gelaste buisprofielen voor constructiedoeleinden van ongelegeerd en fijnkorrelig staal - Deel 2: Toleranties, afmetingen en profieleigenschappen (en)
EN 10246-3	NEN-EN 10246-3	Niet-destructief onderzoek van stalen buizen - Deel 3: Geautomatiseerd wervelstroomonderzoek van naadloze en gelaste (met uitzondering van onderpoedergelaste) stalen buizen voor het aantonen van onvolkomenheden (en)
EN 10246-5	NEN-EN 10246-5	Niet-destructief onderzoek van stalen buizen - Deel 5: Geautomatiseerd onderzoek met magnetische strooiflux over de gehele omtrek van naadloze en gelaste (met uitzondering van onderpoedergelaste) ferromagnetische stalen buizen voor het aantonen van onvolkomenheden in de lengterichting (en)
EN 10246-8	NEN-EN 10246-8	Niet-destructief onderzoek van stalen buizen - Deel 8: Geautomatiseerd ultrasoon onderzoek van de las van weerstandgelaste stalen buizen voor het aantonen van onvolkomenheden in de lengterichting (en)
EN 10246-9	NEN-EN 10246-9	Niet-destructief onderzoek van stalen buizen - Deel 9: Geautomatiseerd ultrasoon onderzoek van de las van onderpoedergelaste stalen buizen voor het aantonen van onvolkomenheden in de lengte- en/of omtreksrichting (en)
EN 10246-10	NEN-EN 10246-10	Niet-destructief onderzoek van stalen buizen - Deel 10: Radiografisch onderzoek van de las van automatisch booggelaste stalen buizen voor het aantonen van onvolkomenheden (en)
EN 10256	NEN-EN 10256	Niet-destructief onderzoek van stalen buizen - Kwalificatie en bekwaamheid van personeel voor niet-destructief onderzoek van niveau 1 en 2 (en)
CR 10261	-	-
EN 10266:2003	NEN-EN 10266:2003	Stalen buizen, fittingen en holle profielen voor staalconstructies - Symbolen en definities van termen voor gebruik in productnormen (en)
EN ISO 377	NEN-EN-ISO 377	Staal en producten van staal - Ligging en voorbereiding van monsters en proefstaven voor mechanische beproeving (nl)

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EN ISO 643	NEN-EN-ISO 643	Staal - Microscopische bepaling van de schijnbare korrelgrootte (en)
EN ISO 2566-1	NEN-EN-ISO 2566-1	Staal - Conversie van rekwaarden - Deel 1: Koolstofstaal en laaggelegeerde staalsoorten (en)
EN ISO 9001:2000	NEN-EN-ISO 9001:2000	Kwaliteitsmanagementsystemen - Eisen (en,nl)
EN ISO 14284	NEN-EN-ISO 14284	Staal en ijzer - Monstername en voorbereiding van monsters voor de bepaling van de chemische samenstelling (en)
EN ISO 15607	NEN-EN-ISO 15607	Beschrijven en goedkeuren van lasmethoden voor metalen - Algemene regels (en,nl)
EN ISO 15609-1	NEN-EN-ISO 15609-1	Beschrijven en goedkeuren van lasmethoden voor metalen - Lasmethodebeschrijving - Deel 1: Booglassen (en,nl)
EN ISO 15614-1	NEN-EN-ISO 15614-1	Beschrijven en goedkeuren van lasmethoden voor metalen - Lasmethodebeproeving - Deel 1: Boog- en autogeenlassen van staal en booglassen van nikkel en nikkellegeringen (en,nl)

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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ICS 77.140.75

Supersedes EN 10219-1:1997

English Version

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.

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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.

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.

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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*

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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)*

3 Terms, definitions and symbols

3.1 Terms and definitions

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 MPa[1)];

— 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/mm^2

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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.

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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 % by mass		Permissible deviation of the product analysis from specified limits for the cast analysis % 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.

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For fine grain hollow sections, repair of the body by welding shall not be permitted unless otherwise agreed.

6.9.5 Welding repair shall be carried out by operators qualified in accordance with EN 287-1. Welding repair procedures shall be in accordance with EN ISO 15607, EN ISO 15609-1 and EN ISO 15614-1.

6.9.6 The repaired hollow section shall conform to all the requirements of this European Standard.

6.10 Non-destructive testing of welds

The seam weld of all hollow sections supplied with specific inspection and testing shall be subjected to a non-destructive test in accordance with 9.4.

6.11 Tolerances and mass

6.11.1 Tolerances

Tolerances shall be as specified in EN 10219-2.

6.11.2 Mass

Mass shall be determined using a density of 7,85 kg/dm^3.

NOTE Dimensions, sectional properties and mass per unit length for a limited range of sizes of cold formed structural hollow sections are given in EN 10219-2. The purchaser should preferably select hollow section dimensions from this limited range of sizes.

7 Inspection

7.1 Types of inspection

7.1.1 Non-alloy steel hollow sections of qualities JR and J0 (see Annex A) shall be supplied with non-specific inspection in accordance with EN 10021 unless Option 1.6 is specified.

Option 1.6 qualities JR and J0 shall be supplied with specific inspection.

7.1.2 Non-alloy steel hollow sections of qualities J2 and K2 (see Annex A) and fine grain steel hollow sections of qualities M, N, ML and NL (see Annex B) shall be supplied with specific inspection in accordance with EN 10021.

7.2 Types of inspection document

7.2.1 For products supplied with non-specific inspection a test report (2.2) in accordance with EN 10204 shall be provided.

The test report shall contain the following codes and relevant information in accordance with EN 10168:

A — Commercial transactions and parties involved.

B — Description of products to which the test report applies.

C — Information on tests as follows:

C10-C13 — Tensile test;

C71-C92 — Cast analysis.

Z — Validation.

7.2.2 For products supplied with specific inspection an inspection certificate 3.1 in accordance with EN 10204 shall be provided unless Option 1.7 is specified.

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Option 1.7 an inspection certificate 3.2 in accordance with EN 10204 shall be supplied. Where this document is specified, the purchaser shall notify the manufacturer of the address of the organization or person nominated by him to carry out the inspection and validate the inspection document. It shall also be agreed which party shall issue the certificate.

The inspection certificate shall contain the following codes and related information in accordance with EN 10168:

A — Commercial transactions and parties involved.

B — Description of products to which the inspection certificate applies.

C — Information on tests as follows:

C02-C03 —Direction of test pieces and test temperature;

C10-C13 — Tensile test — Test piece shape and test results;

C40-C43 — Impact test — Test piece type and test results, if applicable;

C71-C92 — Cast analysis and, if applicable, product analysis.

Z — Validation.

7.3 Summary of inspection

The requirements for inspection are given in Table 2 for hollow sections of non-alloy steels and in Table 3 for hollow sections of fine grain steels.

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Table 2 — Inspection programme for hollow sections of non-alloy steels

Inspection requirements				Inspection programme	
Type of test			Subclause reference(s)	Non-specific inspection	Specific inspection
Mandatory tests	1	Cast analysis	6.6 9.1	One result per delivery item	One per cast
	2	Tensile test	6.7 9.2	One result per delivery item	One per test unit [a] [b]
	3	Impact test for qualities J2 and K2 only	6.7 9.2	Not applicable	One set per test unit [a] [b]
	4	Surface condition and dimensions	6.9 6.11 9.3	See 9.3	See 9.3
	5	NDT of the weld	6.10 9.4	Not applicable	All products, full length
Optional tests	6	Product analysis (Option 1.1)	6.6 9.1	Not applicable	One per test unit [a]
	7	Cast analysis additional elements (Option 1.2)	6.6 9.1	Not applicable	See Option 1.2
	8	Impact test for qualities JR and J0 (Option 1.3)	6.7 9.2	Not applicable	One set per test unit [a] [b]

[a] For test units see 8.1.3.

[b] Longitudinal or transverse samples at the discretion of the manufacturer.

Table 3 — Inspection programme for hollow sections of fine grain steels

Inspection requirements				Inspection programme
Type of test			Subclause reference(s)	Specific inspection
Mandatory tests	1	Cast analysis	6.6 9.1	One per cast
	2	Tensile test	6.7 9.2	One per test unit [a] [b]
	3	Impact test	6.7 9.2	One set per test unit [a] [b]
	4	Surface condition and dimensions	6.9 6.11 9.3	See 9.3
	5	NDT of the weld	6.10 9.4	All products, full length
Optional tests	6	Product analysis (Option 1.1)	6.6 9.1	One per test unit [a]

[a] For test units see 8.1.3.

[b] Longitudinal or transverse samples at the discretion of the manufacturer.

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8 Sampling

8.1 Frequency of tests

8.1.1 For products supplied with non-specific inspection, see Table 2.

8.1.2 For products supplied with specific inspection, the verification of the mechanical properties and product analysis, if applicable, shall be carried out by test unit. A test unit is defined as a quantity of hollow sections from one or more cast(s) of the same grade and dimensions manufactured by the same process (i.e. electric welding or submerged arc welding), and, if applicable, in the same heat treatment condition, submitted for acceptance at the same time.

The following samples shall be taken from one sample product of each test unit:

— 1 sample for tensile testing;

— 1 sample sufficient for 2 sets of 3 impact test pieces;

— 1 sample for product analysis, when required, see 8.2.1.

8.1.3 The mass of a test unit shall not exceed the maximum tonnage of sections specified in Table 4.

Table 4 — Test units

Type of hollow section		**Test unit**
Circular	**Square or rectangular**	
Outside diameter *D* mm	**External perimeter** mm	**Mass** maximum t
≤ 114,3	≤ 400	40
> 114,3 ≤ 323,9	> 400 ≤ 800	50
> 323,9	> 800	75

8.2 Preparation of samples and test pieces

8.2.1 Selection and preparation of samples for chemical analysis

Samples for product analysis, when required, shall be taken from the sample product or alternatively from test pieces used for mechanical testing or from the full thickness of the hollow section at the same location as for the mechanical test samples. The preparation of samples shall be in accordance with EN ISO 14284.

8.2.2 Preparation of test pieces for mechanical tests

8.2.2.1 General

The requirements of EN ISO 377 shall apply in conjunction with the test piece location specified in 8.2.3.

8.2.2.2 Tensile test pieces

The requirements of EN 10002-1, as appropriate, shall apply.

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Test pieces may be non-proportional, but in cases of dispute proportional test pieces having a gauge length $L_o = 5{,}65\sqrt{S_o}$ shall be used (see 9.2.2). For thicknesses less than 3 mm, a gauge length of L_o = 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.

8.2.2.3 Impact test pieces

Impact V-notch test pieces shall be prepared and machined in accordance with EN 10045-1. In addition, the following requirements shall apply:

a) 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 a rolled surface;

b) for specified thicknesses ≤ 12 mm, when test pieces with reduced sections are used, the width shall be ≥ 5 mm.

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

8.2.3 Location and orientation of samples for mechanical tests

8.2.3.1 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 sections, not tested in full section, the test pieces shall be taken either longitudinally or transversely, at the discretion of the manufacturer, at a point remote from the weld (see Annex C);

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, from one of the sides not containing the weld (see Annex C).

8.2.3.2 Impact test pieces

Test pieces for impact testing shall conform to the following:

a) for circular sections the test pieces shall be taken either longitudinally or transversely, at the discretion of the manufacturer, at a point remote from the weld (see Annex C);

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, from one of the sides not containing the weld (see Annex C).

9 Test methods

9.1 Chemical analysis

The elements to be determined and reported shall be those given in Table A.1, and Option 1.2 if specified, or those in Table B.1 or Table B.2, as applicable.

The choice of a suitable physical or chemical analytical method for the analysis shall be at the discretion of the manufacturer.

In case of dispute, the method used shall be agreed taking into account CR 10261.

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9.2 Mechanical tests

9.2.1 Test temperature

Tensile tests shall be carried out in the temperature range 10 ºC to 35 ºC. Impact tests shall be carried out at the temperatures specified in Table A.3 for non-alloy steels and Tables B.4 or B.5 for fine grain steels.

9.2.2 Tensile tests

The tensile test shall be carried out in accordance with EN 10002-1.

For the specified yield strengths in Tables A.3, B.4 and B.5, the upper yield strength (R_{eH}) shall be determined.

If a yield phenomenon is not present, 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. 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 $L_o = 5{,}65 \sqrt{S_o}$ 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 8.2.2.2).

9.2.3 Impact tests

The impact test shall be carried out in accordance with EN 10045-1. 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;

b) If the conditions under a) are not satisfied then an additional set of three test pieces may be taken, at the discretion of the manufacturer, from the same sample and tested. To consider the test unit as conforming after testing the second set, the following conditions shall all be satisfied simultaneously:

1) The average value of the six tests shall be equal to or greater than the minimum specified value;

2) Not more than two of the six individual values may be lower than the minimum specified value;

3) Not more than one of the six individual values may be lower than 70 % of the minimum specified value.

c) If these conditions are not satisfied, the sample product is rejected and retests shall be carried out on the remainder of the test unit (see 9.5).

9.3 Visual inspection and dimensional check

9.3.1 Visual inspection

The hollow sections shall be visually inspected for compliance with the requirements of 6.9.

9.3.2 Dimensional check

The dimensions of the hollow sections shall be checked for compliance with the requirements of EN 10219-2.

9.4 Non-destructive testing

9.4.1 General

When the welds of structural hollow sections are to be subjected to non-destructive testing, the method shall be in accordance with 9.4.2 or 9.4.3. At the manufacturer's discretion, the non-destructive testing may be carried out

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either on the circular shape prior to final forming or on the circular, square or rectangular hollow sections after final forming.

9.4.2 Electric welded sections

The weld seam of electric welded hollow sections shall be tested in accordance with one of the following European Standards. The standard to be applied is at the discretion of the manufacturer.

a) EN 10246-3 to acceptance level E4, with the exception that the rotating tube/pancake coil technique shall not be permitted;

b) EN 10246-5 to acceptance level F5;

c) EN 10246-8 to acceptance level U5.

9.4.3 Submerged arc welded sections

The weld seam of submerged arc welded hollow sections shall be tested either in accordance with EN 10246-9 to acceptance level U4 or by radiography in accordance with EN 10246-10 with an image quality class R2.

Butt welds, used to join lengths of strip/plate together in the spiral submerged arc weld process, shall be permitted, provided that the butt weld is tested to the same type of procedure and meets the same acceptance level as the main weld seam.

9.5 Retests, sorting and reprocessing

For retests, sorting and reprocessing, EN 10021 shall apply.

10 Marking

10.1 Except as provided for in 10.2 for hollow sections which are bundled, each hollow section shall be marked by suitable and durable methods such as painting, stamping, adhesive labels or attached tags with the following:

— the steel designation e.g. EN 10219-S275J0H;

— the manufacturer's name or trademark;

— in the case of specific inspection:

  — an identification number, e.g. order number, which permits the correlation of the product or delivery unit to the related document;

  — the mark of the external inspection representative (where applicable).

10.2 Where the products are supplied bundled, the marking required in 10.1 shall be on a label, which shall be securely attached to the bundle.

11 Evaluation of conformity

Where evaluation of conformity is required for regulatory purposes Annex D shall apply.

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Annex A
(normative)

Structural hollow sections of non-alloy quality steels — Chemical composition and mechanical properties

Table A.1 — Chemical composition — Cast analysis for product thickness ≤ 40 mm

Steel grade		Type of de-oxidation [a]	% by mass, maximum					
Steel name	Steel number		C	Si	Mn	P	S	N [b]
S235JRH	1.0039	FF	0,17	—	1,40	0,040	0,040	0.009
S275J0H	1.0149	FF	0,20	—	1,50	0,035	0,035	0,009
S275J2H	1.0138	FF	0,20	—	1,50	0,030	0,030	—
S355J0H	1.0547	FF	0,22	0,55	1,60	0,035	0,035	0,009
S355J2H	1.0576	FF	0,22	0,55	1,60	0,030	0,030	—
S355K2H	1.0512	FF	0,22	0,55	1,60	0,030	0,030	—

a The deoxidation method is designated as follows:

FF: Fully killed steel containing nitrogen binding elements in amounts sufficient to bind available nitrogen (e.g. min. 0,020 % total Al or 0,015 % soluble Al).

b The maximum value for nitrogen does not apply if the chemical composition shows a minimum total Al content of 0,020 % with a minimum Al/N ratio of 2:1, or if sufficient other N-binding elements are present. The N-binding elements shall be recorded in the Inspection Document.

Table A.2 — Maximum carbon equivalent value (CEV) based on cast analysis [a]

Steel grade		Maximum CEV for nominal thicknesses ≤ 40 mm
Steel name	Steel number	%
S235JRH	1.0039	0,35
S275J0H	1.0149	0,40
S275J2H	1.0138	0,40
S355J0H	1.0547	0,45
S355J2H	1.0576	0,45
S355K2H	1.0512	0,45

a See 6.6.2, Option 1.2.

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Table A.3 — Mechanical properties of non-alloy steel hollow sections in thicknesses ≤ 40 mm

Steel grade		Minimum yield strength R_{eH}		Tensile strength R_m		Minimum elongation A [d]	Minimum impact energy KV [e]		
Steel name	Steel number	MPa		MPa		%	J		
		Specified thickness mm		Specified thickness mm		Specified thickness mm	at test temperature of		
		≤ 16	> 16 ≤ 40	< 3	≥ 3 ≤ 40	≤ 40	-20°C	0 °C	20 °C
S235JRH [a]	1.0039	235	225	360-510	360-510	24 [b]	-	-	27
S275J0H [a]	1.0149	275	265	430-580	410-560	20 [c]	-	27	-
S275J2H	1.0138						27	-	-
S355J0H [a]	1.0547	355	345	510-680	470-630	20 [c]	-	27	-
S355J2H	1.0576						27	-	-
S355K2H	1.0512						40 [f]	-	-

[a] The impact properties are verified only when Option 1.3 is specified.

[b] For thicknesses > 3 mm and section sizes D/T < 15 (round) and (B+H)/2T < 12,5 (square and rectangular) the minimum elongation is reduced by 2. For thicknesses ≤ 3 mm the minimum value for elongation is 17 %.

[c] For section sizes D/T < 15 (circular) and (B+H)/2T < 12,5 (square and rectangular) the minimum elongation is reduced by 2.

[d] For thicknesses < 3 mm see 9.2.2.

[e] For impact properties for reduced section test pieces see 6.7.2.

[f] This value corresponds to 27J at –30 °C (see EN 1993-1-1).

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Annex B
(normative)

Structural hollow sections of fine grain steels — Chemical composition and mechanical properties

Table B.1 — Chemical composition — Cast analyses for product thicknesses ≤ 40 mm, feedstock condition N [a]

Steel grade		Type of deoxidation [b]	Classification [c]	% by mass													
Steel name	Steel number			C max.	Si max.	Mn	P max.	S max.	Nb max.	V max.	Al total [d] min.	Ti max.	Cr max.	Ni max.	Mo max.	Cu [e] max.	N max.
S275NH	1.0493	GF	QS	0,20	0,40	0,50-1,40	0,035	0,030	0,050	0,05	0,020	0,03	0,30	0,30	0,10	0,35	0,015
S275NLH	1.0497						0,030	0,025									
S355NH	1.0539	GF	QS	0,20	0,50	0,90-1,65	0,035	0,030	0,050	0,12	0,020	0,03	0,30	0,50	0,10	0,35	0,015
S355NLH	1.0549			0,18			0,030	0,025									
S460NH	1.8953	GF	SS	0,20	0,60	1,00-1,70	0,035	0,030	0,050	0,20	0,020	0,03	0,30	0,80	0,10	0,70	0,025
S460NLH	1.8956						0,030	0,025									

a See 6.3.

b The deoxidation method is designated as follows:
GF = Fully killed steel containing nitrogen binding elements in amounts sufficient to bind the available nitrogen and having a fine grained structure.

c QS = quality steel; SS = special steel.

d If sufficient N-binding elements are present, the minimum total Al content does not apply.

e If the copper content is greater than 0,30 % then the nickel content shall be at least half of the copper content.

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Table B.2 — Chemical composition - Cast analysis for product thicknesses ≤ 40 mm, feedstock condition M [a]

Steel grade		Type of deoxidation [b]	Classification [c]	% by mass												
Steel name	Steel number			C max.	Si max.	Mn max.	P max.	S max.	Nb max.	V max.	Al total [d] min.	Ti max.	Ni max.	Mo [e] max.	N max.
S275MH	1.8843	GF	SS	0,13	0,50	1,50	0,035	0,030	0,050	0,08	0,020	0,050	0,30	0,20	0,020
S275MLH	1.8844						0,030	0,025							
S355MH	1.8845	GF	SS	0,14	0,50	1,50	0,035	0,030	0,050	0,10	0,020	0,050	0,30	0,20	0,020
S355MLH	1.8846						0,030	0,025							
S420MH	1.8847	GF	SS	0,16	0,50	1,70	0,035	0,030	0,050	0,12	0,020	0,050	0,30	0,20	0,020
S420MLH	1.8848						0,030	0,025							
S460MH	1.8849	GF	SS	0,16	0,60	1,70	0,035	0,030	0,050	0,12	0,020	0,050	0,30	0,20	0,025
S460MLH	1.8850						0,030	0,025							

a See 6.3.

b The deoxidation method is designated as follows:
GF = Fully killed steel containing nitrogen binding elements in amounts sufficient to bind the available nitrogen and having a fine grained structure.

c SS = special steel.

d If sufficient N-binding elements are present, the minimum total Al content does not apply.

e The total sum of Cr, Cu and Mo shall not be higher than 0,60 %.

Table B.3 — Maximum carbon equivalent value based on cast analysis

Steel grade		Maximum CEV for nominal thicknesses ≤ 40 mm %
Steel name	**Steel number**	
S275NH S275NLH	1.0493 1.0497	0,40
S275MH S275MLH	1.8843 1.8844	0,34
S355NH S355NLH	1.0539 1.0549	0,43
S355MH S355MLH	1.8845 1.8846	0,39
S420MH S420MLH	1.8847 1.8848	0,43
S460NH S460NLH	1.8953 1.8956	0,53
S460MH S460MLH	1.8849 1.8850	0,46

Table B.4 — Mechanical properties of hollow sections in thicknesses ≤ 40 mm — Feedstock material condition N

Steel grade		Minimum yield strength R_{eH} MPa		Tensile strength R_m MPa	Minimum elongation A [a] [b] %	Minimum impact energy KV [c] J	
Steel name	**Steel number**	**Specified thickness** mm		**Specified thickness** mm	**Specified thickness** mm	**at test temperature of**	
		≤ 16	> 16 ≤ 40	≤ 40	≤ 40	-50 °C	-20 °C
S275NH	1.0493	275	265	370-510	24	-	40 [d]
S275NLH	1.0497					27	-
S355NH	1.0539	355	345	470-630	22	-	40 [d]
S355NLH	1.0549					27	-
S460NH	1.8953	460	440	540-720	17	-	40 [d]
S460NLH	1.8956					27	-

[a] For section sizes D/T < 15 (circular) and (B+H)/2T < 12,5 (square and rectangular) the minimum elongation is reduced by 2.

[b] For thicknesses < 3 mm see 9.2.2.

[c] For impact properties for reduced section test pieces see 6.7.2.

[d] This value corresponds to 27J at –30 °C (see EN 1993-1-1).

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Table B.5 — Mechanical properties of hollow sections in thicknesses ≤ 40 mm — Feedstock material condition M

Steel grade		Minimum yield strength R_{eH} MPa		Tensile strength R_m MPa	Minimum elongation A [a] [b] %	Minimum impact energy KV [c] J	
Steel name	Steel number	Specified thickness mm		Specified thickness mm	Specified thickness mm	at test temperature of	
		≤ 16	> 16 ≤ 40	≤ 40	≤ 40	-50 °C	-20 °C
S275MH	1.8843	275	265	360-510	24	-	40 [d]
S275MLH	1.8844					27	-
S355MH	1.8845	355	345	450-610	22	-	40 [d]
S355MLH	1.8846					27	-
S420MH	1.8847	420	400	500-660	19	-	40 [d]
S420MLH	1.8848					27	-
S460MH	1.8849	460	440	530-720	17	-	40 [d]
S460MLH	1.8850					27	-

[a] For section sizes D/T < 15 (circular) and (B+H)/2T < 12,5 (square and rectangular) the minimum elongation is reduced by 2.

[b] For thicknesses < 3 mm see 9.2.2.

[c] For impact properties for reduced section test pieces see 6.7.2.

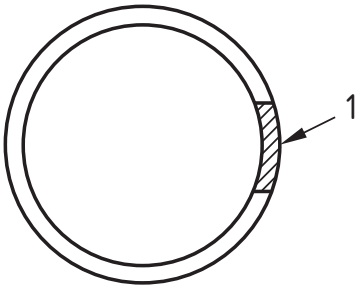
[d] This value corresponds to 27J at –30 °C (see EN 1993-1-1).

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Annex C
(normative)

Location of samples and test pieces

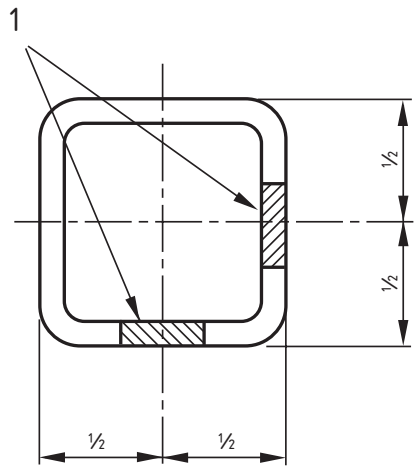
Figures C.1 and C.2 give information on the location of samples and test pieces for hollow sections (see 8.2.2).



Key

1 At any point on circumference but remote from the weld

Figure C.1 — Circular sections



Key

1 Alternative positions (on any side except a side containing the weld)

Figure C.2 — Square and rectangular sections

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Annex D
(normative)

Evaluation of conformity

D.1 General

The conformity of steel hollow sections to the requirements of this standard and with the stated values (including classes) shall be demonstrated by:

- initial type testing

- factory production control by the manufacturer, including product assessment.

For the purposes of testing, steel hollow sections may be grouped into families, where it is considered that the selected property/properties is/are common to all steel hollow sections within that family.

D.2 Type testing

D.2.1 Initial type testing

D.2.1.1 General

An initial type test is the complete set of tests or other procedures, determining the performance characteristics of samples representative of the product types.

To show conformity with this standard, initial type testing shall be performed on first use of this standard for steel hollow sections being put onto the market.

In addition initial type testing shall be performed:

— at the beginning of the production of a new or modified steel hollow sections design;

— if a change occurs in the feedstock;

— at the beginning of a new or modified method of production;

where this would change significantly one or more of the performance characteristics.

In cases where this would mean assessment of steel hollow sections for which type testing in accordance with this standard had already been performed, the testing frequency may be reduced:

— if it has been established that the performance characteristics have not been affected compared to the steel hollow sections already tested;

— if historical data is available (see D.2.1.3).

D.2.1.2 Characteristics

The assessment of the following performance characteristics is required:

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— tolerances on dimensions and shape;

— elongation;

— tensile strength;

— yield strength;

— impact strength;

— weldability (chemical composition).

The following performance characteristics are not subject to initial type testing for the following reasons:

— release of dangerous substances – this may be addressed indirectly by controlling the content of the substance(s) concerned;

— bendability, cold/warm formability – the material is inherently ductile and therefore a specific test for these characteristics is not required;

— fatigue, fracture toughness/brittle strength – these characteristics are controlled by the method of use which is covered by EN 1993-1-1.

D.2.1.3 Use of historical data

Tests previously performed on the same steel hollow sections in accordance with the provisions of this standard (same performance characteristic(s), test method, sampling procedure, system of attestation of conformity, etc.) may be taken into account.

D.2.2 Sampling, testing and conformity criteria

D.2.2.1 Sampling

Initial type testing shall be performed on random samples of steel hollow sections representative of the types of steel hollow sections manufactured.

D.2.2.2 Testing and conformity criteria

The number of steel hollow sections to be tested (or assessed) shall be in accordance with Table D.1.

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Table D.1 — Sampling and conformity criteria for type testing of steel hollow sections

Performance characteristic	Requirement clause	Assessment method	Number of tests/samples	Conformity criteria
tolerances on dimensions and shape	EN 10219-2 :2006, Clause 6	EN 10219-2 :2006, Clause 7	one per test unit (see 8.1.3 for definition of test unit)	6.11
elongation	6.7.1, Tables A.3, B.4 and B.5	9.2.2		6.7
tensile strength	6.7.1, Tables A.3, B.4 and B.5	9.2.2		6.7
yield strength	6.7.1, Tables A.3, B.4 and B.5	9.2.2		6.7
impact strength	6.7.2, Tables A.3, B.4 and B.5	9.2.3		6.7
weldability (chemical composition)	6.6, Tables A.1, B.1, B.2 and 6.8.1	9.1		6.6

The results of all type tests shall be recorded and records retained by the manufacturer for at least 5 years.

D.3 Factory production control (FPC)

D.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market conform to the declared performance characteristics. The FPC system shall consist of written procedures (works' manual), regular inspections and tests and/or assessments and the use of the results to control equipment, feedstock and other incoming material supply, the production process and the product. Records shall remain legible, readily identifiable and retrievable.

An FPC system conforming with the requirements of EN ISO 9001, and made specific to the product and the requirements of this standard, shall be considered to satisfy the above requirements.

The results of inspections, tests or assessments requiring action shall be recorded, as shall any action taken. The action to be taken when control values or criteria are not met shall be recorded and retained for the period specified in the manufacturer’s FPC procedures.

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D.3.2 FPC requirements for all manufacturers

D.3.2.1 General

The manufacturer shall establish procedures to ensure that the production tolerances allow for the performance characteristics of the steel hollow sections to be in conformity with the declared values derived from initial type testing.

The performance characteristics and the means of verification are:

— elongation, tensile strength and yield strength; tensile test in accordance with EN 10002-1;

— impact strength; impact test in accordance with EN 10045-1;

— weldability; chemical analysis in accordance with the methods listed in CR 10261.

The minimum frequency of testing shall be in accordance with Table D.1.

The manufacturer shall record the results of the tests specified above. These records shall, as a minimum, include the following information:

— identification of the steel hollow sections tested;

— date of sampling and testing;

— tests performed;

— test results.

D.3.3 Manufacturer-specific FPC system requirements

D.3.3.1 Personnel

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product conformity, shall be defined. This applies in particular to personnel that needs to initiate actions preventing product non-conformities from occurring, actions in case of non-conformities and to identify and register product conformity problems. Personnel performing work affecting product conformity shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

D.3.3.2 Equipment

All weighing, measuring and testing equipment necessary to achieve, or produce evidence of, conformity shall be calibrated or verified and regularly inspected according to documented procedures, frequencies and criteria. Control of monitoring and measuring devices shall comply with the appropriate clause of EN ISO 9001.

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process.

Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

D.3.3.3 Design process

The factory production control system shall document the various stages in the design of the steel hollow sections, and identify the checking procedure and those individuals responsible for all stages of design.

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During the design process itself, a record shall be kept of all checks, their results, and any corrective actions taken. This record shall be sufficiently detailed and accurate to demonstrate that all stages of the design phase, and all checks, have been carried out satisfactorily. Compliance with EN ISO 9001:2000, 7.3 shall be deemed to satisfy the requirements of this clause.

D.3.3.4 Feedstock and incoming materials

The specifications of all incoming feedstock and materials shall be documented, as shall the inspection scheme for ensuring their conformity. The verification of conformity of the feedstock and incoming materials with their specification shall be in accordance with EN ISO 9001:2000, 7.4.3.

D.3.3.5 In-process control

The manufacturer shall plan and carry out production under controlled conditions. Compliance with EN ISO 9001:2000, 7.5.1 and 7.5.2 shall be deemed to satisfy the requirements of this clause.

D.3.3.6 Traceability and marking

Steel hollow sections shall be identifiable and traceable with regard to their production origin, see Clause 10. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings, see Clause 10, are inspected regularly. Compliance with EN ISO 9001:2000, 7.5.3 shall be deemed to satisfy the requirements of this clause.

D.3.3.7 Non-conforming products

The manufacturer shall have written procedures which specify how non-conforming products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures. Compliance with EN ISO 9001:2000, 8.3 shall be deemed to satisfy the requirements of this clause.

D.3.3.8 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence. Compliance with EN ISO 9001:2000, 8.5.2 shall be deemed to satisfy the requirements of this clause.

D.3.3.9 Handling and storage

The manufacturer shall have written procedures stating methods of product handling and shall provide suitable storage areas to prevent damage or deterioration of the product.

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Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under a mandate M120 (Structural Metallic Products and ancillaries) given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the construction products covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

WARNING: Other requirements and other EU Directives, not affecting the fitness for intended use may be applicable to a construction product falling within the scope of this standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm).

This annex establishes the conditions for the CE marking of the structural hollow sections intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

The scope of this annex is defined by Table ZA.1.

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Table ZA.1 — Relevant clauses for product and intended use

Product:	Steel hollow sections		
Intended use:	To be used in metal structures or in composite metal and concrete structures		
Essential characteristic	**Requirement clauses in this European Standard**	**Levels and/or classes**	**Notes**
Tolerances on dimensions and shape.	EN 10219-2:2006, Clause 6	—	Pass/fail limits are specified in EN 10219-2:2006, Table 2
Elongation	6.7.1, Tables A.3, B.4 and B.5	—	% Values to be achieved are contained in Annexes A and B.
Tensile strength and yield strength	6.7.1, Tables A.3, B.4 and B.5	—	MPa Values to be achieved are contained in Annexes A and B.
Impact strength	6.7.2, Tables A.3, B.4 and B.5	—	J Values to be achieved are contained in Annexes A and B.
Weldability	6.6, Tables A.1, B.1, B.2 and 6.8.1	—	CEV value specified. Tables are in Annexes A and B, formula for calculation is specified.
Durability [a]	6.8.2	—	By option to specify that the product is suitable for galvanizing.
[a] Durability (against corrosion) is dependent on the method of protection and/or thickness of coating.			

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see Clause ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

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ZA.2 Procedure for the attestation of conformity of steel hollow sections

ZA.2.1 System of attestation of conformity

The system of attestation of conformity of steel hollow sections indicated in Table ZA.1, in accordance with the Decision of the Commission (1998/214/EC) of 18 March 1998 as given in the Annex III of the mandate for Structural metallic products and ancillaries is shown in Table ZA.2 for the intended uses and relevant levels or classes.

Table ZA.2 — System of attestation of conformity

Product	Intended use	Level(s) or class(es)	Attestation of conformity system(s)
Steel hollow section	To be used in metal structures or in composite metal and concrete structures.	-	2+
System 2+: See Directive 89/106/EEC (CPD), Annex III.2. (ii), First possibility, including certification of the factory production by an approved body on the basis of its continuous surveillance, assessment and approval.			

The attestation of conformity of the steel hollow section in Table ZA.1 shall be according to the evaluation of conformity procedures indicated in Table ZA.3 resulting from application of the clauses of this European Standard indicated therein.

Table ZA.3 — Assignment of conformity tasks for steel hollow sections under system 2+

Tasks			**Content of task**	**Evaluation of conformity clauses to apply**
Tasks under the responsibility of the manufacturer	Factory production control		All parameters related to all characteristics of Table ZA.1	Clause 11 D.3
	Initial type testing		All relevant characteristics of Table ZA.1	Clause 11 D.2
Tasks under the responsibility of the notified body	Certification of factory production control system on the basis of:	Initial inspection of factory and factory production control system	All parameters related to all characteristics of Table ZA.1	Clause 11 D.3
		Continuous surveillance, assessment and approval of factory production control system	All relevant characteristics of Table ZA.1	

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ZA.2.2 EC Certificate and declaration of conformity

The manufacturer or his agent established in the European Economic Area (EEA), shall prepare and retain a declaration of conformity, which authorises the affixing of the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production;

— description of the product type (type, identification, use…), and a copy of the information accompanying the CE marking;

— provisions to which the product conforms (e.g. Annex ZA of this European Standard);

— particular conditions applicable to the use of the product (if necessary);

— the number of the accompanying factory production control system certificate;

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The declaration shall be accompanied by a factory production control system certificate, drawn up by a notified body, which shall contain in addition to the information above, the following:

— name and address of the notified body;

— the number of the factory production control system certificate;

— conditions and period of validity of the certificate, where applicable;

— name of, and position held by, the person empowered to sign the certificate.

This declaration and certificate shall be presented in the official language or language(s) acceptable to the Member State in which the product is to be used.

ZA.3 CE Marking and labelling

The CE marking shall be in accordance with Directive 93/68/EEC[2)] and be placed on the accompanying commercial documents or inspection document. The CE marking consists of the letters “CE” in the specified form and shall be accompanied by the following information.

— Identification number of the notified body;

— name or identifying mark of the producer;

— the last two digits of the year of marking;

— the number of the EC certificate of conformity and the name or number of the notified body with regard to the factory production control system;

— product designation (see 4.2);

— “No performance determined” for characteristics where this is relevant.

---

[2] Council Directive 93/68/EEC of July 1993 amending 12 Directives, including Directive 89/106/EEC harmonising the provisions for the CE marking.

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The “No performance determined” (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of the information to be given on the product, label, packaging and/or commercial documents.

CE 01234	*CE conformity marking, consisting of the “CE”-symbol given in Directive 93/68/EEC.* *Identification number of the certification body*
AnyCo Ltd, PO Box 21, B-1050 **06** 01234-CPD-00234	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed* *FPC Certificate number*
EN 10219-1:2005 Cold formed steel hollow sections for building and civil engineering **Product designation S355J2H** **Dangerous substance X : Less than 0,2 ppm** **Durability: NPD** **(by coating)**	*No. of European Standard* *Description of product* *and* *information on regulated characteristics*

Figure ZA.1 – Example CE marking information

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE European legislation without national derogations need not be mentioned.

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

EN 1993-1-1, *Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings*

EN 10025-2, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10025-3, *Hot rolled products of structural steels — Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels*

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