INTERNATIONAL STANDARD

ISO 10799-1

First edition
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Cold-formed welded structural hollow sections of non-alloy and fine grain steels —

Part 1: Technical delivery conditions

Profils creux de construction formés à froid, soudés, en acier non allié ou à grains fins —
Partie 1: Conditions techniques de livraison

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10799-1 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 1, *Steel tubes*.

This first edition of ISO 10799-1 cancels and replaces ISO 10799:2001, of which it constitutes a minor revision. In particular, better grouping of several documents by subject area and minor editorial improvements have been carried out.

ISO 10799 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: Dimensions and sectional properties*

Cold-formed welded structural hollow sections of non-alloy and fine grain steels —

Part 1: Technical delivery conditions

1 Scope

This part of ISO 10799 specifies the technical delivery requirements for cold-formed welded structural hollow sections of circular, square or rectangular form. It is applicable to structural hollow sections formed cold without subsequent heat treatment.

The grades, chemical composition and mechanical properties for non-alloy steels and fine grain steels are given in Annexes A and B, respectively.

NOTE 1 For the requirements for tolerances, dimensions and sectional properties, see ISO 10799-2.

NOTE 2 For hot finished structural hollow sections, see ISO 12633-1.

2 Normative references

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

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

ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 404, *Steel and steel products — General technical delivery requirements*

ISO 643, *Steels — Micrographic determination of the apparent grain size*

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

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

ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*

ISO 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels*

ISO 10474:1991, *Steel and steel products — Inspection documents*

ISO 10799-2, *Cold-formed welded structural hollow sections of non-alloy and fine grain steels — Part 2: Dimensions and sectional properties*

ISO 10893-2, *Non-destructive testing of steel tubes — Part 2: Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections*

ISO 10893-3, *Non-destructive testing of steel tubes — Part 3: Automated full peripheral flux leakage testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for the detection of longitudinal and/or transverse imperfections*

ISO 10893-6, *Non-destructive testing of steel tubes — Part 6: Radiographic testing of the weld seam of welded steel tubes for the detection of imperfections*

ISO 10893-11, *Non-destructive testing of steel tubes — Part 11: Automated ultrasonic testing of the weld seam of welded steel tubes for the detection of longitudinal and/or transverse imperfections*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules*

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

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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
tube
hollow long product open at both ends of any cross-sectional shape

3.2
structural hollow section
tube intended to be used for structural purposes

3.3
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 normalizing

3.4
cold forming
process in which the main forming is carried out at ambient temperature

3.5
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 increasing cooling rate with or without tempering including self-tempering, but excluding direct quenching and quenching and tempering.

4 Classification and designation

4.1 Classification

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

4.1.2 Within the steel 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.

4.2 Designation

4.2.1 For non-alloy steel structural hollow sections, the steel designation consists of:

— a reference to this part of ISO 10799, i.e. ISO 10799-1:2011;

— the capital letter S for structural steel;

— the indication of the minimum specified yield strength for thicknesses ≤ 16 mm, expressed in newtons per square millimetre (N/mm^2);

— the capital letters JR for the qualities with specified impact properties at room temperature;

— the capital letter J and a number 0 or 2 for the qualities with specified impact properties at 0 °C and −20 °C respectively;

— the capital letter H to indicate hollow sections.

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

— a reference to this part of ISO 10799, i.e. ISO 10799-1:2011;

— the capital letter S for structural steel;

— the indication of the minimum specified yield strength for thicknesses ≤ 16 mm, expressed in newtons per square millimetre (N/mm^2);

— the capital letter N to indicate normalized or normalized rolled feedstock material (see 6.3);

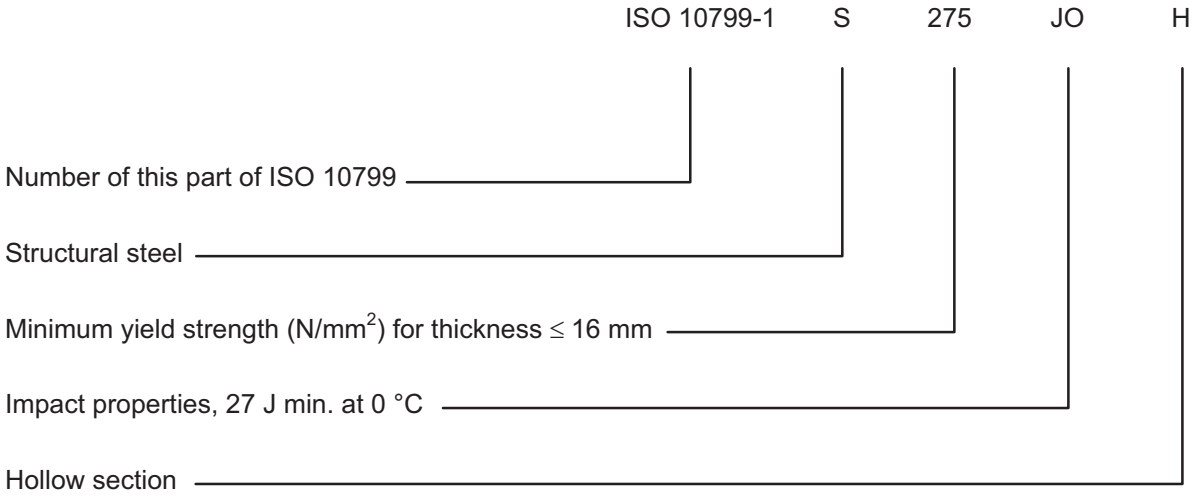
— the capital letter M to indicate thermomechanically rolled feedstock material (see 6.3);

— the capital letter L for the qualities with specified minimum values of impact energy at a temperature of −50 °C;

— the capital letter H to indicate hollow sections.

4.2.3 The product shall be designated as illustrated by the following examples:

EXAMPLE 1



EXAMPLE 2

5 Information to be supplied by the purchaser

5.1 Mandatory information

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

a) the quantity (mass or total length or number);

b) the type of length and length range or length (see ISO 10799-2);

c) details of the product form:

CFCHS = cold-formed welded circular hollow section;

CFRHS = cold-formed welded square or rectangular hollow section;

d) the steel designation (see 4.2);

e) the dimensions (see ISO 10799-2);

f) the options required (see 5.2);

g) the type of inspection document required (see 7.2 and Tables 2 and 3).

5.2 Options

A number of options are specified in this part of ISO 10799; they are listed in this subclause with the appropriate subclause references. In the event that the purchaser does not indicate his/her wish to implement any of these options at the time of enquiry and order, the products shall be supplied in accordance with the basic specification (see 5.1).

a) Option 1: product analysis shall be carried out (see 6.6.1).

b) Option 2: a maximum carbon equivalent value (CEV) in accordance with Table A.2 shall be provided for non-alloy grades (see 6.6.2).

c) Option 3: the Cr, Cu, Mo, Ni, Ti and V cast analysis contents shall be reported in the inspection certificate or inspection report for non-alloy grades (see 6.6.2).

d) Option 4: a maximum CEV in accordance with Table B.3 shall be provided for fine grain steels S275, S355 and S420 (see 6.6.3).

e) Option 5: the cast analysis limits for grade S460 (see 6.6.3) shall be

   1) V + Nb + Ti ≤ 0,22 %, and

   2) Mo + Cr ≤ 0,30 %.

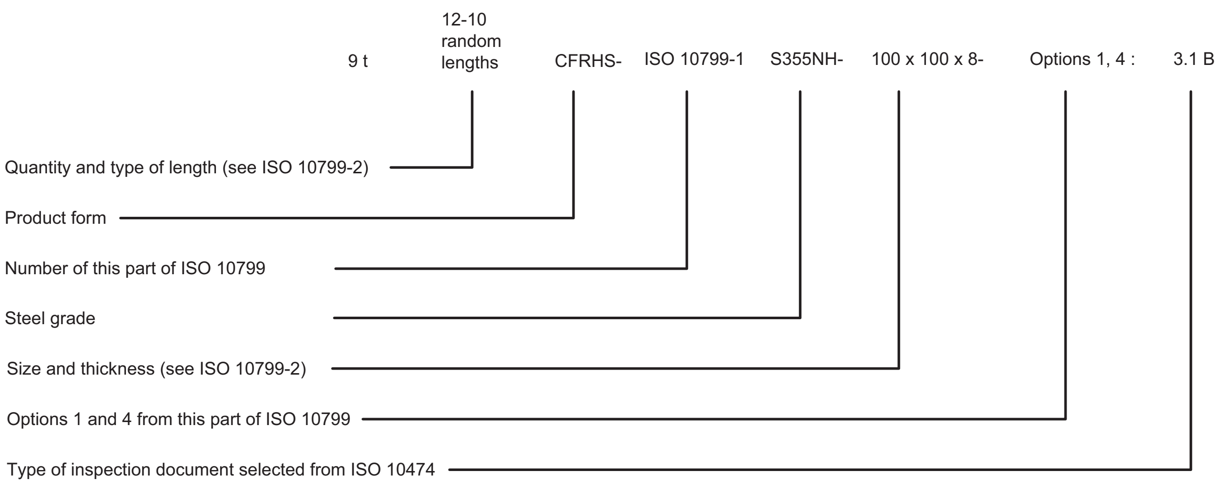
f) Option 6: impact properties of quality J0 and JR shall be verified. This option applies only when products are ordered with specific inspection and testing (see 6.7.4).

g) Option 7: the material shall be suitable for hot dip galvanized coating (see 6.8.2).

h) Option 8: weld repairs to the body of non-alloy structural steel hollow sections shall not be permitted (see 6.9.4).

i) Option 9: specific inspection and testing for non-alloy grades of qualities JR and J0 shall be applied (see 7.1.1).

5.3 Example



6 Requirements

6.1 General

Structural hollow sections of non-alloy steels shall comply with the requirements of Annex A; structural hollow sections of fine grain steels shall comply with the requirements of Annex B.

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 structural steels given in Annex A, the method of deoxidation shall be as given in Table A.1.

6.2.3 For the fine grain steels given in Annex B, the method of deoxidation shall be as given 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 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 and J2 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 6.5.1). Hollow sections manufactured by a continuous process shall not include welds used for joining lengths of the flat-rolled strip prior to forming the hollow section, except that for helically welded submerged arc-welded 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 For quality assurance requirements, see ISO 404. If the purchaser specifies quality assurance, an appropriate International Standard, such as ISO 9001, can be used.

6.5 Delivery conditions

6.5.1 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 submerged arc welded hollow sections above 508 mm outside diameter, it can 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 comply with the requirements of Table A.1 or Table B.1 or B.2.

Option 1 (see 5.2): a product analysis shall be carried out for hollow sections supplied with specific inspection and testing.

The permissible deviations of the product analysis from the specified limits cast analysis are given in Table 1.

When a CEV is required, it shall be determined from the cast analysis using the formula:

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

6.6.2 For non-alloy steel products, the following additional requirements may be requested at the time of enquiry and order for products supplied with specific inspection and testing (see 7.1).

Option 2 (see 5.2): the CEV in accordance with Table A.2.

Option 3 (see 5.2): the recording on the inspection certificate or inspection report of the Cr, Cu, Mo, Ni, Ti and V content (cast analysis).

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 limiting content in the cast analysis mass fraction %		Permissible deviation of the product analysis from specified limits for the cast analysis mass fraction %
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	≤ 0,045	+0,010
	fine grain	≤ 0,035	+0,005
S	non-alloy	≤ 0,045	+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 for thicknesses less than or equal to 16 mm, the permissible deviation is +0,04 % C, and for thicknesses greater than 16 mm and less than or equal to 40 mm, the permissible deviation is +0,05 % C.

6.6.3 For fine grain steel hollow sections, the following additional requirements may be requested at the time of enquiry and order.

Option 4 (see 5.2): the CEV for steel grades S275, S355 and S420 in accordance with Table B.3.

Option 5 (see 5.2): for steel grade S460, the following limits for the cast analysis:

$V + Nb + Ti \leq 0{,}22$ % and $Mo + Cr \leq 0{,}30$ %.

A maximum CEV may be agreed between the purchaser and manufacturer as an alternative to option 5.

6.7 Mechanical properties

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

Stress relief annealing at more than 580 °C or for over 1 h can lead to deterioration of the mechanical properties. If the purchaser intends to stress relief anneal the products at higher temperatures or for longer times, the minimum values of the mechanical properties after such a treatment should be agreed at the time of the enquiry and order.

6.7.2 For impact tests, standard V-notch test pieces (see 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 Tables A.3, B.4 and B.5 shall be reduced in direct proportion of the actual width of the test piece to that of the standard test piece.

Impact tests are not required for nominal thickness less than 6 mm.

6.7.3 For fine grain steel hollow sections in thicknesses that do not permit test pieces of width greater than or equal to 5 mm to be taken, the ferritic grain size (see 6.2.4) shall be verified by the method specified in 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, 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.

Option 6 (see 5.2): the purchaser may request at the time of enquiry and order, for products supplied with specific inspection and testing (see option 9), that the impact properties of steel qualities JR and J0 be verified.

6.8 Technological properties

6.8.1 Weldability

The steels specified in this part of ISO 10799 shall be suitable for welding by all appropriate welding processes.