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Welded cold formed square and rectangular steel tubes (hollow sections) for structural steelwork

Technical delivery conditions

DIN 17 119

Kaltgefertigte geschweisste quadratische und rechteckige Stahlrohre (Hohlprofile) für den Stahlbau; technische Lieferbedingungen

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

The subclauses marked with a single dot • give specifications which are to be agreed upon at the time of ordering. The subclauses marked with two dots •• give specifications which are optional and may be agreed upon at the time of ordering.

Contents

1 Field of application

1.1 This standard applies to welded cold formed square and rectangular steel tubes (hereinafter briefly referred to as "hollow sections") made from the steels listed in clause 2. These hollow sections are predominantly used in structural steelwork (building construction, tubular steel construction, crane building, bridge building, hydraulic engineering, etc.).

1.2 This standard does not apply to

a) – seamless or welded square and rectangular hollow sections made from general structural steels, which are supplied in the hot formed condition or have been normalized after fabrication (see DIN 17 100);
– square and rectangular tubes (hollow sections) made from fine grain structural steels for structural steelwork (see DIN 17 125 (at present at the stage of draft));

b) steel tubes for working scaffolds (see DIN EN 39).

2 Classification into grades

2.1 Hollow sections complying with this standard are normally manufactured from the general structural steels specified in DIN 17 100 and listed in table 1 (see also subclause 4.1.2) or from weather resistant structural steels specified in *Stahl-Eisen-Werkstoffblatt* (Iron and steel material sheet) 087.

2.2 •• If so agreed, cold formed hollow sections complying with this standard can also be made from and supplied in different steel grades, e.g. hot rolled fine grain steels for cold forming as specified in *Stahl-Eisen-Werkstoffblatt* 092.

2.3 • The selection of the steel grade is at the discretion of the purchaser (see also subclause 4.1.2).

Table 1. **Steel grades commonly used in the manufacture of welded cold formed square and rectangular hollow sections**

Steel grade		
Symbol	Material number	For properties see
USt 37-2	1.0036	DIN 17 100
RSt 37-2	1.0038	
St 37-3	1.0116	
St 44-2	1.0044	
St 44-3	1.0144	
St 52-3	1.0570	
WTSt 37-2	1.8960	Stahl-Eisen-Werkstoffblatt 087
WTSt 37-3	1.8961	
WTSt 52-3	1.8963	

3 Designation and ordering

3.1 The specifications given in the dimensional standard (DIN 59 411) shall apply for the standard designation of the hollow sections.

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3.2 • In addition to the standard designation, the order shall always give the quantity required (e.g. total length to be supplied), the type of length (see DIN 59 411), the length of the individual hollow section in the case of specified lengths and exact lengths and the type of document on materials testing as specified in DIN 50 049.

3.3 •• In addition, further details such as are specified in the subclauses marked with two dots may be agreed at the time of ordering.

4 Requirements

4.1 Manufacturing process

4.1.1 The process employed for making the steels used to manufacture the hollow sections conforming to this standard remains at the manufacturer's discretion.

The type of deoxidation of the steels shall be as specified in the standards and the *Stahl-Eisen-Werkstoffblätter* listed in clause 2.

•• If agreed, the purchaser shall be informed of the steelmaking process used.

4.1.2 The process used to manufacture the hollow sections remains at the manufacturer's discretion. The hollow sections conforming to this standard are generally fabricated from sheet or strip by means of mechanical cold forming and fusion welding or electrical pressure welding. Sheet and strip made from the grades listed in table 1 (in accordance with the basic grades specified in DIN 17 100) are normally used in the case of general structural steels. Sheet and strip made from the steel grades specified in DIN 17 100 which are identified by the letter K (e.g. RKSt 37-2) may also be considered.

4.1.3 The manufacturer's works shall have at its disposal the specialists and suitable equipment to enable welding work to be properly carried out and inspected.

The manufacturer shall carry out an initial test to verify that the requirements laid down in this standard are achieved with certainty.

This verification is only valid for the steel grades, dimensional ranges and welding processes, indicated in the certificate issued as a result of the test carried out[1]). If the conditions specified above change, the verification shall be supplemented accordingly.

4.2 As delivered condition

4.2.1 The hollow sections shall be supplied in the condition resulting from the forming process (see subclause 4.1.2).

4.2.2 The external welding burr of pressure welded hollow sections shall be machined off. The weld reinforcement shall be left on fusion welded hollow sections.

4.3 Chemical composition

The values specified in the standards and *Stahl-Eisen-Werkstoffblätter* listed in clause 2 shall apply for the chemical composition (cast analysis[2]) and product analysis).

4.4 Mechanical properties

The specifications as given in the standards and *Stahl-Eisen-Werkstoffblätter* listed in clause 2 shall apply for the mechanical properties, under the conditions for sampling specified in subclause 5.4. The minima for the tensile strength (R_m) and the yield stress (R_{eH}) shall also apply to the weld.

4.5 Weldability

Hollow sections made from the steel grades listed in this standard are suitable for gas fusion welding, arc welding and flash butt welding, they are also suitable for the electrical and gas pressure welding processes.

However, as specified in DIN 8528 Part 1, weldability does not only depend on the steel grade, but also on the conditions under which welding is carried out, on the design and on the operating conditions of the structural component.

4.6 Appearance of surface and weld

4.6.1 The hollow sections shall have a smooth surface appropriate to the manufacturing process.

4.6.2 Slight irregularities in the surface such as raised or depressed areas or shallow grooves resulting from the manufacturing process are permitted as long as the remaining wall thickness lies within the permissible dimensional deviations specified in DIN 59 411 and the function of the hollow section is not impaired (see also subclause 7.1).

It is necessary to take account of the possibility of residues from the lubricant used in the forming process, adhering to the surface.

•• Particular requirements on the surface finish shall be agreed at the time of ordering.

4.6.3 Proper removal of shallow surface defects using appropriate means is permitted provided that the remaining wall thickness fulfils the requirements of DIN 59 411. Stopping of surface defects is not permitted.

4.6.4 The welds may be visible on the external surface of the hollow sections.

•• It shall be agreed at the time of ordering if the welds are to occupy a particular position.

4.6.5 The ends of the hollow sections shall be cut perpendicular to the longitudinal axis of the product. A cutting burr, the shape of which varies according to the cutting method and cross section of the hollow section, is permitted.

4.7 Dimensions, masses per unit length, permissible deviations

4.7.1 DIN 59 411 shall apply for the nominal dimensions, the permissible dimensional deviations and deviations of form of the hollow sections complying with this standard.

4.7.2 DIN 59 411 specifies the mass per unit length for the hollow sections, the calculation being based on a density of 7,85 kg/dm^3.

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[1]) Steel structures conforming to DIN 18 800 Part 7 requiring building inspectorate approval (agrément).

[2]) The term "cast" should be read as "casting unit" where a sequence cast is supplied as is possible where continuous casting processes are used.

5 Testing and documents on materials testing

5.1 General

5.1.1 •• The purchaser may require that one of the documents on materials testing defined in DIN 50 049 be issued with regard to the hollow sections made from the steel grades listed in this standard.

5.1.2 If it is agreed to issue a test report (document DIN 50 049 – 2.2), it shall record the results of the tests listed in subclause 5.3.1.

5.1.3 The specifications laid down in subclauses 5.2 to 5.6 shall apply if it has been agreed to issue a document for which DIN 50 049 requires tests to be carried out on the batch supplied (e.g. document DIN 50 049 – 3.1 B or document DIN 50 049 – 3.1 C).

5.2 Test site

The hollow sections shall be tested at the manufacturer's works. Production at the manufacturer's works shall not be unduly disturbed when acceptance inspection is carried out by experts who are not employees of the manufacturer.

5.3 Scope of test programme

5.3.1 The values obtained for the yield stress, tensile strength and elongation after fracture, and compliance with the requirements specified in subclauses 5.3.3.1 and 5.3.3.2 shall be confirmed on the basis of continuous internal control in the case of hollow sections supplied with a test report.

5.3.2 If the products supplied are to be accompanied by an inspection certificate (see subclause 5.1.3), the hollow sections shall be inspected by batches. For this purpose, the hollow sections shall be divided up by steel grade and, if possible, by dimension, into acceptance units of 20 t each or of smaller quantities submitted for testing in each case.

The inspector shall freely choose one hollow section from each acceptance unit for the purposes of tensile testing.

•• Particular agreements shall be reached at the time of ordering if it is intended to test the chemical composition on the finished hollow section (product analysis, see also subclause 5.4.2) or if additional tests are required. The number of test pieces required for a possible product analysis shall be agreed likewise.

5.3.3 Whatever the type of document on materials testing,

5.3.3.1 all hollow sections shall be inspected for surface appearance,

5.3.3.2 the hollow sections shall be inspected for their accuracy to size (see DIN 59 411).

5.4 Sampling and sample preparation

5.4.1 For the purposes of tensile testing, one flat test piece (see DIN 50 125), which generally is to include the complete wall thickness, shall be taken in the longitudinal direction from the middle of one side outside the area of the weld and the edge curvature of the product to be tested in accordance with subclause 5.3.2.

Test pieces taken transverse to the longitudinal axis of the product may also be tested in the case of large sections.

The test pieces shall not be heat treated and shall not be straightened within the gauge length.

At the manufacturer's discretion, hollow sections may also be subjected to the tensile test in full section (see DIN 50 140).

Short proportional test pieces shall normally be taken for the tensile test. The removal of local irregularities from test pieces which have not been worked on all sides is permitted, but the rolling skin shall be retained at the thinnest spots.

5.4.2 The sample chips required for checking the chemical composition shall be taken uniformly over the entire cross section of the product, the test being carried out as a product analysis on the finished hollow section or, at the manufacturer's discretion, on the starting product (sheet or strip); the procedure for spectral analysis shall be analogous. *Stahl-Eisen-Prüfblatt* (Iron and steel test sheet) 1805 shall normally apply for sampling.

5.5 Test procedure

5.5.1 The tensile test shall be carried out in accordance with DIN 50 145 or DIN 50 140.

5.5.2 The chemical composition shall be determined according to the methods specified by the Chemists' Committee of the *Verein Deutscher Eisenhüttenleute* (Society of German Ferrous Metallurgy Engineers) (see the "Standards and other documents referred to" clause).

5.5.3 The appearance of the hollow sections shall be examined visually by an inspector having normal vision under appropriate lighting conditions.

Note. A demonstrably suitable non-destructive method of test may also be used instead of the visual examination.

5.5.4 DIN 59 411 shall apply for the inspection of the permissible dimensional deviations and deviations of form.

5.6 Retests

5.6.1 Hollow sections not satisfying the requirements when tested as specified in subclauses 5.5.3 and 5.5.4 (examination, check on dimensions) shall be rejected.

The manufacturer's works has the right to correct defects or deviations established in these tests by means of appropriate measures and then to present these hollow sections for renewed acceptance inspection.

5.6.2 If the results of the tensile test as specified in subclauses 5.4.1 and 5.5.1 do not satisfy the requirements, two further tensile tests, the results of both of which are to satisfy the requirements, shall be carried out on the same hollow section.

If the requirements are not satisfied in these new tests either, the hollow section shall be rejected. Two further hollow sections from the acceptance unit concerned shall be taken in its place; the tests specified in subclauses 5.4.1 and 5.5.1 shall be repeated on one test piece from each section. Both test pieces shall satisfy the require-

ments, if not, the acceptance unit is not considered to comply with this standard.

5.6.3 Test results which can be traced back to improperly carried out sampling, sample preparation or test procedure or to an accidental and limited defect in a test piece shall be deemed invalid.

6 Marking

Hollow sections shall be marked. Marking shall be by means of a permanent inked marking on the end of each section. Bundles shall carry labels which shall include the following information:

- manufacturer's mark;
- designation of the hollow section;
- inspector's mark, if the sections are supplied with an inspection certificate.

7 Complaints

7.1 In accordance with current law, a complaint may only be raised against defective hollow sections if the defects noticeably impair their use. This shall apply unless otherwise agreed at the time of ordering.

7.2 It is normal and practical for the purchaser to give the supplier the opportunity to judge whether the complaints are justified, if possible by submitting the hollow section objected to or samples of the hollow sections supplied.

Standards and other documents referred to

DIN 8528 Part 1	Weldability; metallic materials, concepts
DIN 17 100	Steels for general structural purposes; quality standard
DIN 17 125	(at present at the stage of draft) Fine grain structural steel square and rectangular tubes (hollow sections) for structural steelwork; technical delivery conditions
DIN 18 800 Part 7	Steel structures; construction, verification of suitability for welding
DIN 50 049	Documents on materials testing
DIN 50 125	Testing of metallic materials; tensile test pieces, guidelines for their preparation
DIN 50 140	Testing of metallic materials; tensile test on tubes and strips from tubes
DIN 50 145	Testing of metallic materials; tensile test
DIN 59 411	Hollow sections for structural steelwork; welded cold formed square and rectangular steel tubes; dimensions, masses, permissible deviations, static values
DIN EN 39	Steel tubes for working scaffolds; requirements, tests
Stahl-Eisen-Werkstoffblatt 087 [3]	*Wetterfeste Baustähle; Hinweise auf Lieferung, Verarbeitung und Verwendung* (Weather resistant structural steels; notes on supply, processing and application)
Stahl-Eisen-Werkstoffblatt 092 [3]	*Warmgewalzte Feinkornstähle zum Kaltumformen; Gütevorschriften* (Hot rolled fine grain steels for cold forming; quality specifications)
Stahl-Eisen-Prüfblatt 1805 [3]	*Probenahme und Probenvorbereitung für die Stückanalyse bei Stählen* (Sampling and sample preparation for the product analysis of steels)
Handbuch für das Eisenhüttenlaboratorium [3]	(Handbook for the Ferrous Metallurgy Laboratory) Volume 2: *Die Untersuchung der metallischen Stoffe* (Investigation of metallic materials); Düsseldorf, 1966; Volume 5 (supplement): A 4.4 – *Aufstellung empfohlener Schiedsverfahren* (List of recommended arbitration procedures); B – *Probenahmeverfahren* (Sampling procedures); C – *Analysenverfahren* (Methods of analysis); most recent edition in each case.

Other relevant standards

DIN 17 120	Welded circular steel tubes for structural steelwork; technical delivery conditions
DIN 17 121	Seamless circular steel tubes for structural steelwork; technical delivery conditions

3) Publisher: *Verein Deutscher Eisenhüttenleute;* supplied by: *Verlag Stahleisen mbH,* Postfach 82 29, D-4000 Düsseldorf 1.

Explanatory notes

The first editions of the DIN Standards for welded cold formed square and rectangular tubes or hollow sections (see DIN 17 119), welded circular tubes (see DIN 17 120) and seamless circular tubes (see DIN 17 121) for structural steelwork have been prepared in a joint committee of the *Normenausschuss Eisen und Stahl (FES)* (Iron and Steel Standards Committee) and the *Normenausschuss Rohre, Rohrverbindungen und Rohrleitungen (FR)* (Pipes, Pipe Joint Assemblies and Pipelines Standards Committee). In consideration of the differing applications and the consequent differences in the requirements (type and scope of test programme), it was deemed expedient to separate the technical delivery conditions for the products mentioned above which are used in structural steelwork from the delivery conditions for tubes used in process plant, vessel and pipeline construction (see DIN 1615, DIN 1626 and DIN 1628 for welded tubes, DIN 1629 and DIN 1630 for seamless tubes, each at present at the stage of draft, August 1982 editions).

The classification into grades, the values relating to the chemical composition and the mechanical properties of the steels covered by DIN 17 119, DIN 17 120 and DIN 17 121 correspond, to a great extent, to the specifications for general structural steels complying with DIN 17 100. Separate delivery conditions are in preparation for fine grain steel tubes or hollow sections for structural steelwork (DIN 17 123, DIN 17 124 and DIN 17 125, at present at the stage of draft).

In the case of circular tubes, the specifications relating to the permissible deviations with regard to dimensions, form and mass have been aligned with those for the tubes used in process plant, vessel and pipeline construction. A separate dimensional standard, DIN 59 411, deals with the products complying with DIN 17 119.

International Patent Classification

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