Guideline No.: W-13(202204)

W-13

STEEL PIPES AND TUBES

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Foreword

China Classification Society (hereinafter referred to as CCS) Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at http://www.ccs.org.cn. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn.

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Main changes:

1. 1.2 Delete this sentence for low alloy steel and alloy steel, and directly include "alloy steel" in the front.

2. 6.12 It shall be carried out according to the requirements of CCS specification. If eddy current testing is used instead of hydraulic test, it shall be specially agreed by CCS, and the manufacturer shall provide technical documents to prove the reliability of this method.

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STEEL PIPES AND TUBES

1 Application

1.1 This Chapter is applicable to the works approval and inspection of the seamless steel pipes and tubes, which are manufactured in accordance with the requirements of CCS Rules for Materials and Welding.

1.2 This Chapter is applicable to the manufacture of seamless pressure steel pipes of carbon and carbon-manganese alloy steels, which are made of killed steel by rolling, expanding or drawing. This Chapter does not apply to welded steel pipes.

1.3 The classification of pressure piping systems is to comply with the requirements of CCS Rules for Classification of Sea-going Steel Ships.

2 Normative references

2.1 CCS Rules for Materials and Welding;

2.2 Relevant national standards or industry standards for grade of material or designation.

3Terms and definitions

Nil.

4 Drawings and documents

4.1 The following documents are to be submitted to CCS for information:

4.1.1 Particulars of the manufacturer: name, address and history, design manufacturing capacity and actual annual manufacturing capacity; the type, specifications and delivery condition of the current products; qualification of the personnel; registered trademark and qualification certificates obtained.

4.1.2 Quality system documents

(1) Quality management documents, such as organizational structure, quality control points, responsibilities of the management departments / managers.

(2) Control documents, such as raw material purchase, production process and quality control.

4.1.3 Information on main production equipment, inspection and test equipment, including relevant technical parameters.

(1) Steelmaking, secondary refining and vacuum treatment equipment (if applicable), the specifications of the ingot or pipe billet manufactured.

(2) Heating equipment.

(3) Rolling, drift expanding and drawing equipment.

(4) Heat treatment equipment;

(5) Inspection and test equipment for chemical composition analysis and mechanical property, technological, metallographic, hydraulic tests and non-destructive test, and the information on calibration of the equipment.

4.1.4 Production process documents and flowchart, control standard, technological specifications and operation guidance, mainly including:

(1) Steel-making and casting;

(2) Heating or continuous casting or rolling;

(3) Rolling;

(4) Heat treatment;

(5) Sampling and sample delivery;

(6) Inspection and test.

4.1.5 Certified personnel and levels for special work, such as physico-chemical analysis or NDT.

4.2 The type test program is to be submitted to CCS for approval.

The program may be proposed by the applicant and examined and approved by CCS, or proposed by CCS and confirmed by the applicant. The program is to include:

(1) The type, specification and delivery condition of the products for approval;

(2) Selection of typical samples for type test;

(3) The test items and the standard or rules adopted;

(4) Type and number of test specimens and sampling position;

(5) Place of test and qualification of the laboratory (if applicable, the qualification of the subcontractor and the agreement).

5 Technical requirement

5.1 The selection of typical samples in the program is to fully reflect the production capacity and quality control of the applicant. Each type of mill in the application, the maximum outer diameter and wall thickness of the steel pipe(a larger wall thickness of maximum outer diameter steel pipe and outer diameter of maximum wall thickness steel pipe is to be selected according to the rolling specification) are to be selected for type test.

5.2 In the case of same composition and same delivery condition, a higher ratio (pipe diameter to wall thickness) may be adopted in lieu of a lower one, subject to agreement by CCS.

5.3 For continuous casting, the samples are to be taken from the top of pipe in the first ladle or the bottom of the pipe in the final ladle in any casting time, or from both top and bottom of the pipe in the first ladle in any casting time.

5.4 For mould casting, the samples are to be taken from the corresponding positions of the top and bottom respectively of the ingot with the maximum specification.

5.5 For ingot or billet approval, the steel is to be rolled into pipes to check and accept.

5.6 In principle, a representative product is to be selected for each grade, covering the types of rolling mill (cell type), and the edge products of each rolling mill are to be taken for test.

6 Materials and components

Nil.

7 Type test

The test items and requirements are as follows.

7.1 Chemical composition analysis

The analysis is to contain ladle sample analysis and finished product analysis: C, Si, Mn, P, S, Cr,

Ni, Mo, Cu, V, Al for carbon and carbon-manganese steels, and relevant alloy elements and other added elements for low-alloy steel, alloy steel.

The carbon equivalent is to be calculated by the following formula:

$$C_{eq} = C + Mn/6 + (Cr + Mo + V)/5 + (Ni+Cu)/15$$

7.2 Tensile test

Tensile strength, yield strength and elongation are to be determined by tensile test. For materials showing no yield limit, $R_{p0.2}$ is to be determined. The yield-tensile ratio is generally not to be greater than 85%.

Tensile specimens are generally to be of full-thickness flat ones. For thick wall, round specimens may be adopted, the diameter of which is to be as great as possible and to meet the dimensional requirements of proportional specimen.

7.3 Charpy V-notch test

The specimens are generally presented for impact test in longitudinal direction. Where the external diameter and wall thickness of the tubes satisfy the requirements for sampling in transverse direction, additional impact test on a set in transverse direction may be considered, but not as a criterion for acceptance.

Charpy V-notch impact test is to determine the energy value, the percentage of crystalline fracture, and side expansion value, and a temperature-energy curve is to be drawn to determine brittle transition temperature.

Note: when the standard impact specimen with the width of 5mm and above can be taken out from the pipe wall, the impact test shall be carried out.

7.4 Bend test

The test is to be carried out in accordance with the requirements of CCS Rules for Materials and Welding.

7.5 Flattening test

The test is to be carried out in accordance with the requirements of CCS Rules for Materials and Welding. (When the outer diameter and wall thickness are suitable)

7.6 Flanging test and drift expanding test. You can select one to.

The tests are to be carried out in accordance with the requirements of CCS Rules for Materials and Welding, and the acceptance criterion may be referred to relevant standards.

7.7 Mechanical property test at elevated temperature

The test is to be carried out in accordance with the requirements of CCS Rules for Materials and Welding and relevant standards. Only when new steel grades are developed or required.

7.8 Macrostructure examination

The examination is to be carried out on pipe billets.

7.9 Sulphur prints test

The test is to be carried out on billets and finished pipes respectively.

7.10 Metallographic examination

Microscopic examination (×100 and ×500 magnification) is to be carried out to measure actual grain size and nonmetallic intrusions.

7.11 Hardness test

HV hardness test is to be carried out on specimens and finished pipes respectively. The finished pipes are to be tested at a quarter of the length to pipe end.

7.12 Hydraulic test

It shall be carried out in accordance with CCS specifications. If eddy current testing is used instead of hydraulic test, it shall be specially agreed by CCS, and the manufacturer shall provide technical documents to prove the reliability of this method 7.13 Non-destructive test

The test includes ultrasonic, eddy current, magnetic particle and magnetic flux leakage examination.

7.14 Decarburization

For quenched and tempered steel pipes, both the internal and external surfaces are to be examined for decarburized depth.

7.15 Visual and dimensional examination

- Outside diameter and wall thickness;

- Bending angle and roundness;

- Length;

- Edge preparation, beveling, included angle and root face;

- Surface quality inspection. The internal and external surfaces of the pipes and tubes are to be free from defects such as cracks, laps, laminations, scabs, pinches and thick scale. In case of the foregoing defects, they are to be removed. The removal depth is not to exceed the allowable minus deviation. Thin scale not affecting surface inspection may be allowed.

8 Unit/batch inspection

8.1 After works approval by CCS, the marine steel pipes and tubes as manufactured according to the approved conditions (including equipment, process, etc.) are to be applied by the manufacturer for unit/batch inspection by CCS, which can be used onboard only after satisfactory inspection.

8.2 The detailed requirements for unit/batch inspection after approval are to be notified in written form to the works when CCS issues a certificate of works approval.

8.3 The test is to be conducted according to the approved program. The program is to contain the test items for witness, review and on-site examination. The items are to include:

(1) Visual and dimensional examination: including diameter, wall thickness, bending angle, roundness, length, edge preparation and surface quality;

(2) Review of the result for chemical composition analysis;

(3) Mechanical property test: including tensile, impact and hardness test (if applicable);

(4) Technical properties test: flattening, drift expanding and/or bending and flanging;

(5) Hydraulic test (if applicable);

(6) Non-destructive test (if applicable).

9 Other

9.1 Identification After satisfactory inspection, the pipes and tubes are to be clearly marked by the manufacturer at one end (or both ends) with CCS stamp and the following:

(1) Manufacturer's name and trade mark;

(2) Specification of the pipe and grade of steel;

(3) Cast number, batch number;

(4) Date of inspection.

CCS stamps are to be encircled with paint for easy recognition.

9.2 After satisfactory inspection of products, CCS Surveyor is to issue a certificate of marine products or endorse the manufacturer's quality certificate.

9.3 The quality certificate of the manufacturer is to contain the following particulars:

(1) Name of the purchaser and order number;

(2) Steel grade, specification, pressure rating, purpose;

(3) Cast number, batch number;

(4) Chemical composition of ladle samples;

(5) Results of mechanical and technical properties tests;

(6) Results of macro and microscopic examination (if applicable);

(7) Hydraulic test pressure and result (if applicable);

(8) Types of NDT and results (if applicable);

(9) Acceptance criteria (rules, standards, technical agreements, etc.);

(10) Delivery condition;

(11) Result of the mechanical property test at elevated temperature (if applicable);

(12) Space for stamp and endorsement by CCS Surveyor.

9.4 The format of the manufacturer's quality certificate is to be approved by CCS.