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Carbon and low alloy cast steels for general applications

通用铸造碳钢和低合金钢铸件

(ISO 14737:2015, MOD)

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1 Scope

This document specifies the technical requirements, inspection methods, inspection rules, identification, certificate, packaging, storage and transportation for carbon and low alloy cast steels for general applications.

This document applies to carbon and low alloy cast steels for general applications (hereinafter referred to as "the casting").

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.

GB/T 222, *Permissible tolerances for chemical composition of steel products*

GB/T 223.5, *Methods for chemical analysis of iron, steel and alloy - The reduced molybdosilicate spectrophotometric method for the determination of acid-soluble silicon content* (GB/T 223.5-2008, ISO 4829-1:1986, MOD)

GB/T 223.11, *Iron, steel and alloy - Determination of chromium content - Visual titration or potentiometric titration method* (GB/T 223.11-2008, ISO 4937:1986, MOD)

GB/T 223.14, *Methods for chemical analysis of iron, steel and alloy - The N-benzoyl-N-phenylhydroxylamine extraction photometric method for the determination of vanadium content*

GB/T 223.19, *Methods for chemical analysis of iron, steel and alloy - The neocuproine-chloroform extraction photometric method for the determination of copper content*

GB/T 223.23, *Iron, steel and alloy - Determination of nickel content - The dimethylglyoxime spectrophotometric method*

GB/T 223.25, *Methods for chemical analysis of iron, steel and alloy - The dimethylglyoxime gravimetric method for the determination of nickel content*

GB/T 223.26, *Iron, steel and alloy - Determination of molybdenum content - The thiocyanate spectrophotometric method*

GB/T 223.59, *Iron, steel and alloy - Determination of phosphorus content - Bismuth phosphomolybdate blue spectrophotometric method and antimony phosphomolybdate blue spectrophotometric method*

GB/T 223.63, *Iron, steel and alloy - Determination of manganese content - Sodium (potassium) periodate spectrophotometric method*

GB/T 223.68, *Methods for chemical analysis of iron, steel and alloy - The potassium iodate titration method after combustion in the pipe furnace for the determination of sulfur content*

GB/T 223.69, *Iron, steel and alloy - Determination of carbon contents - Gas-volumetric method after combustion in the pipe furnace*

GB/T 228.1, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature* (GB/T 228.1-2010, ISO 6892-1:2009, MOD)

GB/T 229, *Metallic materials - Charpy pendulum impact test method* (GB/T 229-2020, ISO 148-1:2016, MOD)

GB/T 4336, *Carbon and low-alloy steel - Determination of multi-element contents - Spark discharge atomic emission spectrometric method (routine method)*

GB/T 5677, *Castings - Radiographic testing* (GB/T 5677-2018, ISO 4993:205, MOD)

GB/T 6414, *Castings - Dimensional tolerances and geometrical tolerances and machining allowances* (GB/T 6414-2017, ISO 8062-3:2007, MOD)

GB/T 7233.1, *Steel castings - Ultrasonic examination - Part 1: Steel castings for general purposes* (GB/T 7233.1-2009, ISO4992-1:2006, MOD)

GB/T 8170, *Rules of rounding off for numerical values and expression and judgement of limiting values*

GB/T 9443, *Steel and iron castings - Liquid penetrant inspection* (GB/T 9443-2019, ISO 4987:2010, MOD)

GB/T 9444, *Steel and iron castings - Magnetic particle inspection* (GB/T 9444-2019, ISO 4986:2010, MOD)

GB/T 11351, *Mass tolerances of casting*

GB/T 15056, *Casting surface roughness - Appraising method*

GB/T 16923, *Casting surface roughness - Appraising method*

GB/T 16924, *Quenching and tempering of steel parts*

is determined by the supplier. The heat treatment temperatures in Table 2 are for reference only.

4.5 Surface quality

4.5.1 The surface roughness of the casting shall conform to the drawing or contract.

4.5.2 The casting shall be trimmed with flashes, burrs, and risers removed. There shall be no surface casting defects that affect the quality of the product.

4.6 Internal quality

4.6.1 The type, scope and quantity of defects allowed in the casting shall conform to the drawings and technical requirements of the purchaser or shall be agreed upon by the supplier and the purchaser.

4.6.2 Non-destructive testing method can be used to detect the internal quality of the casting.

4.7 Geometry, size

The geometry and size of the casting shall conform to the drawings or contract specifications. Geometric tolerance and dimensional tolerance grade are selected according to GB/T 6414.

4.8 Weight tolerance

The weight tolerance of the casting shall comply with the provisions of GB/T 11351.

4.9 Welding repair

4.9.1 Casting defects can be repaired by welding. Welding repair conditions are determined by the supplier. If the purchaser has other provisions on the defect location, size and welding repair times, it shall be negotiated between the supplier and the purchaser.

4.9.2 Welders who repair the casting shall have corresponding qualifications. Before welding repairs, the defective parts of the casting shall be cleaned up. The transitions in edge areas are smooth. Welding repair shall choose suitable welding consumables. Welding shall be carried out after welding procedure qualification. See Annex C for preheating temperature and maximum interlayer temperature before welding.

4.9.3 This part shall be re-inspected after the casting is repaired by welding.

4.9.4 If the depth of the pit prepared for welding repair exceeds 40% of the wall thickness or 25mm (whichever is the smaller), or the area exceeds 65cm^2, it is regarded as a major welding repair.

4.9.5 For major welding repairs, the location and extent of welding repairs shall be

recorded.

4.9.6 The casting with major welding repairs shall be subjected to post-weld heat treatment. See Annex C for the post-weld heat treatment temperature.

4.10 Correction

The deformation of the casting can be eliminated by correcting. The casting is usually corrected after heat treatment and at room temperature. Thermal correction can be used in special cases. If necessary, the stress relief treatment can be carried out after correction.

5 Test methods

5.1 Chemical composition analysis

5.1.1 Chemical composition analysis adopts conventional chemical analysis or spectroscopic analysis.

5.1.2 Routine chemical analysis is carried out according to GB/T 223.5, GB/T 223.11, GB/T 223.14, GB/T 223.19, GB/T 223.23, GB/T 223.25, GB/T 223.26, GB/T 223.59, GB/ T 223.63, GB/T 223.68 and GB/T 223.69.

5.1.3 Spectral analysis method is carried out according to the provisions of GB/T 4336.

5.1.4 The casting is sampled for chemical composition analysis according to the melting furnace.

5.1.5 The test block for melting analysis shall be prepared during the pouring process. The analysis of the finished product adopts the additional casting or single casting test block.

5.1.6 The sampling and preparation methods of the specimens for analysis shall be carried out in accordance with the provisions of GB/T 20066.

5.1.7 If a single casting is to be smelted with multiple ladles in one heat, chemical composition analysis and records shall be carried out on samples from each ladle.

5.1.8 For castings smelted in multiple furnaces and multi-cladding, samples shall be taken from the casting test block attached to the casting. The chemical composition report is based on the value calculated by the weighted average analysis method.

5.2 Mechanical properties

5.2.1 The tensile test is carried out according to the provisions of GB/T 228.1.

5.2.2 The impact test is carried out in accordance with the provisions of GB/T 229.

provisions of GB/T 7233.1, so as to detect defects inside the casting.

5.4.4 X-ray or γ-ray inspection of the casting shall be carried out in accordance with the provisions of GB/T 5677, so as to detect defects inside the casting.

5.4.5 The testing quantity, testing scope, defect degree and acceptance criteria of non-destructive testing shall be negotiated by both the supplier and the purchaser.

5.5 Geometry and size

5.5.1 For the inspection of casting geometry and size, inspection tools, gauges, templates or scribe lines with corresponding accuracy shall be selected.

5.5.2 The number of sampling inspections for casting geometry and dimensional tolerances shall be agreed upon by both parties.

5.6 Heat treatment

The heat treatment of the casting shall be carried out in accordance with the provisions of GB/T 16923 and GB/T 16924.

5.7 Rounding of test results

The rounding of the test results of mechanical properties and chemical composition shall comply with the provisions of GB/T 8170.

6 Inspection rules

6.1 Inspection procedure

Unless otherwise specified, the inspection of the casting shall be implemented by the supplier.

6.2 Inspection location

6.2.1 In addition to the agreement between the supplier and the purchaser that the inspection can only be done on the purchaser's, the final inspection shall generally be carried out on the supplier's.

6.2.2 If the supplier does not have the necessary inspection means, or the two parties have disputes over the quality of the castings, the inspection can be carried out in a third-party agency confirmed by both parties.

6.3 Batching rules

6.3.1 Divide by heat number: The castings that are poured from the same heat number of molten steel and heat treated in the same heat shall be a batch.

6.3.2 Divide by quantity or weight: Under the condition of stable smelting process of the same designation, cast in several heats and heat-treated for multiple heat numbers in the same process, a certain number or a certain weight of castings are taken as a batch. The specific requirements are negotiated by both parties.

6.3.3 Divide by piece: Take one piece as a batch.

6.4 Sampling

6.4.1 Tensile test: Take three specimens for each batch, one for delivery and two as spare specimens.

6.4.2 Impact test: Take six specimens for each batch, three for delivery and as spare specimens.

6.4.3 When the spare test block is insufficient, samples can be taken from the casting body. Sampling locations and performance indicators are negotiated by both parties.

6.5 Reinspection

6.5.1 When the test results do not meet the requirements due to one of the following reasons, the test is invalid. At this point, reinspection shall be carried out.

a) Improper installation of the specimen or abnormal function of the testing machine;

b) The tensile specimen is broken outside the gauge length;

c) Improper processing of the specimen;

d) The specimen is defective.

6.5.2 When the mechanical properties test results are unqualified, but not caused by the reasons listed in 6.5.1, the supplier may reinspect. Take two spare tensile specimens to repeat the tensile test. Take three spare impact specimens to repeat the impact test.

6.5.3 When the reinspection results of mechanical properties are still unqualified, the corresponding batch of castings and test blocks can be re-heated. Without the consent of the purchaser, the number of re-heat treatments shall not exceed two times (except for tempering unless otherwise specified).

6.6 Determination rules

6.6.1 If the chemical composition analysis results are unqualified, re-sample for reinspection. If there are still unqualified items in the reinspection, the determination of the chemical composition of the batch shall be negotiated by both parties.

6.6.2 If one of the tensile specimens in the reinspection fails, the supplier may repeat the heat treatment. If the test results are still unqualified after re-heat treatment, the batch of castings is finally determined as unqualified.

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