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Heavy steel castings - General technical specification

大型铸钢件 通用技术规范

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1 Scope

China's national general technical specification for heavy steel castings. It specifies the terms and definitions, the ordering requirements and documents, the manufacturing process, the technical requirements, and the inspection and acceptance. A heavy steel casting - a mill housing, a press frame, a turbine casing, a crusher body - is among the largest single pieces of metal made by any industry, and it is made once. Everything about the specification follows from that. The ordering requirements come early because a casting of this size is commissioned: the pattern, the feeding arrangement, the machining allowances, the sampling positions and the acceptance criteria are all agreed before the melt. The manufacturing process is specified rather than only the outcome, because there is no production run over which to demonstrate consistency. And the inspection is non-destructive and extensive, since the alternative to finding a defect is discovering it in service under a machine weighing hundreds of tonnes.

This Standard specifies the ordering requirements, manufacturing process, technical requirements, inspection rules and test methods, acceptance and delivery, etc. of heavy steel castings (hereinafter referred to as "castings"). This Standard applies to heavy steel castings cast using the sand mold or casting mold with equivalent thermal conductivity as the sand mold.

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the editions with the dates indicated are applicable to this document. For the undated references, the latest edition (including all the amendments) are applicable to this document.

GB/T 222 Permissible Tolerances for Chemical Composition of Steel Products

GB/T 223 (all parts) Methods for chemical analysis of iron, steel and alloy

GB/T 228.1 Metallic materials - Tensile testing - Part 1: Method of test at room temperature

GB/T 228.2 Metallic materials - Tensile testing - Part 2: Method of test at elevated temperature

GB/T 229 Metallic Materials - Charpy Pendulum Impact Test Method

GB/T 231.1 Metallic materials - Brinell hardness test - Part 1: Test method

GB/T 232 Metallic materials - Bend test

GB/T 2039 Metallic materials - Uniaxial creep testing method in tension

GB/T 3375-1994 Welding terminology

GB/T 4334 Corrosion of metals and alloys - Test methods for intergranular corrosion of stainless steels

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

GB/T 5611-2017 Foundry terminology

GB/T 5677 Castings - Radiographic testing

5.5.3 Post-weld heat treatment and inspection

5.5.3.1 Post-weld heat treatment In principle, after the repair welding of the casting is completed, the repair welding zone shall be subjected to stress relief annealing (except for products with special materials or special requirements). The post-weld stress relief annealing temperature shall be lower than the tempering temperature during the performance heat treatment. In special cases, if the post-weld stress relief annealing

temperature is higher than the tempering temperature during the performance heat treatment, the performance test bar shall be subjected to stress relief annealing with the furnace and to mechanical property testing again. The stress relief annealing holding time shall be determined according to the depth of the repair welding for the defect and the wall thickness of the product. It is recommended to keep the heat for 2 h~4 h per 100 mm. The minimum holding time is 3 h.

5.5.3.2 Post-weld inspection The repair welding position shall, according to the technical requirements of the product, be subjected to non-destructive testing and surface hardness inspection. Unless otherwise specified, the inspection shall be carried out according to the non-destructive testing requirements of the casting body at the position where the repair welding zone is located. When the hardness inspection of the repair welding position is required in the drawing or the ordering agreement, after the stress relief annealing, it shall carry out the surface hardness inspection.

5.6 Machining

5.6.1 Machining allowance Unless otherwise specified, the machining allowance shall be selected by the manufacturer itself or in accordance with the provisions of

GB/T 6414-2017. But it shall ensure that the dimensions of the casting product after machining comply with the drawings or agreements.

5.6.2 Stress relief annealing after machining purchaser shall specify the sampling position and acceptance level of each inspection. The sample for metallographic inspection shall be prepared from the test bar for mechanical properties. The preparation of the metallographic sample shall be not less than 6 mm from the surface of the test bar blank. If the purchaser requires inspection of the body metallography, the inspection position shall be agreed by both the supplier and the purchaser.

6.4 Non-destructive testing The castings shall, after dressing and finishing and machining, be subjected to non-destructive testing. However, since the shape and structure of the castings have a great influence on the internal quality assurance, the requirements for the method, area, and acceptance level, etc. of the non-destructive testing shall be in accordance with the product design or use requirements. It shall be agreed by both the supplier and the purchaser.

6.5 Appearance, shape, dimensional tolerances, and mass tolerances

6.5.1 Appearance quality requirements It shall clean up the burnt-on sand, sand inclusion, split edge, burr, and scale on the casting. The surface roughness of the casting shall be in accordance with the requirements of the drawings or the ordering agreement. There shall be no defects affecting the use on the casting surface. If there are defects, repair welding may be carried out.

6.5.2 Dimensional tolerances The dimensional tolerances of the castings shall comply with the provisions of the drawings or the ordering agreement. If there are no provisions in the drawings or the ordering agreement, the dimensional tolerances of the castings shall comply with the requirements of Grade DCTG13 to DCTG15 in GB/T 6414-2017.

6.5.3 Mass tolerances When ordering, both the supplier and the purchaser may agree on the mass tolerances of the casting. If not required by the purchaser, the mass tolerances shall meet the requirements of Grade MT13 to MT15 in GB/T 11351-2017.

6.6 Requirements for special tests When required by the purchaser, requirements for special tests (such as metallographic, tensile at elevated temperature, high-temperature short requests acceptance of the performance after the final heat treatment, it shall be specified in the ordering requirements.

7.1.4 Inspection lot

7.1.4.1 When the mass (net mass) of the casting is less than 3 t, according to the principle of double-same (same-furnace melting, same-furnace heat treatment), a set of physical and chemical inspections are carried out.

7.1.4.2 When the mass (net mass) of the casting is greater than or equal to 3 t, each product shall be subjected to a set of physical and chemical inspections.

7.1.5 Processing of sample The sample is taken from the test bar by machining, with a minimum distance of 6 mm from the casting surface and a minimum distance of 30 mm from the thermal cutting surface.

7.2 Provisions on invalid tests When the test result does not meet the requirements, if the following conditions exist, the test will be invalid. When the test is invalid, double quantity of samples may be taken again from the same test portion or from the test portion near the adjacent position of the unqualified test bar for retest. The retest data is used as the test result.

a) Improper processing of sample (There are tool marks, no chamfers, etc.);

b) Improper installation of sample or improper operation of testing machine;

c) There are defects on the sample (There are obvious cast defects such as slag inclusion, pores, and shrinkage porosity at the fracture position);

d) In the tensile test, it breaks at a position outside the gage point.

7.3 Chemical composition analysis

7.3.1 Provisions on sampling and sample preparation Sampling and sample preparation for chemical composition analysis shall be carried out in accordance with the provisions of GB/T 20066 or GB/T 5678.