GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 77.140.85
J 32

GB/T 37683-2019

Large gear and girth gear forgings - Technical specification

大型齿轮、齿圈锻件 技术条件

Issued on: June 04, 2019 **Implemented on: June 04, 2019**

Issued by: State Administration for Market Regulation;

Standardization Administration of the PRC.

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Large gear and girth gear forgings - Technical specification

1 Scope

This Standard specifies the ordering requirements, manufacturing process, technical requirements, inspection rules and test methods, acceptance and quality certification, and marking and packaging of large gear (including gear shaft) and girth gear forgings.

This Standard applies to the ordering, manufacture, and inspection of large gear (including gear shaft) and girth gear forgings.

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 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 229 Metallic Materials - Charpy Pendulum Impact Test Method

GB/T 230.1 Metallic materials - Rockwell hardness test - Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)

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

GB/T 4340.1 Metallic materials - Vickers hardness test - Part 1: Test method

GB/T 6394 Metal - Methods for estimating the average grain size

GB/T 10561-2005 Steel - Determination of Content of Nonmetallic Inclusions - Micrographic Method Using Standards Diagrams

GB/T 37400.15-2019 Heavy mechanical general technical specification - Part 15: Nondestructive test of steel forgings

3 Ordering requirements

3.1 The purchaser shall specify in the ordering contract the forging name, executed standard, material designation, quantity supplied, delivery state, and the corresponding technical requirements and inspection items specified by the supplier and the purchaser.

3.2 The purchaser shall provide the forging ordering drawings.

4 Manufacturing process

4.1 Melting

Steel for forgings shall be melted in an electric furnace or converter and refined outside the furnace. With the consent of the purchaser, other melting methods which guarantee quality may also be used.

4.2 Forging

4.2.1 The nozzle and riser of the ingot shall have sufficient removal, to ensure that the forging product has no shrinkage cavity, looseness, severe segregation, and other harmful defects.

4.2.2 Forgings shall be forged and formed on forging equipment with sufficient capacity, to ensure that the entire section of the forging is thoroughly forged and evenly organized.

4.3 Heat treatment

4.3.1 After the forging is forged, the supplier shall perform normalizing and high temperature tempering treatment.

4.3.2 The normalizing temperature of carburized steel forgings shall be higher than the carburizing temperature.

4.3.3 The supplier may, according to the material designation of forging and the ordering technical requirements, perform performance heat treatment or carburizing heat treatment.

4.4 Machining

4.4.1 Forgings shall be roughed or semi-finished prior to quenching and tempering or carburizing heat treatment.

4.4.2 The dimensions, tolerances, and surface roughness of the forgings shall

5.3 Hardness

When forgings are only required to be accepted according to hardness, the hardness deviation of the same forging does not exceed 40 HBW. However, when the mechanical properties of forgings are required at the same time, the absolute value of hardness is not used as the basis for acceptance.

5.4 Nondestructive testing

5.4.1 General requirements

Forgings shall be free of defects such as white spots, cracks, folds, shrinkage cavities, severe segregation which affect the use performance and surface quality.

5.4.2 Ultrasonic testing

Forgings shall be subjected to ultrasonic testing before tooth punching after roughing and heat treatment. The testing results within the range of 20 mm or $1.5m_n$ (when the modulus m_n>12) below the tooth and root shall meet the requirements of the quality grade II of Table 1 of GB/T 37400.15-2019. The testing results of the remaining positions shall meet the Grade IV requirements.

5.4.3 Magnetic particle testing

When the ordering technical agreement or the ordering contract has the requirement for magnetic particle testing, the magnetic particle testing shall be carried out by the purchaser. The testing method and acceptance criteria shall meet the requirements of the ordering contract or the ordering technical agreement.

5.5 Metallographic structure

5.5.1 Grain size

When the inspection of grain size is required, it shall be indicated in the ordering contract. The inherent grain size of carburized steel shall not be coarser than Grade 5.0.

5.5.2 Nonmetallic inclusions

When it is required to inspect nonmetallic inclusions, it shall be indicated in the ordering contract. The A, B, C, and D nonmetallic inclusions of forgings shall not exceed Grade 2.5.

deformation, the direction of the tensile and impact samples shall be axial (longitudinal). When the ordering technical agreement or ordering drawing requires a tangential or transverse sample, the test results of the mechanical properties shall be lower than the specified values in Table 3 (longitudinal) by the percentage specified in Table 5.

b) For ring forgings, disc forgings, and the forgings mainly based on upsetting deformation, the direction of the tensile and impact samples shall be the direction of the main deformation, i.e. the tangential direction (circumferential direction).

6.2.3 Test methods

6.2.3.1 The tensile test shall be carried out in accordance with the provisions of GB/T 228.1.

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

6.3 Hardness inspection

6.3.1 The hardness inspection of forgings shall be carried out in accordance with the provisions of GB/T 231.1. The hardness inspection of hardened samples shall be carried out in accordance with the provisions of GB/T 230.1. Vickers hardness inspection shall be carried out in accordance with the provisions of GB/T 4340.1.

6.3.2 At least two places shall be measured at the end face of the girth gear forging and about 1/4 of the diameter from the outer surface; the two places are 180° apart. If the forging is larger than ϕ3000 mm in diameter, at least four places shall be measured, each at a distance of 90°. The hardness of gear or gear shaft forgings shall be measured at four places on the outer surface to be tooth-punched, 90° apart.

a) When performing a V-notch impact test, if the arithmetic mean of a set of impact samples is not lower than the specified value, and one of the values is not less than 70% of the specified value, retest may not be performed. When the above requirements are not met, a set of three impact samples may be taken in the adjacent part of the previous sample for retesting. The arithmetic mean of the two sets of samples shall not be lower than the specified requirement. The number of single values below the specified value shall not exceed two. Only one single value is allowed to be less than 70% of the specified value;

b) When performing a U-notch impact test, if a certain test result is unqualified, double quantity of samples may be taken in the adjacent part of the previous sample for retesting. The retest results of the two samples shall conform to the regulations.

6.6.3 If the inspection of mechanical properties is unqualified due to white spots and cracks in the sample, retest shall not be conducted.

6.7 Reheat treatment

When the inspection result of any mechanical property of the forgings is still unqualified, reheat treatment may be carried out; re-sampling shall be carried out for test. The number of reheat treatments shall not exceed two at most. The number of tempering is not limited.

7 Acceptance and quality certification

7.1 Acceptance

7.1.1 The supplier shall provide the necessary conditions for purchaser's acceptance personnel, for the purchaser's acceptance personnel to carry out the on-site inspection work. The purchaser's inspection personnel shall not hinder the production of the supplier.

7.1.2 The purchaser has the right to select certain test items of forgings for acceptance. During the acceptance inspection or the subsequent processing or inspection, if it is found that the forgings do not meet the supplementary technical requirements specified in this Standard and in the ordering contract, the purchaser shall promptly notify the supplier; the two parties shall negotiate to resolve.

7.2 Quality certification

The supplier shall provide the purchaser with a quality certification. The quality certification shall at least include the following:

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