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General rules of dimensions, shape, surface, quality, testing method and inspection for expansion alloys

膨胀合金尺寸、外形、表面质量、试验方法和检验规则的一般规定

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Table of Contents

General rules of dimensions, shape, surface quality, testing method and inspection for expansion alloys

1 Scope

This Standard specifies the dimensions, shape and allowable deviation, surface quality, testing methods, inspection rules, packaging, marks and quality certificates for expansion alloys.

This Standard applies to expansion alloys with a certain average linear expansion coefficient within a certain temperature range.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

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

GB/T 223.3, *Methods for chemical analysis of iron, steel and alloy. The daintily methane phosphomolybdate gravimetric method for the determination of phosphorus content*

GB/T 223.4, *Iron, steel and alloy - Determination of manganese content - Potentiometric or visual titration method*

GB/T 223.5, *Steel and iron - Determination of acid-soluble silicon and total silicon content - Reduced molybdosilicate spectrophotometric method*

GB/T 223.9, *Iron, steel and alloy - Determination of aluminium content - Chrome azurol S photometric method*

GB/T 223.11, *Iron, steel and alloy - Determination of chromium content - Visual titration or potentiometric titration method*

GB/T 223.17, *Methods for chemical analysis of iron, steel and alloy - The diantipyrylmethane photometric method for the determination of titanium content*

GB/T 223.78, *Methods for chemical analysis of iron, steel and alloy - Curcumin spectrophotometric method for the determination of boron content*

GB/T 226, *Test method for macrostructure and defect of steel by etching*

GB/T 228, *Metallic materials - Tensile testing at ambient temperature* (GB/T 228-2002, eqv ISO 6892:1998)

GB/T 342-1997, *Dimension shape mass and tolerance for cold-drawn round square and hexagonal steel wires*

GB/T 702-2004, *Hot-rolled round and square steel bars - Dimension, Shape, weight and tolerance*

GB/T 908-1987, *Forged round and square steels dimension, shape, weight and tolerance*

GB/T 1979, *Standard diagrams for macrostructure and defect of structural steels*

GB/T 2975, *Steel and steel products - Location and preparation of samples and test pieces for mechanical testing* (GB/T 2975-1998, eqv ISO 377:1997)

GB/T 3207-1988, *Bright steel*

GB/T 4339, *Test methods for thermal expansion characteristic parameters of metallic materials*

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

GB/T 6394, *Determination of estimating the average grain size of metal*

GB/T 5778-1986, *Determination of hermeticity of expansion alloys*

GB/T 10561, *Steel - Determination of content of nonmetallic inclusions - Micrographic method using standards diagrams*

GB/T 13297, *General rules of packaging, marking and quality certification for precision alloys*

GB/T 20066, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition* (GB/T 20066-2006, ISO 14284:1998, IDT)

3 Order content

The contract or order for ordering according to this Standard shall include the followings:

a) Reference to this Standard;

b) Product name;

c) Designation or unified numerical code;

d) Weight (or quantity) of the delivery;

e) Size and shape;

f) Processing method;

g) Delivery state and performance;

h) Special requirements.

4 Dimensions, shapes and allowable deviations

4.1 Cold drawn (pulled) wires

4.1.1 Dimension and allowable deviation

The diameter of cold drawn (pulled) wire is: 0.10 mm ~ 7.00 mm. The allowable deviation of its diameter shall comply with the precision requirements in Table 2 or Table 3 in GB/T 342-1997. The accuracy grade should be specified in the contract. When not specified, it is provided with grade 10 accuracy.

4.1.2 Shape

The shape of the cold-drawn (pulled) wire should comply with the relevant regulations of GB/T 342-1997.

4.2 Cold rolled (drawn) pipes

4.2.1 Dimension and allowable deviation

4.2.1.1 Outer diameter and allowable deviation for inner-outer diameters, wall thickness

The outer diameter and allowable deviation for inner and outer diameters, wall thickness of cold rolled (drawn) seamless pipes shall comply with the regulations of Table 1. Other specifications and size tolerances are negotiated between the supplier and the buyer.

4.6.2.1 The diameter of hot rolled bars is 6.0 mm ~ 12.0 mm. The round steel shall be delivered in coils. When the buyer requires delivery in straight strips, it shall be specified in the contract.

4.6.2.2 The curvature of each meter of length of hot rolled products delivered in straight strips shall not be greater than 2.5 mm. The total curvature is not greater than 0.25% of the total length.

5 Surface quality

5.1 Cold rolled (pulled, drawn, polished) material

The surface of cold rolled (pulled, drawn, polished) materials should be smooth. Defects such as microcracks, delamination, folds, scars, rust, scratches, oxidized colors, and pitting are not allowed.

5.2 Hot forged (rolled) material

Defects such as cracks, folds, scales, heavy skin, depressions, and ears are not allowed on the surface of hot forged (rolled) materials. But the above defects allow cleaning. The cleaning depth should not exceed half of the tolerance.

6 Testing methods

The testing methods for the performance inspection of each batch of alloys shall be carried out in accordance with the provisions in Table 5.

7 Inspection rules

7.1 Inspection and acceptance

The inspection and acceptance of finished products shall be carried out by the quality and technical supervision department of the supplier.

7.2 Batching rules

Finished products should be submitted in batches for inspection and acceptance. Each batch consists of alloy materials with the same alloy designation, the same furnace (tank) number, the same processing method, the same size, the same delivery state, and the same heat treatment system.

7.3 Sampling quantity and sampling site

The sampling quantity and sampling site of each batch of alloy materials shall comply with the requirements in Table 5.

7.4 Reinspection and judgement rules

7.4.1 If the inspection results of the expansion coefficient are unqualified, double the number of samples should be taken for reinspection. Even if one sample is unqualified in the reinspection results, this furnace of alloys shall be rejected.

7.4.2 If the grain size and hardness test results are unqualified, double the number of samples should be taken for reinspection. Even if one specimen is unqualified in the reinspection results, this batch of alloys shall be rejected. But piece-by-piece inspection is allowed. When the grain size and hardness pass the inspection at the same time, the products can be delivered.

7.4.3 When the alloy phase transformation test is unqualified, reinspection is not allowed. However, it is allowed to re-roll (forge) alloy materials with smaller dimensions and resubmit them for inspection as a new batch (except for 4J28 alloys).

For the phase transformation inspection of 4J29, 4J32, 4J34, and 4J40 alloys, it is allowed to replace the inspection results of alloy materials of smaller specifications with larger specifications of the same furnace number.

7.4.4 When the user requests to test the airtightness of alloy materials, each batch of alloy materials shall be managed according to A and B heads. The airtightness test specimen is taken from the A head of the first branch. If the inspection result is unqualified, take another sample from the B head of the second branch for reinspection. If the reinspection result is still unqualified, then this batch of alloys shall be rejected.

7.4.5 If the dimension, shape and surface quality are unqualified, it will be judged as unqualified product.

7.4.6 If the results of other inspections are unqualified, double the number of specimens should be taken for reinspection of the unqualified items. If the reinspection results are still unqualified, then this batch of alloys shall be rejected.

8 Packaging, marks and quality certificate

The packaging, marks and quality certificate of finished alloy materials shall comply with the relevant provisions of GB/T 13297.

A.4 Instruments and reagents

A.4.1 Thermos bottle.

A.4.2 Acetone (or absolute ethanol).

A.4.3 Carbon dioxide (dry ice).

A.4.4 Low temperature thermometer.

A.5 Test

A.5.1 Freezing of specimens

Pour an appropriate amount of acetone (or absolute ethanol) into the thermos. Put dry ice in the bottle and stir to bring the temperature down to the desired temperature. Then put the polished or corroded specimen into the thermos. Re-temper to the specified temperature. After freezing, take out the specimen. Warm it up to room temperature, rinse and dry it for inspection. The freezing temperature and freezing time of the alloy shall comply with Table A.3 regulations.

A.5.2 Inspection and assessment of results

A.5.2.1 Take the specimen that has been subjected to freezing treatment. Carefully observe whether there is γ→α martensitic transformation on the entire polished surface under a magnifying glass of 100 ~ 400 times. Fe-Cr (4J28) alloy is examined for acicular martensite at room temperature.

A.5.2.2 At room temperature, the martensite is observed after corrosion. Its needles are black. Frozen martensitic needles are light in color and mostly distributed in groups. When the number is large, it is often distributed in series along the processing direction. Sometimes stripe scratches are visually observed on the polished surface. This is because the γ→α martensitic transformation is an embossing phenomenon caused by volume expansion. Figure A.2 and Figure A.3 are specimens without martensitic transformation and with martensitic transformation, respectively.

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