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**GB**

NATIONAL STANDARD OF THE  
PEOPLE'S REPUBLIC OF CHINA

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**GB/T 3191-2019**

Replacing GB/T 3191-2010

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**Extrusion rods and bars of aluminium and aluminium  
alloys**

铝及铝合金挤压棒材

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## Foreword

This Standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This Standard replaces GB/T 3191-2010, Aluminium and aluminium alloys extruded bars, rods. Compared with GB/T 3191-2010, the main technical changes, except editorial changes, are as follows:

- Delete the normative reference of GB/T 228 (see Chapter 2 and 4.3 of version 2010);
- Add the normative reference of GB/T 8170 (see Chapter 2 and 4.1.3);
- Modify the diameter supply specifications of round rods from "5 mm ~ 600 mm" to "5 mm ~ 350 mm" (see 3.1.1, 3.1.1 of version 2010);
- Modify the provisions of the average value of magnesium content of 5xxx alloys in class-I and class-II designations, that is, change the average value of magnesium content of 5xxx alloys in class-II designation from "greater than or equal to 3%" to "greater than or equal to 4%"; change the average value of magnesium content of 5xxx alloys in class-I designation from "less than 3%" to "less than 4%" (see 3.1.1, 3.1.1 of version 2010);
- Add rods and bars of designations 2219, 2618, 6101B, 6110A (see 3.1.1);
- Add status-O rods and bars of designations 1050A, 2014, and 2014A (see 3.1.1);
- Add status T8, T8510, T8511 rods and bars of designation 2024 (see 3.1.1);
- Add status T1, T73, T73510, T73511 rods and bars of designation 7075 (see 3.1.1);
- Modify the regulations of marking and examples in product classification (see 3.1.2, 3.1.2 of version 2010);
- Modify the provisions of "if it is not specified, it will be supplied as grade-A" in section dimensions of dimensional deviation (see 3.3.1, 3.3.1 of version 2010);
- Modify the name of "fillet radius" to "chamfered radius" in "dimensional deviation" (see 3.3.2, 3.3.2 of version 2010);
- Modify the requirements for bending in dimensional deviation (see 3.3.3, 3.3.3 of version 2010);

# Extrusion rods and bars of aluminium and aluminium alloys

## 1 Scope

This Standard specifies the requirements, test methods, inspection rules and marking, packaging, transportation, storage, quality certificate and order form (or contract) contents of extrusion rods and bars of aluminium and aluminium alloys.

This Standard applies to extrusion round rods, square rods and hexagonal rods (hereinafter referred to as "rods and bars") of aluminium and aluminium alloys.

## 2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the dated version applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

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

GB/T 3190, Wrought aluminum and aluminum alloy - Chemical composition

GB/T 3199, Wrought aluminium and aluminium alloy products - Packing, marking, transporting and storing

GB/T 3246.1, Inspection method for structure of wrought aluminum and aluminum alloy products - Part 1: Inspection method for microstructure

GB/T 3246.2, Inspection method for structure of wrought aluminum and aluminum alloy products - Part 2: Inspection method for macrostructure

GB/T 6519, Ultrasonic inspection of wrought aluminium and magnesium alloy products

GB/T 7999, Optical emission spectrometric analysis method of aluminum and aluminum alloys

GB/T 8170, Rules of rounding off for numerical values & expression and judgment of limiting values

GB/T 16475-2008, Temper designation system for wrought aluminium and aluminium alloy

**3.9.1** The microstructure of the rods and bars after quenching is not allowed to be overburnt.

**3.9.2** The microstructure of 4A11, 4032 alloy rods and bars allow the presence of a small amount of primary silicon; but the distribution shall be uniform and not clustered; the maximum line size of primary silicon does not exceed 0.08 mm.

**3.9.3** When there are special requirements for the grain size of the microstructure, the supplier and the buyer shall negotiate with each other and indicate in the order form (or contract).

### **3.10 Appearance quality**

**3.10.1** Cracks, bubbles or corrosive spots are not permitted on the surface of the rod.

**3.10.2** Peeling on the surface of the rods and bars, if any, shall be removed; however, the diameter of the round rods and the thickness of the square rods or hexagonal rods after removal must not exceed the allowable deviation range.

**3.10.3** The surface of the rods and bars is not allowed to have bruises, scratches, abrasions, dents, and defects such as straightening marks due to straightening, where the depth exceeds the negative deviation of the diameter of the round rods, or the negative deviation of the thickness of the square or hexagonal rods. And the diameter of the round rods, or the thickness of the square rods or the hexagonal rods, after the depth of the defect is deducted, must not exceed the allowable deviation range.

## **4 Test method**

### **4.1 Chemical composition**

**4.1.1** Perform routine chemical analysis only on the numerically specified elements other than those in the columns of the “Al” and “Other” of corresponding designations in GB/T 3190. When the mass fraction of the non-routine analysis element is suspected to exceed the limit value of this Standard, the producer shall analyze these elements.

**4.1.2** The analysis method of chemical composition shall comply with requirements of GB/T 20975 or GB/T 7999; the arbitration analysis shall adopt the methods which are specified in GB/T 20975.

**4.1.3** The determination of analysis value is based on the rounding comparison method; the value rounding rules shall be carried out in accordance with the

Notes:

$T_1$ ,  $T_2$  -- the gap values between the two ends of the raised ends of the rod and the platform.

**Figure 3 -- Schematic diagram of measurement of the twisting degree of square rods**

#### **4.2.6 Length**

The length of the rod shall be measured by a tape whose accuracy is not less than 0.1 mm or other gauges of corresponding accuracy.

#### **4.3 Room-temperature tensile mechanical properties**

Perform the room-temperature tensile test according to the method that is specified in GB/T 16865.

#### **4.4 High-temperature endurance tensile mechanical properties**

Perform the high-temperature endurance tensile mechanical properties according to the provisions in GB/T 2039.

#### **4.5 Ultrasonic flaw detection performance**

Perform the ultrasonic flaw detection in accordance with GB/T 6519.

#### **4.6 Macro-structure**

Inspect the macro-structure in accordance with the method that is specified in GB/T 3246.2.

#### **4.7 Microstructure**

Inspect the microstructure in accordance with the method that is specified in GB/T 3246.1.

#### **4.8 Appearance quality**

Visually inspect the appearance quality under natural scattered light. If necessary, use dimensional measurement tools to define the defect size; determine the defect depth by grinding.

## **5 Inspection rules**

### **5.1 Inspection and acceptance**

**5.1.1** The product shall be inspected by the supplier to ensure that the product quality complies with the requirements of this Standard and the order form (or the contract); the supplier shall fill in the quality certificate.

**5.1.2** The buyer shall inspect the received products in accordance with the provisions of this Standard. If the test result is inconsistent with the provisions of this Standard and the order form (or the contract), a written form shall be submitted to the supplier; the issue shall be settled by negotiation between the supplier and the buyer. Objections of appearance quality and dimensional deviation shall be filed within one month from the date of receipt of the product; objections of other performances shall be filed within three months from the date of receipt of the product. Arbitration, if required, may be carried out by an organization which is recognized by both the supplier and the buyer; the sampling shall be jointly done by the buyer.

## **5.2 Batch**

Products shall be submitted for acceptance in batches. Each batch shall consist of products of the same designation, status and dimensions; the weight of each batch is not limited.

## **5.3 Weight**

The products shall be weighed on the scales (unless it is otherwise agreed by the supplier and the buyer).

## **5.4 Inspection items**

**5.4.1** Each batch of products, before being delivered, shall be inspected for chemical composition, dimensional deviation, room-temperature tensile mechanical properties and appearance quality.

**5.4.2** For rods and bars whose diameter or thickness is not less than 20.00 mm, the macro-structure of each batch shall be inspected; for rods and bars whose macro-structure is less than 20.00 mm, the macro-structure shall be guaranteed by the supplier process.

**5.4.3** Each batch of off-quenched rods and bars shall be inspected for microstructure.

**5.4.4** When the buyer indicates in the order form (or contract) that the inspection of ultrasonic flaw detection performance is required, the inspection of ultrasonic flaw detection shall be performed.

**5.4.5** When the buyer indicates in the order form (or contract) that the inspection of high-temperature endurance tensile properties is required, the inspection of high-temperature endurance tensile properties shall be performed.

repeated test results are qualified, judge the batch (or heat treatment furnace) of rods and bars to be qualified. If the sample properties are still unqualified in the repeated test result, then, judge the batch (or heat treatment furnace) of rods and bars to be unqualified. If it is agreed by both the supplier and the buyer, the supplier is allowed to inspect the products one by one and deliver those qualified ones. The supplier is also allowed to perform a repeated heat treatment to re-sample and test.

**5.6.6** When the ultrasonic flaw detection performance of any sample is unqualified, judge the piece of rod to be unqualified.

**5.6.7** When the macro-structure organization of any sample is unqualified, judge as follows:

- a) If it is unqualified because of metallurgical defects such as cracks, bright grains, non-metallic inclusions, foreign metal inclusions, white spots, and primary crystals, judge the batch of rods and bars to be unqualified. However, it is allowed to perform grade-B ultrasonic inspection one by one, and deliver the qualified ones; or, through negotiation between the supplier and the buyer, the supplier is allowed to inspect one by one and deliver those qualified ones.
- b) If it is unqualified because of layering, shrinkage or coarse grain zone, it is allowed to cut a portion from the extrusion end of the rod for repeated test until it is qualified; then, other rods and bars of the batch shall be tailed according to the maximum length of the above defect distribution of the tested rod OR inspected one by one; deliver the qualified ones.
- c) When the depth of the coarse grain zone is unqualified, the supplier is allowed to take samples in the coarse grain zone (if the depth of the coarse grain zone is less than the diameter or thickness of the standard sample, the sample shall include the entire depth of the coarse grain zone) to test the room-temperature vertical tensile mechanical properties; if the mechanical properties meet the requirements of this Standard, judge the batch of rods and bars to be qualified; otherwise, judge the batch of rods and bars to be unqualified.

**5.6.8** When the microstructure of any sample is unqualified, judge the batch (or heat treatment furnace) of rods and bars to be unqualified.

**5.6.9** When the appearance quality of any rod is unqualified, judge the rod to be unqualified.



- d) product batch number or date of manufacture;
- e) net weight or number of pieces;
- f) various of analysis and test results;
- g) the inspection stamp of the supplier's quality inspection department;
- h) code of this Standard;
- i) date of packaging (or date of manufacture).

## 7 Order form (or contract) contents

The order form (or contract) that orders the materials which are listed in this Standard shall include the following:

- a) product name.
- b) designation, status and dimensions.
- c) weight (or number of pieces).
- d) special requirements of the buyer:
  - special requirements for section dimensions allowable deviation level;
  - special requirements for chamfer radius allowable deviation level;
  - special requirements for vertical bending level;
  - special requirements for twisting degree level;
  - special requirements for room-temperature vertical tensile mechanical properties;
  - special requirements for high tensile strength performance;
  - special requirements for high-temperature endurance tensile mechanical properties;
  - special requirements for ultrasonic flaw detection performance;
  - special requirements for unlayered low organization;
  - special requirements for macro-structure coarse grain zone level;
  - special requirements for macro-structure grain size;

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