

Translated English of Chinese Standard: YB/T4003-2016

[www.ChineseStandard.net](http://www.ChineseStandard.net) → Buy True-PDF → Auto-delivery.

[Sales@ChineseStandard.net](mailto:Sales@ChineseStandard.net)

**YB**

FERROUS METALLURGY INDUSTRY STANDARD  
OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 77.040.99

H 24

**YB/T 4003-2016**

Replacing YB/T 4003-1997

---

**Standard diagrams for macrostructure and defect in  
continuous casting slab**

连铸钢板坯低倍组织缺陷评级图

**Issued on: October 22, 2016**

**Implemented on: April 01, 2017**

---

**Issued by: Ministry of Industry and Information Technology of the People's  
Republic of China.**

## Table of Contents

|                                                                                                                          |    |
|--------------------------------------------------------------------------------------------------------------------------|----|
| Foreword .....                                                                                                           | 3  |
| 1 Scope .....                                                                                                            | 4  |
| 2 Normative references .....                                                                                             | 4  |
| 3 Sampling and sample corrosion methods .....                                                                            | 4  |
| 4 Defect classification and evaluation .....                                                                             | 4  |
| 5 Inspection report .....                                                                                                | 8  |
| Appendix A (Informative) Evaluation details for macrostructure and defect in continuous casting slab .....               | 10 |
| Appendix B (Normative) Standard diagrams for macrostructure and defect in continuous casting slab by etching .....       | 12 |
| Appendix C (Normative) Standard diagrams for macrostructure and defect in continuous casting slab by sulphur print ..... | 41 |

# **Standard diagrams for macrostructure and defect in continuous casting slab**

## **1 Scope**

This Standard specifies the samples used in the testing of macrostructure and defect in continuous casting slab by etching and sulfur print, as well as the morphological characteristics, cause and evaluation principle of defects.

This Standard applies to the evaluation for macrostructure and defect in slabs such as carbon steel and alloy steel produced by continuous casting process.

The qualification grade of various defects in this Standard and the defects that are not allowed to exist shall be stipulated in the corresponding technical conditions and the agreement between the two parties.

## **2 Normative references**

The following referenced 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 226, Test method for macrostructure and defect of steel by etching

GB/T 4236, Steel examination by sulphur print (Baumann method)

## **3 Sampling and sample corrosion methods**

The sample cut-out and display methods shall comply with the provisions of GB/T 226 or GB/T 4236.

## **4 Defect classification and evaluation**

### **4.1 Morphological characteristics, cause and evaluation principle of various defects**

#### **4.1.1 Center segregation**

The morphological characteristics, cause and evaluation principle of center segregation are as follows:

- a) Morphological characteristics: deep corroded dark spots or bands in the central area of the acid-etched test surface of the continuous casting slab; brown spots or concentrated brown bands of different colors in the central area of the sulfur print. The segregated bands are distributed continuously, discontinuously or dispersedly. Type A segregation is a continuously distributed band, type B segregation is a discontinuously distributed band, and type C segregation is a band formed by discontinuous aggregation of spots of different sizes;
- b) Cause: formed during the solidification process of molten steel, when elements such as sulfur and phosphorus with low melting points are pushed to the center of the continuous casting slab due to the result of fractional crystallization;
- c) Evaluation principle: evaluate by segregation type, segregated band thickness or segregated spot size; see A.1 for evaluation details.

#### **4.1.2 Center porosity**

The morphological characteristics, cause and evaluation principle of center porosity are as follows:

- a) Morphological characteristics: many small dark spots or voids in the central area of the acid-etched test surface of the continuous casting slab;
- b) Cause: many micropores formed due to volume shrinkage – during casting and solidification of molten steel – without sufficient molten steel supplementation, and lack of compact structure in the central area resulted from gas precipitation and impurity accumulation during final solidification;
- c) Evaluation principle: evaluate according to the quantity and density of dark spots or voids.

#### **4.1.3 Intermediate crack**

The morphological characteristics, cause and evaluation principle of intermediate crack are as follows:

- a) Morphological characteristics: linear defects appearing in the columnar area on the acid-etched test surface or sulfur print of the continuous casting slab;
- h) Cause: cracks – expanding along the columnar crystal – caused by the uneven cooling in the secondary cooling zone, and thermal stress resulted from rising surface temperature;
- c) Evaluation principle: evaluate according to the length, opening width and quantity of cracks; see A.2 for evaluation details.

#### **4.1.4 Corner crack**

The morphological characteristics, cause and evaluation principle of pinhole bubbles are as follows:

- a) Morphological characteristics: pinhole-like circular holes appearing on the acid-etched test surface or sulfur print of the continuous casting slab, separated by a clear boundary with the steel substrate;
- b) Cause: formed by molten steel peroxidation or gas trapped;
- c) Evaluation principle: evaluate according to the size, quantity and distribution of bubbles; see A.3 for evaluation details.

#### **4.1.8 Honeycomb bubbles**

The morphological characteristics, cause and evaluation principle of honeycomb bubbles are as follows:

- a) Morphological characteristics: strip-shaped, oval-shaped or circular holes perpendicular to the surface of the slab appearing on the acid-etched surface or sulfur print of the continuous casting slab;
- b) Cause: formed due to poor deoxidation of molten steel, damp casting system or gas trapped during argon blowing;
- c) Evaluation principle: evaluate according to the size, quantity and distribution of bubbles; see A.3 for evaluation details.

#### **4.1.9 Silicate inclusions**

The morphological characteristics, cause and evaluation principle of silicate inclusions are as follows:

- a) Morphological characteristics: dark-gray spherical or oval particles with smooth edges appearing on the acid-etched test surface of the continuous casting slab;
- b) Cause: formed when refractories or dirt from smelting or pouring systems enter and remain in molten steel;
- c) Evaluation principle: record only the size and data of inclusions; do not evaluate the grade.

#### **4.1.10 White bands**

The morphological characteristics, cause and evaluation principle of white bands are as follows:

- a) Morphological characteristics: white bands with strong corrosion resistance and dense structure appearing on the acid-etched test surface or sulfur print of the continuous casting slab;

- b) Cause: formed along the solute-enriched molten steel of small temperature gradient before solidification, due to improper electromagnetic stirring, fast moving speed of molten steel;
- c) Evaluation principle: record only the distance from the edge and the width of the band; do not evaluate the grade.

## **4.2 Standard diagrams**

**4.2.1** This Standard includes the following two sets of standard diagrams:

- a) Macrostructure diagram of continuous casting slab by etching (see Appendix B);
- b) Sulfur print standard diagrams (see Appendix C).

**Note:** The defect in the standard diagram is taken from the 210 mm × 1300 mm continuous casting slab. When evaluating the defect grade of continuous casting slabs of other specifications, the standard diagrams can be zoomed out or zoomed in in proportion.

**4.2.2** All types of standard diagrams for defect are composed of 6 grades from 0.5 to 3.0, which increase with the severity of the defect. See Appendix A for the size or quantity of specific defects.

## **4.3 Evaluation method and qualification grade**

**4.3.1** All types of defects are limited to visual visibility, at a start-rating grade of 0.5. When evaluating, grade by comparing with the diagrams listed in Appendix B and Appendix C. Where the defect grade cannot be determined by comparison, refer to Appendix A for measurement and evaluation.

**4.3.2** The selection of the standard diagram, the qualification grade of various defects and the defects that are not allowed to exist shall be in accordance with the provisions of product standards or technical conditions.

# **5 Inspection report**

The inspection report shall include the following contents:

- a) entrusting unit;
- b) test steel designation;
- c) melting number of the test sample;
- d) sample number;
- e) specifications of the continuous casting slab;

**This is an excerpt of the PDF (Some pages are marked off intentionally)**

**Full-copy PDF can be purchased from 1 of 2 websites:**

1. <https://www.ChineseStandard.us>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Select your country (currency), for example: USA (USD); Germany (Euro).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Tax invoice can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with download links).

2. <https://www.ChineseStandard.net>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Add to cart. Only accept USD (other currencies - <https://www.ChineseStandard.us>).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with PDFs attached, invoice and download links).

Translated by: Field Test Asia Pte. Ltd. (Incorporated & taxed in Singapore. Tax ID: 201302277C)

About Us (Goodwill, Policies, Fair Trading...): <https://www.chinesestandard.net/AboutUs.aspx>

Contact: Wayne Zheng, [Sales@ChineseStandard.net](mailto:Sales@ChineseStandard.net)

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

**----- The End -----**