

ICS 25.120.30

CCS J61



National Standard of the People's Republic of China

GB/T 31553-2025

Replaces GB/T 31553-2015

External-heating Hot Blast Cupola Furnace

Issued: October 31, 2025

Effective: May 1, 2026

State Administration for Market Regulation (SAMR)

Standardization Administration of the People's

Republic of China (SAC)

Issued

Translated by www.china-standards.com

Table of Contents

Foreword	III
1 Scope	1
2 Normative References	1
3 Terms and Definitions	1
4 Types and Basic Parameters	2
5 Technical Requirements	3
6 Test Methods	6
7 Inspection Rules	8
8 Marking, Packaging, Transportation and Storage	8
Table 1 Basic Parameters of Cupola	2
Table 2 Minimum Thickness of Steel Plates	3
Table 3 Specifications and Quantities of Bolts for Shell Connecting Flanges	3
Table 4 Permissible Deviations of Shell Perimeter and Roundness	4
Table 5 Tapping Temperature of Molten Iron and Total Carbon Consumption Rate	5
Table 6 Single-piece Mass of Metallic Charge	6

Foreword

This document is drafted in accordance with the provisions of GB/T 1.1-2020 Directives for Standardization—Part 1: Rules for the Structure and Drafting of Standard Documents.

This document replaces GB/T 31553-2015 External Hot Blast Cupola. Compared with GB/T 31553-2015, in addition to structural adjustments and editorial revisions, the main technical changes are as follows:

- Deleted the classification of external hot blast cupolas by lining type, operation system, heat source of hot blast and heat exchange mode of heat exchangers (see Clause 4.2, 4.3, 4.4 and 4.5 of the 2015 edition);
- Revised the basic parameters of cupolas (see Table 1, Table 1 of the 2015 edition);
- Deleted the requirements for the minimum thickness of steel plates selected for some specifications of cupolas (see Table 2, Table 2 of the 2015 edition);
- Deleted the specifications and quantities of bolts for flanges of some specifications of cupolas (see Table 3, Table 3 of the 2015 edition);
- Deleted the inner diameter tolerances and roundness tolerances of the shell for some specifications of cupolas (see Table 4, Table 4 of the 2015 edition);
- Revised the clause of Manufacturing Requirements (see Clause 5.2.1.12, Clause 6.3.10 of the 2015 edition);
- Deleted the tapping temperature of molten iron and total carbon consumption rate of some specifications of cupolas (see Table 5, Table 5 of the 2015 edition);
- Revised the clause of Service Performance Requirements (see Clause 5.4, Clause 6.5 of the 2015 edition);
- Revised the clause of Safety and Environmental Protection Requirements (see Clause 5.5, Clause 6.6 of the 2015 edition).

Please note that certain contents of this document may involve patents. The issuing body of this document shall not be liable for identifying patents.

This document is proposed by China Machinery Industry Federation.

This document is under the jurisdiction of National Technical Committee for Foundry Machinery Standardization (SAC/TC 186).

The drafting organizations of this document are: Qingdao Qingli Environmental Protection Equipment Co., Ltd., Shenyang Yate Heavy Industry Equipment Manufacturing Co., Ltd., Qingdao Zhongzhida Environmental Protection Smelting Equipment Co., Ltd., Fujian Yuanzhiwei Import and Export Co., Ltd., Jinan Foundry & Forging Institute Inspection, Testing and Technology Co., Ltd., Nan'an China Machinery Standardization Research Institute Co., Ltd., Fujian Minxuan Technology Co., Ltd., Jiangyin Foundry Equipment Factory Co., Ltd., China Automotive Industry Engineering Co., Ltd., Zhiheng (Tianjin) Industrial Co., Ltd., Qingdao Antai Heavy Industry Machinery Co., Ltd., Qingdao Kaijie Heavy Industry Machinery Co., Ltd., Qingdao Beinuo Magnetolectric Technology Co., Ltd., Weihai Gongyou Foundry Machinery Co., Ltd., Shandong Jietron Machinery Co., Ltd.

The principal drafters of this document are: Yu Kuotao, Sun Xin, Jia Chunyang, Duan Yudong, Xu Guipeng, Bao Yanqing, Ke Zhenzhen, Zhu Bin, Duan Jinting, Xia Xinhai, Liu Hongliang, Ren Yubao, Liu Yantao, Su Ligu, Zhu Shijia, Chi Yingjie, Hou Yongzhen.

The release history of this document and the document it replaces is as follows:

- First released as GB/T 31553-2015 in 2015;
- This is the first revision.

External-heating Hot Blast Cupola Furnace

1 Scope

This document specifies the types, basic parameters and technical requirements for external hot blast cupolas, describes the corresponding test methods, and specifies the inspection rules, marking, packaging, transportation and storage requirements.

This document is applicable to the manufacture of external hot blast cupolas.

2 Normative References

Contents of the following documents are incorporated as indispensable clauses of this document through normative reference in the text. For dated referenced documents, only the edition corresponding to the specified date applies to this document; for undated referenced documents, the latest edition (including all amendments) applies to this document.

GB/T 713.2-2023 Steel Plates and Strips for Pressure Equipments—Part 2: Non-alloy and Alloy Steels with Specified Temperature Properties

GB/T 985.1 Recommended Grooves for Oxyfuel Gas Welding, Shielded Metal Arc Welding, Gas Shielded Welding and High Energy Beam Welding

GB/T 985.2 Recommended Grooves for Submerged Arc Welding

GB/T 1184-1996 Geometric Tolerances—Unspecified Tolerance Values

GB/T 1804-2000 General Tolerances—Tolerances for Linear and Angular Dimensions Without Individual Tolerance Indications

GB/T 3098.1-2010 Mechanical Properties of Fasteners—Bolts, Screws and Studs

GB/T 3098.2-2015 Mechanical Properties of Fasteners—Nuts

GB/T 5226.1 Electromechanical Safety of Machinery—Electromechanical Equipment of Machinery—Part 1: General Technical Requirements

GB/T 9969 General Rules for Instruction Manuals of Industrial Products

GB/T 18717.2 Ergonomic Design for Machine Safety—Part 2: Principles for Determining the Aperture Sizes for Partial Body Access to Machinery

GB 20905-2007 Safety Requirements for Foundry Machinery

GB/T 23570 General Technical Requirements for Welded Components of Metal Cutting Machine Tools

GB/T 23571 Compilation of Accompanying Technical Documents for Metal Cutting Machine Tools

GB/T 25370 Terminology for Foundry Machinery

GB/T 25371 Measurement Method for Noise Sound Pressure Level of Foundry Machinery

GB/T 25711-2023 General Technical Specifications for Foundry Machinery

GB/T 31552 Classification and Model Designation Method for Foundry Machinery

JB/T 11534 Operating Requirements for Cupola Melting

JB/T 12245 Terminology for Cupola Melting and Casting

NB/T 47013.3-2023 Non-destructive Testing of Pressure Equipments—Part 3: Ultrasonic Testing

3 Terms and Definitions

The terms and definitions specified in GB/T 25370 and JB/T 12245 as well as the following ones apply to this document.

3.1 external-heating hot blast cupola furnace

A cupola where the combustion-supporting gas is heated in an external combustion chamber before being fed into the furnace.

[Source: GB/T 25370-2020, 9.1.7]

3.2 combustion chamber

A complete hot blast unit equipped on an external-heating hot blast cupola, which burns carbon monoxide in the furnace gas or other added fuels, and uses the generated heat to heat the air blown into the cupola.

[Source: GB/T 25370-2020, 9.1.38]

3.3 heat exchanger

A heat exchange assembly equipped on an external-heating hot blast cupola, which transfers part of the heat of the hot fluid to the cold fluid.

3.4 tuyere area ratio

The percentage of the total area of tuyeres to the cross-sectional area of the furnace hearth.

Note: The total area of the furnace hearth is generally taken as the cross-sectional area of the furnace hearth at the center of the main tuyeres.

[Source: GB/T 25370-2020, 9.1.46]

3.5 effective height

The vertical distance from the cross-section at the center of the first row of tuyeres to the lower edge of the charging opening inside the furnace hearth of an external-heating hot blast cupola.

[Source: GB/T 25370-2020, 9.1.24, with modification]

4 Types and Basic Parameters

4.1 Types

External-heating hot blast cupolas (hereinafter referred to as "cupolas") can be classified into top-mounted type and side-mounted type according to the installation position of the combustion chamber.

4.2 Basic Parameters

4.2.1 The basic parameters of cupolas shall comply with the requirements specified in Table 1.

Table 1 Basic Parameters of Cupola

Melting Rate [t/h]	Hot Blast Temperature [°C]	Furnace Diameter at Melting Zone [mm]	Furnace Diameter at Tuyere Zone [mm]	Effective Height [mm]	Number of Tuyeres units	Tuyere Area Ratio [%]	Tuyere Inclination Angle [(°)]	Air Supply Intensity at Melting Zone [Nm ³ /(m ² ·min)]	Melting Intensity [t/(m ² ·h)]
10	≥500	1200	1000	7800	6	3~5	5~15	80~120	7.5~10.5
15	≥500	1500	1220	8500	6				
20	≥500	1700	1420	10500	6				
25	≥500	1900	1600	11500	6				
30	≥500	2100	1720	12500	6				
35	≥500	2250	1860	13200	6				
40	≥500	2400	2000	13700	6				
45	≥500	2600	2100	14200	6				
50	≥500	2700	2200	14800	6				