ICS 77.010
CCS P 73

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 50567-2022

Technical code for shell structure of ironmaking furnace

Issued on: January 5, 2022 **Implemented on: May 1, 2022**

Issued by: Ministry of Housing and Urban-Rural Development of the People's Republic of China;
State Administration for Market Regulation

Table of Contents

1 General

1.0.1 This specification is formulated to standardize the structural design and construction of ironmaking process furnace shells, to achieve advanced technology, reasonable economy, safety and applicability, and ensure quality.

1.0.2 This code is applicable to the structural design and construction of newly built, rebuilt and expanded blast furnaces, hot blast furnaces, gravity dust collectors and crude gas pipeline shells with an effective volume of 1000m3 to 5000m3.

1.0.3 In addition to this standard, the design and construction of the shell structure of the iron-making process furnace should also comply with the current relevant national standards.

2.0.1 blast furnace blast furnace

A special metallurgical kiln for continuously reducing iron-containing raw materials into pig iron under high temperature and high pressure is the main equipment of contemporary ironmaking production. Use steel plates as the furnace shell, install cooling equipment inside the shell and build a refractory lining or install shell cooling equipment outside the shell and build a refractory lining inside the shell. From top to bottom, the blast furnace body is divided into six parts. the cover, the furnace throat, the furnace body, the furnace waist, the furnace belly, and the hearth.

2.0.2 hot blast stove

The thermal power equipment that heats the cold air blown by the blower to a certain temperature and sends it to the blast furnace. The hot blast stove system is composed of hot blast stove groups, external combustion, and air supply system pipeline valves and other process facilities. Through the alternate combustion and heat storage, air supply and

heat release operation of different hot blast stoves in the hot blast stove group, the blast furnace is realized. Continuous air supply. The main body of the hot blast stove is a pressure-bearing steel structure shell lined with refractory and heat-insulating materials. The main body of the hot blast stove is built with refractory structures such as a hot chamber, a combustion chamber and a burner.

2.0.3 de-duster

Process facilities used to remove coarse dust contained in blast furnace gas. Generally, there are typical structural forms such as gravity dust collector and cyclone dust collector.

2.0.4 raw gas pipeline

A large gas pipeline that exports the blast furnace gas generated by the blast furnace smelting reaction and sends the gas to the gas purification facility. It is composed of ascending pipe, descending pipe, five-way ball or three-way pipe.

2.0.5 The campaign life of the first generation furnace service

The actual operating life of a blast furnace from ignition and commissioning to shutdown and overhaul is the life of the structure or components specified in the shell structure design for the intended purpose.

2.0.6 Shell structure shell structure

Sheet-like structures whose mid-surface is curved and whose thickness i is much smaller than the minimum radius of curvature R and plane size can be divided into thin shells and medium-thick shells. The thickness and center of the shell structure of the ironmaking process furnace The ratio of the minimum curvature radius of the surface is less than 1/50, which belongs to the thin shell structure.

2.0.7 Equivalent stress Equivalent stress

Combined stresses defined by the fourth strength theory used as strength criteria for arbitrary stress states.

2.0.8 allowable stress allowable stress

Allowable limit of equivalent stress. The maximum stress value that a material is allowed to bear in engineering structure design.

2.0.9 elastic analysis elastic analysis

According to elastic failure criterion analysis of structure C and displacement.

2.0.10 elastic-plastic analysis elastic-plastic analysis

A method for calculating the state of a structure under a given load based on the plastic properties of the material.

2.0.11 Welding

Heating by arc or gas flame, etc. and sometimes pressurizing, filling or not filling material to make the connected weldment reach the state of atomic or molecular bonding.

2.0.12_ welding process welding process All processing methods and implementation requirements related to welding process operation instructions in the production of weldments, including welding preparation, material selection, welding method selection, welding parameters, operation requirements, etc.

2.0.13 Welding process evaluation welding process evaluation

The test process and result evaluation to verify the correctness of the proposed welding process.

2.0.14 butterfly head dished head

It consists of a spherical cap with a large radius in the center, a ring shell with a small radius around the periphery, and a cylindrical diameter section.

2.0.15 Pre-assembled pre-assembly

Assembly to meet the installation quality requirements of the inspection housing.

2.0.16 shell assembly shell assembly

On the platform within the working range of the hoisting machinery at the installation site, the process of assembling the block shells into a complete ring and welding.

2.0.17 Shell installation shell installation

3.0.9 Construction requirements such as manufacturing, inspection, transportation, installation, welding, weld quality inspection, coating, overall air tightness test, and completion acceptance of the shell structure shall comply with the relevant provisions of Chapter 10 of this standard.

4 Loads

4.1 Load classification and load effect combination

4.1.1 The load on the shell structure can be divided into permanent load and variable load.

4.1.2 When designing the shell structure and connections, the combination of load effects should be calculated according to the following formula according to the loads that may act simultaneously during production and use, and the strength should be checked according to the most unfavorable one.

4.1.3 The temperature effect of the shell is resisted by the allowable stress at the design temperature, but the temperature difference effect should not be included.

4.1.4 When designing the anchor bolts connecting the hearth section of the hot blast stove to the foundation, the earthquake action effect should be calculated.

4.2 Shell loads

4.2.1 The blast furnace shell load shall be determined according to Table 4.2.1.

4.2.2 The shell load of the hot blast stove shall be determined according to Table 4.2.2

4.2.3 The shell load of the gravity dust collector shall be determined according to Table 4.2.3.

4.2.4 The shell load of crude gas pipeline shall be determined according to Table 4.2.4.

4.2.5 The standard values of wind load, snow load, platform dust load and platform live load shall comply with the relevant provisions of the current national standard "Code for Building Structure Loads" GB 50009.

5 materials

5.1 Steel 5.1.1 The selection of steel grades shall be determined according to factors such as the importance of the shell structure, structural form, load conditions, stress characteristics, design temperature, corrosive medium characteristics and steel plate thickness.

5.1.2 Except for the bottom plate of the blast furnace, the steel materials of the blast furnace, hot blast stove and five-way spherical shell structure shall have the qualified guarantee of 0 degrees C impact toughness. Steel materials for other shell structures should have a qualified guarantee of normal temperature impact toughness. The steel carbon equivalent (CEV) of the blast furnace shell structure should not be greater than 0.42% or the welding cold crack sensitivity index (Pcm) should not be greater than 0.26%. The formula (B.1.2-1) and formula (B.1.2-2) in B are calculated using the smelting analysis value.

5.1.3 The steel for blast furnace shell structure should adopt the steel for shell structure in Appendix B of this standard. For the shell structure of blast furnaces with an effective volume of 1200m3~2000m3, Q355C steel, Q390C steel and Q390D steel can be used. The bottom plate of the blast furnace can be made of Q355B steel.

5.1.4 The steel materials for the body and bottom shell of the hot blast stove should be