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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 22395-2022

Replacing GB/T 22395-2008

Specification for the design of boiler steel structures

锅炉钢结构设计规范

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1 Scope

China's national design code for the steel structure of a boiler. It specifies the design principles and methods for the steel structures of supported and suspended boilers, and it applies to the design of such structures. A large utility boiler is not a vessel standing on the ground: it is a furnace some sixty metres tall hung from a steel frame, and the frame is a substantial structure in its own right - several thousand tonnes of steel carrying the whole weight of the boiler, its water, its pressure parts and its ash. The reason it is hung rather than supported is thermal. A furnace that grows half a metre downward as it heats can hang from a fixed top and expand freely; if it stood on the ground it would grow upward into every connection above it. That single decision governs the structure. The frame carries the

load in tension through hanger rods from the top girders, the boiler moves relative to the building throughout its whole height, and every connection between the two - buckstays, seals, ducts, piping - has to accommodate that movement while transferring wind and seismic load. So a boiler frame is a structure with a moving mass inside it, and the load cases are not those of an ordinary building: dead load that shifts as the boiler expands, the enormous thermal displacements, wind on a very tall and largely open frame, seismic action on a suspended mass, and the furnace pressure excursion that a boiler explosion door is sized on. The code covers the materials, the load cases and combinations, the analysis, the design of members and connections, the buckstay system, the stability of a tall slender frame and the fabrication and erection requirements. Issued on 11 July 2022 and in force since 1 February 2023, it replaces GB/T 22395-2008.

This document specifies the design principles and methods for steel structures of supported and suspended boilers. This document applies to the design of steel structures for supported and suspended boilers.

2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. Among them, for dated references, only the version corresponding to the date applies to this document; for undated references, the latest version (including all amendments) applies to this document.

GB/T 700 Carbon structural steels

GB/T 1228 High strength bolts with large hexagon head for steel structures

GB/T 1229 High strength large hexagon nuts for steel structures

GB/T 1230 High strength plain washers for steel structures

GB/T 1231 Specifications of high strength bolts with large hexagon head, large hexagon nuts, plain washers for steel structures

GB/T 1591 High strength low alloy structural steels

GB/T 3632 Sets of torshear type high strength bolt hexagon nut and plain washer for steel structures

GB/T 5117 Covered electrodes for manual metal arc welding of non-alloy and fine grain steels

GB/T 5118 Covered electrodes for manual metal arc welding of creep-resisting steels

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Frame structure A structure, which is capable of resisting shear and bending AND is composed of columns and beams rigidly connected.

3.2 Frame-bracing structure A structure, that consists of a frame and braces AND together forms a lateral force- resistant system.

3.3 Bracing structure A structure, in the plane where the beam-column member is located, where bracing members are arranged obliquely, to support the axial stiffness against lateral action.

3.4 Main column A column, which mainly bears the boiler body load, wind load, seismic action.

3.5 Main boiler support level The general term for the load beam, on the top of the boiler steel structure, to suspend or support the boiler body.

3.6 Main girder Beams in the main boiler support level, that directly transfer the boiler body loads to the columns.

4 General requirements

4.1 The steel structure of the boiler supports the components of the boiler body; maintains their relative positions; bears wind load, snow load, seismic action; bears the load provided by the design organization of the power station and the load approved to act on the steel structure of the boiler. Except for special requirements, boiler steel structures do not directly bear dynamic loads.

4.2 When designing boiler steel structures, structural schemes, materials, connection methods and structural measures shall be reasonably selected, to meet the strength, stability and rigidity requirements of structural components, during transportation, installation, use.

4.5 When designing the boiler steel structure, according to the limit state of bearing capacity, the basic combination and accidental combination of load (action) effects shall be adopted. When designing the boiler steel structure, according to the limit state of normal service, the standard combination of load (action) effects shall be adopted.

4.6 The steel structure of boilers, in areas with seismic fortification intensity of 6 degrees or above, shall be subjected to seismic design. This document is applicable to the design of boiler steel structures, in areas with seismic fortification intensity ranging from 6 to 9 degrees. When the seismic fortification intensity is greater than 9 degrees, it shall follow special provisions.

4.7 The steel structure of boilers, which adopts open-air layout and tight enclosure, shall be checked for wind resistance.

4.12 The structural safety level of the steel structure of the boiler is Class II; the importance

factor (γ_0) is taken as 1.0.

4.13 The natural environmental conditions, which are required for boiler steel structure design, are.

4.14 The boiler steel structure, which is designed according to this document, shall be manufactured and inspected, according to NB/T 47043.

5 Provisions on deformation of materials, design indicators, structural (component)

5.1 The steel structure of the boiler shall be selected, according to the importance of the structure and the working environment and other factors. The main stress structure of the boiler steel structure should adopt Q235 steel, Q355 steel, Q390 steel, Q420 steel; its quality shall meet the requirements of GB/T 700 and GB/T 1591, respectively. When there is a reliable basis, other designations of steel can be used.

5.2 The steel of the main stress-bearing components shall have the qualification assurance of yield strength, tensile strength, elongation at break, cold bending test, sulfur and phosphorus content. The welding structure shall have the qualification assurance of carbon equivalent.

5.3 The steel, which is used for the main lateral force-resisting members of the boiler steel structure for seismic fortification, shall meet the following requirements.

5.4 The quality grade of the main stress-bearing members of the steel structure of the boiler shall be adopted, in accordance with Table 1.

5.5 For steel structures that adopt welded connections, when the thickness of the steel plate is not less than 40 mm AND there is a relatively high tearing force along the direction of the plate thickness, including the effect of high restraint tensile stress, it should use a Z15-grade steel plate with thickness direction properties; its quality shall meet the requirements of GB/T 5313.

6.1 Classification of boiler steel structures

6.1.1 According to the characteristics of lateral force resistance of the structure, the structural system of boiler steel structure can be divided into frame structure, frame-bracing structure, bracing structure.

6.1.2 According to the fixing method of boiler body parts, boiler steel structure can be divided into supporting type and suspension type.

6.2 Layout principles of boiler steel structure

6.2.1 For the steel structure of the boiler, it shall, based on the characteristics of the boiler and the external conditions, select a structural system with good load-bearing performance and economical rationality. Plane and elevation layout should be regular, symmetrical, with