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

GB/T 16507.7-2022

Replacing GB/T 16507.7-2013

**Water-tube boilers - Part 7: Safety appurtenances and
instruments**

水管锅炉 第7部分：安全附件和仪表

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1 Scope

GB/T 16507.7-2022 is the Chinese national standard on water-tube boilers - part 7: safety appurtenances and instruments, in the field of energy and heat transfer engineering. The /T suffix marks it as a recommended standard: it is not compulsory by itself, but it becomes binding as soon as a contract, a tender or a customer specification calls it up - which in practice is how most foreign buyers meet it. It was issued on 9 March 2022 by the State Administration for Market Regulation; Standardization Administration of China, and has been in force since 1 October 2022. Classification: ICS 27.060.30, CCS J98. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This document specifies the requirements for safety appurtenances and instruments of water-tube boilers, including safety valves, pressure measuring devices, water (liquid) level measurement and display control devices, temperature measuring devices, blowdown emission and water emission devices, and protection devices. This document is applicable to the safety appurtenances and instruments selected for water-tube boilers defined in

GB/T 16507.1.

2 Normative references

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

GB/T 1239.2, Cold coiled helical springs technical specifications - Part 2: Compressions spring

GB/T 12228, General purpose industrial valves - Specification of carbon steel forgings

GB/T 12229, General purpose industrial valves - Specification of spheroidal graphite iron castings

GB/T 12230, General purpose industrial valves - Specification of stainless steel castings

GB/T 12241, Safety valves - General requirements

GB/T 12242, Pressure relief devices - Performance test code

GB/T 16507.1, Water-tube boilers - Part 1: General requirements

GB/T 16507.2, Water-tube boilers - Part 2: Materials

GB/T 16507.4, Water-tube boilers - Part 4: Strength calculation of pressure parts

GB/T 20438 (all parts), Functional safety of electrical/electronic/programmable electronic safety-related systems

GB/T 21109 (all parts), Functional safety of safety instrumented systems in the process industry sector

GB/T 23934, Hot formed helical compression springs - Technical Requirement

GB 50116, Code for design of automatic fire alarm system

3 Terms and definitions

The following terms and definitions defined in GB/T 16507.1 apply to this document.

3.1 instrument A device used alone or in combination with other equipment to make measurements.

3.2 quencher The equipment that uses air or water to cool the slag emission at the bottom of the circulating fluidized bed boiler.

3.3 bed temperature The temperature of the gas-solid two-phase flow in the dense phase zone of the circulating fluidized bed boiler.

3.4 bed pressure The pressure difference obtained by subtracting the resistance of the air distribution plate from the pressure difference between the lower air chamber of the circulating fluidized bed boiler air distribution plate and the furnace outlet.

3.5 safety valve Valves that protect pipelines or equipment. NOTE: When the medium pressure in the pipeline or equipment exceeds the specified value, the opening-closing parts (disc) will automatically open to emission the medium. When it is lower than the specified value, the opening-closing parts (disc) will automatically close.

3.6 relief valve An automatic pressure relief device. NOTE: Its action is controlled by the static pressure on the inlet side of the valve. Its opening increases with the increase of the opening pressure. It is mainly used for incompressible media.

3.7 power operated pressure relief valve A valve whose opening or closing action is controlled entirely by a power source (electric, pneumatic, hydraulic or pulse). NOTE: It is a kind of controlled safety valve.

3.8 set pressure of safety valve The set pressure at which a safety valve begins to open under operating conditions.

4 Basic requirements

4.1 The safety appurtenances and instruments configured by the boiler shall meet the requirements for safe and reliable operation of the boiler.

4.2 The safety appurtenances and instruments configured by the boiler shall meet the requirements of product standards.

4.3 The calibration and maintenance of measuring instruments shall comply with the regulations of the national metrology department.

4.4 The pressure, water level and temperature measuring devices configured by the boiler shall be installed in all necessary places. They shall be properly ranged and reliable. The measurement value shall have enough precision.

5.1 Number and type of safety valve

5.1.1 Each boiler is equipped with at least two safety valves (including drum and superheater safety valves). Only one safety valve may be installed if one of the following requirements is met:

- a) Steam boilers with rated evaporation not greater than 0.5t/h;
- b) Steam boilers with rated evaporation less than 2t/h and equipped with reliable overpressure interlock protection device; such that when all the safety valves on the boiler are fully opened, the pressure inside the boiler shall not exceed

1.1 times the calculated pressure.

5.2.3 The proportion of the emission of the superheater outlet safety valve to the total emission shall ensure that the superheater can be cooled sufficiently when the safety valve is opened.

5.2.4 For hot water boilers whose rated outlet water temperature is not less than 100°C, the maximum steam production (E_v) of the boiler at the rated thermal power shall be determined according to the formula (1): Where, E_v - the maximum steam output of the boiler at rated thermal power, in kilograms per hour (kg/h); Q - the rated thermal power of the boiler, in megawatts (MW); Δi - the enthalpy increase, in kilojoules per kilogram (kJ/kg), which is equal to the difference between saturated steam enthalpy and feedwater enthalpy at rated pressure.

5.2.5 The total emission of the reheater safety valve shall be greater than the maximum design steam flow of the reheater. The emission of the safety valve at the outlet shall ensure that the reheater can be cooled sufficiently when the safety valve is fully opened.

5.2.6 The total emission of the safety valve of the external start-up (steam-water) separator of the DC steam boiler shall be greater than the steam production when the DC steam boiler starts. The combined emission of the DC steam boiler safety valve and power operated pressure relief valve (no valve at the inlet) shall be greater than the maximum continuous evaporation capacity of the boiler. Among them, the proportion of the emission of the power operated pressure relief valve shall not be greater than 30% of the maximum continuous evaporation of the boiler. The emission of the power operated pressure relief valve shall not be less than 10% of the maximum continuous evaporation capacity of the boiler.

5.2.7 The safety valve manufacturer shall determine the emission coefficient of the safety valve through tests. The test method and emission calculation shall meet the requirements of GB/T 12241 and GB/T 12242. When the test conditions are lacking, the emission of the safety valve can be calculated according to the provisions of 5.2.8.

5.2.8 The emission of steam boiler safety valve shall be calculated according to one of the following methods:

a) According to the rated emission provided by the safety valve manufacturer; appurtenances between the pressure element and the safety valve shall not be less than the calculated cross-sectional area of the flow channel of the safety valve. The steam- water resistance of such connecting pipes or pipe appurtenances shall not affect the emission and normal operation of the safety valve.

5.4.5 The opening design of the pressure element shall ensure that the medium flow between the pressure element and the safety valve is unimpeded. When two or more safety valves need to be installed on one interface of the pressure element, the calculated