

ICS 27.060.30
CCS J98



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

GB/T 16507.6-2022

Replacing GB/T 16507.6-2013

Water-tube boilers - Part 6: Inspection, testing and acceptance

水管锅炉 第6部分：检验、试验和验收

Issued on: March 9, 2022

Implemented on: October 1, 2022

**Issued by: State Administration for Market Regulation;
Standardization Administration of China**

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1 Scope

GB/T 16507.6-2022 is the Chinese national standard on water-tube boilers - part 6: inspection, testing and acceptance, 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 material inspection, product size, forming process and appearance inspection of welded joints, ball inspection, spectral inspection, non-destructive testing, mechanical performance inspection of product welded joints, hydraulic test, inspection documents, exit-factory information, metal nameplates and marking requirements for pressure elements of water-tube boilers and non-pressure elements directly connected to the load. This document is applicable to the inspection, test and acceptance of the pressure elements of water-tube boilers defined in GB/T 16507.1 and the non-pressure elements directly connected to them.

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 2652, Destructive tests on welds in metallic materials - Longitudinal tensile test on weld metal in fusion welded joints

GB/T 2900.48, Electrotechnical terminology of boilers

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

GB/T 16507.5, Water-tube boilers - Part 5: Fabrication

JB/T 3375, Rules for receiving acceptance of materials for boiler construction
NB/T 47013.2, Nondestructive testing of pressure equipment - Part 2: Radiographic testing
NB/T 47013.3, Nondestructive testing of pressure equipment - Part 3: Ultrasonic testing
NB/T 47013.4, Nondestructive testing of pressure equipment - Part 4: Magnetic particle testing
NB/T 47013.5, Nondestructive testing of pressure equipment - Part 5: Penetrant testing
NB/T 47013.10, Nondestructive testing of pressure equipment - Part 10: Ultrasonic time of flight diffraction technique
NB/T 47013.11, Nondestructive testing of pressure equipment - Part 11: Standard practice for X-ray digital radiography
NB/T 47013.14, Nondestructive testing of pressure equipment - Part 14: X-ray Computed radiographic testing
NB/T 47013.15, Non-destructive testing of pressure equipment - Part 15: Phased array ultrasonic testing
NB/T 47016, Mechanical property tests of product welded test coupons for pressure equipment
Catalog of Special Equipment (General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China No. 114 in 2014)

3 Terms and definitions

The terms and definitions defined in GB/T 2900.48 and GB/T 16507.1 as well as the followings apply to this document.

3.1 hydrostatic test pressure During the hydrostatic test, the pressure applied to the boiler system or pressure components (elements) according to regulations.

4 Material acceptance

4.1 General requirements Boiler manufacturers shall formulate material procurement standards. According to the regulations, steel plates for boilers, steel pipes for boilers, structural steel plates (used to manufacture flanges and webs of large plate girders), steel strips, section steel (height is 250mm and above, or angle steel side width is 250mm and above), round steel (for the manufacture of tie rods and suspenders with a diameter of 40mm and above), forgings, steel castings, iron castings, welding materials (including welding rods, welding wires, flux-cored welding wires and fluxes), are subject to enter-factory acceptance.

4.2 Material quality certification records.

5.3 The finished product shall be tested for the corresponding size. The testing results shall comply with the provisions of GB/T 16507.5.

5.4 Welded joints of pressure elements (including joints welded between non-pressure elements and pressure elements) shall be visually inspected and at least meet the following requirements.

a) The overall dimensions of the weld shall meet the requirements of design drawings and process documents.

b) Butt weld height shall not be lower than base metal surface. The weld and base metal shall transition smoothly. There are no cracks, slag inclusions, arc craters, incomplete fusion and pores on the surface of the weld and heat-affected zone.

c) Longitudinal and circular seams of drum, start-up (steam-water) separator, water storage tank, header or pipeline, and splicing welds of heads have no undercuts. The undercut depth of other welds shall not be greater than 0.5mm. The total length of the undercut on both sides of the pipe weld shall not exceed 20% of the circumference of the pipe. It shall not exceed 40mm.

d) Concave depth: no more than 2mm.

e) Start-up (steam water) separators, water storage tanks, headers, and roots of pipes protrude: not more than 3mm.

f) Butt weld reinforcement: 1) Drum, start-up (steam-water) separator, water storage tank, header, pipeline: not more than $15\%t$ and not more than 4mm; NOTE: For single-sided welding, t is the nominal thickness of the plate or pipe; for double-sided welding, t is the groove depth of the front and back sides. 2) Pipe: no more than 3mm.

g) Connection weld between flat steel and pipe: 1) The welding between the flat steel and the pipe shall be continuous. There shall be no missing welding; 2) Weld formation shall be smooth and flat. The transition between the weld and the base metal shall be smooth. There

shall be no cracks, slag inclusions, arc craters and other defects on the surface of the weld;
 3) There shall be no single air hole with a diameter greater than 2mm on the surface of the weld between the flat steel and the pipe. At the same time, there passing ball.

6.4 When the ball passes the internal threaded pipe, the steel ball as the passing ball shall be selected according to the minimum inner diameter given in the internal threaded pipe standard. If a pipe specification chosen that is not specified in the internal thread pipe standard or if the minimum inner diameter is not specified, then the minimum inner diameter is the nominal outer diameter of the pipe minus 2 times the sum of the nominal wall thickness of the pipe and the thread height. That is, $d = D - 2 \times (\text{nominal wall thickness of the pipe} + \text{thread height})$.

6.5 If the passing ball is blocked according to the provisions of 6.1~6.4, select the steel ball to pass according to the minimum inner diameter of the pipe actually measured.

6.6 Sponge ball can be used for passing ball inspection to ensure the cleanliness inside the pipe. The pressure of the compressed air used for the test is about 0.4MPa.

7 Spectral inspection

Alloy steel pipe (pipe fittings) butt joint welds and base metals shall be verified by 100% chemical composition spectrum analysis. Issue a spectral analysis test report.

8 Non-destructive testing

8.1 Basic methods for non-destructive testing Non-destructive testing methods mainly include ray (RT), ultrasonic (UT), magnetic particle (MT), penetrant (PT), eddy current (ET) and other testing methods. Radiographic testing methods (RT) include film ray testing (F-RT), digital imaging testing (DR), computer-aided imaging testing (CR). Ultrasonic testing methods (UT) include pulse echo ultrasonic testing (PE), phased array ultrasonic testing (PAUT) and time-of-flight diffraction ultrasonic testing (TOFD). The manufacturer shall select the testing method according to the design, process and related technical conditions, and formulate the corresponding testing process. When time-of-flight diffraction (TOFD) is selected, it shall be combined with pulse-echo ultrasonic testing (PE). The testing conclusion is judged comprehensively based on the results of TOFD and PE methods.

8.2 Non-destructive testing personnel Non-destructive testing personnel shall be assessed in accordance with relevant technical specifications. Only after obtaining the qualification certificate can they engage in the non-destructive testing work of the corresponding method and technical level.

8.6.1 The local non-destructive testing position of pressure parts shall be determined by the manufacturer. However, the intersecting butt joints of longitudinal seams and circular seams shall be included.