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NB

**ENERGY INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

NB/T 11270-2023

Replacing JB/T 4745-2002

Titanium pressure vessels

钛制压力容器

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Foreword

This document was issued on 26 May 2023 by the National Energy Administration of the PRC and takes effect on 26 November 2023.

It is a NB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

It is classified under ICS 23.020.30, Chinese classification J 74.

It replaces JB/T 4745-2002, which is superseded.

This document has been drafted in accordance with the rules given in GB/T 1.1-2020, Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents.

This document replaces JB/T 4745-2002, Titanium welded vessels. In addition to structural adjustments and editorial changes, the following main technical changes have been made with respect to JB/T 4745-2002:

a) the field of application has been modified, so that the body of the standard now applies to titanium pressure vessels (see Clause 1);

- b) the necessary normative references have been adjusted according to the needs of the text (see Clause 2);
- c) terms and definitions have been added (see Clause 3);
- d) the basis for determining the allowable stress has been modified (see Table 1);
- e) the provisions for the classification of welded joints have been modified (see 4.7.1);
- f) a method for the combined gas and liquid pressure test has been added (see 4.8);
- g) titanium material designations for pressure vessels have been added (see 5.1.3) and the upper limit of the design temperature of titanium materials has been adjusted to 315 degrees Celsius;
- h) supplementary requirements for the room temperature mechanical properties of titanium plate, titanium tube, titanium forgings and titanium bar have been added (see 5.2.1, 5.3.2, 5.4.1 and 5.5.1);
- i) requirements for welding consumables have been added (see 5.6);
- j) the allowable stress tables for titanium materials have been recalculated and updated (see Table 7 to Table 10);
- k) the external pressure stress coefficient B curves for titanium materials have been recalculated and updated (see Figure 1 to Figure 8), together with their corresponding tables (see Table 11 to Table 18);
- l) the design requirements have been simplified by reference to other standards (see Clause 6);
- m) the basis for the fabrication, inspection and acceptance of titanium vessels has been modified (see 7.1.1.1);
- n) requirements for purchased finished titanium parts and components have been added (see 7.1.1.2);
- o) requirements relating to risk prevention and control during the fabrication of titanium vessels have been added (see 7.1.5 and 7.1.6);
- p) requirements for the re-examination of materials have been added (see 7.2.1);
- q) the provisions relating to forming have been modified (see 7.3.1);
- r) the requirements of the welding part have been modified and supplemented (see 7.4);
- s) the requirements of the heat treatment part have been modified and supplemented (see 7.5);
- t) the requirements of the part dealing with test coupons and test specimens have been modified and supplemented (see 7.6);

- u) the requirements of the non-destructive testing part have been modified and supplemented (see 7.7);
- v) the requirements of the part dealing with the pressure test and the leak test have been modified and supplemented (see 7.8);
- w) requirements for the part dealing with the hot gas circulation test have been added (see 7.9);
- x) the normative annex Titanium clad plate pressure vessels and titanium lined pressure vessels has been added (see Annex A); by reference to the applicable regulations the annex Rules for the qualification examination of welders of titanium vessels has been deleted; by reference to other standards the annexes Welding procedure qualification for titanium vessels and Mechanical property tests of product welded test plates of titanium vessels have been deleted;
- y) the informative annexes Welding procedure specifications for titanium vessels (see Annex B), Designations and properties of titanium materials for pressure vessels (see Annex C) and Joint structures of titanium vessels, titanium clad plate vessels and titanium lined vessels (see Annex D) have been modified and supplemented.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The issuing body of this document shall not be held responsible for identifying any or all such patent rights.

This document has been proposed by and is under the jurisdiction of the National Technical Committee on Boilers and Pressure Vessels of Standardization Administration of China (SAC/TC 262).

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The successive editions of this document and of the document it replaces are as follows: first published in 2002 as JB/T 4745-2002; this is the first revision.

1 Scope

NB/T 11270-2023 governs pressure vessels made of titanium and titanium alloys, replacing JB/T 4745-2002 on welded titanium vessels and widening the scope to pressure vessels proper. Titanium is chosen where corrosion defeats stainless steel - chlor-alkali plant, seawater and brine service, bleaching and organic acid duty - and almost every rule in the document follows from how the metal behaves: it must be protected from oxygen, nitrogen and hydrogen pickup at temperature, it cannot be welded or handled with steel tooling without contamination, and its strength falls sharply as temperature rises. The standard sets the permitted grades of commercially pure titanium and titanium alloy and their allowable stresses, together with titanium-clad steel plate and the requirements for the bond. It covers the general requirements on design conditions, the design of shells, heads, openings and flanges, and the wall thickness calculation with the corrosion allowance appropriate to titanium. Fabrication is treated at length: forming and its temperature limits, cutting, cleanliness and segregation from ferrous contamination, welding procedure and welder qualification with the inert gas shielding and trailing shields required, heat treatment, and the inspection of the finished welds. Testing, marking and the documentation supplied on delivery close the document. It applies to the design, manufacture, inspection and acceptance of titanium pressure vessels in China.

1.1 This document specifies the requirements for the materials, design, fabrication, inspection and acceptance of titanium pressure vessels. It applies to single-layer plate-welded pressure vessels (including tube-made shells) whose shell is made entirely of titanium material. The requirements for the materials, design, fabrication, inspection and acceptance of titanium vessels operating at atmospheric pressure may also be taken as a reference from this document.

1.2 This document applies to titanium pressure vessels with a design pressure not greater than 35 MPa.

1.3 The titanium materials covered by this document have an upper design temperature limit of 315 degrees Celsius.

1.4 The design and calculation methods listed in this document apply to pressure-retaining components made entirely of titanium material. Those parts of a titanium pressure vessel that are made of non-titanium materials shall be designed and calculated in accordance with the corresponding product standards for those materials.

1.5 This document does not apply to the following pressure vessels:

- a) vessels with a design pressure lower than 0.1 MPa and with a degree of vacuum lower than 0.02 MPa;
- b) vessels governed by the Regulation on Safety Technology Supervision of Mobile Pressure Vessels;
- c) pressure vessels used in military equipment, nuclear facilities, aerospace and aviation