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NB

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

NB/T 20003.2-2021

Replacing NB/T 20003.2-2010

**Non-destructive testing for mechanical components in nuclear
island of nuclear power plants - Part 2: Ultrasonic testing**

核电厂核岛机械设备无损检测 第2部分：超声检测

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Foreword

This document was issued on 7 January 2021 by the National Energy Administration of the PRC and takes effect on 1 July 2021.

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 27.120.20, Chinese classification F69.

It replaces NB/T 20003.2-2010, which is superseded.

This document is 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 is Part 2 of NB/T 20003 Non-destructive testing for mechanical components in nuclear island of nuclear power plants. The following parts of NB/T 20003 have been published: Part 1: General requirements; Part 2: Ultrasonic testing; Part 3: Radiographic

testing; Part 4: Penetrant testing; Part 5: Magnetic particle testing; Part 6: Eddy current testing; Part 7: Visual testing; Part 8: Leak testing.

This document replaces NB/T 20003.2-2010 Non-destructive testing for mechanical components in nuclear island of nuclear power plants - Part 2: Ultrasonic testing. Compared with NB/T 20003.2-2010, apart from structural adjustments and editorial changes, the main technical changes are listed below.

The scope of the document has been changed: the provisions on ultrasonic testing acceptance standards have been changed to ultrasonic testing quality grading (see Clause 1; Clause 1 of the 2010 edition).

Some normative references have been deleted (see Clause 2 of the 2010 edition), and some terms already defined in the referenced documents have been deleted (see Clause 3 of the 2010 edition).

Provisions on essential variables and non-essential variables in the testing procedure have been added (see Table 1), and the provisions on the content of the testing procedure have been changed (see 4.4.1; 4.2.2 of the 2010 edition).

The provisions on procedure qualification have been changed (see 4.4.1 and 4.4.3; 4.2.1 and 4.4.3 of the 2010 edition), as have the provisions on testing instruments and probes (see 4.5.1 and 4.5.2; 5.1 and 5.2 of the 2010 edition).

The provisions on similar acoustic properties of reference blocks have been changed (see 4.5.4.2.1; 5.4.2 of the 2010 edition), and requirements on surface curvature, surface condition and quality of reference blocks and on machining of reference reflectors have been added (see 4.5.4.2 and 4.5.4.3).

The requirements on performance tests and test periods have been changed (see 4.5.5 and Table 2; 5.5 and Table 1 of the 2010 edition), and the requirements on environmental conditions have been changed (see 4.6.6; 6.6 of the 2010 edition).

The provisions on identification of test objects and reference coordinates have been deleted (see 6.7 of the 2010 edition), as have the provisions on straight-beam testing, angle-beam testing and special or new techniques (see 8.2 and 8.4 of the 2010 edition).

The provisions on sensitivity setting by the distance-amplitude curve method have been changed (see 4.8.3.3; 9.3.3 of the 2010 edition), together with the provisions on attenuation compensation (see 4.8.4.2 and Annex A) and curvature compensation (see 4.8.4.3 and Annex B).

The provisions on verification have been changed (see 4.10; Clause 7 of the 2010 edition); provisions on probes for testing castings have been added (see 5.1.4) and the provisions on castability assessment of castings have been deleted (see 12.7 of the 2010 edition).

For plates, the scope has been changed (see 5.2.1, Annex D and Annex E), the provisions

on probes and scanning modes have been changed (see 5.2.4 and 5.2.7), and the provisions on measuring back-wall echo loss of plates have been deleted (see 13.9 of the 2010 edition).

For forgings, provisions on testing timing have been added (see 5.3.3), the provisions on probes and reference blocks have been changed (see 5.3.5 and 5.3.6), and the provisions on grid scanning of forgings have been deleted (see 14.6.2.2 of the 2010 edition).

The provisions on testing timing, probes and scanning of bars have been changed (see 5.4.2, 5.4.4 and 5.4.7), and the provisions on testing timing, probes, reference blocks and scanning of bolting materials have been changed (see 5.5.2, 5.5.4, 5.5.5 and 5.5.7).

For tubes, the scope and the provisions on probes and reference blocks have been changed (see 5.6.1, 5.6.4 and 5.6.5), and the provisions on calibration and verification in tube testing have been deleted (see 17.11 of the 2010 edition).

For full penetration welded joints, the scope has been changed (see 6.1 and Annex G) and the provisions on testing timing, surface preparation, probes, reference blocks, scanning and recording have been changed (see 6.2, 6.4, 6.6, 6.7 and 6.10).

For weld overlay cladding and buttering, the scope has been changed (see 7.1, Annex E and Annex I) and the provisions on testing timing, surface preparation, probes, reference blocks, scanning and recording have been changed (see 7.2, 7.4, 7.6, 7.7 and 7.10).

The annexes on screen height linearity (Annex A of the 2010 edition) and on horizontal and vertical linearity tests (Annex B of the 2010 edition) have been deleted, and an annex on the recommended method for determining curvature compensation has been added (see Annex B).

The annex on the angle-beam ultrasonic testing method for castings has been changed (see Annex C), and an annex on the angle-beam ultrasonic testing method for plates has been added (see Annex D).

The annexes on scanning of critical forgings (Annex E of the 2010 edition), on ultrasonic testing of centrifugally cast austenitic stainless steel main pipes (Annex G of the 2010 edition) and on drawing the profile of welded joints (Annex I of the 2010 edition) have been deleted.

The annex on the ultrasonic testing method for austenitic stainless steel butt welded joints has been changed (see Annex G; Annex H of the 2010 edition), and an annex on thickness measurement by the contact ultrasonic pulse-echo method has been added (see Annex I).

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

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This document was first published in 2010; this is the first revision.

1 Scope

NB/T 20003.2-2021 is Part 2 of the Chinese standard for non-destructive examination of mechanical components in nuclear power plants, and it governs ultrasonic testing. It replaces the 2010 edition. Mechanical components of a nuclear plant - reactor pressure vessel, steam generators, pressurisers, main coolant piping, pumps and valves - are examined during manufacture, during construction and repeatedly in service, and the ultrasonic examination is the method that finds and sizes internal flaws in thick forgings, castings and welds. The standard sets the scope, the normative references and the defined terms, then the general requirements: the qualification of personnel, the written procedure, the equipment and its performance checks, the probes, the couplant, and the reference blocks with their reflectors. It covers the calibration of time base and sensitivity, the construction of distance-amplitude curves, and the examination technique for each product form - plates, forgings, bars, castings, pipes and tubes, bolting, cladding and its bond, and butt, nozzle and attachment welds - with the scanning directions, coverage and overlap. For each it gives the recording level, the characterisation and sizing of indications, and the acceptance criteria by quality class, tabulated by thickness and component type. Surface preparation, the treatment of geometric indications, re-examination after repair, and the examination report close the part. It applies to nuclear plants built in China.

This document specifies the ultrasonic testing methods and quality grading for raw materials or parts of mechanical components in nuclear island of nuclear power plants.

This document is applicable to ultrasonic testing, during manufacturing and installation, of raw materials or parts such as castings, plates, forgings, bars, bolting materials and tubes, as well as welded joints, weld overlay cladding and buttering, in mechanical components in nuclear island of nuclear power plants.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their