

ICS 77.040.20

CCS H 26



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

GB/T 47623-2026

**Non-destructive testing of steel pipes - Automatic ultrasonic
testing for weld seam imperfections of thick-wall welded steel
pipes**

钢管无损检测 厚壁焊接钢管焊缝缺欠的自动超声检测

Issued on: May 25, 2026

Implemented on: December 1, 2026

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

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4 General Requirements

4.1 The steel pipe to be inspected shall pass a visual inspection. All rust, splashes, and dirt that may affect ultrasonic testing shall be removed, and the surface shall be... smooth.

4.2 There should be no delamination in the area through which the sound beam passes on both sides of the weld, which would affect the effectiveness of the detection.

4.3 The testing site should be away from strong light, strong magnetic fields, strong vibrations, corrosive gases, heavy dust, and other factors that may affect the stability of the automatic ultrasonic testing system. Factors observed by inspectors.

4.4 Unless otherwise specified in the product standard or agreed upon by the purchaser and the manufacturer, automated ultrasonic testing shall be performed after the hydrostatic test is completed.

4.5 The coupling agent should have good sound transmission and suitable flowability, be non-corrosive to materials, and be easy to clean. Water is preferred as the coupling agent, and it should be used at 0°C. The following can be done using an aqueous solution of ethanol or a similar medium. The same coupling agent should be used for both instrument adjustment and testing.

4.6 Testing shall be performed by qualified operators trained in accordance with GB/T 9445, ISO 11484 or equivalent standards, and by an operator appointed by the employer. The testing should be supervised by qualified personnel. In the case of third-party testing, this should be negotiated between the supplier and the buyer.

5.1 Detection System

5.1.1 The inspection system shall at least include a multi-channel ultrasonic testing instrument, a control system, a coupling system, an automatic weld tracking system, and a transmission system (or... The system includes a probe gantry moving system, a probe gantry system, a signal processing system, a printing output system, and auxiliary devices.

5.1.2 The inspection system should provide a sufficient number of inspection channels to ensure that the entire weld seam is scanned, and that the entire weld seam thickness direction is inspected in sections. The division of the weld area should conform to the provisions of Figure 1.

5.1.3 The instrument performance shall meet the requirements of GB/T 27664.1, with an amplitude linearity error not exceeding 4%, and a time baseline linearity error for digital ultrasonic testing instruments. The difference should meet the requirement that the deviation between the reference signal and the ideal position does not exceed $\pm 0.5\%$ of the full screen width; the baseline linearity error of other ultrasonic testing instruments should meet the requirement. The deviation of the reference signal from the ideal position shall not exceed $\pm 1\%$ of the full screen width, and the ultrasonic testing instrument shall be calibrated at least every 12 months.

5.1.4 The absolute value of the difference in sensitivity between similar detection channels in the detection system (sensitivity fluctuation) should not exceed 2dB.

5.1.5 An encoder shall be used to record the position of the entire weld seam during scanning. The encoder shall be equipped with a calibration system to ensure that the recorded weld seam distance is accurate. The location should correspond to the actual external surface markings. The recording or marking system should clearly indicate the position of the defect relative to the scan start point, with an error margin. It is $\pm 15\text{mm}$.

5.1.6 Weld defect inspection records may be generated using A-scan (strip chart) or other image display methods. The weld inspection results should be displayed on the scan. The records should include the results of coupled monitoring.

5.2 Probe

5.2.1 The probe should be labeled with its type, refraction angle (K-value), nominal frequency, and crystal size, and should comply with GB/T 27664.2 requirements. The recommended probe parameters are shown in Table 1.

5.2.2 The surface shape of the probe wedge should match the curvature of the steel pipe being inspected, as shown in Figure

2. The contact surface between the edge of the wedge and the steel pipe being inspected... The gap X should not be greater than 0.5mm.

5.2.3 The design of the probe should be set according to the weld groove type and the effective beam width. The arrangement of the probe is shown in Appendix A.

6 Comparison sample tube

6.1 The comparison sample tube should be made of a pipe section (or pipe) with the same specifications and similar acoustic performance as the steel pipe being tested. The sample tube should be of sufficient length. When the sample tube material is tested with sensitivity at a 2mm diameter flat-bottomed hole, the echo amplitude should not exceed the equivalent of the 2mm diameter flat-bottomed hole. defect.

6.2 The number, location, and type of artificial reflectors on the comparison sample tube should be determined according to the weld bevel type and wall thickness, and should comply with Appendix B. Request. With mutual agreement, other artificial reflective materials may also be used as comparison tubes.

6.3 The horizontal arrangement of artificial reflectors should ensure that the displayed signals are independent, but reflectors in adjacent areas should not interfere with each other. Artificial reflectors should meet the requirements of Appendix C. Other artificial reflectors may be added upon request from the buyer.

6.4 The permissible error for artificial reflectors shall not exceed the following values.

---Hole diameter. $\pm 0.2\text{mm}$;

---Groove width. $\pm 0.2\text{mm}$;

---Groove depth. $\pm 15\%$ or $\pm 0.05\text{mm}$ of the groove depth, whichever is greater;

---Reflector center position. $\pm 0.5\text{mm}$.

6.5 The dimensions of the artificial reflector can be inspected using conventional physical measurement methods or by using a silicone rubber molding method. Artificial Reflector The inspection method for silicone rubber coating is given in Appendix D.

6.6 Comparative sample tubes should be tested before use.

7.1 System Settings

7.1.1 Before system setup, the weld should be divided into zones along its thickness, with each zone inspected using a pair or a set of probes. The zoning should be based on the weld slope. The weld bead shape and wall thickness are specified, with a height of

6.0 mm in each zone on both the inner and outer surfaces and

12.0 mm in each zone inside the weld. A pair of probes are installed. The artificial reflector corresponding to the head is used to adjust sensitivity and locate defects. A pair of probes on both sides of the weld seam completes the inspection of one area.

7.1.2 The determination of probe position and reference sensitivity shall comply with the following provisions.

- a) On both sides of the weld centerline, arrange the probes in the scanner of the probe gantry system according to the position of the reflector;
- b) Move the scanner and adjust the probe position until the signal of the primary reflector corresponding to each probe reaches its peak value; this is the probe position.
- c) The peak signal of the primary reflector in the detection area of each probe is adjusted to 80% of the full amplitude, which is the reference sensitivity of the probe.

7.1.3 The installation of gates shall comply with the following provisions.

- a) Gate configurations should include longitudinal, lateral, and layered defect gate configurations. When configuring gates, their respective corresponding... Artificial defects are set on the test block.
- b) The starting point of the gate should be set at least 3 mm in front of the corresponding artificial primary reflector, and the ending point of the gate should be set at the corresponding artificial primary reflector. At least 1 mm behind the ejector.

7.1.4 The gate level should not be lower than 60% of the full amplitude. Signals exceeding this amplitude should be evaluated in accordance with Chapter 9.

7.1.5 The output signal of each channel shall be displayed on the monitor, and for each primary reflector, it shall be displayed on the weld band diagram.

7.2 System Debugging

7.2.1 The signal of each primary reflector should reach 80% of full amplitude.

7.2.2 Accuracy of the code position displayed on the monitor. The error of the displayed code position between the reflectors relative to the actual weld position is recorded as follows: $\pm 2\text{mm}$.

7.2.3 During the scanning process, when the amplitude of the primary reflector on the sample tube reaches 80% of its full amplitude, in order to ensure the effective overlap of adjacent sound beams in the wall thickness direction... When stacked, the displayed amplitude of the reflectors on both sides should be between -6dB and -24dB. If this value is not reached, the probe position should be re-determined or the probe should be replaced. The probe was readjusted.

Note. Below -24dB, poor coverage is likely to cause missed detections; above -6dB, interference is likely to occur.

7.2.4 If the defective area displayed by the coupling monitoring channel of the recording system exceeds the minimum allowable length of the defect, it should be readjusted.