

Procedure For The Ultrasonic Testing Of Full Penetration Welds In Mild Steel And Low Alloy Steel Plate And Pipe To ASME BPVC V:2025

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1. Scope

This procedure describes the method of ultrasonic examination of full penetration welded joints in steel plate and pipe sections and must be adhered to as applicable to ensure customer requirements are met and that compliance with orders received is achieved.

This procedure only covers the pulse echo contact method of ultrasonic examination of fusion welded joints in low alloy ferrous steel having wall thickness of between 8mm and 100mm and at temperatures between 0 °C to 50 °C.

Weld undergoing ultrasonic inspection shall be subject to 100% volumetric examination of the weld body and heat affected zone.

This procedure covers the testing of, 1) newly fabricated products, 2) any required repairs to newly fabricated products, 3) in-service welds 4) repair work to in-service welds.

This procedure does not cover the testing of welds in coarse grained materials, for example austenitic stainless steel.

This procedure is designed to cover a variety of welds of different configurations and material thicknesses, therefore this procedure shall be used in conjunction with a technique sheet(s) which cover the specific weld(s) under test.

2. References

This procedure makes reference to the following documents:-

ASME BPVC Section V: 2025 Non-destructive Examination

ASME BPVC Section VIII, Div 1: 2025 Rules for construction of pressure vessels.

BS EN ISO 9712:2022 Non-destructive testing. Qualification and certification of NDT personnel.

BS EN ISO 2400:2025 Non-destructive testing - Ultrasonic testing - Specification for calibration block No 1

BS EN ISO 7963:2022 Non-destructive testing - Ultrasonic testing - Specification for calibration block No 2

BS EN ISO 22232-1:2020 Non-destructive testing. Characterization and verification of ultrasonic test equipment. Part 1: Instruments

BS EN ISO 22232-2:2020 Non-destructive testing. Characterization and verification of ultrasonic test equipment. Part 2: Probes

BS EN ISO 22232-3:2020 Non-destructive testing. Characterization and verification of ultrasonic test equipment. Part 3: Combined equipment

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3. Definitions & abbreviations

The following definitions and abbreviations are used in this procedure.

BWE	Back wall echo
DAC	Distance amplitude correction
dB	Decibel
FSH	Full screen height
NDT	Non-destructive testing
PCN	Personnel Certification In NDT
UT	Ultrasonic Testing

4. Personnel qualifications

All personnel operating to this procedure shall be qualified and certified to a minimum of Level 2 in ultrasonic testing in accordance with their employer's written practice, as required by ASME BPVC V Article 1, T-120(e). As permitted by T-120(f), certification under a BS EN ISO 9712-based central certification scheme (e.g. PCN Level 2 ultrasonic testing of welds) may be used to fulfil the written practice requirements for training, experience and the general, basic and method examinations.

Note: It is critical that UT operator certification must cover the configuration of weld that is to be tested i.e. 3.1 for plate welds 3.2 for pipe welds, etc.

All personnel shall also hold a valid eyesight certificate (meeting the requirements of BS EN ISO 9712 section 7.4) obtained within the last 12 months.

5. Surface finish

Surfaces from which scanning is carried out shall be such that satisfactory acoustic coupling can be maintained at all times.

Surfaces shall be free from scale, foreign material, rust, oil/grease, gouge marks, burning slag residue or any other material that could affect the sensitivity of the test.

The scanning surface shall be given as either 1.25 x the maximum beam path or three times the weld thickness, whichever is greatest.

6. Equipment

The following equipment shall be used when working to this procedure.

- A-scan ultrasonic flaw detector.
- No.1 / No.2 Calibration block.
- 0° Twin crystal, 45°, 60°, 70° twin and single crystal 10mm Ø, 4-5MHz probes.

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- Commercial couplant.
- Plate: DAC block with notches and SDH's in compliance with ASME V T-434.2.1
- Pipework: DAC block with 8–11% T notches (Figure T-434.3-1), or the alternate side-drilled hole block (Figure T-434.3-2), in compliance with ASME V T-434.3

All flaw detectors and probes used shall comply with BS EN ISO 22232 and ASME BPVC V Article 4 Section T-430.

The flaw detector shall be a pulse-echo instrument capable of operation at frequencies over the range of at least 1 MHz to 5 MHz, and shall be equipped with a stepped gain control in units of 2.0 dB or less. If the instrument has a damping control, it may be used if it does not reduce the sensitivity of the examination. The reject control shall be in the off position for all examinations, unless it can be demonstrated that it does not affect the linearity of the examination (ASME BPVC V T-431). Any control which affects instrument linearity (e.g. filters, reject or clipping) shall be in the same position for calibration, calibration checks, instrument linearity checks and examination (T-462.5).

All flaw detectors shall have a valid external calibration certificate issued within the last twelve months.

Where curved surfaces are to be scanned, e.g. pipe sections, contoured wedges shall be used when the component diameter at the examination surface is equal to or less than the diameter given by the calculation in ASME BPVC V T-432.2(a). The wedge contour shall be selected from the tables in T-432.2(b), using the same component dimension (O.D. or I.D.) from which the examination is performed. Where a contoured wedge is used, the calibration block diameter shall also meet the requirements for the selected wedge curvature range (T-432.1).

7. Equipment and performance checks

All functional and calibration checks of equipment shall be performed in accordance with BS EN ISO 22232-3:2020

Daily checks to include:-

- Probe index point
- Probe beam angle
- Physical state and external aspects.

Weekly checks to include:-

- Timebase linearity
- Amplification linearity
- Probe signal to noise ratio
- Pulse duration

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