Procedure For The Ultrasonic Testing Of Austenitic And Austenitic-ferritic Stainless Steel Flat Product Of Thickness Between 6mm And 200mm

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1. Scope

This procedure covers the ultrasonic testing of rolled austenitic and austenitic-ferritic (duplex) stainless steel flat product (plates and profiles) of thicknesses between 6mm and 200mm using manual scanning techniques and the pulse-echo method.

This procedure does not cover the testing of steel plate less than 6mm thick.

Steel plate of thickness greater than 200mm may be tested using this procedure but will be subject to agreement between all parties concerned.

This procedure only covers austenitic and austenitic-ferritic (duplex) stainless steels. Non-alloyed and alloyed steels are not covered by this procedure; these are covered by BS EN 10160.

2. Application

The examination shall take place at stages defined in the purchasing specification, drawings, inspection/test plans, etc.

All plates tested in accordance with this procedure shall be examined using longitudinal waves and the manual pulse-echo contact scanning technique. Ultrasonic test equipment shall utilise an A scan presentation.

Plates shall be tested from one side only.

3. References

This procedure makes reference to the following documents:-

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

BS EN 10307:2001 Non-destructive testing. Ultrasonic testing of austenitic and austenitic-ferritic stainless steels flat products of thickness equal to or greater than 6 mm (reflection method)

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

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

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

BS EN ISO 16811:2025 Non-destructive testing. Ultrasonic testing. Sensitivity and range setting

BS EN ISO 16827:2025 Non-destructive testing. Ultrasonic testing. Characterization and sizing of discontinuities

4. Definitions & Abbreviations

Internal discontinuity - Any imperfection lying within the thickness of the flat product, e.g. planar or laminar imperfection, single plane or multi-plane inclusion bands or clusters.

Defect - Unacceptable internal discontinuity i.e. one exceeding the specified maximum size or population density limits.

Population density - The number of individual internal discontinuities of a size greater than a specified minimum size and less than a specified maximum size per specified area of body or length of edge zone.

Manual or assisted manual testing - Testing by an operator applying an ultrasonic probe, or probes, to the flat surface, manually executing the appropriate scanning pattern on the flat product surface and visually assessing ultrasonic signal indications on the electronic equipment screen either by direct viewing or built-in signal amplitude alarm devices.

FBH - Flat bottom hole

DAC - Distance amplitude correction curve

5. Personnel Qualifications

All personnel operating to this procedure shall hold a minimum of Level 2 certification in accordance with BS EN ISO 9712 in the ultrasonic testing of forgings and wrought products, e.g. PCN Level 2.

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.

6. 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 loose scale, foreign material, heavy rust, oil/grease, gouge marks, burning slag residue or any other material that could affect the sensitivity of the test.

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7. Equipment

The ultrasonic flaw detector shall comply with the requirements of BS EN ISO 22232-1 and have a calibration certificate obtained within the last year.

Calibration blocks shall comply with BS EN ISO 2400.

Reference blocks of 5/8/11mm FBH shall be used as required (which shall cover the thickness of the plate to be tested).

8. Probes

Single and combined double crystal 0° compression wave probes, with a greatest transducer dimension of 10-35mm and of nominal frequencies of 1-5 MHz are to be used.

Where the product exhibits high attenuation (e.g. due to coarse grain structure) and the required sensitivity cannot be achieved, a lower frequency probe may be tried in the first instance (BS EN 10307 clause 8.2.2). Any deviation from the technique or this procedure shall be agreed with the customer or end user.

All probes shall comply with the requirements of BS EN ISO 22232-2.

The focusing zone of combined double transducers shall be adapted to the thickness of the flat product.

Single probes shall have a dead zone of no more than 15% of the plate thickness or 15mm, whichever is the smaller. The suitability of each probe shall therefore be confirmed for the thickness of plate being tested.

9. Equipment and Performance Checks

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

Daily checks to include:-

- Physical state and external aspects.

Weekly checks to include:-

- Timebase linearity
- Amplification linearity
- Probe signal to noise ratio
- Pulse duration
- Probe dead zone check.

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