Procedure For The Ultrasonic Testing

Of Steel Castings To ASTM A609/ASME B16.34

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1. Scope

This procedure covers the ultrasonic inspection of steel castings in accordance with ASTM A609 and ASME B16.34

This procedure is only to be used for the inspection of newly manufactured castings and does not cover in-service inspection, however the procedure does cover items have been subject to initial upgrading and repair work

This procedure does not cover any castings which have been extensively machined (i.e. into finished components) except where proof machining/turning has taken place to improve surface condition.

This procedure shall be carried out once all heat treatment operations have been completed (excluding post weld repair stress relief) and at least 24 hours after the final heat treatment operation has been completed.

2. References

This procedure makes reference to the following documents:-

ASTM A609 (2018) Standard Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof
ASME B16.34 - (2017) Valves--Flanged, Threaded, and Welding End
BS EN ISO 9712:2012 Non-destructive Testing. Qualification and certification of NDT personnel.
SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing
BS EN ISO 2400:2012 Non-Destructive testing - Ultrasonic Examination - Specification for calibration block No. 1
BS EN 12668-1:2010 Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 1: Instruments
BS EN 12668-2:2010 Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 2: Probes
BS EN 12668-3:2013 Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 3: Combined equipment
BS EN 1330-1:2014 Non-destructive testing - Terminology - List of general terms
BS EN 1330-4:2010 Non-destructive testing - Terminology - Terms used in ultrasonic testing
BS EN ISO 16811:2014 Non-destructive testing - Ultrasonic testing - Sensitivity And Range Setting

3. Definitions & Abbreviations

As well as the terms defined in BS EN 1330-1 and BS EN 1330-4 this procedure uses the following definitions:

PCN	Personnel certification in Non-destructive testing
COSHH	Control of substances hazardous to health
PPE	Personal protective equipment
FBH	Flat-bottom hole
SDH	Side drilled hole
FSH	Full screen height
DAC	Distance-amplitude correction
DGS	Distance gain scale

4. Safety

All consumables used shall have accompanying COSHH data sheets and shall be disposed of in a way that is non-injurious to site personnel or to the environment.

Personnel working to this procedure shall at all times wear mandatory PPE; overalls, safety boots, hard hat, high visibility clothing, safety eyewear.

5. Personnel Qualifications

All personnel following this procedure must be currently certified by SNT or PCN to a minimum of Level 2 covering the ultrasonic testing of castings.

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

Documentation relating to ultrasonic operators employed by or working for the foundry shall be kept on file at the administration offices for review purposes.

6. Identification And Datum Points

All castings tested shall be marked (either cast on or stamped) with a unique number for identification purposes, this number shall be used as the datum point for reporting purposes.

7. Equipment

7.1 Electronic apparatus

An A-scan ultrasonic pulsed reflection type of instrument that is capable of generating, receiving and amplifying frequencies of at least 1 to 5 MHz.

The ultrasonic instrument shall provide linear presentations (within ± 5%) for at least 75%of the screen height (sweep line to top of screen).

The electronic apparatus shall contain a signal attenuator or calibrated gain control that shall be accurate over its useful range to ± 10% of the nominal attenuator or gain ratio to allow measurement of signals beyond the linear range of the instrument, and shall be determined by section 8.3.

7.2 Probes

Longitudinal wave, p[robes shall be internally ground, having a 1/2in. to 1 1/8in. (13 to 28mm) crystal diameter or 1in. (25mm) square piezo-electric element. Based on the signal-to-noise ratio of the response pattern of the component, a frequency in the range of 1 to 5 MHz shall be used. The background noise shall not exceed 25% of the DAC curve.

Dual element probes shall be 5 MHz, 1/2in. by 1in. (13 to 25mm), 12° included angle search units are recommended for sections 1in. (25mm) and under.

Other frequencies and sizes of search units may be used for evaluating and pinpointing indications.

7.3 Reference Blocks

Reference blocks containing flat bottom holes (FBH) shall be used to establish the test sensitivity for the longitudinal beam technique.

Reference blocks shall be made from cast steels that give an acoustic response similar to the items being examined.

The design of the reference blocks shall be in accordance with Figure 1 and the basic set shall consist of those blocks listed in Table 1. These shall be used to establish a DAC curve. When section thicknesses over 15” (380mm) are to be inspected, an additional block of the maximum test thickness shall be made to supplement the basic test.

Machined blocks with 3/32in. FBH at depths and locations as shown in Figure 2.
These shall be used to establish a DAC curve for dual element longitudinal probes.