Procedure For The Ultrasonic Testing Of Ferritic Or Martensitic Steel Forgings to BS EN 10228-3:2016

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CONTENTS

1. Scope

2. References

3. Definitions & Abbreviations

4. Safety

5. Personnel Qualifications

6. Identification and Datum Points

7. Surface Finish

8. Extent of Inspection

9. Equipment Specification

10. Equipment Calibration

11. Equipment Checks

12. Technique

13. Assessment of Ultrasonic Indications

14. Reporting

15. Non-compliance Statement

Appendix A – Scan Plans

Appendix B – Surface Finish Relating To Quality Class

Appendix C – Acceptance Criteria

Appendix D – Probes

Appendix E – Revision History

SAMPLE

1. Scope

This procedure covers the ultrasonic inspection of ferritic and martensitic steel forgings using the longitudinal and shear wave manual pulse-echo technique for on-site and in-house use.

This procedure follows practices laid down in BS EN 10228-3:2016.

The procedure only covers the testing of ferritic or martensitic steel forged products.

This procedure is to be used for the inspection of newly manufactured wrought/forged products and where suitable can be used to cover in-service inspection or items which have been subject to any repair work.

This procedure does not cover forgings which have been extensively machined (i.e. into complex components) except where turning has taken place to improve surface condition.

This procedure does not cover the testing of closed die forgings or turbine rotor and generator forgings.

This procedure shall be carried out once all heat treatment operations have been completed and at least 48 hours after the final heat treatment operation has been completed.

2. References

This procedure makes reference to the following documents:-

BS EN 10228-3:2016 Non-destructive testing of steel forgings. Part 3: Ultrasonic testing of ferritic or martensitic steel forgings.

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 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

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

BS EN 1330-1:2014 Non-destructive testing. Terminology. List of general terms

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BS EN ISO 5577:2025	Non-destructive testing. Ultrasonic testing. Vocabulary
BS EN ISO 16811:2025	Non-destructive testing. Ultrasonic testing. Sensitivity and range setting
BS EN ISO 16827:2025	Non-destructive testing. Ultrasonic testing. Characterisation and sizing of discontinuities

3. Definitions & Abbreviations

As well as the terms defined in BS EN 1330-1 and BS EN ISO 5577 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

Point Discontinuity: As the probe is moved, the A-scan display shows a single sharp indication rising smoothly in amplitude to a maximum then falling smoothly to zero and/or an indication with dimensions equal or less than the -6dB beam width.

Extended Discontinuity: As the probe is moved, the A-scan display shows a single sharp indication rising smoothly in amplitude to a maximum which is maintained with or without amplitude variation, and then falling smoothly to zero and/or an indication with dimensions greater than the -6dB beam width.

Isolated Discontinuity: The distance d, between points corresponding to the maxima of the indications of adjacent discontinuities exceeds 40mm.

Grouped Discontinuities: The distance d, between points corresponding to the maxima of the indications of adjacent discontinuities is less than or equal to 40mm.

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.

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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.

Documentation relating to ultrasonic operators working on-site for the steel supplier/end user shall be kept on file at the administration offices for review purposes.

6. Identification And Datum Points

All items tested shall be permanently stamped/engraved at one end with an identifying cast number and where more than one forging from the same cast is to be tested, each forging shall be uniquely numbered by stamping/with indelible ink at the same end for identification purposes.

The end of the forging marked with the cast number shall be used as the datum point for reporting purposes.

7. Surface Finish

See appendix B for further information.

Machined condition
In the machined condition, for testing to class 1 a surface finish of roughness $Ra \leq 25\ \mu m$ shall be achieved, for classes 2 and 3 a surface finish of roughness $Ra \leq 12.5\ \mu m$ shall be achieved and for testing to class 4, surface finish of roughness $Ra \leq 6.3\ \mu m$ shall be achieved. Surface comparator blocks shall be acceptable in determining surface roughness level.

If the forging has been subject to heat treatment after machining then only classes 1,2 and 3 can be achieved.

As forged condition
When forgings are supplied in the as forged condition they shall be considered acceptable providing the specified surface finish for the quality class can be achieved. Normally only quality class 1 shall be applicable to an as forged surface. Where it is not practical to perform a comprehensive test, shot/sand blasting or surface grinding shall be employed to improve surface condition and ensure that acoustic coupling can be maintained.

Regardless of surface condition, all surfaces to be examined shall be clean and free from paint, scale, dry couplant, surface irregularities or any other substance that could reduce coupling efficiency, hinder the free movement of the probe or cause errors in interpretation.

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