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**PCN/GEN APPENDIX D1 ISSUE 4 REV F**

Further information concerning the content of PCN documents is available from the PCN Scheme Manager at the above address.

**CERTIFICATION OF PERSONNEL IN ULTRASONIC TESTING OF WROUGHT PRODUCTS**

**ASSOCIATED DOCUMENTS:**

- Appendix Z1 to PCN/GEN (examination syllabus compendium)
- Appendix Z2 to PCN/GEN (specimen examination questions compendium)

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## 1. SCOPE

1.1 This document prescribes the specific requirements and procedures by which personnel may be examined and, if successful, certificated for the ultrasonic testing of wrought products. Requirements contained in this document are supplementary to those contained in PCN General Requirements for Certification of Personnel engaged in Non-Destructive Testing.

1.2 Candidates are encouraged to bring their own equipment including probes, but examination centre equipment may be hired subject to availability. Additional time will be allowed in the practical examination for candidates using examination centre provided equipment the additional time allowed is only to calibrate equipment, producing DAC curves, checking beam spread and main beam angles not for testing samples.

## 2. EXAMINATION CONTENT

The examination format is described in PCN General Requirements. This Appendix amplifies the provisions of that document only where necessary.

### 2.1 Level 1

Except where exemptions apply (refer to PCN General Requirements), all candidates will be required to attempt an examination comprised of the following parts:

2.1.1 General Theory of the Ultrasonic NDT method.

2.1.2 Sector Specific Theory of the application of the Ultrasonic NDT method to wrought products including basic production processes and associated defects.

2.1.3 Sector Specific Practical examination comprised of:

- I. preparation and calibration of testing equipment for use (this may involve system sensitivity and control checks).
- II. testing 1 plate lamination, 1 billet and 1 bar – selected to demonstrate a range of thicknesses.
- III. reporting the results in a prescribed manner on proforma report sheets.

The total time allowed for the practical examination is six hours. The minimum pass mark for the practical part is 70% in each sample tested

### 2.2 Level 2

Except where exemptions apply (refer to PCN General Requirements), all candidates will be required to attempt an examination comprised of the following parts:

2.2.1 General Theory of the Ultrasonic NDT method.

2.2.2 Sector Specific Theory of the application of the Ultrasonic NDT method to the testing of wrought products.

2.2.3 Sector Specific Practical examination comprising:

- I. preparation and calibration of testing equipment for use (this may involve system sensitivity and control checks).
- II. Practical testing of:
  - a) bar, billet and plate – 3 samples shall be tested:- 1 plate lamination, 1 billet and 1 bar selected to demonstrate a range of thicknesses.
  - b) bar, billet, plate and general forging – 4 samples shall be tested 1 plate lamination, 1 billet, 1 bar and 1 general forging selected to demonstrate a range of thicknesses.
- III. reporting test results in a prescribed manner on proforma report sheets.
- IV. preparing a detailed NDT instruction (suitable for level 1 personnel to follow) for the testing of one of the above samples to a provided procedure, code, standard or specification, and to prove the instruction by application.

Total time for the practical test includes (ii) a. 6 hours (ii) b. 7 hours. The minimum pass mark for the practical part is 70% in each sample tested.

### **2.3 Level 3**

Except where exemptions apply (refer to PCN General Requirements), all candidates will be required to attempt an examination comprising a Basic examination and a Main Method examination. Information on the content and grading of PCN level 3 examinations is provided in PCN General Requirements for Certification of Personnel engaged in Non-Destructive Testing.

Level 3 candidates who do not hold PCN level 2 certification for the ultrasonic testing of wrought products will be required to successfully complete the examination described in Clause 2.2.3 (excepting sub-clause (iv)).

## **3. CERTIFICATION AVAILABLE**

3.1 Level 1 Ultrasonic Testing: Bar, Billet and Plate

3.2 Level 2

3.2.1 Level 2 Ultrasonic Testing: Bar, Billet and Plate

3.2.2 Level 2 Ultrasonic Testing: Bar, Billet, Plate and General Forgings

3.3 Level 3 Ultrasonic Testing of Wrought Products.

Candidates who achieve an overall score of 80% or more for Level 1, 2 and 3 examinations shall be awarded with the distinction level 'D' excluding ISO 20807 certificates (refer to PCN GEN – Grading of Examinations).

## **4. RENEWAL AND RECERTIFICATION**

The general rules for level 1 and level 2 renewal and recertification are fully described in PCN document CP16, and the rules for level 3 are detailed in PCN document CP17.

## **5. SUPPLEMENTARY EXAMINATION CONTENT**

Existing holders of certification described under 3.2.1 may progress to certification described under 3.2.2 by examining 1 additional sample which will be a general forging.

## **6. GRADING**

The method for grading of initial examinations and supplementary examinations, and the rules for re-examination of failed parts, will be as specified in the current edition of PCN General Requirements, and information on the grading of practical examinations is provided in PCN document CP22.

## **7. REFERENCE LITERATURE**

### **Essential Reading - Standards and Specifications**

- ❑ BS EN 1330-2 Non-destructive testing – Terminology – Part 2: Terms common to the non-destructive testing methods
- ❑ BS EN 1330-4 Glossary of terms used in non-destructive testing: Ultrasonic flaw detection.
- ❑ BS EN 12668-1 Non-destructive testing – Characterisation and verification of ultrasonic examination equipment – Part 3 combined equipment
- ❑ BS EN 583-1 Non-destructive testing – Ultrasonic examination – Part 1: General principles
- ❑ BS EN 583-3 Non-destructive testing – Ultrasonic examination – Part 3: Transmission techniques
- ❑ BS EN 583-5 Non-destructive testing – Ultrasonic examination – Part 5: Characterisation and sizing of discontinuities
- ❑ BS EN ISO 2400: Non-destructive testing. Ultrasonic testing. Specification for calibration block No. 1
- ❑ BS EN 10228-3 Non-destructive testing of steel forgings: Ultrasonic testing of ferritic or martensitic steel forgings

- ❑ BS EN 10228-4 Non-destructive testing of steel forgings: Ultrasonic testing of austenitic-ferritic stainless steel forgings.
- ❑ BS EN 10160 Ultrasonic testing of steel flat products of thickness equal to or greater than 6mm (reflection method)
- ❑ BS EN ISO 9000 Quality management and quality assurance standards.

NOTE. National or international standards equivalent to the above may be used as alternatives.

### **Training Course Notes**

PCN requires candidates to have attended an approved course of training. Accredited Training Establishments are required to provide trainees with an up-to-date set of training course notes. These are considered essential reading.

### **Recommended Reading**

- ❑ ESI 98-13 issue 1 1983. Manual ultrasonic testing of forgings for turbine generator rotors, shafts and discs.
- ❑ Basic Metallurgy for NDT Edited by J L Taylor. British Institute of NDT, Midsummer House, Riverside Way, Bedford Road, Northampton, NN1 5NX.
- ❑ 'Ultrasonic Testing of Materials' by J and H Krautkramer. George Allen & Unwin Limited, London.
- ❑ 'Principles and Practice of Non-Destructive Testing' edited by Dr J H Lambell. Heywood and Company, London.
- ❑ Non-Destructive Testing (second edition, 1991) by R Halmshaw. Edward Arnold.
- ❑ 'Ultrasonic Flaw Detection for Technicians' by J C Drury. Obtainable from The British Institute of NDT, Midsummer House, Riverside Way, Bedford Road, Northampton, NN1 5NX
- ❑ ASNT Classroom Training Handbook originally published by General Dynamics.
- ❑ ASNT Self Study Handbook originally published by General Dynamics.
- ❑ ASNT Question and Answer Book.
- ❑ ASNT Level III Study Guide.
- ❑ NDT Handbook, second edition, volume 3 (1985).
- ❑ ASNT Student Package.
- ❑ ASNT Instructor Package (overheads for training).

NOTE. Some of the above are available only in reference libraries. For information on sources of the above recommended reading contact The British Institute of Non-Destructive Testing, Midsummer House, Riverside Way, Bedford Road, Northampton, NN1 5NX.