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PCN/GEN APPENDIX A Initial Issue 1 dated 1st October 2011
CERTIFICATION OF PERSONNEL FOR GUIDED WAVE TESTING OF PIPES

ASSOCIATED DOCUMENTS:

Annex 1

Examination syllabus for the certification of personnel for Guided Wave Testing of pipes

Annex 2

Specimen examination questions for the certification of personnel for Guided Wave Testing of pipes

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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, certified competent for Guided Wave Testing of pipes. Requirements contained in this document are supplementary to those contained in the current edition of the General Requirements for Qualification and PCN Certification of Guided Wave Testing Personnel. Information on the status of PCN documents is available from PCN or from any PCN examination centre.

2. EXAMINATION CONTENT

General information on examination content and time allowed for each written part is described in General Requirements for Qualification and PCN Certification of Guided Wave Testing Personnel. This Appendix amplifies the provisions of that document only where necessary.

2.1 LEVEL 1

All candidates will be required to attempt an examination comprised of the following parts:

2.1.1 General and Equipment Specific Theory of the Guided Wave Testing of Basic pipe.

2.1.3 Equipment Sector Specific Practical examination comprising:

(i) Setting up of test equipment.
(ii) Testing one straight pipe to a specified instruction (excluding areas close to other features) with total attenuation no more than 1dB per metre range.
(iii) Reporting the results in a prescribed manner in accordance with the instructions provided.
(iv) Classify and report on a total of three recorded data files representative of GWT examinations. Report the results in required format as per the training course showing the location and classification of features present in the pipe. Time allowed 2 hours

The total time allowed for all parts of the practical examination is 4 hour. The minimum pass mark for the practical part is 80% in each sample tested

2.2 LEVEL 2

All candidates will be required to attempt an examination comprised of the following parts:

2.2.1 Equipment Sector Specific Theory of the application of the Guided Wave Testing method in the testing of pipes.

2.2.2 Equipment Sector Specific practical examination comprising:

(i) setting up of test equipment as defined for level 1.

(ii) test collect and store test data for one pipe sample selected by the Examiner. NDT instructions, including information and test parameters will be provided to all candidates. Time allowed: one hour per specimen.

(iii) interpret and report on a total of three recorded data files representative of a range of GW examinations. Report the results in an indicated format, showing the location and classification of flaws present in the pipe. Time allowed: 2 hours.

(iv) prepare a detailed NDT instruction suitable for level 1 certificate holders to follow for GW screening of pipes to a provided code, standard or specification, and to prove the instruction by testing. Time allowed: one hour.

The total time allowed for all parts of the practical examination is 4 hours.

2.3 LEVEL 3

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.

3. CERTIFICATION AVAILABLE

All certification will be issued stating which GWT equipment the holder is certified to use MSS, Teletest or Wavemaker

3.1 LEVEL 1

Guided Wave Testing of Basic pipe.

3.2 LEVEL 2

Guided Wave Testing in advanced basic pipe.

3.3 LEVEL 3

Guided Wave Testing – Only available during the transitional arrangement in accordance with CP 12A.

4. RECERTIFICATION

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

4.2 Level 1 and Level 2 certificate holders seeking recertification will be required to undertake the practical examination described above for their level.

5. GRADING

General information on the grading of examinations 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

6. TRAINERS AND EXAMINERS

	Trainer qualification
Level 1	PCN GWT Level 2 (under supervision of Level 3) or 3
Level 2	PCN GWT Level 3
Level 3	PCN GWT Level 3

	Examiner qualification
Level 1	PCN GWT Level 2 (under supervision of Level 3) Must be reviewed by Level 3 before issue
Level 2	PCN GWT Level 3
Level 3	PCN GWT Level 3 for both marking and peer review

7. REFERENCE LITERATURE AND DEFINITIONS

1. **Essential Reading** –

Product Technology Classroom Training Handbook – The British Institute of Non-Destructive Testing.

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

2. **British Standard** (ref when it becomes available)

3. Pre course information (Where provided by the AQB)

ANNEX 1 TO PCN GEN APPENDIX A

EXAMINATION SYLLABUS FOR GWT

GWT – Levels 1 and 2 The letters T and P followed by a value indicate theory part of training and practical part of training respectively, in hours.

Content	Level 1 Basic Pipe	Duration (h)
G.1 **Introduction to terminology and history of NDT**	Tasks of NDT personnel History of NDT History of GW Terminology of GW Purpose of GWT	T 1,0
G.2 **Physical principles of the method and associated knowledge** **This section to be rearranged into general and specific**	**Review of mathematical basis.** Wave propagation theory. Dispersion, attenuation and reflection effect. Properties of Guided waves in pipes. **Various types of GW modes** Torsional, longitudinal and flexural **Transmission and reception of Guided Waves** Piezoelectric effect Magnetostriction EMAT **Transduction** (equipment specific) Types of transducers/sensors. Array arrangement. Directionality. Frequency limits. Dead zone and near field Influence of transduction and frequency on inspection. Guided wave focusing. Factors influencing selection of test conditions. Influence of pipe geometry and pipe configurations.	T 8,0
G.3 **Product knowledge and related capability of the method and derived techniques**	**Pipe design and various defects related to the manufacturing processes and service-induced defects.** Implementation of the testing techniques according to products and to expected discontinuities. Influence of geometry and structure	T. 4.5
G.4 **Equipment**	**Various probes and software functions.** Pulser-receiver unit Transducers/sensors and cabling system. Pulse echo operation	T.2.5 P. 5.0

	A-scan presentation C-scan type display (If applicable) System self check and calibration. Coupling check. Distance calibration/time base calibration Amplitude calibration.	
G.5 **Information prior to testing**	**Written instructions (prepared by a level 2 or 3):** Objectives and Requirements	T 1.5
G.6 **Testing**	**Gathering data and recognition of symmetric features** Methodical approach to data analysis using GW pulse echo information. Recognition of Welds and flanges. **Distance amplitude correction/Time Corrected Gain (TCG)** Setting of range and sensitivity Use of welds and flanges for DAC setting **Gathering data and recognition of non-symmetric features** Recognition of bends, branches, vents and different types of supports **Influence of coatings, linings and pipe condition on pulse echo analysis.** Various attenuation phenomena and typical result traces **Spurious echoes (See definitions)** Analysis of spurious echoes present in pulse echo traces.	T 10.0 P 35.0
G.7 **Evaluation and reporting**	**Reporting of non visible features (hidden geometry)** **Reporting of defects** Reporting thresholds Influence of frequency on defect detection Influence of focusing on defect detection Estimation of defect severity	T 4.5 P 7.0
G.8 **Assessment**	**Not applicable**	
G.9 **Quality aspects**	**Personnel qualification (according to EN473 and ISO 9712)** Equipment verification Roles and Responsibilities of Level 1, 2 and 3 Data quality assessment	T 1.0
G.10 **Developments**	**Not applicable**	
Total duration		T 33.0 P 47.0

Content	**Level 2 Group 3.1** **Advanced "basic pipe"**	**Duration (h)**
G.1 **Introduction to terminology and history of**	Review of level 1 knowledge. Terminology and definitions	T 0.5

NDT		
G.2 **Physical principles of the method and associated knowledge**	Review of level 1 Various types of GW modes (deeper knowledge of dispersion curves normal transmission modes available and how to apply them) **Transduction.** Factors influencing selection of test parameters. Sensitivity to stiffness changes Effect of feature geometry. Transducer position	T 4.0
G.3 **Product knowledge and related capability of the method and derived techniques**	**Same as level 1 plus:** Implementation of testing techniques when targeting areas in close proximity or within axial extent of other features. Various types of pipeline supports. Structural integrity of pipelines –codes and standards for the specific sector	T 4.0
G.4 **Equipment**	**Same as level 1 plus:** Advanced transduction systems Hardware and software requirements for optimization of test parameters C-scan presentation (deeper knowledge)	T 0.5 P 2.0
G.5 **Information prior to testing**	Contents and requirements of instructions, procedures and standards. Preparation of written instructions.	T 3.0
G.6 **Testing**	**Same as level 1 plus:** Advanced DAC/TCG Advanced spurious echoes Phase information Advanced C-scan display Testing under supports Temperature effect	T. 8.0 P. 10.0
G.7 **Evaluation and reporting**	**Same as level 1 plus:** Estimation of defect severity (deeper knowledge) Identification of defects in close proximity of other features.	T 1.0 P 4.0
G.8 **Assessment**	**Evaluation and confirmation of test reports** Application of the acceptance: Criteria according to standards, codes and procedures.	T 1.5
G.9 **Quality aspects**	**Personnel qualification (according to EN473 and ISO 9712)** Equipment verification (Calibration) Written instructions Traceability of documents	T 1.0
G.10 **Developments**	**General information/Lessons learned**	T 0.5
Total duration		T 24.0 P 16.0