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CERTIFICATION SCHEME FOR PERSONNEL

PERSONNEL CERTIFICATION IN NDT

DOCUMENT No. CSWIP/PCN-NWIT-1-15

Requirements for the Certification of Nuclear Welding Inspection Technicians

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Issued jointly under the authority of the TWI Certification Ltd (TWI Cert) Governing Board for Certification

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FOREWORD

The Certification Scheme for Personnel (CSWIP) and Personnel Certification in NDT (PCN) schemes are comprehensive schemes that provide for the examination and certification of individuals seeking to demonstrate their knowledge and/or competence in their field of operation. The scope of this joint CSWIP and PCN scheme includes, all levels of welding inspection and NDT for nuclear applications, including new build, operations and maintenance of critical plant and structures. This document should be read in conjunction with the Apprenticeship Standard ST0292: Nuclear Welding Inspection Technician.

CSWIP and PCN are managed by the Certification Management Board, and Certification Management Committee which act as the Governing Boards for Certification, in keeping with the requirements of the industries served by the schemes. All CSWIP and PCN Boards and Committees comprise member representatives of relevant industrial and other interests.

TWI Certification Ltd and BINDT understand the importance of impartiality in carrying out their certification activities, managing conflict of interest and ensuring the objectivity of all its certification activities, in accordance with BS EN ISO/IEC 17024.

The current document covers the Certification of Nuclear Welding Inspection Technicians. Endorsements to the certificate are provided for additional NDT methods.

Whilst Registration with the Engineering Council as an Engineering Technician remains a personal choice, the requirements governing Registration of Nuclear Welding Inspection Technicians are included in this document.

Registration is strongly recommended as it supports continuing professional development and the certificate renewal requirements, see Clause 4.5.1

ACCESS TO CERTIFICATION

Access to certification schemes is not improperly restricted. The sole criteria for certification are given in the document (and any subsequent amendments) and no other criteria will be applied. Certification is not conditional on the candidate applying for other services or membership from TWI Certification Ltd, its parent, the British Institute of NDT or any other groups or associations.

1. General

1.1 Scope

This document prescribes procedures by which personnel may be examined, and, if successful, certificated for the duties of a Nuclear Welding Inspection Technician.

1.2 Responsibilities of personnel

Typical areas of work activity of personnel for whom CSWIP/PCN Nuclear Welding Inspection Technician certification would be suitable are given below:

1.2.1 Nuclear Welding Inspection Technician

- a) Post weld visual inspection
Visual inspection and dimensional check of completed weldment against specification requirements and drawings.
- b) Establish correct welding processes
- c) Codes and standards
Application of the requirements of codes and standards.

- d) Parent material identity
Verification against documentation and markings of correctness of parent material.
- e) Welding consumables identity
Verification of correctness of welding consumables (electrodes, filler wires, consumable inserts, gases, fluxes etc).
- f) Pre-weld inspection
Verification that dimensions, fitup and weld preparations are in accordance with the engineering drawings.
- g) Preheating
Verification that preheat (where required) is in accordance with specified procedures.
- h) In-process welding surveillance
Surveillance during welding to verify compliance with specified procedure including any preheat, interpass temperature control and post heat requirements.
- i) Supervision of Visual Welding Inspectors in the conduct of activities (b) to (h) above.
- j) Welding procedures
Establishing that a procedure is available, has been approved as required by the appropriate authority and is being employed in production.
- k) Witnessing of welder and procedure approval tests
Witnessing the preparation of test pieces and destructive tests, and verifying compliance with appropriate standards and specifications.
- l) Welder approvals
Verification that adequate and valid welder approvals are available, and that only approved welders as required are used in production.
- m) Post weld heat treatment
Verification that post weld heat treatment has been conducted in accordance with specification requirements.
- n) Reports
Preparation of inspection reports.
- o) A Nuclear Welding Inspection technician with NDT Level 2 endorsement is qualified to perform and direct non-destructive testing in accordance with established or recognised techniques. The individual shall be competent to choose the test techniques to be used; to set up and calibrate equipment; to interpret and evaluate results in accordance with applicable codes, standards and specifications; to carry out all duties for which a Level 1 individual is qualified and to check that they are properly executed; and to prepare written instructions and organise and report the results of non-destructive tests. The individual shall also be familiar with the scope and limitations of the method for which they are qualified, and be able to exercise assigned responsibility for on-the- job training and guidance of trainees and NDT Level 1 personnel.
- p) Knowledge, Skills and Behaviours as outlined by Apprenticeship Standard ST0292: Nuclear Welding Inspection Technician.

1.2.2 Training

All candidates (with the exception of 'mature candidates,' see section 1.4) must attend a CSWIP or PCN approved course of training prior to examination. Details of such courses are available on request.

1.2.3 Health/Eyesight

Candidates need to be in satisfactory physical condition and the person completing the application form will be required to signify that the candidate's health and eyesight are adequate to enable him/her to carry out his/her duties.

The candidate shall provide documented evidence of satisfactory vision in accordance with the following requirements:

a) Unaided or corrected near visual acuity in at least one eye shall be such that the candidate is capable of reading N4.5 Times Roman or Jaeger number 1 or equivalent letters (having a height of 1.6mm) type at a distance of not less than 30cm with one or both eyes on a standard reading test chart.

b) Colour vision shall be sufficient that the candidate can distinguish and differentiate contrast between the colours used in the NDT methods concerned. All candidates and holders of CSWIP-PCN certification will be required to have a colour perception assessed by the Ishihara 24 plate test, in the event of colour perception deficiency, indicated by misreading any of the first 17 plates, the employer shall be notified, a further 'trade test shall be carried out by the employer to ascertain whether the detected colour perception deficiency affects the individual's ability to perform the NDT method for which he is certified.

The evidence must be in the form of a certificate issued by a medically recognised person or a trained appointed representative of the medically recognised person within the previous 12 months, covering all the above points.

1.3 Mature Candidate Route

A mature candidate route offering exemption from formal training is available for the following:

1.3.1 Nuclear Welding Inspection Technician

Candidates who are able to demonstrate at least five years' recent continuous experience in nuclear welding inspection duties, as indicated in Clause 1.2.1 under qualified supervision, independently verified.

Or

Candidates who hold CSWIP or PCN Welding Inspector and Level 2 VT certification with two years' recent continuous experience in nuclear welding inspection duties, as indicated in Clause 1.2.1 under qualified supervision, independently verified.

Or

Candidates who hold an International Welding Inspector Standard Level Diploma and an accredited certification to ISO 9712 Level 2 in VT with three years' recent continuous experience in nuclear welding inspection duties, as indicated in Clause 1.2.1 under qualified supervision, independently verified.

Or

Candidates who hold a Level 4 Higher National Certificate in Manufacturing Engineering with three years' recent continuous experience in nuclear welding inspection duties, as indicated in Clause 1.2.1 under qualified supervision, independently verified. The following HNC units are required as a minimum:

Core Units

- Analytical Methods for Engineers

- Engineering Science
- Project Design, Implementation and Evaluation

Specialist Units

- Materials Engineering
- Fabrication and Welding Processes in Manufacturing
- Welding Technologies
- Welding Inspection
- Quality and Business Improvement

Those who wish to apply for the Nuclear Welding Inspection Technician Certificate via the Mature Candidate Route, must complete a specific Mature Candidate Route application form to demonstrate how they meet the requirements listed above. Technical experience is assessed by three independent (of the applicants company) members of the Nuclear Welding Inspection Technician Trailblazer Committee.

2. EXAMINATION PROCEDURE

2.1 Nuclear Welding Inspection Technician

The examination procedure for the Nuclear Welding Inspection Technician (consists of written and practical examinations. Please refer to Appendices 1 and 2 respectively for details of the examination format, syllabus.

2.1.1 Written examination

The written examination consists of multiple choice questions and is designed to test the candidate's knowledge of the syllabus.

2.1.1.1 General Welding Theory and Product Technology examination

30 multiple choice questions. Time allowed 1 hour.
Pass mark 70%.

2.1.1.2 Specific Welding Technology, Welding Inspection and NDT examination.

60 multiple choice questions. Time allowed 2 hours.
Pass mark 70%.

2.1.1.3 Visual Testing General theory examination

30 multiple choice questions
Time allowed: 1 hour
Pass mark 70%

2.1.1.4 Visual Testing Specific theory examination

20 multiple choice questions
Time allowed: 40 minutes
Pass mark 70%

2.1.2 Practical examination

Candidates will be required to inspect and report on the following:

- At least three completed welds for compliance with stated requirements and,

- b) A set of destructive tests (two macros or two bends or two fractured fillets) for a welder or procedure approval test intended to comply with a stated specification.

The candidate is required to test and report on three specimens: butt weld in plate, butt weld in pipe and a T joint, using three different techniques selected by the examiner.

Time allowed 3 hours

Practical Part A1: Inspection of eight plate butt weld specimens to a code provided by the Test Centre. Time allowed 1 hour 30 minutes.

Practical Part B: Inspection of a set of destructive test samples to a code provided by the Test Centre (two macros, two bends or two fractures). Time allowed 45 minutes.

Instruction Writing

The candidate shall draft an NDT instruction suitable for Level 1 personnel as selected by the examiner.

Time allowed 1 hour

Pass mark for all sections is 70%.

2.2 Supplementary tests

2.2.1 Magnetic Particle or Penetrant Testing Inspection

Candidates who have gained the NWIT certification may, at any time after gaining the requisite 20 hours of training and two months of practical experience, apply to gain the MT or PT method endorsement to their CSWIP/PCN NWIT certificate.

2.2.1.3 Written Examination

The written examination consists of multiple choice questions and is designed to test the candidate's knowledge of the syllabus

2.2.2 Practical Examination

The practical examination may be a set of examinations each addressing one element in 2.1.2, or may be in the form of a scenario based examination addressing all elements in 2.1.2. The overall examination time and pass mark requirements are to be satisfied, irrespective of the format of the examination.

2.2.3 Ultrasonic and Radiographic Inspection

Candidates who have gained the NWIT certification may, at any time after gaining the requisite 60 hours of training and six months of practical experience, apply to gain the UT or RT method endorsement to their CSWIP/PCN NWIT certificate.

2.2.3.3 Written Examination

The written examination consists of multiple choice questions and is designed to test the candidate's knowledge of the syllabus

2.2.4 Practical Examination

The practical examination may be a set of examinations each addressing one element in 2.1.2a) or may be in the form of a scenario based examination addressing all elements in 2.1.2a). The overall examination time and pass mark requirements are to be satisfied, irrespective of the format of the examination.

2.3 Application for Examination and Fees

Candidates will be required to submit an application form. All the information requested must be on these forms. No applications can be considered confirmed until receipt of correctly completed documents. Application forms ask for specific details of experience and training and must be signed to the effect that these details are correct.

In the event of a false statement being discovered on forms any examination undertaken will be declared null and void. A certificate is automatically invalidated if there are any outstanding examination fees in respect of that certificate.

Candidates proved to have cheated, or found to have attempted to remove or found to have removed examination material in a CSWIP/PCN examination will not be accepted as a candidate for any CSWIP/PCN examination for a minimum period of five years from the date of the examination where cheating, attempt to remove or removal of examination material, was established to have taken place.

Examinations may be taken at any one of a number of Test Centres in the UK and overseas. Lists are available on request.

3 CATEGORIES OF CERTIFICATION

Candidates may apply for one of the following certification categories:

- a) CSWIP/PCN Nuclear Welding Inspection Technician
- b) CSWIP/PCN Nuclear Welding Inspection Technician with NDT Endorsement (MT/PT/UT/RT)

4 CERTIFICATION

4.1 Results notices

All candidates will be sent a results notice. This notice will also be sent to the organisation paying the examination fee, if not paid by the candidate.

4.2 Successful candidates

Two copies of a certificate of proficiency will be issued to the organisation or person that pays the examination fees. Duplicate certificates to replace those lost or destroyed will be issued only after extensive enquiries.

4.3 Unsuccessful candidates

Candidates who fail to obtain a certificate may attempt one retest on those parts of the examination in which success was not achieved. The retest must be completed within one year of the initial examination, otherwise candidates will have to repeat the complete examination.

The retest (or complete re-examination) may not be taken within 30 days of the previous examination, unless additional approved training is undertaken before taking the retest.

Candidates who are unsuccessful in the retest will be required to undertake further training followed by the full examination. If a candidate fails a practical part of the Welding Inspector examination they are allowed a second retest on that part, if they have one day's approved training before taking the second retest, this option only applies to candidates who have taken the full CSWIP or PCN approved course of training in accordance with section 1.2.2.

4.4 Period of validity

The certificate is valid for five years from the date of completion of the initial examination and may be renewed for a further five years on application, provided evidence is produced in accordance with Clause 4.5.1. Certificates are only valid provided:

- a) they are within date;
- b) they are on CSWIP-PCN certificate paper, signed by an officer of CSWIP or PCN, and embossed with the CSWIP or PCN stamp;
- c) they have been signed by the individual to whom the certificate is awarded; and
- d) they are accompanied by a valid official CSWIP-PCN card.

Photocopies are unauthorised by CSWIP and PCN and should only be used for internal administrative purposes.

4.5 Renewal

4.5.1 Five year renewal

In order for the certificate to be renewed after five years, the holder has to demonstrate that he/she has maintained his/her competence by:

- i) *providing evidence of continuous work activity in welding inspection; and
- ii) providing evidence that the holder has kept up to date in welding technology.

* As a guide, 'reasonable continuity' in any given five year period means that absences from work for which the certificate was granted should not exceed one year in one or several periods.

Part (i) renewal can be satisfied by completing the relevant documentation which may be a points system or submitting a work log of work activity covering the period of validity of the certificate log to either CSWIP or PCN contact details on page 9.

One way of satisfying Part (ii) is by Registration as EngTech through BINDT or The Welding Institute.

The certificate will not be renewed without further test if a substantiated complaint is notified to either of the Governing Boards during the period of its validity. Further instruction and retest may then be required.

It is the certificate holder's responsibility to ensure that renewal takes place at the appropriate time. It is possible for certificates to be renewed up to a maximum of six calendar months from the date of expiry shown on the certificate by completing a late renewal application and late renewal will be subject to a special fee.

4.5.2 Ten year recertification

Certificates are renewed beyond ten years from the initial examination (or from a previous ten year renewal) by the holder successfully completing a renewal examination prior to the expiry of the certificate in addition to the renewal procedure given in Clause 4.5.1. Requests for the appropriate documentation should be sent to one of the Certification Bodies listed on page 9.

The 10 year examination for Nuclear Welding Inspection Technician will consist of the following:

Multi choice paper

Practical visual inspection of a plate or pipe butt weld.

One retest, within six months of the 10 year renewal examination, will be allowed.

Failure at the retest point will mean that the candidate must take the full course and successfully pass the full initial examination to regain the certification

NDT endorsements can be recertified in accordance with the requirements of the CSWIP or PCN scheme documents for the relevant method and level of certification.

4.6 Complaints and appeals

An aggrieved party in a dispute which considers itself to have reasonable grounds for questioning the competency of a CSWIP/PCN certified person may petition the Governing Board for non-renewal of the certificate. Such a petition must be accompanied by all relevant facts, and if in the opinion of the Board an adequate case has been presented, a full investigation of the circumstances under dispute will be initiated. If the petition is substantiated to the satisfaction of the Board, the certificate will not be renewed without further test.

Appeals against failure to certify or against non-renewal of the certificate may be made by the inspector or the employer upon application in writing to the Governing Board.

5 RECORDS

TWI Certification Ltd and BINDT maintain records of successful and unsuccessful candidates. These records are accessible to the Governing Boards or their nominees at all reasonable times.

6 REFERENCES

1. BS EN ISO 17637 (latest revision) Non-destructive testing of welds -- Visual testing of fusion-welded joints
2. ISO 9712 (latest revision) Non-destructive testing – Qualification and Certification of NDT personnel
3. ST0292: Nuclear Welding Inspection Technician Apprenticeship Standard

7 ADDRESSES

For further general information contact:

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Website: www.bindt.org

For specific information on examinations and tests and arranging for them to be carried out, contact the approved Examining Body:

Certification of Nuclear Welding Inspection Technicians in accordance with the requirements of BS EN ISO 9712:2012 and BS EN ISO 17637¹:2011

APPENDICES TO DOCUMENT NO CSWIP/PCN-NWIT-1-15

Appendix 1:	Examination Syllabus for Welding Inspector
Appendix 2	Examination Syllabus for Visual Testing

APPENDIX 1: EXAMINATION SYLLABUS

Examination format

Theory Part A2: General Welding Theory, Product Technology and NDT
30 multiple choice questions. Time allowed 60 minutes.

Theory Part B2: Specific Welding Technology.
60 multiple choice questions. Time allowed 2 hours.

Practical Part A2: Inspection of eight plate butt weld specimens to a code provided by the Test Centre. Time allowed 1 hour 30 minutes.

Practical Part C2: Inspection of a set of destructive test samples to a code provided by the Test Centre (two macros, two bends or two fractures). Time allowed 45 minutes.

Passmark for all parts is 70%.

Subjects

- a) **Codes and Standards**
The make-up of typical application standards.
- b) **Terminology**
Welds, joints, weld face, toe, root, throat, leg length, HAZ, fusion boundary. Terminology for defects.
- c) **Materials – Inspection points**
 - Size: thicknesses, lengths, diameters
 - Type: grade, composition against documentation
 - Condition: cleanliness and surface for welding
 - Heat treatment condition and distortion
- d) **Welding processes**
Basic features of manual and mechanised flux shielded and gas shielded arc processes, gas welding and electroslag welding.

The identification of weld defects due to misuse or malfunction of processes.
- e) **Consumables**
The identification of consumables to British, European, ISO and American standards.

Coating types and fluxes. Shielding gas compositions. Electrode and filler wire compositions.

The storage and drying of electrodes and fluxes, matching consumables (electrodes with shielding gases, electrodes with fluxes).
- f) **Visual examination and dimensional checking before and after welding**
Weld preparations and fit-up. Dimensions and shape of finished welds. Defects. Code requirements.
- g) **Identification of pre-heat**
Application and control.
- h) **Safety**
Health and safety requirements and practices.
- i) **Visual examination of repaired welds**

Partially removed welds and completed removed welds.

j) **Materials**

- Size: thicknesses, lengths, diameters
- Type: grade composition against documentation
- Condition: cleanliness and surface for welding
- Heat treatment condition and distortion

k) The effect of composition, thickness and hydrogen on welding of certain grades of steel. The techniques and control used to avoid hydrogen induced cracking and lamellar tearing.

Post weld heat treatment, its conduct and control.

l) **Welding processes**

The effect of variations in welding parameters. The influence of process on appearance and penetration, and centreline cracking. British, American and ISO symbols on drawings.

m) **Welding procedures and welder approvals and their control**

The essential features of a procedure.

British, European, American and other systems of procedure and welder approval and appropriate documentation.

n) **Quality control of welding**

The implementation of quality controls and in-process inspection. Organisation and records.

o) **Destructive tests**

The selection and purpose of all destructive tests specified in standards. Assessment of results.

p) **Non-destructive testing**

The methods, capabilities and limitations, and assessments of reports related to penetrant, magnetic particle, radiographic and ultrasonic testing of parent materials and welded joints.

q) **Weld defects**

Identification of defects. Reasons for their occurrence and acceptance.

r) **Distortion**

The influence of welding techniques on distortion. The control of distortion. The influence of heat treatment and machining.

s) **Reporting**

The preparation of technical reports on all aspects of inspection referred to above.

APPENDIX 2: EXAMINATION SYLLABUS VISUAL TESTING

Examination format

Visual Testing General theory examination

30 multiple choice questions

Time allowed: 60 minutes

Pass mark 70%

Visual Testing Specific theory

20 multiple choice questions (welds), time allowed: 40 minutes

30 multiple choice questions (general engineering), time allowed 1 hour 30 minutes

Pass mark 70%.

Specific practical examination

The candidate is required to test and report on three specimens: butt weld in plate, butt weld in pipe and a T joint, using three different techniques selected by the examiner.

Time allowed 3 hours

Practical Part A1: Inspection of a plate butt weld to a code provided by the Test Centre. Time allowed 1hr 15 mins.

Practical Part A2: Inspection of a pipe butt weld to a code provided by the Test Centre. Time allowed 1hr 30 mins.

Practical Part A3: Inspection of a T joint to a code provided by the Test Centre. Time allowed 1hr 15 mins.

Practical Part B: Inspection of a set of destructive test samples to a code provided by the Test Centre (two macros, two bends or two fractures). Time allowed 45 mins.

Instruction Writing

The candidate shall draft an NDT instruction suitable for Level 1 personnel as selected by the examiner.

Time allowed 1 hr

Pass mark for all sections is 70%.

Subjects

a) Introduction to visual testing

Definition and history of visual testing

b) Factors influencing visual inspection

Vision, lighting, material properties, environmental, visual perception, surface preparation, direct and indirect inspection.

c) Equipment

Mirrors, magnifiers, borescopes, fibrescopes, CC TV, gauges, templates, scales, automated systems, computer enhanced.

d) Vision

The eye, limitations, disorders, vision requirements

e) Light

Fundamental theories, light measurements, required levels, lighting techniques

f) Material Attributes

Cleanliness, colour, condition, shape, size, temperature, texture, type, surface finish.

g) Environmental and Physical Factors

Atmosphere, comfort, distance, elevation, fatigue, health, humidity, mental attitude, position, safety, temperature, cleanliness.

h) Visual Perception

i) Equipment

Imaging systems, optical systems.

j) Inspection and Testing

Selection of parameters, inspection objectives and test points.

k) Reporting

Test standards/calibration, classification of indications.

l) Welding technology

Terminology for welds, welded joints, welding procedures, weld defects, parent metal defects.

Influence on techniques of geometry, size, surface condition, parent metal composition, weld metal structure. Influence of surface cladding, heat treatments and weld repairs.

Basic principles of fusion welding processes.

Types of defect associated with particular parent metal/welding process combinations. Types of defect in welds and parent metals detectable by visual and optical inspection.