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PCN RADIOGRAPHIC TESTING (RT) OF WELDS IN THE AEROSPACE MANUFACTURING, SERVICE, MAINTENANCE AND OVERHAUL INDUSTRIES USING FILM OR FILMLESS TECHNIQUES AS APPROPRIATE TO THE CERTIFICATION SOUGHT.

FOR THE TESTING OF MATERIALS, PRODUCTS, COMPONENTS, (ASSEMBLIES AND SUBASSEMBLIES, WHICH INCLUDES STRUCTURES).

1. SCOPE

This appendix document to PCN AERO A0 forms one part of the specific suite of requirements documents for the third-party certification of personnel within the aerospace sector for non-destructive testing using the PCN Scheme.

PCN AERO Appendix A4 addresses the specific requirements for the qualification and certification of NDT personnel engaged in the radiographic non-destructive testing of aerospace welds.

Included herein are the specific requirements for the PCN examination and certification of Level 2 and/or Level 3 personnel for the non-destructive testing of aerospace welds in the aerospace manufacturing, service, maintenance and overhaul industries.

The UK National Aerospace NDT Board (UK NANDTB) has published document NANDTB/10 – Policy on recognition of PCN aerospace certificates for NDT personnel operating under EASA Part 145.

In accordance with the requirements within EN 4179, the NANDTB is entitled to recognise *“other NDT qualification programmes”*, and in this regard the UK National Aerospace NDT Board recognises the PCN AERO scheme. This includes PCN AERO examinations conducted at overseas PCN aerospace approved Authorised Qualifying Bodies (AQB) that are also BINDT-approved Outside Agencies (OAs), under the control of the UK NANDTB.

It remains the responsibility of the Nominated Level 3 (as defined in the UK Civil Aviation Authority (CAA) Generic Requirement No 23) to determine whether additional job-specific training and examination, covering the NDT processes and products utilised by the employer, is required. Note: CAA defined ‘Nominated Level 3’ equates to EN 4179 ‘Responsible Level 3’ (RL3).

It shall be for the company RL3 to satisfy his / herself that the personal certification detailed on an individual’s PCN certificate meets the requirements of their company’s written practice.

Any person(s) requiring information on the content of PCN documents should visit www.bindt.org or email pcn@bindt.org directly with their concern.

2. Terms and Definitions

2.1. Full terms and definitions are defined in PCN GEN and PCN AERO A0.

2.2. In addition, for the purposes of this document, the following definition applies:

2.2.1. **Radiographic technology:** A sub-division of the radiography method including, but not limited to:

2.2.1.1. Film radiography

2.2.1.2. Non-film radiography (including computed radiography and digital radiography)

2.2.1.3. Radioscopy

2.2.1.4. Computed radiography.

3. Certification Available

3.1. **PCN Level 1:** PCN Aerospace Radiographic Testing certification for welds is currently NOT available at Level 1. Should PCN Aerospace Radiographic Testing (RT) at be required at Level 1 please contact PCN at pcn@bindt.org to discuss your requirement.

3.2. **PCN Level 2:** Radiographic Testing of Aerospace welds (light and dense) OR (light or dense)

3.3. **PCN Level 3:** Radiographic Testing of Aerospace welds (light and dense)

3.3.1. Certification attempted can be for film or filmless technologies and techniques. Certification training and examinations attempted shall be as specified on application form PSL/57A. This shall allow the AQB/OA to tailor the specific and practical examination module elements to the certification requirement.

3.3.2. PCN certification for all forms of RT (excluding radiographic interpretation only) shall be valid only so long as the certificate holder holds certification for either basic radiation safety or radiation protection. In the United Kingdom, this requirement is satisfied by holding valid PCN certification for radiation safety. Where required, PCN can provide guidance for radiographic certificate holders and candidates based in countries other than the UK.

3.3.3. Where current radiation safety certification is NOT held by the candidate, then they may attempt the PCN basic radiation safety (BRS) module training and examination. It shall be noted that main method RT certification will NOT be released by PCN until success for radiation safety can be demonstrated by the candidate. Details of the PCN radiation safety examinations are in Appendix E3.1 to the current edition of PCN/GEN.

4. Examination Details

4.1. PCN Aerospace RT certification for welds is currently available at Level 2 and Level 3 for aerospace products. Except where exemptions apply (refer to PCN Aerospace A0 specific requirements), all Level 2 initial candidates shall be required to attempt an examination comprising general, specific, and practical examination modules as detailed herein.

4.2. The pass mark for each individual module shall be $\geq 70\%$ with the candidate required to attain an overall RT welds examination composite score of $\geq 80\%$ to comply with the requirements of EN 4179.

4.3. Each module attempted shall be of equal weighting for the purpose of calculating the composite examination score.

5. General Theory Written Examination (Level 2)

- 5.1. The general theory written examination is aimed at assessing the candidate's general knowledge of the radiographic NDT method at the appropriate level.
- 5.2. The general theory examination is a closed-book examination consisting of a minimum of 40 multi-choice answer questions covering the general theory of the method at the appropriate level.
- 5.3. The general theory examination shall include only validated questions selected in an unpredictable way from the collection of general questions approved by the British Institute of NDT at the time of the examination.
- 5.4. The time allowed for the examination is calculated based upon 2 minutes per question; the pass mark shall be $\geq 70\%$.

6. Sector-Specific Written Examination (Level 2)

- 6.1. The specific examination shall be an examination where candidates have access to authorised reference material supplied to them by the examiner. The reference material shall be restricted to copies of the specifications/standards/codes upon which specific examination questions are based.
- 6.2. The Aerospace-approved AQB/OA shall prepare the specific examination paper in accordance with the candidate's employer's instructions supplied to them by the candidate on form PSL/57A.
- 6.3. The specific examination shall consist of a minimum of 30 questions based upon the application of the NDT method and technique(s) to aerospace products. A minimum of 20 questions from the total number of questions supplied shall be multi choice.
- 6.4. At Level 2, a minimum of five of the specific examination questions shall address **aerospace sector-specific product technology** relevant to the certification sought.
- 6.5. The specific examination shall be written against the specifications listed in PCN AERO A0 Appendix 1 for the method in which certification is sought.
- 6.6. The specifications listed for the construction of the specific examination (see appendix 1 PCN AERO A0) shall be used to build the default core examination where no other specifications have been requested by the candidate's employer on form PSL/57A (see 6.7)
- 6.7. Candidates may also be examined against other additional specifications/standards as advised by the candidate's employer or Responsible Level 3 at the time of application on form PSL/57A. The AQB/OA shall determine, in consultation with the candidate's employer/RL3, what, if any, additional specifications are to be used in the preparation of the candidate's specific examination paper.
- 6.8. Where no other specifications/standards are advised, the core specifications listed in Appendix 1 of PCN AERO A0 shall be used as the default option for construction of the specific exam.
- 6.9. The specific examination questions shall be appropriate to the NDT method, technology and technique(s) for the certification sought.
- 6.10. Specific questions shall require the candidate to demonstrate understanding of the reference material provided, rather than merely finding the location of the referenced material.
- 6.11. The specific examination paper shall contain a minimum of 20 multi-choice specific questions. Where appropriate, questions requiring the candidate to provide a narrative response may also be included.

- 6.12. Where narrative questions carry more than one mark, the AQB shall provide to the candidate details of the total number of marks allocated to each question requiring a narrative response.
- 6.13. The AQB shall allocate an appropriate amount of time for the candidate to complete the examination.
- 6.13.1. For multi-choice questions, the time allocation per question shall be 2 minutes; however,
- 6.13.2. Where the candidate is required to interrogate a standard, code or specification to determine an answer, then the AQB shall allocate an appropriate amount of time per question to take into account such things as reading time, candidates whose primary language is not English and other considerations such as dyslexia.
- 6.13.3. The type and difficulty of the questions asked will also have a direct influence on examination times allocated, as will the employer's ability to have the candidates examined on other standards, codes and procedures not listed within the core examination suite. Due to these factors it is recognised that examination times may vary significantly, however the AQB shall provide written confirmation to the candidate of the total examination time available to them prior to the commencement of the examination.
- 6.13.4. The pass mark shall be $\geq 70\%$.

7. Practical Examination (Level 2)

- 7.1. The sector-specific practical examination requires the candidate to demonstrate proficiency in performing tasks that are typical of those to be accomplished in the performance of the candidate's duties. The use of appropriate equipment and NDT techniques relevant to the certification that is sought shall be demonstrated.
- 7.2. The Level 2 practical examination shall consist of the following:
- 7.2.1. System controls and functional checking of radiographic test equipment appropriate to the certification sought (film or filmless). The equipment control checks can be included during setting up for practical testing of specimens and marks allocated accordingly to each specimen. System controls and functional checking does not necessarily have to form a separate exam module in its own right. Time allowed: 1 hour.
- 7.2.2. Preparation of a detailed written NDT instruction providing step-by-step information on the testing of one of the specimens (selected by the examiner for 7.2.3) to a provided procedure, code, standard or specification, and subsequently proving the instruction by application. Time allowed: 2 hours.
- 7.2.3. Practical radiography of a minimum of two weldments selected by the examiner of differing configurations, processing the resulting images, commenting upon their suitability for interpretation, and reporting significant areas for further investigation in accordance with the code, specification or standard provided by the examiner appropriate for the category of certification sought, (film or filmless). This may include any calculations necessary to establish inspection sensitivities. Time allowed: calculated total time based upon 2.5 hours arbitrary time per specimen.

Note 1:

The minimum number of practical weld examination specimens tested shall be two; this number may be increased as determined by the candidate's employer or Responsible Level 3 on form PSL/57A.

Where additional supplementary technologies/techniques are requested within the initial or recertification examination, there shall be sufficient specimens to allow the candidate to demonstrate proficiency in the associated technology and technique.

The test specimens attempted shall comprise aerospace, materials, products, components, assemblies, and sub-assemblies appropriate to the certification sought.

The practical examination specimens shall be representative of the employer's product and shall test the candidate's ability to utilise the test method, technologies and techniques as requested by the employer.

- 7.2.4. Interpret and report on a total of 12 radiographs or digital images. Time allowed: 3 hours.
- 7.2.5. For light OR dense metal weld certification only, this shall be 12 radiographs for either light OR dense metal welds as appropriate to the certification sought. Time allowed: 3 hours.
- 7.2.6. Where certification shall include both light AND dense metal weld configurations then the candidate shall view and interpret six light metal weld radiographs + six dense metal weld radiographs (total 12 radiographs). Time allowed: 3 hours.
- 7.2.7. As with the specific written examination the total time allowed for the practical examination may vary significantly and shall be dependent upon the total number of practical specimens attempted by the candidate in line with the employer's request.
- 7.2.8. Total practical examination time shall be calculated based upon the times permitted for each individual technology/technique attempted, based upon a standard time of 2.5 hours arbitrary time per specimen.
- 7.2.9. For processing practical specimens, the pass mark shall be $\geq 70\%$ per specimen tested. Failure to detect and report a reportable (mandatory) discontinuity in any one specimen shall result in failure of the examination part and subsequent certification examination.
- 7.2.10. For the purposes of radiographic interpretation, the specimen shall be considered to be the set of 12 radiographs. Where the candidate fails to identify a mandatory reportable defect on any one sample radiograph, then the sample radiograph shall be awarded a fail. This shall result in the overall composite mark awarded for the specimen set of 12 radiographs to be zero, irrespective of whether the combined marks for the remaining radiographs have resulted in a composite pass mark.
- 7.2.11. The candidate shall achieve a grade of $\geq 70\%$ for each radiograph interpreted.
- 7.2.12. The candidate shall achieve a grade of $\geq 70\%$ for the preparation of the written instruction. Failure to achieve 70% shall result in failure of the examination part, and subsequent certification examination.
- 7.2.13. EN 4179 requires the candidate to achieve a composite grade of $\geq 80\%$ for the certification examination (written and practical combined).
- 7.2.14. Details of RT technologies and techniques for certification are detailed in PCN GEN AERO Appendix 2 and Table 1 below.

Table 1: RT technologies / techniques section from Appendix 2	
Main methods as specified in EN 4179	Technology / technique
Radiography (RT)	X-ray using film
	Gamma ray using film
	Digital radiography (filmless)
	Computerised radiography (filmless)
	Interpretation
	<i>Others</i>

8. Level 3

8.1. Except where exemptions apply (refer to PCN/GEN/AERO A0 aerospace specific requirements), all Level 3 candidates will be required to attempt an examination comprising the following parts:

8.1.1. Basic Examination

8.1.1.1. The basic examination shall be passed first and the result will remain valid, provided that the first main method examination is passed within five years after passing the basic examination. A candidate holding a valid Level 3 certificate is exempt from the need to retake the basic examination.

8.1.1.2. Examination questions shall be selected from the current collection of questions approved by BINDT at the time of the examination. The number of questions set will be as defined in Table 2.

8.1.1.3. The questions shall be multiple choice. The total time allowed for this examination is 3 hours.

Table 2: Number of basic examination questions		
Part	Examination questions on:	Number of questions
A	Materials technology and science, including typical defects in a wide range of products including castings, welds and wrought products.	30
B	Qualification and certification procedure in accordance with PCN AERO A0	10
C	15 general questions at Level 2 standard for each of four NDT methods chosen by the candidate, including at least one volumetric NDT method (UT or RT). See PCN GEN and PCN AERO A0 for possible exemptions.	60

8.1.2 Main Method Examination (Parts D, E and F – See also PCN GEN and PCN AERO A0)

8.1.2.1 This examination shall assess the candidate's knowledge of the main method subject using a combination of general theory multiple-choice questions approved by the BINDT at the time of the examination, by a specific written theory examination produced by the AQB, and by the production of a written procedure. The number of questions shall be as defined in Table 3.

8.1.2.2 The examination timings for examination parts D, E and F shall be.

8.1.2.2.1 2 minutes per multi-choice question (see Table 3 for number of questions); and 4 hours for part F.

8.1.2.3 Level 3 candidates not holding appropriate Level 2 certification shall pass a relevant Level 2 practical examination except that they need not draft an NDT instruction where their Level 3 procedure incorporates a written instruction.

8.1.2.4 The successful candidate for PCN Level 3 certification may be issued Level 2 certification in the same NDT method and sector without further examination provided the relevant PCN Level 2 practical examination was passed in order to gain the Level 3 certification.

8.1.2.5 Any resultant Level 2 certification issued will be valid only for those categories in which success in the practical examination was achieved, and will expire on the same date as the related Level 3 certification.

8.1.2.6 Candidates seeking the issue of a PCN Level 2 certificate under the procedure defined in this clause shall submit their request using form PSL/70 (Request for L2 issue to L3 holder).

8.1.2.7 The candidate shall achieve a composite grade of $\geq 80\%$ to be eligible for Level 3 certification.

Table 3: Main method examination		
Part	Subject	Questions
D	<p>Level 3 knowledge relating to the test method applied.</p> <p>A closed book written examination covering the general theory of the method for which certification is sought.</p> <p>This shall be a closed-book examination comprising 40 multiple-choice questions. Time allowed: 80 minutes; pass mark: 70%.</p>	40
E	<p>Application of the NDT method in the sector concerned.</p> <p>An open-book examination administered with access to specific reference material provided by the examiner which may include applicable codes, standards, and specifications. Time allowed 60 minutes; pass mark: 70%</p> <p>30 multiple-choice questions covering the application of the testing method in the aerospace industry sector.</p>	30
F	<p>An open-book examination in which the candidate will be required to produce a comprehensive written test procedure which embodies an NDT instruction for a specific aerospace product.</p> <p>Details of the product will be provided to the candidate by the examiner along with the specification, standard or code to assist with the completion of the examination task. Time allowed: 4 hours arbitrary per procedure; pass mark: 70%</p> <p>For a candidate who has already drafted an NDT procedure in a successfully passed Level 3 examination, the certification body may replace the drafting of a procedure with the critical analysis of an existing procedure covering the relevant method and sector, and containing errors and/or omissions.</p>	

9 Renewal and Recertification

9.1 The general rules for renewal and recertification are fully described in PCN GEN and PCN AERO A0.

9.2 Level 2 certificate holders seeking recertification shall be required to undertake the specific written examination described in section (6) and the practical examination as described in (7) for the method and technique(s) for which certification is sought.

9.3 For Level 3 renewal and recertification the candidate shall comply with the requirements contained within PCN document CP17A.

9.4 Level 3 renewal and recertification shall be by:

9.4.1 Examination OR by evidence-based points supplied to BINDT for review which meet the minimum requirements contained within PCN document CP17A.

10 Supplementary Examinations

10.1 In addition to the core techniques attempted in the candidate's initial certification examination, the candidate's employer may also specifically request further training and examination(s) be supplied to an agreed engineering standard or process. This extra requirement shall be included on the application form PSL/57A which shall form part of the contract review process between candidate's employer and the AQB.

10.2 Where additional techniques to any core Level 2 certification examination are requested at initial examination, the candidate shall be required to answer further specific written questions for each additional technique. An additional ten specific questions (minimum) per each additional technique sought shall be administered by the AQB.

10.3 Where additional techniques to any core Level 2 certification examination are requested at initial examination, the candidate shall be required to be successful in a practical examination for each additional technique sought.

10.3.1 For each additional technique this shall involve the practical testing of one specimen (minimum) appropriate to the method and which covers the technology and technique for which additional certification is sought.

10.3.2 Processing and reporting on the results obtained in accordance with the written instruction, code, specification or standard provided by the examiner; this may include any calculations necessary to establish inspection sensitivities. Recommended arbitrary time allowed for each additional specimen attempted is 2.5 hours.

10.4 Based upon the number of the practical specimens examined, which shall be determined by the number of techniques for which certification is sought, it shall be noted that total examination time may vary significantly.

10.5 For those candidates wishing to add supplementary techniques to an already existing current PCN AERO certificate the candidate shall be required to;

10.5.1 Answer a minimum of 20 additional specific questions for the methods, technology and technique in which the additional technique certification is sought.

10.5.2 Carry out the practical testing of a minimum of two specimens appropriate to the method's technology, and which covers the technique for which the additional certification is sought.

10.5.3 Process and report on the results obtained in 10.5.2 in accordance with the written instruction, code, specification or standard provided by the examiner, this may include any calculations necessary to establish inspection sensitivities. Recommended arbitrary time allowed for each additional specimen attempted is 2.5 hours.

10.5.4 Where the candidate has been successful in gaining any supplementary certification technique(s) these shall be added to the current certification certificate, which shall be up-issued by PCN.

10.5.5 However, the certification shall retain the expiry date of the original certificate. This is to maintain currency of the original examination modules to which the supplementary technique(s) are added.

10.6 Level 2 candidates attempting supplementary examination are not required to produce a further written instruction.

11 Grading

11.1 General information on the grading of examinations will be as specified in the current edition of the PCN General Requirements document, CP22.

12 Reference Literature (Essential Reading)

12.1 PCN/GEN/AERO (PCN A0).

12.2 BS EN ISO 9712 General principles for qualification and certification of NDT personnel.

12.3 ISO 18490 Evaluation of vision acuity of NDT personnel.

12.4 EN 4179 Aerospace series – Qualification and approval of personnel for non-destructive testing.

Table of Document amendments: PCN Aero A4		
Document Issue status	Amendment details	Amendment Date:
PCN Aero A4 Issue 4	Level 3 main method examination requirements clarification for “open and closed book” to remove perceived ambiguity when reading in conjunction with PCN Aero A0.	08/09/2021