# PCN24/SYL/DOC/RUT

PCN training and examination syllabus document for:
rail sector – Ultrasonic testing (RUT) rail track and
rail axle testing at PCN Levels 1, 2 and 3

*Issue 1 • January 2025*

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# Contents

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# 1. Scope

This document details the syllabus and minimum training content applicable to the training of students in the application of the manual pulse-echo ultrasonic testing (UT) method within the rail sector. This document should be read in conjunction with PCN24/GEN and PCN24/AQB/REQ/RUT. This document details the minimum syllabus content for ultrasonic testing in the rail sector as applicable for the testing of rail track and railway axles. The training syllabuses (syllabi) herein are aimed at the training of personnel seeking to attain BS EN ISO 9712-compliant PCN certification.

*Note: This document supersedes the syllabus sub-appendices related to the previous BINDT rail appendices F0, F1 and F2, which are withdrawn as of January 2025.*

**This document addresses the requirements for the following techniques/technologies within the ultrasonic non-destructive testing (NDT) method, as stipulated in BS EN ISO 9712:2022.**

● Conventional UT pulse-echo manual and/or automated using single- and/or twin-crystal transducers (ISO 9712 designation: UT).

*Note 1: The document content herein will also be of relevance to BINDT's network of Approved Training Organisations (ATOs) that prepare PCN candidates for specific PCN UT examinations, as the document provides an understanding for the provision of suitable training delivery.*

Those candidates who are <u>new entrants</u> within the PCN certification system, and where not confirmed by prior appropriate screening, will be required to demonstrate successful completion of the following self-study training module required to demonstrate prior knowledge for materials and processes:

● Product technology: an online remote self-study or ATO-attended self-study training module for materials and processes technology.

In addition, all PCN examination candidates shall demonstrate that they have successfully attended and passed an appropriate NDT method training course for the certification sought and meet the requirements for acuity of vision, colour perception and practical industrial experience prior to the award of certification by PCN.

In all instances, ATOs and Authorised Qualifying Bodies (AQBs) shall inform/remind and reaffirm with candidates of their obligation to undertake and abide by the BINDT's code of ethics, published as PCN24/CP27 at all times.

# 2. Associated documents

2.1     PCN24/GEN: General requirements for qualification and PCN certification of NDT personnel.

2.2     PCN24/GEN/AQB/RUT: PCN training and examination requirements document for: rail sector – Ultrasonic testing (RUT) rail track and rail axle testing at PCN Levels 1, 2 and 3.

2.3     PCN24/GEN/APP/RUT: Examination requirements for personnel seeking PCN certification in the ultrasonic testing (UT) method within the rail sector, available to download free of charge at www.bindt.org

2.4     BS EN ISO 9712:2022: Non-destructive testing – Qualification and certification of NDT personnel.

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## 3.    Syllabus for training – UT inspection of rail track – Levels 1 and 2

| Item | Content/subject matter | Level | |
|---|---|---|---|
| | | Level 1 | Level 2 |
| **1** | **General theory** | **Level 1** | **Level 2** |
| **1.1** | **Essential features of ultrasonic testing** | ✓ | ✓ |
| 1.1.1 | Wave properties – Types of wave, vibration, waves, sound waves, continuous wave, pulse, frequency, velocity, wavelength. Units, relationship between frequency velocity and wavelength | ✓ | ✓ |
| 1.1.2 | Principles of reflection and transmission of sound waves at perpendicular incidence. Effect of coupling media on transmission. Acoustic impedance | ✓ | ✓ |
| 1.1.3 | Principles of reflection and refraction of sound waves at inclined incidence. Factors affecting angles of reflection, refraction and mode conversion | ✓ | ✓ |
| 1.1.4 | Mode conversion echoes due to geometry | ✓ | ✓ |
| 1.1.5 | Effect of reflector on echo response | ✓ | ✓ |
| 1.1.6 | Sound field – Influence of frequency, sound velocity and size of transducer. Estimate of near field, far field and beam divergence | ✓ | ✓ |
| 1.1.7 | Influence of properties of test object on sound propagation, sound velocity, attenuation, geometry and surface condition | ✓ | ✓ |
| **1.2** | **Equipment** | ✓ | ✓ |
| 1.2.1 | Construction and mode of operation | ✓ | ✓ |
| 1.2.2 | Block diagram of an ultrasonic instrument with a single and double transducer, controls and functions of ultrasonic instrument | ✓ | ✓ |
| 1.2.3 | Types of probe – Normal beam, single- and twin-crystal, angle beam. Construction and mode of operation | ✓ | ✓ |
| 1.2.4 | Signal presentation – A-, B- and C-scans | ✓ | ✓ |
| 1.2.5 | Definition and use of decibel | ✓ | ✓ |
| 1.2.6 | Test methods – Manual, semi-automatic and automatic | ✓ | ✓ |
| **1.3** | **Testing techniques** | ✓ | ✓ |
| 1.3.1 | Pulse-echo technique – Basic principle, measured values (transmit time, echo amplitude), advantages and limitations | ✓ | ✓ |
| 1.3.2 | Through-transmission technique – Basic principle, measured value (intensity), advantages and limitations | ✓ | ✓ |
| 1.3.3 | Application of compression and shear waves | ✓ | ✓ |
| 1.3.4 | Coupling | ✓ | ✓ |
| 1.3.5 | Contact technique – Couplant, protective layer | ✓ | ✓ |
| 1.3.6 | Gap scanning | ✓ | ✓ |
| 1.3.7 | Immersion technique – Basic principle | ✓ | ✓ |
| **2** | **Sector-specific theory** | **Level 1** | **Level 2** |
| **2.1** | **Calibration of testing systems** | ✓ | ✓ |
| 2.1.1 | Time-base calibration – Normal, single-, twin-crystal and angle-beam probes. Calibration blocks and sensitivity checks. Effect of different sound velocities in calibration block and test-piece | ✓ | ✓ |
| 2.1.2 | Sensitivity and signal-to-noise ratio | ✓ | ✓ |
| 2.1.3 | Effect of finish, geometry, attenuation in specimen | ✓ | ✓ |
| 2.1.4 | Probe index, beam angle, squint and pulse duration | ✓ | ✓ |

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| | | | |
|---|---|---|---|
| **2.2** | **Detectability of defects** | ✓ | ✓ |
| 2.2.1 | Advantages and limitations of the test method with regard to defect detection | ✓ | ✓ |
| **2.3** | **Factors affecting the performance of the ultrasonic test** | ✓ | ✓ |
| 2.3.1 | Mechanical properties of the material, attenuation | ✓ | ✓ |
| 2.3.2 | Sound behaviour in rail | ✓ | ✓ |
| 2.3.3 | Surface condition | ✓ | ✓ |
| **2.4** | **Codes of practice and standards/specifications** | ✓ | ✓ |
| 2.4.1 | Familiarisation with applicable industry codes, specifications and standards | ✓ | ✓ |
| **2.5** | **Conducting and recording the tests** | ✓ | ✓ |
| 2.5.1 | Scanning techniques for rail defects | ✓ | ✓ |
| 2.5.2 | Reporting | ✓ | ✓ |
| **3** | **General theory (advanced)** | **Level 1** | **Level 2** |
| **3.1** | **Principles of ultrasonic testing** | – | ✓ |
| 3.1.1 | Behaviour of sound wave for perpendicular incidence. Acoustic impedance. Reflection and transmission factors. Calculations of reflected and transmitted energy | – | ✓ |
| 3.1.2 | Behaviour of sound wave for inclined incidence. Snell's Law concerning reflection, refraction and mode conversion. Critical angles. Calculations | – | ✓ |
| 3.1.3 | Interpretation and prediction of boundary echoes. Time-base position of mode-converted echoes under known conditions | – | ✓ |
| 3.1.4 | Influence on sound waves of reflector size (reflection, scatter, refraction, interference) | – | ✓ |
| 3.1.5 | Echoes from defined reflectors. Laws concerning distance and size of back-wall echo, side-drilled hole and disc reflectors. Comparison with real flaws | – | ✓ |
| 3.1.6 | Generation of ultrasonic waves. Electromechanical transducer (piezoelectric, magnetostrictive and electrodynamic). Properties of the transducer (nominal and working frequency, bandwidth). Effect of different transducer materials | – | ✓ |
| 3.1.7 | Sound field. Calculation and estimation of near field, far field and beam spread | – | ✓ |
| 3.1.8 | Influence of specimen material properties on sound propagation, attenuation, cause, effect and measurement, attenuation coefficient. Surface shape and condition. Sound velocity, cause, effect and measurement | – | ✓ |
| **3.2** | **Equipment** | – | ✓ |
| 3.2.1 | Probe construction and mode of operation. Special probes, double-crystal angle probes, focused probes, probes with different damping | – | ✓ |
| 3.2.2 | Measurement of resolving power of angle probes. Correlation between resolution, frequency, penetrating power and damping | – | ✓ |
| 3.2.3 | Amplifier characteristics, broad and narrowband, logarithmic, saturation, linearity, suppression, distance amplitude correction (DAC) | – | ✓ |
| 3.2.4 | Signal presentation. Deeper knowledge of automatic test systems | – | ✓ |
| **4** | **Sector-specific theory (advanced)** | **Level 1** | **Level 2** |
| **4.1** | **Calibration of testing systems** | – | ✓ |
| 4.1.1 | Time-base calibration – Projected distance, effect of different materials | – | ✓ |
| 4.1.2 | Calibration for sensitivity with reference to back-wall echo and flat-bottomed holes | – | ✓ |
| **4.2** | **Detectability of defects** | – | ✓ |
| 4.2.1 | Advantages and limitations of the test method with regard to defect detection | – | ✓ |

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| | | | |
|---|---|---|---|
| **4.3** | **Factors affecting the performance of the ultrasonic test** | – | ✓ |
| 4.3.1 | Relationship of material properties and surface condition with attenuation and sound velocity | – | ✓ |
| 4.3.2 | Selection of probe type, frequency and angle | – | ✓ |
| 4.3.3 | Preparation of test surface | – | ✓ |
| 4.3.4 | Selection of couplant and testing technique | – | ✓ |
| 4.3.5 | Influence of defect type, position and orientation on detection | – | ✓ |
| **4.4** | **Codes of practice and standards** | – | ✓ |
| 4.4.1 | Familiarisation with applicable industry codes, specifications and standards | – | ✓ |
| 4.4.2 | Establishing of testing instructions considering application, equipment, technique, probes, calibration, operation of test, recording of test results | – | ✓ |
| **4.5** | **Conducting and recording the test** | – | ✓ |
| 4.5.1 | Procedure to be adopted to carry out the test | – | ✓ |
| 4.5.2 | Information to be recorded on the report | – | ✓ |
| 4.5.3 | Flaw assessment and reporting | – | ✓ |
| **4.6** | **Interpretation of test results** | – | ✓ |
| 4.6.1 | Interpretation of test results to acceptance standards | – | ✓ |
| **5** | **Product technology theory (this is in addition to any prior product technology training received)** | **Level 1** | **Level 2** |
| **5.1** | **Basic production – Crude and finished products** | – | ✓ |
| 5.1.1 | Grades of steel; steel-making processes. Ingot types (narrow end up and wide end up), concast methods (continuous casting process). Definition used in the production of ingots and casting | – | ✓ |
| 5.1.2 | Difference between ingot and concast production processes. Ingot casting for further hot working, rolling, forging and extrusion | – | ✓ |
| **5.2** | **Forging processes and basic forging defects** | – | ✓ |
| 5.2.1 | The appearance of defects and how they are formed:<br>i.  Forging bursts<br>ii.  Laps<br>iii.  Seams<br>iv.  Cracks | – | ✓ |
| **5.3** | **Heat treatment** | – | ✓ |
| 5.3.1 | What stress relieving is and why it is carried out | – | ✓ |
| 5.3.2 | Explanation of how annealing is carried out and the results obtained; full anneal and definitions; subcritical anneal and definition | – | ✓ |
| 5.3.3 | Rectification | – | ✓ |
| **5.4** | **Inspection** | – | ✓ |
| 5.4.1 | Brand marks, surface condition, dimensional checks and protection in transit | – | ✓ |
| **5.5** | **Defects arising in service** | – | ✓ |
| 5.5.1 | Causes and rectification | – | ✓ |
| **5.6** | **Rail joining processes** | – | ✓ |
| 5.6.1 | Thermit welds and fish-plated joints | – | ✓ |

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## 4.    Syllabus for training – UT inspection of rail axles – Levels 1 and 2

| Item | Content/subject matter | Level | |
|------|------------------------|---------|---------|
| | | **Level 1** | **Level 2** |
| **1** | **General theory** | | |
| **1.1** | **Essential features of ultrasonic testing** | ✓ | ✓ |
| 1.1.1 | Wave properties – Types of wave, vibration, waves, sound waves, continuous wave, pulse, frequency, velocity, wavelength. Units, relationship between frequency velocity and wavelength | ✓ | ✓ |
| 1.1.2 | Principles of reflection and transmission of sound waves at perpendicular incidence. Effect of coupling media on transmission. Acoustic impedance | ✓ | ✓ |
| 1.1.3 | Principles of reflection and refraction of sound waves at inclined incidence. Factors affecting angles of reflection, refraction and mode conversion | ✓ | ✓ |
| 1.1.4 | Mode conversion echoes due to geometry | ✓ | ✓ |
| 1.1.5 | Effect of reflector on echo response | ✓ | ✓ |
| 1.1.6 | Sound field – Influence of frequency, sound velocity and size of transducer. Estimate of near field, far field and beam divergence | ✓ | ✓ |
| 1.1.7 | Influence of properties of test object on sound propagation, sound velocity, attenuation, geometry and surface condition | ✓ | ✓ |
| **1.2** | **Equipment** | ✓ | ✓ |
| 1.2.1 | Construction and mode of operation | ✓ | ✓ |
| 1.2.2 | Block diagram of an ultrasonic instrument with single and double transducer, controls and functions of ultrasonic instrument | ✓ | ✓ |
| 1.2.3 | Types of probe – Normal beam, single and twin crystal, angle beam. Construction and mode of operation | ✓ | ✓ |
| 1.2.4 | Signal presentation – A-, B- and C-scans | ✓ | ✓ |
| 1.2.5 | Definition and use of decibel | ✓ | ✓ |
| 1.2.6 | Test methods – Manual, semi-automatic, automatic | ✓ | ✓ |
| **1.3** | **Testing techniques** | ✓ | ✓ |
| 1.3.1 | Pulse-echo technique – Basic principle, measured values (transmit time, echo amplitude), advantages and limitations | ✓ | ✓ |
| 1.3.2 | Through-transmission technique – Basic principle, measured value (intensity), advantages and limitations | ✓ | ✓ |
| 1.3.3 | Application of compression and shear waves | ✓ | ✓ |
| 1.3.4 | Coupling | ✓ | ✓ |
| 1.3.5 | Contact technique – Couplant, protective layer | ✓ | ✓ |
| 1.3.6 | Gap scanning | ✓ | ✓ |
| 1.3.7 | Immersion technique – Basic principle | ✓ | ✓ |
| **2** | **Sector-specific theory** | **Level 1** | **Level 2** |
| **2.1** | **Calibration of testing systems** | ✓ | ✓ |
| 2.1.1 | Time-base calibration – Normal, single-, twin-crystal and angle-beam probes. Calibration blocks and sensitivity checks. Effect of different sound velocities in calibration block and test-piece. The use of low-angle probe types for the far-end scan | ✓ | ✓ |
| 2.1.2 | Sensitivity and signal-to-noise ratio | ✓ | ✓ |
| 2.1.3 | Effect of finish, geometry, attenuation in specimen | ✓ | ✓ |
| 2.1.4 | Control checks, including probe index, beam angle, squint, resolution and pulse duration | ✓ | ✓ |

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| | | | |
|---|---|---|---|
| **2.2** | **Detectability of defects** | ✓ | ✓ |
| 2.2.1 | Advantages and limitations of the test method with regard to defect detection | ✓ | ✓ |
| **2.3** | **Factors affecting the performance of the ultrasonic test** | ✓ | ✓ |
| 2.3.1 | Mechanical properties of the material, attenuation | ✓ | ✓ |
| 2.3.2 | Sound behaviour in a shaft – Classical trajectories | ✓ | ✓ |
| 2.3.3 | Surface condition | ✓ | ✓ |
| 2.3.4 | Defect signal type identification | ✓ | ✓ |
| **2.4** | **Codes of practice and standards/specifications** | ✓ | ✓ |
| 2.4.1 | Familiarisation with applicable industry codes, specifications and standards | ✓ | ✓ |
| **2.5** | **Conducting and recording the tests** | ✓ | ✓ |
| 2.5.1 | Axle scanning techniques; far end, near end, high angle, surface wave | ✓ | ✓ |
| 2.5.2 | Information to be recorded on the report | ✓ | ✓ |
| 2.5.3 | Flaw location and reporting | ✓ | ✓ |
| 2.5.4 | Trace pattern prediction, including wheelset/axle terms/types, abbreviations and definitions | ✓ | ✓ |
| **3** | **General theory (advanced)** | **Level 1** | **Level 2** |
| **3.1** | **Principles of ultrasonic testing** | – | ✓ |
| 3.1.1 | Behaviour of sound wave for perpendicular incidence. Acoustic impedance. Reflection and transmission factors. Calculations of reflected and transmitted energy | – | ✓ |
| 3.1.2 | Behaviour of sound wave for inclined incidence. Snell's Law concerning reflection, refraction and mode conversion. Critical angles. Calculations | – | ✓ |
| 3.1.3 | Interpretation and prediction of boundary echoes. Time-base position of mode converted echoes under known conditions | – | ✓ |
| 3.1.4 | Influence on sound waves of reflector size (reflection, scatter, refraction, interference) | – | ✓ |
| 3.1.5 | Echoes from defined reflectors. Laws concerning distance and size of back-wall echo, side-drilled hole and disc reflectors. Comparison with real flaws | – | ✓ |
| 3.1.6 | Generation of ultrasonic waves. Electromechanical transducer (piezoelectric, magnetostrictive and electrodynamic). Properties of the transducer (nominal and working frequency, bandwidth). The effect of different transducer materials | – | ✓ |
| 3.1.7 | Sound field. Calculation and estimation of near field, far field and beam spread | – | ✓ |
| 3.1.8 | Influence of specimen material properties on sound propagation, attenuation, cause, effect and measurement, attenuation coefficient. Surface shape and condition. Sound velocity, cause, effect and measurement | – | ✓ |
| **3.2** | **Equipment** | – | ✓ |
| 3.2.1 | Probe construction and mode of operation. Special probes, double-crystal angle probes, focused probes, probes with different damping | – | ✓ |
| 3.2.2 | Measurement of resolving power of angle probes. Correlation between resolution, frequency, penetrating power and damping | – | ✓ |
| 3.2.3 | Amplifier characteristics, broad and narrowband, logarithmic, saturation, linearity, suppression, DAC | – | ✓ |
| 3.2.4 | Signal presentation. Deeper knowledge of automatic test systems | – | ✓ |

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| 4 | Sector-specific theory (advanced) | Level 1 | Level 2 |
|---|---|---|---|
| **4.1** | **Calibration of railway axle testing systems** | – | ✓ |
| 4.1.1 | Time-base calibration – Projected distance, effect of different materials | – | ✓ |
| 4.1.2 | Construction of reference lines and calibration of sensitivity with reference to back-wall echo and flat-bottomed hole | – | ✓ |
| 4.1.3 | Measurement of the differences for surface condition and attenuation between test-piece and reference block. Correction for attenuation depending on path length | – | ✓ |
| 4.1.4 | Calibration of other specialist angled probe approaches regarding the near-end, high-angle and surface wave techniques | – | ✓ |
| **4.2** | **Detectability of defects** | – | ✓ |
| 4.2.1 | Advantages and limitations of the test method with regard to defect detection | – | ✓ |
| **4.3** | **Factors affecting the performance of the ultrasonic test** | – | ✓ |
| 4.3.1 | Relationship of material properties and surface condition with attenuation and sound velocity | – | ✓ |
| 4.3.2 | Selection of probe type, frequency and angle | – | ✓ |
| 4.3.3 | Preparation of test surface | – | ✓ |
| 4.3.4 | Selection of couplant and testing technique | – | ✓ |
| 4.3.5 | Influence of defect type, position and orientation on detection | – | ✓ |
| **4.4** | **Codes of practice and standards** | – | ✓ |
| 4.4.1 | Familiarisation with applicable industry codes, specifications and standards | – | ✓ |
| 4.4.2 | Establishing of testing instructions considering application, equipment, technique, probes, calibration, operation of test, recording of test results | – | ✓ |
| **4.5** | **Conducting and recording the test** | – | ✓ |
| 4.5.1 | Procedure to be adopted to carry out the test | – | ✓ |
| 4.5.2 | Information to be recorded on the report | – | ✓ |
| 4.5.3 | Flaw assessment and reporting | – | ✓ |
| **4.6** | **Interpretation of test results** | – | ✓ |
| 4.6.1 | Interpretation of test results to acceptance standards | – | ✓ |
| **5** | **Product technology theory (this is in addition to any prior product technology training received)** | Level 1 | Level 2 |
| **5.1** | **Basic production – Crude and finished products** | – | ✓ |
| 5.1.1 | Grades of steel; steel making processes. Ingot types (narrow end up and wide end up), concast methods (continuous casting process). Definition used in the production of ingots and casting | – | ✓ |
| 5.1.2 | Difference between ingot and concast production processes. Ingot casting for further hot working, rolling, forging and extrusion | – | ✓ |
| **5.2** | **Forging processes and basic forging defects** | – | ✓ |
| 5.2.1 | The appearance of defects and how they are formed: <br> v.   Forging bursts <br> vi.  Laps <br> vii. Seams <br> viii. Cracks | – | ✓ |

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| | | | |
|---|---|---|---|
| **5.3** | **Heat treatment** | – | ✓ |
| 5.3.1 | What stress relieving is and why it is carried out | – | ✓ |
| 5.3.2 | Explanation of how annealing is carried out and the results obtained; full anneal and definitions; subcritical anneal and definition | – | ✓ |
| 5.3.3 | Rectification | – | ✓ |
| **5.4** | **Inspection** | – | ✓ |
| 5.4.1 | Brand marks, surface condition, dimensional checks and protection in transit | – | ✓ |
| **5.5** | **Defects arising in service** | – | ✓ |
| 5.5.1 | Causes and rectification | – | ✓ |
| **5.6** | **Rail joining processes** | – | ✓ |
| 5.6.1 | Thermit welds and fish-plated joints | – | ✓ |

# 5. Syllabus for training – UT Level 3 in the rail sector

**\*\*Level 3 candidates must have proven knowledge of all items defined in the syllabuses at Levels 1 and 2**

| Item | Content/subject matter | Level 3 |
|---|---|---|
| **6** | **General theory (Level 3)** | ✓ |
| **6.1** | **Alternative methods of data presentation** | ✓ |
| 6.1.1 | Brief knowledge of the principles of B-, C- and D-scan systems and time-of-flight diffraction (TOFD) | ✓ |
| 6.1.2 | Methods of digital data processing | ✓ |
| **6.2** | **Alternative probe arrangements** | ✓ |
| 6.2.1 | The purpose, construction and performance of twin-crystal probes | ✓ |
| 6.2.2 | Special arrays for detection of near-surface defects | ✓ |
| 6.2.3 | Probes with focused crystals | ✓ |
| 6.2.4 | Probes with wideband frequency reception | ✓ |
| 6.2.5 | The effective range of the above probes, comparative sensitivity to given reflectors and establishment of principal characteristics of beam spread, distance amplitude response curves and sensitivity settings to achieve standard reflector equivalents | ✓ |
| **7** | **General theory of other NDT methods** | ✓ |
| 7.1 | General knowledge of at least four other methods as required for Level 2 and chosen by the candidate from the methods given in BE EN ISO:9712 Table 1. These four methods for each test method shall include at least one volumetric method | ✓ |
| 7.2 | Knowledge of the Level 2 general theory syllabus covering the UT method in which Level 3 certification is sought and, in addition, three others selected by the candidate from RT, UT, PT, MT, ET and VT | ✓ |
| **8** | **Knowledge of PCN requirements** | ✓ |
| 8.1 | A thorough understanding of the PCN criteria for certification of all levels of personnel as applied in the current edition of the PCN24/GEN general requirements for the certification of personnel engaged in NDT | ✓ |
| **9** | **Sector-specific theory (Level 3) – Additional to Level 1 and 2 knowledge** | ✓ |
| **9.1** | **Flaw sizing and recording systems** | ✓ |
| 9.1.1 | Knowledge of the currently used systems for defect sizing in rail. Knowledge of current systems for flaw recording. Recording echo height comparisons from actual defects and their equivalent reflectors from the test block used | ✓ |

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| 9.2 | Sensitivity | ✓ |
|---|---|---|
| 9.2.1 | Methods of setting sensitivity for normal probes. Methods of setting sensitivity for angle probes to obtain 'grain interference level' (or 'grass') and the recording of the equivalent calibration block echoes and comparison with a standard calibration block | ✓ |
| 9.3 | Accuracy and limitation | ✓ |
| 9.3.1 | A thorough knowledge of the effective range of all types of probe beams, both of maximum and minimum path distances. Determination of the repeatability and accuracy of the cross-section of simulated defects and their length. Tabulation of the results achieved | ✓ |
| 10 | Materials technology theory | ✓ |
| 10.1 | In addition to the product technology syllabus requirements for Level 2, the Level 3 candidate will also require an understanding of the casting and forging processes and associated defects | ✓ |
| 11 | NDT procedure writing | ✓ |
| 11.1 | Level 3 candidates must receive training in the preparation of a written NDT procedure. BINDT/PCN document PCN24/CP25 gives guidance on the required content of a NDT procedure | ✓ |