# PCN24/GEN/Appendix Z1 NDT examination syllabi

Issue 1 • February 2024



## Contents

Section	PCN24/GEN/Appendix Z1: Content	Page
	Document title cover sheet	1
	Document contents	
	Scope	3
	PCN syllabus – Eddy current testing (ET)	3
	PCN syllabus – Alternating current field measurement (ACFM)	8
	PCN syllabus – Magnetic testing (MT)	13
	PCN syllabus – Penetrant testing (PT)	
	PCN syllabus – Radiography (RT-F – Film)	23
	PCN syllabus – Digital radiography (RT-D – Computed and digital)	28
	PCN syllabus – Ultrasonic testing (UT)	35
	PCN syllabus – Phased array ultrasonic testing (PAUT)	40
	PCN syllabus – Ultrasonic testing – Time-of-flight diffraction (TOFD)	
	PCN syllabus – Visual testing (VT)	45
	PCN syllabus – Limited certification ultrasonic testing (UT) of manufactured wrought plate (ISO 9712)	51
	Change control record	54

The British Institute of Non-Destructive Testing is an accredited Certification Body offering personnel and quality management systems assessment and certification against criteria set out in international and European standards through the PCN Certification Scheme.

©2024 The British Institute of Non-Destructive Testing. All Rights Reserved.

This document is protected by UK and international copyright laws and remains the intellectual property of BINDT. Reproduction and distribution of the document without the written permission of BINDT is strictly prohibited.



# Scope

This document gives requirements and recommendations for non-destructive testing (NDT) training syllabi with the intention of harmonising and maintaining the general standard of training of NDT personnel for industrial needs. It also establishes the minimum requirements for effective structured training of NDT personnel to ensure eligibility for qualification examinations leading to third-party certification according to recognised standards. This document provides guidelines for syllabi covering eddy current testing (ET), alternating current field measurement (ACFM), magnetic testing (MT), penetrant testing (PT), radiographic testing (RT), ultrasonic testing (UT), phased array ultrasonic testing (PAUT), time-of-flight diffraction (TOFD), visual testing (VT) and limited certification ultrasonic testing of manufactured wrought plate. Syllabus document developed in accordance with ISO/TS 25107 (2019) as per BS EN ISO 9712 (2022), Section 5.2.2, Subsection e). ISO/TS 25108 gives requirements and recommendations for NDT training organisations.

Syllabus reference number	Title	Module subcontent	Eddy cu	irrent test	ing (ET)
1	Terminology and history	of ET	Level 1	Level 2	Level 3
1.0	History of ET	History of eddy current testing	Х	Х	Х
1.1	Purpose of NDT	What is testing?	Х	Х	Х
		What is the purpose of NDT?	Х	Х	Х
		At what stage of life is NDT performed on a product?	Х	Х	Х
		How does it add value?	Х	Х	Х
		Who may carry out NDT?	Х	Х	Х
		Main NDT methods	Х	Х	Х
1.2	Purpose of ET	Definition:			
		• Electromagnetic interaction between a sensor and a test object conducting electricity	х		
		• Providing information on physical characteristics of the test object	Х		
		Applicability and limitations	Х		
1.3	Terminology	Please refer to PCN24 standards document	Х	Х	Х
2	Physical principles and as	ssociated knowledge	Level 1	Level 2	Level 3
2.0	Fundamentals		Х	Х	Х
2.1	Electricity: elements	Direct current:	Х	Х	Х
		Current	Х	Х	Х
		Voltage	Х	Х	Х
		Resistance	Х	Х	Х
		Conductance	Х	Х	Х
		Ohm's Law	Х	Х	Х
		Resistivity	Х	Х	Х
		Conductivity	Х	Х	Х
		Units:	Х	Х	Х
		Conductivity values for some metals	Х	Х	Х
		Alternating current:	Х	Х	Х
		Sinusoidal current	Х	Х	Х
		Voltage	Х	Х	Х
		Amplitude	Х	Х	Х

#### PCN syllabus - Eddy current testing (ET)

2.1		Frequency	Х	Х	Х
(continued)		Period	X	Х	Х
		Phase	Х	Х	Х
		Vector representation		Х	Х
		Other periodic currents			X
2.2	Magnetism	Magnetic field	Х	Х	X
		Lines of force		X	X
		Magnetic field strength	Х	X	Х
		Permeability	Х	Х	Х
		Flux density (induction)	X	X	X
		Flux	X	X	X
		Hysteresis loop	Х	Х	Х
		Units	X	X	X
		Diamagnetism		X	X
		Paramagnetism		X	X
		Ferromagnetism		X	X
		Reluctance		X	X
		Magnetomotive force		X	X
2.3	Electromagnetism	Magnetic field created by a current (wire, coil)	Х	X	X
		Electromagnetic induction phenomenon	Х	Х	Х
		Inductance	Х	Х	Х
		Mutual inductance		Х	Х
		Electromagnetic coupling	Х	Х	Х
		Induced currents	Х	Х	Х
		Secondary field	Х	Х	Х
		Lenz's Law	Х	Х	Х
		Distribution in conducting materials:	Х	Х	Х
		Planar wave		Х	Х
		Depth of penetration	Х		
		<ul> <li>Standard depth of penetration</li> </ul>		Х	Х
		Amplitude	Х	Х	Х
		Phase	Х	Х	Х
		Cylindrical conductors:	Х	Х	Х
		Characteristic frequency	Х	Х	Х
		Real (practical) depth of penetration		Х	Х
		Impedance:	Х	Х	Х
		Complex plane representation		Х	Х
		Impedance plane diagrams		Х	Х
2.4	Alternative techniques	Pulsed eddy current			Х
		Magnetic field sensors			Х
		Alternating current field measurements			X
2.5	Simulation	Remote field eddy currents Analytical calculation of eddy current tests			X X
2.5	Simulation	Analytical calculation of eduy culterit tests			Λ

3	Product knowledge and	capabilities	Level 1	Level 2	Level 3
3.1	Defectology/product	Manufacturing-related discontinuities	Х	Х	Х
	technology	Service-induced discontinuities	Х	Х	Х
		Material properties influencing eddy current testing:	Х	Х	Х
		Conductivity	Х	Х	Х
		Permeability	Х	Х	Х
		Product characteristics influencing eddy current testing:		Х	Х
		<ul> <li>Condition (surface, heat treatment, cold working)</li> </ul>		Х	Х
		Temperature		Х	Х
		Shape		Х	Х
		Wall thickness		х	х
		Accessibility		Х	Х
		Products being tested:		Х	
		Semi-finished products		X	
		Pipes		X	
		<ul> <li>Heat exchanger tubes</li> </ul>		X	
		<ul> <li>Mechanical parts (for example cars, railway and aircraft industry)</li> </ul>		X	
		<ul> <li>Welds (for example offshore)</li> </ul>		X	
		<ul> <li>Characteristics of flaws affecting detection</li> </ul>		X	
		-			
2.2		Width/depth ratio		Х	
3.2	Applications of eddy	Material characterisation: conductivity, ferrite content, metal sorting, heat treatment sorting, thickness of thermochemical			
	current testing	treatments (case hardening, nitriding), coating thickness	Х	Х	Х
		(conductive or non-conductive) and derived information (hardness)			
		Detection of discontinuities: cracks (SCC, fatigue), wall thinning,			
		corrosion, deposits, etc	Х	Х	Х
3.3	Capabilities	Depth of penetration	Х	Х	Х
	Capabilities	Conductive materials	Х	Х	Х
		Non-contact	Х	Х	Х
		High speed	Х	Х	Х
		High temperature	х	х	х
		Multiplexed arrays	Х		
		Mechanised	Х	Х	Х
3.4	Techniques	Single frequency	X	X	X
		Multi-frequency	X	X	X
		Multi-parameter	X	X	X
		Pulsed current		X	X
		Multiplexed arrays		X	X
		Remote field		X	X
		Similarity rules for surface inspection and tube characteristic/			
		limit frequencies		Х	Х
3.5	Codes and standards	Please refer to PCN24 standards document		Х	Х
4	Equipment		Level 1	Level 2	Level 3
4.1	Eddy current testing	Instrument	Х	Х	Х
	system	General-purpose applications – essential functions	Х	Х	Х
		Specific applications:		Х	Х
		Pulsed eddy current			Х
		Magnetic field sensors			Х
		Alternating current field measurement			Х

4.1		Mechanised equipment		Х	Х
(continued)		Probes:	Х	X	X
(		Combined	Λ	X	X
		Separate transmit – receive		X	X
		Surface	Х	X	X
		Coaxial	Х	X	X
		• Designs		X	X
		Array probes (description and operating principles)		Х	Х
		Measurements:	Х	Х	Х
		Absolute	Х	Х	Х
		Differential	Х	Х	Х
		Impedance testing	Х	Х	Х
4.2	Output and signal	Signal-to-noise ratio	Х	Х	Х
	display	Distortion/non-linearity	Х	Х	Х
		Filters	Х	Х	Х
4.3	Reference blocks	Material	Х	Х	Х
		Design		Х	Х
		Production		Х	Х
		Storage		Х	Х
4.4	Codes and standards	Please refer to PCN24 standards document		Х	Х
5	Information prior to testi	ng	Level 1	Level 2	Level 3
5.1	Information about the	Written instructions	Х		
	test object	Identification or designation material:	Х	Х	Х
		Object to be tested	Х	Х	Х
		Kind of manufacture	Х	Х	Х
		Catalogue of defects		Х	Х
		Extent of test coverage		Х	Х
5.2	Test conditions and	Accessibility		Х	Х
	application of standard	Temperature			Х
		Humidity			Х
		Availability			Х
		Unwanted interfering signals			Х
		Electric and/or magnetic disturbances			Х
		Infrastructure			X
		Particular test conditions		Х	Х
		Application standard		Х	Х
		Stage of manufacture or service life when testing is to be carried out			X
		Standards assigned to the test object		Х	X
		Requirements of test personnel		X	X
		Acceptance criteria		X	X
5.3	Technique and sequence	Surface condition		X	X
5.5	of performing test	Surface preparation		X	
	1	Post-test documentation		X	
		Equipment to be used		X	
	Instructions	Requirement for recording		Х	V
5.4	Instructions	Preparation of written procedure		V	Х
		Preparation of written instruction	V	Х	
		Performing inspection in accordance with written instruction	Х		

5.4		Documents			Х
(continued)		Presentation of the standards, codes and procedures			Х
6	Testing		Level 1	Level 2	Level 3
6.1	Probe selection as a	Product:			
	result of information in	• Grade		Х	Х
	Section 5	Metallurgical condition		Х	Х
		• Shape		Х	Х
		Type of discontinuity sought		Х	Х
		Location		Х	Х
		Duty of the product		Х	Х
		Extent of examination		Х	Х
6.2	Operating conditions as	Temperature		Х	Х
	a result of information in	Humidity		Х	Х
	Section 5	Access		Х	Х
		Availability		Х	Х
		Interfering signals		Х	Х
		Electric and/or magnetic disturbances		Х	Х
6.3	Parameters	Excitation frequency	Х	Х	Х
		Auxiliary frequencies	Х	Х	Х
		Probe speed	Х	Х	Х
		Probe clearance	Х	Х	Х
		Probe vibration	Х	Х	Х
		Probe centring	Х	Х	Х
6.4	Adjustment curves	Adjustment curves	Х	Х	Х
6.5	Settings Data ad	Data acquisition	Х	Х	Х
		Written procedure		Х	Х
		Written instruction	Х	Х	
7	Evaluation and reporting		Level 1	Level 2	Level 3
7.1	Reporting	Reporting level		Х	Х
		Examination report	Х	Х	Х
7.2	Evaluation	Characterisation of the indications:		Х	Х
		Single-frequency analysis		Х	Х
		Multi-frequency analysis		Х	Х
		Data analysis		Х	Х
8	Assessment		Level 1	Level 2	Level 3
8.1	Evaluation and	Acceptance criteria according to standards, codes and procedures		Х	Х
	confirmation of test reports	Training of Level 1 and Level 2 of the acceptance criteria			Х
9	Quality aspects		Level 1	Level 2	Level 3
9.1	Factors affecting quality	Personnel qualification:	Х	Х	Х
	of testing	• ISO 9712	Х	Х	Х
		• Other NDT qualification and certification systems			Х
		Format and scope of working procedures			Х
		Qualification of NDT procedures			Х
		Authorisations (NDT instruction, procedures and personnel)			Х
		Developing written instruction		Х	
		Working correctly to written instruction	Х		
		Traceability of documents		Х	Х
		Reliability of measurements		Х	Х

9.2	5 11	Correct technique selection		Х	
	NDT application and	Use of correct test parameters		Х	
	product standards	NDT method selection		Х	Х
		Job-specific training	Х	Х	Х
		Equipment verification	Х	Х	Х
10	Developments		Level 1	Level 2	Level 3
10.1	General information	Non-inductive techniques:			Х
		Magneto-optical imaging			Х
		• Superconducting quantum interference device (SQUID)			Х
		Giant magnetoresistance			Х
		Imaging			Х
		Modelling			Х

## PCN syllabus - Alternating current field measurement (ACFM)

Syllabus reference number	Title	Module subcontent		Alternating current fiel measurement (ACFM)		
1	Terminology and history	of ACFM	Level 1	Level 2	Level 3	
1.0	History of electromagnetic testing	History of electromagnetic testing	х	х	х	
1.1	Purpose of NDT	What is testing?	Х	Х	Х	
	What is the purpose of NDT?	Х	Х	Х		
		At what stage of life is NDT performed on a product?	Х	Х	Х	
		How does it add value?	Х	Х	Х	
		Who may carry out NDT?	Х	Х	Х	
		Main NDT methods	Х	Х	Х	
1.2	Purpose of ACFM	Definition:				
		• Electromagnetic interaction between a sensor and a test object conducting electricity	Х			
		• Providing information on physical characteristics of the test object	х			
		Applicability and limitations	Х			
1.3	Terminology	Please refer to PCN24 standards document	Х	Х	Х	
2	Physical principles and as	sociated knowledge	Level 1	Level 2	Level 3	
2.0	Fundamentals					
2.1	Electricity: elements	Direct current:	Х	Х	Х	
		Current	Х	Х	Х	
		Voltage	Х	Х	Х	
		Resistance	Х	Х	Х	
		Conductance	Х	Х	Х	
		Ohm's Law	Х	Х	Х	
		Resistivity	Х	Х	Х	
		Conductivity	Х	Х	Х	
		Units:	Х	Х	Х	
		Conductivity values for some metals	Х	Х	Х	

2.1		Alternating current:	Х	Х	Х
(continued)		Sinusoidal current	X	X	X
		Voltage	X	X	X
		Amplitude	X	X	X
		Frequency	X	X	X
		Period	X	X	X
		Phase	X	X	X
		Vector representation	~	X	X
		Other periodic currents		~	X
2.2	Magnetism	Magnetic field	Х	Х	X
2.2	Magnetism	Lines of force	^		
		Magnetic field strength	Х	X X	X X
		Magnetic fluid components <i>Bx, Bz</i>	X	X	X
		Permeability	X	X	X
		Flux density (induction)	X	X	X
		Flux	X	X	X
		Hysteresis loop	X	X	Х
		Units	Х	Х	Х
		Diamagnetism		Х	Х
		Paramagnetism		Х	Х
		Ferromagnetism		Х	Х
		Reluctance		Х	Х
2.3	Electromagnetism	Magnetic field created by a current (wire, coil)	Х	Х	Х
		Electromagnetic induction phenomenon	Х	Х	Х
		Inductance	Х	Х	Х
		Electromagnetic coupling	Х	Х	Х
		Induced currents	Х	Х	Х
		Secondary field	Х	Х	Х
		Lenz's law	Х	Х	Х
		Distribution in conducting materials:	Х	Х	Х
		Planar wave		Х	Х
		Depth of penetration	Х		
		Standard depth of penetration		Х	Х
		Amplitude	Х	Х	Х
		• Phase	Х	Х	Х
		Cylindrical conductors:			Х
		Characteristic frequency	Х		Х
		Real (practical) depth of penetration		Х	Х
2.4	Alternative techniques	Pulsed eddy current			Х
		Magnetic field sensors			Х
		Conventional eddy current testing		Х	Х
		Remote field eddy currents			Х
2.5	Simulation	Analytical calculation of eddy current tests			Х
3					
3	Product knowledge and o	capabilities	Level 1	Level 2	Level 3
3.1		apabilities Manufacturing-related discontinuities	Level 1 X	Level 2 X	Level 3 X

3.1       Material properties influencing eddy current testing:       X       X         (continued)       • Conductivity       X       X         • Permeability       X       X       X         • Product characteristics influencing eddy current testing:       X       X       X         • Condition (surface, heat treatment, cold working)       X       X       X         • Temperature       X       X       X         • Shape       X       X       X         • Wall thickness       X       X       X			Material properties influencing eddy current testing:		X	V
<ul> <li>Permeability</li> <li>N</li> <li>Permeability</li> <li>X</li> <li>Product characteristics influencing eddy current testing:</li> <li>X</li> <li>Condition (surface, heat treatment, cold working)</li> <li>X</li> <li>Temperature</li> <li>X</li> <li>Shape</li> <li>X</li> <li>Wall thickness</li> <li>X</li> </ul>	(continued)					
Product characteristics influencing eddy current testing:XX• Condition (surface, heat treatment, cold working)XX• TemperatureXX• ShapeXX• Wall thicknessXX	(continued)		·			
<ul> <li>Condition (surface, heat treatment, cold working)</li> <li>X</li> <li>Temperature</li> <li>Shape</li> <li>Wall thickness</li> <li>X</li> </ul>						
• TemperatureXX• ShapeXX• Wall thicknessXX						
Shape     Shape     X     X     Wall thickness					Х	Х
Wall thickness     X     X			Temperature		Х	Х
			• Shape		Х	Х
Accessibility X X			Wall thickness		Х	Х
			Accessibility		Х	Х
Permeability value and variability X X			Permeability value and variability		Х	Х
Products being tested: X			Products being tested:		Х	
Semi-finished products X			Semi-finished products		Х	
Threads X			Threads		Х	
Mechanical parts (for example cars, railway and aircraft industry)     X			• Mechanical parts (for example cars, railway and aircraft industry)		Х	
Welds (for example offshore) X			Welds (for example offshore)		Х	
Flaw detection:     X			Flaw detection:		Х	
Characteristics of flaws affecting detection X			Characteristics of flaws affecting detection		Х	
Width/depth ratio X			Width/depth ratio		Х	
3.2 Applications of eddy Detection of discontinuities: cracks (SCC, fatigue), wall thinning, X X X	3.2	Applications of eddy	Detection of discontinuities: cracks (SCC, fatigue), wall thinning,	v	v	v
current testing corrosion, deposits, etc		current testing	corrosion, deposits, etc	Λ	^	^
3.3CapabilitiesDepth of penetrationXXX	3.3	Capabilities	Depth of penetration	Х	Х	Х
Conductive materials X X X			Conductive materials	Х	Х	Х
Non-contact X X X			Non-contact	Х	Х	Х
High speedXXX			High speed	Х	Х	Х
High temperature     X     X			High temperature	Х	Х	Х
Multiplexed arrays X			Multiplexed arrays	Х		
3.4TechniquesSingle frequencyXXX	3.4	Techniques	Single frequency	Х	Х	Х
Multiplexed arrays X X			Multiplexed arrays		Х	Х
3.5     Codes and standards     X     X	3.5	Codes and standards			Х	Х
4 Equipment Level 1 Level 2 Level	4	Equipment		Level 1	Level 2	Level 3
4.1ACFMPortable instrumentXXX	4.1	ACFM	Portable instrument	Х	Х	Х
Underwater instrument     X     X     X			Underwater instrument	Х	Х	Х
General-purpose applications – essential functionsXX			General-purpose applications – essential functions		Х	Х
Specific applications: X X			Specific applications:		Х	Х
Magnetic field sensors X			Magnetic field sensors			Х
Alternating current field measurement equipment X			Alternating current field measurement equipment			Х
Manual equipment X X			Manual equipment		Х	Х
Probes: X X X			Probes:	Х	Х	Х
Combined X X			Combined		Х	Х
Separate transmit – receive X X			Separate transmit – receive		Х	Х
Surface X X			• Surface		Х	Х
Designs X X			• Designs		Х	Х
Array probes (description and operating principles) X X			• Array probes (description and operating principles)		Х	Х
Measurements: X X X			Measurements:	Х	Х	Х
Absolute     X     X     X			Absolute	Х	Х	Х
Differential X X X			• Differential	Х	Х	Х

4.2	Output and signal	Signal-to-noise ratio	Х	Х	Х
	display	Filters	Х	Х	Х
4.3	Reference blocks	Material	Х	Х	Х
		Design		Х	Х
		Production		Х	Х
		Storage		Х	Х
4.4	Codes and standards			Х	Х
5	Information prior to testi	ng	Level 1	Level 2	Level 3
5.1	Information about the	Written instructions	Х		
	test object	Identification or designation material:	Х	Х	Х
		• Object to be tested (welds, threads, coated products)	Х	Х	Х
		Kind of manufacture	х	Х	Х
		Catalogue of defects		Х	Х
		Extent of test coverage		Х	Х
5.2	Test conditions and	Accessibility		Х	Х
	5       Information prior to test         5.1       Information about the test object         5.2       Test conditions and application of standard	Temperature			Х
	Humidity			Х	
		Availability			Х
		Unwanted interfering signals			Х
		Electric and/or magnetic disturbances			Х
		Infrastructure			Х
		Particular test conditions		Х	Х
		Application standard		Х	Х
		Stage of manufacture or service life when testing is to be carried out			Х
		Standards assigned to the test object		Х	Х
		Qualification requirements of test personnel		Х	Х
		Acceptance criteria		Х	Х
5.3	Technique and sequence	Surface condition		Х	
	of performing test	Surface preparation		Х	
	<ul> <li>5.3 Technique and sequence of performing test</li> <li>5.4 Instructions</li> <li>6 Testing</li> </ul>	Post-test documentation		Х	
		Equipment to be used		Х	
		Requirement for recording		Х	
5.4	Instructions	Preparation of written procedure			Х
		Preparation of written instruction		Х	
		Performing inspection in accordance with written instruction	Х		
		Documents			Х
		Presentation of the standards, codes and procedures			Х
6	Testing		Level 1	Level 2	Level 3
6.1	Probe selection as a	Product:			
		• Grade		Х	Х
	Section 5	Metallurgical condition		Х	Х
		• Shape		Х	Х
		• Type of discontinuity sought		Х	Х
		Location		Х	Х
		• Duty of the product		Х	Х
		Extent of examination		Х	Х

6.2	Operating conditions as	Temperature		Х	Х
0.2	a result of information in	Humidity		X	X
	Section 5	Access		X	X
		Availability		X	X
		Interfering signals		X	X
		Electric and/or magnetic disturbances		X	X
6.3	Parameters	Excitation frequency	Х	X	X
0.5	Parameters		X	X	X
C A		Probe speed	X		
6.4	Adjustment curves	Adjustment curves	X	X	X
6.5	Settings	Data acquisition	Χ	X	X
		Written procedure Written instruction	Х	X	Х
7	Fuch setion and you setion	written instruction		X	Level 3
	Evaluation and reporting	Penerting level	Level 1	Level 2	
7.1	Reporting	Reporting level	Х	X	X
7.2	Fuchanting	Examination report Characterisation of the indications:	X		
7.2	Evaluation		V	X	X
		Single-frequency analysis	Х	X	X
		Data analysis	N/	X	X
		Defect sizing (length and depth)	X	X	X
		Analysing transverse defects	Х	X	X
		Identification and analysis of 'bridging'		X	X
		Identification of subsurface defects		Х	Х
8	Assessment		Level 1	Level 2	Level 3
8.1	Evaluation and	Acceptance criteria according to standards, codes and procedures		Х	Х
	confirmation of test reports	Training of Level 1 and Level 2 of the acceptance criteria			Х
9	Quality aspects		Level 1	Level 2	Level 3
9.1	Factors affecting quality	Personnel qualification:	Х	Х	Х
	of testing	• ISO 9712	Х	Х	Х
		<ul> <li>Other NDT qualification and certification systems</li> </ul>			Х
		Format and scope of working procedures			Х
		Qualification of NDT procedures			Х
		Authorisations (NDT instruction, procedures and personnel)			Х
		Developing written instruction		Х	
		Working correctly to written instruction	Х		
		Traceability of documents		Х	Х
		Reliability of measurements		Х	Х
9.2	Knowledge of applicable	Correct technique selection		Х	
	NDT application and	Use of correct test parameters		Х	
	product standards	NDT method selection		Х	Х
		Job-specific training	Х	Х	Х
		Equipment verification	Х	Х	Х
10	Developments		Level 1	Level 2	Level 3
10.1	General information	Non-inductive techniques:			Х
					Х
		Magneto-optical imaging			~
		<ul> <li>Magneto-optical imaging</li> <li>Superconducting quantum interference device (SQUID)</li> </ul>			X
		• Superconducting quantum interference device (SQUID)			Х

Syllabus

reference number	Title	Module subcontent	Magne	etic testin	g (MT)
1	Terminology and history	of MT	Level 1	Level 2	Level 3
1.0	History of MT	History of magnetic particle testing	Х	Х	Х
1.1	Purpose of NDT	What is testing?	Х	Х	Х
		What is the purpose of NDT?	Х	Х	Х
		At what stage of life is NDT performed on a product?	Х	Х	Х
		How does it add value?	Х	Х	Х
		Who may carry out NDT?	Х	Х	Х
		Main NDT methods	Х	Х	Х
1.2	Purpose of MT	Definition	Х	Х	Х
		Applicability and limitations	Х	Х	Х
1.3	Terminology	Please refer to PCN24 standards document	Х	Х	Х
2	Physical principles and as	ssociated knowledge	Level 1	Level 2	Level 3
2.1	Basic physical	Electric circuits:	Х	Х	Х
	phenomena	Typical values	Х	Х	Х
		Units	Х	Х	Х
		Magnetic circuits:	Х	Х	Х
		Typical values	Х	Х	Х
		Units	Х	Х	Х
		Magnetic field:	Х	Х	Х
		Characterisation	Х	Х	Х
		Measurements	Х	Х	Х
		• Magnetic field ( <i>H</i> )	Х	Х	Х
		• Magnetic induction (B)	Х	Х	Х
		<ul> <li>Designation of alloys (classification of material types)</li> </ul>	Х	Х	Х
		Magnetic field created by electric circuits:	Х	Х	Х
		Indefinite rectilinear conductor	Х	Х	Х
		Long magnetic coil	Х	Х	Х
		Short or flat magnetising coil	Х	Х	Х
		• Influences of the flux of a magnetic field in a non-magnetic media	Х	Х	Х
		• Continuity of $H_t$	Х	Х	Х
		• Continuity of $B_n$	Х	Х	Х
		• Passage and distribution of flux from a magnetic medium (ferromagnetic) to a non-magnetic medium (paramagnetic)	Х	Х	Х
		Distribution of flux around material discontinuities:	Х	Х	Х
		Influence of depth	Х	Х	Х
		Influence of orientation	Х	Х	Х
2.2	Properties of materials	Non-magnetic materials	Х	Х	Х
		Magnetic materials:	Х	Х	Х
		Influence of temperature on the magnetic properties	х	Х	х
		Diamagnetism	Х	Х	Х
		Paramagnetism	Х	Х	Х
		Ferromagnetism	Х	Х	Х
		Ferrimagnetism			Х

### PCN syllabus – Magnetic testing (MT)

2.2		Influence of work hardening			Х
(continued)		Influence of heat treating			Х
		Particular alloys:		Х	Х
		Permalloys		Х	Х
		• Invar		Х	Х
		Inconel		Х	Х
2.3	Characteristics of magnetic particle testing	Characteristics of magnetic discontinuities affecting their detection:	Х	Х	Х
		• Depth	Х	Х	Х
		Thickness	Х	Х	Х
	Product knowledge and o	Orientation	Х	Х	Х
		Magnetic properties:	Х	Х	Х
		Principal ferromagnetic alloys	Х	Х	Х
		Non-magnetic properties	Х	Х	Х
		Magnetic materials:	Х	Х	Х
		Field of application	Х	Х	Х
		• Curie point	X	X	X
		Curve of the first magnetisation	X	X	X
		Hysteresis cycle and remarkable points	X	X	X
		Magnetic properties of steel	X	X	X
		Behaviour of a magnetic particle in the vicinity of a magnetic flux:	Х	X	X
		Magnetic field (H)		X	X
		Magnetic induction (B)		X	X X
		<ul> <li>Relative magnetic permeability, μ<sub>r</sub></li> <li>Coercive force, H<sub>c</sub></li> </ul>		X	X
		<ul> <li>Electrical resistivity, ρ</li> </ul>		X	X
		Influence of composition	Х	X	X
3	Product knowledge and c		Level 1	Level 2	Level 3
3.1	Processing	Test conditions	Х	Х	Х
		Preparation of parts	Х	Х	Х
		Viewing conditions:	Х	Х	Х
		Visual ergonomics			Х
		<ul> <li>Modulation (increase) of lighting and adaption period in darkened environment according to age of inspector</li> </ul>			Х
		Light sources:	Х	Х	Х
		<ul> <li>Physiological human factor knowledge of aspects related to lighting</li> </ul>			Х
		Quality of light sources products			Х
		Application of medium	Х	Х	Х
		Technique selection		Х	Х
		Factors affecting indications		Х	Х
		Metrological uncertainties			Х
3.2	Typical discontinuities	Typical discontinuities according to the production process:	Х	Х	Х
		Castings	Х	Х	Х
		• Forgings	Х	Х	Х
		• Welds	Х	Х	Х
		Wrought products	Х	Х	Х

4.1     Magnetising equipment Permanent magnets     X     X     X     X       Produb electromagnets     X     X     X     X       Colis     X     X     X     X       Threading bars     X     X     X     X       Prods     X     X     X     X       Magnetic benches:     X     X     X     X       0     Automatic     X     X     X       0     Roboliscid     X     X     X       0     Roboliscid     X     X     X       0     Magnetic benches:     X     X     X       0     Roboliscid     X     X     X       0     Roboliscid     X     X     X       4.1     Measurement and adjustment     Hall probe     X     X       1     Hall probe     X     X       4.2     Demagnetisation     Recessories:     Field indicators     X     X       1     Hall probe     X     X     X     X       4.3     Demagnetisation     K     K     X       1     Hall probe     X     X     X       4.4     Detection media     Contrast paint     X     X <th>4</th> <th>Equipment</th> <th></th> <th>Level 1</th> <th>Level 2</th> <th>Level 3</th>	4	Equipment		Level 1	Level 2	Level 3
Portable electromagnets         X			Permanent magnets			
cols         xx         xx         xx         xx           Prods         xx         xx         xx         xx           Prods         xx         xx         xx         xx           Prods         xx         xx         xx         xx           Fixed and portable         xx         xx         xx         xx           Fixed and portable         xx         xx         xx         xx           Cable wraps         xx         xx         xx         xx           Swinging field         xx         xx         xx         xx           Mobile         xx         xx         xx         xx           4.3         Demagnetisation         Accessories;         xx         xx         xx           Field indicators         xx         xx         xx         xx           4.4         Detection media         Cattings paint		5 5 1 1	-	х	х	х
Prode         X         X         X         X           Magnetic benches:         X         X         X         X           Fixed and portable         X         X         X         X           Robotised         Calie wraps         X         X         X         X           Calie wraps         X         X         X         X         X           Calie wraps         X         X         X         X         X           Calie wraps         X         X         X         X         X           Swinging field         X         X         X         X         X           Adust         Field indicators         X         X         X         X           Adust         Accessories:         X         X         X         X           Field indicators         X         X         X         X         X           Adust         Particies         X         X         X         X         X           Adust         Particies         X         X         X         X         X         X           Adust         Particies         X         X         X         X         <				Х	Х	х
Magnetic benches:         X         X         X         X           Fixed and portable         X         X         X         X           Automatic         Calmps         X         X         X         X           Clamps         X         X         X         X         X         X           Calpe wraps         X <td></td> <td></td> <td>Threading bars</td> <td>Х</td> <td>Х</td> <td>Х</td>			Threading bars	Х	Х	Х
• Fixed and portable         X         X         X           • Automatic         · Automatic         X         X         X           • Robotised         X         X         X         X         X           Clamps         X         X         X         X         X         X           Cable wraps         X         X         X         X         X         X           Cable wraps         X			Prods	Х	Х	Х
• Automatic         · · · · · · · · · · · · · · · · · · ·			Magnetic benches:	Х	Х	х
Productional set of the set of t			Fixed and portable	Х	Х	Х
Imps         X         X         X         X           Cable wraps         X         X         X         X           Swinging field         X         X         X         X           Mobie         X         X         X         X           A         All probe         X         X         X         X           A.3         Demagnetisation         Accessories:         X         X         X         X           Field indicators         Field indicators         X         X         X         X           4.4         Detection media         Contrast paint         X         X         X         X           4.5         Vewing conditions         If eld stources:         X         X         X         X           4.5         Vewing conditions of adaptation for darkened environment         X         X         X         X           9         Quality of LED products         X         X         X         X           10         Conditions of adaptation for darkened environment         X         X         X           10         Conditions of adaptation for darkened environment         X         X         X           10         <			Automatic		Х	Х
Cable wrapsXXXSwinging fieldXXXMobileIXXX4.2Messurement and adjustmentField indicatorsXXX4.3DemagnetisationAccessories:XXX4.4DemagnetisationField indicatorsXXX4.4Detection mediaContrast paintXXX4.5Viewing conditionsContrast paintXXX4.4Detection mediaContrast paintXXX4.5Viewing conditionsLight sources:XXX4.6Quality of LED productsXXX4.7Identification for darkened environmentXXX6Information prior to testLooi of adaptation for darkened environmentXX7Information prior to testLooi of adaptation for darkened environmentXX7Information aboutth test objectAccessitation or designation material:XXX6Coldicitos of illumination:XXXX7.2Information aboutth application of standardIdentification or designation material:XXX7.5.2Test conditions and application of standardIdentification scille when testing is to bc carried outXX7.3Technique and sequence of performing testGrad calculation fieldIdentification scille when testing is to bc carried ou			Robotised		Х	Х
Swinging field         Swingingingingingingingingingingingingingi			Clamps	Х	Х	Х
NoneNo			Cable wraps	Х	Х	Х
4.2 adjustmentField indicatorsXXX4.3 adjustmentDemagnetisation Field indicatorsAccessories: Field indicatorsXX4.3 a bDemagnetisation Field indicatorsXXX4.4 bDetection mediaContrast paint ParticlesXXX4.4 bDetection mediaContrast paint bXXXX4.4 bViewing conditionsLight sources: bXXXX4.5 bViewing conditionsLight sources: bXXXXX4.4 bOutput LED products bXXXXXXX5 bInformation prior to testive bConditions of illumination: bXXX<			Swinging field		Х	Х
adjustmentHall probeIntermediationKKK4.3DemagnetisationAccessories:Field indicatorsKKK• Field indicatorsField indicatorsKKK• Field strength measuring devicesKKK• Field indicatorsKKKK• Field indicatorsKKKK• ParticlesContrast paintKKK• Contrast paintKKKK• Quality of LED productsKKKK• Quality of LED productsKKKK• Adaptation for darkened environmentKKKK• Adaptation for darkened environmentKKKK• Role of adaptation for darkened environmentKKKK• Photometers and radiometersKKKKK• Information prior to testKKKKK• Object to be testedKKKKKK• Catalogue of defectsKKKKKK• Extent of test coverageKKKKKK• Particular test conditionsKKKKKK• Extent of test conditionsKKKKKKK• Conditions and application for attract or service life when testing is to be carried outKKKK• Exte			Mobile		Х	Х
4.3     Demagnetisation     Accessories:     X     X       • Field indicators     in     X     X       • Paticles     Contrast paint     X     X     X       • Quality of LED products     in     X     X     X       • Quality of LED products     in     X     X     X       • Quality of LED products     in     X     X     X       • Quality of LED products     in     X     X     X       • Quality of LED products     in     X     X     X       • Quality of LED products     in     X     X     X       • Role of adaptation for darkened environment     in     X     X       • Role of adaptation for darkened environment     in     X     X       • Role of adaptation for darkened environment     in     X     X       • Role of adaptation in material:     in     X     X       • Notometers and radiometers     in     X     X       • Conditions about the test object     Identification or designat	4.2		Field indicators	Х	Х	Х
<ul> <li>Field indicators</li> <li>Field indicators</li> <li>Field strength measuring devices</li> <li>Filux indicators</li> <li>Flux indicators</li> <li>Flux indicators</li> <li>Flux indicators</li> <li>A</li> <li>X</li> <li>X</li></ul>		adjustment	Hall probe		Х	Х
Pield strength measuring devicesIntermedia <td>4.3</td> <td>Demagnetisation</td> <td>Accessories:</td> <td>Х</td> <td></td> <td></td>	4.3	Demagnetisation	Accessories:	Х		
Image: Plux indicatorsImage: Plux ind			Field indicators		Х	
4.4 ADetection mediaContrast paintXXXXParticlesXXXXX4.5Viewing conditionsLight sources:XXXX• Quality of LED productsXXXX• Quality of LED productsXXXX• Adaptation to darkened environmentXXX• Adaptation for darkened environmentXXX• Role of adaptation for darkened environmentXXX• Photometers and radiometersXXX• Photometers and radiometersXXX• Object to be testedXXX• Catalogue of defectsXXX• Catalogue of defectsXXX• Extent of test coverageXXX• Particular test conditionsXXX• Adaptation for standardInfrastructureXX• Catalogue of test personnelXXX• Standards assigned to the test objectXXX• Acceptance criteriaXXX• Catalogue of test personnelXXX• Catalogue of test personnelXXX• Catalogue of test personnelXXX• Standards assigned to the test objectXXX• Catalogue of test personnelXXX• Catalogue of test personnelXXX•			Field strength measuring devices		Х	
ParticlesNormal stateNormal state						
4.5Viewing conditionsLight sources: Quality of LED productsXXXQuality of LED productsXXXHuman factors:XXX• Adaptation to darkened environmentXXX• Transition from bright/darkened lighting conditionsXXX• Role of adaptation for darkened environmentXXX• Role of adaptation material:XXX• Role of adaptation material:XXX• Object to be testedXXX• Catalogue of defectsXXX• Kind of manufactureXXX• Extent of test coverageXXX• Extent of test coverageXXX• Application of standardXXX• Application standardXXX• Application standardXXX• Acceptance riteriaXXX• Extent of test personnelXXX• Acceptance criteriaXXX• Acceptance criteriaXXX• Acceptance criteria<	4.4	Detection media			Х	
• Quality of LED products       Intermediate of the products       X       X         • Adaptation to darkened environment       X       X       X         • Adaptation from bright/darkened lighting conditions       X       X       X         • Role of adaptation for darkened environment       X       X       X         • Role of adaptation for darkened environment       X       X       X         • Photometers and radiometers       X       X       X         • Object to be tested       X       X       X         • Object to be tested       X       X       X         • Catalogue of defects       X       X       X         • Extent of test coverage       X       X       X         \$2.2       Extent of test coverage       X       X       X         \$2.3       Test conditions and application of standard       Accessibility       Infrastructure       X       X         Particular test conditions       X       X       X       X       X         \$2.4       Application standard       X       X       X       X         \$2.5.2       Test conditions and application of standard       X       X       X       X         \$2.5.2       Test co						
Fund a factors:         X         X         X         X         X           Adaptation to darkened environment         X         X         X         X           Transition from bright/darkened lighting conditions         X         X         X         X           Role of adaptation for darkened environment         X         X         X         X           Conditions of illumination:         X         X         X         X           Photometers and radiometers         X         X         X         X           S         Information about the test object         Identification or designation material:         X         X         X         X           Object to be tested         X         X         X         X         X         X           Catalogue of defects         X         X         X         X         X         X           S.2         Test conditions and application of standard         Infrastructure         X         X         X         X           Particular test conditions         Sandards assigned to the test object         X         X         X           Stadge of manufacture or service life when testing is to be carried out         X         X         X         X <td< td=""><td>4.5</td><td>Viewing conditions</td><td>-</td><td>Х</td><td>Х</td><td></td></td<>	4.5	Viewing conditions	-	Х	Х	
<ul> <li>Adaptation to darkened environment</li> <li>NX</li> <li>Xa</li> <li>X</li></ul>						
Image: section of the sectin of the section of the section of the				Х		
• Role of adaptation for darkened environmentVXXConditions of illumination:VXX• Photometers and radiometersVXX5Information prior to testingLevel 1Level 2Level 35.1Information about the test objectIdentification or designation material:XXX• Object to be testedXXXX• Catalogue of defectsXXXX• Extent of test coverageXXXX• Extent of test coverageXXXX• Extent of test conditionsInfrastructureInfrastructureXX• Particular test conditionsInfrastructureXXX• AccessibilityIstadards assigned to the test objectXXX• Stadards assigned to the test objectInfrastructureXXX• Stadards assigned to the test objectImage of manufacture or service life when testing is to be carried outXXX• Standards assigned to the test objectImage of manufacture or service life when testing is to be carried outXXX• Standards assigned to the test objectImage of manufacture or service life when testing is to be carried outXXX• Standards assigned to the test objectImage of manufacture or service life when testing is to be carried outImage of manufacture or service life when testing is to be carried outImage of manufacture or service life when testing is to be carried outI						
Conditions of illumination:NXX• Photometers and radiometersImage: Condition prior to test:Photometers and radiometersImage: Condition prior to test:Image: Condition prior test:Image: Condition p						
SInformation prior to testimationNX5.1Information about the test objectIdentification or designation material:XXX0 Object to be testedXXXX• Object to be testedXXXX• Catalogue of defectsXXXX• Extent of test coverageXXXX5.2Test conditions and application of standardAccessibilityInformation standardXXApplication standardApplication standardInfrastructureInformation standardXX5.3Technique and sequence of performing testSurface conditionsInfract CurieriaXX5.3Technique and sequence of performing testSurface conditionInfract CurieriaXX5.3Technique and sequence of performing testSurface conditionInfract CurieriaXX5.4Technique and sequence of performing testSurface conditionInfractXX5.3Technique and sequence of performing testSurface conditionInfractXXSurface preparationSurface preparationSurface SurfaceInfractXX5.3Technique and sequence of performing testSurface preparationSurface SurfaceInfractXXSurface preparationSurface preparationSurface Surface Surf			· · · · · · · · · · · · · · · · · · ·			
5Information prior to testingLevel 1Level 2Level 35.1Information about the test objectIdentification or designation material:XXX• Object to be testedXXXX• Kind of manufactureXXXX• Catalogue of defectsXXXX• Extent of test coverageXXXX5.2Test conditions and application of standardAccessibilityXXX• InfrastructureInfrastructureXXX• Particular test conditionsXXXX• Stage of manufacture or service life when testing is to be carried outXXX• Standards assigned to the test objectXXXX• Coeptance criteriaXXXX• Standards assigned to the test objectXXX• Coeptance criteriaXXX• Coeptance criteriaXXX• Surface preparationInfract or Surface preparationXX						Х
5.1 test objectInformation about the test objectIdentification or designation material:XXX0 Object to be testedXXXX• Object to be testedXXXX• Catalogue of defectsXXXX• Extent of test coverageXXXX5.2Test conditions and application of standardAccessibilityXXX• AccessibilityInfrastructureXXXX• Particular test conditionsXXXX• Application standardXXXX• Application standardXXXX• Application standardXXXX• Catalogue of defectsXXXX• Extent of test personnelXXXX• Application standardXXXX• Catalogue of test personnelXXX• Catalogue of test personnelXXX<	F	Information prior to tosti				
test object• Object to be testedXXX• Kind of manufactureXXXX• Catalogue of defectsXXXX• Catalogue of defectsXXXX• Extent of test coverageXXXX5.2Test conditions and application of standardAccessibilityXXXInfrastructureXXXXParticular test conditionsXXXApplication standardXXXStage of manufacture or service life when testing is to be carried outXXStandards assigned to the test objectXXXRequirements of test personnelXXXAcceptance criteriaXXXSurface conditionXXXSurface preparationXXX						
Second conductionNNNN• Kind of manufactureXXXX• Catalogue of defectsXXXX• Extent of test coverageXXXX5.2Test conditions and application of standardAccessibilityXXXInfrastructureInfrastructureInfrastructureXXXParticular test conditionsXXXXApplication standardInfrastructureInfrastructureXXParticular test conditionsXXXXApplication standardInfrastructure or service life when testing is to be carried outXXStage of manufacture or service life when testing is to be carried outXXXKequirements of test personnelXXXXAcceptance criteriaInfrace conditionXXX5.3Technique and sequence of performing testSurface preparationXXX	5.1		-			
Image: section of the section of section s			-			
5.2Test conditions and application of standardAccessibilityXXInfrastructureInfrastructureInfrastructureXXParticular test conditionsInfrastructureXXApplication standardInfrastructureXXApplication standardInfrastructureXXApplication standardInfrastructureXXApplication standardInfrastructureXXApplication standardInfrastructureXXApplication standardInfrastructureXXStage of manufacture or service life when testing is to be carried outXXStandards assigned to the test objectInfrastructureXXAcceptance criteriaInfrastructureXXS.3Technique and sequence of performing testSurface conditionInfrastructureX				~		
5.2Test conditions and application of standardAccessibilityAcc InfrastructureXXInfrastructureInfrastructureInfrastructureXXParticular test conditionsICXXApplication standardICXXStage of manufacture or service life when testing is to be carried outICXStage of manufacture or service life when testing is to be carried outICXStandards assigned to the test objectICXXRequirements of test personnelICXXAcceptance criteriaICXXSurface conditionICXXSurface preparationICXX			-	Х		
application of standard         Infrastructure         Image: Standard         X           Particular test conditions         X         X           Application standard         X         X           Stage of manufacture or service life when testing is to be carried out         X         X           Stage of manufacture or service life when testing is to be carried out         X         X           Standards assigned to the test object         X         X           Requirements of test personnel         X         X           Acceptance criteria         X         X           Staff condition         X         X           Staff condition         X         X           Staff condition         X         X           Staff condition         X         X           Surface preparation         X         X	5.2	Test conditions and				
Particular test conditions       Image: Stage of manufacture or service life when testing is to be carried out       X       X         Application standard       Image: Stage of manufacture or service life when testing is to be carried out       X       X         Stage of manufacture or service life when testing is to be carried out       Image: Stage of manufacture or service life when testing is to be carried out       X       X         Standards assigned to the test object       Image: Stage of manufacture or service life when test object       X       X         Requirements of test personnel       Image: Stage of manufacture or service life when test object       X       X         Stage of manufacture or service life when test object       Image: Stage of manufacture or service life when test object       X       X         Standards assigned to the test object       Image: Stage of manufacture or service life when test object       X       X         Requirements of test personnel       Image: Stage of manufacture or service life when test object       X       X         Stage of manufacture or service life when test object       Image: Stage of manufacture or service life when test object       X       X         Standards assigned to the test object       Image: Stage of manufacture or service life when test object       X       X         Stage of manufacture or service life when test object       Image: Stage of manufacture or service life when tes		application of standard				
Stage of manufacture or service life when testing is to be carried out       Image: Constraint of test object       Image: Constest       Image: Constraint of test			Particular test conditions		Х	
Stage of manufacture or service life when testing is to be carried out       Image: Constraint of the test object       Image: Constraint of test personnel			Application standard		Х	х
Standards assigned to the test object     N     X       Requirements of test personnel     X     X       Acceptance criteria     X     X       5.3     Technique and sequence of performing test     Surface condition     X     X       Surface preparation     X     X						Х
Requirements of test personnel         X         X           Acceptance criteria         X         X           5.3         Technique and sequence of performing test         Surface condition         X         X           Surface preparation         X         X         X					Х	Х
Acceptance criteria     X     X       5.3     Technique and sequence of performing test     Surface condition     X     X       Surface preparation     X     X     X					Х	Х
of performing test Surface preparation X					Х	Х
	5.3	Technique and sequence	Surface condition		Х	
Post-test documentation X		of performing test	Surface preparation		Х	
			Post-test documentation		Х	

5.4	Instructions	Preparation of written procedure			Х
		Preparation of written instruction		Х	
		Documents			Х
		Presentation of the standards, codes and procedures			Х
6	Testing		Level 1	Level 2	Level 3
6.1	Testing according to the	Performing inspection in accordance with written instruction	Х		
	written instructions	Supervision of testing personnel		Х	Х
6.2	Parameters	Preparation of the parts and influence of the surface quality:	Х	Х	
		Surface preparation	Х	Х	
		Demagnetisation	Х	Х	Х
		Cleaning, machining	Х	Х	
		Magnetisation:	Х	Х	
		Equipment	Х	Х	
		Current type	Х	Х	
		• Туре	Х	Х	
		Time of application	Х	Х	
		Control of magnetisation conditions:	Х	Х	Х
		<ul> <li>Values of the magnetising parameters</li> </ul>		Х	
		Continuous or simultaneous technique		Х	Х
		Remanence technique		х	
		<ul> <li>Use of flux indicators and magnetometers</li> </ul>		Х	
		Technique:	Х	Х	Х
		Correct use	Х	Х	
		Selection		х	х
		Magnetic field strength		Х	Х
		Orientation	х	х	х
		Planning of the test:	Х	Х	х
		• Grids		х	х
		Coverage		Х	Х
		Detecting medium:		Х	
		Correct use	Х	Х	Х
		Correct selection		Х	Х
		Wet medium	Х	Х	
		Dry medium	Х	Х	
		Contrast paint	Х	Х	
		Viewing conditions:	Х	Х	Х
		Adaptations to darkened environment		Х	
		Cleanliness		х	
		Observation and indications	Х	Х	Х
		Recording of discontinuities		Х	Х
		Reporting	Х	Х	
		Interpretation of indications		Х	
		Labelling and disposition of tested product		Х	
6.3	Treatment of	Residual field:	Х	Х	
	components	Condition requiring demagnetisation		Х	
		Level of residual		Х	
		Influence on later use of material			Х

( )		Demagnetisation:	Х	Х	Х
6.3 (continued)		-			^
(continueu)		Basic principles	X	X	
		Industrial methods	Х	X	X
		Influence of terrestrial magnetic field		X	Х
		• Minimal value of the magnetic field of demagnetisation principles	X	X	
		• Frequency	X	Х	
		Effect of skin	Х	Х	
		Calculation of magnetising coil		Х	Х
6.4	Cleaning of components		Х	Х	Х
7	Evaluation and reporting		Level 1	Level 2	Level 3
7.1	Classification of	Welding		Х	Х
	indications	Casting		Х	Х
	Forging		Х	Х	
		FE tubes		Х	Х
7.2	Inspection conditions	Viewing according to reference block	Х	Х	Х
		Use of other reference blocks		Х	Х
		Verification of the indication quality (ISO 3059)	Х	Х	Х
		Adjustment of test units		Х	Х
		Batch test report		Х	
7.3	Test report	Basics of evaluation			Х
		Test report:	Х	Х	Х
		Check test report		Х	
		In accordance with written procedure			Х
		Report of imperfections	Х	Х	
		Evaluation of the indication quality		Х	Х
		Preservation of indications		Х	
8	Assessment		Level 1	Level 2	Level 3
8.1	Assessment of indications	Relevant and non-relevant	Х		
8.2	Assessment of	Influence of manufacture		Х	
	discontinuities	Influence of material		Х	
		Influence of depth		Х	Х
		Influence of shape		Х	Х
		Influence of position		Х	Х
		Influence of orientation		Х	Х
9	Quality aspects		Level 1	Level 2	Level 3
9.1	Personnel qualification	ISO 9712	Х	Х	Х
		Other NDT qualification and certification systems			Х
9.2	Documentation	Format and scope of working procedures			Х
		Qualification of NDT procedures			Х
		Authorisations (NDT instruction, procedures and personnel)			Х
		Developing written instruction		Х	
		Working correctly to written instruction	Х		
		Traceability of documents		Х	Х
		Reliability of measurements		Х	Х
9.3	Knowledge of applicable	Correct technique selection		Х	
	NDT application and	Use of correct test parameters		X	
	product standards	NDT method selection		X	х
		Job-specific training	Х	X	X
		sou opeane danning	~	~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

9.3		Equipment verification:	Х	Х	Х
(continued)		Medium concentration	х		
		Medium contamination	Х		
		Ammeter adjustment	Х		
		Lift test	Х		
10	Environmental and safety	/ conditions	Level 1	Level 2	Level 3
10.1	Human factors	Extended stay in dark areas		Х	Х
		Role of breaks		Х	Х
		Role of anti-UV glasses			Х
10.2	Chemicals	Proper handling (aerosols/propellants)	Х	Х	Х
		Disposal of effluents		Х	Х
		Environmental conditions		Х	Х
		Treatment and rejection of the effluents			Х
		Toxicity of lead contact pads		Х	
		Toxicity of products			Х
		Risks related to the products	Х	Х	Х
		Material safety data sheet	Х	Х	
		Review of applicable NDT application and product standard			Х
		Fire hazards			Х
10.3	Accessories	UV radiation hazards	Х	Х	Х
		Hazards of white light			Х
		Electrical hazards	Х	Х	Х
		UV filters	Х	Х	
		Vision considerations:	Х	Х	Х
		Protective glasses	Х	Х	Х
11	Developments		Level 1	Level 2	Level 3
11.1	Developments	Special installation and equipment		Х	
		Actinic blue (alternative wavelengths)		Х	Х
		New techniques			Х
		Creative and innovative special installations			Х

reference numberTitleModule subcontentPI = User1 USEUser11Ferninology and history PTKew1Kew1Kew11.0History of PTHistory of penetrant testingXXX1.1Purpose of NDTMuhai testing?XXXX1.1Purpose of NDTMuhai testing?XXXXX1.1Muhai stesting?KXXX<	reference numberTitleModule subcontentPeneturistic (PT)1Terminology and history of PTHistory of PTHistory of PTWall is tory of penetant testingXXXX1.0Purpose of NDTXXX <td< th=""><th>Syllabus</th><th></th><th></th><th></th><th></th><th></th></td<>	Syllabus					
1.0     History of PT     History of penetrant testing     X     X     X       1.1     Purpose of NDT     What is testing?     X     X     X       Name     At what stage of life is NDT performed on a product?     X     X     X       At what stage of life is NDT performed on a product?     X     X     X       How does it add value?     X     X     X       Mon may carry out NDT     X     X     X       Main NDT methods     X     X     X       1.2     Purpose of PT     Definition     X     X       Applicability and limitations     X     X     X       1.3     Terminology     Please refer to PCN24 standards document     X     X     X       2.1     Physical principles and associated knowledge     Level 1     Level 2     Level 3       2.1     Penetrant systems     Fluorescent     X     X     X       9     Fluorescent     X     X     X     X       1     Interactions between different dyes     X     X     X       1     Wate washable     X     X     X       9     Solvent removeable     X     X     X       1     Wet (aqueous and non-aqueous)     X     X     X </th <th>1.0       History of PT       History of penetrant testing       X       X       X       X         1.1       Purpose of NDT       What is testing?       X<th>reference</th><th>Title</th><th>Module subcontent</th><th>Penet</th><th>rant testir</th><th>ng (PT)</th></th>	1.0       History of PT       History of penetrant testing       X       X       X       X         1.1       Purpose of NDT       What is testing?       X <th>reference</th> <th>Title</th> <th>Module subcontent</th> <th>Penet</th> <th>rant testir</th> <th>ng (PT)</th>	reference	Title	Module subcontent	Penet	rant testir	ng (PT)
1.1     Purpose of NDT     X     X     X       What is the purpose of NDT     X     X     X       At what stage of Ille is NDT performed on a product?     X     X     X       How does it add value?     X     X     X     X       What is the purpose of NDT     X     X     X     X       Main NDT methods     X     X     X     X       1.2     Purpose of PT     Definition     X     X     X       Applicability and limitations     X     X     X     X       2     Physical principles and associated knowledge     Level 1     Level 2     Level 3       2.1     Penetrant systems     Penetrant types:     X     X     X       9     Visible     X     X     X     X       Basis of fluorescent and absorption principles used in dye penetrants     X     X     X       1     Water washable     X     X     X     X       9     Vater washable     X     X     X       1     Solvent removeable     X     X     X       1     Water washable     X     X     X       0     Vater washable     X     X     X       0     Vet (aqueous and non-aqueous)	1.1       Purpose of NDT       X       X       X       X         Mhat is the purpose of NDT?       X       X       X       X         At what stage of life is NDT performed on a product?       X       X       X       X         How does it add value?       X       X       X       X       X         Main NDT methods       X       X       X       X       X         1.2       Purpose of PT       Definition       X       X       X       X         1.3       Terminology       Please refer to PCN24 standards document       X       X       X       X         2       Physical principles and associated knowledge       Level 1       Level 2       Level 1       Level 2         2.1       Penetrant systems       Penetrant types:       X       X       X       X         • Fluorescent       X       X       X       X       X       X         • Visible       Basi off fluorescent and aborption principles used in dye penetrants       X       X       X         • Visible       Basi off fluorescent and aborption principles used in dye penetrants       X       X       X         • Post emulsifiable       X       X       X       X	1	Terminology and history	of PT	Level 1	Level 2	Level 3
What is the purpose of NDT?         X         X         X           At what stage of life is NDT performed on a product?         X         X         X           How does it add value?         X         X         X         X           How does it add value?         X         X         X         X         X           How qcary out NDT?         X         X         X         X         X           Main NDT methods         X         X         X         X         X         X           1.3         Terminology         Please refer to PCN24 standards document         X         X         X         X           2         Physical principles and associated knowledge         Level 1         Level 2         Level 3           2.1         Penetrant systems         Renetrant types:         X         X         X         X           2         Physical principles and asso filourescent and absorption principles used in dype penetrants         X         X         X           2         Protert washable         X         X         X         X           0         Visible         Solvent removeable         X         X         X           Emulsifies/         Post emulsifiable         X	What is the purpose of NDT?         X         X         X           At what stage of II/E is NDT performed on a product?         X         X         X           How does it add value?         X         X         X         X           Who may carry out NDT?         X         X         X         X         X           1.2         Purpose of PT         Definition         X         X         X         X         X         X           1.3         Terminology         Please refer to PCN24 standards document         X         X         X         X         X           2         Physical principles and associated knowledge         Level 1         Level 2         Level 2         Level 2         Level 2           2.1         Penetrant systems         Penetrant hypes:         Fluorescent         X         X         X         X           2         Physical principles and associated inforent dyes         X         X         X         X         X           2         Posteriant systems         Fluorescent ind absorption principles used in dye penetrant         X         X         X         X         X         X         X         X         X         X         X         X         X         X	1.0	History of PT	History of penetrant testing	Х	Х	Х
At what stage of life is NDT performed on a product?         X         X         X           How does it add value?         X         X         X           Who may carry out NDT?         X         X         X           1.2         Purpose of PT         Definition         X         X         X           1.3         Terminology         Please refer to PCN24 standards document         X         X         X           2         Physical principles and associated knowledge         Level 1         Level 2         Level 3           2.1         Penetrant systems         Fluorescent         X         X         X           9         Pisoical principles and associated knowledge         Level 3         X         X           2.1         Penetrant systems         Fluorescent         X         X         X           9         Visible         X         X         X         X           9         Visible         X         X         X         X           9         Visible         X         X         X         X           9         Post emulsifiable         X         X         X         X           9         Visostint removeable         X         X </td <td>At what stage of life is NDT performed on a product?         X         X         X           How does it add value?         X         X         X           Who may carry out ND?         X         X         X           Main NDT methods         X         X         X         X           1.2         Purpose of PT         Definition         X         X         X         X           2         Physical principles and associated knowledge         Level 1         Level 2         Level 2           2.1         Penetrant systems         Penetrant types:         X         X         X           5.1         Terminology         Penetrant types:         X         X         X           2.1         Penetrant systems         Penetrant types:         X         X         X           6         Visible         X         X         X         X           9         Post emulsifiable         X         X         X         X           9         Vater washable         X         X         X         X           9         Vater washable         X         X         X         X           0         Developer:         X         X         X</td> <td>1.1</td> <td>Purpose of NDT</td> <td>What is testing?</td> <td>Х</td> <td>Х</td> <td>Х</td>	At what stage of life is NDT performed on a product?         X         X         X           How does it add value?         X         X         X           Who may carry out ND?         X         X         X           Main NDT methods         X         X         X         X           1.2         Purpose of PT         Definition         X         X         X         X           2         Physical principles and associated knowledge         Level 1         Level 2         Level 2           2.1         Penetrant systems         Penetrant types:         X         X         X           5.1         Terminology         Penetrant types:         X         X         X           2.1         Penetrant systems         Penetrant types:         X         X         X           6         Visible         X         X         X         X           9         Post emulsifiable         X         X         X         X           9         Vater washable         X         X         X         X           9         Vater washable         X         X         X         X           0         Developer:         X         X         X	1.1	Purpose of NDT	What is testing?	Х	Х	Х
How does it add value?XXXWho may carry out NDT? Main NDT methodsXXX1.2Purpose of PTDefinition Applicability and limitationsXXX1.3TerminologyPlease refer to PCN24 standards documentXXX2Physical principles and associated knowledgeLevel 1Level 2Level 32.1Penetrant systemsPenetrant types: • VisibleXXXX2Physical principles and associated knowledgeLevel 1Level 2Level 32.1Penetrant systemsPenetrant types: • VisibleXXXX• FluorescentXXXXX• VisibleDestemulifiableXXXX• DestemulifiableXXXXX• OstemulifiableXXXXX• Developer:XXXXX• DeryXXXXX• Vet (aqueous and non-aqueous)XXXX• ViscosityXXXXX• ViscosityXXXXX• DeryXXXXX• DeryXXXXX• OstemulifiableXXXX• OstemulifiableXXXX• DeryXXXX• DeryXX <td>Purpose of PT How does it add value? Who may carry out NDT? X</td> <td></td> <td></td> <td>What is the purpose of NDT?</td> <td>Х</td> <td>Х</td> <td>Х</td>	Purpose of PT How does it add value? Who may carry out NDT? X			What is the purpose of NDT?	Х	Х	Х
Who may carry out NDT?         X         X         X           Main NDT methods         X         X         X           1.2         Purpose of PT         Definition         X         X         X           1.3         Terminology         Please refer to PCN24 standards document         X         X         X         X           2         Physical principles and subserver to PCN24 standards document         Level 1         Level 2         Level 3           2.1         Penetrant systems         Penetrant types:         X         X         X         X           9         Fluorescent         A         X         X         X         X         X           1         Terrations between different dyes         X         X         X         X         X           9         Fost emulsifiable         X         X         X         X         X           9         Note mulsifiable         X         X         X         X         X           1         Eveloper:         X         X         X         X         X           1         Ory         X         X         X         X         X           1         Net equeous and non-aqueous)	Who may carry out NDT?         X         X         X           Main NDT methods         X         X         X           1.2         Purpose of PT         Definition         X         X         X           1.3         Terminology         Please refer to PCN24 standards document         X         X         X           2         Physical principles and associated knowledge         Level 1         Level 2         Level 3           2.1         Penetrant systems         Penetrant types: <ul> <li>Fluorescent</li> <li>Visible</li> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>X</li> <li>Visible</li> <li>X</li> <li>X<!--</td--><td></td><td></td><td>At what stage of life is NDT performed on a product?</td><td>Х</td><td>Х</td><td>Х</td></li></ul>			At what stage of life is NDT performed on a product?	Х	Х	Х
Main NDT methodsXXX1.2Purpose of PTDefinitionXXX1.3TerminologyPlease refer to PCN24 standards documentXXX2Physical principles and associated knowledgeLevel 1Level 2Level 32.1Penetrant systemsPenetrant types:XXX3Fluorescent and absorption principles useds in dypenetrantsXXX4Fluorescent and absorption principles used in dypenetrantsXXX9VisibleXXXX9Penetrant types:XXXX9VisibleXXXX9Penetrant techniques:XXXX9Vater washableXXXX9Post emulsifiableXXXX10CleanerXXXX9Vet (aqueous and non-aqueous)XXXX9ViscosityXXXX9Properties andXXXX9Properties andXXXX9Properties andXXXX9Porperties andXXXX9Porperties andXXXX9Porperties andXXXX9Porperties andXXXX <td>Main NDT methods     X     X     X       1.2     Purpose of PT     Definition     X     X     X       1.3     Terminology     Please refer to PCN24 standards document     X     X     X       2     Physical principles and sscrefer to PCN24 standards document     X     X     X     X       2.1     Penetrant systems     Penetrant types:     X     X     X     X       2     Physical principles and sscrefer to PCN24 standards document     X     X     X     X       2.1     Penetrant systems     Penetrant types:     X     X     X     X       4     Fluorescent     X     X     X     X     X       5     Fluorescent and absorption principles used in dye penetrants     X     X     X       1     Interactions between different dyes     X     X     X     X       9     Vater washable     X     X     X     X       0     Poter emulsifiable     X     X     X     X       0     Vater washable     X     X     X     X       0     Enulsifierat     X     X     X     X       0     Vater washable     X     X     X     X       0</td> <td></td> <td></td> <td>How does it add value?</td> <td>Х</td> <td>Х</td> <td>Х</td>	Main NDT methods     X     X     X       1.2     Purpose of PT     Definition     X     X     X       1.3     Terminology     Please refer to PCN24 standards document     X     X     X       2     Physical principles and sscrefer to PCN24 standards document     X     X     X     X       2.1     Penetrant systems     Penetrant types:     X     X     X     X       2     Physical principles and sscrefer to PCN24 standards document     X     X     X     X       2.1     Penetrant systems     Penetrant types:     X     X     X     X       4     Fluorescent     X     X     X     X     X       5     Fluorescent and absorption principles used in dye penetrants     X     X     X       1     Interactions between different dyes     X     X     X     X       9     Vater washable     X     X     X     X       0     Poter emulsifiable     X     X     X     X       0     Vater washable     X     X     X     X       0     Enulsifierat     X     X     X     X       0     Vater washable     X     X     X     X       0			How does it add value?	Х	Х	Х
1.2Purpose of PT Applicability and limitationsXXX1.3TerminologyPlease refer to PCN24 standards documentXXX2Physical principles and associated knowledgeLevel 1Level 2Level 32.1Penetrant systemsPenetrant types:XXX6FluorescentXXXXBasis of fluorescent and absorption principles used in dye penetrantsXXXRenetrant techniques:XXXXPost emulsifiableXXXX0Solvent removeableXXXEmulsifiersXXXXDeveloper:XXXX0Wet (aqueous and non-aqueous)XXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0DryXXXX0 <t< td=""><td>1.2         Purpose of PT         Definition Applicability and limitations         X         X         X           1.3         Terminology         Please refer to PCN24 standards document         X</td><td></td><td></td><td>Who may carry out NDT?</td><td>Х</td><td>Х</td><td>Х</td></t<>	1.2         Purpose of PT         Definition Applicability and limitations         X         X         X           1.3         Terminology         Please refer to PCN24 standards document         X			Who may carry out NDT?	Х	Х	Х
Applicability and limitationsXXX1.3TerminologyPlease refer to PCN24 standards documentXXX2Physical principles and associated knowledgeLevel 1Level 2Level 32.1Penetrant systemsPenetrant types:XXX• FluorescentXXXX• VisibleXXXXBasis of fluorescent and absorption principles used in dype penetrantsXXX• Net washableXXXX• Penetrant techniques:XXXX• Post emulsifiableXXXX• Post emulsifiableXXXX• Developer:XXXX• Uter (aqueous and non-aqueous)XXX• DryXXXX• DrySu	Applicability and limitations         X         X         X           1.3         Terminology         Please refer to PCN24 standards document         X         X         X           2         Physical principles and societed knowledge         Level 1         Level 2         Level 2           2.1         Penetrant systems         Penetrant types:         X			Main NDT methods	Х	Х	Х
1.3TerminologyPlease refer to PCN24 standards documentXXXLevel 1Level 2Level 32Physical principles and associated knowledgeXXXXXX2.1Penetrant systemsPenetrant types:XXXXX• FluorescentXXXXXXX• VisibleXXXXXXBasis of fluorescent and absorption principles used in dye penetrantsXXXX• Penetrant techniques:XXXXX• Water washableXXXXX• Orst emulsifiableXXXXX• Solvent removeableXXXXX• Developer:XXXXX• Wet (aqueous and non-aqueous)DryXXX• UsicosityXXXXX• ViscosityXXXXX• ViscosityXXXXX• ViscosityXXXXX• Bleed outXXXXX• Superficial tensionXXXX• Superficial tensionXXXX• Variable values of roughness ( $n_e + R_p$ )XXX• Variable values of roughness ( $n_e + R_p$ )XXX	1.3TerminologyPlease refer to PCN24 standards documentXXXX2Physical principles and associated knowledgeLevel 1Level 2Level 2Level 22.1Penetrant systemsPenetrant types:XXXXX• FluorescentXXXXXXX• UsibleInteractions between different dyesInteractions between different dyesInteractions between different dyesXXX• Penetrant types:XXXXXX• Vater washableXXXXX• Post emulsifiableXXXXX• Developer:XXXXX• Developer:XXXXX• Developer:XXXXX• DryXXXXX• DryXXX <td< td=""><td>1.2</td><td>Purpose of PT</td><td>Definition</td><td>Х</td><td>Х</td><td>Х</td></td<>	1.2	Purpose of PT	Definition	Х	Х	Х
2Physical principles and associated knowledgeLevel 1Level 2Level 32.1Penetrant systemsPenetrant types:XXXX $             FluorescentXXXX             VisibleXXXXBasis of fluorescent and absorption principles used in dye penetrantsXXX             VisibleXXXXBasis of fluorescent and absorption principles used in dye penetrantsXXXPenetrant techniques:XXXX             VisibleXXXX             VisibleVisibleXXX             VisibleVisibleXXX             VisibleVisibleXXX             VisibleVisibleXXX             VisibleVisi$	2Physical principles and associated knowledgeLevel 1Level 2Level 2Level 2Level 32.1Penetrant systemsPenetrant types:XXXXX• VisibleBasis of fluorescentXXXXXX• VisibleBasis of fluorescent and absorption principles used in dye penetrantsXXXXXInteractions between different dyesXXXXXXXXPenetrant techniques:XXX			Applicability and limitations	Х	Х	Х
2.1     Penetrant systems     Penetrant types:     X     X     X       Fluorescent     X     X     X     X       Visible     X     X     X     X       Basis of fluorescent and absorption principles used in dye penetrants     X     X     X       Interactions between different dyes     X     X     X       Penetrant techniques:     X     X     X       Post emulsifiable     X     X     X       Post emulsifiable     X     X     X       Solvent removeable     X     X     X       Emulsifiers     X     X     X       Overloper:     X     X     X       Wet (aqueous and non-aqueous)     X     X     X       Wet (aqueous and non-aqueous)     X     X     X       Ory     X     X     X     X       Penetrant:     X     X     X     X       Ory     X     X     X     X       Visosity     X     X     X     X       Visosity     X     X     X     X       Visosity     X     X     X     X       Ory     X     X     X     X       Enlastics of the method	2.1       Penetrant systems       Penetrant types:       X       X       X         Normal Systems       Fluorescent       X       X       X       X         Normal Systems       Fluorescent and absorption principles used in dye penetrants       X       X       X         Basis of fluorescent and absorption principles used in dye penetrants       X       X       X       X         Penetrant techniques:       X       X       X       X       X         Penetrant techniques:       X       X       X       X       X         Water washable       X       X       X       X       X       X         Post emulsifiable       X<	1.3	Terminology	Please refer to PCN24 standards document	Х	Х	Х
Properties and characteristics Properties and characteristic Properties and characteristic Properties and characteristic </td <td>Properties and characteristics          Properties and characteristics       N       X       X       X         Niscolut characteristics       X       X       X       X         Name       X       X       X       X         Name       X       X       X       X         Name       X       X       X       X         Penetrant techniques:       X       X       X       X         Name       Vater washable       X       X       X       X         Name       Solvent removeable       X       X       X       X         Emulsifiers       X       X       X       X       X       X         Opereloper:       X<!--</td--><td>2</td><td>Physical principles and as</td><td>ssociated knowledge</td><td>Level 1</td><td>Level 2</td><td>Level 3</td></td>	Properties and characteristics          Properties and characteristics       N       X       X       X         Niscolut characteristics       X       X       X       X         Name       X       X       X       X         Name       X       X       X       X         Name       X       X       X       X         Penetrant techniques:       X       X       X       X         Name       Vater washable       X       X       X       X         Name       Solvent removeable       X       X       X       X         Emulsifiers       X       X       X       X       X       X         Opereloper:       X </td <td>2</td> <td>Physical principles and as</td> <td>ssociated knowledge</td> <td>Level 1</td> <td>Level 2</td> <td>Level 3</td>	2	Physical principles and as	ssociated knowledge	Level 1	Level 2	Level 3
<ul> <li>Visible</li> <li>Nisible</li> <li>Nisible</li> <li>Basis of fluorescent and absorption principles used in dye penetrants</li> <li>NX</li> <li< td=""><td>Norman Properties and characteristics   • Visible X X X   Basis of fluorescent and absorption principles used in dye penetrants X X   Interactions between different dyes X X X   Penetrant techniques: X X X X   • Water washable X X X X X   • Post emulsifiable X</td><td>2.1</td><td>Penetrant systems</td><td>Penetrant types:</td><td>Х</td><td>Х</td><td>Х</td></li<></ul>	Norman Properties and characteristics   • Visible X X X   Basis of fluorescent and absorption principles used in dye penetrants X X   Interactions between different dyes X X X   Penetrant techniques: X X X X   • Water washable X X X X X   • Post emulsifiable X	2.1	Penetrant systems	Penetrant types:	Х	Х	Х
2.2         Properties and characteristics         Physical basics of the method (Augue)         X         X         X           2.2         Properties and characteristics         Physical basics of the method (Capillarity)         X         X         X           1         Value         X         X         X         X           2.2         Properties and characteristics         Physical basics of the method (Capillarity)         X         X         X           1         Viscosity         X         X         X         X           1         Viscosity         X         X         X         X           1         Viscosity         X         X         X         X           1         Superficial tension         X         X         X         X           1         Vispur pressure         XX	Basis of fluorescent and absorption principles used in dye penetrants         N         X           Interactions between different dyes         X         X           Penetrant techniques:         X         X         X           Water washable         X         X         X         X           Post emulsifiable         X         X         X         X           Solvent removeable         X         X         X         X           Cleaner         X         X         X         X           Developer:         X         X         X         X           Wet (aqueous and non-aqueous)         X         X         X         X           Developer:         X         X         X         X         X           Wet (aqueous and non-aqueous)         X         X         X         X           Dry         X         X         X         X           Pisocial basics of the method         X         X         X         X           Viscosity         X         Viscosity         X         X           Flashpoint         X         X         X         X           Gapillarity         X         X         X		2 Physical principles and a	Fluorescent	Х	Х	Х
Interactions between different dyesIIIIPenetrant techniques:XXXX• Water washableXXXX• Post emulsifiableXXXX• Solvent removeableXXXXEmulsifiersXXXXDeveloper:XXXX• Wet (aqueous and non-aqueous)XXX• Uve (aqueous and non-aqueous)XXX• DryXXXX• UscosityXXXX• ViscosityXXXX• Superficial tensionXXX• Superficial tensionXXX• Contact angleXXX• Vapour pressureXXX• Vapour pressureXXX• Variable values of roughness ( $R_g + R_p$ )······• Variable values of roughness ( $R_g + R_p$ )······	Interactions between different dyes         Image: Ima			• Visible	Х	Х	Х
Penetrant techniques:         X         X         X           Water washable         X         X         X           Post emulsifiable         X         X         X           Solvent removeable         X         X         X           Emulsifiers         X         X         X           Cleaner         X         X         X           Developer:         X         X         X           Wet (aqueous and non-aqueous)         X         X         X           Dry         X         X         X         X           Org         X         X         X         X           Viscosity         X         X         X         X           Viscosity         X         X         X         X           Viscosity         X         X         X         X           Bleed out         X         X         X         X           Superficial tension         X         X         X         X           Capillarity         X         X         X         X           Oppur pressure         X         X         X         X           Vapour pressure         X	Penetrant techniques:NNNWater washableNNNPost emulsifiableNNNSolvent removeableNNNEmulsifiersNNNCleanerNNNDeveloper:NNNOut (aqueous and non-aqueous)NNNDrNNNPhysical basics of the methodNNNProperties and characteristicsNNNPostosityNNNNI slashpointNNNNI slashpointNNNN<			Basis of fluorescent and absorption principles used in dye penetrants		Х	
$ \begin{array}{ c c c } & & & & & & & & & & & & & & & & & & &$	• Water washableXXX• Post emulsifiableXXX• Solvent removeableXXXEmulsifiersXXXCleanerXXX• Developer:XXX• Wet (aqueous and non-aqueous)XXX• DryXXX• DryXXX• DryXXX• DryXXX• NiscosityXXX• ViscosityXXX• ViscosityXXX• Eleed outXXX• Superficial tensionXXX• Qapour pressureXXX• Variable values of roughness: (n=foundry with machining)XX• Omoronents with multiple roughness: (n=foundry with machining)XX• Components with multiple roughness (n=foundry with machining)XX• Signal-to-noise ratio conceptXXX• Emulsification of penetrantXXX• CleanerXXXX			Interactions between different dyes			Х
<ul> <li>Post emulsifiable</li> <li>Solvent removeable</li> <li>Solvent removeable</li></ul>	<ul> <li>Post emulsifiable</li> <li>Solvent removeable</li> <li>Solvent removeable</li> <li>Cleaner</li> <li>Components with multiple roughness (k<sup>a</sup> + R<sup>a</sup>)</li> <li>Components with multiple roughness (k<sup>a</sup> - R<sup>b</sup>)</li> <li>Components with multiple roughness (k<sup>a</sup> - R<sup>b</sup>)</li> <li>Components with multiple roughness (k<sup>a</sup> - R<sup>b</sup>)</li> <li>Cleaner</li> <li>Cleaner<td></td><td></td><td>Penetrant techniques:</td><td>Х</td><td>Х</td><td>Х</td></li></ul>			Penetrant techniques:	Х	Х	Х
• Solvent removeableXXXEmulsifiersXXXCleanerXXXDeveloper:XXX• Wet (aqueous and non-aqueous)XXX• Uvet (aqueous and non-aqueous)XXX• DryXXX• ViscosityXXX• ViscosityXXX• Superficial tensionXXX• Contact angleXXX• Vapour pressureXXX• Vapour pressureXXX• Variable values of roughness ( $R_a + R_2$ )VXX	• Solvent removeable       X       X       X         Emulsifiers       X       X       X         Cleaner       X       X       X         Developer:       X       X       X         • Wet (aqueous and non-aqueous)       X       X       X         • Dry       X       X       X       X         Penetrant:       X       X       X       X         • Viscosity       X       X       X       X         • Superficial tension       X       X       X       X         • Superficial tension       X       X       X       X         • Vapour pressure       X       X       X       X         • Vapour pressure       X       X       X       X         • Variable values of roughness ( <i>ie</i> foundry with machining)       X       X       X         • Variable values of roughness ( <i>ie</i> foundry with machining)       X       X       X         • Signal-to-noise ratio concept       X       X       X       X         • Emulsification of penetrant       X       X       X       X			Water washable	Х	Х	Х
Emulsifiers         X         X         X           Cleaner         X         X         X           Developer:         X         X         X           • Wet (aqueous and non-aqueous)         X         X         X           • Dry         X         X         X         X           • Dry         X         X         X         X           • Dry         X         X         X         X           • Properties and characteristics         Physical basics of the method         X         X         X           • Viscosity         Penetrant:         X         X         X         X           • Viscosity         Image: Superficial tension         X         X         X           • Superficial tension         X         X         X         X           • Contact angle         X         X         X         X           • Vapour pressure         X         X         X         X           • Variable values of roughness: ( $n_a + R_2$ )         X         X         X	Emulsifiers         X         X         X           Cleaner         X         X         X           Developer:         X         X         X           • Wet (aqueous and non-aqueous)         X         X         X           • Dry         X         X         X         X           Penetrant:         X         X         X         X           • Viscosity         X         X         X         X           • Flashpoint         X         X         X         X           • Capillarity         X         X         X         X           • Oxpour pressure         X         X         X         X           • Vapour pressure         X         X         X         X           • Oxpour pressure         X         X         X         X           • Variable values of roughness ( $n_g + R_2$ )         X         X         X           • Variable values of roughness ( $ie$ foundry with machining)         X         X         X           • Variable values of roughness ( $ie$ foundry with machining)         X         X         X           • Variable values of roughness ( $ie$ foundry with machining)         X         X         X			Post emulsifiable	Х	Х	Х
Cleaner       X       X       X         Developer:       X       X       X         • Wet (aqueous and non-aqueous)       X       X       X         • Dry       X       X       X       X         2.2       Properties and characteristics       Physical basics of the method       X       X       X         Penetrant:       X       X       X       X       X         • Viscosity       X       X       X       X         • Flashpoint       X       X       X       X         • Capillarity       X       X       X       X         • Superficial tension       X       X       X       X         • Vapour pressure       X       X       X       X         • Vapour pressure       X       X       X       X	Cleaner     X     X     X       Developer:     X     X     X       • Wet (aqueous and non-aqueous)     X     X     X       • Dry     X     X     X       Properties and characteristics     Physical basics of the method     X     X     X       • Viscosity     X     X     X     X       • Viscosity     X     X     X       • Flashpoint     X     X     X       • Bleed out     X     X     X       • Capillarity     X     X     X       • Vapour pressure     X     X     X       • Vapour pressure     X     X     X       • Variable values of roughness (if oundry with machining)     X     X       • Variable values of roughness (if oundry with machining)     X     X       • Signal-to-noise ratio concept     X     X     X       • Signal-to-noise ratio concept     X     X     X       • Residual background noise (over/under washing risks)     X     X     X       • Cleaner     X     X     X     X			Solvent removeable	Х	Х	Х
Developer:       X       X       X         Wet (aqueous and non-aqueous)       X       X       X         Dry       X       X       X         Properties and characteristics       Physical basics of the method       X       X       X         Properties and characteristics       Penetrant:       X       X       X       X         Image: Properties and characteristics       Penetrant:       X       X       X       X         Properties and characteristics       Image: Penetrant:       X       X       X       X         Penetrant:       Image: Penetrant:       X       X       X       X         Image: Properties and characteristics       Image: Penetrant:       X       X       X         Image: Properties and characteristics       Image: Penetrant:       X       X       X         Image: Properties and characteristics       Image: Penetrant:       Image: Penetrant:       X       X       X         Image: Properties and characteristics       Image: Penetrant:	Developer:     X     X     X       Wet (aqueous and non-aqueous)     X     X     X       Dry     X     X     X       Properties and characteristics     Physical basics of the method     X     X     X       Viscosity     X     X     X     X       • Viscosity     X     X     X     X       • Releat out     X     X     X     X       • Superficial tension     X     X     X       • Vapour pressure     X     X     X       • Vapour pressure     X     X     X       • Variable values of roughness ( <i>ie</i> foundry with machining)     Imfluence of material roughness:     X     X       • Variable values of roughness ( <i>ie</i> foundry with machining)     Imfluence fractic concept     X     X       • Signal-to-noise ratio concept     X     X     X       • Residual background noise (over/under washing risks)     X     X     X       • Emulsification of penetrant     X     X     X			Emulsifiers	Х	Х	Х
• Wet (aqueous and non-aqueous)XXX• DryXXX• DryXXX• CharacteristicsPhysical basics of the methodXX• Penetrant:XXX• ViscosityXXX• ViscosityXXX• Bleed outXX• CapillarityXX• Superficial tensionXX• Contact angleXX• Vapour pressureXX• Vapour pressureXX• Variable values of roughness: $(R_a + R_z)$ ······• XXX	• Wet (aqueous and non-aqueous)       X       X       X         • Dry       X       X       X         • Properties and characteristics       Physical basics of the method       X       X       X         • Characteristics       Physical basics of the method       X       X       X       X         • Viscosity       X       V       X       X       X       X         • Viscosity       X       X       X       X       X       X         • Relachout       X			Cleaner	Х	Х	Х
Image: constraint of the series of the methodXXX2.2Properties and characteristicsPhysical basics of the methodXXXPenetrant:XXXXX• ViscosityXXXX• FlashpointXXXX• Bleed outXXXX• CapillarityXXXX• Contact angleXXXX• Vapour pressureXXXX• Variable values of roughness:XXX• Variable values of roughness:XXX	• Dry       X       X       X         2.2       Properties and characteristics       Physical basics of the method       X       X         Penetrant:       X       Viscosity       X       X       X         • Viscosity       X       X       X       X         • Flashpoint       X       X       X       X         • Capillarity       X       X       X       X         • Contact angle       X       X       X       X         • Vapour pressure       X       X       X       X         • Variable values of roughness ( $R_a + R_z$ )       Influence of material roughness ( $r_6$ foundry with machining)       X       X         • Signal-to-noise ratio concept       X       X       X         • Residual background noise (over/under washing risks)       X       X       X         • Emulsification of penetrant       X       X       X         • Cleaner       X       X       X       X			Developer:	Х	Х	Х
2.2Properties and characteristicsPhysical basics of the methodXXXPenetrant:XXXX $\cdot$ ViscosityXXXX $\cdot$ FlashpointXXXX $\cdot$ Bleed outXXXX $\cdot$ CapillarityXXXX $\cdot$ Superficial tensionXXX $\cdot$ Contact angleXXX $\cdot$ Vapour pressureXXX $\cdot$ Influence of material roughness: $\cdot$ Variable values of roughness ( $R_a + R_2$ ) $\cdot$ $\cdot$ X	Properties and characteristicsPhysical basics of the methodXXXPenetrant:XXXX• ViscosityXXXX• ViscosityXXXX• FlashpointXXXX• Bleed outXXXX• CapillarityXXXX• Cuptificial tensionXXXX• Contact angleXXXX• Vapour pressureXXXX• Vapour pressureXXXX• Variable values of roughness ( $n_{a} + R_{z}$ )Influence of material roughness:XX• Signal-to-noise ratio conceptXXXX• Residual background noise (over/under washing risks)XXX• CleanerXXXX			Wet (aqueous and non-aqueous)	Х	Х	Х
characteristicsPenetrant:XXX $V$ viscosityXXXX $V$ viscosity $X$ XXX $F$ FlashpointXXXX $Bleed out$ XXXX $Capillarity$ XXXX $Superficial tension$ XXX $Contact angle$ XXX $Vapour pressure$ XXX $Influence of material roughness: (R_a + R_z)KXX$	CharacteristicsPenetrant:XXXPenetrant:ViscosityXXXViscosityXXXXFlashpointXXXXBleed outXXXXCapillarityXXXXSuperficial tensionXXXXContact angleXXXXVapour pressureXXXXInfluence of material roughness:XXXVariable values of roughness ( $R_a + R_2$ )IXXComponents with multiple roughness ( $ie$ foundry with machining)XXXSignal-to-noise ratio conceptXXXXResidual background noise (over/under washing risks)XXXCleanerXXXX			• Dry	Х	Х	Х
• ViscosityXXX• ViscosityXXX• FlashpointXXX• Bleed outXXX• CapillarityXXX• Superficial tensionXXX• Contact angleXXX• Vapour pressureXXXInfluence of material roughness:XXX• Variable values of roughness ( $R_a + R_z$ ) $\ldots$ $\ldots$ X	ViscosityXXX $\cdot$ ViscosityXXX $\cdot$ FlashpointXXX $\cdot$ Bleed outXXX $\cdot$ CapillarityXXX $\cdot$ CapillarityXXX $\cdot$ Superficial tensionXXX $\cdot$ Contact angleXXX $\cdot$ Contact angleXXX $\cdot$ Vapour pressureXXX $\cdot$ Variable values of roughness:XXX $\cdot$ Variable values of roughness ( $R_a + R_a$ ) $\cdot$ XX $\cdot$ Components with multiple roughness ( $ie$ foundry with machining) $\cdot$ XX $\cdot$ Signal-to-noise ratio conceptXXXX $\cdot$ Residual background noise (over/under washing risks)XXX $\cdot$ CleanerXXXX	2.2	Properties and	Physical basics of the method	Х	Х	Х
• FlashpointXX• Bleed outXX• CapillarityXX• CapillarityXX• Superficial tensionXX• Contact angleXX• Vapour pressureXX• Vapour pressureXX• Name of material roughness:XX• Variable values of roughness ( $R_a + R_z$ )Image of the second sec	• FlashpointXX• Bleed outXX• CapillarityXX• CapillarityXX• Superficial tensionXX• Contact angleXX• Vapour pressureXXVapour pressureXX• Variable values of roughness ( $R_a + R_z$ )Influence of material roughness ( $R_a + R_z$ )Influence• Variable values of roughness ( $R_a + R_z$ )InfluenceXX• Components with multiple roughness ( $R_i$ of $R_i$ )XXX• Signal-to-noise ratio conceptXXX• Residual background noise (over/under washing risks)XXX• Emulsification of penetrantXXX• CleanerXXXX		characteristics	Penetrant:	Х	Х	Х
• Bleed outXX• CapillarityXX• Superficial tensionXX• Contact angleXX• Contact angleXX• Vapour pressureXXInfluence of material roughness:XX• Variable values of roughness ( $R_a + R_z$ )Image: State S	• Bleed outXX• CapillarityXX• Superficial tensionXX• Contact angleXX• Vapour pressureXX• Vapour pressureXX• Variable values of roughness:-X• Variable values of roughness ( $R_a + R_2$ )• Signal-to-noise ratio conceptXX• Residual background noise (over/under washing risks)XX• CleanerXXX			• Viscosity	Х	Х	Х
• CapillarityXX• Superficial tensionXXX• Contact angleXXX• Vapour pressureXXXInfluence of material roughness:XXX• Variable values of roughness $(R_a + R_z)$ Image: Second Sec	• CapillarityXX• Superficial tensionXXX• Contact angleXXX• Vapour pressureXXX• Variable values of roughness:XXX• Variable values of roughness ( $R_a + R_z$ )InfluenceXX• Components with multiple roughness ( <i>ie</i> foundry with machining)XXX• Signal-to-noise ratio conceptXXXX• Residual background noise (over/under washing risks)XXX• Emulsification of penetrantXXXX• CleanerXXXXX			Flashpoint	Х	Х	
Superficial tensionXXX• Contact angleXXX• Vapour pressureXXXInfluence of material roughness:XXX• Variable values of roughness $(R_a + R_z)$ $\cdot$ $\cdot$ X	• Superficial tensionXXX• Contact angleXXX• Vapour pressureXXX• Vapour pressureXXXInfluence of material roughness:XXX• Variable values of roughness ( $R_a + R_z$ )Image: Components with multiple roughness ( $ie$ foundry with machining)Image: Components with multiple roughness ( $ie$ foundry with machining)XX• Signal-to-noise ratio conceptXXXX• Residual background noise (over/under washing risks)XXX• Emulsification of penetrantXXXX• CleanerXXXXX			Bleed out	Х	Х	
• Contact angleXXX• Vapour pressureXXXInfluence of material roughness:XXX• Variable values of roughness $(R_a + R_z)$ $\cdot$ XX	• Contact angleXXX• Vapour pressureXXXInfluence of material roughness:XXX• Variable values of roughness ( $R_a + R_z$ )XXX• Components with multiple roughness ( <i>ie</i> foundry with machining)XXX• Signal-to-noise ratio conceptXXXX• Residual background noise (over/under washing risks)XXXX• CleanerXXXXXX			Capillarity	Х	Х	
• Vapour pressureXXXInfluence of material roughness:XX• Variable values of roughness $(R_a + R_z)$ XX	• Vapour pressureXXX• Vapour pressureXXXInfluence of material roughness:XXX• Variable values of roughness ( $R_a + R_2$ )Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image: Components with multiple roughness ( <i>ie</i> foundry with machining)Image:			Superficial tension	Х	Х	Х
Influence of material roughness:XXVariable values of roughness $(R_a + R_z)$ X	Influence of material roughness:XXVariable values of roughness ( $R_a + R_z$ )XXComponents with multiple roughness ( <i>ie</i> foundry with machining)XXSignal-to-noise ratio conceptXXXResidual background noise (over/under washing risks)XXXEmulsification of penetrantXXXCleanerXXXX			Contact angle	Х	Х	Х
• Variable values of roughness $(R_a + R_z)$ X	• Variable values of roughness ( $R_a + R_z$ )X• Components with multiple roughness (ie foundry with machining)XX• Signal-to-noise ratio conceptXXX• Residual background noise (over/under washing risks)XXX• Emulsification of penetrantXXX• CleanerXXX			Vapour pressure	Х	Х	Х
	<ul> <li>Components with multiple roughness (<i>ie</i> foundry with machining)</li> <li>Signal-to-noise ratio concept</li> <li>Residual background noise (over/under washing risks)</li> <li>X</li> <li>X</li></ul>			Influence of material roughness:		Х	Х
Components with multiple roughness (ie foundry with machining)     X	• Signal-to-noise ratio conceptXXX• Residual background noise (over/under washing risks)XXX• Emulsification of penetrantXXX• CleanerXXX			• Variable values of roughness $(R_a + R_z)$			Х
Components with multiple rough less (croaniary with much lining)	<ul> <li>Residual background noise (over/under washing risks)</li> <li>X</li> <li>X&lt;</li></ul>			• Components with multiple roughness ( <i>ie</i> foundry with machining)			Х
Signal-to-noise ratio concept     X     X     X     X	• Emulsification of penetrantXXX• CleanerXXX			Signal-to-noise ratio concept	Х	Х	Х
Residual background noise (over/under washing risks) X X X	Cleaner X X X			Residual background noise (over/under washing risks)	Х	Х	Х
Emulsification of penetrant     X     X     X     X				Emulsification of penetrant	Х	Х	Х
Cleaner     X     X     X     X				• Cleaner	Х	Х	Х
	Developer     X X X			Developer	Х	Х	Х

#### PCN syllabus - Penetrant testing (PT)

3	Product knowledge and c	apabilities	Level 1	Level 2	Level 3
3.1		Test conditions:	Х	Х	Х
		Lighting in work and surrounding areas		Х	
		Adaption to black light environment		Х	
		• Transition between bright and darkened areas		Х	
		Viewing conditions:	Х	Х	Х
		Performance of penetrant based on temperature		х	
		Role of adaptation to darkened environment		Х	
		Cleanliness		х	
		<ul> <li>Modulation (increase) of lighting and adaptation period to darkened environment according to age of inspector</li> </ul>			х
		Technique selection		Х	Х
		Technique application	Х	Х	Х
3.2	Typical defects	Castings	Х	Х	Х
	according to the	Forgings	Х	Х	Х
	production process	Welding	Х	Х	Х
		Wrought products	Х	Х	Х
4	Equipment		Level 1	Level 2	Level 3
4.1	Design and operation of	Aerosol spray cans:	Х	Х	Х
	penetrant installations	<ul> <li>Compressed gas, liquefied gas, 'atomisation'</li> </ul>			х
	and units	Dip tanks	Х	Х	Х
		Electrostatic systems, fluidised bed		х	Х
		Semi-automatic systems		Х	Х
		Automatic systems		Х	Х
		Application	Х	Х	Х
		Light sources:	Х	х	
		Introduction to actinic blue		Х	
		<ul> <li>Physiological human factor knowledge of aspects related to lighting</li> </ul>			х
		Quality of LED products			Х
		Measuring units:	Х	Х	
		Basics of metrology		Х	
		Metrological uncertainties			Х
		Reference blocks:	Х	Х	
		Minimum quality required for a reference photo		Х	Х
		Viewing conditions	Х	Х	
5	Information prior to testi	-	Level 1	Level 2	Level 3
5.1	Information about the	Identification or designation material:	Х	Х	Х
	test object	Object to be tested	Х	Х	Х
		Kind of manufacture	Х	Х	Х
		Catalogue of defects		Х	Х
		Extent of test coverage	Х	Х	Х
5.2	Test conditions and	Accessibility		Х	Х
	application of standard	Infrastructure			Х
		Particular test conditions:		Х	Х
		Actinic blue			х
		Application standard		Х	Х
		Stage of manufacture or service life when testing is to be carried out			х

5.2		Standards assigned to the test object		Х	Х
(continued)		Requirements of test personnel		X	X
(		Acceptance criteria		~	X
5.3	Technique and sequence	Surface condition		Х	Λ
5.5	of performing test	Surface preparation:		X	
	······································	<ul> <li>Differences between aqueous alkaline degreaser and water</li> </ul>		~	
		based/solvent		Х	
		<ul> <li>Danger of borates and silicate in water-based cleaners – soaps</li> </ul>			Х
		Post-test documentation		Х	
5.4	Instructions	Preparation of written procedure			Х
		Preparation of written instruction		Х	
		Documents			Х
		Presentation of the standards, codes and procedures			Х
6	Testing		Level 1	Level 2	Level 3
6.1	Preparation and	Performing inspection in accordance with written instruction	Х		
	performance of the test	Supervision of personnel		Х	Х
6.2	Parameters	Preparation of the parts and influence of the surface quality:	Х	Х	Х
		Surface preparation	Х	Х	
		Cleaning	Х	Х	
		Technique:		Х	Х
		Selection		Х	Х
		Correct use	Х	Х	Х
		Planning of the test:		Х	
		• Grids		Х	
		Coverage		Х	
		Detecting medium:	Х	Х	Х
		Correct use	Х	Х	
		Correct selection		Х	Х
		Viewing conditions	Х	Х	Х
		Observation and indications	Х	Х	
		Recording of discontinuities	Х	Х	
		Reporting (including length and breadth of indications)	Х	Х	
		Interpretation of indications		Х	Х
		Labelling and disposition of tested product		Х	Х
		Cleaning of components	Х	Х	
7	Evaluation and reporting		Level 1	Level 2	Level 3
7.1	Test report	Viewing conditions	Х	х	х
		Reference block No 1		Х	Х
		Reference block No 2:	Х	Х	Х
		• Differences between progressive and non-progressive panels			Х
		Statistical aspects of analysed parameters to revalidate penetrant use			Х
		Verification of indication quality:	Х	Х	X
		Use of reference photographs to validate visual conditions		х	
		Report of simple welding, forging rolled products and casting			
		imperfections	Х		
		Other reference blocks used		Х	Х
		Adjustment of test units batch test report		Х	Х
7.2	Evaluation	Report of discontinuities		Х	

8	Assessment		Level 1	Level 2	Level 3
8.1	Assessment of	Influence of manufacture and material		Х	Х
	discontinuities	Depth		Х	Х
		Width		х	Х
		Shape		х	Х
		Position		х	Х
		Orientation		X	X
9	Ouality aspects		Level 1	Level 2	Level 3
	8.1Assessment of discontinuities9Quality aspects9.1Personnel qualification9.2Documentation9.3Knowledge of applicable product standards9.4Relevant standards10Environmental and safety	ISO 9712	Х	Х	Х
		Other NDT qualification and certification systems			Х
9.2		Format and scope of working procedures			X
		Qualification of NDT procedures			X
		Authorisations (NDT instruction, procedures and personnel)			X
		Developing written instruction		Х	~
		Working correctly to written instructions	Х	~	
			^	V	V
		Traceability of documents		X	X
		Reliability of documents		X	Х
9.3		Correct technique selection		X	
		Use of correct test parameters		X	Х
	product standards	NDT method selection		Х	Х
		Job-specific training	Х	Х	Х
		Equipment verification	Х	Х	Х
9.4	Relevant standards	Please refer to PCN24 standards document			Х
10	Environmental and safety	y conditions	Level 1	Level 2	Level 3
10.1	Chemicals	Chemical handling (aerosols/propellants)	Х	Х	Х
		Disposal:	Х	Х	Х
		Penetrant	Х	Х	Х
		• Developer	Х	Х	Х
		Emulsifier	Х	Х	
		Soluble remover			Х
		Material of process excess removal	Х	Х	
		Active carbon method		Х	
		Ultrafiltration method		х	
		Material safety data sheet	Х		
		Review of applicable NDT application and product standard			Х
10.2	Accessories	Violet and UV radiation hazards	Х	Х	X
10.2		Dangers of white lights	X	X	X
		Electrical hazards	X	X	X
		UV filters	X	X	~
		Vision considerations	X	X	Х
10.2	Human fastara	Protective glasses	Х	Х	X
10.3	Human factors	Extended stay in dark areas			X
	Develop	Role of breaks			X
11	Developments		Level 1	Level 2	Level 3
11.1	Developments	Special installations		X	
		Automotive installations		Х	
		Creative and innovative special installations			Х
		Tube installations			Х

Syllabus					
reference number	Title	Module subcontent	Film ra	diograph	y (RI-F)
1	Terminology and history	of RT	Level 1	Level 2	Level 3
1.1	History	History and discovery of radiographic materials, X-rays	Х	Х	Х
1.2	Purpose of NDT	What is testing?	Х	Х	Х
	•	What is the purpose of NDT?	х	Х	х
		At what stage of life is NDT performed on a product?	Х	Х	Х
		How does it add value?	х	Х	х
		Who may carry out NDT?	Х	Х	Х
		Main NDT methods	х	Х	х
1.3	Purpose of RT	Definition	Х	Х	Х
		Applicability and limitations	Х	Х	х
1.4	Terminology	Electromagnetic radiation	Х	Х	Х
		Energy	Х	Х	Х
		Dose	Х	Х	Х
		Dose rate	Х	Х	Х
		Wavelength	Х	Х	Х
		Intensity	Х	Х	Х
		Dose rate constant	Х	Х	Х
		Activity	Х	Х	Х
1.5	Relevant standards	Please refer to PCN24 standards document		Х	Х
2	Physical principles and as	sociated knowledge	Level 1	Level 2	Level 3
2.1	General	Structure of the atom	Х	Х	Х
		Electromagnetic spectrum	Х	Х	Х
		Sources of radiation and its properties:			
		• X-rays	Х	Х	Х
		Gamma rays	Х	Х	Х
		Neutrons			Х
		X-ray and gamma ray spectrum	Х	Х	Х
		Essential radiographic parameters:			
		• Voltage	Х	Х	Х
		Current	Х	Х	Х
		Activity	Х	Х	Х
		Radiation filters		Х	Х
		Focal spot	Х	Х	Х
		Dose	Х	Х	Х
		Dose rate	Х	Х	Х
		Dose rate constant	Х	Х	Х
2.2	Attenuation of radiation	General mechanism of interaction:			
		Photoelectric effect	Х	Х	Х
		Compton effect	Х	Х	Х
		Pair production	Х	Х	Х
		HVL, TVL and attenuation law	Х	Х	Х
		Hardening of radiation	Х	Х	Х
		Scattered radiation and build-up factor	Х	Х	Х

#### PCN syllabus - Radiography (RT-F - Film)

2.2		Filtering and collimation	Х	Х	Х
(continued)		X-ray fluorescence	~	X	X
. ,		Attenuation of neutrons and electrons		~	X
2.3	Radiation contrast and	Contrast, noise, granularity	Х	Х	X
2.5		Specific contrast	~	X	X
		Scatter influence	Х	X	X
	Radiation contrast and noise Optimisation of image quality Geometrical projection conditions Image quality indicators Product knowledge and General defects				
2.4	Ontinization of image	Unsharpness Castha masteria	X	X	X
2.4		Scatter protection	Х	X	X
2.5		Maximum/optimum X-ray voltage	X	X	X
2.5		Geometrical and inherent unsharpness	Х	X	X
	conditions	Geometrical magnification		X	X
		Effect of magnification		Х	Х
		Optimum magnification			Х
		Difference between radiography and radioscopy		Х	Х
	2.6 Image quality indicators	Law of the squared distance	Х	Х	Х
2.6	Image quality indicators	Wire type	Х	Х	Х
		Step hole type	Х	Х	Х
		Plate hole type	Х	Х	Х
		Duplex wire type	Х	Х	Х
		Measurement of basic spatial resolution		Х	Х
		Measurement of total unsharpness		Х	Х
		Converging line pairs			Х
		Line pair gauges (MTF)			Х
3	Product knowledge and	capabilities	Level 1	Level 2	Level 3
3.1	General defects	Processes overview:			
		Casting		Х	Х
				Λ	
		• Forging		X	Х
		<ul><li>Forging</li><li>Welding</li></ul>			
				Х	Х
		Welding		X X	X X
		<ul><li>Welding</li><li>Tubes and pipes</li></ul>		X X X	X X X
		<ul><li>Welding</li><li>Tubes and pipes</li><li>Wrought products</li></ul>		X X X X	X X X X
		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> </ul>	X	X X X X X X	X X X X X X
		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> </ul>	X	X X X X X X X	X X X X X X X
		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> </ul>	X	X X X X X X X	X X X X X X X X
		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> </ul>	X	X X X X X X X	X X X X X X X X X
		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> </ul>	X	X X X X X X X X	X X X X X X X X X X X
		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> <li>Material properties</li> </ul>	X	X X X X X X X X	X X X X X X X X X X X X X
3.2	Influence on	<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> <li>Material properties</li> <li>Origin of defects</li> </ul>	X	X X X X X X X X X X	X X X X X X X X X X X X
3.2	Influence on detectability	<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> <li>Material properties</li> <li>Origin of defects</li> <li>Evaluation</li> </ul>		X X X X X X X X X X X X X	X X X X X X X X X X X X X X
3.2		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> <li>Material properties</li> <li>Origin of defects</li> <li>Evaluation</li> <li>Type of defect</li> </ul>	X	X X X X X X X X X X X X	X X X X X X X X X X X X X X
3.2		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> <li>Material properties</li> <li>Origin of defects</li> <li>Evaluation</li> <li>Type of defect</li> <li>Size</li> </ul>	X X	X X X X X X X X X X X X X X X	X X X X X X X X X X X X X X X X X
3.2		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> <li>Material properties</li> <li>Origin of defects</li> <li>Evaluation</li> <li>Type of defect</li> <li>Size</li> <li>Orientation</li> </ul>	X X	X X X X X X X X X X X X X X X X	X X X X X X X X X X X X X X X X
3.2		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> <li>Material properties</li> <li>Origin of defects</li> <li>Evaluation</li> <li>Type of defect</li> <li>Size</li> <li>Orientation</li> <li>Number of exposures</li> </ul>	X X X X	X X X X X X X X X X X X X X X X X X	X X X X X X X X X X X X X X X X X X X
3.2		<ul> <li>Welding</li> <li>Tubes and pipes</li> <li>Wrought products</li> <li>Corrosion assessment</li> <li>Composite materials</li> <li>Types of discontinuity</li> <li>Fracture mechanics</li> <li>Working load</li> <li>Material properties</li> <li>Origin of defects</li> <li>Evaluation</li> <li>Type of defect</li> <li>Size</li> <li>Orientation</li> <li>Number of exposures</li> <li>Beam direction</li> </ul>	X X X X	X X X X X X X X X X X X X X X X X X	X X X X X X X X X X X X X X X X X X X

4	Equipment		Level 1	Level 2	Level 3
4.1	Radiation sources –	Standard sources:			
	X-ray sources	• Types of source	Х	Х	Х
		Stationary <i>versus</i> mobile	Х	Х	Х
		<ul> <li>Construction and function of X-ray tubes</li> </ul>	Х	х	Х
		Unipolar versus bipolar		Х	Х
		Special sources		Х	Х
		Generation of high voltage		Х	Х
		Cooling	Х	Х	Х
		Handling	Х	Х	Х
		Parameters:			
		• kV	Х	Х	Х
		• mA	Х	Х	Х
		Focal spot size	Х	Х	Х
		Measurement of parameters		Х	Х
4.2	Radiation sources –	Container:			
	gamma sources	• Shielding	Х	Х	Х
		Classes of containers			Х
		Transportation	Х	Х	Х
		Source holder and capsule:			
		Handling and projection	Х	Х	Х
		Special design		Х	Х
		Collimation	Х	Х	Х
		Parameters:			
		Isotope type	Х	Х	Х
		• Spectrum	Х	Х	Х
		• Energy	Х	Х	Х
		Activity	Х	Х	Х
		Source size	Х	Х	Х
		Half life	Х	Х	Х
4.3	Film	Construction:	Х	Х	Х
		Latent image information origin	Х	Х	Х
		Base, emulsion, silver bromide, grain size, grain form	Х	Х	Х
		Photo process	Х	Х	Х
		Processing:			
		Properties of film systems	Х	Х	Х
		Characteristic curve	Х	Х	Х
		Film gradient, film contrast, speed	Х	Х	Х
		Influence of film processing	Х	Х	Х
		Sensitivity	Х	Х	Х
		Granularity	Х	Х	Х
		Detail perceptibility		Х	Х
		Classification of film systems	Х	Х	Х
		Quality assurance with film test strips		Х	Х
		Film screens:			
		Types of screen	Х	Х	Х
		<ul> <li>Inherent unsharpness</li> </ul>	Х	Х	Х

4.2		• Internet in a offeret	V	V	V
4.3 (continued)		<ul><li>Intensifying effect</li><li>Effect of filtering</li></ul>	X X	X X	X X
(continued)		Screens for Cobalt 60 and LINAC	X		X
		Working with exposure charts	X	X X	X
4.4	Film development and	Darkroom design	X	X	X
4.4	darkroom conditions	Manual versus machine development	X	X	X
		Baths:	~	~	~
		<ul> <li>Different baths</li> </ul>	Х	Х	Х
		Quality assurance in the darkroom	X	X	X
		Developing process:	~		Λ
		Principles	Х	Х	Х
		<ul> <li>Processing equipment, adjustment</li> </ul>	X	X	X
		Checking	X	X	X
		Storage of unexposed films	X	X	Х
		Darkroom light test	Х	X	Х
		Fog test	Х	Х	х
		Clearing time	Х	Х	Х
		Tally sheet	х	Х	х
		Use of test film strips		Х	Х
4.5	Film digitisation	Scanner design:			
		Camera based		Х	Х
		Line scanners		Х	Х
		Laser scanners		Х	Х
		Quality assurance (phantom)		Х	Х
		Handling, archiving		Х	Х
		System selection			Х
		Classification		Х	Х
4.6	Accessories	Equipment:			
		Lead letters and tape	Х	Х	Х
		Holding magnets	Х	Х	Х
		<ul> <li>Lead shielding, collimation, masking</li> </ul>	Х	Х	Х
		Rubber bands	Х	Х	Х
		Radiation protection equipment	Х	Х	Х
5	Information prior to testi		Level 1	Level 2	Level 3
5.1	Information about the	Identification or designation material:			
	test object	Object to be tested	Х	Х	Х
		Kind of manufacture	Х	Х	Х
		Catalogue of defects		Х	Х
	<b>T</b> 1 111	Extent of test coverage	Х	X	X
5.2	Test conditions and	Accessibility		X	X
	application of standard	Infrastructure		X	X
		Particular test conditions		X	X
		Application standard		X	X
		Stage of manufacture or service life when testing is to be carried out		X	X
		Standards assigned to the test object		X	X
		Requirements of test personnel		X	X
		Acceptance criteria		Х	Х

5.3	Technique and sequence	Surface condition		Х	Х
5.5	of performing test	Surface preparation		X	X
		Post-test documentation		X	X
5.4	Instructions	Preparation of written procedure		~	X
		Preparation of written instruction		Х	X
		Performing inspection in accordance with written instruction	Х	X	X
		Presentation of the standards, codes and procedures	Л		Х
6	Testing	resentation of the standards, codes and procedures	Level 1	Level 2	Level 3
6.1	Standard practice and	Selection of technique:			Levers
0.1	evaluation standards	Different exposure geometries		Х	Х
		Interpretation of images		X	X
		Evaluation of flaws		X	Х
		Use of catalogues		X	X
		Measurement of flaw dimensions		X	X
7	Evaluation and reporting		Level 1	Level 2	Level 3
7.1	Basics of evaluation	Viewing conditions:	Lever		Levers
	busies of evaluation	Room condition	Х	Х	Х
		Viewing time	X	X	X
		Lapsed time after dazzling	X	X	X
		Luminance	~	X	X
		Density measurement	Х	X	X
		Mach effect	~	X	X
		Film illuminator:		Λ	Χ
		Introduction	Х	Х	Х
		Minimum luminance	^	X	X
				X	X
		Homogeneity factor Measurement tools:		X	X
		Linear scales		X	X
		Magnifiers		X	X
		<ul><li>Measurement of flaw length</li><li>Measurement of areas</li></ul>		X X	X
					X
7 2	Dhysical factors	Measurement of depth		X	X
7.2	Physical factors	Eyesight		X	X
7.2	Evaluation of	Adaption prior viewing	V	X	X
7.3	radiographs	Verification of the image quality	Х	X	X
7 4		Report of imperfections		X	X
7.4	Test report	Complies with examination standard		X	X
		Conformed to test quality Achieved test class	V	X	X
			X	X	X
8	Association	Achieved diagnostic coverage of test object	X Level 1	X Level 2	X Level 3
8.1	Assessment Classification of	Туре	Level T	Level 2 X	Level 3 X
0.1	imperfections	Size		X	X
		Localisation			X
				X X	X
		Frequency Influence of manufacture and material		X	X
		innuence of manufacture and material		Λ	Λ

9	Quality aspects		Level 1	Level 2	Level 3
9.1	Personnel qualification	ISO 9712	Х	Х	Х
		Other NDT qualification and certification systems			Х
9.2	Documentation	Format and scope of working procedures			Х
		Qualification of NDT procedures			Х
		Authorisations (NDT instruction, procedures and personnel)			Х
		Developing written instruction		Х	Х
		Working correctly to written instruction	Х		
		Traceability of documents		Х	Х
		Reliability of measurements		Х	Х
9.3	Knowledge of applicable	Correct technique selection		Х	Х
	NDT application and	Use of correct test parameters		Х	Х
	product standards	NDT method selection			Х
		Job-specific training		Х	Х
		Equipment verification		Х	Х
10	Developments		Level 1	Level 2	Level 3
10.1	Special techniques	Stereo radiography		Х	Х
		Backscatter radiography			Х
		Phase contrast X-ray imaging			Х
		Computed tomography (CT):			Х
		Introduction			Х
		Applications			Х
		Requirements, limitations			Х
		RT-F versus RT-D		Х	Х

## PCN syllabus – Digital radiography (RT-D – Computed and digital)

Syllabus reference number	Title	Module subcontent	Digital radiography (RT-D)		aphy
1	Terminology and history	of RT	Level 1	Level 2	Level 3
1.1	History	History and discovery of radiographic materials, X-rays	Х	Х	Х
1.2	Purpose of NDT	What is testing?	Х	Х	Х
		What is the purpose of NDT?	Х	Х	Х
		At what stage of life is NDT performed on a product?	Х	Х	Х
		How does it add value?	Х	Х	Х
		Who may carry out NDT?	Х	Х	Х
		Main NDT methods	Х	Х	Х
1.3	Purpose of RT	Definition	Х	Х	Х
		Applicability and limitations	Х	Х	Х
1.4	Terminology	Electromagnetic radiation	Х	Х	Х
		Energy	Х	Х	Х
		Dose	Х	Х	Х
		Dose rate	Х	Х	Х
		Wavelength	Х	Х	Х
		Intensity	Х	Х	Х
		Dose rate constant	Х	Х	Х
		Activity	Х	Х	Х
1.5	Relevant standards	Please refer to PCN24 standards document		Х	Х

2	Physical principles and a	ssociated knowledge	Level 1	Level 2	Level 3
2.1	General	Structure of the atom	Х	Х	Х
		Electromagnetic spectrum	Х	Х	Х
		Sources of radiation and its properties:			
		• X-rays	Х	х	Х
		Gamma rays	Х	Х	Х
		Neutrons			Х
		X-ray and gamma ray spectrum	Х	х	Х
		Essential radiographic parameters:			
		Voltage	Х	Х	Х
		Current	х	х	Х
		Activity	Х	х	Х
		Radiation filters		х	Х
		Focal spot	Х	х	Х
		Dose	х	х	Х
		Dose rate	Х	х	Х
		Dose rate constant		х	Х
2.2	Attenuation of radiation	General mechanism of interaction:			
		Photoelectric effect	х	х	Х
		Compton effect	Х	Х	Х
		Pair production		х	Х
		HVL, TVL and attenuation law	Х	х	Х
		Hardening of radiation	Х	х	Х
		Scattered radiation and build-up factor	Х	х	Х
		Filtering and collimation	Х	Х	Х
		X-ray fluorescence	Х		Х
		Attenuation of neutrons and electrons			Х
2.3	Radiation contrast and	Contrast, noise, granularity	Х	Х	Х
	noise	Specific contrast		Х	Х
		Scatter influence	Х	Х	Х
		Signal-to-noise ratio (SNR)	Х	Х	Х
		Contrast-to-noise ratio		Х	Х
		Unsharpness	Х	Х	Х
		Basic spatial resolution	Х	Х	Х
		Pixel size	Х	Х	Х
		Normalised SNR (SNR <sub>N</sub> )	Х	Х	Х
2.4	Optimisation of image	Compensation principles:			
	quality	Contrast <i>versus</i> SNR		Х	Х
		Basic spatial resolution versus SNR		х	Х
		Local unsharpness versus SNR		Х	Х
		Scatter protection	Х	Х	Х
		Maximum/optimum X-ray voltage		Х	Х
2.5	Geometrical projection	Geometrical and inherent unsharpness	Х	Х	Х
	conditions	Geometrical magnification		Х	Х
		Effect of magnification	Х	Х	Х
		Optimum magnification		Х	Х
		Difference between radiography and radioscopy		Х	Х
		Law of the squared distance	Х	Х	Х

2.6	Image quality indicators	Wire type	Х	Х	Х
		Step hole type	Х	х	Х
		Plate hole type	Х	х	Х
		Duplex wire type	Х	Х	Х
		Measurement of basic spatial resolution		Х	Х
		Measurement of total unsharpness		Х	Х
		Converging line pairs		Х	Х
		Line pair gauges (MTF)			Х
3	Product knowledge and c	capabilities	Level 1	Level 2	Level 3
3.1	3.1 General defects	Processes overview:			
		Casting		Х	Х
		• Forging		Х	Х
		Welding		Х	Х
		Tubes and pipes		Х	Х
		Wrought products		Х	Х
		Corrosion assessment		Х	Х
		Composite materials		Х	Х
		Types of discontinuity	Х	Х	Х
		Fracture mechanics			X
		Working load		X	X
		Material properties		X	X
		Origin of defects Evaluation		X X	X X
3.2	Influence on	Type of defect	Х	X	X
5.2	detectability	Size	X	X	X
	· ·	Orientation	X	X	X
		Number of exposures		X	X
		Beam direction	Х	X	X
		Increase in wall thickness		X	X
		Thickness ranges for X- and gamma rays		х	Х
		Number of exposures <i>versus</i> distortion angle (tubes and pipes)		Х	Х
4	Equipment	pipes)	Level 1	Level 2	Level 3
4.1	Radiation sources – X-ray	Standard sources:	Lever	Level 2	Level 5
	sources	Types of source	Х	Х	Х
		Stationary versus mobile	X	X	X
		<ul> <li>Construction and function of X-ray tubes</li> </ul>	X	X	X
		Unipolar versus bipolar		X	X
		Special sources		х	Х
		Generation of high voltage		X	X
		Cooling	Х	Х	Х
		Handling	Х	Х	Х
		Parameters:			
		• kV	Х	Х	Х
		• mA	х	Х	Х
		Spot size	Х	Х	Х
		Measurement of parameters		Х	Х

4.2	Radiation sources –	Container:			
	gamma sources	Shielding	Х	Х	Х
		Classes of containers			Х
		Transportation	Х	Х	Х
		Source holder and capsule:			
		Handling and projection	Х	Х	х
		Special design		X	X
		Collimation	х	X	X
		Parameters:		~	
		Isotope type	х	Х	Х
		Spectrum	X	Х	X
		Energy	X	X	X
		Activity	X	X	X
		Source size	X	X	X
		Half life	X	Х	X
4.3	Film	Construction:		~	
		Latent image information origin			Х
		<ul> <li>Base, emulsion, silver bromide, grain size, grain form</li> </ul>			X
		<ul> <li>Photo process</li> </ul>			X
		Processing:			
		<ul> <li>Properties of film systems</li> </ul>			Х
		Optical density			X
		Characteristic curve			X
		<ul> <li>Film gradient, film contrast, speed</li> </ul>			X
4.4	Computer radiography	Phosphor imaging plates:			
	(CR), imaging plates	<ul> <li>Introduction</li> </ul>	Х	Х	х
		Design	X	Х	X
		Imaging plate and CR scanner	X	Х	X
		CR system and classification		Х	X
		Quality assurance (phantom)		Х	X
		Exposure conditions	Х	Х	X
		Working with exposure charts	Х	Х	Х
		Handling	Х	Х	Х
		System selection		Х	Х
4.5	Digital detector arrays	Digital detector arrays (DDAs):			
	(DDAs)	<ul> <li>Introduction</li> </ul>	Х	Х	х
		• Design	Х	Х	Х
		Indirect converting		Х	Х
		Direct converting		Х	Х
		CCD, amorphous silicon, CMOS		Х	Х
		Detector adjustment		Х	Х
		Quality assurance		Х	Х
		Exposure conditions		Х	Х
		Handling	Х	Х	Х
		System selection			Х
4.6	Line detector arrays	Line detector arrays (LDAs):			
	(LDAs)	Introduction	Х	Х	Х
		• Design		Х	Х

4.6		Application areas		Х	Х
(continued)		Comparison to DDAs		X	X
(continued)				X	X
		Quality assurance (phantom) Exposure conditions and diagrams		X	X
		Handling		X	X
		System selection		^	X
4.7	Intensifiers, fluoroscope	Introduction			X
4.7	-				^
4.0	Film digitisation	Scanner design:			
		Camera based			
		Line scanners			V
		Laser scanners			X
		Quality assurance (phantom)			X
		Handling, archiving			X
		System selection		V	X
4.0	• ·	Classification		Х	Х
4.9	Accessories	Equipment:	X	X	X
		Lead letters and tape	X	X	X
		Holding magnets	X	X	X
		Lead shielding, collimation, masking	X	X	X
		Rubber bands	X	X	X
		Radiation protection equipment	X	X	X
4.10	Data acquisition,	A/D interface	Х	Х	Х
	detector adjustment	Computer structure:			
		Processor, memory, bus, disk	Х	Х	Х
		Load and save of digital images	Х	Х	Х
		Image formats	Х	Х	Х
		Image integration:			
		On-chip integration/frame time	Х	Х	Х
		In-memory integration/frame number	Х	Х	Х
		Optimum gain and latitude settings		Х	Х
		Accumulation versus integration		Х	Х
5	Information prior to testi	ng	Level 1	Level 2	Level 3
5.1	Information about the	Identification or designation material:	Х	Х	Х
	test object	Object to be tested	Х	Х	Х
		Kind of manufacture	Х	Х	Х
		Catalogue of defects		Х	Х
		Extent of test coverage	Х	Х	Х
5.2	Test conditions and	Accessibility		Х	Х
	application of standard	Infrastructure		Х	Х
		Particular test conditions		Х	Х
		Application standard		Х	Х
		Stage of manufacture or service life when testing is to be carried out		Х	Х
		Standards assigned to the test object		Х	Х
		Requirements of test personnel		Х	Х
		Acceptance criteria		Х	Х
5.3	Technique and sequence	Surface condition		Х	Х
	of performing test	Surface preparation		Х	Х
		Post-test documentation		Х	Х

5.4	Instructions	Preparation of written procedure			Х
		Preparation of written instruction		Х	Х
		Performing inspection in accordance with written instruction	Х		
		Presentation of the standards, codes and procedures			Х
6	Testing		Level 1	Level 2	Level 3
6.1	Standard practice and	Selection of technique:			
	evaluation standards	Different exposure geometries		Х	Х
		Interpretation of images		х	Х
		Evaluation of flaws		Х	Х
		Use of catalogues		Х	Х
		Measurement of flaw dimensions		Х	Х
7	Evaluation and reporting		Level 1	Level 2	Level 3
7.1	Basics of evaluation	Viewing conditions:			
		Room condition	Х	Х	Х
		Viewing time	Х	х	Х
		Luminance		Х	Х
		Mach effect		Х	Х
		Review monitor:	Х	Х	Х
		Introduction		х	Х
		Pixel density		Х	Х
		Bit depth		х	Х
		Brightness/luminance cd/m <sup>2</sup>		Х	Х
		<ul> <li>Contrast and min/max driving level (DDL)</li> </ul>			Х
		Gamma and GSDF			Х
		Luminance ratio			Х
		Just noticeable differences			Х
		Resolution			Х
		Colour/greyscale			Х
		Positive/negative			Х
		Monitor test patterns			Х
		Viewing angle			Х
		Monitor calibration			Х
		Monitor/viewing environment			Х
7.2	Physical factors	Eyesight		Х	Х
7.3	Evaluation of	Verification of the image quality	Х	Х	Х
	radiographs	Report of imperfections		х	Х
7.4	Test report	Complies with examination standard		х	Х
		Conformed to test quality		х	Х
		Achieved test class	Х	х	Х
		Achieved diagnostic coverage of test object	X	Х	Х
7.5	Digital image processing	Image structure, quantisation (bits and bytes)	X	X	X
	J J I I I I I I I I I I I I I I I I I I	Basic operation:			
		Picture element (pixel)	Х	Х	Х
		Grey value	X	X	X
		Point operations:	A		~
		Contrast	Х	Х	Х
		Brightness	X	X	X
		Digitiless	~	Λ	Λ

7.5		Gamma correction	Х	Х	Х
(continued)		Histogram	~	X	X
		Lookup table (LUT)		X	X
		Matrix operations, filters:		~	~
		Smoothing, improvement of SNR		Х	Х
		High pass, gradient		X	X
		Edge enhancement, line extraction		X	X
		Median		X	X
		Measurement tools:		Λ	Л
		Adjustment		Х	Х
		Line profile		X	X
		Measurement of flaw length		X	X
		Measurement of new length     Measurement of areas		X	X
		Measurement of depth		X	X
		Correction of raw data:		~	~
		Introduction		Х	х
		Linearisation, LUT			X
		Bad pixel interpolation			X
7.6	Automated image	Principles		Х	X
	interpretation	Binarisation			Х
		Measurement of dimensions		Х	Х
		Artificial Intelligence		Х	Х
8	Assessment		Level 1	Level 2	Level 3
8.1	Classification of	Туре		Х	Х
	imperfections	Size		Х	Х
		Localisation		Х	Х
		Frequency		Х	Х
		Influence of manufacture and material		Х	Х
9	Quality aspects		Level 1	Level 2	Level 3
9.1	Personnel qualification	ISO 9712	Х	Х	Х
		Other NDT qualification and certification systems			Х
9.2	Documentation	Format and scope of working procedures			Х
		Qualification of NDT procedures			Х
		Authorisations (NDT instruction, procedures and personnel)			Х
		Developing written instruction		Х	Х
		Working correctly to written instruction	Х		
		Traceability of documents		X	X
0.2		Reliability of measurements		X	X
9.3	Knowledge of applicable NDT application and	Correct technique selection		X	X
	product standards	Use of correct test parameters NDT method selection		Х	X
				V	X
		Job-specific training Equipment verification		X X	X X
10	Developments		Level 1	A Level 2	A Level 3
10.1	Special techniques	Stereo radiography	Lever	X	X
10.1	special techniques	Backscatter radiography		~	X
		Phase contrast X-ray imaging			X
		Thase contrast A-ray imaging			~

10.1		Computed tomography (CT):		
(continued)		Introduction	Х	Х
		Inspection geometry	Х	Х
		• 2D versus 3D		Х
		Reconstruction principles		Х
		Filtered back projections		Х
		Artefacts	Х	Х
	Applications	Х	Х	
		Requirements, limitations		Х
		RT-F versus RT-D	Х	Х

### PCN syllabus – Ultrasonic testing (UT)

Syllabus reference number	Title	Module subcontent	Ultrasonic testing (UT)		
1	Terminology and history	of UT	Level 1	Level 2	Level 3
1.1	History of UT	History of ultrasonic testing	Х	Х	Х
1.2	Purpose of NDT	What is testing?	Х	Х	Х
		What is the purpose of NDT?	Х	Х	Х
		At what stage of life is NDT performed on a product?	Х	Х	Х
		How does it add value?	Х	Х	Х
		Who may carry out NDT?	Х	Х	Х
		Main NDT methods	Х	Х	Х
1.3	Terminology of NDT	Please refer to PCN24 standards document	Х	Х	Х
1.4	Terminology of UT	Please refer to PCN24 standards document	Х	Х	Х
2	Physical principles and as	ssociated knowledge	Level 1	Level 2	Level 3
2.0	Relevant standards	Please refer to PCN24 standards document	Х	Х	Х
2.1	Review of mathematical	Algebra	Х	Х	
	basics	Trigonometry	Х	Х	
		Logarithms	Х	Х	
2.2	Physical definitions and	Sinusoidal movement	Х	Х	
	typical parameters	Amplitude	Х	Х	
		Period	Х	Х	
		Frequency	Х	Х	
		Velocity	Х	Х	
		Acoustic impedance	Х	Х	
		Acoustic pressure	Х	Х	
		Factors of reflection and transmission (normal beam only)	Х	Х	
		Isotropic materials	Х		Х
		Anisotropic materials		Х	Х
2.3	Waves	Sinusoidal movement	Х		
		Amplitude	Х		
		Frequency	Х		
		Wavelength	Х		
		Propagation velocity	Х		
		Longitudinal	Х	Х	

2.3 (continued)TransverseXXXRayleigh waves (surface waves)XXXXXCreeping wavesXXXXXGuided wavesXXXXXX2.4Transmission and reflectionXRXXXXXPerfectionXRXXX <th>'continued)</th>	'continued)
Creeping waves Guided wavesCreeping waves Guided wavesNNN2.4Transmission and reflectionEffects at interfaces at normal incidence: • TransmissionXXX• ReflectionXXXXXX• ReflectionXXXXXX• InterferenceXXXXXXX• DispersionXXX	
Quided waves     Image: Solution of the second	2.4
2.4     Transmission and reflection     Effects at interfaces at normal incidence:     X     X     X       0     Transmission     X     X     X     X       0     Reflection     X     X     X     X       0     Interference     X     X     X     X       0     Dispersion     X     X     X     X       0     Snell's Law     X     X     X     X       1     Transmission     X     X     X     X       0     Between velocity and elastic properties     X     X     X       0     Reflection     X     X     X       0     Mode conversion     X     X     X       1     Electrostriction     X     X     X       1     Reverse piezoelectric effect     X     X     X       1     Piezoelectric effect     X     X     X       1	2.4
reflection     Transmission     X     X       • Reflection     X     X     X       • Interference     X     X     X       • Dispersion     X     X     X       Snell's Law     X     X     X       Relation between velocity and elastic properties     X     X     X       • Transmission     X     X     X       • Transmission     X     X     X       • Transmission     X     X     X       • Reflection     X     X     X       • Mode conversion     X     X     X       • Mode conversion     X     X     X       • Mode conversion     X     X     X       • Reflection     X     X     X	
<ul> <li>Reflection</li> <li>Name</li> <li>Interference</li> <li>Dispersion</li> <li>Name</li> <li>Dispersion</li> <li>Name</li> <li>Snell's Law</li> <li>Relation between velocity and elastic properties</li> <li>Relation between velocity and elastic properties</li> <li>Transmission</li> <li>Name</li> <li>Reflection</li> <li>Rame</li> <li>Rame</li> <li>Reflection</li> <li>Rame</li> <li>Rame</li> <li>Reflection</li> <li>Rame</li> <li>Reflection</li> <li>Rame</li> <li>Ra</li></ul>	
Piezoelectric effect Nord fields of disc-shaped transduces Nord field (Freunhofer zone) Nord field (So disc-shaped transduces Nord field (Freunhofer zone) Nord field (So disc-shaped transduces Nord field (Freunhofer zone) Nord field (So disc-shaped transduces Nord field (Freunhofer zone) Nord field (So disc-shaped transduces Nord field (Freunhofer zone) Nord field (Freun	
<ul> <li>Poispersion</li> <li>N</li> <l< td=""><td></td></l<></ul>	
Snell's Law     X     X     X       Relation between velocity and elastic properties     I     X     X       Effects at interfaces at oblique incidence:     X     X     X       Transmission     X     X     X     X       Reflection     X     X     X     X       Refraction     X     X     X     X       Reflection     X     X     X     X       Mode conversion     X     X     X     X       Electrostriction     X     X     X     X       Magnetostriction     X     X     X     X       Piezoelectric effect     X     X     X       Reverse piezoelectric effect     X     X     X       Z.5     Transducer characteristics     Material     X     X       Piezoelectric constants     X     X     X       Z.6     Sound fields of disc- shaped transducers     Nar field (Fraunhofer zone)     X     X       Far field (Fraunhofer zone)     X     X     X	
Relation between velocity and elastic properties     Image: State of the state of t	
Fifects at interfaces at oblique incidence:       X       X       X         • Transmission       X       X       X       X         • Reflection       X       X       X       X         • Refraction       X       X       X       X         • Refraction       X       X       X       X         • Reflection:       X       X       X       X         • Reflection:       X       X       X       X         • Mode conversion       X       X       X       X         • Electrodynamic generation       X       X       X       X         • Electrodynamic generation       X       X       X       X         • Piezoelectric effect       X       X       X       X         • Characteristics       Material       X       X       X       X         • Piezoelectric constants       X       X <td></td>	
Intransmission (Constants)	
<ul> <li>Reflection</li> <li>Reflection</li> <li>Refraction</li> <li>Refraction</li> <li>Reflectors:</li> <li>Reflection</li> <li>Reflection</li></ul>	
<ul> <li>Refraction</li> <li>Refraction</li> <li>X</li> <lix< li=""> <li>X</li> <li>X</li></lix<></ul>	
Image: Conserve reflectors:         X         X         X         X           • Reflection         X         X         X         X           • Mode conversion         X         X         X         X           • Mode conversion         X         X         X         X           Electrostriction         X         X         X         X           Magnetostriction         Image: Second Secon	
<ul> <li>Reflection</li> <li>Mode conversion</li> <li>M</li> <li>Mode conversion</li> <li>M</li> <li>M</li></ul>	
<ul> <li>Mode conversion</li> <li>X</li> <li>X</li></ul>	
Image: Probability of the section of the se	
Magnetostriction         Magnetostriction           Electrodynamic generation         Image: Second Sec	
Electrodynamic generation       Image: Second	
Generation by laser     Image: constant of the sector of the	
Piezoelectric effectXXReverse piezoelectric effectXXX2.5Transducer characteristicsMaterialXXDimensionsXXXXFrequencyXXXXPiezoelectric constantsXXX2.6Sound fields of disc- shaped transducersNear field (Fresnel zone)XXFar field (Fraunhofer zone)XXXBeam divergenceXXX	
Reverse piezoelectric effectXXX.5Transducer characteristicsMaterialXXDimensionsXXXFrequencyXXXPiezoelectric constantsXXXSound fields of disc- shaped transducersNear field (Fresnel zone)XXFar field (Fraunhofer zone)XXXBeam divergenceXXX	
2.5       Transducer characteristics       Material       X       X       X         Dimensions       X <t< td=""><td></td></t<>	
characteristics       Dimensions       X       X       X         Frequency       X       X       X       X         Piezoelectric constants       X       X       X       X         Sound fields of disc- shaped transducers       Near field (Fresnel zone)       X       X       X       X         Eam divergence       X       X       X       X       X       X       X	2.5
2.6     Sound fields of disc- shaped transducers     Near field (Fresnel zone)     X     X       Frequency     X     X       Piezoelectric constants     X     X       Sound fields of disc- shaped transducers     Near field (Fresnel zone)     X     X       Beam divergence     X     X     X	2.5
Piezoelectric constants     X     X       2.6     Sound fields of disc- shaped transducers     Near field (Fresnel zone)     X     X       Far field (Fraunhofer zone)     X     X     X       Beam divergence     X     X     X	
2.6     Sound fields of disc- shaped transducers     Near field (Fresnel zone)     X     X       Far field (Fraunhofer zone)     X     X     X       Beam divergence     X     X     X	
shaped transducers     Far field (Fraunhofer zone)     X     X       Beam divergence     X     X	
Beam divergence     X     X	2.6
Influence of transducer frequency and diameter X X	
3 Product knowledge and capabilities Level 1 Level 2 Lev	
3.1 General defects Casting X X	3.1
Welding X X	
Wrought products (including forgings, tubes and pipes)       X       X	
Composite material X X	
3.2 Implementation of the According to products X X	3.2
testing techniques According to expected discontinuities X X	
Standards, specifications and codes     X	
3.3 Overall properties of the Influence of surface conditions X X	3.3
specimen     Geometry (additional echoes due to grazing incidence and radial straight beam incidence)     X     X	
Structure (sound attenuation) X X	
Selection of probe: X	
Inspection-oriented design of specimen	

3.3		Testing technique based on task:		Х	
(continued)		Simulations			х
4	Equipment		Level 1	Level 2	Level 3
4.1	Ultrasonic instruments	Digital instruments:	Х	Х	
		• Design	Х	Х	
		• Function	Х	Х	
		Pulse generation	Х	Х	
		Reception	Х	Х	
		Amplification	Х	Х	
		A-scan presentation	Х	Х	
		RF-signal	Х	Х	
		Rectification	Х	Х	
		Peak and flank measurement	Х	Х	
		Analogue versus digital		Х	Х
		Ultrasonic thickness gauge	Х	Х	
		Automated and semi-automated systems		Х	Х
		Manual			Х
		Speed			Х
		Incrementation			Х
		Repeatability			Х
		Sampling rate			Х
4.2	Probes	Straight beam:	Х	Х	
		• Design	Х	Х	
		Application	Х	Х	
		Angle beam:	Х	Х	
		• Design	Х	Х	
		Effects at interface wedge/specimen	Х	Х	
		Critical angles	Х	Х	
		Typical angles for testing of steel	Х	Х	
		Sound fields	Х	Х	
		Probe index	Х	Х	
		Beam angles	Х	Х	
		<ul> <li>Change of probe index and beam angle due to abrasion or probe shoes</li> </ul>	Х	х	
		Half and full skip	Х	Х	
		Application	Х	Х	
		Dual element:	Х	Х	
		• Design	Х	Х	
		Deviation error	Х	Х	
		Sound field	Х	Х	
		Adjustment	Х	Х	
		Application	Х	Х	
		Dynamic range			Х
		Immersion probes (focused, spherical, cylindrical, Fermat surface)		Х	Х
		Measurement of pulse length		Х	Х
		Practical measurements of directional characteristics		Х	Х
		Shoe (delay, curvature)		Х	Х

4.3	Couplant		Х	Х	
4.4	Connecting cables	Length	~	~	х
	connecting cubics	Impedance			X
4.5	Adjustment reference	Adjustment block No 1	Х	Х	X
	and transfer blocks	Adjustment block No 2	X	X	X
		Reference blocks	X	X	X
		Resolution:	X	X	X
		Near	X	X	X
		• Far	X	X	X
5	Information prior to testi		Level 1	Level 2	Level 3
5.1	Information about the	Identification or designation material:	Х	X	X
5.1	test object	Object to be tested	X	X	X
		Kind of manufacture	X	X	X
			~	X	X
		Catalogue of defects	V		
5.2	Test conditions and	Extent of test coverage	Х	X	X
5.2	application of standard	Accessibility		Х	X
		Infrastructure		X	X
		Particular test conditions		X	X
		Application standard		Х	X
		Stage of manufacture or service life when testing is to be carried out			Х
		Standards assigned to the test object		Х	Х
		Requirements of test personnel		Х	Х
		Acceptance criteria		Х	Х
5.3	Technique and sequence	Surface condition	Х	Х	
	of performing test	Surface preparation	Х	Х	
		Post-test documentation		Х	
5.4	Instructions	Preparation of written procedure			Х
		Preparation of written instruction		Х	
		Performing inspection in accordance with written instruction	Х		
6	Testing		Level 1	Level 2	Level 3
6.1	Techniques	Pulse echo and transmission	Х	Х	
		Contact	Х	Х	
		Tandem technique		Х	
		Immersion technique		Х	
		TOFD technique		Х	
		Phased array technique		Х	
		TFM technique		Х	
		Techniques for ultrasonic thickness measurement:	Х	Х	
		Reference reflectors (laws of distance and size)		Х	
		Verification of combined equipment:	Х	Х	
		DGS techniques		Х	
		Multiple-probe arrays			Х
		Electromagnetic acoustic transducer (EMAT)		Х	
		Range setting:	Х	Х	
		Single-point adjustment	Х	Х	
		Two-point adjustment	Х	Х	

6.1 (continued)		<ul><li>Sensitivity setting:</li><li>Reference reflectors (BW, SDH, DSR)</li></ul>	X X	X X	
(			~		
		<ul> <li>Single-reflector technique (reference height)</li> </ul>	X	X	
		Air-coupled ultrasonic testing	~	~	Х
		Guided waves		Х	X
		Testing at higher temperatures		X	X
		Different sizing techniques:		X	Λ
		Principles		X	
		Limitations		X	
		Requirements for reference blocks	Х	X	
		DAC technique	X	X	
		Transfer correction	X	X	
		Recording gain (testing level)	X	X	
		Errors at echo height evaluation	X	X	
		Laser UT	~	~	Х
		Verification of procedures and instructions for their efficiency			X
7	Evaluation and reporting	remeator of procedures and instructions for their enciency	Level 1	Level 2	^ Level 3
	Interpretation	Relevant standards			X
	interpretation	Relevant specifications			X
		Relevant codes			X
		Evaluation (conventional or computer-aided methods, for example			X
		echo tomography, synthetic aperture focusing technique (SAFT))			Х
		Data storage process (for example ALOK)			Х
7.2	Detecting, locating and	Detecting	Х	Х	
	sizing techniques	Distinction between defect and geometry echo	Х	Х	
		Locating (calculation, trigonometrical rules)	Х	Х	
		Interpretation		Х	
		Evaluation		Х	
		A-scan presentation	Х	Х	Х
		B-scan presentation		Х	Х
		C-scan presentation		Х	Х
		D-scan presentation			Х
		E-scan presentation			Х
		F-scan presentation			Х
		P-scan presentation			Х
		S-scan presentation			Х
		Recording results	Х	Х	
		Classifying results	Х	Х	
		Acceptance levels	Х	Х	
		Echo height evaluation with distance gain size (DGS) method		Х	
		Sizing and half-amplitude technique	Х		
		Sizing using the fixed-amplitude-level technique		Х	
		Echo height evaluation with single-reflector technique and DAC method	х	х	
		Reporting	Х	Х	
		Checking content and matching of test reports, instructions and procedures			Х

8	Assessment		Level 1	Level 2	Level 3
8.1	Evaluation and confirmation of test reports	Application of the acceptance criteria according to standards, codes and procedures		Х	
9	Quality aspects		Level 1	Level 2	Level 3
9.1	Personnel qualification	ISO 9712	Х	Х	Х
		Other NDT qualification and certification systems		Х	Х
9.2	Documentation	Traceability of documents		Х	Х
		Equipment verification		Х	Х
		Reliability of measurements		Х	Х
		Format of working procedures			Х
10	Developments		Level 1	Level 2	Level 3
10.1	Newest developments	Phased array	Х	Х	Х
	for industrial and	Time-of-flight diffraction	Х	Х	Х
	scientific applications of UT	Long range	Х	Х	Х
		Computer modelling			Х
		TFM technique		Х	Х

# PCN syllabus - Phased array ultrasonic testing (PAUT)

Syllabus reference number	Title	Module subcontent	Phased array ultrasonic testing (PAUT)		
1	Terminology and history	of PAUT	Level 1	Level 2	Level 3
1.0	History of PAUT	History of phased array ultrasonic testing	Х	Х	Х
1.1	Introduction to PAUT	Overview	Х	Х	Х
		Applicability and limitations	Х	Х	Х
		Difference between conventional and ultrasonic phased array techniques	Х	х	х
2	Physical principles and a	ssociated knowledge	Level 1	Level 2	Level 3
2.1	Mathematical and physical basics	Basics of sound beam	Х	Х	Х
		Waves:	Х	Х	Х
		Sinusoidal movement	Х	Х	Х
		Amplitude	Х	Х	Х
		• Frequency	Х	Х	Х
		Wavelength	Х	Х	Х
		Propagation velocity	Х	Х	Х
		Longitudinal waves	Х	Х	Х
		Transverse waves	Х	Х	Х
		• Consideration of near field, beam spread, element width	Х	Х	Х
		Terms relating to sound:		Х	Х
		Side lobes		Х	Х
		Grating lobes		Х	Х
		Artefacts		Х	Х
		Terms relating to arrays:	Х	Х	Х
		Active aperture	Х	Х	Х
		Elementary aperture	Х	Х	Х

2.1		Primary axis of an array	Х	Х	Х
continued)		• Secondary axis of an array	Х	Х	Х
		Influence of band width		Х	Х
		Electronical beam steering and focusing of sound beams		Х	Х
3	Product knowledge and	capabilities	Level 1	Level 2	Level 3
3.1	Defects relating to	Welding	Х	Х	Х
	the manufacturing	Forgings	Х	Х	Х
	processes	Castings	Х	Х	Х
3.2	Implementation of PAUT techniques according to products and to expected discontinuities	Likely flaw types and flaw orientations per product, including probe type, beam type and encoder to optimise the scanning	Х	Х	Х
3.3	Overall properties of	Influence of surface conditions	Х	Х	Х
	specimen	Geometry	Х	Х	Х
		Attenuation	Х	Х	Х
		Reference reflectors:	Х	Х	Х
		Backwall	Х	Х	Х
		Side-drilled holes	Х	Х	Х
		Flat-bottom holes	Х	Х	Х
		Notches	Х	Х	Х
4	Equipment		Level 1	Level 2	Level 3
4.1	Test instrument and	Phased array instrument	Х	Х	Х
	combined equipment	Multi-channel instrument (number of pulses and receivers that can be addressed)		Х	х
		Transmitting delay		Х	Х
		Receiving delay		Х	Х
		Delay laws		Х	Х
		Amplitude balancing		Х	Х
		Multi-group capability		Х	Х
		Number of focal laws		Х	Х
		Digitisation concepts and associated instrument settings (replication of analogue signal)		х	х
		Axial, lateral and encoder resolution (effects of instrument settings)		Х	Х
4.2	Phased array probes	Linear array	Х	Х	Х
		Annular array	Х	Х	Х
		Annular sectorial array	Х	Х	Х
		Acoustic properties of wedge materials that affect phased arrays		Х	Х
		Encircling array	Х	Х	Х
		1,5D array	Х	Х	Х
		Linear array with separate transmitters and receivers	Х	Х	Х
4.3	Multi-group capabilities	Number of focal laws that may be addressed		Х	Х
	Encoders	Different types of scanner and encoding system		Х	Х
4.4	Encoders				
4.4 4.5	Couplant and coupling techniques	Couplant types, built-in irrigation systems or manually applied		Х	Х
	Couplant and coupling			X X	X X
4.5	Couplant and coupling techniques	Couplant types, built-in irrigation systems or manually applied			
4.5	Couplant and coupling techniques	Couplant types, built-in irrigation systems or manually applied Block No 1 according to ISO 2400		Х	Х

5	Information prior to testi	ng	Level 1	Level 2	Level 3
5.1	Applied standards for UT	-		Х	Х
	and PAUT	Requirements for procedures			Х
		Developing of test procedures			Х
б	Testing		Level 1	Level 2	Level 3
6.1	Techniques	Linear scanning with zero-degree (forgings and castings)	Х	Х	Х
	•	Linear scanning with constant angle (welding)	Х	Х	Х
		Sectorial scanning (welding, forging)	X	X	X
		Multi-group scanning		Х	Х
		Compound scans			Х
		Focusing techniques, including overview of dynamic depth focusing (DDF), total focusing method (TFM) and full matrix capture (FMC)			х
		Range setting:		Х	Х
		Single-point adjustment		Х	Х
		Two-point adjustment		Х	Х
		Sensitivity setting:		Х	Х
		Angle correct gain (ACG)		Х	Х
		Reference reflectors (BW, SDH, FBH)		Х	Х
		Single-reflector technique (reference height)		Х	Х
		Requirements for reference blocks		Х	Х
		DAC method		Х	Х
		TCG method		Х	Х
		DGS method		Х	Х
		Typical applications of phased array techniques	Х	Х	Х
7	Evaluation and reporting	<u> </u>	Level 1	Level 2	Level 3
7.1	Evaluation of indications	DGS method		Х	Х
		DAC method		Х	Х
		TCG method		Х	Х
		Distinction between defect and geometry echo		Х	Х
		Location of defects		Х	Х
		Interpretation and evaluation of indications		Х	Х
		Sizing of defects		Х	Х
		A-, E-, S-, B- and C-scan interpretation		Х	Х
7.2	Reporting	Recording		Х	Х
		Classifying of results according to written procedure		Х	Х
		Storage of data files		Х	Х
		Generation of reports		Х	Х
8	Assessment		Level 1	Level 2	Level 3
8.1		Evaluation and confirmation of test reports		Х	Х
		Application of the acceptance criteria according to standards, codes and procedures		Х	Х
9	Quality aspects		Level 1	Level 2	Level 3
9.1	Personnel qualification	ISO 9712		Х	Х
		Other NDT qualification and certification systems		Х	Х
10	Developments		Level 1	Level 2	Level 3
10.1		Not applicable			

Syllabus reference number	Title	Module subcontent		Time-of-f action (TC	
1	Terminology and history	of TOFD	Level 1	Level 2	Level 3
1.0	History of TOFD	History of TOFD	Х	Х	Х
1.1	Introduction to ultrasonic	Overview	Х	Х	Х
	TOFD technique	Applicability and limitations	Х	Х	Х
2	Physical principles and as	sociated knowledge	Level 1	Level 2	Level 3
2.1	Mathematical and	Basics of sound beam	Х	Х	Х
	physical basics	Waves:	Х	Х	Х
		Sinusoidal movement	Х	Х	Х
		Amplitude	Х	Х	Х
		• Frequency	Х	Х	Х
		• Wavelength	Х	Х	Х
		Propagation velocity	Х	Х	Х
		Longitudinal waves	Х	Х	Х
		Transverse waves	Х	Х	Х
		Principle of wave diffraction	Х	Х	Х
		Sound field of UT-TOFD probes		Х	Х
		Visualisation of UT-TOFD images		Х	Х
		Probe centre separation (PCS)		Х	Х
		Dead-zone assessments and consideration		Х	Х
3	Product knowledge and o		Level 1	Level 2	Level 3
3.1	Various defects related	Defects related to the manufacturing processes (welding)	Х	X	X
	to the manufacturing processes and service- induced defects related to the defined sectors	Implementation of UTTOFD technique according to products and to expected discontinuities (weld defects)		Х	Х
3.2	Overall properties of	Influence of surface conditions		Х	Х
	specimen	Geometry		Х	Х
		Attenuation		Х	Х
		Reference reflectors (SDH, notch)		Х	Х
4	Equipment		Level 1	Level 2	Level 3
4.1	Test instrument and	UT TOFD instrument	Х	Х	Х
	combined equipment	UT TOFD probes	Х	Х	Х
		Adaption of probes to curved scanning surfaces		Х	Х
		Encoders and scanning mechanisms (parallel and non-parallel scan set-ups)		Х	Х
		Different types of scanners		Х	Х
		Reference blocks		Х	Х
		Different reference blocks		Х	Х
		Digitisation concepts (replication of analogue signal)		Х	Х
5	Information prior to testi		Level 1	Level 2	Level 3
5.1	Items to be defined by	Purpose	Х	Х	Х
	specification	Extent of UT TOFD testing	Х	Х	Х
		Information required by the operator	Х	Х	Х
		Written test instruction or procedure		Х	Х

# PCN syllabus - Ultrasonic testing - Time-of-flight diffraction (TOFD)

6	Testing		Level 1	Level 2	Level 3
6.1	Testing	Setting of test range and sensitivity	Х	Х	Х
		Set-up of probes:		Х	Х
		Scan increment setting		Х	Х
		Geometry considerations		Х	Х
		Preparation of scanning surfaces		Х	Х
		Couplant and coupling techniques		Х	Х
		Range and sensitivity settings:		Х	Х
		Time window		Х	Х
		Time-to-depth conversion		Х	Х
		Sensitivity settings		х	Х
		Checking of settings		Х	Х
		Averaging, signal filtering		Х	Х
		Reference blocks:		Х	Х
		Material		Х	Х
		• Dimensions		Х	Х
		• Shape		Х	Х
		Reference reflectors, SDH and notch		Х	Х
		Interpretation and analysis of UT TOFD images:		Х	Х
		<ul> <li>Assessing the quality of the UT TOFD image</li> </ul>		Х	Х
		Identification and classification of relevant UT TOFD indications		Х	Х
		Determination of location and size		Х	Х
7	Evaluation and reporting		Level 1	Level 2	Level 3
7.1	Evaluation and reporting	Evaluation according to acceptance criteria		Х	Х
		Test report:		Х	Х
		<ul> <li>Information relating to the test object</li> </ul>		Х	Х
		Equipment		Х	Х
		Test technique		Х	Х
		Test results		Х	Х
		Storage of data files	Х	Х	Х
		Generation of reports		Х	Х
		Near-surface and opposite-surface resolution		Х	Х
		Defect location and length measurement		Х	Х
8	Assessment		Level 1	Level 2	Level 3
8.1	Assessment	Evaluation and confirmation of test reports		Х	Х
		Application of the acceptance criteria according to standards,		V	V
		codes and procedures		Х	Х
		Offline evaluation using PC software		Х	Х
9	Quality aspects		Level 1	Level 2	Level 3
9.1	Personnel qualification	ISO 9712		Х	Х
		Other NDT qualification and certification systems		Х	Х
10	Developments		Level 1	Level 2	Level 3
10.1		Not applicable			

Syllabus reference number	Title	Module subcontent	Visu	Visual testing (VT)	
1	Terminology and history	of VT	Level 1	Level 2	Level 3
1.0	History of VT	History of visual testing	Х	Х	Х
1.1	Purpose of NDT	What is testing?	Х	Х	Х
		What is the purpose of NDT?	Х	Х	Х
		At what stage of life is NDT performed on a product?	Х	Х	Х
		How does it add value?	Х	Х	Х
		Who may carry out NDT?	Х	Х	Х
		Main NDT methods	Х	Х	Х
1.2	Purpose of VT	Definition	Х	Х	Х
		Applicability and limitations	Х	Х	Х
		Extended overview of visual testing applications	Х	Х	
		Use of visual testing as a complement to other NDT methods	Х	Х	
1.3	Terminology	Please refer to PCN24 standards document	Х	Х	Х
2	Physical principles and as	sociated knowledge	Level 1	Level 2	Level 3
2.1	Fundamentals	Goals and principles of visual testing	Х	Х	
		Comprehensive knowledge and understanding of the physical principles and physics of light	Х	Х	Х
		Optical performance:	Х	Х	
		Polarisation of light	Х	Х	
		Stroboscopic principles	Х	Х	
		Dispersion	Х	Х	
		Refraction and refractive index	Х	Х	
		Reflection	Х	Х	
		Fluorescence	Х	Х	
		• Advantages and disadvantages of different wavelengths of optical radiation (UV, infrared (IR)), including colour temperature	Х	Х	Х
2.2	Vision	The eye:	Х	Х	
		Operation	Х	Х	
		Construction	Х	Х	
		Vision limitations	Х	Х	
		Adaption and accommodation	Х	Х	
		• Disorders	Х	Х	
		Vision ranges	Х	Х	Х
		Effects of disorders	Х	Х	Х
2.3	Lighting	Transmission	Х	Х	
		Reflection	Х	Х	
		Absorption	Х	Х	
		Physics of light	Х	Х	
		Electromagnetic radiation	Х	Х	
		Visible wavelengths	Х	Х	
		Types of light source:	Х	Х	Х
		Natural	Х	Х	Х
		Artificial – including laser	Х	Х	Х

### PCN syllabus – Visual testing (VT)

2.2			X	V	V
2.3 (continued)		LED light sources (advantages and disadvantages):	Х	Х	X
(continucu)		Different wavelengths of optical radiation (UV, IR)		Ň	X
		Colour temperature		Х	X
		LED light sources	Х	Х	Х
		Photometry	Х	Х	
		Light levels	Х	Х	
		Light measurement	Х	Х	
		Luminance:	Х	Х	
		Lighting levels	Х	Х	
		Lighting techniques	Х	Х	
		Contrast	Х	Х	
2.4	Optical principles	Operation of lenses		Х	
		Operation of magnifiers		Х	
		Image construction		Х	
		Virtual images		Х	
		Chromatic aberration		Х	
		Geometric distortion		Х	
		Magnification principles		Х	
2.5	Camera and photo	Optical filters			Х
	sensor operation and	Construction of digital images and problems			Х
	principles	Image processing			Х
		Image analysis			Х
		Image compression and transmission			Х
		Image storage			Х
		Resolution			Х
		Video monitors			Х
		Other monitors			Х
		Light meters and photometers			Х
2.6	Principles of operation of	Coherent			Х
	fibre bundles and lenses	Incoherent			Х
2.7	Photogrammetry				Х
2.8	Visual perception	What the eye sees		Х	
		What the mind sees		Х	
		What others perceive		Х	
		What the designer, engineer, etc, sees		Х	
2.9	Material attributes	Colour	Х	Х	
	affecting the test	Surface condition	Х	Х	
		Surface preparation	Х	Х	
		Cleanliness	Х	Х	
		Shape	Х	Х	
		Size	Х	Х	
		Temperature	X	X	
		Texture	X	X	
		Туре	X	X	
		Surface finish	X	X	

2.10	Environmental and	Atmosphere		Х	
	physiological factors	Comfort		X	
		Perspective		X	
		Distance		X	
		Accessing		X	
		Fatigue		X	
		Health		X	
		Humidity		X	
		Mental attitude			
				X	
		Position		X	
		Safety		X	
		Temperature		X	
2.44		Cleanliness		Х	
2.11	Direct and remote methods		Х	Х	
2.12	Vision	Requirements	Х	Х	
		Employer's responsibility		Х	
3	Product knowledge and o	capabilities	Level 1	Level 2	Level 3
3.1	Product knowledge	Outline of basic flaws detected with visual testing as necessary to work in a specific sector	Х		
		Evaluation of surfaces			Х
		Test objects and flaws		Х	Х
		Basic production and degradation process		Х	Х
		Terms, origin, nature and appearance of flaws		Х	Х
		Product technology sectors		Х	Х
		Basic metallurgy of the process/component		Х	Х
		Welding/joining methods		Х	Х
		Cladding and buffering:		Х	Х
		Wrought product production methods		Х	Х
		Cold working processes		Х	Х
		Heat treatment processes		Х	Х
		Roughness and waviness			Х
		Definition of shape and geometry of flaws			Х
		Material composition:		Х	Х
		Surface-finishing methods		Х	Х
		Basic foundry technology		Х	Х
		<ul> <li>Machining and material removal processes</li> </ul>		Х	Х
		Polymers/composites		Х	Х
		In-service aspects:		Х	Х
		Service-induced flaws		Х	Х
		Mechanically		Х	Х
		• Thermally		Х	Х
		Tribology		Х	Х
		• Wear		Х	Х
		Chemical		Х	Х
		Electrochemical		Х	Х

3.2	Capability and	Overview/awareness	Х		
3.2	limitations of visual	Detectability:	X	Х	
	testing	Flaw size	X	X	
		• Shape	X	X	
		Orientation/position	X	X	
		Flaw types	X	X	
		Surface condition effects	X	X	
		Equipment limitations	X	X	
		Lighting effects	X	X	
3.3	Associated techniques	Gauging	Λ	X	
5.5	Associated teeninques	Comparators		X	
		Measurement		X	
		Thermographic imaging		X	
		Replication		X	
4	Equipment	Replication	Level 1	^ Level 2	Level 3
4.1	Introduction and	Mirrors	X	X	X
ч. I	applications	Magnifiers	X	X	X
	. P.P. State of the second sec	Borescopes	X	X	X
		Fibrescopes	X	X	X
4.2	Photographic and video	Imaging cameras	X	X	~
4.2	Photographic and video	Video monitors	X		
		Light sources and special lighting	X	X X	
			X		
		Gauges		X	
		Templates Control	X	X	
		Scales	Х	Х	N N
		Special tools		X	X
		Automated systems		X	X
		Computer-enhanced systems		X	Х
		Demonstration test-piece	Х	Х	
		Resolution targets	Х	Х	X
		Graticules		Х	X
		Effect on test arrangement			X
		Evaluation of equipment to fulfil a particular task			X
		Development of verification for equipment performance:			X
		Choice/design			X
4.2	lange and a south and the second	Application of demonstration test-pieces		X	Х
4.3	Image recording, transfer and storage equipment	Equipment selection		X	
		Equipment limitations	V	X	
		Verification of equipment	Х	Х	X
		Procedure for control, maintenance and adjustment of equipment			Х
4.4	Sizing of indications	Imaging systems		Х	
		Special optical systems		Х	
		Special equipment requirements ( <i>ie</i> underwater, radiation resistant)	Х	Х	

5	Information prior to testin	ng	Level 1	Level 2	Level 3
5.1	Information about the	Identification or designation of material:		Х	Х
test object		Object to be tested		Х	Х
		Kind of manufacture		Х	Х
		Catalogue of defects		Х	Х
		• Extent of test coverage		Х	Х
5.2	Test conditions and	Accessibility		Х	Х
	application of standard	Infrastructure		Х	Х
		Particular test conditions		Х	Х
		Application of standard		Х	Х
		Stage of manufacture or service life when testing is to be carried out		Х	Х
		Standard and codes assigned to the test object		Х	Х
		Requirements of test personnel		Х	Х
		Acceptance criteria		Х	Х
5.3	Technique and sequence	Surface condition		Х	
	of performing test	Surface preparation		Х	
		The illumination (type, level and direction)		Х	
		Post-test documentation		Х	
		Visual testing equipment to be used		Х	
		Demonstration test-piece and inspection checkpoints		Х	
		Requirement for recorded images		Х	
5.4	Instructions	Preparation of written procedure			Х
		Preparation of written instruction		Х	
		Performing inspection in accordance with written instruction	Х		
		Documents		Х	Х
		Presentation of the standards, codes and procedures			Х
6	Testing		Level 1	Level 2	Level 3
6.1	Test set-up	Demonstration test-pieces	Х	Х	
		Resolution targets	Х	Х	
		Adjustment		X	
		Written instruction		Х	X
-		Written procedure		X	X
7	Evaluation and reporting		Level 1	Level 2	Level 3
7.1	Reporting results	Reference to test standards	X	X	
		Adjustment status	X	X	
		Reference points for location of indications	X	X	
		Classification of indications:	X	X	
		Instructed acceptance criteria	X	X	
		Reports and documentation	X	X	
7.2	Control on division iterian	Reporting verification results	Х	X	X
7.2	Control and monitoring of test results	Interpretation		X	X
		Evaluation:		X	X
		Objective		X	X
		• Subjective		X	X
		Reporting of results to specifications and standards		X	X
7.2	Developing	Completion of adjustment forms		Х	X
7.3	Developing report forms	Organisation of final forms			Х

7.3		Storage of final forms			Х
(continued)		Distribution of final forms			Х
		Investigation of suitable codes and product standards for each application			х
		Acting as a reference point for Level 2 advice for interpretation and evaluation			Х
8	Assessment		Level 1	Level 2	Level 3
8.1	Classification and	Acceptance criteria:		Х	Х
	assessment of	Codes		Х	Х
	observations	• Standards		Х	Х
		Written instructions		Х	Х
		• Level 3 reference where no codes or standards exist		Х	Х
		Design specifications			Х
		By comparison		Х	Х
		By measurement		Х	
		Automated evaluation (for example pattern recognition)		Х	
		Recording		Х	
		Reporting		Х	
		Analysing results			Х
		Translation of codes, standards and design specifications, etc, into clear			
		acceptance criteria to be written into procedures and instructions			Х
		Finding information of assistance to investigate observations not			V
		covered by codes and standards, and develop acceptance criteria			Х
		Training of Level 1 and 2 for acceptance criteria			Х
9	Quality aspects		Level 1	Level 2	Level 3
9.1	Personnel qualification	ISO 9712	Х	Х	Х
		Other NDT qualification and certification systems			Х
9.2	Documentation	Format and scope of working procedures			Х
		Qualification of NDT procedures			Х
		Authorisations (NDT instruction, procedures and personnel)			Х
		Developing written instruction		Х	
		Working correctly to written instructions	Х		
		Traceability of documents		Х	Х
		Reliability of measurements		Х	Х
9.3	Knowledge of applicable	Correct technique selection		Х	Х
2.5	NDT application and product standards	Use of correct test parameters		Х	Х
		NDT method selection			X
		Job-specific training			X
			Х	V	X
				A .	
10	Developments	Equipment verification		X Level 2	
10 10.1	Developments Importance of investigatir	g current and developing technology and methods of application	^ Level 1	A Level 2	Level 3 X

Syllabus reference number	Title	Module subcontent	Level 2		
1	Terminology and history of UT				
1.1	Task of NDT personnel	What is testing?	Х		
		What is the purpose of NDT?	Х		
		At what stage of life is NDT performed on a product?	Х		
		How does it add value?	Х		
		Who may carry out NDT?	Х		
		Main NDT methods	Х		
1.2	Overview of general and product standards	Please refer to PCN24 standards document	Х		
1.3	Terminology	Please refer to PCN24 standards document	Х		
2	Physical principles and as	ssociated knowledge			
2.2	Physical definitions and	Amplitude	Х		
	typical parameters	Period	Х		
		Frequency	Х		
		Velocity	Х		
		Acoustic impedance	Х		
		Factors of reflection and transmission (normal beam only)	Х		
2.3	Properties of sound waves	Amplitude	Х		
		Frequency	Х		
		Wavelength	Х		
		Propagation velocity	Х		
		Longitudinal/compression waves	Х		
2.4	2.4 Transmission and reflection	Effects at interfaces at normal incidence (transmission, reflection, interference and dispersion)	Х		
		Piezoelectric effect	Х		
		Reverse piezoelectric effect	Х		
2.5	Transducer characteristics	Transducer materials and construction	Х		
		Dimensions	Х		
		Frequency (crystal thickness relationship)	Х		
		Transducer types (single crystal, single crystal with standoff, twin crystal)	Х		
		Sensitivity resolution and damping	Х		
		Mechanical vibration into test material	Х		
2.6	Sound fields of disc-	Near field (Fresnel zone)	Х		
	shaped transducers	Far field (Fraunhofer zone)	Х		
		Beam divergence	Х		
		Influence of transducer frequency and diameter	Х		
3	Product knowledge and o	capabilities			
3.1	General defects	Wrought products (continuous casting, plate, rolling process, types and origins of discontinuities, response of discontinuities to ultrasound, discontinuity detection, sensitivity to reflections, size type and locations of discontinuities)	Х		

# PCN syllabus – Limited certification ultrasonic testing (UT) of manufactured wrought plate (ISO 9712)

2.2			Y
3.2	Implementation of the testing technique	According to products	X
		According to expected discontinuities	X
		Standards, specifications and codes	X X
		Selection of probe (inspection-oriented design of specimen) Testing technique based on task	X
		Influence of surface conditions	
3.3	Overall properties of the specimen		Х
	specificit	Geometry (additional echoes due to grazing incidence and radial straight beam incidence)	Х
		Structure (sound attenuation)	Х
4	Equipment		
4.1	Ultrasonic instruments	Digital instruments (design, function, pulse generation TX, pulse reception RX, probe delay, dead zone, amplification, A-scan presentation, RF signal, rectification, peak and flank measurement)	Х
		Analogue versus digital	Х
		Signal gating and alarms	Х
		Ultrasonic thickness gauge	Х
		Automated and semi-automated systems	Х
		Manual	Х
		Scanning speed	Х
		Incrementation	Х
		Repeatability	Х
		Sampling rate/pulse repetition frequency (PRF)	Х
		Knowledge and understanding of timebase and timebase linearity	Х
		Knowledge of timebase functionality, amplifier, pulsar, receiver, monitor displays	Х
4.2	Transducers	Straight beam (design, application)	Х
		Effects of ultrasonic frequency	Х
		Damping effects	Х
		Dual element (design, deviation error, sound field, adjustment, application)	Х
		Dynamic range	Х
		Practical measurements of directional characteristics	Х
		Shoe (delay)	Х
4.3	Couplants	Purpose and principles, materials and efficiency	Х
		Length	Х
		Impedance	Х
4.4	Calibration	Basic instrument calibration	Х
		Calibration blocks	Х
		Reference blocks	Х
		Resolution (near, far)	Х
5	Information prior to testi	ng	
5.1	Information about the test object	Identification or designation material (object to be tested, kind of manufacture, catalogue of defects, extent of test coverage)	Х
5.2	Test conditions and application of standard	Accessibility	Х
		Particular test conditions	Х
		Application standard	Х
		Stage of manufacture of service life when testing is to be carried out	Х

F 2		Chandende accienced to the test shipst	V
5.2 (continued)		Standards assigned to the test object	X
(continucu)		Requirements of test personnel	X
5.2	<b>-</b> 1 · 1	Acceptance criteria	X
5.3	Technique and sequence	Transmission factors of materials	X
	of performing test	Surface condition	X
		Surface preparation	Х
		Post-test documentation	Х
5.4	Instructions	Preparation of written instruction	Х
		Performing inspection in accordance with written instruction	Х
б	Testing		
6.1	Techniques	Pulse echo and transmission	Х
		Contact	Х
		Techniques for ultrasonic thickness measurement (reference reflectors, laws of distance and size)	Х
		Range setting (single-point adjustment, two-point adjustment)	Х
		Sensitivity setting (reference reflectors: BW, SDH, DSR; single- reflector technique reference height, testing at higher temperatures)	Х
		Different sizing techniques (principles, limitations, requirements for reference blocks, DAC technique, DGS, transfer correction, recording gain, errors at echo height evaluation)	Х
7	Evaluation and reporting		
7.1	Interpretation	Relevant standards	Х
		Relevant specifications	Х
		Relevant codes	Х
		Evaluation (conventional)	Х
7.2	Detecting, locating and	Detection probability of type of discontinuity	Х
	sizing techniques	Distinction between defect and geometry echo	Х
		Locating	Х
		Interpretation	Х
		Evaluation	Х
		A-scan presentation	Х
		C-scan presentation	Х
		Recording results	Х
		Classifying results	Х
		Acceptance levels	Х
		Echo height evaluation with DGS method	Х
		Sizing and half-amplitude technique	Х
		Sizing using the fixed amplitude level technique	Х
		Echo height evaluation with single-reflector technique and DAC method	Х
		Reporting	Х
		Check content and matching of test reports and instructions	Х
8	Assessment		
8.1	Evaluation	Transducer movement versus display	Х
		Signal patterns (abnormal values, no readout, loss of signals)	Х
		Location of discontinuity	Х

8.1		Amplitude and linear time	Х
(continued)		Search technique	X
(00110110100)		· · · ·	
		Mapping (spot, grid)	Х
		Evaluation and use of correction factors/charts	Х
		Comparison procedures	Х
		Standards and references	Х
		Amplitude, area and distance	Х
		Object appraisal	Х
		Type of discontinuity and location	Х
8.2	Confirmation of test reports	Application of the acceptance criteria according to standards, codes and procedures	Х
9	Quality aspects		
9.1	Personnel qualification	ISO 9712	Х
9.2	Documentation	Traceability of documents	Х
		Equipment verification	Х
		Reliability of measurements	Х
		Format of working procedures	Х
9.3	Employer and certificate holder responsibilities	ISO 9712 Section 5	Х
10	Developments		
10.1	Newest developments for industrial and scientific applications of UT	Awareness of UT method, technique and equipment developments	Х

# **Change control record**

PCN24/GEN/Appendix Z1 – Document issue and review status				
Document issue for review	Changes/amendments	Current document status		
Issue 01	New document to meet PCN24/GEN, BS EN ISO 9712:2022 and ISO/TS 25107:2019 requirements. Supersedes PCN/GEN Appendix Z1, which is now withdrawn.			



Issued by Certification Services Department, The British Institute of Non-Destructive Testing Midsummer House, Riverside Way, Bedford Road, Northampton NN1 5NX, United Kingdom Tel: +44 (0)1604 438300 | Email: pcn.enquiries@bindt.org | www.bindt.org/certification