



Radiographic Testing (RT)

Course Curriculum





AFRICAN NDT CENTRE
COURSE CURRICULUM
RADIOGRAPHIC TESTING LEVEL 1, 2 and 3

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Who we are?

African NDT Centre (Pty) Ltd is an NDT training and service provider organization located in Roodepoort, South Africa, providing complete solutions for NDT training and inspection.

We conduct training for PCN certification for level 1,2 and 3 in the following methods:

- PCN - Eddy Current Testing (ET)
- PCN - Ultrasonic Testing (UT)
- PCN - Magnetic Particle Testing (MT)
- PCN - Liquid Penetrant Testing (PT)
- PCN - Radiographic Testing (RT)
- PCN – Radiographic Interpretation (RI)
- PCN – Basic Radiation Safety (BRS)
- PCN – Visual Testing (VT)
- PCN – UT Phased Array (PAUT)
- PCN – UT Time of Flight Diffraction (TOFD)

How to Book Your Training Course

To book a training course, simply contact us via phone or email and we will be happy to discuss your requirements. If necessary, we can provide advice on which type of training and certification is appropriate for you or your company.

Courses can be booked and paid online on the following links:

ANDTC Constantia Kloof Campus: <https://andtc.com/courses-constantia-kloof/>

ANDTC Vaal Training Centre: <https://andtc.com/courses-vaal/>

Training courses are conducted on a regular basis at both our branches, and PCN examinations are run ongoing at our Roodepoort Examination Centre.

Contact Us

ANDTC Constantia Kloof

AFRICAN NDT CENTRE (PTY) LTD
21 Constantia Boulevard, Constantia Kloof
Roodepoort, 1709, Gauteng

Phone or WhatsApp: +27 (0)69 122 9848

Email: Bookings@andtc.com

Web: www.andtc.com

PCN ATO Authorization Number: 0838

ANDTC Vaal

AFRICA NDT VAAL (PTY) LTD
8 Leeuwenhoek Street, Duncanville,
Vereeniging, 1939, Gauteng

Phone or WhatsApp : +27 (0)73 223 1832

Email: info@andtc.com

Web: www.andtc.com

PCN ATO Authorization Number: 0837

What is Radiographic Inspection?

Radiographic Testing (RT) is a non-destructive testing (NDT) method that uses penetrating radiation (X-rays or gamma rays) to create an image of the internal structure of an object on a radiographic film, digital detector, or fluorescent screen. It reveals internal defects such as cracks, voids, inclusions, porosity, or lack of fusion in welds and castings.

How It Works:

1. Radiation Source
 - X-ray tube (electricity-generated, adjustable energy).
 - Gamma source (radioisotopes like Ir-192, Co-60, Se-75 – portable, constant energy).
2. Radiation Penetration
 - Beam passes through the test object.
 - Dense areas (e.g., metal) absorb more radiation → appear lighter on the image.
 - Less dense areas (e.g., voids, cracks) allow more radiation → appear darker.
3. Image Capture
 - Film Radiography: Radiation exposes photographic film → developed into a negative.
 - Digital Radiography (DR/CR): Uses imaging plates or flat-panel detectors → instant digital image.
4. Image Interpretation
 - Qualified radiographer evaluates contrast, density, and defect indications.

Applications:

- Weld inspection (pipelines, pressure vessels, structural steel).
- Casting inspection (porosity, shrinkage in engine blocks, valves).
- Aerospace (turbine blades, composite bonding).
- Corrosion under insulation (CUI) via profile radiography.

Advantages:

- Permanent visual record.
- Detects volumetric defects (porosity, slag) and planar defects (cracks).
- No surface preparation needed (unlike UT/MT).
- Suitable for thick materials.

Limitations:

- Radiation hazard – requires safety controls (ALARP, dosimetry).
- Access to both sides needed (source & detector).
- Orientation-sensitive – defects must be aligned with beam.



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About the Course

PCN Level 2

This course provides participants with a comprehensive understanding of the theory and practical application of radiographic testing for welds. It covers the interpretation and reporting of radiographs on dense metals, preparing and qualifying candidates for PCN Level 2 certification in Radiographic Film Interpretation..

PCN Level 3

This guidance course targets the PCN Level 3 requirements for Radiographic Testing practitioners. Its primary goal is to familiarise candidates with the examination scope and required knowledge level. It helps identify weaker subject areas and provides advice on any additional training needed.



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Qualification Requirements

Prerequisites

- Matric (Grade 12) with Mathematics and/or Science
- Basic understanding of physics principles (recommended)
- For Level 3: Previous PCN certification as required by PCN standards

Training Hours

Level 1& Level 2 combined	Level 3
15 Days	5 Days

Note: Direct access to Level 2 or 3 requires the total days shown in the table for Levels 1 and 2, or Levels 1, 2 and 3 respectively.

Product Sector

Multi Sector - This course prepares candidates for certification across multiple product sectors as defined by PCN standards.

Experience Requirements

Level 1& Level 2 combined	Level 3
180 Days	450 Days

Note: Experience may be acquired either prior to (for Level 1 and 2 entry only) or following success in the qualification examination. However, the chances of success in a PCN examination may be significantly reduced if candidates have little or no current experience in the application of the NDT method in the sector concerned.

Documents to be Submitted for Examination

- ID
- PCN BRS
- SA Rad Safety
- PSL 57-A Initial Examination Application
- PSL 30 - Log of Experience
- PSL 44 - Vision Requirements
- CP-27 Code of Ethics
- PCN ID (wallet or e-certificate) -only for existing PCN certificate holders
- Proof of either holding PCN certification or successful completion of BINDT PCN Online Product Technology- cert with QR code
- One government-approved identity document (Passport/ID Card/Driver's License)
- Note: Blank PSL and CP forms can be collected from ANDTC offices during course or downloaded from BINDT website.



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Learning Outcomes

PCN Level 1&2 combined

Upon completion, the candidate shall be able to:

PCN Level 1 & 2 Combined

1. Master Radiographic Theory & Physics
2. Select & Set Up Radiographic Techniques
3. Perform Full Radiographic Procedure (Hands-On)
4. Evaluate Radiographic Quality On-Site
5. Detect, Identify & Classify Weld Imperfections
6. Interpret Results & Apply Acceptance Criteria
7. Produce Complete RT Reports & Records
8. Execute Radiation Safety & Regulatory Compliance
9. Perform Practical Examination (PCN RT Level 2)

PCN Level 3

Upon completion, the candidate shall be able to:

1. Master Advanced Radiographic Physics & Mathematics
2. Design & Validate Radiographic Techniques for Critical Applications
3. Supervise, Audit & Calibrate RT Systems
4. Interpret Complex Radiographs & Resolve Ambiguities
5. Lead Radiation Safety & Regulatory Compliance
6. Select & Justify Alternative/Advanced RT Methods
7. Train, Examine & Certify Level 1&2 Personnel
8. Resolve Code Conflicts & Client Specifications
9. Prepare for PCN Level 3 Examination (

What to Bring?

- Own PPE (coveralls or lab coat, safety boots)
- PCN wallet card or other form of photographic identification

Special Notes

- African NDT Centre reserves the right to disqualify participants from the certification program when personnel are found not to meet PCN requirements
- Participants are not allowed to use their own equipment during training and examination. African NDT Centre provides all necessary ET equipment and accessories
- Professional dress code must be followed during the entire training and examination period
- Once enrolled, joining instructions will be sent via email with all necessary information communicated telephonically.



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Training and Examination Information

The training program comprises daily assessments after completion of each chapter, and participants are required to achieve above 70% marks. Based on daily assessment performance, candidates are awarded successful completion of training.

Participants are then required to undergo PCN examination which consists of:

- Theory examination
- Practical examination
- NDT instruction writing (Level 2 only)

Candidates must obtain a minimum of 70% in each examination element to achieve PCN certification as Level 1, 2, or 3.

PCN certification is valid for 5 years from the date of certification. The certificate must be renewed according to PCN requirements.

Syllabus Reference

This curriculum is aligned with the PCN examination syllabus as published in **PCN24/GEN/Appendix Z1 - NDT Examination Syllabi, Issue 1, February 2024**.

The detailed syllabus breakdown covering all topics for Level 1, 2, and 3 is available in our comprehensive course documentation (Document No: CC-RT, Issue 2, dated 01/07/2025 noted as Annexure A)

African NDT Centre regularly reviews and updates the curriculum in line with scientific, industrial, and technological developments in eddy current testing, as well as any changes to PCN certification requirements.



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ANNEXURE A

Contents	Level 1	Level 2	Level 3
1.0 Introduction, Terminology, History of NDT	1.0 History Purpose	1.0 History Purpose	1.0 History Purpose
	1.1 Terminology Electromagnetic radiation Energy Dose Dose rate	1.1 Terminology Wave-length Dose Dose rate Intensity Dose rate constant	1.1 Terminology EN 1330 - 3
2.0 Physical principles of the method and associated Knowledge	2.0 Properties of X- and gamma Radiation Relevant standards: EN 444: General Principles Straight line propagation Effects of radiation Capability of penetration	2.0 Properties of X- and gamma Radiation Photon Process of ionisation photochemical effects biological effects fluorescent effects Energy	2.0 Properties of radiation X-radiography Gamma radiography Neutron radiography Electron radiography Process of ionization photochemical effects biological effects fluorescent effects



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	2.1 Generation of X-radiation Function of X-ray tubes Tube current I High voltage U effects on dose rate and energy of radiation	2.1 Generation of X-radiation Function of X-ray tubes Spectrum intensity max. energy effective energy change of spectrum by tube current and tube voltage Inherent filtering	2.1 Generation of X-radiation Function of X-ray tubes Spectrum intensity max. energy effective energy change of spectrum by tube current and tube voltage Characteristic radiation Inherent filtering Hardening effect
	2.2 Origin of gamma radiation Radio isotope Ir 192, Co 60, Se 75 Activity half life characteristics of $\square$-sources life time energy activity source size	2.2 Origin of gamma radiation Radio nuclide Isotope Ir 192, Co 60, Se 75, Yb 169 Activity A Characteristics of $\square$-sources half life decay curves maximum activity source size Characteristic of Gamma ray Dose rate constant Spectrum and effective energy	2.2 Origin of gamma radiation Natural and artificial decay Decay series Radio nuclides for NDT Isotope Ir 192, Co 60, Se 75, Yb 169 Activity A Characteristics of $\square$-sources half life decay curves maximum activity source size Characteristic of Gamma ray Dose rate constant Spectrum and effective energy



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	2.3 Interaction of radiation with matter Attenuation absorption primary radiation scattered radiation Influence of:penetrated thickness Type of material Energy Half value layer Tenth value layer	2.3 Interaction of radiation with matter Attenuation photo effect coherent scattering Compton scattering pair production Attenuation coefficient Scatter radiation Specific contrast Radiation contrast Effects of filtering Beam hardening	2.3 Interaction of radiation with matter Attenuation vs. energy photo effect coherent scattering Compton scattering pair production Attenuation coefficient Scatter radiation Specific contrast Radiation contrast Effects of filtering Beam hardening Klein-Nishina law
	2.4 Properties of film systems and Screens Construction base, emulsion, silver bromide grain size and distribution Processing Properties of films sensitivity granularity contrast optical density film system class	2.4 Properties of film systems and Screens Construction Latent image information origin Photo process Properties of film systems characteristic curve film gradient, film contrast, speed influence of film processing sensitivity granularity detail perceptibility Classification of film systems according to. EN 584-1	2.4 Properties of film systems, screens and digital detection systems additional to level 2 New detectors storage phosphor imaging plates flat panels x-ray intensifier line detector Classification of detector systems application



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	Film screens - type of film screens - intensifying effect - filtering effect - film to screen contact	Film screens - type of screens - film screen contact - inherent unsharpness - intensifying effect of filtering - screens for Co 60 and Linac	
	2.5 Geometry for radiographic exposures Geometric unsharpness - object to film distance - focus size d - source to object distance Source film distance	2.5 Geometry for radiographic exposures Geometric unsharpness - object to film distance - focus size d - source to object distance Source film distance Determination of the focal spot size of Gamma sources	2.5 Geometry for radiographic exposures Additional to level 2 Method of focal spot measurement according to EN 12543, EN 12579 Requirements for optimisation by: Geometric unsharpness, total Unsharpness Focus size, current, voltage Source size, activity
3.0 Product knowledge and capabilities of the method and derived techniques	3.0 Typical weld defects imperfections Type of discontinuity according. to EN ISO 6520	3.0 Weld imperfections Type of weld seam and weld seam Preparation	3.0 Weld imperfections Additional to level 2 Introduction to fracture mechanics working load



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		Welding process origin Type of discontinuity according to EN ISO 6520	Materials properties Origin of defects Further NDT methods
	3.1 Typical defects in castings Types of defects	3.1 Defects in castings Casting process Types of cast imperfections and their origin Structural indications Beam direction to detectability	3.1 Defects in castings Casting process Type of cast imperfections and their origin Structural indications Working load Materials properties Production caused defects
	3.2 Influence to detectability type of defect, size orientation Imaged thickness range Number of exposures	3.2 Influence to detectability beam direction geometric distortion increase in wall thickness Imaged thickness range Thickness ranges for x- and gamma rays Number of exposures	3.2 Influence to detectability beam direction geometric distortion increase in wall thickness Imaged thickness range Thickness ranges for x- and gamma rays Number of exposures vs. distortion angle
4.0 Equipment	4.0 Design and Operation of X-ray Machines Stationary systems, mobile unit	4.0 Design and Operation of X-ray Machines Additional to level 1:	4.0 Design and Operation of X-ray Machines Additional to level 2



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	Tubes glass- and metal-ceramic tube Design of tubes standard tube rod anode tube short anode tube Cooling: Gas, water, oil Focal spot High voltage, max. current Exposure time Diaphragm Safety circuit Operation instructions	inherent filtering pre-filtering Devices for special applications micro focus tubes enlargement technique radioscopy Linac Construction Field of application Typical dates	beam opening characteristics x-ray flash devices rod anode devices micro focus devices high voltage devices Line focus tubes Rotary anode tubes
	4.1 Design and Operation of Gamma ray Devices container, shielding class: P, M type: A, B (transportation) source holder and source capsule Enclosed radioactive material manipulation device connections accessory remote control collimation fittings Operation instructions Reference to national requirements and safety regulations	4.1 Design and Operation of Gamma ray Devices Additional to level 1: crawler for pipelines special device for testing of heat exchanger tubes	4.1 Design and Operation of Gamma ray Devices Same as level 2



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	4.2 Accessories for radiographic testing equipment - lead tape measure - holding magnets - lead screens shielding - rubber bands etc. - radiation protection equipment		
5.0 Information prior the Test	5.0 Written procedures are given information about the test object Object dimensions Test class of standard Equipment to be used Exposure arrangement Extent of testing (20 % inspection) marking	5.0 Information about the test object Identification or designation Material, dimensions, isometrics number of parts field of application kind of manufacture catalogue of defects Test conditions - accessibility - infrastructure - particular test conditions Applicable standards Overview Standards assigned to the test object Preparation of written instructions	5.0 Information about the test object and national requirements Additional to level 2: Selection of standards for specific testing Applications European standards - Application standards overview - purpose - technical contents and systematic Product specific standards for special industrial sectors - for welding - for casting - for pipes - pressurised equipment directive ISO standards



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			American standards: overview ASME-Code overview ASTM-Standards
6.0 Testing	Reference blocks : design, production, storage. Operating conditions : Excitation frequency and if necessary auxiliary frequencies Probe speed, probe clearance, probe vibration and centring Calibration curves Settings : data acquisition procedure/instructions	Reference blocks : design, production, storage. Probe : selection, as a result of the information in 5.0, Operating conditions as a result of the information in 5.0 : Excitation frequency and if necessary auxiliary frequencies Probe speed, probe clearance, probe vibration and centring Calibration curves Settings : data acquisition procedure	Reference blocks : design, production, storage. Probe : selection or design, as a result of the information in 5.0, Operating conditions as a result of the information in 5.0 : Excitation frequency and if necessary auxiliary frequencies Probe speed, probe clearance, probe vibration and centring Calibration curves Settings : data acquisition procedure



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7.0 Evaluation And Reporting	7.0 Evaluation NOT APPLICABLE	7.0 Evaluation. Characterisation of the indications : single frequency analysis, multifrequency analysis, data analysis procedure	7.0 Evaluation. Characterisation of the indications : single frequency analysis, multifrequency analysis, data analysis procedure
	7.1 Reporting Examination report	7.1 Reporting Reporting level Examination report	7.1 Reporting Reporting level Examination report
8.0 Assessment	NOT APPLICABLE	Acceptance criteria Codes, standards	Acceptance criteria Significance of discontinuities Codes, standards



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9.0 Quality aspects	9.0 Personnel qualification (according to EN ISO 9712) Equipment verification	9.0 Personnel qualification (according to EN ISO 9712) Equipment verification Written instructions Traceability of documents	9.0 Personnel qualification (according to EN ISO 9712) Equipment verification Format of working procedures, Traceability of documents Other NDT qualification and certification systems A review of applicable NDT application and product standards
10.0 Developments	NOT APPLICABLE	General information	Array probes Pulsed eddy currents Non inductive techniques : Magneto-Optical Imaging, SQUID, Giant magneto resistance,... Imaging Modelling