



# NZ Non Destructive Testing Association Inc.

C/- HERA, PO Box 76-134 Manukau City, Auckland 2241

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<b><u>COURSE TITLE</u></b>	<b>Liquid Penetrant Level 2</b>
<b><u>COURSE CODE</u></b>	<b>PT20A</b>
<b><u>Revision</u></b>	<b>Initial Issue Dated 01 June 2021</b>

## **Purpose:**

The body of technical knowledge required of non-destructive testing (NDT) personnel is essential for maintaining the quality level of all NDT inspections regardless of method or technique. The content and expected outcomes of this course are designed to cover the Liquid Penetrant (PT) inspection of all product forms for evaluation of surface discontinuities ((Manufacturing and In-service) at qualification Level 2 (ISO 9712).

This course is also designed to prepare the trainee for the **Theory** (Formal Training) part of the CBIP Liquid Penetrant certification **PT2**

Practical training and assessments have been included in this course for demonstration purposes and to confirm the adequacy of the training.

Introduction to specialized inspection techniques such as Leak Testing and Filtered Particle Testing are included in the training, however additional formal training in these categories will be required before applying for certification in these techniques

## **Competency Standards:**

This course and associated training materials have been designed to comply with the following documents

ISO 9712-2012 -Non-Destructive Testing - Qualification and Certification of NDT Personnel

ISO/TS 25107:2019 - Non-destructive testing — NDT training syllabuses

CBIP PRO-CER-18 - Guidelines for certification General

CBIP PRO-CER-15 - Guidelines for certification Liquid Penetrant testing



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## Learning Outcome:

Trainees will be able to demonstrate knowledge of the Liquid Penetrant inspection process including practical applications and Interpretation and evaluation at Level 2

They should be able to perform the following;

- Select the PT technique to be used based on general specifications (AS 2062)
- Define the limitations of PT (Liquid Penetrant) method.
- Translate PT standards, specifications and procedures into written instructions.
- Set up and verify equipment settings and perform PT inspections including interpretation and evaluation of results according to applicable standards
- Provide supervision and guidance for personnel at or below Level 2,
- Report the results of Liquid Penetrant Inspections.

## For Whom

Personnel involved in the PT inspection of all product forms for surface discontinuities and personnel seeking PT certification to Level 2 iaw CBIP PRO-CER-15 and ISO 9712.

## Prerequisite

This course is designed for personnel seeking qualification directly to **PT Level 2**. Level 1 certification (or equivalent) is not a prerequisite for this course, ***however it is strongly advised that trainees have a basic understanding of the method along with some practical experience with both portable and stationary tank equipment.***

Theory and Practical training hours are based upon the candidate possessing both prior knowledge of materials and processes and exposure to the basic penetrant processing steps (including inspection).

If the CBIP certification exams are to be attempted at the completion of this course, it is recommended that the candidate have at least 2 months practical experience in the penetrant testing in addition to this course.

Trainees shall also have an understanding of English (written and spoken) to a level of TOEFL 500

## Course Duration

The course will be delivered over a period of 40 hours covering (5 days).

A course plan detailing the expected timetable will be issued to the trainee at the start of the course. The course will consist of theory lecturers, practical exercises and assessments as detailed in the course programme and attached syllabi.

The practical content of this course can be delivered at a remote training facility or at the trainee's workplace.



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## Instructor

Course instructors shall be accepted by NZNDTA and their adequacy documented. Instructors should be qualified to L3 (or equivalent as determined by NZNDTA) in the Liquid Penetrant method.

## Assessments:

Informal assessments will be allocated to trainees at the end of each day. These will be used for determining training effectiveness. The end of course assessment shall consist of a minimum of 40 questions adapted from the ASNT Recommended Practice SNT-TC-1A question and answer book. To successfully complete this course a minimum pass mark of 70% is required

***CBIP certification exams need to be applied for separately – Additional charges apply***

## Resources:

Trainees will be issued with training notes and handouts reflecting the training presentation as identified in the course program.

Course evaluation/feedback forms will also be supplied and, upon successful completion of all modules, an NZNDTA endorsed completion certificate will be issued.

Trainees will also be provided with a list of training material required along with any Health and Safety requirements prior to commencement.

## Course Delivery

The course may be delivered by one (or a combination) of the following

- A. ***Computer based interactive webinar.***- This will be confined to specific theory modules that do not include any practical content or where trainees are required to have only minimal participation. Trainees will have the ability to communicate with the instructor and other participants. Learning outcomes and training effectiveness will be evaluated by written assessments delivered at the end of each module
- C ***Classroom.***- Interactive classroom training where the trainee has access training material, equipment and test pieces.
- B ***Home study.*** - Trainees will be given written assessments that require them to review and interpret the training material at the end of each day/module
- D ***Workplace Practical Exercises*** – Trainees will be given written practical exercises that can be completed at their normal place of work. This will enable trainees to access additional equipment and resources to complement their training. These will be supervised by the instructor or delegated representative to confirm and supervise the effectiveness of the training. The delegated representative will be approved by the instructor and NZNDTA and will be at least PT Level 2 and IANZ signatory. This may be the trainees employer/supervisor. Training effectiveness will be evaluated by specific checks documented at each stage of the exercise.



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## **Course Program and Syllabi**

The Course syllabus is designed to comply with CBIP PRO-CER-15 and ISO 25107

## **Appendix A**

The course syllabi and instructor guide (appendix A) will detail the acceptable delivery system(s) and timing for each module.

Practical exercises are documented at the end of appendix A along with itemised practical training samples required for each exercise.

Minimum requirements for the PT equipment used for the practical exercises are also included.

## **Documentation Control**

Course documentation will be approved, controlled and owned by NZNDTA.

## **Course APPROVAL:**

NZNDTA Rep \_\_\_\_\_

PT Level 3 \_\_\_\_\_



## Appendix A

### Course PT20A Liquid Penetrant Inspection Level 2

#### Course Syllabi and Instructor Time Table

The following referenced material has been used to develop the structure and content of this PT course PT20A

- CBIP PRO-CER-18 and 15 Training Guidelines
- ISO/TS 25107 Non-destructive testing — NDT training syllabus
- ANSI/ASNT CP-105 Qualification outlines
- ASNT Training handbook – Liquid Penetrant Testing
- NDE/NDT Resource Centre
- OEM supplied equipment training material

<b>Module 1</b>	
<b>Introduction to terminology and history of Liquid Penetrant testing (PT)</b>	
<b>Content</b>	<b>Timeframe and notes</b>
Introduction to NDT and Certification (ISO9712)	<b>Notes</b>  <b>4 hours</b>
Certification Examination overview and responsibilities	
Definitions	
Introduction to NDT	
Penetrant Testing overview	
Limitations and capabilities	
History of Liquid penetrant Inspection	
Confirmation of training effectiveness - Module 1	<ul style="list-style-type: none"><li>• Review questions</li></ul>



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<b>Module 2 Penetrant Properties</b>		
<b>Section</b>	<b>Content</b>	<b>Timeframe and notes</b>
Penetrant Properties	Capillary Action	<b>Notes</b>  <b>4 hours</b>  <b>End of Day 1</b>
	Surface Tension, Contact angle and Wet ability	
	Viscosity	
	UV stability, flash point and removability	
	Brightness and Dye Threshold	
	Sensitivity	
	Colour Contrast and Fluorescent	
	Classification AMS 2644	
	Type method sensitivity WW, PE Solvent	
	Developers and solvents	
Family concept		
Confirmation of training effectiveness - Module 2		<ul style="list-style-type: none"> <li>Review questions</li> </ul>



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<b>Module 3</b>			
<b>Penetrant Processing Steps</b>			
<b>Section</b>	<b>Content</b>	<b>Timeframe and notes</b>	
Surface Preparation	Pre cleaning Solvents	<b>Notes</b>  <b>6 hours</b>	
	Acid and Alkaline		
	Detergent - Aqueous		
	Non Aqueous		
	Corrosion and Paint removal		
	Etching		
	Pre cleaning studies		
Penetrant Application	Selection		
	Immersion, spray, dip and drain		
	Contact dwell times		
	Electrostatic spray		
Penetrant removal	Water washable		
	Post Emulsification		
	Lipophilic and Hydrophilic		
	Immersion and Spray		
	Solvent Removable		
Drying	Temperature		
	Time		
	Air and oven drying		
Development	Application and developer action		
	Dry and wet		
	Non aqueous		
	Spray and dust cabinets		
	Dwell times		
Confirmation of training effectiveness - Module 3			• Review questions



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<b>Module 4</b>		
<b>Lighting and Equipment</b>		
<b>Section</b>	<b>Content</b>	<b>Timeframe and notes</b>
Lighting	Inspection area	<b>Notes</b>  <b>2 hours</b>  <b>End of Day 2</b>
	Electromagnetic Spectrum	
	Fluorescence	
	Black – UV light	
	LED and Mercury Bulbs	
	Dark adaption	
	Visual Acuity	
Equipment	Portable Kits and Stationary Tank lines	
	Automatic systems	
Confirmation of training effectiveness - Module 4		<ul style="list-style-type: none"> <li>• Review questions</li> </ul>

<b>Module 5</b>		
<b>Inspection</b>		
<b>Section</b>	<b>Content</b>	<b>Timeframe and notes</b>
Inspection	Inspection	<ul style="list-style-type: none"> <li>• Notes</li> <li>• Practical exercises</li> </ul> <b>4 hours</b>
	Wipe off technique	
	Evaluation	
	Indications	
	Relevant, non relevant and false	
	Types of true indications	
	Recording Indications	
Test Record and Report		
Confirmation of training effectiveness - Module 5		<ul style="list-style-type: none"> <li>• Review questions</li> <li>• Practical exercises</li> </ul>





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<b>Module 6</b>		
<b>Technique Considerations</b>		
<b>Section</b>	<b>Content</b>	<b>Timeframe and notes</b>
Technique considerations	Information prior to test	<b>Notes</b>  <b>1 hour</b>
	Human Factors	
	Post cleaning	
	Water based penetrants	
	Filtered Particle Inspection	
Confirmation of training effectiveness - Module 6		<ul style="list-style-type: none"> <li>• Review questions</li> </ul>

<b>Module 7</b>		
<b>Equipment Control and EHS</b>		
<b>Section</b>	<b>Content</b>	<b>Timeframe and notes</b>
Equipment Control	Penetrant control and checks	<ul style="list-style-type: none"> <li>• <b>Notes</b></li> <li>• <b>Practical exercises</b></li> </ul> <b>3 hours</b>  <b>End of Day 3</b>
	Emulsifier control	
	Developer checks	
	Timers and gages	
	Portable kit checks	
	Reference Blocks	
	Process sensitivity test – TAM panel	
	Health and safety and chemical handling	
	Penetrant treatment and disposal	
Confirmation of training effectiveness - Module 7		<ul style="list-style-type: none"> <li>• Review questions</li> <li>• Practical exercises</li> </ul>



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<b>Module 8</b>		
<b>Product Knowledge and Manufacturing</b>		
<b>Section</b>	<b>Content</b>	<b>Timeframe and notes</b>
Basic manufacturing And associated discontinuities	Production of steel and fabrication processes.	<ul style="list-style-type: none"> <li>• Notes</li> <li>• Practical exercises</li> </ul> <p><b>4 hours</b></p>
	Casting, Rolling, Forging and Wrought	
	Heat treatment	
	Welding	
	Extrusion, Tubing and Pipe	
	Common defects associated with the processing and finishing	
In-service inspection	Corrosion and cracking	
	Fatigue	
Confirmation of training effectiveness - Module 8		<ul style="list-style-type: none"> <li>• Review questions</li> </ul>

<b>Module 9</b>	
<b>Examination Preparation</b>	
<b>Content</b>	<b>Timeframe and notes</b>
Production of written Instruction	<ul style="list-style-type: none"> <li>• BINDT CP25</li> <li>• Notes</li> </ul> <p><b>4 hours (End of Day 4)</b></p>
Theory, Specific and Practical exam review	
ISO 9712	
AS 2062 – ISO3452-1-2-3	
ASTM E 1417	
<b>Review and CBIP examinations</b>	<b>8 Hours (Day 5)</b>



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## PT20A Practical Exercises

Test Piece Description	Identification	Practical Demonstration
TAM Panel	S/n 4748	<ul style="list-style-type: none"> <li>• <b>Process sensitivity test</b></li> </ul>
Ni Cr Panels	84321 A and B	<ul style="list-style-type: none"> <li>• <b>Sensitivity test</b></li> </ul>
Steel Weld – Groove Steel Weld - Fillet	CEC5596 94566	<ul style="list-style-type: none"> <li>• <b>Written Instruction</b></li> <li>• <b>Defect detection</b></li> <li>• <b>Datum</b></li> <li>• <b>Reporting</b></li> </ul>
SS steel Welded tube	LP25	<ul style="list-style-type: none"> <li>• <b>Defect detection</b></li> <li>• <b>Datum</b></li> <li>• <b>Reporting</b></li> </ul>
Extruded Aluminium plate	PN06-5	<ul style="list-style-type: none"> <li>• <b>Corrosion detection</b></li> <li>• <b>Datum</b></li> <li>• <b>Reporting</b></li> </ul>
Forged Aluminium plate	LP34	<ul style="list-style-type: none"> <li>• <b>Crack detection</b></li> <li>• <b>Datum</b></li> <li>• <b>Reporting</b></li> </ul>
Cast Aluminium Arm	LP1D	<ul style="list-style-type: none"> <li>• <b>Crack detection</b></li> <li>• <b>Datum</b></li> <li>• <b>Reporting</b></li> </ul>
Steel fillet weld (macro)		<ul style="list-style-type: none"> <li>• <b>Visual Insp with Magnification</b></li> </ul>

## PT20A Practical Exercises - Equipment

All PT equipment used for the practical exercises shall comply with AS 2062

Full immersion tank lines are not required

Visible and fluorescent portable inspection kits designed for weld inspection are required along with suitable ventilated areas satisfying the requirements of the equipment MSDS

Tam Panels (or equivalent), UV inspection lights and light meter also required