



QUALITY CONTROL – IRAQ

Revision: 01
Effective: 20.July.2020

WORK INSTRUCTION

QC LPT/2015/01

LIQUID PENETRANT INSPECTION PROCEDURE

Record of Amendments

The following is a brief summary of the most recent revisions to this document.

Date	Revision No.	Amended By	Description of Changes
01 Mar 2015	00	Quality Control	Initial Issue.
20 July 2020	01	Quality Control	Update Edition SNT TC 1A 2001 to SNT TC 1A 2016



Checked by: _____
Ahmed Mohamed Abd Alkader
Operations Manager

Approved by: _____
Syed Muhammad
General Manager



QUALITY CONTROL – IRAQ

Revision: 01
Effective: 20.July.2020

WORK INSTRUCTION

QC LPT/2015/01

LIQUID PENETRANT INSPECTION PROCEDURE

Contents

1.0	Introduction	-----	3
2.0	Scope	-----	3
3.0	Standards and References	-----	3
4.0	Terminology	-----	4
5.0	Safety	-----	4
6.0	Personnel Qualifications	-----	5
7.0	Identification and Datum Points	-----	5
8.0	Surface Preparation	-----	5
9.0	Extent of Inspection	-----	6
10.0	Equipment Specification	-----	6
11.0	Equipment Calibration	-----	11
12.0	Equipment Function Test	-----	11
13.0	Technique Sheets	-----	11
14.0	Acceptance / Rejection Criteria	-----	14
15.0	Reporting	-----	14
16.0	Post Cleaning	-----	15



	QUALITY CONTROL – IRAQ	Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION	QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE	

1.0 Introduction

1.0

- 1.1 The objective of this procedure is to provide the Customer and Verifying Bodies with a documented procedure for the execution of Liquid Penetrant Inspection and provide NDT personnel with a general but non-specific procedure which addresses the activities associated with the Inspection of ferrous and non-ferrous materials.
- 1.2 Prior to commencement of any inspection, (Quality Control - Iraq) shall inform NDT personnel of the scope of work ahead. Inspectors shall ensure that they are familiar with the instruction and procedural requirements of work to be undertaken and that all relevant information documented or otherwise is made available to facilitate job completion.

2.0 Scope

- 2.1 The scope of this procedure covers the use of both visible and fluorescent techniques for the detection of surface discontinuities only and is based on BS EN ISO 571, Part 1 – Standard Practice for Non-Destructive Testing, Liquid Penetrant Testing and ASTM E165-02 – Standard Practice for Liquid Penetrant Testing.
- 2.2 The basis of this procedure covers the use of Liquid Penetrant Inspection using visible and / or fluorescent methods, solvent removable or water washable techniques.
- 2.3 Unless otherwise agreed by (Quality Control - Iraq), this procedure shall be used when performing duties or activities involving Liquid Penetrant inspection.
- 2.4 This procedure is intended to reveal flaws from the test, which may or may not be detrimental to the integrity of the structure. It will, at all times be the objective of the technician to find and report all significant flaws.
- 2.5 Clients may request that the work-scope be carried out in accordance with BS 6443:1984 and its associated documents for reference for Liquid Penetrant Flaw Detection. To accommodate this requirement, reference should be made to the technique sheets within the appendices of this procedure in order to withdraw the need to further amend the text of this main procedure.

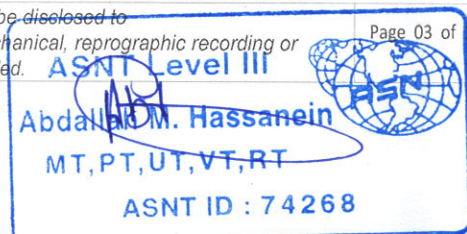
3.0 Standards and References

- 3.1 The following documents are applicable to meet the general or specific industry requirements:

- BS EN ISO 571-1 – Liquid Penetrant Testing, Part 1 – General
- Company Safety Procedures
- Company Operating procedures
- Health & Safety Law
- COSHH Regulations

▪ SNT-TC-1A Recommended Practice – Qualification and Certification in NDT 2016 Edition

This document is the property of Quality Control – Iraq Neither the whole nor any part of this document may be disclosed to others or reproduced, stored in a retrieval system, or transmitted in any form by any means (electronic, mechanical, reprographic recording or otherwise) without prior written consent of the owner. Printed copies of this document are considered Uncontrolled.



	QUALITY CONTROL – IRAQ	Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION	QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE	

PCN Certification Scheme Documentation – Personal Qualification and Certification in NDT

- Company Written Practice
- ASME VIII Acceptance Standard
- Client Specification – Acceptance Standards (Attached Separately)
- BS EN ISO 1330-1 – Non Destructive Testing, Terminology Part 1 and General Terms
- BS EN ISO 3059 – Non Destructive Testing – Viewing Conditions
- BS EN 473 – General Criteria for Certification and Qualification of NDT Personnel
- BS EN 571-1 – Liquid Penetrant Examination
- ASTM E165-02 – Standard Test Method for Liquid Penetrant Examination

(All above documents shall be based on the latest revision).

Note – Other standards which may be required, as part of customers' requirements shall be detailed on the technique sheet without further amendments to the text of the main procedure.

4.0 Terminology

4.1 Standard terms and abbreviations used within this procedure are defined within the glossary terms and definitions BS EN 1330-1 Non Destructive Testing Terminology Part 1 – Glossary Terms.

4.2 Non standard definitions / abbreviations are as follows:

- SNT – Society of Non-Destructive Testing
- PCN – Personnel Certification in NDT
- NDT – Non Destructive Testing

5.0 Safety

Where deemed necessary, all technicians performing Liquid Penetrant inspection shall wear, and prior to and during inspection, safety glasses, safety boots, safety coveralls and gloves as a minimum.

All operators shall be familiar with the Health and Safety Law and be cognisant with the Company Safety Procedure.

Operators carrying out Liquid Penetrant Inspection shall be aware of the hazards involved, i.e. fire, chemical reaction, toxic, UV-A radiations etc and this would be cognizant with C.O.S.H.H. Regulations and associated risk assessments.

All inspection work carried out on clients' installations or sites must be aware of and adhere to the permit to work systems, where applicable.

No inspection tasks will be performed without the operators being in possession of a valid permit entitling them to carry out inspections as specified within the correct permit.

This document is the property of Quality Control – Iraq Neither the whole nor any part of this document may be disclosed to others or reproduced, stored in a retrieval system, or transmitted in any form by any means (electronic, mechanical, reprographic recording or otherwise) without prior written consent of the owner. Printed copies of this document are considered Uncontrolled.

Page 04 of 15



ASNT Level III
Abdullah M. Hassanein
MT, PT, UT, VT, RT
ASNT ID : 74268



	QUALITY CONTROL – IRAQ	Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION	QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE	

In compliance with the installation / work site permit requirements, any materials / consumables used during the inspection must be disposed of safely using the receptacles provided.

6.0 Personnel Qualifications

- 6.1 All operators performing Liquid Penetrant inspection shall be trained, experienced and currently certified in that method to SNT or PCN Level II, or equivalent in weld sector, as a minimum or to the sector and category for the item being inspected. Relevant to the department of their employ.

All training records shall be kept within personnel files. All operators shall hold current valid certification in accordance with the Company Written Practice and in line with SNT-TC-1A 2016 Edition.

Operators' qualification certificates shall be available for review by the client at any time.

All personnel shall meet, in addition to the above; the qualification requirements stated by the client and shall demonstrate their experience and competence in any given aspect of the technique, if required.

7.0 Identification and Datum Points

- 7.1 All material inspected shall have evidence of a unique number for traceability as determined by client.
- 7.2 A datum point shall be clearly marked by means of paint, marker pen, tape or other means acceptable by the client in order to identify the areas where indications or discontinuities may be present and to ensure the repeatability of test results or the future location of defects.
- 7.3 In the event of any material being found defective a detailed drawing will be provided. The item shall be identified as rejected and marked clearly on the component using a marking pen or similar that will not affect the use of the component or prejudice any subsequent testing.

8.0 Surface Preparation

- 8.1 All area(s) under inspection shall be clean and dry and free from all contaminants such as oil, grease, debris, rust, scale, paint, water and or any foreign matter that may affect or hinder the sensitivity of the test.
- 8.2 Mechanical cleaning operations must be carefully managed so as not to damage the surfaces of inspection leading to mechanical damage or by peening the surface which may lead to closing discontinuities open to the surface.



	QUALITY CONTROL – IRAQ	Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION	QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE	

10.0 Extent of Inspection

- 9.1 All areas to be inspected should be identified on a request for inspection as required or provided by the client / issuing authority.
- 9.2 Where sections or part sections require inspection, at least 25mm either side of those areas shall be tested unless otherwise agreed by contracting parties.

10.1 Equipment Specification

- 10.1 The equipment used will be maintained in proper working order in accordance with the requirements and applicable reference specifications (BS EN ISO 571-1 and ASTM E165-02).

Radiometers / Photometers will be identified by a unique serial number and will be calibrated by an independent body every 12 months and carried with a valid certificate of calibration, sighting the corresponding serial number of the equipment.

- 10.2 The type of equipment normally used in the activities associated with the material under test, but not limited to, are as follows:

- Penetrants – Johnson & Allen (JAP) or Equivalent
- Cleaners – Johnson & Allen (JAC) or Equivalent
- Developers – Johnson & Allen (JAD) or Equivalent
- UV-A Lamps Portable 110V A.C.
- Radiometer / Photometer
- Comparator Block, Aluminium or Silver
- Sherwin Panel (Tam Panel) for Fluorescent

Note – Penetrants, cleaners and developers shall be from the same family and manufacturer. Only approved product families shall be used.

10.3 Visible Penetrant Examination

This method used a penetrant that can be seen in visible light conditions.

The penetrant is usually required, so that the indications produce a definite contrast with the white background of the developer. The visible penetrant process does not require the use of a black-light (UV-A lamp). However, visible penetrant indications must be viewed under adequate white-light.

10.4 Fluorescent Penetrant Examination

This method uses penetrants that fluoresce brilliantly when excited by black-light (UV-A lamp). The sensitivity of the fluorescent penetrants depends on their ability to be retained in the various size discontinuities during processing, then to bleed out into the developer coating and produce indications



th
at will fluoresce. Fluorescent indications are many times brighter than their surroundings when viewed under black-light (UV-A) illumination.

- 10.5 Technique No. PT/EN/T/01 – Visible Colour Contrast Solvent and Removable
Technique No. PT/EN/T/02 – Fluorescent Solvent Removable

10.5.1 This method is designed so that excess surface penetrant can be removed by wiping until most of the penetrant has been removed.

The remaining traced should be removed with solvent dampened wipes. To minimise removal of penetrant from discontinuities, care should be taken to avoid the use of excess solvent. Flushing the surface with solvent at the intermediate cleaning stage to remove the excess penetrant is prohibited.

10.5.2 Application

The method of penetrant application shall be by any appropriate method which wets the surface and is conveniently portable and suitable for location application.

10.5.3 The penetrant shall remain wet on the part surface for the total duration of dwell time (contact time). Additional penetrant may be re-applied during the dwell time.

10.5.4 Temperature

The temperature of the test surface shall generally be within the range from 10°C to 50°C. In special cases, temperatures as low as 5°C may be used, higher temperatures than 50°C may dry the penetrant within the discontinuities.

10.5.5 Dwell Time (Penetration Time)

The dwell time shall meet the specification requirements but shall not be less than 5 minutes. The penetration time can vary from 5 to 60 minutes. The penetration time should be at least as long as the time used for the determination of sensitivity from a practical test carried out previous to inspection of the surface to be inspected.

Practical tests may be carried out in accordance with the client's requirements and BS EN 571, Part 3.

10.5.6 Where no specific requirement is set, general dwell time of 20 to 30 minutes shall be used.

10.5.7 Excess Penetrant Removal

During excess penetrant removal the test surface shall be visually checked for penetrant residues. For fluorescent penetrants, this shall be carried out under a UV-A source. The minimum UV-A irradiance at the test surface shall not be less than 3W/M² (300 μw/cm²).

	QUALITY CONTROL – IRAQ	Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION	QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE	

Excess penetrant shall be removed by a dry lint free wipe followed by a solvent dampened lint free wipe until most traces of penetrant have been removed. Avoid the use of excess solvent as this may wash the penetrant from the discontinuities.

10.5.8 Developer

Application of developers shall be carried out as soon as possible after the removal of excess penetrant and meet with Section 10.7 of this procedure and comply with the requirements of the relevant standard specified by the client.

10.6 Technique No. PT/EN/T/03 – Visible Colour Contrast Water-Washable Technique No. PT/EN/T/04 – Fluorescent Water Washable

10.6.1 This method is designed to be directly water-washable from the surface of the test part, after a suitable penetrant dwell time.

10.6.2 Because the emulsifier is “built in” to the water-washable penetrant, it is extremely important to exercise proper process control in removal of excess surface penetrant to ensure against over washing. Water washable penetrants can be washed out of the discontinuities if the rinsing step is too long or too vigorous.

10.6.3 Application

The method of penetrant application shall be by any appropriate method, which wets the surface and is conveniently portable and suitable for local applications.

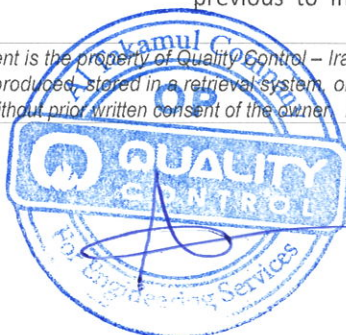
10.6.4 Temperature

The temperature of the test surface shall generally be within the range from 10°C to 50°C. In special cases, temperatures as low as 5°C may be used, higher temperatures than 50°C may dry the penetrant within the discontinuities.

10.6.5 Dwell Time (Penetration Time)

The penetrant shall remain wet on the part surface for the total duration of dwell time (contact time). Additional penetrant may be re-applied during the dwell time.

The dwell time shall meet the specification requirements but shall not be less than 5 minutes. The penetration time can vary from 5 to 60 minutes. The penetration time should be at least as long as the time used for the determination of sensitivity from a practical test carried out previous to inspection of the surface to be inspected.



WORK INSTRUCTION

QC LPT/2015/01

LIQUID PENETRANT INSPECTION PROCEDURE

Practical tests may be carried out in accordance with the clients' requirements and BS EN 571, Part 3.

10.6.6 Removal

During excess penetrant removal the test surface shall be visually checked for penetrant residues. For fluorescent penetrants, this shall be carried out under a UV-A source. The minimum UV-A irradiance at the test surface shall not be less than 3W/M² (300 μw/cm²).

First the excess penetrant shall be removed with water. Subsequent cleaning with a clean lint free cloth, lightly moistened with solvent, shall then be carried out.

The removal process from the water washable technique shall be that the pressure of the spray should not exceed 40 p.s.i. (2.75 bar) in pressure and any air supply used should not exceed a maximum of 25 p.s.i. (1.72 bar) in pressure. The wash cycle shall be ≤ 120 seconds. Water temperatures shall not exceed 50°C.

The temperature of the water shall be relatively constant and should be maintained within the range of 50° to 100°F (10° to 38°C) or otherwise agreed by the contracting parties. Wash angle shall be at 45° to the part surface and the nozzle to the surface distance shall be ≥ 300mm.

10.6.7 Drying

Drying the surface of the parts is necessary prior to the application of a Non-aqueous wet developer (solvent based). Drying time will vary with the size, nature, and number of the parts under inspection.

Note* Parts can be dried free from excess water by using various modes e.g. Hot or circulating air, ovens etc, provided temperatures do not exceed specification limitations, or less than 50°C whichever is the lesser.

10.6.8 Developer

Application of developers shall be carried out as soon as possible after the removal of excess penetrant and meet with Section 10.7 of this procedure and / or comply with the requirements of the relevant standard specified by the client.

10.7 Developers

10.7.1 Non-aqueous wet developers shall be the preferred type within, after the excess penetrant has been removed and the surface has been dried. Application of the developer shall be applied as soon as possible after the removal of excess penetrant and there by spraying in such a manner as to ensure complete part / area coverage with a thin even layer of developer. Non-aqueous



WORK INSTRUCTION

QC LPT/2015/01

LIQUID PENETRANT INSPECTION PROCEDURE

wet developers form a coating on the surface of the part when dried, which serves as a developing medium; this type of developer is intended for application by aerosol spray only.

- 10.7.2 The length of time the developer is to remain on the part prior to inspection shall begin immediately after the developer coating is dry. The interpretation time shall be normally between 10 and 30 minutes. Maximum permitted developing times is one hour or otherwise agreed by the contracting parties / client and manufacturers recommendations. The operator will observe the bleed out while applying the developer as an aid in the interpreting and evaluating indications at regular intervals throughout the developing time.

10.8 Viewing

- 10.8.1 All examinations shall start with a visual examination to ensure removal of all surface contaminants and/or identify discontinuities that may produce indications during inspection.

Note: Any mechanical damage found during visual inspection shall be reported for further evaluation.

- 10.8.2 Visual examination(s), shall be performed under evenly illuminated light (artificial or daylight) which shall be at or exceed 500 lux.

- 10.8.3 UV-A Intensity irradiance shall be $\geq 1000 \text{ W/cm}^2$ (10 W/m^2) at the inspection surface in accordance with BS EN ISO 3059.

Note: A warm up period of 10 minutes may be required when using mercury vapour arc lamps prior to use.

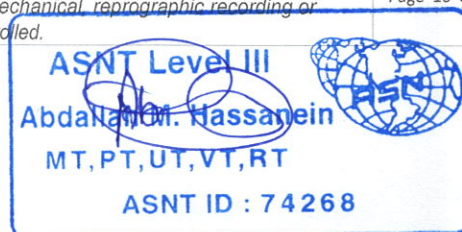
- 10.8.4 When fluorescent UV-A techniques are used, the operator shall carry out the inspection in a darkened area ($\leq 20 \text{ lux}$) and allow at least 5 minutes prior to the inspection to enable their eyes to adapt to the dark viewing conditions. Photo chromatic spectacles shall not be worn when working with UV-A light. For prolonged periods within the UV-A test areas, sodium tinted glasses may be worn.

- 10.8.5 UV-A lamps shall be fitted with a suitable filter and checked to verify they are free from any damage and be kept clean prior to each use. Damaged filters shall be immediately replaced.

Black-lights (UV-A Lamps) shall be checked periodically for cleanliness and integrity and shall be cleaned, repaired or replaced, as appropriate.

Periodic checks of cleanliness / integrity need not be recorded in accordance with BS EN ISO 3059 and ASTM E165.

- 10.8.6 A radiometer shall be used to verify light levels for both the visible & fluorescent techniques used.



	QUALITY CONTROL – IRAQ	Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION	QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE	

11.0 Equipment Calibration

- 11.1 Only equipment that holds current valid calibration certification to National or International standards shall be used when performing Liquid Penetrant Inspection. Calibration information shall be identified on the equipment either by tags, stickers or by any other method approved.
- 11.2 Records of calibration shall be kept / controlled within the Company Quality System.

12.0 Equipment Function Tests

- 12.1 The operator shall carry out a functional test on a daily basis or prior to commencement of work. The test shall be designed to ensure the proper functioning of both the equipment and the penetrants in order to reveal discrepancies in the process or the penetrant / consumables.

The most reliable test is to inspect and representative part containing natural or artificial discontinuities of a known type, location, size and size distribution.

In the absence of actual production parts with known discontinuities, e.g. comparator blocks or tam panels may be used.

- 12.2 An updated record of all the checks shall be kept on file within the Quality System to include sensitivity checks, and any other function tests that may be required.

Any equipment that fails a function test shall be quarantined and tagged as to the nature of the non-conformance.

After repair of any equipment, a new calibration shall be carried out in accordance with Section 11.0 of this procedure and a record of the equipment history shall be maintained on file.

- 12.3 Restrictions

Any restrictions of the operator carrying out this procedure or on its application shall be reported to one person only and they should be an IMES Supervisor, employer or client. Any deviation from this procedure shall be approved by IMES prior to its application. All amendments shall be recorded.

13.0 Technique Sheets

- ☐ The Inspection Company shall apply this procedure in conjunction with the appropriate standard technique sheet(s) detailed in Appendix 1, which are based on the requirements of BS EN ISO 571 and ASTM E165.
- ☐ Where required, by client / contract, job specific technique sheets shall be compiled and issued to address any differing parameters that may be applicable. These techniques sheets must be read in conjunction with this procedure.

This document is the property of Quality Control – Iraq Neither the whole nor any part of this document may be disclosed to others or reproduced, stored in a retrieval system, or transmitted in any form by any means (electronic, mechanical, reprographic recording or otherwise) without prior written consent of the owner. Printed copies of this document are considered Uncontrolled.

Page 11 of 15

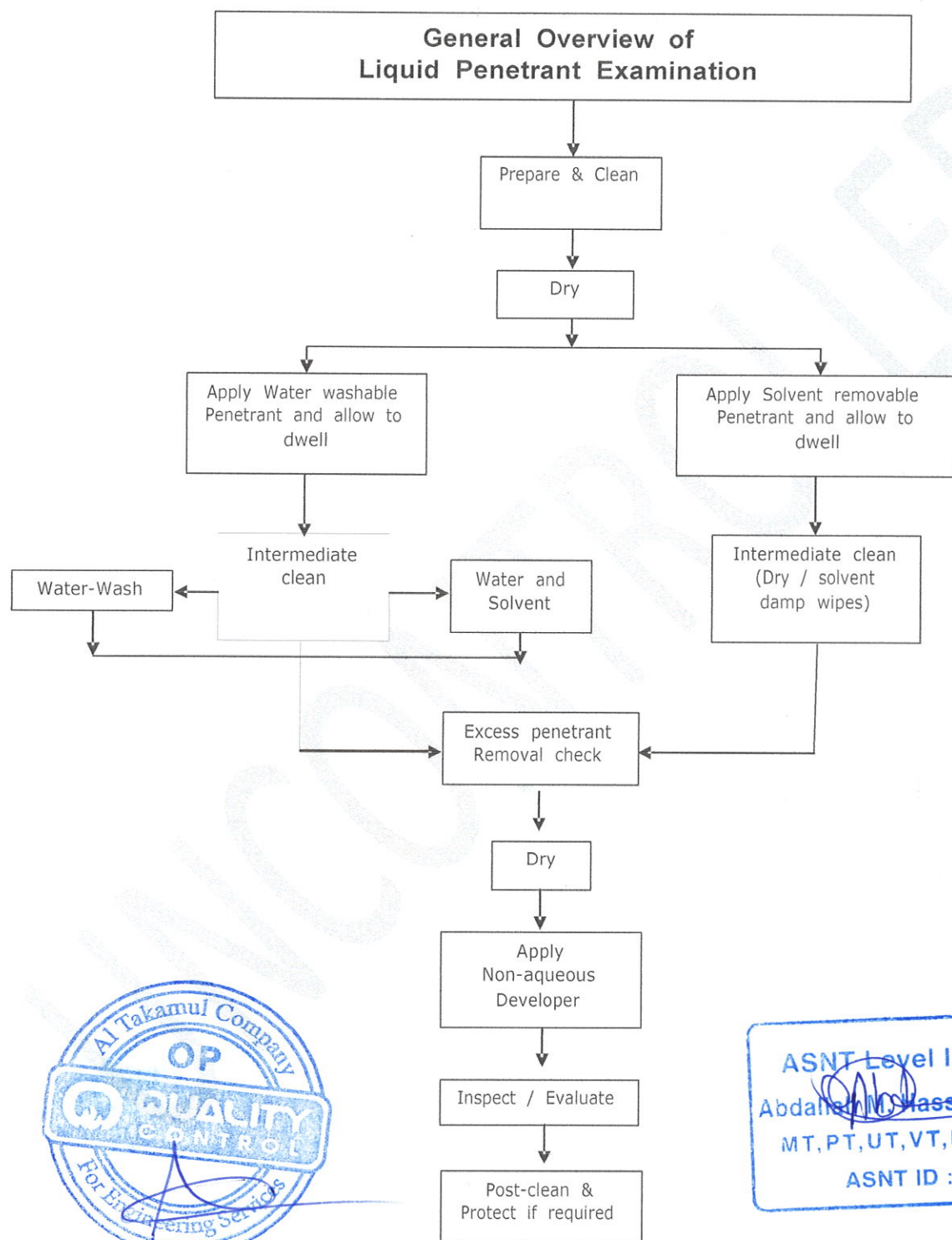


	QUALITY CONTROL – IRAQ	Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION	QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE	

- ☐ Technique sheets shall be compiled and / or approved by personnel qualified to at least Level II in the appropriate method, sector and category of the product to be examined.
- ☐ Technique sheets shall be completed in the same format as that given in Appendix 1 of this procedure and furnished with a form number and controlled by the Quality Department.



13.1 Liquid Penetrant Process Flowchart for Water Washable and Solvent Removable Techniques



	QUALITY CONTROL – IRAQ	Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION	QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE	

14.0 Acceptance / Rejection Criteria

Acceptance Standards are a matter of agreement between the manufacturer and the purchaser and should be stated in a referenced contract, specification or code prior to NDE Inspection. The operator is normally issued the acceptance standards to be applied before commencement of work.

These acceptance standards shall apply unless other more restrictive standards are specified for specific materials or applications within this Division.

Where the client or contract does not require items to be assessed in accordance with defined acceptance criteria Lloyds British, shall provide a factual report detailed all detected true, relevant flaw detections. In this case, (Integrated Inspection & Surveying) shall not accept or reject an item. Determination of an indication and its detriment to the component under its service life conditions becomes the responsibility of the client.

As a standalone document, ASME VIII Acceptance Standard, Appendix 8 has been used as minimum requirement. Evaluations assessed shall not be less stringent than that of ASME VIII unless otherwise specified by the client.

All surfaces to be examined shall be free of:

- a) Relevant linear indications
- b) Relevant rounded indications greater than 3/16 in. (4.8mm)
- c) Four or more relevant rounded indications in a line separated by 1/16 in. (1.6mm) or less (edge to edge).

15.0 Reporting

15.1 On completion of Liquid Penetrant Inspection a detailed report shall be completed and include essential data as follows, as a minimum:

- Customer
- Job Number
- Identification (Component)
- Item number
- Material Type - Surface Condition
- Dimensions
- Quantity
- Test Procedure Number
- Date of Inspection
- Inspectors Signature and Qualifications
- Penetrant Type
- Method Used
- Results / Sentencing / Rework



	QUALITY CONTROL – IRAQ		Revision: 01 Effective: 20.July.2020
	WORK INSTRUCTION		QC LPT/2015/01
	LIQUID PENETRANT INSPECTION PROCEDURE		

Specific report formats may be requested by various clients and may be attached to this procedure as an appendix only.

Note: For specific accept / reject criteria set by clients shall be attached to this procedure as an appendix only and may be clearly defined within the technique sheet available. Refer to Appendix 1.

15.2 Reporting Results

All indications shall be considered to be relevant until proved otherwise. Surface dressing may be carried out to prove the relevancy of any indication but only with the permission of the client who should be given the opportunity to witness this.

A concise report including sketches and or photographs where necessary will be submitted to the client on completion of each inspection or otherwise as instructed.

Acceptance criteria will be in accordance with the relevant reference document specified by the client, but not less stringent than that of ASME VIII, refer to Section 14 of this procedure.

The reporting of Liquid Penetrant Examination will be done on a controlled report form detailing all aspects of inspection conducted.

Report formats may be attached to this procedure as an appendix only and be controlled within the company quality control system.

16.0 Post – Cleaning

- 16.1 Post cleaning shall be carried out on the material under inspection only in those cases where the penetrant testing products could interface with subsequent processing or service requirements. Care shall be taken to ensure that the surface is clean and dry and free from all penetrants and developers that may be harmful to the surface under inspection.

Parts shall be protected from corrosion or damage, as required.

- 16.2 Disposal of all cleaning materials and aerosol canisters shall be disposed of in accordance with manufacturers or work-site safety regulations.

-End of Page-

