

RADIANT NDT SERVICES

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RADIANT NDT SERVICES



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LIQUID PENETRANT TESTING PROCEDURE

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Revision & Issue date

Revision Number	Issue Date	Changes	Remarks
0	24.01.2014	Initial Issue	
1	28.12.2019	Para 8.2.2 added <i>The minimum light intensity shall be 100 fc or 1076lx.</i>	

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1. SCOPE:

- 1.1 This procedure is established for the application of Liquid Penetrant Examination to detect Discontinuities that are open to the surface of non-porous metallic materials and applicable for solvent removal colour contrast penetrant testing processes.

2. REFERENCES:

- 2.1 ASTM E165 (2010 Edition) – Standard Test Method for Liquid Penetrant Examination.
2.2 ASME B31.1 Edition 2010 –Standard for Power Piping
2.3 ASME Section V (2010 Edition) Article-6 & 24– Boiler and Pressure Vessel Code Procedure.
2.4 RNS/WP/001 Rev.1 Company Written Practice

3. Personnel Qualification:

The Personnel who carry out Liquid Penetrant Examination shall be minimum qualified to NDT level II MT as per ASNT-SNT-TC-1A of RNS Company written practice (RNS/NDT/WP-001) or PCN Level II or ASNT Level III/ PCN Level III.

4. RESPONSIBILITY

NDT level II Technician shall be responsible for performing Penetrant Testing, interpretation and evaluation of discontinuities.

5. EQUIPMENT & TESTING MATERIAL:

- 5.1 The materials used for obtaining indications shall be approved by the applicable STANDARDS. The material used shall be such as to provide adequate sensitivity and contrast for intended use. Only penetrant testing system consisting of penetrant, cleaner and developer shall be used belonging to one family.
- 5.2 The chemicals used for the examination of austenitic stainless steel or nickel base alloys sulphur and total halogens shall meet the Mandatory Appendix II of ASME Section V, Article 6 (The Residual amount of total sulphur and chloride content shall not exceed 1% by weight). The records of certification issued by Penetrant manufacturer with batch no. and Results of Penetrant shall be recorded and maintained on file.
- 5.3 The penetrant system shall be of a manufacturer standard type.

List of Penetrant, Cleaner / Remover and Developer are use:

MACK	Penetrant	Cleaner/Remover	Developer
MAGNAFLUX	SKL-SP2	SKD-S2	SKC-S
ARDROX	9VF2	9PR5	NQ1
TASETO	FP-S	FP-Q	FP-S

6. SURFACE PREPARATION & TIME OF TESTING:**6.1 Preparation and pre-cleaning of the surface:**

Prior to each liquid penetrant examination, the surface to be examined and all adjacent areas within at least 25mm both side of the weld shall dry and free of Contaminations, e.g. scale, rust, oil, grease or paint, spatter shall be removed, if necessary using mechanical or chemical methods or a combination of these methods. Pre-cleaning shall ensure that the test surface is free from

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residues and that it allows the penetrant to enter any discontinuities.

NOTE -1: Surface temperature shall generally be within the range from 10°C to 50°C. In special cases temperatures as low as 5°C may be accepted.

NOTE-2: For temperatures below 10°C or above 50°C only penetrant product Families and Procedures approved in accordance with recognized Standard for the purpose shall be used.

7.2 Application of penetrant:

7.2.1 Methods of application:

The penetrant can be applied to the object to be tested by spraying brushing, flooding or immersion. care shall be taken to ensure that the test surface remains completely wetted throughout the entire penetration time.

7.2.2 Penetration (Dwell) time:

The penetration time shall be in accordance with the time used by the manufacture when certifying the product family in accordance with ASME Section V Article-6 Table T-672 for certain sensitivity level or at least 15 minutes.

7.3 Excess Penetrant Removal:

The application of the remover medium shall be done such that no Penetrant is removed from the defects/discontinuities.

Excess Solvent Penetrant shall be removed by following methods:

- wiping with dry clean lint free cloth.
- remaining traces shall be removed by lightly wiping the surface with cloth paper moistened with solvent.
- wiping only one direction for minimize removal of penetrant from discontinuities
- Flushing the surface with solvent, following the application of the penetrant and prior to developing, is prohibited.
- 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.

7.4 Drying:

Solvent removable technique, the surfaces may be dried by normal evaporation, blotting, wiping, or forced air.

7.5 Application of developer:

The developer shall be applied by spraying uniformly, except where safety or restricted areas. The spray shall be such that the developer arrives slightly wet on the surface, giving a thin, uniform layer. Usually this requires a spraying distance of minimum 300mm (12 inch).

7.6 Development time:

The development time shall as a minimum be the same as the penetrant time, however, longer time may be agreed. The development time shall be stated in the test procedure to ensure repeatable test results with respect of defect sizing.

The development begins:

- Immediately after application when dry developer is applied.

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8.0 INSPECTION :

8.1 General:

Final inspection shall be made not less than 10 minutes nor more than 60 minutes after the application of the developer. Generally, it is advisable to carry out the first examination just after the application of the developer or soon as the developer is dry. This facilitates a better interpretation of indications. The final inspection shall be carried out when the development time has elapsed. Equipment for visual examination, such as magnification instruments or contrast spectacles, can be used.

8.2 Viewing condition:

8.2.1 Fluorescent Penetrant:

Photo chromatic spectacles shall not be used. Sufficient time shall be allowed for the operator's eyes to become dark adapted in this inspection booth, usually at least 5min. UV radiation shall not be directed in the operator's eyes.

The test surface shall be viewed under a UV-A radiation source. The UV-A irradiance at the surface inspected shall not be less than 1000 $\mu\text{W}/\text{cm}^2$.

The statement above shall apply to inspections in darkened rooms where visible light is limited to a maximum of 20lx.

8.2.2 Colour Contrast Penetrant:

The test surface shall be inspected under illumination natural or supplemental white light of the examination surface is required for evaluation of indications. ***The minimum light intensity shall be 100 fc or 1076lx.*** The light intensity natural or supplemental white light source shall be measured with white light meter prior to the evaluation of indications or verified light source light source shall be used. Verification of light sources is required to be demonstrated only one time, documented and maintained on file. The viewing condition shall be such that glare and reflection are avoided.

Calibration:

Light meter shall be calibrated at least once a year or whenever a meter has been repaired.

If meters have not been used for one year or more, calibration shall be done before being used.

9. POST CLEANING:

Post cleaning is necessary in cases where residual penetrant or developer could interfere with subsequent processing or with service requirements. Penetrant and developing materials shall be removed by wiping the surface with a dry cloth. A cleaning agent /solvent may be used to assist in cleaning surface.

10. REPAIR & RETESTING:

Where the product specification permits, local grinding may be used to reduce or remove imperfections which are the cause of unacceptable indications. All such areas shall be re-tested and evaluated with the same penetrant system and technique.

If, repair by grinding and re-weld, retest area should be an overlap of 100 mm on both sides of the repair length shall be tested.

11. REPORTING:

All test results shall be recorded and reported in the standard format of RNS.(Attached).

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12. EVALUATION OF INDICATIONS:

(A) Evaluation of Indications :

- i. Mechanical discontinuities at the surface will be indicated by bleeding out of the penetrant; however, localized surface imperfections, such as may occur from machining marks or surface conditions, may produce similar indications which are non-relevant to the detection of unacceptable discontinuities.
- ii. Any indication that is believed to be non-relevant shall be regarded as a defect and shall be re-examined to verify whether or not actual defects are present.
Surface conditioning may precede the re-examination. Non-relevant indications and broad areas of pigmentation which would mask indications of defects are unacceptable.
- iii. Relevant indications are those which result from mechanical discontinuities. Linear indications are those indications in which the length is more than three times the width. Rounded indications are indications which are circular or elliptical with the length less than three times the width.
- iv. An indication of a discontinuity may be larger than the discontinuity that causes it; however, the size of the indication and not the size of the discontinuity is the basis of acceptance or rejection.

13. ACCEPTANCE CRITERIA:

The acceptance criteria shall be in accordance with ASME B31.1 Para 136.4.4

Acceptance Standards. Indications whose major dimensions are greater than 1/16 in.

(2.0 mm) shall be considered relevant. The following relevant indications are unacceptable:

- i. any cracks or linear indications
- ii. rounded indications with dimensions greater than 3/16 in. (5.0 mm)
- iii. four or more rounded indications in a line separated by 1/16 in. (2.0 mm) or less edge to edge
- iv. ten or more rounded indications in any 6 in. (152 mm) of surface with the major dimension of this area not to exceed 6 in. (152 mm) with the area taken in the most unfavourable location relative to the indications being evaluated.



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APPENDIX A– SAMPLE TEST REPORT



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