KERONE
Kerone Engineering Solutions Limited

48+ Years
Of experience

LIQUID / DYE PENETRANT TESTING PROCEDURE

In Association with SVCH-Technologii, Moscow (Russia)

ISO 9001:2015 | ISO 14001:2015 | ISO 45001:2018

LIQUID PENETRANT TESTING PROCEDURE

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1.0 SCOPE:

1.1 This procedure describes the minimum requirements for performing Liquid Penetrant Testing of non-porous metallic material s of ferrous, non-ferrous and elements in accordance with ASME Section V

1.2 The procedure covers color contrast penetrant inspection method, using solvent removable penetrant.

1.3 The extent of examination shall be as per the client specifications or specified in the applicable document.

1.4 Liquid Penetrant Testing shall be carried out in accordance with procedure of our firm personnel.

2.0 REFERENCES:

International Standard references shall be applicable as below:

- ASME Section V 2010 Edition, Addenda 2011a
- ASME Section VIII Div.1,2010 Edition, Addenda 2011a
- ASME Section I;2010 Edition, Addenda 2011a
- ASME Section IX;2010 Edition, Addenda 2011a
- ASME B31.1, B31.3 & B31.4;2007 Edition
- ASNT SNT-TC-1A Edition 2001 & 2006

3.0 PERSONNEL QUALIFICATION:

Personnel performing LPT examinations shall be certified in accordance with written procedures. Level I personnel may perform LPT examination only under the direct supervision of Level II or Level III personnel. Level I personnel shall not independently interpret the results of examination.

4.0 DEFINITIONS:

Relevant Indications: Those indications which require further investigation to determine acceptance or rejection.

Irrelevant Indications: Those indications which do not require any further investigations to determine acceptance or rejection.
NDT: Non Destructive Testing
UV: Ultra Violet
Acc: Acceptance
Rej: Refection

5.0 PROCEDURE:

5.1 Personnel Qualification:

5.1.1 All NDT operators are trained and qualified in accordance with approved Written practice for Training, Qualification and Certification of NDT personnel in line with the requirements of SNT-TC-1A

5.1.2 Personnel conducting LPT shall be competent in conduction testing as described in the procedure

5.1.3 Annul vision test shall be administered to all NDT personnel. The NDT personnel shall have vision with correction, if necessary to enable them to read at least a Jaeger Type No.2 standard chart at a distance of not less than 12" and shall be capable of distinguishing and differentiating contrast between colors used.

5.2 Procedure Requirement:

When Procedure qualification is specified by customer, the change requirement in the following paragraphs identifies Essential and Non-essential variables for the procedure requalification.

5.2.1 Essential Variables

- Identification of any change in type or family group of penetrant materials including developers, emulsifiers, etc.
- Surface preparation (finishing and cleaning including type of cleaning solvent)
- Method of applying penetrant
- Method of removing excess surface penetrant
- Hydrophilic or lipophilic emulsifier concentration and dwell time in dip tanks and agitation time for hydrophilic emulsifier s
- Hydrophilic emulsifier concentration in spray applications
- Method of applying developer
- Minimum and maximum time periods between steps & drying aids
- Decrease in penetrant dwell time
- Increase in penetrant dwell time (interpretation time)
- Minimum light intensity
- Surface temperature outside 50 to 125 ^{0}F (10 to 52^{0}C) or as previously qualified
- Performance demonstration when required

5.2.2 Non-essential Variables

- Personnel qualification requirements
- Materials, shapes or sizes to be examined and the extent of examination
- Post examination cleaning technique

5.3 Safety Precautions:

Testing media must be used with caution and always within the limits of Supplier recommendations.

Inspection area must be sufficiently ventilated and remote from heat sources, sparks, open fires and flames.
The operators must ensure that the chemicals used do not come in direct contact with their skin during the examination.

5.4 Surface preparation:
Prior to Liquid Penetrant Examination, the surface to be examined and the adjacent areas at least 1" either sides shall be dry and free from any dirt, grease. Lint, scale welding flux, weld spatter, oil or other extraneous matter that could obscure surface openings / or otherwise interfere with the examination.

5.5 Penetrant Material:

The penetrant testing materials normally used as given below or any equivalent brand.

Brand	Penetrant	Cleaner	Developer
Magnaflux	SKL-SP	SKC-S	SKD-S2
ELY	222	S-72	LD-3

The penetrant material shall be from the same manufacturer's group or family. Mixing one manufacturer's with other manufacturer's group is not permitted. All consumable shall be stored as recommended by the manufacturer's and shall be used within the shelf life specified on the product.

When examining Nickel based alloys or Austenitic Stainless steel or Titanium material, the penetrant material shall meet the requirements of ASME Section V, T640 and relevant records shall be maintained.

5.6 Liquid Penetration Test Method:
Liquid Penetrant Leak Testing is a method of Liquid Penetrant Testing in which the penetrant and developer are applied on either side to detect through hole on capillary action of the penetrant.

5.6.1 Pre-examination cleaning and drying:
Prior to the application of penetrant all areas to be examined will be dry cleaned from any scale, rust, flux, grease, paint, oil or other foreign material that might interfere with the penetrant.

For cleaning solvent cleaner may be used by spraying or flushing, covering all areas to be inspected. When inspecting welds, the adjacent area within 1" (25mm) from the weld shall be cleaned.

After cleaning, drying of the surfaces to be examined shall be accomplished by normal evaporation or with forced hot air, as appropriate.

The drying time shall be sufficient to assure that the cleaning solution has evaporated prior to application of the penetrant. This shall be minimum 5minutes from the time the cleaning process is completed.

5.6.2 Application of penetrant:
The penetrant and the areas to be examined must have a temperature within the limits specified by the manufacturer. The normal temperature range acceptable to ASME Section V is from 50^{o}F (or 10^{0}C) to 125^{0}F (or 52^{0}C).

Manufacturer's recommendations are also to be taken into account. When the testing cannot be carried out within the specified temperature limit then it must be demonstrated that same level of test

sensitivity could be achieved at the actual metal temperature using cracked aluminum comparator in ASME Section V, Article -6.

When consumables in aerosol can are used it will be sprayed thoroughly and uniform on the test areas and after application excess penetrant will be allowed to drain out from that part.

The penetration time (dwell time) will depend on the type of discontinuity to be detected and shall be minimum 10 minutes (manufacturer's recommendations should be taken into account). The penetrant must stay wet at all times during the penetration process. If for any reason, penetrant dries up during the penetrating process, the test shall be repeated from the beginning after cleaning the test area thoroughly.

5.6.3 Excess penetrant removal:

The excess penetrant shall to the extent possible be removed by wiping with clean, lint free material, repeating the operation until most traces of penetrant have been lightly moistened with solvent cleaner shall be used. Wiping shall be continued until all remaining traces of excess penetrant have been removed.

Excessive washing shall be avoided and flushing or soaking the surface with solvent after the application of penetrant is prohibited.

For cleaning the solvent, cleaner any be used by spraying or flushing covering both side of the areas to be inspected. When inspecting welds, the adjacent area within 1" (25mm) from the weld shall be cleaned.

After cleaning, drying of the surfaces to be examined shall be accomplished by normal evaporation or with forced hot air as applicable.

The drying time shall be sufficient to assure that the cleaning solution has evaporated prior to application of penetrant. This shall be minimum 5 minutes from the time the cleaning process is completed.

5.6.4 Application of Developer:

Before each application, the developer shall be agitated to ensure uniform dispersal of solid particles in the carried fluid.

The Developer shall be uniformly sprayed with a thin layer just sufficient to draw the penetrant retained in the reservoir and provide a contrasting background within a period not exceeding 10 minutes from removal and drying of the excess penetrant. Thick coatings and pools of wet developer shall be avoided.

After the application of the developer, the work piece shall be left for a sufficient time around 7- 30 minutes for any indication to develop.

Manufacturer's recommendations shall also be considered. The evaluation of indications generally shall begin as soon as the developer is applied and completed within 30 minutes from the time the developer is applied.

5.8 Viewing conditions:

While performing the examination using visible daylight technique in order to evaluate properly all indications revealed on the test surface, the area under inspection shall have sufficient daylight otherwise illuminated by artificial light to an adequate level. This should be at least 1000 Lux.

For fluorescent penetrant testing the test shall be performed in a darkened area. The UV light (Black light) used shall be allowed to warm up for minimum of 10 minutes before measurement of UV light intensity and commencement of inspection. The examiner shall be in the darkened area for at least 5 minutes prior to performing the examination to ensure his eyes adapt to dark viewing. If the examiner is wearing glasses or lenses, they shall not be photosensitive.

The black light intensity shall be measured with a black light meter and a minimum of 1000 p WIcm2 on the surface of the part inspected shall be required. The black light intensity shall be measured every time when the black light is switched on at the beginning of the inspection and once in 8 hours of whenever the workstation or bulb is changed. The background ambient light intensity inside the test area shall not be more than 20 Lux.

5.9 Inspection:

Inspection shall be performed when the applicable development time has elapsed. If the background is such that the interpretation of indications is impaired, the surface shall be completely re-tested.
If the surface of the part to be examined is so large as to preclude complete examination within the prescribed time, the surface shall be examined part by part.

5.10 Evaluation of Indications:

All non-relevant indications which may mask the relevant indication shall be removed and the area shall be re-tested.
All relevant indications shall be masked and shall be checked as per the acceptance standards. The marking method shall be with wax crayon or paint marker. All relevant indications which are not acceptable as per acceptance standard shall be recorded and evaluated. For Liquid Penetrant Leak Testing, all the indications shall be repaired and re-tested as per above procedure.

5.11 Acceptance Standards:

ASME Pressure Vessels - ASME Sec VIII Div.1 Appendix 8
ASME Power Piping - ASME B31.1
ASME Process Piping - ASME B31.3

5.12 Post Cleaning:

Post cleaning to remove residual penetrant or developer is required when the residue of the liquid penetrant system may have adverse chemical reaction with the material tested or the fluid that may come in contact during service. When such condition prevails the residual penetrant or developer is cleaned by a course water spray or by using solvents.

5.13 Reports :

Reports shall be issued for each examination with the interpretation of discontinuities evaluated preferably with a sketch/photograph showing location of the defects, type and size to enable quick effective defect repair.
Reports shall include the following information as a minimum and as required by the applicable fabrication document or invoking specification.

- Client name
- Project
- Location
- Item / drawing number
- PT procedure

- Material and thickness
- Surface condition
- Inspection standard
- Illumination
- Result accept / reject
- Test temperature
- Acceptance standard
- Consumable type
- Consumable used
- Technique
- Date of examination

6.0 Documentation:

Records shall be prepared for every item tested as per this procedure in the Dye Penetrant Inspection Report or may be in the Client's format.
However, the report format shall include all the information as stated in clause 4.14 of this procedure.

THANK YOU

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