SARA SAE PRIVATE LIMITED

Management System Document Control Cover Sheet

Document Title	Ref. No.	Revision No.
Procedure for Liquid Penetrant Testing	**SES-26-701**	**3**

	Name	Position	Signature	Date
Prepared by	J.M.SINGH	Manager (QA)		19/12/2015
Reviewed by	M. L. SHARMA	ASNT NDT LEVEL III RT, UT, MT, PT File No 67185		19/12/2015
Approved by	S. DHAWAN	Managing Director		19/12/2015

MADAN LAL SHARMA
Cert. Nr. - 67185
ASNT NDT Level-III RT, UT, MT, PT

Issued To		
Name:	Signature:	Date:

Document Control Stamp (Valid only if in red)

Revision Status

Revision No.	Effective Date	Description / Summary of Revision
0	23.06.2008	Initial Issue after NOV Sara
1	20.10.2011	Change of name of company from NOV Sara to SARA SAE
2	10.11.2012	Amendments added to highlighted clauses
3	19.12.2015	Amendments added to highlighted clauses for compliance to ASTM E 1417, API 6A/16A/16C/17D.

Contents

1. PURPOSE

1.1 The purpose of this procedure is to establish the requirements for liquid penetrant testing of metallic materials.

1.2 This procedure provides a system of general conditions and specific instructions as an aid to qualified personnel required to perform penetrant inspection.

2. SCOPE

2.1 This procedure gives the methods, techniques, quality, and reporting requirements necessary for the liquid penetrant inspection of materialsusing the solvent removable colour contrast method / fluorescent method.

2.2 This procedure covers the liquid penetrant inspection of non-porous ferrous and non-ferrous metallic materials including fusion welded butt joints in plate and pipe welds.

2.3 This is the Company approved procedure and shall be adhered to at all times except where the Client or Contract Document specifies other requirements.

.

3. REFERENCES

3.1 ASME V - Nondestructive Examination.

3.2 API 1104 - Welding of Pipelines and Related Facilities.

3.3 ASME Vlll - Rules for the Construction of Pressure Vessels.
Division 1.

3.4 ASMEB31-3 - Chemical Plant and Petroleum Refinery Piping.

3.5 AWSD1.1 - Structural Welding Code.

3.6 SARA SAE Quality assurance Manual

3.6.1 SDP-22-004 Personal Certification

3.6.2 SDP-27-009 Control of Non-conforming Products

3.7 American Petroleum Institute (API)

3.7.1 Specification 6A " Specification for Well Head and Christmas Tree Equipment"

3.7.2 Specification 16A " Specification for Drill Through Equipment"

3.7.3 Specification 16C "Specification for Choke and kill system"

3.7.4 Specification 16D "Specification for Control System for Drilling Well Control equipment"

3.8 American Society for Testing of Metals :

3.8.1 ASTM E-433 , " Standard Reference Photographs for Liquid Penetrant Examination"

3.8.2 ASTM SE-165 "Standard Practice for Liquid Penetrant Examination for General Industry"

3.8.3 ASTM E – 1417 – 13 "Standard Practice for Liquid Penetrant Testing

4. RESPONSIBILITIES

The Director / Manager QA shall be responsible for ensuring that the necessary resources are available for the requirements of this procedure to be carried out.

4.1 NDT Level III shall be responsible for ensuring that the requirements of this procedure are fully implemented at all times.

4.2 Employees involved in the implementation of this procedure shall be responsible for adherence to the requirements stated within.

5. DEFINITIONS

5.1 Company – SARA SAE PRIVATE LIMITED.

5.2 Client - Those companies, Organizations or Individuals to which the company is contracted to provide Services.

5.3 Contract - The form of agreement for the provision of the Services to the Client by the Company.

5.4 Services - All things provided under the Contract including all activities to be carried out by the company for the client.

6. PROCEDURE

6.1 PERSONNEL QUALIFICATIONS

6.1.1 The NDT Inspector shall be trained, qualified and certified to a minimum ASNT (third party) Level II, reference to ASNT-TC-1 A, "Recommended Practice for Non-Destructive Testing Personnel Qualification and Certification", OR international equivalent, i.e., PCN, CSWIP in the applicable NDT method.

6.2 TESTING MEDIA

6.2.1 Testing media from a recognized manufacturer shall be used.

6.2.2 Recognized manufacturers include Magnaflux and Ardrox.

6.2.3 When nickel based alloys are to be examined, testing media are to be certified as containing less than one per cent (1%) sulphur.

6.2.4 When stainless steel are to be examined, testing media are to be certified containing less than one per cent (1%) chloride.

6.2.5 Intermixing of Penetrant materials from various manufactures is prohibited.

6.2.6 Packages of Penetrant material shall include the date of manufacture, period of validity and indentify the production batch or run.

6.3 INSPECTION PROCEDURE

6.3.1 All surfaces within 25mm of the area to be examined shall be free of grease, clean, dry, and free or irregularities which could mask, or be confused with, an indication. Blasting surfaces before liquid penetrant inspection shall be prohibited.

6.3.2 Surface cleaning can be accomplished by detergent wash, organic solvents, descaling solutions, paint removers or mechanical cleaning. When mechanical cleaning is necessary, the process must not decrease the effectiveness of the penetrant examination by smearing or peening over surfaces or filling discontinuities that are open to the surface.

6.2.1 Fluorescent Penetrant examination shall not be follow a color contrast Penetrant examination.

6.2.2 Drying of the pre-cleaned surfaces shall be accomplished by normal evaporation. A minimum of five (5) minutes shall be allowed before applying the penetrant.

6.2.3 The temperature of the surface being examined shall be within the range of 4° to 52° C throughout the examination period.

6.2.4 The penetrant shall be applied to the surface being examined. The area being examined shall be maintained wet with the penetrant for a minimum or ten (10) minutes dwell time. The penetrant may be applied by brushing, dipping or spraying. List of recommended dwell time is given in Table 1.

6.2.5 After the prescribed dwell time, the excess penetrant shall be removed, insofar as possible, by using wipes of clean, lint-free material, repeating the operation until most traces of penetrant have been removed.

6.2.6 Using a lint-free material, slightly moistened with solvent, wipe the surface until all remaining traces of excess penetrant have been removed. To minimize the removal of penetrant care shall be taken to avoid the use of excessive solvent. Spray or pouring of solvent directly on the surface to be examined is prohibited.

6.2.7 Final drying of the surface shall be by normal evaporation

6.2.8 Developer shall then be applied, as a thin even film, from a distance of not less than 30cm from the test surface.

6.2.9 Examination should begin as the developer is being applied and shall continue for a minimum of seven (7) minutes after the developer appears dry (i.e. solvent carriers have evaporated). If bleed-out does-not alter the inspection results, development periods of up to thirty (30) minutes are permitted.

6.2.10 The inspected area shall be free from interfering debris.

6.2.11 The area under inspection shall be illuminated by daylight or artificial light from either a normal tungsten filament lamp or a fluorescent tube, to a level of illumination not less than 100 FTC (1076 Lux) so as to enable a proper evaluation to be made of the indications revealed. The viewing conditions shall be such that no glare will be experienced during inspection on the component.

6.2.12 In case of fluorescent inspection the background light level shall not exceed 2 FTC (21.5 Lux) and the intensity shall be greater than 1000μW/cm2, the warm up time for the lamp shall not be less than 5 minutes. The black light wavelength shall be in the range of 320 – 380 nm.

6.2.13 The examiner shall be in darkened area for at least 5 minutes before examining parts for Dark area adaptation. Glasses or lenses worn by examiners shall not be photosensitive.

6.2.14 In those cases where residual penetrant or developer could interfere with subsequent processing or with service requirements, post cleaning is required. It is particularly important where residual penetrant inspection materials might combine with other factors in service to produce corrosion or interfere with welding operations.

Table – 1

RECOMMENDED MINIMUM DWELL TIMES

Material	Form	Type of Discontinuity	Dwell Times[A] (minutes)	
			Penetrant[B]	Developer[C]
Aluminum, magnesium, steel, brass and bronze, titanium and high-temperature alloys	castings and welds	cold shuts, porosity, lack of fusion, cracks (all forms)	5	10
	wrought materials — extrusions, forgings, plate	laps, cracks (all forms)	10	10
Carbide-tipped tools		lack of fusion, porosity, cracks	5	10
Plastic	all forms	cracks	5	10
Glass	all forms	cracks	5	10
Ceramic	all forms	cracks, porosity	5	10

6.3 EVALUATION OF INDICATIONS

6.3.1 All indications shall be investigated to the extent that the Inspector can evaluate such indications in terms of the applicable acceptance criteria.

As a guide, this can be achieved by using either a fluorescent tube of 80W at a distance of approximately 1m or a tungsten filament pearl lamp of 100W at a distance of approximately 0.2m.

6.3.2 Relevant indications are those which result from mechanical discontinuities. Such indications include.

- Cracks.
- **Linear indications** – 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.

6.3.3 Non-relevant indications include :-

- Localized surface imperfections, such as may occur from machining marks or surface conditions. These are not relevant to the detection of unacceptable discontinuities and shall not be reported.

6.3.4 Any questionable or doubtful indications shall be retested to verify that actual discontinuities are present

6.4 ACCEPTANCE STANDARDS

6.4.1 The acceptance standards for the interpretation of items inspected shall be Client requirements or the Contract Document.

6.4.2 If no Client requirements or Contract Document are available the international specification relevant to the work-scope shall be used.

6.4.3 Appendix B refers to some standard international acceptance criteria.

6.4.4 LPT subcontractors must use this examination method and acceptance criteria in performing the examination.

6.6 EXAMINATION OF REPAIRS

6.6.1 Repairs shall be re-examined by the same procedure used for the original examination.

6.7 POST INSPECTION CLEANING

6.7.1 Post cleaning to remove residual penetrant and developer is required on all parts. Any suitable method such as water rinse, water spray, solvent wipe or other method which will not interfere with further processing of the part is acceptable.

6.8 REPORTING

6.8.1 Reporting requirements will be as specified by the Client or the Contract Document. Key elements of report shall be:

6.8.1.1 Report Number
6.8.1.2 Part Number and Revision Level
6.8.1.3 Part Description
6.8.1.4 Client Procedure number with revision.
6.8.1.5 Lightning Equipment.
6.8.1.6 Traceability code
6.8.1.7 Date of examination
6.8.1.8 Scope of examination
6.8.1.9 Examination parameter
6.8.1.10 Type and manufacturer of cleaner, Penetrant and developer used.
6.8.1.11 Quantity examined
6.8.1.12 Results of examination reject able, and recordable indication
6.8.1.13 Technician name and certification level and type

6.8.2 Compilation of report shall be according but not limited to the following :-

(a) Job Order Card (if applicable)
(b) Client Information (if applicable)
(c) Inspection Reports

6.9 SAFETY

6.9.1 Care shall be exercised during inspection with due regard to the fact that penetrant materials may have relatively toxic and flammable properties.

6.9.2 Manufacturer's recommendations shall be followed at all times.

6.9.3 Smoking is prohibited while performing liquid penetrant inspection.

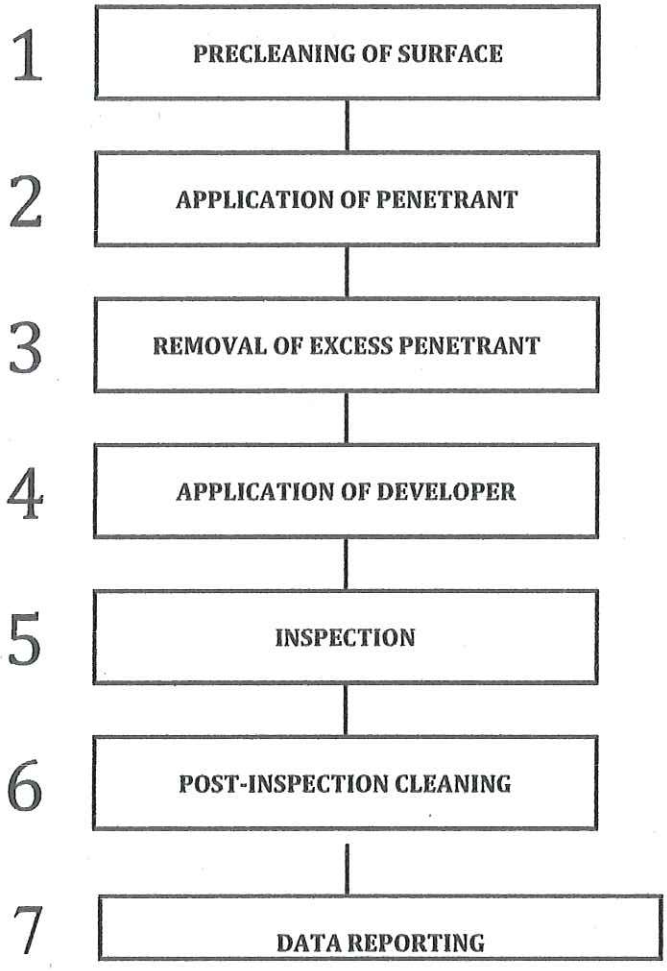
6.9.4 Controlled conditions shall be established for correct disposal of pressurized aerosol cans.

7. Attachment

7.1 Process Flow Chart

ATTACHMENT 7.1

PROCESS FLOW CHART



7.2 Appx'A' – WORK SHEET FOR LPT

Appendix B
Acceptance Criteria

API 6A/API 16C

Surface NDE

The following acceptance criteria apply:

- no relevant linear indication;
- no relevant rounded indication with a major dimension equal to or greater than 5 mm ($^{3}/_{16}$ in);
- four or more relevant rounded indications in a line separated by less than 1,6 mm ($^{1}/_{16}$ in) (edge to edge) are unacceptable;
- no relevant indication in pressure-contact sealing surfaces.

Weld NDE

In addition to above requirements following additional acceptance requirements shall apply:

Rounded indications greater than 3 mm (1/8 in) for welds whose depth is 16 mm (5/8 in) or less, or 5 mm (3/16 in) for welds whose depth is greater than 16 mm (5/8 in).

API 16 A

Surface other than pressure – contact (metal – to – metal) sealing surface:

- No relevant indication with a major dimension equal to or greater than 5 mm (0,2 in).
- No more than ten relevant indications in any continuous 10 cm^2 (2,5 in^2) area.
- Four or more relevant indications in a line separated by less than 1,5 mm (0,06 in) (edge to edge) are unacceptable.

Pressure – contact (metal – to – metal) sealing surface:

There shall be no relevant indications in the pressure-contact (metal-to-metal) sealing surfaces.

Weld NDE (Pressure containing welds, repair and weld overlay)

- no rounded indications greater than 3 mm (0,125 in) for welds whose depth is 16 mm (0,63 in) or less or 5 mm (0,2 in) for welds whose depth is greater than 16 mm (0,63 in).