

1. Scope

1.1 This procedure shall be followed for the examination of both ferromagnetic and non-ferromagnetic material, welds, drilling and production equipment, raw, semi-finished, and machined surfaces. Type II penetrants with Removal Methods A or C used with Non-Aqueous Wet Developers are discussed in this procedure for the detection of surface breaking discontinuities

2. Referenced Documents

2.1 ASTM E165 – Standard Guide for Liquid Penetrant Testing, latest edition

2.2 ASNT SNT-TC-1A – RP for the Qualification and Certification of NDT Personnel, latest edition

2.3 ASTM E1417 – Standard Practice for Liquid Penetrant Testing, latest edition

2.4 ASME Section V, Article 6 – Standard for Liquid Penetrant Examination, latest edition

2.5 AWS D1.1 – Structural Welding Code - Steel, latest edition

2.6 API 6A/ ISO 10423 – Specification for Wellhead and Christmas Tree Equipment, latest edition

2.7 If contract requirements specify reference documents other than the latest edition Frontline Testing and Inspection's Management will ensure that all details of this procedure still comply. If noncompliance is found this procedure shall be revised or a project specific procedure shall be written

3. Personnel Qualification

3.1 Personnel performing inspections in accordance with this procedure shall be qualified and certified in accordance with ASNT SNT-TC-1A latest edition and the company's personnel qualification procedure

3.2 Only those personnel certified Level II or higher in the method being employed will be performing inspections in accordance with this procedure

4. Definitions

4.1 Type II penetrant – visible penetrant used to conduct inspections

4.2 Removal Method A – is the technique whereby the excess penetrant is removed using a water wash

4.3 Removal Method C – is the technique whereby the excess penetrant is removed using a solvent

5. Techniques

5.1 This procedure identifies the following techniques:

- Technique 1 – Type II, Method A

- Technique 2 – Type II, Method C

5.2 Regardless of the technique the developer to be used shall be Non-aqueous wet

5.3 The mixing of penetrant materials from different manufacturers is strictly prohibited. This prohibition stands for solvents used in the excess penetrant removal process as well. Only solvents approved by the manufacturer will be used during the excess penetrant removal process

5.4 The following material manufacturers shall be used:

www.sherwininc.com, www.magnaflux.com

6. Inspection Equipment

6.1 The following equipment will be required as applicable:

- 6.1.1 Cleaning equipment: Appropriate cleaning agents may include degreasers, detergents, soap and water, scrapers or paint stripper
- 6.1.2 Mirrors, as applicable
- 6.1.3 White light meter
- 6.1.4 Lint free rags
- 6.1.5 Non-aqueous wet developer
- 6.1.6 Thermometer
- 6.1.7 Visible water-washable penetrant
- 6.1.8 Portable water can with spray nozzle
- 6.1.9 Solvent cleaner

7. Preparation

7.1 Lighting Requirements

7.1.1 Minimum White Light Level: When conducting visible liquid penetrant inspection, the minimum ambient white (daylight, or indoor facility) light intensity at the inspection surface shall be 100 foot candles (1000 lux), or customer-stated requirements if higher

7.2 Cleaning Requirements

7.2.1 All surfaces to be inspected plus 1" of adjacent material shall be cleaned such that grease, oil, scale, dirt, weld spatter, slag, paint or any other foreign matter deemed by the Level II as obstructing the inspection is removed

7.2.2 Upon completion of the cleaning operations the areas to be inspected must be completely dry prior to the start of the inspection

7.3 Special Requirements

7.3.1 When inspecting nickel based alloys; the penetrant materials shall not exceed Sulphur content of 1% of residue by mass

7.3.2 When examining austenitic stainless steels or titanium, the penetrant materials shall not exceed a chlorine or fluorine content of 1% of residue by mass

7.3.3 When required and, regardless of temperature, the system performance will be verified by performing an examination on a specimen with known defects such as a TAM panel

7.4 Temperature Requirements

7.4.1 Penetrant materials and the test specimen shall be between 40° F and 125° F (4.44° and 52° C) before, during and after inspection. An approximation of the temperature may be made with temperature sticks. In cases where the temperature of the part exceeds 125° F, or is less than 40° F, see section 7.6.

7.5 Equipment Calibration Requirements

7.5.1 The white light meter shall be calibrated or have the calibration verification performed not less than every 6 months or anytime there is question as to the accuracy of the equipment

7.5.2 Calibrated equipment must be serialized and evidence of calibration or calibration verification must be maintained

7.6 Inspection system verification requirements

7.6.1 In this event, the inspection is to be performed at temperatures outside of those specified in this procedure a comparator block may be used to verify system reliability

7.6.1.1 On one side of the block perform the applicable inspection technique as dictated within this procedure at the temperature range dictated by this procedure

7.6.1.2 On the other side of the block perform the applicable inspection technique as dictated within this procedure at the temperature range required by the job. The block should be brought to the temperature of the test specimen along with the penetrant materials

7.6.1.3 Compare the results

7.6.1.4 To accept the procedure the results of both sides should be similar. If a noticeable difference is found by the Level II inspector, then inspecting outside of the temperature range dictated in this procedure is not acceptable

8. Process

8.1 Technique 1 - Type II (Visible), Method A (Water-washable)

8.1.1 Penetrant application: Upon completion of cleaning and drying operations liberally apply penetrant ensuring that the entire area to be inspected is covered plus an adjacent 1" of material surface. Penetrant may be applied by spraying, brushing, or immersing

8.1.2 Dwell Time: Penetrant dwell time shall vary depending on temperature to consider the viscosity of the penetrant selected. The following shall be used for proper dwell times within the temperature ranges shown: 15 to 25 minutes' dwell for temperature ranging from 40° F to 75° F - 10 to 15-minute dwell for temperature ranging from 75° F to 100° F - 5 to 10-minute dwell for temperature ranging from 100° F to 125° F

Note – During dwell time penetrant is not allowed to dry out on the part or weld. If penetrant dries out on the test specimen the inspection process must start over

8.1.3 Removal of Excess penetrant: A coarse, low pressure water spray, not to exceed 40 psi and water temperature between 50° F - 100° F shall be used

8.1.3.1 This procedure allows the employment of wet rags to be utilized in the excess penetrant removal process in place of the coarse water spray. Rags shall be wetted with water and gently applied to the surface being inspected

8.1.4 Drying: A dry lint free rag may be used to blot the test specimen. This operation shall not take longer than 5 minutes

8.1.5 Developer application: A Non-Aqueous Wet developer shall be applied in light, thin, even coats over the entire surface to be tested. The minimum developer dwell time is 10 minutes and the maximum is 30 minutes after the developer has dried

8.1.6 Inspection shall be performed

8.2 Technique 2 - Type II (Visible), Method C (Solvent removable)

8.2.1 Penetrant application: Upon completion of cleaning and drying operations liberally apply penetrant ensuring that the entire area to be inspected is covered plus an adjacent 1" of material surface. Penetrant may be applied by spraying, brushing, or immersing

8.2.2 Dwell Time: Penetrant dwell time shall vary depending on temperature to consider the viscosity of the penetrant selected. The following shall be used for proper dwell times within the temperature ranges shown: - 15 to 25-minute dwell for temperature ranging from 40° F to 75° F - 10 to 15-minute dwell for temperature ranging from 75° F to 100° F - 5 to 10-minute dwell for temperature ranging

from 100° F to 125° F Note – During dwell time penetrant is not allowed to dry out on the part. If penetrant dries out on the test specimen the inspection process must start over

8.2.3 Removal of Excess penetrant: A dry, lint free rag shall be used to wipe the test specimen so that excess penetrant is removed. A dry, lint free rag shall be dampened with the applicable solvent

(cleaner/remover) and then applied to the test specimen

The test specimen shall then be wiped clean and excess penetrant removed

Note – Solvent shall not be sprayed onto the test specimen. If this happens the inspection must start over

8.2.4 Drying: A dry lint free rag may be used to blot and/ or wipe the test specimen. This operation shall not take longer than 5 minutes

8.2.5 Developer application: A Non-Aqueous Wet developer shall be applied in light, thin, even coats over the entire surface to be tested. The minimum developer dwell time is 10 minutes and the maximum is 30 minutes after the developer has dried

8.2.6 Inspection shall be performed

9. Evaluation & Acceptance Criteria

9.1 All discontinuities found shall be evaluated in accordance with the applicable code or specification as dictated by the client. Minimum evaluation will be as follows

9.1.1 Indications shall be determined to be relevant or non-relevant

9.1.1.1 Relevant indications shall be defined as an indication, which is caused by an actual discontinuity in the test specimen, with a dimension greater than 1/16", unless otherwise specified by the applicable code

9.1.1.2 Non-relevant indications shall be defined as indications, which may or may not be caused by an actual discontinuity, which is (\leq) 1/16", unless otherwise specified by the applicable code. Non-relevant indications may also be defined as false indications caused by part geometry or some other anomaly

9.1.2 Once relevance is determined indications shall then be defined in terms of type, either linear or round

9.1.2.1 Linear indication is defined as an indication having one dimension at least three times greater than another

9.1.2.2 Round indication is defined as an indication having a dimension less than three times greater than another

9.2 The client is ultimately responsible for dictating the applicable reject criteria. The following is a list of possible applicable codes that this procedure may be applied to

9.2.1 API 6A – PSL Level 2, 3, 4, latest edition

9.2.2 AWS D1.1 Clause 6, latest edition

9.2.3 API 1104, latest edition

9.2.4 API 16A, latest edition

9.2.5 ASME Section 8, latest edition

9.3 Unless otherwise specified, non-relevant indications shall be checked for relevance by redressing the area in question and re-inspecting using the same method and technique

10. Post-cleaning

10.1 Upon completion of the inspection the test specimen shall be cleaned and penetrant materials removed

11. Reporting

11.1 All rejected findings shall be reported to the client or client representative immediately

11.2 Frontline Testing and Inspection personnel will produce a report at the end of each job with the following minimum information

11.2.1 Name of inspector (printed and signed)

11.2.2 Inspector's certification level and method

11.2.3 Date of inspection

11.2.4 Location of inspection

11.2.5 Description of test specimens

11.2.6 Results of inspection (acceptable or rejected) including indication types and location

11.2.7 Inspection procedure number including revision level

11.2.8 Acceptance criteria including revision level

11.2.9 Test equipment serial number and calibration due date (as applicable)

11.2.10 Inspection variable (light intensity, temperatures) 11.2.11 Inspection report number

11.2.12 Traceability of test specimens (part number, revision level, serial number, weld number)

11.2.13 Welder symbol, if applicable

11.2.14 Penetrant manufacturer, type and batch number

11.2.15 Developer manufacturer, form and batch number

11.2.16 Cleaner/ Remover manufacturer and type

11.2.17 Test specimen thickness

11.2.18 Client representative name and date (if applicable)

11.2.19 Customer name

11.2.20 Customer project name, if applicable

11.2.21 Customer PO or job number, if applicable

11.2.22 Drawing number and revision, if applicable