MOGAS INDUSTRIES, INC.

Nondestructive Testing Procedure: Liquid Penetrant Testing

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Nondestructive Testing Procedure: Liquid Penetrant Testing

NDT – 0200

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Liquid Penetrant Examination

1.0 Scope

1.1. This procedure provides a nondestructive means for locating surface discontinuities using water washable visible penetrant method.

1.2. This procedure is applicable to the examination of components fabricated to ASME Boiler and Pressure Vessel Code Section VIII, Division 1, as well as the ASME B 16.34 Valves – Flanged, Threaded and Welding End, Latest Editions.

1.3. The requirements contained in this procedure apply to all nondestructive testing personnel who perform, monitor, or evaluate water washable visible penetrant examination in accordance with this procedure. This procedure describes the method used for detecting discontinuities open to the surface on ferrous and nonferrous materials.

2.0 References

The latest effective editions of the following specification have been used as references in the composition of this procedure:

2.1. ASME Boiler and Pressure Vessel Code Section V, Article 6 and Article 24, Latest Edition.

2.2. ASME SE-1209, "Standard Test Method for Fluorescent Penetrant Examination Using the Water-Washable Process".

2.3. ASME Boiler and Pressure Vessel Code Section VIII, Division I, Latest Edition.

2.4. ASME B 16.34 Valves, Appendix III – Flanged, Threaded and Welding End, Latest Edition.

2.5. MOGAS Written Practice: MST-0001, Qualification and Certification of NDT Personnel, Latest Edition

3.0 Inspection Materials

3.1. This procedure has been prepared for the aerosol spray application of Visible Penetrant.

3.2. The following penetrant system materials and/or equivalent brand used:
- 3.2.1 Penetrant - Magnaflux Spotcheck SKL-WP or equivalent.
- 3.2.2 Developer - Magnaflux Spotcheck SKD-S2 or equivalent.
- 3.2.3 Cleaner – Magnaflux Spotcheck SKC-S and water or equivalent.

3.3 When penetrant materials are used on nickel based alloys, titanium and austenitic stainless steels, the penetrant materials shall be analyzed for sulfur, chloride and fluorine content. Analysis shall be in accordance with ASME Section V, Article 6 Paragraph T-641. For each penetrant material used, certification of the tests, giving batch numbers and the test results shall be obtained from the manufacturer. The residual content of sulfur, chloride or fluorine shall not exceed the limitations of, ASME Section V, Article 6 Appendix II.

3.4 Penetrant systems shall only be used in combinations recommended by the manufacturer.

3.5 This procedure has been qualified by demonstration on a comparator test block with known surface crack conditions. Interchangeability of different brands of cleaners, penetrants, and developers is allowed provided that a qualification test has been performed on the combination of penetrant materials used.

3.6 Magnifying glasses, mirrors, scales, or other measuring devices, etc., may be used to aid visual observation of the examination surface.

4.0 Responsibility

4.1. The examiner shall be responsible for implementing the requirements of this procedure.

4.2. Personnel performing examinations shall be certified in accordance with the **MOGAS'** MST-000, Qualification and Certification of NDT Personnel, Latest Edition, which is in accordance to the guidelines set forth in ASNT Document SNT-TC-1A.

4.3. Personnel performing examinations shall have at the minimum of Level I certification. Personnel evaluating test results shall have a minimum Level II certification.

5.0 Procedure

5.1. Surface Preparation

In general, satisfactory results may be obtained when the surface of the part to be tested is in the as-welded, as-rolled, as-cast, or as-forged condition. Surface preparation by grinding, machining, or other methods may be necessary where surface irregularities could mask indications.

5.2. Precleaning/Cleaning

5.2.1 Prior to each liquid penetrant examination, the surface to be examined and all adjacent areas within at least one (1) inch (25mm) shall be dry and free of all dirt, grease, lint, scale, welding flux, weld spatter, paint, oil, and other extraneous matter that could obscure surface openings or otherwise interfere with the examination.

Note: Typical cleaning agents that may be used are detergents, organic solvents, de-scaling solutions and paint removers. Degreasing and ultrasonic cleaning methods may also be used. Cleaning solvents shall not exceed the limitations of, ASME Section V, Article 6 Appendix II.

5.2.2 Final cleaning shall be performed by wiping or flushing the surface with cleaner/remover specified in this procedure.

5.3 Penetrant Application

5.3.1 The penetrant may be applied by brushing, dipping or spraying. If the penetrant is applied by spraying using compressed- air-type apparatus, filters shall be placed on the upstream side near the air inlet to preclude contamination of the penetrant by oil, water, dirt, or sediment that may have collected in the lines.

5.3.2 The temperature of the penetrant material and the surface of the part to be examined shall remain between 50°F to 100°F through the entire examination period. Local heating or cooling is permitted provided the part temperature remains within this range.

5.3.3 The penetration or dwell time shall be a minimum of ten (10) minutes and a maximum of thirty (30) minutes. Should drying begin to occur, re-spray penetrant

to prevent drying. Should drying occur, the surface shall be cleaned thoroughly with the plan for re-starting the examination.

5.4 Penetrant Removal

After the penetration time has elapsed, any penetrant material remaining on the surface shall be removed, taking care to minimize removal of penetrant from discontinuities.

5.4.1 Remove excess penetrant by rinsing with fine water spray (50-100 F temperature range) and a constant pressure not to exceed 50 psi or can be removed utilizing a lint-free cloth dampened with solvent. Note: Do not flush or spray solvent directly onto part or wipe excess surface penetrant with a cloth saturated with solvent.

5.4.2 Penetrant shall be removed under white light conditions until all visible signs of penetrant have disappeared from the surface. Rinsing shall not continue beyond this point.

5.4.3 After rinsing, dry the surface by blotting with clean material or by using circulating air, provided the temperature of the surface is not raised above 100 F.

5.5 Developing

5.5.1 The non-aqueous wet developer must be thoroughly agitated to ensure adequate dispersion of suspended particles.

5.5.2 The developer shall be applied as soon as possible after penetrant removal: no more than five (5) minutes shall elapse prior to developer application.

5.5.3 The developer shall be applied thinly and evenly by spraying evenly over the inspection surface from the aerosol can. Insufficient coating thickness may not draw the penetrant out of discontinuities; conversely, excessive coating thickness may mask indications.

5.5.4 The developing time shall be set for a minimum of five (5) minutes, and may last for as long as twenty (20) minutes depending on the metal characteristics and ambient temperature at the test location.

5.6 Evaluation of Indications

5.6.1 Lighting

Adequate illumination shall be used to ensure adequate sensitivity during the examination and evaluation of indications. A minimum of 100 foot candles must be obtained.

5.6.2 Definition of Indications

An indication of an imperfection may be larger than the imperfection that causes it; however, the size of the indication is the basis for acceptance evaluation. For this reason, evaluations shall be started within five (5) minutes of the time the developer is applied and allowed to dry on the test area in order to prevent excessive “bleed-out” prior to measurement of indications. Only indications with major dimensions greater than 1/16” shall be considered relevant.

(a) Non-relevant indications are surface imperfections other than true discontinuities and are to be regarded as defects. Re-examination of these areas, following additional surface conditioning as necessary, shall be performed to determine if there are any actual discontinuities present. Non-relevant indications that could mask true discontinuities are unacceptable.

(b) Relevant indications are those which result from mechanical discontinuities.

(c) A Linear indication is one having a length greater than three times the width.

(d) A rounded indication is one of circular or elliptical shape with the length equal to or less than three times the width.

(e) Any questionable or doubtful indications shall be reexamined to determine whether or not they are relevant.

5.7 Acceptance Standards

These shall apply unless other, more restrictive standards are specified by the owner client of the item that is subject to liquid penetrant testing by MOGAS personnel.

All surfaces to be examined shall be free of:

(a) Relevant linear indications;
(b) Relevant rounded indications greater than 3/16" (5mm);
(c) Four or more relevant rounded indications in a line separated by 1/16" (1.5 mm) or less (edge to edge);
(d) An indication of an imperfection may be larger than the imperfection that causes it; however, the size of the indication is the basis for acceptance evaluation.

5.8 Post Examination Cleaning

Following the examination remove all penetrant and developer by rinsing with water or by solvent cleaning. This should be performed as soon as practical after evaluation and documentation.

6.0 Defect Removal and Repair

6.1. All unacceptable imperfections shall be repaired and re-examined by the same NDT method used to detect the indication originally. Whenever the imperfection is removed by chipping or grinding, and repair by welding is not required, the excavated area shall be blended into the surrounding surfaces so as to avoid sharp notches, corners, or crevices.

6.1.1 Where welding is required after repair of an imperfection, the area shall be cleaned and welding performed in accordance with a qualified welding procedure. Completed repairs shall be re-examined by the method originally used for detection of the defect.

6.1.2 Any indication which is believed to be nonrelevant shall be regarded as an imperfection unless it is shown by reexamination by the same method or by the use of other nondestructive methods and / or by surface conditioning that no unacceptable imperfection is present.

6.1.3 After a defect is thought to have been removed and prior to making weld repairs, the area shall be examined by suitable methods to ensure it has bee removed or reduced to an acceptably sized imperfection.

6.1.4 After repairs have been made, the repaired area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners and re-examined by the liquid penetrant method, and by all other methods of examination that were originally required for the affected area, except that, when the depth of repair is less than the radiographic sensitivity required, re-inspection by radiography may be omitted.

7.0 Reporting

7.1 The results of the examination shall be reported on the form shown in Appendix 1 of this procedure. The report shall contain the following information as a minimum:

(a) Procedure identification and revision;

(b) Liquid penetrant type;

(c) Type (number of letter designation) of each penetrant, penetrant remover, and developer used;

(d) Examination personnel identity and if required by referencing code section, qualification level;

(e) Map or record of indications per 8.0 of this procedure;

(f) Material and thickness;

(g) Lighting equipment;

(h) Date and time examinations were performed.

8.0 Documentation

A Nondestructive Test Report (Appendix I) is generated as a result of the tests covered by this procedure. Copies of the report are distributed as required within the MOGAS documentation system.

8.1 Non rejectable indications shall be recorded as specified in paragraph 5.6

8.2 The Rejectable indications shall be recorded. As a minimum, the type of indications (linear of rounded), location and extent (length of diameter of aligned) shall be recorded.

APPENDIX I
PT Examination Report

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SEVERE SERVICE BALL VALVES

LIQUID PENETRANT TEST REPORT

DATE	REPORT NUMBER		
CUSTOMER/PROJECT Job No:		WELD OR PART IDENTIFICATION	
PROCEDURE NO:		ACCEPTANCE STANDARD	TEST TEMP
MATERIAL:	SURFACE CONDITION	THICKNESS/DIMENSIONS:	
CONSUMABLE BRAND	CLEANER	PENETRANT	DEVELOPER
DWELL TIME	CLEANING:	PENETRANT:	DEVELOPER/INTERPRETATION:

SKETCH

NOTES

RESULTS

IND. NO.	TYPE OF INDICATION	LOCATION	SIZE/EXTENT	EVALUATION	REMARKS

EXAMINED BY:

PRINT NAME _____

SIGNATURE _____

WITNESSED BY:

PRINT NAME _____

SIGNATURE _____

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