SUPPLIER FLUORESCENT PENETRANT INSPECTION

1.0 PURPOSE

1.1 This SOP documents acceptance criteria and exceptions to ASTM E 1417 for fluorescent penetrant inspection.

2.0 SCOPE

2.1 Applicable to all fluorescent penetrant inspection performed by suppliers, for Eaton FSD, Euclid.

3.0 REFERENCES

The latest revision of the following shall apply:

AIA NAS 410 “Certification and Qualification of Nondestructive Test Personnel”.

SAE AMS 2644 "Inspection Materials, Penetrant”.

ASTM E 1417 “Standard Practice for Liquid Penetrant Examination”.

TAP-PS-498 “Arid Pickling Aluminum Castings”.

S.O.P. 52-10-011.1-00-001 "Vendor Request for MRBA"

QPL SAE AMS 2644 "Qualified Products List of Products Qualified under SAE Aerospace Material Specification AMS 2644 Inspection Materials, Penetrants".

Adhesive identification arrows available from: Complete Reading Electric., 13311 Enterprise Avenue, Cleveland Ohio 44135.

Transparent comparators TAM 13275 available from: Transparent Comparators available from: Transparent Comparators, 30 S. Third Street, Wet Milton, PA 17886.

4.0 GENERAL REQUIREMENTS

4.1 Inspection, processing and control tests shall conform to ASTM E 1417, Type 1 except in Par. 5.3.1 minimum dwell time shall be 20 minutes and in Par. 5.4.1. Dryer temperature shall be 150 F. maximum.

4.1.1 Unless otherwise specified on the blueprint or VQR, use of developer is required.

4.2 All FPI materials used shall conform to SAE AMS 2644, and be listed within QPL SAE AMS 2644. Materials used shall be from the same manufacturer family group.

4.3 Inspectors making accept / reject disposition shall be certified to Level II or Level III in accordance with AIA NAS 410.

4.4 Deviations from the following procedure shall be made only with approval of the NDT Quality Assurance Representative.

5.0 PROCEDURE
5.1 Parts shall be inspected prior to any coating operation unless otherwise specified by blueprint, Vendor Quality Requirements (VQR) or operational sketch.

5.2 Parts Preparation

5.2.1 Etching procedures shall conform to TAP-PS-498. Blueprints, VQRs, or operational sketches will specify if etching is required.

5.3 PENETRANT DWELL TIME

5.3.1 Elapsed time from application of penetrant to end of drain time shall be called "dwell" time and shall be 20 minutes minimum.

5.4 DRYING

5.4.1 Dry part in a circulating hot air oven (150° F max.) only until part surface is dry.

6.0 EVALUATION OF INDICATIONS BY INSPECTOR

6.1 Solvent Wiping

6.1.1 Indications may be evaluated by wiping them, transversely if possible, with a clean cotton swab, or china bristle brush dampened with solvent. The swab or brush shall not be saturated with solvent. The affected area shall be allowed to dry, and redevelop.

6.1.2 Redevelopment time shall be as long as the original development time. If no indication reappears, the original indication is considered false. This procedure may be performed twice for any given original indication. If the distance from the discontinuity edge to the indication edge is greater than 1/16 after 15 minutes redeveloping time the part is unacceptable.

7.0 ACCEPTANCE CRITERIA

Unless otherwise specified acceptance criteria for both castings and wrought materials shall be as follows:

Note: A transparent comparator such as TAM 13275 may be used to determine the approximate size of discontinuities or indications. When the size of the discontinuity or indication is not clearly less than or does not clearly exceed the acceptable size, gage pins shall be used for measurement. Acceptance criteria when described as "indications" shall be effective after evaluations per pars. 6.1.1 and 6.1.2.

7.1 No cracks or linear discontinuities are permitted. A linear discontinuity is at least three (3) times longer than it's width. Linear discontinuities, less than .030" in length, observed on cast surfaces except for leading and trailing edges of impeller blades shall be considered incidental. Discontinuities from oxide inclusions on areas other than ribs, impeller blades, gear pocket webs and o-ring seal surfaces which appear linear shall be evaluated as dross.

7.2 Linear indications caused by pattern or mold parting line discontinuities shall be considered relevant.

7.3 Porosity caused by a reaction with the mold material at the cast surface may be acceptable. This porosity will be on a cast surface and shall be no deeper than .040 into the cast surface. When observed at the edge of a machined face, the porosity is acceptable when the individual porosities are smaller than .015 in diameter and the porosity is no deeper than .040.

7.4 The following actual discontinuities are unacceptable:

7.4.1 Chain Porosity: three (3) or more discrete indications in a linear pattern spaced less than 2-1/2 times the average

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porosity diameter apart (Except per par. 7.3).

7.4.2 Gross Porosity: local patches or an entire part's machined surface having unconnected porosity indications, .015" diameter or larger, round or elongated and less than 1/4 inch apart.

7.4.3 Sponge Shrink: localized grouping of either round indications, crack-like indications or a combination of both. The perimeter of these groupings tends to fade or dissipate into the parent material.

7.4.4 Shrink Cavity: Shrink cavity is associated with sponge shrink. The shrink cavity appears as a void located near the middle of a sponge shrink indication. When examined under white light with a 10X magnifying glass, the surfaces will be very rough.

7.4.5 Gas Hole greater than .060" in diameter or greater than 50% of the section thickness whichever is smaller: A gas hole is a solitary void. When examined under white light with a 10X magnifying glass, the internal surface will be smooth and spherical.

7.4.6 Dross which cannot be encircled within .060" or is greater than 50% of the section thickness whichever is less. Dross is due to oxidation or impurities within the molten metal and has a distinct outer shape which often appears linear. The discontinuity could appear spongy or solid and is usually visible to the unaided eye.

7.4.7 Through-wall indications.

7.4.8 Round or elongated discontinuities less than ¼ inch apart or single discontinuities greater than .015" diameter on any o'ring seal surface. Dross discontinuities which occur longitudinal to the o-ring seal and greater than .040" x .005.

8.0 ACCEPTABLE PARTS:

8.1 Acceptable parts shall be marked in the manner and location called for by the part drawing or SOP, and be released for further processing. The approval stamping location and method of application shall be harmless to the part. The penetrant acceptance symbol shall be a borderless "P". The Symbol "P" within a border is unacceptable.

8.2 Post Cleaning. Non aqueous and aqueous wet developers shall be removed by suitable means following inspection. Dry developer shall be removed using shop air to thoroughly blow off the part following inspection.

9.0 DISPOSITION OF MATERIAL AT AN N.D.T. VENDOR

9.1 All discontinuities shall be identified with adhesive arrows. (Ref. par. 3.1.6) or other suitable means of marking. Marking must be removed following Material Review disposition.

9.2 Rejected parts shall be processed in accordance with the Nondestructive Test Discrepancies Section of SOP 52-10-011.1-00-001.

9.3 Radiographic examination of discontinuity shall be used to determine severity when required.

9.4 Mechanical Evaluation is the removal of shallow discontinuities to determine their depth and extent.

9.4.1 Mechanical evaluation may be performed by a designated individual or vendor responsible for the material and dimensional integrity of the part.

9.4.2 A powered or manual tool may be utilized to remove shallow discontinuities and/or to determine depth and extent of a discontinuity.

9.4.2.1 Acceptable tools for use of non-ferrous parts include:

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A) Sharp, clean hand files  
B) Sharp, unclogged, rotary burrs, cutters, and rolled emery points used in conjunction with rotary power tools and cutting lubrications.

9.4.2.2 Acceptable tools for use on ferrous materials include:

A) Emery paper  
B) Mounted grinding points used with rotary power tools.

9.4.3 Excess pressure which may cause heat generation must be avoided. "PEENING" shall not be utilized to close or hide a discontinuity.

9.4.4 Mechanical evaluation must be confined to surfaces which are not machined. Blueprint requirements must be maintained.

9.4.5 This method of evaluation shall be performed only on parts which have not been anodized. Any rework performed on anodized parts must first be approved by the cognizant Quality Assurance Representative.

9.4.6 Parts shall be reinspected after indication is removed to assure all blueprint dimensional requirements are met. This must be performed by the individual performing the rework or evaluation.

9.4.6.1 Reinspection shall include an additional penetrant inspection of the repaired area. This inspection shall include local etch of the reworked area unless the indications were caused by the following:
- discontinuities identified as nicks, dents or scratches
- discontinuities identified as burrs
- discontinuities identified as high metal spots

10.0 PACKAGING

10.1 Acceptable Parts. These parts shall, as a minimum, be re-packaged in a similar manner as when received, e.g. bagged, boxed, separators, etc. so as to preclude their being damaged by handling or in transit.

10.2 Rejected Parts. Until these parts receive Eaton's final disposition, they shall be conspicuously identified as rejects and packaged separately from acceptable parts. They shall also, as a minimum, be re-packaged in a similar manner as when received so as to preclude their being damaged. Their containers shall be clearly marked as containing rejected material.

11.0 CERTIFICATION

Certification and inspection reports shall identify parts by serial number, and the disposition. Casting serial numbers are to be used. Do not re-serialize.