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BULK MATERIAL HANDLING

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NON DESTRUCTIVE TESTING PROCEDURE
LIQUID PENETRANT EXAMINATION (PT)

SCOPE

- This procedure shall be used for Liquid Penetrant Examination of either magnetic or non-magnetic materials for the detection of discontinuities that are open to the surface.

REFERENCE

- A.S.M.E. B & PV Code: Section V, Article 6, Latest Edition

MATERIALS

- Penetrant materials shall be of one family group (type and mfg.).
- Pre-cleaners: detergents, organic solvents, descaling solutions, paint removers, and cleaners compatible with penetrant may be used.
- Penetrant shall be visible dye, solvent removable type.
- Penetrant Removal: Organic solvents and cleaners compatible with penetrant shall be used.
- Developers: Wet-type developers suspended in a volatile solvent, as supplied by the same manufacturer of the penetrant shall be used.
- Certification of contaminant content for all materials used on nickel base alloys, austenitic stainless steels, and titanium shall be made available from manufacturer.

SURFACE PREPARATION

- In general, satisfactory results may be obtained when the surface of the part 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 of non-acceptable discontinuities. Blasting with shot or dull grit is not advisable since surface indications could be peened over and testing rendered non-conclusive.
- When cleaning stainless steel, only approved brushes or grinders shall be used to avoid carbon contamination.
- Prior to all liquid penetrant examinations, the surface to be examined and all adjacent areas shall be dry and free of all dirt, grease, lint, scale, welding flux, weld spatter, oil, and any and all extraneous matter that could obscure surface openings or otherwise interfere with the examination.

TECHNIQUE

- Cleaning: Clean the area to be examined and at least 1" adjacent area just prior to performing penetrant examination, using approved pre-cleaner. Dry the surface by normal evaporation for a minimum of five (5) minutes or by the use of forced hot air as required to ensure that the cleaning solution has evaporated prior to application of the penetrant.
- Application of Penetrant: Penetrant may be applied to the part by dipping, brushing, or spraying. When compressed air spray equipment is used, proper filters shall be used to prevent introduction of compressor oil, dirt, scale, or other air line contaminants into the penetrant.
- Surface temperature of the part to be inspected shall not be lower than 60 degrees F or higher than 125 degrees F prior to application of penetrant and throughout the examination period. Local heating and cooling to achieve this temperature range is permitted.

- Penetration time shall normally be between 5 and 15 minutes.
- Penetrant manufacturers instructions shall be used when available, if they differ from this range. Dwell time shall not be less than 5 minutes in any case.
- Excess Penetrant Removal: Remove excess penetrant only after the specified penetrating dwell time. Care should be taken to minimize removal of penetrant from any discontinuities. Remove excess penetrant by lint-free cloth or absorbent paper toweling moistened with solvent or cleaner. Repeat this step as necessary to remove any remaining visible traces of penetrant and to ensure a high-contrast field. Any flushing or flooding of the surface with the penetrant remover is prohibited.
- Surfaces shall be thoroughly dry prior to application of developer.
- When penetrant remover has been used, let surfaces dry by normal evaporation for a minimum of two (2) minutes.
- Developing: Wet developer shall normally be applied as a suspended solid in solution with a volatile solvent. When safety, health, or work restriction preclude application by spray, brushing is an acceptable alternative. When spraying, agitate the developer solution thoroughly to assure adequate dispersion of the solids in suspension. Application shall be thin, even coating, sufficient to properly draw out penetrant from indications, but nor excessive so as to result in pooling and masking of indications.
- Interpretation: Lighting in the area where evaluation is being performed shall be sufficient to assure proper visibility of all relevant indications that might be present. Interpretation of indications should begin as soon as the developer is applied in order to more properly evaluate indications that diffuse excessively in the developer. Final interpretation shall be made only after allowing the penetrant to bleed out for 5-20 minutes. When the surface size precludes completion of the examination in the prescribed time frame, examination shall be performed in increments. With color contrast penetrant, the developer forms a reasonably uniform white coating. Surface discontinuities are indicated by a deep red color that stains the developer where the penetrant bleeds out of the discontinuity.

EVALUATION OF INDICATIONS

- Discontinuities at the surface will be indicated by bleed-out of the penetrant. Broad areas with a light pink color may be due to excessive background penetrant remaining prior to developer application. These areas could mask indication of discontinuities and are unacceptable. These areas shall be cleaned and re-examined.
- An indication is evidence of a mechanical discontinuity. Only indications with a major dimension greater than 1/8” shall be considered as relevant.
- Linear indications are those indications in which the length is more than three times the width.
- Rounded indications are indications that are circular or elliptical in the shape with the length equal or less than the width.
- Any questionable or doubtful indications shall be re-tested to verify whether or not actual defects are present.

ACCEPTANCE STANDARDS

- These acceptance standards shall apply unless other standards are specified. All surfaces examined shall be free of:
    - Relevant linear indications.
    - Four (4) or more rounded indications in a line separated by 1/16” or less (edge to edge).
    - Any indication of an imperfection that is believed to be non-relevant shall be regarded as a defect unless it is shown, after re-examination and re-evaluation by the same methods, to assure that no defect is present.

DEFECT REMOVAL AND REPAIR

- Non-acceptable indications shall be removed by suitable means and re-welded if required. When a defect is removed and repair by welding is not required, the excavated area shall be blended back into the surrounding surface so as to avoid sharp notches, crevices, or corners remaining. Re-welding shall be by the same method or procedure as the original welding and re-examination shall be by the original examination method procedure.
- After a defect has been removed and prior to re-welding of the affected area, re-examination of the area by PT shall be performed to verify removal of the offending condition.

- After repairs have been made, the repaired areas shall be blended.

REPORTING

- After all examinations and required repairs have been performed to the satisfaction of the applicable code or standard, a letter of compliance shall be generated reflecting acceptance of satisfactory test results.