



Prime Inspections, Inc.

Liquid Penetrant (PT) Examination Procedure Solvent-Removable Visible (Color- Contrast) and Post-Emulsifiable Fluorescent Methods

Procedure No.: PII-TC-PT | Revision: 0 | Effective: 2026-07-28

Applicable Project: TC Energy (USA)

Technical Approval

**Joshua de Monbrun, CEng -
Consultant**

Quality Approval

Oscar Gonzales - VP of Quality

Company Approval for Use

Code & Specification Basis

- ASME BPVC Section V, Article 6 — Liquid Penetrant Examination (2025 Edition).
- ASME BPVC Section V, Article 24 — SE-165 Standard Practice for Liquid Penetrant Testing.
- ASTM E165 / E165M — Standard Practice for Liquid Penetrant Testing for General Industry.
- ASTM E1417 / E1417M — Standard Practice for Liquid Penetrant Testing (process control).
- ASTM E1219 — Standard Practice for Fluorescent Liquid Penetrant Testing (Solvent-Removable Process).
- ASTM E1220 — Standard Practice for Visible Penetrant Testing (Solvent-Removable Process).
- ASTM E433 — Standard Reference Photographs for Liquid Penetrant Inspection.
- ISO 3452-1, -2, -3, -4, -5, -6 — Non-destructive Testing — Penetrant Testing.
- API 1104, 21st Edition — §11.3 Penetrant Testing; §9.6 Acceptance Standards.
- ASME B31.3 (2024); B31.4 (2025); B31.8 (2025) as applicable to project scope.
- AWS D1.1/D1.1M — Structural Welding Code (Steel) when applicable.
- ASNT SNT-TC-1A (2024 Ed.); ANSI/ASNT CP-189; ISO 9712 — Personnel.
- PII-WP-1 — Written Practice.

Revision History

Rev	Date	Prepared / Approved	Description of Change
0	2026-07-28	J. de Monbrun / O. Gonzales	Initial issue of Prime Inspections, Inc. (PII) controlled procedure under the PII Quality Management System. Issued as Rev 0 — no prior PII revision history. Aligned with API 1104 21st Edition (with current addenda), ASME BPVC Section V (2025 Edition), and the current TC Energy TES/TEN/TEP series specifications applicable to the project scope.

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1.0 Scope

- 1.1. This procedure establishes the minimum requirements implemented by Prime Inspections, Inc. (PII) for performing Liquid Penetrant (PT) examination using the preferred technique of solvent-removable visible (color-contrast Type II, Method C) and, if requested by the company, post-emulsifiable fluorescent (Type I, Method D) techniques.
- 1.2. Applicability — This procedure applies to the detection of surface-breaking discontinuities (cracks, laps, seams, cold shuts, porosity open to the surface, fold marks) in non-porous metallic and ceramic materials such as welds, castings, forgings, machined components, piping, valves, fittings, and pressure-vessel components.
- 1.3. This procedure applies to procedure-qualification welds, welder/welding-operator performance qualification welds, production welds, integrity excavations, and base-material anomaly investigations.
- 1.4. Where this procedure, ASME V, ASTM E165 / E1417, API 1104, or the applicable project specification does not explicitly address the required condition, PII shall identify the gap, notify the customer, apply the more conservative interpretation, and document the method used. Where requirements conflict, the more stringent shall govern.

2.0 Purpose

- 2.1. To provide a written, controlled, code-compliant procedure for the application of PT examination on PII projects, satisfying the requirements of ASME BPVC Section V Article 6, ASTM E165 / E1417, ISO 3452, and the acceptance criteria of the governing construction code (API 1104, ASME B31.3, AWS D1.1, etc.).

3.0 References (Latest Editions Unless Stated Otherwise)

3.1. Industry Codes and Standards

- 3.1.1. ASME BPVC Section V, Article 6, Liquid Penetrant Examination (2025 Ed.).
- 3.1.2. ASME BPVC Section V, Article 24, Standard Practices: SE-165 (LP Testing).
- 3.1.3. ASTM E165 / E165M, Standard Practice for Liquid Penetrant Testing.
- 3.1.4. ASTM E1417 / E1417M, Process-control LP testing standard.
- 3.1.5. ASTM E1219, Fluorescent Solvent-Removable LP Testing.
- 3.1.6. ASTM E1220, Visible Solvent-Removable LP Testing.
- 3.1.7. ASTM E1208 / E1209 / E1210 / E1418, additional LP standards (water-washable, lipophilic, hydrophilic, fluorescent).
- 3.1.8. lipophilic, hydrophilic, fluorescent).
- 3.1.9. ASTM E433, Reference photographs for LP indications.
- 3.1.10. ISO 3452-1, -2, -3, -4, -5, -6; Non-destructive Testing, Penetrant Testing.

- 3.1.11. ASTM A380 / A967, Pickling/passivation (background for chloride-sensitive materials).
- 3.1.12. AMS 2644, Inspection materials, penetrant (aerospace qualification of PT materials).
- 3.1.13. API 1104, 21st Ed., §11.3 Penetrant Testing; §9.6 Acceptance Standards.
- 3.1.14. ASME B31.3 (2024), §344.4; §302.3.3 (castings).
- 3.1.15. AWS D1.1/D1.1M, Structural Welding Code, §8.27 / §9.27.
- 3.1.16. ASNT SNT-TC-1A (2024 Ed.); ANSI/ASNT CP-189; ISO 9712.

3.2. PII Internal Documents

- 3.2.1. PII-QC-01, Quality Control Manual.
- 3.2.2. PII-WP-1, Written Practice for Qualification and Certification of NDE Personnel.
- 3.2.3. PII-PT-CAL-01, PT Material Process-Control Record (per-batch certificate of conformance + AMS 2644 verification where applicable).
- 3.2.4. PII-PT-RPT-01, PT Examination Report.
- 3.2.5. PII-VAE-1, Vision Acuity Examination Record.

3.3. Regulatory References

- 3.3.1. 49 CFR Part 192 (PHMSA — Gas) and Part 195 (Hazardous Liquid) — pipeline NDE records retention.
- 3.3.2. 29 CFR 1910.1200 — OSHA Hazard Communication (penetrant SDS, solvent labeling).

4.0 Definitions and Acronyms

Term	Definition
Type I	Fluorescent penetrant (viewed under UV-A black light).
Type II	Visible / color-contrast penetrant (viewed under white light, typically red dye).
Method A	Water-washable penetrant — excess penetrant removed with water spray.
Method B	Lipophilic post-emulsifiable — emulsifier applied directly, then water rinse.
Method C	Solvent-removable penetrant — excess removed with cloth and solvent.
Method D	Hydrophilic post-emulsifiable — emulsifier diluted with water, applied, then water rinse.
Form a	Dry powder developer (typically used after fluorescent processes).
Form b	Aqueous (water-soluble) developer.
Form c	Aqueous suspendible developer.

Term	Definition
Form d	Non-aqueous wet developer (solvent-suspended; typical for Method C field work).
Form e	Special applications developer.
Dwell Time	The time penetrant is in contact with the test surface before excess removal.
Development Time	The time the developer is allowed to act before final interpretation.
Bleed-out	Penetrant exiting a discontinuity into the developer, forming the indication.
UV-A	Long-wave (320–400 nm) ultraviolet 'black' light used for fluorescent penetrant viewing; peak 365 nm.
Lux / Foot-Candle	Visible-light intensity units: 1 fc $\approx$ 10.76 lux.
$\mu\text{W}/\text{cm}^2$	Irradiance units for UV-A measurement.

5.0 Responsibilities

- 5.1. PII Quality Manager (QM) - VP of Quality. Owns preparation, review, and control of this procedure; ensures personnel and equipment are current.
- 5.2. PII ASNT Level III (PT). Provides technical review and approval of this procedure; approves any essential-variable changes; serves as cognizant authority for PT method application.
- 5.3. Site Supervisor / Project Manager. Verifies certifications, OQ status, material expiration dates, and light-source calibrations prior to mobilization.
- 5.4. NDT Technician (Level II or III in PT). Performs PT examination per this procedure, completes records per Section 21.0; halts work and notifies supervisor if any requirement cannot be met.
- 5.5. Level I personnel may assist a certified Level II/III but shall not independently set up the examination, interpret indications, or sign reports. PT Level II-Limited (Visible Only) is restricted to color-contrast / visible methods only.

[Reference: ASNT SNT-TC-1A §8; PII-WP-1 §7.]

6.0 Safety Requirements

6.1. PPE

- 6.1.1. ANSI Z87.1 safety eyewear; for UV-A operations, UV-A-blocking eyewear meeting ANSI Z87.1+ U6.
- 6.1.2. Hard hat; FR coveralls where mandated; ASTM F2412/F2413 footwear.
- 6.1.3. Chemical-resistant gloves compatible with solvents in use (per SDS).

- 6.1.4. Respiratory protection per SDS when spraying solvent-based penetrants/developers in enclosed spaces.
- 6.2. Chemical Hazards — All penetrant, emulsifier, solvent, and developer products shall be stored, used, and disposed of per the manufacturer's Safety Data Sheet (SDS) and applicable environmental regulations. SDS shall be on-site at every PT operation location.
- 6.3. Flammability — Many solvent-based penetrants and removers are flammable. PT operations shall not be performed in areas with open flame, hot work, or in atmospheres classified as flammable per NFPA 70 / API RP 500 unless the materials in use are explicitly rated for that environment.
- 6.4. UV-A Exposure — UV-A black-light operations require UV-A-blocking eyewear and limited skin exposure. Cumulative exposure shall be managed in accordance with ACGIH TLVs for UV-A. Do not look directly at unfiltered UV-A bulbs.
- 6.5. Material Compatibility — Solvent products containing halogens or sulfur shall not be used on austenitic stainless steel, nickel-based alloys, or titanium without certificate-verified limits (see Section 9.0). Use of an unverified product can potentially cause stress-corrosion cracking failure, later in service.
- 6.6. JHA — Job Hazard Analysis completed and signed by all crew members prior to performing PT work each day; reissued whenever conditions change.

7.0 Personnel Qualifications and Vision

- 7.1. Personnel performing PT shall be qualified and certified per PII-WP-1 to ASNT SNT-TC-1A (2024 Ed.) Level II or higher in the PT method (or to ANSI/ASNT CP-189, ISO 9712 Level 2 / 3, or CAN/CGSB 48.9712 as applicable to jurisdiction).
- 7.2. PT Level II-Limited (Visible) personnel are restricted to color-contrast solvent-removable PT only. They shall not perform fluorescent PT without further qualification.
- 7.3. Vision Examination — Annual per PII-WP-1 §15: near-vision Jaeger J-1 at ≥ 12 in. (one eye, corrected or uncorrected), AND color-contrast examination capable of distinguishing the colors used in the PT process.
- 7.4. Operator Qualification (TC Energy/pipeline operator work) – Personnel shall hold the current Covered Task qualification when working on regulated assets (PHMSA OQ for the relevant penetrant testing task).

8.0 Penetrant Materials — Type / Method / Sensitivity

8.1. Approved material families (Type / Method / Sensitivity)

Application	Type	Method	Developer Form	Notes
Field PT — welds, fittings, valves	II (Visible)	C (Solvent-Removable)	d (Non-aqueous wet)	PII default for field work.
Shop PT — high-sensitivity components	I (Fluorescent)	D (Hydrophilic PE)	a (Dry) or c (Aqueous suspendible)	Shop bench / dedicated PT line.
Shop PT — solvent-removable fluorescent	I (Fluorescent)	C (Solvent-Removable)	d (Non-aqueous wet)	Field-portable fluorescent.

8.2. Sensitivity Levels (ASTM E1417 / AMS 2644)

8.2.1. Level 1/2 — Low / Medium sensitivity (general fabrication; PT II Method C).

8.2.2. Level 3 — High sensitivity (critical aerospace and pressure components).

8.2.3. Level 4 — Ultra-High sensitivity (rare; AMS 2644-qualified materials only).

8.3. Material Certification — Each new lot of penetrant, emulsifier, solvent remover, and developer shall arrive with a Certificate of Conformance (Cert C) from the manufacturer documenting compliance with the applicable ASTM / AMS standard. The Cert C is retained in PII-PT-CAL-01 by batch/lot number; the lot number is recorded on every PT examination report.

8.4. Shelf Life — Materials shall not be used past the manufacturer's expiration date. Aerosol cans shall be discarded when nozzle clogs cannot be cleared or when discharge becomes intermittent.

9.0 Compatibility, Intermixing, and Halogen / Sulfur Controls

9.1. Mixed-family rule — Penetrants, emulsifiers, solvents, and developers from different manufacturers shall NOT be intermixed without written approval from the cognizant Level III. Within a manufacturer's family, only the manufacturer-paired combinations shall be used.

9.2. Austenitic Stainless / Nickel Alloy / Titanium materials

Total chloride + fluoride content of penetrant, emulsifier, remover, and developer combined shall be $\leq 1\%$ by weight for general austenitic work, with the manufacturer's Cert C confirming the value. For nuclear or aerospace austenitic work, the limit may be ≤ 50 ppm (per ASME V Art. 6 T-641 and AMS 2644).

9.3. Titanium and Nickel Alloy — Total sulfur + halogen content of the consumable shall be controlled by ASME V Art. 6 T-641; certificate evidence required.

9.4. Contamination — Materials suspected of contamination (open container, dropped, wrong-labeled) shall be quarantined and replaced; never used on production work.

[Reference: ASME V Art. 6 T-641; ASTM E165 §6.3; AMS 2644.]

10.0 Surface Preparation and Pre-Cleaning

- 10.1. The surface to be examined and all adjacent areas within 1 in. (25 mm) shall be free of rust, scale, weld spatter, slag, oil, grease, paint, coatings, and any other contaminant that could mask discontinuities or interfere with penetrant action.
- 10.2. **Acceptable cleaning methods**
- 10.2.1. Solvent cleaning — Wipe with a clean cloth and approved solvent; allow to dry fully before applying penetrant
 - 10.2.2. Detergent / alkaline cleaning — Followed by thorough water rinse and drying.
 - 10.2.3. Vapor degreasing — Effective for oil and grease.
 - 10.2.4. Mechanical cleaning — Wire brushing, grinding, sanding — used cautiously; aggressive mechanical methods can smear discontinuities closed and shall NOT be used as final preparation prior to PT unless followed by chemical cleaning (etching).
 - 10.2.5. Etching — Required when prior mechanical cleaning may have smeared the surface; use manufacturer-approved etchant compatible with the base material
- 10.3. Drying — Surface shall be visibly dry before penetrant application. Minimum drying time after solvent cleaning: 5 minutes at ambient temperature. Heated drying is acceptable, but surface temperature shall remain within the range of Section 11.0.
- 10.4. Coatings — PT examination through any coating (paint, plating, weld primer) is PROHIBITED. Coatings shall be removed for the area of interest plus 1 in. (25 mm) on each side.

[Reference: ASME V Art. 6 T-642; ASTM E165 §7.]

11.0 Temperature Range and Verification

- 11.1. Standard temperature range: penetrant, test surface, and developer shall all be between 50°F and 125°F (10°C and 52°C) per ASME V Art. 6 T-651 and ASTM E165.
- 11.2. Outside the standard range — When the temperature must be outside 50–125°F, the procedure shall be qualified by demonstration on a known-defect comparator block (TAM Panel or Aluminum Quench Block) for the temperature range to be used. Qualification record retained in PII-PT-CAL-01.
- 11.3. Temperature verification — Surface temperature shall be measured prior to penetrant application using a calibrated contact pyrometer or IR thermometer (NIST-traceable). Temperature recorded on the PT examination report.

12.0 Penetrant Application and Dwell Time

12.1. Application Methods

12.1.1. Spraying (aerosol or pressurized spray) — Most common for field work.
Hold can 8-12 in. from surface; apply even, wet coat.

12.1.2. Brushing — Acceptable for spot or restricted-access areas.

12.1.3. Dipping / Flooding — Bench-shop use only.

12.2. Coverage — A uniform, wet coat of penetrant shall be maintained on the test surface for the full dwell time. Reapply if any area dries before dwell is complete.

12.3. Dwell Time (ASME V Art. 6 Table T-672)

Material	Form	Discontinuity Type	Minimum Penetrant Dwell (min)	Minimum Developer Dwell (min)
Aluminum, Magnesium, Steel, Brass, Bronze, Titanium, High-Temperature Alloys	Casting / Weld	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 / Ceramic	All forms	Cracks, porosity	5	10

NOTE: Dwell times may be extended (typically not more than 2× table value) for tight or fine discontinuities; document the value used. Dwell time SHALL NOT be reduced.

13.0 Excess-Penetrant Removal

13.1. Method C — Solvent-Removable (PII default field method)

13.1.1. Wipe excess penetrant from the surface using a clean, dry, lint-free cloth. Multiple passes; do not rub.

13.1.2. Dampen a SECOND clean cloth lightly with solvent (NOT solvent-saturated) and gently wipe the surface to remove the remaining surface film. Use a NEW cloth area / fresh cloth for each pass.

13.1.3. DO NOT flood, spray, or splash solvent directly on the test surface — this washes penetrant out of true discontinuities and produces false negatives.

- 13.1.4. Inspect the surface visually under white light to confirm the surface appears clean / penetrant-residue-free before applying developer.
- 13.2. Method A (Water-Washable) – Apply low-pressure (< 40 psi / 275 kPa) water spray at $\leq 110^{\circ}\text{F}$ (43°C) for the minimum time necessary to remove surface penetrant. Inspect under UV-A (fluorescent) or white light (visible) to confirm removal. Over-rinse can wash the penetrant from the indications.
- 13.3. Methods B and D (Post-Emulsifiable) – Apply emulsifier per manufacturer's dwell time; then water rinse. Emulsifier dwell is critical and shall be timed.

14.0 Developer Application

- 14.1. **Form (d) Non-Aqueous Wet Developer — PII default field developer**
 - 14.1.1. Shake aerosol thoroughly (per manufacturer) before each application.
 - 14.1.2. Hold can 8-12 in. from surface; apply LIGHT, EVEN coat such that test surface is partially visible through the developer film.
 - 14.1.3. DO NOT flood; an excessive coat will mask indications.
 - 14.1.4. Allow minimum 10 minutes development time (per Section 12.3 table) before final interpretation. Maximum 60 minutes for most penetrants; consult manufacturer.
- 14.2. Form (a) Dry Powder Developer — Dust uniformly via powder bulb, electrostatic spray, or floating. Excess removed by light air. Used primarily with fluorescent processes.
- 14.3. Form (b/c) Aqueous Developer — Apply by dip, spray, or pour; allow to drain and dry per manufacturer.
- 14.4. Development Time Limits — Minimum 10 min as table; maximum 60 min unless manufacturer specifies longer. Indications observed forming late in the development time shall be flagged for re-evaluation per Section 17.0.

15.0 Interpretation, Evaluation, and Indication Classification

- 15.1. **Viewing Conditions**
 - 15.1.1. Visible Penetrant (Type II) — Minimum 1076 lux (100 fc) white light at the examined surface, measured at 24 in. (610 mm). Light source verified per Section 19.0.
 - 15.1.2. Fluorescent Penetrant (Type I) — Minimum UV-A intensity $1000\ \mu\text{W}/\text{cm}^2$ at the examined surface, measured at 15 in. (380 mm). Ambient white light at viewing location ≤ 20 lux (2 fc). Examiner shall have been in the darkened area for at least 5 minutes prior to viewing to allow dark adaptation. UV-A-blocking eyewear shall be worn.

15.2. Final Interpretation — Performed AFTER the minimum development time and within the maximum development time. Indications observed before minimum dwell may not be representative of the true defect.

15.3. Indication Classification

15.3.1. Linear indication — length is greater than three (3) times the width.

15.3.2. Rounded indication — circular or elliptical; length is equal to or less than three (3) times the width.

15.3.3. Relevant indication — caused by a discontinuity that requires evaluation against the acceptance criteria (per Section 16.0).

15.3.4. Non-relevant indication — caused by geometric configuration (e.g., weld undercut, surface roughness, threaded joint) or material structure; documented and not classified as a defect unless the geometry itself is unacceptable.

15.3.5. False indication — caused by external contamination (lint, splashed penetrant from another area, solvent overspray). Surface shall be cleaned and re-examined to verify.

15.4. Indications $\leq 1/16$ in. (1.6 mm) in maximum dimension are classified as non-relevant per API 1104 §9.5 / ASME V Art. 6, unless the referencing code states otherwise.

15.5. When the relevance of any indication is in doubt, the surface shall be cleaned and re-examined per Section 17.0, or verified using a complementary NDE method (MT, VT, UT).

16.0 Acceptance Standards

16.1. The acceptance criteria shall be defined in this procedure or the governing construction code prior to the start of examination and shall be documented on the examination report. Where multiple codes or acceptance criteria are referenced, the applicable criteria shall be explicitly identified and approved prior to execution and shall not be selected or interpreted in the field. In the absence of a project-specific requirement, the most conservative applicable acceptance criteria shall govern. All inspection results shall be evaluated in accordance with the defined acceptance basis to ensure consistency, traceability, and auditability.

16.2. API 1104, 21st Edition — §9.5 PT Acceptance

16.2.1. Classification of Indications

a. Indications produced by liquid penetrant testing are not necessarily imperfections. Machining marks, scratches, and surface conditions may produce indications that are similar to those produced by imperfections but that are not relevant to acceptability. The criteria given in b and c apply when indications are evaluated.

b. Any indication with a maximum dimension of $1/16$ in (2mm) or less shall be classified as non-relevant. Any larger indication believed to be non-

relevant shall be regarded as relevant until re-examined by liquid penetrant or another nondestructive testing method to determine whether or not an actual imperfection exists. The surface may be ground or otherwise conditioned before re-examination. After an indication is determined to be non-relevant, other non-relevant indications of the same type need not be re-examined.

- c. Relevant indications are those caused by imperfections. Linear indications are those in which the length is more than three times the width. Rounded indications are those in which the length is three times the width or less.

16.2.2 Acceptance Standards – Relevant indication shall be considered defects should any of the following conditions exist:

16.2.2.1 Linear Indications

- a. Linear indications are evaluated as crater cracks or star cracks and exceed 5/32in (4mm) in length.
- b. Linear indications are evaluated as cracks other than crater cracks or star cracks.
- c. Linear indications are evaluated as IF and exceed 1in (25mm) in total length in a continuous 12in (300mm) length of weld or 8% of the weld length.

16.2.2.2 Rounded Indications – For evaluation purposes, the maximum dimension of a rounded indication shall be considered its size. Rounded indications shall be evaluated as follows:

- a. Individual or scattered porosity (P) shall be considered a defect should any of the following conditions exist:
 - i. The size of an individual pore exceeds 1/8in (3mm).
 - ii. The size of an individual pore exceeds 25% of the thinner of the nominal wall thickness joined.
 - iii. The distribution of scattered porosity exceeds the concentrations permitted by Figures 1 or 2.

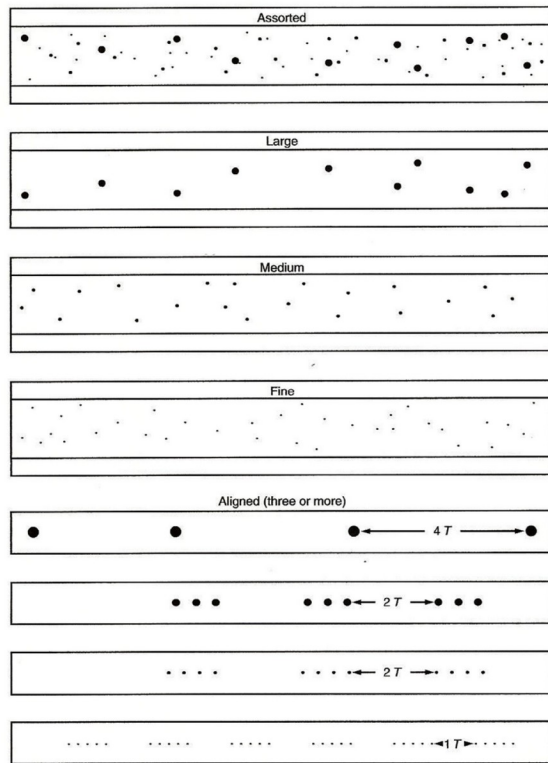


Figure 1: Max Distribution of Porosity ≤ 0.500 in (12.7mm)

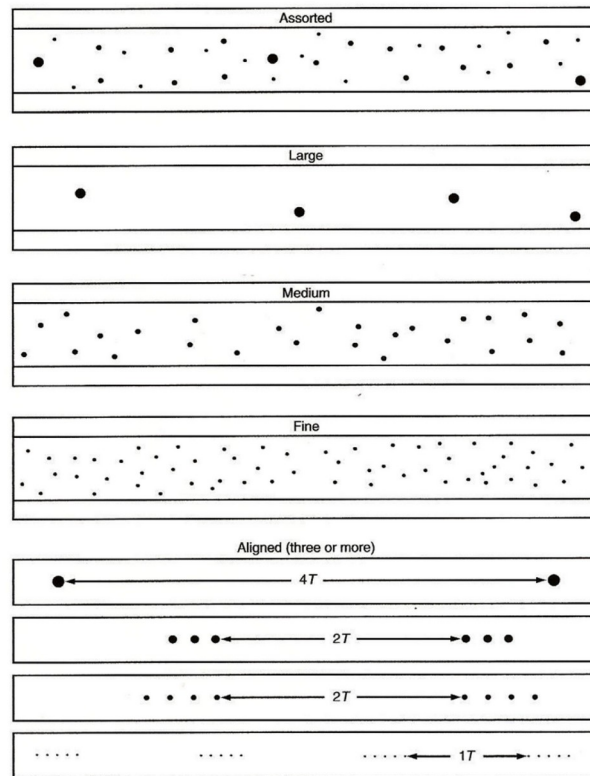


Figure 2: Max Distribution of Porosity > 0.500 in (12.7mm)

- b. Cluster porosity (CP) that occurs in any pass except the finish pass shall comply with the criteria for individual or scattered porosity ("a" above). CP that occurs in the finish pass shall be considered a defect should any of the following conditions exist:
 - i. The diameter of the cluster exceeds 1/2in (13mm).
 - ii. The aggregate length of CP in any continuous 12in (300mm) length of weld exceeds 1/2in (13mm).

NOTE: Where doubt exists about the imperfection type, verification shall be obtained with a complementary NDT method (UT, RT) before disposition.

16.3 ASME B31.3 (2024) — §344.4 PT Acceptance

16.3.2 Discontinuities at the surface will be indicated by bleed-out of penetrant; however, localized surface irregularities due to machining marks or other surface conditions may produce non-relevant indications. Inadvertent evidence of penetrant, not related to actual bleed-out, is classified as a false indication. Indications shall be verified as being relevant, non-relevant, or false. Additional surface preparation and/or other test methods may be used, as needed, to verify the relevance of an indication.

16.3.3 An indication of a discontinuity may be larger than the discontinuity that causes it; however, the dimensions of the indication and not the size of

the discontinuity is the basis for acceptance and rejection. Only indications with major dimensions greater than 1/16in (1.5mm) are required to be evaluated for acceptance.

16.3.4 All surfaces to be examined shall be free of:

- a. Linear Indications;
- b. Rounded indications greater than 3/16in (5mm)
- c. Four or more relevant rounded indications in a line, separated by 1/16in (1.5mm) or less, edge to edge.

17.0 Re-Examination and Repair Verification

17.1. Surfaces evaluated as doubtful or rejected may be re-examined after surface conditioning (light grinding / blending — per code limits) and a complete repeat of the PT sequence (Section 10.0 onward). Re-examination shall be performed by a different examiner when practicable, or by the same examiner with a documented second look.

17.2. Repair Verification — Repaired areas (weld repairs, surface grinding, replacement components) shall be re-examined by PT using the same procedure and same acceptance criteria as the original examination. The re-examination shall include the repair length plus 1 in. (25 mm) of base material on each end.

18.0 Post-Examination Cleaning

18.1. After interpretation and recording, all penetrant residue, developer, and cleaning-solvent residue shall be removed from the examined surface using appropriate cleaning methods compatible with the base material and any subsequent coatings, welding, or service environment. For stainless steel and nickel alloys: use only low-chloride / low-halogen cleaners (≤ 250 ppm).

19.0 Lighting and Light-Source Verification

19.1. Visible Light Source

- 19.1.1. Minimum 1076 lux (100 fc) at the examined surface at 24 in. (610 mm).
- 19.1.2. Verified annually with a NIST-traceable light meter (≤ 12 mo calibration), OR supplied with a current manufacturer's letter of conformance demonstrating ≥ 1076 lux at the working distance.
- 19.1.3. Light source ID, output, and verification method recorded on every PT examination report.

19.2. UV-A Light Source (for fluorescent PT)

- 19.2.1. Minimum 1000 $\mu\text{W}/\text{cm}^2$ UV-A irradiance at the examined surface at 15 in. (380 mm).
- 19.2.2. Verified before each shift's work using a NIST-traceable UV-A radiometer.

- 19.2.3. UV-A wavelength filter intact and clean; cracked or scratched filter requires bulb/filter replacement.
- 19.2.4. Ambient white-light at viewing location ≤ 20 lux (2 fc), verified.
- 19.2.5. Bulb warm-up — Allow ≥ 5 min after switch-on before measuring irradiance and starting examinations.

[Reference: ASME V Art. 6 T-676; ASTM E165 §10; ASTM E2297 (UV-A measurement).]

20.0 Calibration / Verification of Process Controls

- 20.1. System Performance — Daily / start-of-shift verification using a TAM Panel (Type 1 / Type 2 per ASTM E1417) or known-defect Aluminum Quench Block. The panel is run through the full PT sequence using the materials in use; indications shall match the panel's known indication pattern. Result recorded on PII-PT-CAL-01.
- 20.2. Material Process Control — At weekly intervals (or per ASTM E1417), the in-use materials shall be checked for sensitivity using a TAM Panel; for fluorescent, the brightness shall be compared to a reference standard (e.g., AMS 2644 brightness specimen). Failing materials are tagged and replaced.
- 20.3. Light meters and UV-A radiometers — Calibrated annually with NIST-traceable certificates retained in equipment file.
- 20.4. Penetrant / Emulsifier / Developer batch records — Each batch tracked by lot number from receipt through depletion; expiration date enforced; usage logged on PII-PT-CAL-01.

21.0 Records and Reporting

- 21.1. Each PT examination shall be documented on the PII PT Examination Report. As a minimum, the following shall be recorded:
 - 21.1.1. Procedure number and revision (PII-PT Rev 0);
 - 21.1.2. Date and time of examination;
 - 21.1.3. Project / facility / drawing / weld number / chainage / station (as applicable);
 - 21.1.4. NDT Technician's name, signature, certification standard, and level (e.g., SNT-TC-1A Level II PT);
 - 21.1.5. Material specification, grade, and thickness inspected;
 - 21.1.6. Surface temperature of the test piece (and ambient);
 - 21.1.7. Penetrant manufacturer, product, lot/batch number, and Cert C reference;
 - 21.1.8. Emulsifier manufacturer/product/lot (if used);
 - 21.1.9. Solvent remover manufacturer/product/lot;
 - 21.1.10. Developer form (a/b/c/d/e), manufacturer, product, lot;
 - 21.1.11. Type / Method / Sensitivity (e.g., Type II Method C Form d, Sensitivity Level 2);

- 21.1.12. Penetrant dwell time and developer dwell time used;
 - 21.1.13. Excess-removal method (and water pressure/temperature if Method A);
 - 21.1.14. Lighting verification — light source ID, intensity (lux or $\mu\text{W}/\text{cm}^2$), verification reference (meter S/N + cal date or letter of conformance);
 - 21.1.15. TAM Panel/reference block ID and start-of-shift sensitivity check result;
 - 21.1.16. Surface preparation method;
 - 21.1.17. Acceptance code/specification (e.g., API 1104 §9.5; ASME B31.3 §344.4);
 - 21.1.18. Results — number, type (linear/rounded), size, location of indications; disposition (accept/reject / for evaluation);
 - 21.1.19. Sketch or photograph when indications are recorded;
 - 21.1.20. Signature of Level II/III examiner; Site Supervisor countersignature.
- 21.2. Reports are transmitted to the customer at the end of each working day; originals are retained in PII Project Records.
- 21.3. Retention — Minimum 7 years or design life of the asset, whichever is greater (per 49 CFR §192.709 / §195.404 and PII-QM-01 Section 20.0).

22.0 Variances

- 22.1. Any deviation from this procedure shall be processed through the PII Variance Register (PII-VR-01) with Level III concurrence. Where the work is being performed under a customer-controlled procedure (e.g., TC Energy), the customer variance procedure additionally applies (e.g., TC Energy Item ID 007728702).

23.0 Compliance Cross-Reference Matrix

Procedure §	Subject	Governing Reference
7.0	Personnel & Vision	SNT-TC-1A 2024; PII-WP-1
8.0	Materials — Type/Method/Sensitivity	ASTM E165, E1417, E1219, E1220; AMS 2644
9.0	Halogen / Sulfur Controls	ASME V Art. 6 T-641; ASTM E165 §6.3
10.0	Surface Preparation	ASME V Art. 6 T-642; ASTM E165 §7
11.0	Temperature Range	ASME V Art. 6 T-651; ASTM E165 §6.4
12.0	Dwell Times	ASME V Art. 6 Table T-672; ASTM E165 §8
13.0	Excess Removal	ASME V Art. 6 T-673; ASTM E165 §9
14.0	Developer	ASME V Art. 6 T-674; ASTM E165 §10
15.0	Interpretation	ASME V Art. 6 T-675; ASTM E165 §11; ASTM E433
16.2	API 1104 Acceptance	API 1104 §9.5

Procedure §	Subject	Governing Reference
16.3	ASME B31.3 Acceptance	ASME B31.3 §344.4 / §302.3.3
19.0	Lighting Verification	ASME V Art. 6 T-676; ASTM E165 §12; E2297
20.0	Process Control (TAM Panel)	ASTM E1417 §8
21.0	Records & Reporting	ASME V Art. 6 T-690; 49 CFR §192.709/§195.404; PII-QM-01 §20
22.0	Variance Process	PII-QM-01 §21; TC Energy Item ID 007728702 (when applicable)

24.0 Liquid Penetrant Examination Report



Magnetic Particle / Penetrant Examination Report

CUSTOMER: TC ANR PROJECTS CUSTOMER JOB/AFE 12223 DATE: 6/8/2026 PAGE: 1 of 1

JOB LOCATION				P.O. OR JOB NO.			
11				1234			
M.T. MACHINE S/N N/A	COMPANY PROCEDURE N/A	COMPANY TC SPEC	ACCEPTANCE STANDARD API 1104 21ST	MAG YOKE CURRENT	AC ☐ DC ☒	TEST BLOCK S/N	N/A
PRODS SPACING N/A	COIL N/A	LIFT CHECK NO	WEIGHT OF TEST YOKE	AMP. SETTING	DRY POWDER N/A	WET SUSPENSION	N/A
LIGHT METER SERIAL # 12345	PROCEDURE NO. UTQ APPROVED GOES HERE	ACCEPTANCE STANDARD CODE INSPECTING TO	LIGHTING 100FC	TEMP. & PART 70°-80°	DWG. NO. 15 MIN		
MAT'L CERTIFICATION NO.	PENETRANT DEVELOPR INFO HERE			TYPE MAT'L STAINLESS STEEL	DIA. MAT'L 2"	LGTH. MAT'L 12"	

WELD IDENTIFICATION AND OR PART NUMBER	WELDER IDENTIFICATION	AREA	SURFACE CONDITIONS	ACCEPT	REJECT	TYPE DEFECT					REMARKS	TEST RESULTS: PHOTO: _____ GRID SHEET: _____ SKETCH _____
						ROUNDED INDICATION	LINEAR INDICATION	SURFACE INDICATION	OTHER			
1001	ET	100%	CLEAN	X								
1002	ET	100%	CLEAN	X								
1003	ET	100%	CLEAN	X								
1004	ET	100%	CLEAN	X								
1005	ET	100%	CLEAN	X								

ASSISTANT: JOHN DOE PER DIEM YES NO ☒

TRAVEL HOURS IF APPLICABLE: 0 MILES: 0 HOURS WORKED: 0 TO A.M. AND TO P.M. NO. OF MEN: 2 TOTAL HOURS: 10

CUSTOMER: TC ANR PROJECTS DATE: 6/8/2026 TECHNICIAN: DIGITALLY SIGNED BY BRANDON CHAMPION ON 2026-06-08 16:34:51 (CDT) LEVEL: II DATE: 6/8/2026

— END OF DOCUMENT —