



PII-VT

Visual Testing Examination

PNDT-VT

Revision 04

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**PRIME
INSPECTIONS** INC.
Revision / Change Summary

Revision/Change	No.	Date	Description
Original	0	4/1/2020	Original Issue
Revision	01	1/1/2023	ASME Code Reviews; Acceptance Criteria Added
Revision	02	1/1/2024	Code Review; updated for ASME Section V 2023 Edition
Revision	03	1/1/2026	Code Review/Update; updated for ASME Section V 2025 Edition
Revision	04	9/6/2026	Complete rewrite to ASME Section V Article 9 (Visual Examination); added API 1104 21st Edition Section 9.7 (VT Acceptance); expanded procedure qualification per Article 9, T-920; added detailed acceptance criteria for ASME B31.1, B31.3, B31.8, Section VIII, and API 1104; updated SNT-TC-1A 2020 Edition; added in-process VT checklist; added procedure essential variables table

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1.0 SCOPE

1.1 This procedure establishes the minimum technique requirements for performing visual examination (VT) for the detection of surface discontinuities, mechanical deterioration, distortion, deformation, leaks, and other surface-related defects on welds, piping, pressure vessels, storage tanks, and structural components. This procedure is written in accordance with ASME Section V, Article 9, "Visual Examination," 2025 Edition, and applicable referencing codes including API 1104, 21st Edition, Section 9.7.

1.2 This procedure is intended to be used for the examination of the in-process and/or final surface condition of welds and materials. It covers direct visual examination, remote visual examination, and translucent visual examination techniques as defined in ASME Section V, Article 9.

1.3 In the absence of specific visual technique requirements provided in other codes such as AWS D1.1, API 1104, or ASME B31 series, the technique parameters herein may be utilized, and this procedure referenced for the performance of VT.

1.4 This procedure is applicable to carbon steel, austenitic stainless steel, duplex stainless steel, alloy steels, aluminum, and other metallic materials. It may also be applied to non-metallic materials when the referencing code or specification permits visual examination as an acceptance method.

1.5 This procedure does not cover visual examination of buried welds, internal surfaces not accessible by direct or remote means, or areas where the required illumination cannot be achieved. For such conditions, alternative NDT methods shall be considered.

1.6 This procedure meets the essential variable requirements of ASME Section V, Article 9, Table T-921. Any change to an essential variable as defined in Article 9 shall require re-qualification of this procedure by demonstration in accordance with Article 9, paragraph T-920.

2.0 REFERENCED DOCUMENTS

2.1 The following documents are referenced in this procedure. Current editions apply unless otherwise noted. Where a referenced document contains requirements that conflict with this procedure, the referencing code or contract specification shall govern.

2.2 Codes and Standards

2.2.1 ASME Boiler and Pressure Vessel Code, Section V, "Nondestructive Examination," 2025 Edition, Article 9 – "Visual Examination"

2.2.2 ASME Boiler and Pressure Vessel Code, Section I, "Power Boilers," 2025 Edition

2.2.3 ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Divisions 1 and 2, 2025 Edition

2.2.4 ASME B31.1, "Power Piping," 2024 Edition

2.2.5 ASME B31.3, "Process Piping," 2024 Edition

2.2.6 ASME B31.8, "Gas Transmission and Distribution Piping Systems," 2024 Edition

2.2.7 ASME B31.12, "Hydrogen Piping and Pipelines," 2023 Edition

2.2.8 AWS D1.1, "Structural Welding Code – Steel," 2025 Edition

2.2.9 API 1104, "Welding of Pipelines and Related Facilities," 21st Edition, Section 9.7 – Visual Acceptance

2.2.10 API 510, "Pressure Vessel Inspection Code," Current Edition

2.2.11 API 570, "Piping Inspection Code," Current Edition

2.2.12 API 653, "Tank Inspection, Repair, Alteration, and Reconstruction," Current Edition

2.2.13 ASNT SNT-TC-1A, "Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing," 2020 Edition

2.2.14 ASTM E165, "Standard Practice for Liquid Penetrant Testing for General Industry," Annex 1 (Cleaning)

2.2.15 PII-WP-1, "Written Practice for the Qualification and Certification of NDE Personnel," Current Revision

3.0 TERMS AND DEFINITIONS

3.1 The terminology used in this procedure is consistent with ASME Section V, Article 9, and the glossary of terms in Section V, Appendix III. The following definitions are provided for clarity.

3.1.1 **Direct Visual Examination** — A visual examination technique in which the examiner's eyes are within 24 inches (610 mm) of the surface being examined, with the viewing angle not less than 30 degrees from the surface plane. Mirrors may be used to improve the angle of vision, and magnifying lenses may be used to assist the examination.

3.1.2 **Remote Visual Examination** — A visual examination technique using borescopes, fiber optics, video cameras, or other remotely operated optical devices to examine surfaces that are not accessible for direct visual examination. The minimum resolution and illumination requirements of Article 9 shall be met.

3.1.3 **Translucent Visual Examination** — A visual examination technique used on translucent materials where a light source is placed on the opposite side of the material from the examiner, causing transmitted light to reveal internal discontinuities or structural variations.

3.1.4 **Foot-Candle (fc)** — A unit of illuminance equal to one lumen per square foot. One foot-candle equals approximately 10.76 lux.

3.1.5 **Lux** — The SI unit of illuminance equal to one lumen per square meter. One lux equals approximately 0.0929 foot-candles.

3.1.6 **In-Process Visual Examination** — Visual examination performed during welding operations to verify fit-up, joint preparation, welding consumables, interpass cleaning, and other quality-critical process parameters.

3.1.7 **Final Visual Examination** — Visual examination performed after completion of welding or fabrication to verify the finished product meets the applicable acceptance criteria.

3.1.8 **Visual Examiner** — Personnel qualified and certified in accordance with SNT-TC-1A to perform visual examination at Level I, II, or III.

4.0 RESPONSIBILITY

4.1 Prime Inspections Inc. is responsible for the preparation, review, approval, and control of this procedure. The Prime Inspections Inc. NDT Level III is responsible for the technical review and approval of this procedure.

4.2 Level III, Level II, and Level I visual examiners are responsible for implementing the requirements of this procedure. Level III and Level II examiners are responsible for the supervision of Level I examiners and trainees.

4.3 Prime Inspections Inc. is responsible for monitoring compliance with this procedure. The Corporate Quality Manager shall ensure that periodic audits of VT activities are performed and documented.

4.4 Technicians are responsible for complying with this procedure and for completing all required records and reports. Technicians shall report any deviations from this procedure to the Level III for disposition.

4.5 Prior to beginning work, all personnel shall read, understand, and follow the requirements of the applicable Job Hazard Analysis (JHA). Personnel shall also observe and follow all site-specific safety requirements.

4.6 Should there be a question or clarification needed regarding any safety or technical requirement, the supervisor, lead technician, or facility representative shall be contacted for resolution before beginning or resuming work.

5.0 PERSONNEL QUALIFICATIONS

5.1 Personnel performing visual examinations shall be qualified and certified in accordance with PII-WP-1, which complies with ASNT SNT-TC-1A, 2020 Edition. Personnel shall be certified as a minimum to Level I for performing specific calibrations and obtaining specific examinations under supervision, or Level II for performing examinations and evaluations independently.

5.2 Level III personnel are responsible for the technical adequacy of the visual examination program, including procedure development, personnel qualification, and final disposition of examination results.

5.3 Near-vision acuity shall be verified annually. The examiner shall be able to read Jaeger J-1 (or equivalent) at a minimum distance of 12 inches (300 mm). Personnel who require corrective lenses to meet this requirement shall wear them during all examinations.

5.4 Color vision shall be verified annually using the Ishihara color test or equivalent. The examiner shall be able to distinguish colors as required for the examination. Personnel who cannot pass the color vision test may still be qualified for specific applications where color discrimination is not essential, subject to Level III approval.

5.5 Personnel shall have documented training, experience, and examinations (general, specific, and practical) meeting the requirements of SNT-TC-1A, 2020 Edition, for the visual method.

5.6 Minimum training and experience hours for VT certification per SNT-TC-1A, 2020 Edition:

Level	Training (hrs)	Experience (hrs)	Total (hrs)
Level I	8	80	88
Level II	24	320	344
Level III	48	640	688

6.0 GENERAL REQUIREMENTS

6.1 Safety

6.1.1 Prior to beginning work, all personnel shall read, understand, and follow the requirements of the applicable Job Hazard Analysis (JHA). In addition, personnel shall observe and follow all site-specific safety requirements.

6.1.2 Should there be a question or clarification needed regarding any safety requirement, the supervisor, lead technician, or facility representative shall be contacted for resolution before beginning or resuming work.

6.1.3 Personal protective equipment (PPE) shall be worn as required by the site safety plan. Minimum PPE includes hard hat, safety glasses, steel-toed boots, and work gloves. Additional PPE shall be worn as dictated by the work environment.

6.2 Illumination Requirements

6.2.1 Adequate visible light shall be provided at the examination surface. The minimum illumination for direct visual examination shall be 100 foot-candles (1,076 lux) at the examination surface, as required by ASME Section V, Article 9, paragraph T-922.

6.2.2 Lighting shall be either natural or artificial. Direct natural sunlight, from 30 minutes after sunrise to 30 minutes before sunset, exceeds 100 fc (1,076 lux) at an unlimited distance when unobstructed by clouds or structures.

6.2.3 When required, a calibrated visible light meter shall be available to verify the required illumination at the examination surface. Light meter calibration shall be current within 12 months.

6.2.4 For remote visual examination using video or fiber-optic systems, the minimum resolution shall be sufficient to distinguish the smallest rejectable flaw per the applicable acceptance standard. The minimum illumination at the target surface shall be 100 fc (1,076 lux) or the equivalent thereof through the remote system.

6.3 Visual Acuity Requirements

6.3.1 The examiner shall verify that the visual acuity and color vision requirements of Section 5.0 are met prior to performing examination. The verification shall be documented on the most recent vision test record.

6.3.2 For examinations requiring color discrimination (e.g., heat tint, coating condition, surface staining), the examiner shall have passed the color vision test within the past 12 months.

7.0 EQUIPMENT

7.1 The examiner shall have access to any gauges, templates, scales, special tools, light sources, mirrors, magnifiers, or other devices necessary to perform the required visual examination. The following minimum equipment shall be available:

- 7.1.1 6-inch rule with 1/32-inch graduations
- 7.1.2 Weld gages / offset gages (CAM gages, Hi-Lo gages)
- 7.1.3 Inspection mirrors (flat and angled)
- 7.1.4 Flashlight or portable inspection light (minimum 100 fc at 24 inches)
- 7.1.5 Pit gauge (for corrosion depth measurement)
- 7.1.6 File (for surface condition assessment)
- 7.1.7 Ball-peen hammer (for soundness testing of vessel/tank shells)
- 7.1.8 Scraper or chisel (for scale removal)
- 7.1.9 Calibrated visible light meter (when illumination verification is required)
- 7.1.10 Magnifying lens (3x to 10x) for fine detail examination
- 7.1.11 Borescope or video inspection system (for remote examination of inaccessible areas)
- 7.1.12 Digital camera (for documentation of examination findings)

7.2 Other items such as comparative standards, fiber-optic scopes, video imaging systems, or other specialized equipment may be utilized when applicable and when approved by the Level III.

7.3 The examiner shall be familiar with the operation of any tools or equipment used. When using specialized devices, the examiner shall be familiar with the manufacturer's operating instructions and recommendations.

7.4 Visible light meters shall be calibrated annually or when sent out for repair. Calibration certificates shall be maintained and shall be traceable to national standards. Expired calibrations shall not be used.

7.5 All measuring tools (rules, weld gages, pit gauges) shall be verified against a known standard prior to use. Damaged or worn tools shall be replaced.

8.0 SURFACE PREPARATION

8.1 Surfaces to be examined shall be free of paint, oil, scale, grease, dirt, loose rust, or other foreign matter that could interfere with the visual examination or the interpretation of results.

8.2 Visual examinations that require clean surfaces for valid interpretation of results shall be preceded by appropriate cleaning methods. The method of cleaning shall be selected based on the surface material, coating, and accessibility.

8.3 Surface preparation and cleaning methods include, but are not limited to, those provided in ASTM E-165, Annex A1 (Cleaning of Parts and Materials). See Appendix II of this procedure for a description of those methods when needed beyond typical requirements.

8.4 Tightly adhering paint or coating may remain on surfaces being examined for general visual condition assessment (e.g., coating condition, external corrosion). However, for examination of welds for surface discontinuities, the weld and adjacent base metal (minimum 1 inch on each side) shall be free of paint and coatings.

8.5 For in-process visual examination (during welding), the weld groove and adjacent surfaces shall be free of mill scale, rust, oil, moisture, and other contaminants that could adversely affect weld quality. Interpass cleaning shall be verified between weld passes.

8.6 For final visual examination of completed welds, the weld crown and adjacent base metal surfaces shall be free of slag, spatter, arc strikes, and other welding debris. The surface finish shall permit visual detection of surface discontinuities.

9.0 EXAMINATION

9.1 Direct Visual Examination

9.1.1 When performing direct visual examination, the examiner's eyes shall be within 24 inches (610 mm) of the surface to be examined, and the viewing angle shall be not less than 30 degrees to the surface of the area being inspected. Mirrors may be used to improve the angle of vision, and aids such as magnifying lenses may be used to assist examinations, in accordance with ASME Section V, Article 9, paragraph T-923.

9.1.2 Lighting shall be natural or artificial and shall be sufficient to provide adequate illumination of the examination surface. The light source shall not produce interfering glare or reflections from the surface being examined. The minimum illumination at the examination surface shall be 100 foot-candles (1,076 lux).

9.1.3 A calibrated visible light meter shall be used to verify the illumination at the examination surface when required by the referencing code or when artificial lighting is used. The light meter shall be current on its annual calibration.

9.2 Remote Visual Examination

9.2.1 Remote visual examination may be used when direct visual examination is not possible due to access limitations. Remote examination shall be performed using borescopes, fiber-optic endoscopes, video cameras, or other remote optical devices capable of providing the required resolution and field of view.

9.2.2 The remote visual system shall provide a minimum resolution equivalent to that achieved by direct visual examination at the same distance. The system shall be capable of detecting the smallest rejectable discontinuity per the applicable acceptance standard.

9.2.3 The illumination provided by the remote system shall be sufficient to achieve the minimum 100 fc (1,076 lux) at the target surface, or equivalent through the system optics. The system shall be verified against a reference standard of known features prior to use.

9.3 Translucent Visual Examination

9.3.1 When translucent visual examination is performed, a light source shall be placed on the side of the material opposite to the examiner. The transmitted light shall reveal internal discontinuities, structural variations, or other features not visible by direct or remote examination.

9.3.2 This technique is applicable only to translucent materials and requires prior approval from the Level III and the client.

9.4 Examination Requirements

9.4.1 The examination requirements, including the extent of the examination and any customer requirements, shall be documented on the examination checklist or job-specific inspection plan prior to commencement.

9.4.2 All accessible areas within the examination zone shall be examined. Areas that are inaccessible for direct or remote visual examination shall be recorded on the report and may require alternative NDT methods.

10.0 EXAMINATION OF WELDS

10.1 Examination of welds may be performed prior to welding (joint preparation), during welding (in-process), and after welding (final). Each phase has specific examination objectives as described below.

10.2 Pre-Welding Examination (Joint Preparation)

10.2.1 Verify that the joint geometry (bevel angle, root face, root opening/gap) meets the requirements of the welding procedure specification (WPS).

10.2.2 Verify that the weld groove and adjacent surfaces (minimum 1 inch on each side) are clean and free of mill scale, rust, oil, moisture, and other contaminants.

10.2.3 Verify alignment and fit-up; check for Hi-Lo (mismatch) using a weld gage. The maximum permitted mismatch shall be per the applicable code (e.g., ASME B31.3, API 1104).

10.2.4 Verify that tack welds are sound and free from cracks, porosity, or other defects that could affect the final weld quality.

10.3 In-Process Examination (During Welding)

10.3.1 Verify that the correct welding consumables are being used per the WPS (wire, flux, electrode type and size)

10.3.2 Verify preheat and interpass temperatures are within the WPS range

10.3.3 Verify that interpass cleaning is performed and complete (removal of slag, spatter)

10.3.4 Verify weld bead profile, width, and thickness are consistent

10.3.5 Check for visible surface defects (cracks, porosity, undercut) between passes

10.3.6 Verify that the welder is following the WPS parameters (current, voltage, travel speed)

10.4 Final Examination (Post-Weld)

10.4.1 Verify the weld profile is acceptable — convexity, concavity, reinforcement height

10.4.2 Check for surface discontinuities: porosity, cracks, undercut, overlap, slag, arc strikes, spatter

10.4.3 Verify weld dimensions: bead width, face reinforcement, root penetration (where accessible)

10.4.4 Check for underfill, incomplete fusion visible at the surface, and incomplete penetration

10.4.5 Verify that the weld toe is smooth and free of sharp transitions that could act as stress concentrators

10.4.6 Check for distortion or warping that exceeds the allowable tolerance

10.4.7 Verify that the weld length and placement meet the drawing or specification requirements

10.5 Typical discontinuities found in welds include: porosity, incomplete penetration, incomplete fusion, undercut, overlap, cracks, slag inclusions, excessive reinforcement, insufficient reinforcement, underfill, arc strikes, spatter, and distortion. Each type shall be evaluated per the acceptance criteria of the referencing code (Section 14.0).

11.0 EXAMINATION OF PIPING

11.1 Visual examination of piping may be performed for detection of the following conditions:

- 11.1.1 External corrosion and corrosion under insulation (CUI)
- 11.1.2 Insulation damage, deterioration, or water ingress
- 11.1.3 Adequate pipe support condition — broken, corroded, or detached supports
- 11.1.4 Misalignment or distortion of piping runs
- 11.1.5 Leaks at flanges, fittings, valves, or welds
- 11.1.6 Vibration or movement beyond design limits
- 11.1.7 Mechanical deterioration, dents, gouges, or mechanical damage
- 11.1.8 Coating or paint deterioration
- 11.1.9 Crevice corrosion at supports, hangers, or contact points
- 11.1.10 Stress corrosion cracking (SCC) indications at branch connections or high-stress areas

11.2 For insulated piping, the insulation shall be removed at the locations specified by the inspection plan or as required by API 570 / API 583 for CUI assessment. The exposed surface shall be examined for corrosion, pitting, cracking, and other deterioration.

11.3 For piping in sour service (NACE MR0175 / MR0103), visual examination shall include assessment for sulfide stress cracking (SSC), hydrogen blistering, and hydrogen-induced cracking (HIC) indications.

11.4 Flange face examination shall include verification of gasket surface condition, flange face damage (warping, erosion, pitting), and bolt condition (stretched, corroded, or missing bolts).

11.5 Valve examination shall include visual assessment of valve body condition, bonnet and packing gland leaks, stem condition, and external corrosion or damage.

12.0 EXAMINATION OF TANKS AND VESSELS

12.1 Examination of storage tanks may be performed for detection of the following conditions:

- 12.1.1 Shell corrosion — general, localized, and pitting
- 12.1.2 Blisters and hydrogen damage
- 12.1.3 Cracks at welds, particularly at shell-to-bottom, shell-to-roof, and nozzle attachments
- 12.1.4 Mechanical deterioration, dents, or deformation from impact or settlement
- 12.1.5 Bulges or buckling in shell courses
- 12.1.6 Roof condition — corrosion, sagging, holes, or ponding water
- 12.1.7 Bottom plate condition — under-bottom corrosion, bulging, or settlement
- 12.1.8 Leaks at seams, rivets, or bolted connections
- 12.1.9 Coating or lining condition — cracking, peeling, blistering, or holiday detection
- 12.1.10 Appurtenance condition — vents, overflows, ladders, platforms, and manways

12.2 Examination of pressure vessels may be performed for detection of corrosion, distortion, cracks, leaks, blisters, bulges, and other signs of deterioration. The examination shall follow the requirements of API 510 for in-service vessels and ASME Section VIII for new construction.

12.3 Internal examination of vessels and tanks shall be performed when the item is out of service and safe for entry. The internal examination shall include assessment of the surface condition, weld integrity, and any signs of cracking, corrosion, or other deterioration not visible from the exterior.

12.4 For vessels and tanks subject to hydrogen service, examination shall include assessment for hydrogen blistering, hydrogen-induced cracking (HIC), and stepwise cracking. Blisters detected visually shall be mapped and ultrasonically assessed for remaining wall thickness.

12.5 Shell settlement, out-of-roundness, and shell verticality shall be assessed in accordance with API 653, Appendix B for aboveground storage tanks. Deviations from the as-built condition shall be documented and evaluated for fitness-for-service.

13.0 EVALUATION

13.1 All examinations shall be evaluated in terms of the acceptance standards of the referencing Code Section, Standard, or Specification. The applicable acceptance criteria shall be determined prior to commencement of the examination and documented on the inspection plan.

13.2 An examination checklist shall be used to plan the visual examination and to verify that all required visual observations were performed. The checklist shall be completed and signed by the examiner and reviewed by the Level II or Level III.

13.3 Any job-specific criteria or checklist modifications shall be established with the client prior to work commencing. The agreed-upon criteria shall be documented in the job-specific inspection plan.

13.4 Discontinuities detected during visual examination shall be documented with the following information:

13.4.1 Type of discontinuity (e.g., crack, porosity, undercut, corrosion pit)

13.4.2 Location (measured from a reference point)

13.4.3 Dimensions (length, width, depth where measurable)

13.4.4 Orientation (parallel to weld, transverse, random)

13.4.5 Photograph or sketch

13.4.6 Disposition (accept, reject, repair, or refer for further NDT)

13.5 When the acceptance criteria are based on dimensional measurements (e.g., undercut depth, reinforcement height, angular distortion), calibrated measuring tools shall be used and the measurements recorded to the nearest increment of the tool.

13.6 If the examination results indicate a potential safety concern (e.g., severe corrosion, cracking in a critical area, or leakage of hazardous material), the examiner shall immediately notify the Level III, who shall notify the client and the appropriate plant personnel.

14.0 STANDARDS OF ACCEPTANCE

14.1 The acceptance criteria for visual examination shall be as specified by the referencing Code, Standard, or client specification. The following sections summarize the acceptance criteria from the most commonly referenced codes. Detailed criteria are provided in the Appendices.

14.2 API 1104, 21st Edition, Section 9.7 – Visual Acceptance

14.2.1 Visual acceptance criteria for production welds per API 1104, 21st Edition, Section 9.7, are summarized below. Welds shall be visually examined on both the inside and outside surfaces where accessible.

Criterion	Acceptance Limit
Cracks (any type or location)	Not permitted
Undercut	$\leq 1/32$ in. (0.8 mm) deep; $\leq 1/3$ of wall thickness; $\leq 1/2$ in. (12 mm) long per 12 in. (300 mm) of weld
Porosity (surface)	Shall not exceed limits of the applicable acceptance standard or as specified by the company
Slag inclusions (surface)	Shall not exceed limits of the applicable acceptance standard
Incomplete penetration	Shall not exceed limits of the applicable acceptance standard
Incomplete fusion	Not permitted on the surface
Arc strikes	Not permitted on the surface
Weld reinforcement (face)	Shall not exceed $1/16$ in. (1.6 mm) above the parent metal surface
Weld reinforcement (root)	Shall not exceed $1/16$ in. (1.6 mm) for filled welds or $3/32$ in. (2.4 mm) for pipe $\leq$ NPS 8
Concavity	Shall not reduce the total weld thickness below that of the pipe wall
Burn-through	May be accepted if the total weld thickness is not reduced below that of the pipe wall
Spatter	Shall be removed
Hi-Lo (mismatch)	Shall not exceed $1/16$ in. (1.6 mm) for pipe $\leq$ NPS 20; $1/8$ in. (3.2 mm) for pipe $>$ NPS 20

14.2.2 For complete acceptance criteria, refer to API 1104, 21st Edition, Section 9.7. Where the client specifies more restrictive acceptance criteria, the more restrictive criteria shall govern.

14.3 ASME Section VIII, Division 1 – Visual Acceptance

14.3.1 Visual acceptance criteria per ASME Section VIII, Division 1, Appendix 6, are summarized in Appendix V of this procedure. The criteria cover surface finish, weld reinforcement, undercut, and other dimensional requirements.

14.4 ASME B31.3 – Visual Acceptance

14.4.1 Visual acceptance criteria per ASME B31.3, 2024 Edition, Table 341.3.2, are summarized in Appendix IV of this procedure. The criteria vary by service category (Normal, Severe, High Severity).

14.5 ASME B31.1 – Visual Acceptance

14.5.1 Visual acceptance criteria per ASME B31.1, 2024 Edition, are summarized in Appendix III of this procedure. Criteria cover weld reinforcement, undercut, and surface finish requirements for power piping.

15.0 PROCEDURE QUALIFICATION

15.1 This procedure has been qualified in accordance with the requirements of ASME Section V, Article 9, paragraph T-920. Procedure qualification shall be performed by demonstration on a test specimen or actual component with known surface conditions.

15.2 When procedure qualification is required, any change to an essential variable (see Table T-921 and Appendix I of this procedure) shall require re-qualification of this procedure by demonstration. The following are considered essential variables for visual examination:

15.2.1 A change in examination technique (direct to remote or vice versa)

15.2.2 A change in illumination method or level below the minimum required (100 fc / 1,076 lux)

15.2.3 A change in viewing distance from within 24 inches to beyond 24 inches without remote equipment

15.2.4 A change in viewing angle from ≥ 30 degrees to < 30 degrees without compensating mirrors or lenses

15.2.5 A change in the use of magnification from non-magnified to magnified or vice versa

15.2.6 A change in remote visual equipment type or manufacturer

15.2.7 A change in the minimum resolution of the remote visual system

15.3 All changes of essential or nonessential variables from those specified in this procedure shall require a revision of, or addendum to, this procedure. Revisions shall be reviewed and approved by the NDT Level III and the Corporate Quality Manager.

15.4 Procedure qualification records shall include identification of the procedure and revision, the personnel performing the qualification, a description of the qualification test, the equipment used, and the results. The NDT Level III shall sign the qualification record.

16.0 RECORDS AND REPORTING

16.1 The results of the visual examination shall be documented on a Visual Examination Report. The report shall include, but not be limited to, the following information:

- 16.1.1 Date examination performed
- 16.1.2 Procedure identification and revision used
- 16.1.3 Code, Standard, or Specification referenced (as applicable)
- 16.1.4 Examination technique employed (direct, remote, translucent)
- 16.1.5 Types of equipment used (as applicable) — light meter, light source, remote system
- 16.1.6 Illumination level measured (fc or lux) and light meter identification
- 16.1.7 Identification of the examiner, including name, signature, and qualification level
- 16.1.8 Identification of the part, component, or weld examined (including equipment ID and location)
- 16.1.9 Examination results including any discontinuities detected, their type, size, and location
- 16.1.10 Disposition of each finding (accept, reject, repair, or refer for further NDT)
- 16.1.11 Acceptance criteria referenced
- 16.1.12 Any deviations from this procedure
- 16.1.13 Photographs or sketches of findings (when applicable)

16.2 Unless otherwise specified, all VT records and reports shall be maintained in accordance with Prime Inspections Inc.'s document retention policy. Records shall be retained for a minimum of 5 years or as required by the client or applicable code, whichever is longer.

16.3 Examination reports shall be submitted to the client within the timeframe specified in the job-specific inspection plan. Reports shall be reviewed and signed by the Level II or Level III prior to submission.

16.4 A copy of the Visual Examination Report form is provided in Appendix IX of this procedure.

17.0 SAFETY

17.1 All personnel performing visual examinations shall comply with the applicable Job Hazard Analysis (JHA) and all site-specific safety requirements.

17.2 Personal protective equipment (PPE) shall be worn as required by the site safety plan, including as a minimum: hard hat, safety glasses, steel-toed boots, and work gloves. Additional PPE shall be worn as dictated by the work environment (hearing protection, respiratory protection, fire-retardant clothing, etc.).

17.3 When working at elevated locations, proper fall protection shall be used in accordance with the site fall protection plan and OSHA 29 CFR 1926 Subpart M (Construction) or 29 CFR 1910 Subpart D (General Industry) as applicable.

17.4 In confined spaces, atmospheric testing shall be performed and confined space entry permits shall be obtained in accordance with OSHA 29 CFR 1910.146. A standby person shall be stationed outside the confined space. Continuous atmospheric monitoring shall be performed during the entry.

17.5 When examining equipment in hazardous (classified) areas, all equipment shall be rated for the area classification. Intrinsically safe flashlights and lighting shall be used in Division 1 or Zone 0 locations. Hot work permits shall be obtained if required.

17.6 When examining equipment that contains or has contained hazardous materials, the client shall verify that the equipment is safe for examination. Lines shall be isolated, depressurized, and purged as appropriate. The examiner shall be informed of the contents and hazards associated with the equipment.

17.7 When examining insulated equipment, insulation removal may disturb asbestos-containing materials (ACM). If ACM is suspected, insulation removal shall be performed by a licensed asbestos abatement contractor in accordance with 29 CFR 1910.1001 / 1926.1101.

17.8 The use of flashlights in process areas shall be limited to approved, intrinsically safe models. Standard consumer flashlights shall not be used in classified areas.

18.0 QUALITY CONTROL

18.1 The quality of visual examination is dependent on proper illumination, appropriate equipment, qualified personnel, and accurate recording. The following quality control measures shall be implemented:

18.2 All light meters shall have a current annual calibration certificate on file. Expired calibrations shall not be used; meters shall be removed from service and sent for recalibration.

18.3 Measuring tools (rules, weld gages, pit gauges) shall be verified against a known standard prior to use and at least annually. Damaged or worn tools shall be replaced.

18.4 Vision test records shall be maintained for all personnel performing VT. Annual vision tests shall be documented and shall include both near-vision and color-vision results.

18.5 A sample of visual examination results (minimum 10%) shall be re-examined by a second technician to verify consistency. Discrepancies shall be investigated and resolved.

18.6 All examination records shall be reviewed by the Level II or Level III prior to submission to the client. The review shall verify completeness, accuracy, and compliance with this procedure.

18.7 Deviations from this procedure shall be documented and approved by the NDT Level III. Non-conformances shall be tracked and corrected in accordance with the Prime Inspections Inc. quality management system.

18.8 The NDT Level III shall perform periodic audits of visual examination activities to ensure continued compliance with this procedure and applicable codes. Audit results shall be documented and communicated to the Corporate Quality Manager.

Appendix I – ASME Section V Article 9 Essential Variables

The following table summarizes the essential variables for visual examination per ASME Section V, Article 9, Table T-921. Changes to any essential variable require re-qualification of this procedure by demonstration per Article 9, paragraph T-920.

Variable	Essential	Change Requiring Re-Qualification
Examination technique	Yes	Change from direct to remote or vice versa
Illumination level	Yes	Reduction below 100 fc (1,076 lux) minimum
Viewing distance	Yes	Change from within 24 in. to beyond 24 in. without remote equipment
Viewing angle	Yes	Change from $\geq 30^\circ$ to $< 30^\circ$ without compensating mirrors or lenses
Magnification	Yes	Change from non-magnified to magnified or vice versa
Remote equipment type	Yes	Change of remote visual system type or manufacturer
Remote system resolution	Yes	Reduction below the qualified minimum resolution
Surface preparation	No	Information only — record in report
Acceptance criteria	No	Per client or referencing code
Reporting format	No	Information only

Appendix II – Cleaning Methods

The following cleaning methods are referenced from ASTM E-165, Annex A1, and may be used to prepare surfaces for visual examination. The method selected shall be appropriate for the material and surface condition and shall not damage the base material.

Method	Description	Suitable For	Limitations
Solvent cleaning	Wipe with solvent (acetone, alcohol, MEK)	General surface cleaning	May not remove heavy scale or paint
Vapor degreasing	Solvent vapor condensation on surface	Oily/greasy surfaces	Not for field use; batch process
Alkaline cleaning	Immersion in alkaline solution	Heavy oil, grease contamination	May attack aluminum or soft alloys
Steam cleaning	High-pressure steam jet	Large surfaces, tanks, vessels	Requires equipment; not for delicate parts
Wire brushing	Manual or power wire brush	Loose scale, rust, spatter	May polish/smear surface; not for SS
Sanding / grinding	Power sanding or light grinding	Paint, scale, heavy rust	Removes base metal; control depth
Scraping	Manual scraper	Loose paint, scale, debris	Limited to accessible surfaces
Grit blasting	Abrasive blasting (grit, sand, bead)	Heavy scale, rust, coatings	May roughen surface; requires containment
Ultrasonic cleaning	Immersion in ultrasonic bath	Small parts, intricate geometry	Not for field use; batch process
High-pressure water	Water jet 5,000–40,000 psi	Large surfaces, CUI	May damage coatings; requires containment

Notes:

- (a) For stainless steel, titanium, and nickel alloys, cleaning tools and abrasives shall be iron-free to prevent cross-contamination and rusting.
- (b) For sour service applications, cleaning shall not introduce sulfur or halogen compounds. Cleaning chemistry shall be documented.
- (c) The cleaning method shall be verified to be effective prior to examination. If the method does not achieve the required surface condition, an alternative method shall be used.

Appendix III – ASME B31.1 Acceptance Criteria

Visual acceptance criteria for welds per ASME B31.1, "Power Piping," 2024 Edition. These criteria apply to visual examination of completed welds.

Criterion	Acceptance Limit
Cracks	Not permitted in any location
Undercut	≤ 1/32 in. (0.8 mm) deep; shall not reduce wall below minimum required
Porosity (surface)	Shall not exceed that shown in BPV Code, Section VIII, Appendix 4, Fig. 4
Weld reinforcement (face)	≤ 1/16 in. (1.6 mm) for wall ≤ 1/8 in.; ≤ 1/8 in. (3.2 mm) for wall > 1/8 in.
Weld reinforcement (root)	≤ 1/16 in. (1.6 mm) for filled welds; ≤ 3/32 in. (2.4 mm) for socket welds
Concavity	Shall not reduce wall thickness below minimum required
Incomplete fusion	Not permitted on the surface
Incomplete penetration	Not permitted on the surface
Overlap	Not permitted
Arc strikes	Not permitted on the surface
Spatter	Shall be removed
Misalignment (Hi-Lo)	≤ 1/16 in. (1.6 mm) for pipe ≤ NPS 20; ≤ 1/8 in. (3.2 mm) for pipe > NPS 20
Underfill	Shall not reduce wall below minimum required
Burn-through	Shall not reduce wall below minimum required

Appendix IV – ASME B31.3 Acceptance Criteria

Visual acceptance criteria for welds per ASME B31.3, "Process Piping," 2024 Edition, Table 341.3.2. Acceptance criteria vary by service category: Normal Fluid Service, Severe Cyclic Conditions, and Category M (High Severity) Fluid Service.

Criterion	Normal Service	Severe Cyclic	Category M
Cracks	Not permitted	Not permitted	Not permitted
Undercut	$\leq 1/32$ in.; $\leq 1/3$ wall	$\leq 1/32$ in.; $\leq 1/4$ wall	$\leq 1/32$ in.; $\leq 1/3$ wall
Surface porosity	Per Appendix 4, Section VIII	Per Appendix 4, Section VIII	Per Appendix 4, Section VIII
Reinforcement (face)	$\leq 1/8$ in. (3.2 mm)	$\leq 1/16$ in. (1.6 mm)	$\leq 1/16$ in. (1.6 mm)
Reinforcement (root)	$\leq 1/8$ in. (3.2 mm)	$\leq 1/16$ in. (1.6 mm)	$\leq 1/8$ in. (3.2 mm)
Concavity	Shall not reduce below min. wall	Shall not reduce below min. wall	Shall not reduce below min. wall
Incomplete fusion	Not permitted	Not permitted	Not permitted
Incomplete penetration	Not permitted	Not permitted	Not permitted
Overlap	Not permitted	Not permitted	Not permitted
Arc strikes	Not permitted	Not permitted	Not permitted
Misalignment (Hi-Lo)	$\leq 1/16$ in. for $\leq$ NPS 20	$\leq 1/16$ in. for $\leq$ NPS 20	$\leq 1/16$ in. for $\leq$ NPS 20
Spatter	Shall be removed	Shall be removed	Shall be removed

Note: For complete acceptance criteria, refer to ASME B31.3, Table 341.3.2 and Table 341.3.3. The values summarized above are for typical applications; the full code tables contain additional conditions and exceptions.

Appendix V – ASME Section VIII Acceptance Criteria

Visual acceptance criteria for welds per ASME Section VIII, Division 1, Appendix 6. These criteria apply to the visual examination of pressure vessel welds.

Criterion	Acceptance Limit
Cracks	Not permitted at any location
Undercut	$\leq 1/32$ in. (0.8 mm) or $1/4$ of the thinner section, whichever is less
Surface porosity	Shall not exceed limits per Appendix 4, Figure 4
Weld reinforcement (face)	See table below for limits by thickness
Weld reinforcement (root)	$\leq 1/8$ in. (3.2 mm) for filled welds
Concavity	Shall not reduce the total weld thickness below minimum required
Incomplete fusion	Not permitted on the surface
Incomplete penetration	Not permitted on the surface
Overlap	Not permitted
Arc strikes	Not permitted
Spatter	Shall be removed

Maximum weld reinforcement (face) per Section VIII, UW-35:

Material Thickness (in.)	Maximum Reinforcement (in.)
Up to $1/8$	$1/32$
$1/8$ to $1/4$	$1/16$
Over $1/4$ to $1/2$	$1/8$
Over $1/2$ to 1	$3/16$
Over 1 to 2	$1/4$
Over 2 to 3	$5/16$
Over 3 to 4	$3/8$
Over 4	$3/8$

Appendix VI – API 1104 21st Edition, Section 9.7 Acceptance Criteria

Visual acceptance criteria for production welds per API 1104, "Welding of Pipelines and Related Facilities," 21st Edition, Section 9.7. These criteria apply to visual examination of completed girth and seam welds on pipeline and related facilities.

Criterion	Acceptance Limit
Cracks (any type)	Not permitted in any location or orientation
Undercut	$\leq 1/32$ in. (0.8 mm) deep AND $\leq 1/3$ of wall thickness AND $\leq 1/2$ in. (12 mm) long per 12 in. (300 mm) of weld length
Surface porosity	Shall not exceed applicable acceptance standard or as specified by company
Slag inclusions (surface)	Shall not exceed applicable acceptance standard
Incomplete penetration (surface)	Shall not exceed applicable acceptance standard
Incomplete fusion (surface)	Not permitted on the surface
Arc strikes	Not permitted on the surface
Excessive reinforcement (face)	$\leq 1/16$ in. (1.6 mm) above parent metal
Excessive reinforcement (root)	$\leq 1/16$ in. (1.6 mm) for filled welds; $\leq 3/32$ in. (2.4 mm) for pipe $\leq$ NPS 8
Concavity	Shall not reduce total weld thickness below pipe wall thickness
Burn-through	May be accepted if the total weld thickness is not reduced below pipe wall thickness
Spatter	Shall be removed
Hi-Lo (mismatch)	$\leq 1/16$ in. (1.6 mm) for pipe $\leq$ NPS 20; $\leq 1/8$ in. (3.2 mm) for pipe $>$ NPS 20
Weld bead profile	Shall be uniform and free of sharp transitions at weld toes
Weld length/spacing	Shall conform to drawing/specification requirements

Notes:

- (a) Where the company specifies more restrictive acceptance criteria than those listed above, the more restrictive criteria shall govern.
- (b) For welder qualification test welds, refer to API 1104, Section 6 for additional acceptance criteria.
- (c) The complete text of the acceptance criteria shall be consulted for edge cases, special conditions, and exceptions not covered in this summary table.

Appendix VII – ASME B31.8 Acceptance Criteria

Visual acceptance criteria for welds per ASME B31.8, "Gas Transmission and Distribution Piping Systems," 2024 Edition. These criteria apply to visual examination of completed welds on gas transmission and distribution pipelines.

Criterion	Acceptance Limit
Cracks	Not permitted in any location
Undercut	$\leq 1/32$ in. (0.8 mm) deep; $\leq 1/3$ of wall thickness
Weld reinforcement (face)	$\leq 1/8$ in. (3.2 mm) for wall $\leq 1/2$ in.; $\leq 3/16$ in. (4.8 mm) for wall $> 1/2$ in.
Weld reinforcement (root)	$\leq 1/16$ in. (1.6 mm) for filled welds
Concavity	Shall not reduce wall below minimum required
Incomplete fusion	Not permitted on the surface
Incomplete penetration	Not permitted on the surface
Overlap	Not permitted
Arc strikes	Not permitted
Spatter	Shall be removed
Misalignment (Hi-Lo)	$\leq 1/16$ in. (1.6 mm) for pipe $\leq$ NPS 20; $\leq 1/8$ in. (3.2 mm) for pipe $>$ NPS 20
Surface porosity	Shall not exceed limits of applicable acceptance standard

Appendix VIII – In-Process VT Inspector Checklist

The following checklist shall be used to document in-process visual examination of welding operations. The examiner shall verify each item and record the result. Items not applicable to the specific job shall be marked "N/A."

A. Pre-Weld Verification

- _____ 1. WPS available at the work location?
- _____ 2. Joint geometry verified (bevel angle, root face, gap)?
- _____ 3. Surface condition of groove and adjacent base metal clean?
- _____ 4. Alignment / fit-up checked (Hi-Lo measured)?
- _____ 5. Line-up clamp positioned and tack welds sound?
- _____ 6. Preheat temperature verified (if required by WPS)?
- _____ 7. Welding consumables correct per WPS?
- _____ 8. Welder qualified and identified?

B. In-Process Verification

- _____ 9. Interpass cleaning performed (slag, spatter removed)?
- _____ 10. Interpass temperature within WPS range?
- _____ 11. Weld bead profile, width, and thickness acceptable?
- _____ 12. No visible surface cracks between passes?
- _____ 13. No visible porosity between passes?
- _____ 14. Filler material wire diameter correct per WPS?
- _____ 15. Travel speed within WPS range?
- _____ 16. Arc voltage / amperage within WPS range?

C. Final Weld Verification

- _____ 17. All passes completed per WPS?
- _____ 18. Reinforcement height measured and within limits?
- _____ 19. No undercut exceeds acceptance limit?
- _____ 20. No surface porosity exceeds acceptance limit?
- _____ 21. No surface cracks detected?
- _____ 22. No arc strikes on the base metal?
- _____ 23. All spatter removed?
- _____ 24. Weld length and placement per drawing?
- _____ 25. Weld bead profile uniform and free of sharp transitions?
- _____ 26. No burn-through or excessive penetration?

_____ 27. Weld cleaned and ready for final inspection?

Appendix IX – Visual Examination Report Form

The following form shall be used for documenting visual examination results. All fields shall be completed; fields marked with an asterisk (*) are mandatory.

Date:	_____	Report No.:	_____
Equipment ID:	_____	Location:	_____
Material/Spec:	_____	Service:	_____
Code/Standard:	_____	Acceptance:	_____

Examination Information*

Illumination (fc):	_____ Light Meter S/N: _____
Viewing Distance:	_____ Viewing Angle: _____
Magnification:	_____ (if used)

Examination Findings*

Location	Discontinuity Type	Length (in.)	Width (in.)	Depth (in.)	Disposition

Examination Summary*

Acceptable:	_____	Rejected:	_____
Repaired:	_____	Re-Examined:	_____

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Reviewed By:	_____	Level:	_____	Date:	_____
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