

Note to specifier:

The following paragraphs 1.01 through 1.04 need to be included in Part 1 and paragraphs 3.01 through 3.06 need to be included in Part 3 of the High Pressure Steam and Condensate or Medium/High Temperature Hot Water piping specification you are writing. These paragraphs are only applicable to High Pressure Steam and Condensate or Medium/High Temperature Hot Water piping. Your specification needs to be clear about this. The numbering of all of these paragraphs needs to be edited to coordinate with other paragraphs in Part 1 and Part 3 of your specification.

This is not a complete specification. There are additional specification items for Parts 1, 2, and 3 that need to be included to complete the specification of High Pressure Steam and Condensate or Medium/High Temperature Hot Water piping. It is the specifier's choice how/where all other specification items for Parts 1, 2, and 3 for High Pressure Steam and Condensate or Medium/High Temperature Hot Water piping systems are included in the specifications.

1.01 SUBMITTALS

A. Specific Submittals include the following:

1. Welding Procedure Specifications (WPS)
2. Welder/Welding Operator Performance Qualifications (WPQ)
3. Welder Certifications and Continuity
4. Records of Welds

1.02 WELDING PROCEDURES QUALIFICATION

A. Welding Procedure Qualification shall be determined for each group of materials to be welded in accordance with Section IX ASME BPVC, ASME B31.1, AWS B2.1/B2.1M and as specified. Submit for approval a completed Welding Procedure Specification on the ASME BPVC form QW-482 for every welding procedure to be utilized on the project along with the supporting Procedure Qualification Record (PQR) on ASME BPVC form QW-483. The welding procedures shall specify end preparation for butt welds, including cleaning, alignments, and root openings. Type of backing rings or consumable inserts, if used, will be described and, if they are to be removed, the removal process shall be described. Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable welds. Welding procedure qualifications shall be identified individually and shall be referenced on the Shop Drawings or suitable keyed to the Contract Drawings.

1.03 WELDING PERFORMANCE QUALIFICATIONS

A. Performance qualification shall be determined in accordance with Section IX, "ASME Boiler and Pressure Vessel," ANSI B31.1, AWS B2.1/B2.1M and as specified. Each welder/welding operator assigned to work covered by this specification shall be required to be qualified as part of the project by performance tests using the submitted WPS. Welders/welding operators who pass a qualification test will be considered performance-qualified for the welding procedure used.

1. Qualifications: The Welder/Welding Operator Performance Qualification (WPQ) shall be submitted on the ASME BPVC form QW-484A/B for every welder/welding operator assigned to the project. Qualification of all welder/welding operators working on this project shall be completed by the same American Welding Society accredited welding facility. Qualification is to be obtained only for welders/welding operators working on this project. The qualification procedure shall be done on steel pipe in the 6G test position using a nominal pipe size of 2-3/4" with a wall thickness of 5/8" using the weld

processes identified in the submitted WPS. The qualification shall include an ASME required visual inspection and a radiographic examination.

2. Certification: Submit certification information including continuity records for all weld processes and previous tests.
3. Identification: Each welder/welding operator shall be assigned an identifying number, letter, or symbol that shall be used to identify all of its welds. A list of the welders' names and symbol of each shall be submitted. Each welder or welding operator shall apply his mark adjacent to this weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or other approved methods that do not deform the metal.
4. Renewal of Qualification: Requalification of a welder/welding operator during the project shall be required if there is a specific reason to question ability to make welds that will meet the requirements of the specification.

1.04 RECORDS OF WELDING

- A. Contractor is to provide an administrative procedure for approval by the Owner which is required to record, locate and monitor and maintain the quality of the pipe welds. Provide drawings that will act as a key plan along with a spreadsheet that contains the required data to be collected on the welds.
 1. Identifying the location of each weld of the pipe by a unique identification tag, the name of the welder and their assigned identification number letter or symbol along with the date, location, temperature and time the weld was performed and the WPS utilized.

PART 2 -

NOTE TO SPECIFIER: THERE IS NO ADDITIONAL INFORMATION TO BE ADDED TO PART 2 OF YOUR SPECIFICATION FROM THIS SECTION.

PART 3 -

3.01 WELDING

- A. No welding shall start prior to the approval of the WPS and the WPQ submittals identified in Part 1 of this specification.
- B. The Owner reserves the right to remove any welder from the project for any reason.
- C. If a welder fails 10% of the Owners visual inspection and/or radiographic examination the Owners testing agency shall bring this to the attention of the Owner.
- D. All welding of pipe joints and procedures shall be in accordance with the following:
 1. Section IX – Welding and brazing qualifications of the ASME Boiler and Pressure Vessel Code.
 2. American Welding Society B2.1 – Specification for Welding Procedure and Performance Qualifications.
 3. ASME B31.1 Power Piping.
- E. Parts that are to be joined by welding may be held in alignment during the welding process by the use of bars, jacks and clamps.

F. Socket weld couplings shall be used for welded line joints, where specified, in nominal pipe sizes 1-1/2 inches and smaller.

G. Piping

1. Weld end preparations for field joints and for joining to supplied items shall be in accordance with Chapter V of ASME B31.1. All weld ends preparation dimensions shall be in accordance with ASME B16.25.
2. Base pipe material shall be prepared in accordance with the following:
 - a. The edges or surfaces of the parts to be joined by welding shall be machined and cleaned of all oil, grease, scale, rust, or other deleterious materials.
 - b. Maximum joint gap distance shall be 3/16" for 2 1/2 NPS pipe and larger and 1/8" for 2" NPS and smaller.

H. Welding Processes

1. Welding shall be performed by one or more of the following processes. Other processes may be permitted when the technical adequacy has been demonstrated to the satisfaction of the Owner and Engineer.
 - a. Shielded Metal Arc (SMAW) - Only low hydrogen electrodes shall be permitted.
 - b. Gas-Tungsten Arc (GTAW) – Non-consumable tungsten electrodes shall be AWS A5.12 Class EWTh-2. Filler metal addition shall be used with the gas-tungsten arc process.
2. The following shall establish, at a minimum the quality controls that shall be incorporated with any of the above mentioned welding processes:
 - a. Initiation points of all weld passes and weld layers shall be staggered.
 - b. When using the shielded metal arc process, the depth of weld metal deposited in each layer shall not exceed 3/16 inch.
 - c. Vertical position welding shall proceed uphill.
 - d. Complete penetration and fusion shall be achieved in all regions of the weld zone.
 - e. All slag, flux or foreign materials remaining on any bead of welding shall be removed by grinding, chipping or wire brushing before depositing the next or successive bead.
 - f. Any cracks, slag incursions, incomplete fusion or blow holes that appear on the surface of any bead of welding shall be removed by chipping or grinding before depositing the next successive bead of welding.
 - g. Preheat at all welds to a minimum temperature of 250°F.
 - h. Each welder or welding operator shall apply his mark adjacent to this weld using an approved rubber stamp or felt-tipped marker with permanent, weatherproof ink or other approved methods that do not deform the metal.

I. Filler Materials

1. All welding filler materials, including any consumable inserts, shall comply with the requirements of ASME or AWS filler material specifications as submitted.
2. All welding filler materials shall be stored in a clean, dry location protected from contamination.

3. After opening of new sealed electrode containers or removal of electrodes from drying ovens, all electrodes, which are not immediately issued for use, shall be stored in holding ovens at a minimum temperature of 200°F.

3.02 VISUAL EXAMINATION OF WELDS

- A. Visual examinations will be performed by the Owner on 100% of all weld joints post welding. The Owner will retain the services of a qualified commercial inspection or testing agency to examine the welds. Provide access to all welds for testing, and provide full cooperation with the testing agency. Include all labor and materials as required to permit the visual examination.
- B. The visual examination will examine each weld for any defect. The visual examination will be performed in accordance with Section V, Article 9, of the ASME B31.1, Section 136.4.2. Repair any defects noted in the visual examination at no additional cost to the Owner. All repairs will be re-examined. Welds that are shown by visual examination to have any of the following types defects are unacceptable:
 1. Cracks – external surface.
 2. Undercut on surface, which is greater than 1/32 deep.
 3. Weld reinforcement greater than 5/32 inch.
 4. Lack of fusion of surface.
 5. Incomplete penetration (applies only when inside surface is readily accessible).
 6. Any other linear indications greater than 3/16" long.
 7. Surface porosity with rounded indications having dimensions greater than 3/16" or four or more rounded indications separated by 1/16" or less edge to edge in any direction. Rounded indications are indications which are circular or elliptical with their length less than three times their width.
- C. The following additional visual quality examinations shall be performed:
 1. Arc strikes shall be removed by grinding and the area examined for freedom from defects by liquid penetrate. Any crack or linear indications are unacceptable.
 2. Grinding shall not result in a reduction in wall thickness below the minimum required by the applicable code, material specification, or design calculation.
 3. Each weld shall be uniform in width and size throughout its full length.
 4. Wash pass welding (re-melting cover pass to smooth weld contour) is prohibited.
 5. Butt welds shall be full penetration.
 6. Socket welds, depth of insertion of pipe or tube within the socket or sleeve shall be 3/8 inch minimum.
 7. Attachment Welds: All temporary welded attachments used for erection purposes shall be removed by mechanical cutting or air-arc cutting the attachment a distance from the supporting metal surface sufficient to preclude damage, but in no case less than 1/8 inch. The remainder of the attachment shall be ground flush with the base metal surface. The ground area shall then be examined visually to ensure freedom from defects. Under no conditions are temporary attachments to be removed by hammer blows.

- D. Written reports for each visual examination performed by the Owner's testing agency will be available for review. The Owner's testing agency shall have the final word in determining the acceptability of any welds.

3.03 RADIOGRAPHIC EXAMINATION OF WELDS

- A. Radiographic examinations will be performed by the Owner on 100% of welds suitable for radiographic examination, such as but not limited to, butt welds and full penetration welds. The Owner will retain the services of a qualified commercial inspection or testing agency to examine the welds. Provide access to all welds for testing, and provide full cooperation with the testing agency. Include all labor and materials as required to permit the radiographic examination.
- B. Any unacceptable defects encountered during the radiographic examination shall be repaired at no additional cost to the Owner. All repairs will be re-inspected. All costs associated with retesting failed welds and testing of additional welds as a result of failed welds will be the responsibility of the Contractor.
- C. All radiographic examinations shall be performed in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code and ASME 31.1 section 136.4.5, except that the requirements of T-274 are to be used as a guide but not for the rejection of radiographs unless the geometrical unsharpness exceeds 0.07 in. Welds that are shown by radiography to have any of the following types of discontinuities are unacceptable:
 - 1. Any type of crack or zone of incomplete fusion or penetration.
 - 2. Any other elongated indication which has a length greater than:
 - a. $\frac{1}{4}$ inch for t up to $\frac{3}{4}$ inch inclusive.
 - b. $\frac{1}{3} t$ for t from $\frac{3}{4}$ inch to $2\frac{1}{4}$ inch inclusive
 - c. $\frac{3}{4}$ inch for t over $2\frac{1}{4}$ inch
 - 3. Any group of indications in line that have an aggregate length greater than t in a length of $12t$, except where the distance between the successive indications exceeds $6L$ where L is the longest indication in the group.
 - 4. Porosity in excess of that shown as acceptable in Appendix A-250 of Section I of the ASME Boiler and Pressure Vessel Code.
 - 5. Root concavity when there is an abrupt change in density, as indicated on the radiograph.
- D. Written reports for each radiographic examination performed by the Owner's testing agency will be available for review. The Owner's testing agency shall have the final word in determining the acceptability of any welds.

3.04 MAGNETIC PARTICLE EXAMINATION OF WELDS

- A. Magnetic particle examinations will be performed by the Owner on 100% of welds for which radiographic examination is not performed such as socket welds, welded branch connections. The Owner will retain the services of a qualified commercial inspection or testing agency to examine the welds. Provide access to all welds for testing and provide full cooperation with the testing agency. Include all labor and materials as required to permit the magnetic particle examination.
- B. Any unacceptable defects encountered during the magnetic particle examination shall be repaired at no additional cost to the Owner. All repairs will be re-inspected. All costs

associated with retesting failed welds and testing of additional welds as a result of failed welds will be the responsibility of the Contractor.

- C. All magnetic particle examinations shall be performed in accordance with Article 7 of Section V of the ASME Boiler and Pressure Vessel Code.
- D. Written reports for each magnetic particle examination performed by the Owner's testing agency will be available for review. The Owner's testing agency shall have the final word in determining the acceptability of any welds.

3.05 TESTING

E. Hydrostatic Testing of Pipe

1. Hydrostatically test all new piping. Tests for all new piping shall be performed in accordance with part C2.270 of Section VII of the ASME Boiler and Pressure Vessel Code, and the requirements noted in this Section of this Specification. All materials and equipment required to perform the hydrostatic test shall be furnished. All tests shall be performed successfully prior to insulation.
2. Sanitary water of a potable quality shall be used for hydrostatic testing. Test pressures shall be maintained in the systems for at least 30 minutes with no visible leaks or loss of pressure.
3. Unless otherwise specified, all piping shall be subjected to a minimum pressure of 1.5 times the system design pressure.
4. All tests shall be witnessed, certified and documented by the Owner's Site Representative.
5. Any defective joints shall be repaired; their welds re-examined, and re-tested. Successfully complete a hydrostatic test of the pipe prior to insulation.

3.06 CLEANING

- A. Piping shall be clean inside and outside at time of shipment. All waste, such as metal chips and filings, welding rods and stubs, waste, rags, debris, shall be removed from the interior of each piping unit. All mill scale, rust, oil, grease, chalk, crayon, paint marks, sand and other deleterious material shall be removed from interior and exterior surfaces.
- B. Thoroughly clean all new piping of all contaminants such as oil, grease, welding slag and spatter, loose mill scale, dirt, corrosion product, or any other foreign substances. Install temporary vents and drains with isolation valves on all new piping to permit flushing of the pipe.
- C. Fill and flush the system a minimum of two times using potable water. Supply all labor and materials to flush the system. Potable water will be available from the facility.

END OF SECTION