

# 05 05 23 - Welding

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy  
under Contract 89303320DEM000030



**P.O. Box 1464**  
**Richland, Washington 99352**

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 **CPCCo**  
Central Plateau  
Cleanup Company  
P.O. Box 1464  
Richland, Washington 99352

**APPROVED**  
*By Lynn M Ayers at 1:43 pm, May 13, 2024*

Release Approval

Date

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#### PART 1 GENERAL

##### 1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Society of Mechanical Engineers (ASME):
    - a. BPVC SEC V, Nondestructive Examination.
    - b. BPVC SEC IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
  2. American Society of Nondestructive Testing (ASNT): SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.
  3. ASTM International (ASTM): A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
  4. American Welding Society (AWS):
    - a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
    - b. A3.0, Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermalspraying.
    - c. D1.1/D1.1M, Structural Welding Code - Steel.
    - d. D1.2/D1.2M, Structural Welding Code - Aluminum.
    - e. D1.3, Structural Welding Code - Sheet Steel.  
D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
    - f. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
    - g. QC1, Standard for AWS Certification of Welding Inspectors.

##### 1.02 DEFINITIONS

- A. CJP: Complete Joint Penetration.
- B. CWI: Certified Welding Inspector.
- C. MT: Magnetic Particle Testing.
- D. NDE: Nondestructive Examination.
- E. NDT: Nondestructive Testing.
- F. PJP: Partial Joint Penetration.
- G. PQR: Procedure Qualification Record.

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- H. PT: Liquid Penetrant Testing.
- I. RT: Radiographic Testing.
- J. UT: Ultrasonic Testing.
- K. VT: Visual Testing.
- L. WPQ: Welder/Welding Operator Performance Qualification.
- M. WPS: Welding Procedure Specification.

### 1.03 SUBMITTALS

- A. All submittal information shall be provided in English.
- B. Shop Drawings:
  - 1. Shop and field WPSs and PQRs.
  - 2. NDT procedure specifications prepared in accordance with applicable welding code.
  - 3. Welding Data (Shop and Field):
    - a. Show on Shop Drawings or a weld map complete information regarding base metal specification designation, location, type, size, and extent of welds with reference called out for WPS and NDE numbers in tails of combined welding and NDE symbols as indicated in AWS A2.4.
    - b. Distinguish between shop and field welds.
    - c. Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
    - d. For pipe fittings, provide a joint weld beveling diagram. Refer to AWS D1.1/D1.1M, Annex Q Local Dihedral Angle that can be used to calculate bevels for weld joint details of intersecting pipes.
    - e. Welding and NDE symbols shall be in accordance with AWS A2.4.
    - f. Welding terms and definitions shall be in accordance with AWS A3.0.
    - g. Submit welding data together with shop drawings as a complete package. Welding data shall include method of passivation for heat effected zone.
- C. Approval Required Submittals:
  - 1. WPQs.
  - 2. CWI credentials, including acuity exam.
  - 3. Testing agency personnel credentials.

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4. CWI reports.
5. Welding Documentation: Submit on appropriate forms in referenced welding codes.

### 1.04 QUALIFICATIONS

- A. WPSs and PQRs: In accordance with applicable welding code.
- B. WPQs: In accordance with applicable welding code.
- C. CWI: Certified in accordance with AWS QC1, and having prior experience with the welding codes specified. Alternate welding inspector qualifications require approval by the Buyer's Technical Representative (BTR).
- D. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.

### 1.05 SEQUENCING AND SCHEDULING

- A. Unless otherwise specified, all Submittals required in this section shall be submitted and approved prior to commencement of welding operations.

## **PART 2 PRODUCTS**

### 2.01 SOURCE QUALITY CONTROL

- A. CWI shall be present whenever shop welding is performed. CWI shall perform inspection, as necessary, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in applicable welding code as follows:
  1. Verifying conformance of specified job material and proper storage.
  2. Monitoring conformance with approved WPS.
  3. Monitoring conformance of WPQ.
  4. Inspecting weld joint fit-up and performing in-process inspection.
  5. Providing 100 percent visual inspection of welds.
  6. Supervising nondestructive testing personnel and evaluating test results.
  7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.

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### 3.02 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

#### A. Weld Inspection Criteria:

1. Selection of welds to be tested unless 100 percent NDT is specified herein, shall be as agreed upon between BTR and Contractor.
2. Unless otherwise specified, perform NDT of welds at a frequency as shown below or in the attached table in accordance with the referenced welding codes as follows. Perform UT on CJP groove welds that cannot be readily radiographed. In case there is a conflict the higher frequency level of NDT shall apply:
  - a. CJP Butt Joint Welds: 10 percent random RT.
  - b. CJP Groove Welds: 10 percent random UT.
  - c. Fillet Welds and PJP Groove Welds: 10 percent random PT or MT.
  - d. All Welds: 100 percent VT.
3. Weld Acceptance:
  - a. VT:
    - 1) Structural Pipe and Tubing: AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Tubular Connections.
    - 2) All Other Structural Steel: AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
    - 3) Stud Connections: AWS D1.1/D1.1M, Paragraph 7.8.1.
  - b. UT: Perform UT of CJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 6.13.3, Class R Indications.
  - c. RT: Perform RT of CJP butt joint welds in accordance with AWS D1.1/D1.1M, Paragraph 6.12.1.
  - d. PT or MT:
    - 1) Perform on fillet and PJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 6.10.
    - 2) Acceptance shall be in accordance with VT standards specified above.
4. All welds found defective shall be repaired and/or replaced and retested for adequacy at the Contractor's sole expense.

### 3.03 FIELD QUALITY CONTROL

- #### A. The CWI shall be present whenever field welding is performed. The CWI shall perform inspection, as necessary, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:
1. Verifying conformance of specified job material and proper storage.
  2. Monitoring conformance with approved WPS.
  3. Monitoring conformance of WPQ.
  4. Inspecting weld joint fit-up and performing in-process inspection.

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5. Providing 100 percent visual inspection of all welds.
6. Supervising nondestructive testing personnel and evaluating test results.
7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

### 3.04 WELD DEFECT REPAIR

- A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

### 3.05 SUPPLEMENTS

- A. The supplement listed below, following “End of Section,” is a part of this Specification.
  1. Welding and Nondestructive Testing table.

<b>Welding and Nondestructive Testing</b>						
Specification Section	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
SGW-64290, 03 21 00- Reinforcing Steel (When Used)	AWS D1.4/D1.4M, Structural Welding Code - Reinforcing Steel	Yes	Yes	Yes	Yes	100% MT of all rebar splices; see SGW-64290, 03 21 00- Reinforcing Steel
SGW-64476, 05 12 00- Structural Steel Framing	AWS D1.1/D1.1M, Structural Welding Code - Steel	Yes	Yes	Yes	Yes	10% UT or RT of all groove-and-butt joint welds; 10% MT of all fillet welds; see SGW-64476, 05 12 00- Structural Steel Framing
05 31 00 Steel Decking	AWS D1.1/D1.1M, Structural Welding Code - Steel or AWS D1.3, Structural Welding Code - Sheet Steel	Yes	Yes	Yes	No	100% VT; see Section 05 31 00
SGW-54023, 05 50 00.01- Metal Fabrications	AWS D1.1/D1.1M, Structural Welding Code - Steel or AWS D1.2/D1.2M, Structural Welding Code - Aluminum or AWS D1.6/D1.6M, Structural Welding Code - Stainless Steel	Yes	Yes	Yes	No	100% VT; see SGW-54023, 05 50 00.01- Metal Fabrications
SGW-59111, 05 52 00- Metal Railings	AWS D1.1/D1.1M, Structural Welding Code - Steel or AWS D1.2/D1.2M, Structural Welding Code - Aluminum	No	No	No	No	100% VT; see SGW-59111, 05 52 00- Metal Railings
05 53 00 Metal Gratings	AWS D1.1/D1.1M, Structural Welding Code - Steel or AWS D1.2/D1.2M, Structural Welding Code - Aluminum	No	No	No	No	100% VT; see Section 05 53 00