

**Part 1 General****1.1 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1-14, Power Piping.
  - .2 ASME B31.3-14, Process Piping.
  - .3 ASME Boiler and Pressure Vessel Code-2013:
    - .1 BPVC 2013 Section I: Power Boilers.
    - .2 BPVC 2013 Section V: Nondestructive Examination.
    - .3 BPVC 2013 Section IX: Welding and Brazing Qualifications.
- .2 American Water Works Association (AWWA)
  - .1 AWWA C206-11, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
  - .1 AWS B3.0, Standard Qualifying Procedure.
  - .2 AWS C1.1M/C1.1-2000 (R2012), Recommended Practices for Resistance Welding.
  - .3 AWS Z49.1-2012, Safety in Welding, Cutting and Allied Process.
  - .4 AWS WI-2000, Welding Inspection Handbook.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA B51-14, Boiler, Pressure Vessel and Pressure Piping Code.
  - .2 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.
  - .3 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
  - .4 CSA-W117.2-12, Safety in Welding, Cutting and Allied Processes.
  - .5 CSA W178.1-14, Certification of Welding Inspection Organizations.
  - .6 CSA W178.2-14, Certification of Welding Inspectors.

**1.2 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Welders:
    - .1 Welding qualifications in accordance with CSA B51.
    - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
    - .3 Submit welder's qualifications to Departmental Representative.
    - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
    - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
  - .2 Inspectors:
    - .1 Inspectors qualified to CSA W178.2.

- .3 Certifications:
  - .1 Registration of welding procedures in accordance with CSA B51.
  - .2 Copy of welding procedures available for inspection.
  - .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## **Part 2 Products**

### **2.1 GENERAL REQUIREMENTS**

- .1 NPS 2 piping and under: Unless otherwise indicated, screwed fittings with union for connections at equipment.
- .2 NPS 2-1/2 and over: Unless otherwise indicated, welded fittings with flanged connections at equipment.

### **2.2 ELECTRODES**

- .1 Electrodes: in accordance with CSA W48 Series.

## **Part 3 Execution**

### **3.1 APPLICATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 QUALITY OF WORK**

- .1 Welding: in accordance with ANSI/ASME B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

### **3.3 INSTALLATION REQUIREMENTS**

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
  - .1 Where used, fit to minimize gaps between ring and pipe bore.
  - .2 Do not install at orifice flanges.
- .3 Fittings:
  - .1 NPS 2 and smaller: install welding type sockets.
  - .2 Branch connections: install welding tees or forged branch outlet fittings.

**3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS**

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.
- .5 Proceed with hydrostatic tests:
  - .1 Fill all new piping system with water
  - .2 Water pressure test at 1.5 times design pressure for a minimum period of 10 minutes, then the test pressure shall be reduced to the design pressure for the remainder of the testing period in order to detect any leak.

**3.5 SPECIALIST EXAMINATIONS AND TESTS**

- .1 General:
  - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
  - .2 Inspect and test of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination.
- .2 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .3 Failure of visual examinations:
  - .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative by radiographic tests.
- .4 Full radiographic tests for piping systems.
  - .1 Spot radiography:
    - .1 Conduct spot radiographic tests of up to 10% of welds, selected at random by Departmental Representative from welds which would be most difficult to repair in event of failure after system is operational.
  - .2 Radiographic film:
    - .1 Identify each radiographic film with date, location, name of welder, and submit to Departmental Representative. Replace film if rejected because of poor quality.
  - .3 Interpretation of radiographic films:
    - .1 By qualified radiographer.
  - .4 Failure of radiographic tests:
    - .1 Extend tests to welds by welder responsible when those welds fails tests.

**3.6 DEFECTS CAUSING REJECTION**

- .1 In chilled water systems:
  - .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.

- .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
- .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
- .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
- .5 Repair cracks and defects in excess of 0.8 mm in depth.
- .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic tests.

### **3.7**

#### **REPAIR OF WELDS WHICH FAILED TESTS**

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

**END OF SECTION**