

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **1.2 REFERENCES**

- .1 Furthermore, the works will be done in accordance with any other code or norm having jurisdiction, as per the latest edition, notably including, but not limited to:
  - .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
    - .1 ANSI/ASME B31, ASME Code for Pressure Piping and Power Piping.
      - .1 ANSI/ASME B31.1, Power Piping.
      - .2 ANSI/ASME B31.3, Process Piping Addenda A.
      - .3 ANSI/ASME B31.3, Process Piping Addenda B.
    - .2 ANSI/ASME Boiler and Pressure Vessels Code.
      - .1 Section I: Pressure Boilers.
      - .2 Section V: Non-Destructive Examinations.
      - .3 Section IX: Welding and Brazing Qualifications.
  - .2 American National Standards Institute/American Water Works Association (ANSI/AWWA).
    - .1 ANSI/AWWA C206-03 Field Welding of Steel Water Pipe.
  - .3 American Welding Society (AWS).
    - .1 AWS B3.0, Welding Procedures and Performance Qualifications.
    - .2 AWS C1.1, Recommended Practices for Resistance Welding.

- .3 AWS Z49.1, Safety Welding, Cutting and Allied Process.
- .4 AWS W1, Welding Inspection Handbook.
- .4 Canadian Standards Association (CSA International).
  - .1 CSA W47.2-M1987(R2008), Certification of Companies for Fusion Welding of Aluminum.
  - .2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
  - .3 CSA B51-03(R2007), Boiler, Pressure Vessel and Pressure Piping Code.
  - .4 CSA-W117.2-2006, Safety in Welding, Cutting and Allied Processes.
  - .5 CSA W178.1-2008, Certification of Welding Inspection Organizations.
  - .6 CSA W178.2-2008, Certification of Welding Inspectors.
- .5 Canadian General Standards Board (ONGC/CGSB).
  - .1 CAN/CGSB 48.2, Spot Radiography of Welded Butt Joints in Ferrous Materials.

### 1.3 QUALIFICATIONS OF WELDERS

- .1 Welding qualifications in accordance with CSA B51 Standard.
- .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 Standard.

### 1.4 QUALIFICATION OF INSPECTORS

- .1 Inspectors qualified to CSA W178.2 Standard.

### 1.5 WELDING METHOD

- .1 Registration of welding procedures in accordance with CSA B51 Standard.

- .2 Copy of welding procedures available for inspection.
- .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2 Standard.

## **PART 2 - PRODUCTS**

### **2.1 ELECTRODES**

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

## **PART 3 - EXECUTION**

### **3.1 QUALITY OF WORK**

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

### **3.2 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.

### **3.3 SPECIAL REQUIREMENTS - STAINLESS STEEL WELDING**

- .1 Special attention should be paid when welding stainless steel in both worksite and workshop. Avoid carbon steel welding or grinding close to stainless steel welding in order to avoid contamination by carbon steel particles.
  - .2 Stainless steel welded joints must fully penetrate pipes.
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- .3 First pass must be performed with GTAW-GAS TUNGSTEN ARC (TIG) method. Provide a minimum of two passes.
- .4 Do not use "Backing Rings" for stainless steel welding of pipe tips.
- .5 Stainless steel welding must be carried out using a noble gas purge method.
- .6 When welding, pipes must be pre-purged and purged at a constant flow.

### 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.

### 3.5 SPECIALIST EXAMINATIONS AND TESTS

- .1 General:
  - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 Standards and approved by Departmental Representative.
  - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 Standard and requirements of authority having jurisdiction.
  - .3 Inspect and test 100% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle" tests) and spot gamma ray radiographic (hereinafter referred to as "radiography" tests).
- .2 Hydrostatically test welds to ANSI/ASME B31.1 Standard.
- .3 Visual Examinations: Include entire circumference of weld externally and wherever possible internally.
- .4 Failure of Visual Examinations:
  - .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 10% of welds, selected at random by Departmental Representative by radiographic tests.

### 3.6 DEFECTS CAUSING REJECTION

- .1 General :
  - .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.
- .2 In addition, chilled water systems below 1,000 kPa:
  - .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 1,500 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.

### 3.7 REPAIR OF WELDS WHICH FAILED TESTS

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

### 3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

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