CAN/CSA-N287.5-11 – Examination and testing requirements for concrete containment structures for nuclear power plants

This document provides an overview of the requirements of *Welding Requirements CSA-N287.5 – Examination and testing requirements for concrete containment structures for nuclear power plants* with respect to welding. It is designed to provide guidance for individuals and organizations involved in examination and testing requirements that apply to the work of any organization participating in the construction, fabrication, or installation of parts or components of concrete containment structures for nuclear power plants that are designated as class containment for CANDU nuclear power plants.

This document is only for general guidance purposes; reference to the full text of CSA N287.5 should be made. For further information, please contact the CWB at 1-800-844-6790 or info@cwbgroup.org.

Introduction

Welding is a key joining method used in the fabrication of concrete containment structures for nuclear power plants. To ensure welds of the highest quality and the safety of both the users of CANDU power plants and the general public, CSA Standard N287.5 provides specific requirements around the examination and testing requirements that apply to the work of any organization participating in the construction, fabrication, or installation of parts or components of concrete containment structures, with awareness that the CANDU nuclear plants are used by people.

Welded Fabrication

CSA N287.5 provides the following requirements:

6. Reinforcement
6.1.3 *Operators shall be qualified to the requirements of Clause 6.5.4 of CSA N287.4. A welder who has not welded reinforcing bars during the preceding six months shall require requalification to both CSA W186 and Clause 6.5.5 of CSA N287.4.*

An organization meeting the requirements of CSA Standard W186 will have qualified welders, accepted welding procedures and accepted supervisory/engineering personnel. All elements of the welding operation will be independently verified by the Canadian Welding Bureau on an on-going basis.

Please note that there are no domestic or international equivalents to CSA Standard W186. Other national systems, such as that of the American Welding Society (AWS) do not include key concepts such as independent and on-going verification and welding supervisors/engineers. The CWB strongly cautions the reader around accepting substitutions; doing so may place public safety at risk.

For a listing of all organizations that currently meet the requirements of CSA Standard W186 please see *www.cwbgroup.org*.

Welding Inspection

6.3 Examination of arc-welded splices
6.3.1.1 *All arc-welded splices shall be visually examined for compliance with CSA W186 by a welding inspector certified to CSA W178.2.*

6.3.1.2 *Arc-welded splices that pass the visual examination shall be radiographed in accordance with CSA W59 and Clause 6.3.2.*

6.3.1.3 *Arc-welded splices that fail the visual examination shall be repaired or replaced. The repaired or new splice shall be radiographed in accordance with CSA W59 and Clause 6.3.2.2.*

6.3.2 Radiographic examination

6.3.2.1 *The first production splice in each position of welding for each welder and, thereafter, one splice selected at random from each group of 25 production splices, shall be radiographed in accordance with CSA W59 from two directions perpendicular to each other.*

6.3.2.2 *The results of radiographic examinations shall meet the acceptance requirements of CSA W186. When an arc-welded splice fails to meet these requirements, the splice shall be replaced and the new splice examined radiographically. Every arc-welded splice adjacent to the new splice shall also be examined radiographically. If an adjacent splice fails to meet the acceptance requirements of CSA W186, the work shall be stopped and corrective action taken to the satisfaction of the designer.*

9 Metallic parts

9.1.2.1 *All welds shall be visually examined by a welding inspector certified to CSA W178.2 in accordance with Clause 9.5.1.*

9.2 Examination of welded joints

The welded joints described in CSA N287.3 shall be radiographed in accordance with Clause 9.5.2 or ultrasonically examined in accordance with Clause 9.5.3. In addition, each surface of tee joints reinforced with fillet welds shall be examined using the magnetic particle method specified in Clause 9.5.4 or the liquid penetrant method specified in Clause 9.5.5 for a minimum of 13 mm on each side of the weld. The designer shall specify whether

(a) a full or spot weld examination is required; or

(b) static or dynamic loading conditions apply in accordance with CSA W59.

9.5.2 Radiographic examination

Radiographic examination procedures and acceptance requirements shall be in accordance with CSA W59.

9.5.3 Ultrasonic examination

Ultrasonic examination procedures and acceptance requirements shall be in accordance with CSA W59.

9.5.4 Magnetic particle examination

Magnetic particle examination procedures shall be in accordance with ASTM E709 and magnetic particle examination acceptance requirements shall be in accordance with CSA W59.

9.5.5 Liquid penetrant examination

Liquid penetrant examination procedures shall be in accordance with ASTM E165 and liquid penetrant examination acceptance requirements shall be in accordance with CSA W59.

9.5.6.4 *Operators of vacuum boxes shall be qualified to CSA W1 78.2.*

9.5.7 Spot examination

Spot examination by radiography or ultrasonic shall be performed in accordance with CSA W59, except that one 150 mm length of weld in every 8 m or less shall be examined.

9.6 Records

9.6.1 The following shall be prepared by the constructor and reviewed by the engineer in accordance with CSAW59:

(a) a full set of radiographs of welds subjected to radiographic examination, including any that show unacceptable quality before repair; and

(b) a report interpreting the radiographs.

9.6.2 *A full set of completed report forms for welds subjected to ultrasonic examination, including any that show unacceptable quality before repair, shall be prepared by the constructor in accordance with CSAW59.*

CSA Standard W59 and CSA standard W186 have provisions for nondestructive examination methods like radiography, ultrasonic, magnetic particle and liquid penetrant. CSA Standard W59 and CSA standard W186 have also criteria of acceptability of welds and provisions for preparation and disposition of reports.

CSA Standard W186 and CSA Standard W59 require that all welds be visually inspected. In addition, when required by contract weld inspection must be completed by certified welding inspectors or a welding inspection organization following the requirements of CSA Standard W178.2 or CSA Standard W178.1 respectively. It also requires that CSA Standard W186 and CSA Standard W59 be followed for the acceptance criteria for all welds. It should be noted that CSA Standard W178.2 has individual "product categories" that inspectors may qualify to, including one for CSA Standard W59.

For a listing of all organizations and individuals who currently meet the requirements of CSA Standard W178.1 and CSA Standard W178.2, please see *www.cwbgroup.org* .