

CAN/CSA-N287.3-93 – Design Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants

This document provides an overview of the requirements of *Welding Requirements CSA-N287.3 – Design Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants* with respect to welding. It is designed to provide general requirements for the design of concrete containment structures of a containment system, designated as “class containment” components and parts, as defined in CSA Standard N287.1.

This document is only for general guidance purposes; reference to the full text of CSA N287.3 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 steel structures and concrete containment structures. To ensure welds of the highest quality and the safety of both the users of CANDU power plants and the general public, CSA Standard N287.3 provides specific requirements around the design of concrete containment structures of a containment system, designated as “class containment” components and parts, with awareness that the CANDU nuclear plants are used by people.

Welded Fabrication

CSA N287.3 provides the following requirements:

9.2 Arc-welded splice materials

9.2.2 *The design of welded splices and welded connections of reinforcement to metallic parts shall be in accordance with the requirements of CSA Standard W186, except that*

(a) only direct butt-welded joints as shown in Figure 9.1 and complete penetration tee-joints as shown in figure 9.2 shall be permitted;

(b) the welded joint shall be capable of developing in tension or compression, as applicable, the minimum specified ultimate tensile strength of the bars; and

Note: Special metallurgical processes may be required in order to meet the requirements of this Clause.

(c) the materials being joined shall be compatible for welding.

9.3 Mechanical Splices

9.3.1.5 *Where a splice sleeve is used to connect reinforcement to metallic parts, the following requirements shall apply:*

(a) the design of the welded joint shall be in accordance with CSA Standard W59, except that complete penetration welds or partial penetration welds reinforced with fillets shall be used;

(b) tests shall be carried out to determine the capacity of the joint to be used for design; and

(c) the materials being joined shall be compatible for welding.

13 Metallic parts

13.2.1 *Metallic parts shall be designed in accordance with the requirements of CSA Standard S16.1, except as otherwise given herein.*

Note: Alternative methods of design not covered by CSA Standard CAN/CSA S16.1 may be used, provided such methods demonstrate that the design ensures a level of safety and performance commensurate with the requirements of this Standard.

13.3.5 Welding

The design of welded joints for the liner shall be in accordance with CSA Standard W59, except that the allowable stresses for plug and slot welds shall be reduced by 50%, and the design of welded joints for anchorages and attachments shall comply with the requirements of Clause 13.4.3.

13.3.4.3 Design of Welded Joints

13.4.3.1 *The welded joints of embedded parts shall be designed in accordance with the requirements of CSA Standard W59.*

Only the following types of welds shall be used where permitted by CSA Standard W59, otherwise the requirements of Clause 13.4.3.2 shall be met:

(a) Continuous complete penetration groove welds for butt joints, T-joints, and corner joints. Typical butt joints are shown in Figure 13.1.

(b) Continuous partial penetration T-joints reinforced with fillets in a T-joint in accordance with Figure 13.2.

(c) Double fillet welded lap joints in accordance with Figure 13.3.

(d) Complete penetration T-joints for reinforcing steel in accordance with Figure 9.2.

CSA Standard S16 requires all fabricators and erectors responsible for welding structures fabricated or erected under this Standard to be certified by the Canadian Welding Bureau to the requirements of CSA W47.1 (Division 1 or Division 2), CSA W55.3, or both, as applicable. Part of the work may be sublet to a Division 3 fabricator or erector; however, the Division 1 or Division 2 fabricator or erector shall retain responsibility for the sublet work.

CSA Standard W47.1 and CSA Standard W186 provide requirements for the qualification of welders and welding operators, welding procedures and welding supervisory and engineering personnel. A company certified to CSA W47.1 Division 1 requires having full time engineer(s) and a company certified to Division 2 requires having retained part time engineer(s).

CSA Standard W59 requires that contractors performing work under this standard be certified under the requirements of CSA Standard W47.1 unless the Engineer of record approves the contractor for the work to be undertaken. CSA Standard W47.1 provides requirements for the qualification of welders and welding operators, welding procedures and welding supervisory and engineering personnel.

An organization meeting the requirements of CSA Standard W47.1 and / or 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 W47.1, CSA Standard W186 and / or CSA Standard W55.3. 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 and / or CSA Standard W47.1 please see www.cwbgroup.org.

Welding Inspection

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.