CAN/CSA-S474-04 – Concrete Structures Welding Requirements

This document provides an overview of the requirements of *CAN/CSA- S474-04 –Concrete Structures* with respect to welding. It is designed to provide guidance for individuals and organizations involved in the material selection, design, and construction requirements for fixed concrete offshore structures in Canada.

This document is only for general guidance purposes; reference to the full text of CSA S474 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 offshore concrete structures. To ensure welds of the highest quality and the safety of both the users of offshore structures and the general public, CSA Standard S474 provides specific requirements around the design of offshore concrete structures and welded fabrication and erection of offshore steel structures that are being part of the offshore concrete structures.

Welded Fabrication

CSA S474 provides the following requirements:

11.4 Fabrication and placement of hardware

Fabrication and placement of hardware shall be in accordance with CSA A23.1, except that all welding procedures shall be in accordance with CSA S473.

11.7.4 When mechanical splice sleeves are used to attach reinforcing bars to structural steel members or metallic parts, the requirements of CSA S473 shall apply.

11.8 Welding of reinforcing bars

11.8.1 Welding of reinforcing bars shall comply with CSA W186, except as modified by Clauses11.8.2 to 11.8.7.

1.8.5 Welding procedures shall be qualified in accordance with CSA W186 and the following requirements:
(a) the macro-etch specimen for direct butt-spliced joints connecting reinforcing bars to structural members shall show complete fusion and be free of imperfections to a degree that exceeds the quality requirements of CSA W186; and
(b) two macro-etch specimens for joints connecting reinforcing bars to structural members shall be prepared from two transverse surfaces, 90° to each other.

11.21 Anchorage devices

As applicable, the fabrication and installation of the anchorage system shall comply with:
(a) the material requirements specified in CSA A23.1 and CSA A23.3;
(b) the approved drawings and procedures;
(c) the welding requirements specified in Clause11.8 or CSA S473;
(d) the requirement that grouted and expansion anchors be installed by qualified personnel; and
(e) the testing and examination requirements specified by the designer.

CSA Standard S473 states that detailed requirements applicable to the welding design, construction, and inspection of steel fixed offshore structures are specified in Annexes A, B, and C, CSA W178.1, and CAN/CSA-W178.2. Also all contractors fabricating steel under this Standard shall be certified to Annex B and CSA W47.1 in the division specified in the contract documents.

Annexes A, B and C of CSA Standard S473 specify supplementary requirements to CSA Standard W47.1 and CSA Standard W59. These additional requirements are related to procedure qualification requirements, toughness testing, hardness testing, and improved welding skills, as they apply to the design, construction, and inspection of steel fixed offshore structures.

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 and CSA Standard W186 provide guidance on weld design, fabrication techniques, inspection and other key considerations around welding for steel. 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.

An organization meeting the requirements of CSA Standard W47.1 or CSA Standard W186 will have qualified welders, operators, 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 or 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 contravene the intent of CSA S474 and place public safety at risk.

For a listing of all organizations that currently meet the requirements of CSA Standard W47.1 and CSA Standard W186 please see *www.cwbgroup.org*.

Welding Inspection

CSA Standard S473 and CSA Standard W186 require that all welds be visually inspected and 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 W59 and Annex A of CSA standard S473 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 CSA Standard W59 and CSA Standard S473.

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* .

Welding Consumables

CSA Standard S473 and CSA Standard W186 require electrodes and electrode-gas and electrode-flux combinations for the processes listed shall be certified to CAN/CSA-W48. Only welding consumables meeting classifications that have toughness requirements shall be used, except as otherwise approved by the owner. When toughness tests are required, welding consumables shall meet the applicable requirements of Clause 6 and Annex C.

CSA Standard W48 provides requirements for the classification and certification of welding consumables by itself or in conjunction with gas mixtures or fluxes as applicable. Welding consumables certified by the CWB have undergone through periodically testing and acceptance of quality management system of the manufactures.

For a listing of all consumables who currently meet the requirements of CSA Standard W48 please see *www.cwbgroup.org* .