

CAN/CSA-S6-14 – Canadian Highway Bridge Design Code

Welding Requirements

This document provides an overview of the requirements of CAN/CSA-S6-14 –Canadian Highway Bridge Design Code with respect to welding. It is designed to provide guidance for individuals and organizations involved in the design, evaluation, and structural rehabilitation design of fixed and movable highway bridges in Canada.

This document is only for general guidance purposes; reference to the full text of CSA S6 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 highway bridges and their components. To ensure welds of the highest quality and the safety of both the users of highway bridges and the general public, CSA Standard S6 provides specific requirements around the design of bridge foundation, bridge structure, bridge components and welded fabrication of highway bridges.

Welded Fabrication

CSA S6 provides the following requirements:

8.5.3.1 Reinforcing bars

Unless otherwise approved, tack welding of reinforcing bars shall not be permitted. For bars containing complete joint penetration groove welds that meet the requirements of CSAW186, the stress range in the vicinity of welds shall not exceed 100MPa. For other types of welded splices, the stress range shall not exceed 65MPa.

8.14.4.2 Spirals

Splices in spiral bars shall be provided by one of the following means:

(a) complete joint penetration groove welds meeting the requirements of CSA W186;

10.4.6 Welding electrodes

Except as permitted by Clause 10.23.4, welding electrodes, electrode/gas, or electrode/flux combinations shall include hydrogen designators (e.g., H16, H8, H4, H2), be low hydrogen, and shall comply with CSA W48 or the AWS A5 series, and with CSA W47.1 and CSA W59.

10.4.7 Stud shear connectors

Material requirements for stud shear connectors and the qualification of the shear connector base shall comply with CSA W59, Annex H. Only studs of Type B shall be used.

A.10.1.2.4 Welding procedures:

Welding procedures shall comply with CSA Standard W47.1.

A.10.1.2.6 Symbols for welding and non-destructive testing

The symbols for welding and non-destructive testing on shop drawings shall be in accordance with CSA Standard W59.

A.10.1.5 Welded construction

All welding procedures, including those related to quality of work, techniques, repairs, and qualifications, shall comply with CSA W47.1 and CSA W59, except where modified by Clauses A10.1.5.2 to A10.1.5.7 of this Section.

A.10.1.5.5 Certification of fabrication companies

Any company undertaking welded fabrication and/or welded erection (including steel piles, railings and guards, or other welded attachments) shall be certified to Division 1 or 2 of CSA W47.1.

A.10.1.8.1 Qualification of inspectors

Visual welding inspectors shall comply with the requirements of CSA W178.2 level 2 minimum. Non-destructive testing personnel (other than visual) shall comply with CAN/CGSB-48.9712 level 2 minimum.

10.24.10.8 Field Welding

Any company undertaking field welding in accordance with this Section shall be certified to Division 1 or 2 of CSA Standard W47.1.

17.22.3.1 Welded connections

Welding design shall comply with CSA W59.2. In the design of welded joints, consideration should be given both to the strength of the welds and to the strength of the HAZ.

17.25.1.4 Welding procedures

Welding procedures shall comply with CSA W47.2.

17.25.1.6 Symbols for welding and non-destructive testing

The symbols for welding and non-destructive testing on shop drawings shall be in accordance with CSA W59.2.

17.25.2.3 Electrodes

The supply and storage of filler shall comply with CSA W59.2.

17.25.4.1 Welded construction

All fusion welding procedures, including those related to quality of work, techniques, repairs, and qualifications, shall comply with CSA W59.2, except where modified by Clauses 17.25.4.2 to 17.25.4.6.

17.25.4.3 Stud welds

Stud welds shall comply with CSA W59.2.

17.25.4.5 Certification of fabrication companies

Any company undertaking welded fabrication in accordance with this Section shall be certified to Division 1 or 2 of CSA W47.2.

17.25.7.1 Qualification of inspectors

Welding inspectors shall be qualified to CSA W178.2.

17.25.9.8 Field welding

Any company undertaking field welding in accordance with this Section shall be certified to CSA W47.2. Field welding shall only occur with Approval and with sufficient shelter provided in accordance with CSA W59.2.

CSA Standard W47.1 and CSA standard W47.2 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 186 "Welding of Reinforcing Bars in Reinforced Concrete Construction" provides guidance on weld design, fabrication techniques, inspection, qualification of welders and welding operators, welding procedures and other key considerations around welding for reinforcing bars.

CSA Standard W59 provides 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.

CSA Standard W59.2 provides guidance on weld design, fabrication techniques, inspection and other key considerations around welding for aluminum. CSA Standard W59.2 requires that contractors performing work under this standard be certified under the requirements of CSA Standard W47.2.

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.

An organization meeting the requirements of CSA Standard W47.1, CSA Standard W47.2 and / or CSA Standard 186 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 W47.2 and / 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 S6 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 W59, CSA Standard W59.2 and / or CSA Standard W186 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 W59, CSA Standard W59.2 and / or CSA Standard W186 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 and CSA Standard W59.2.

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.