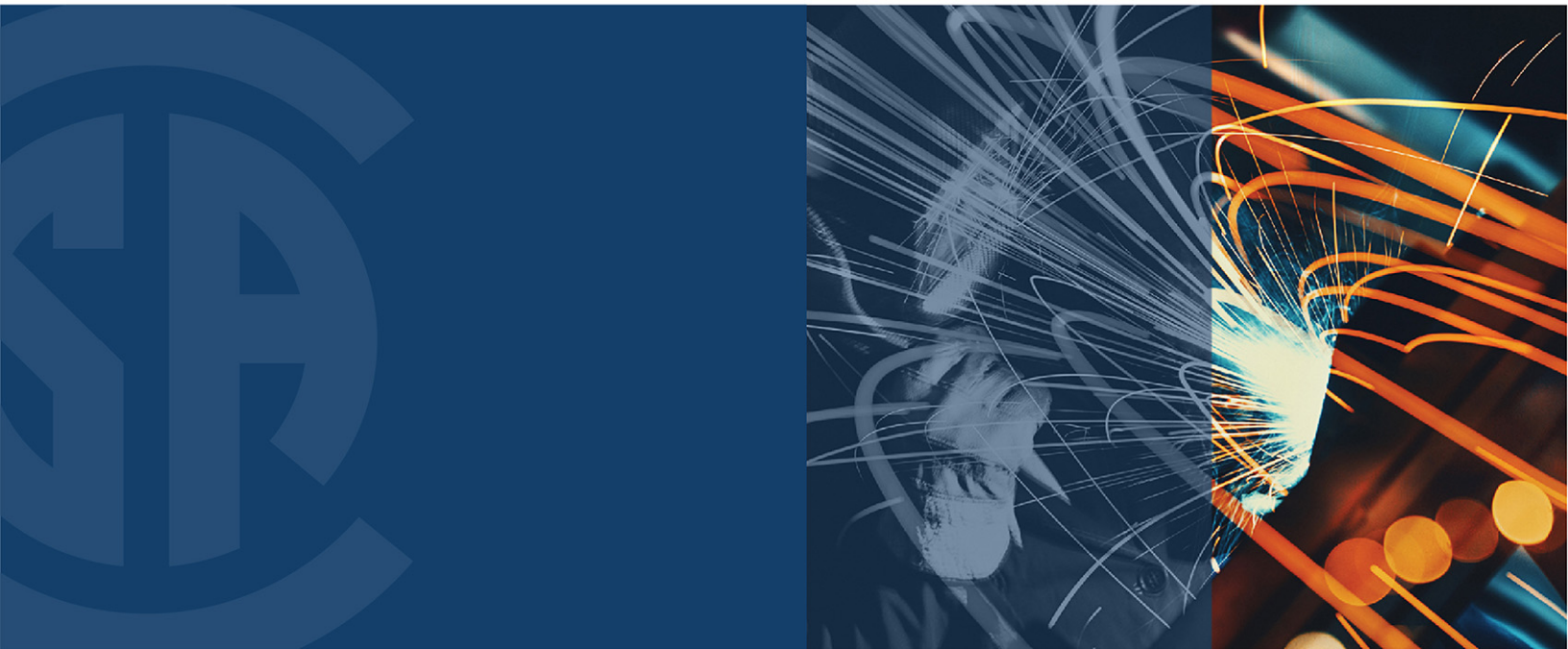




# Welded steel construction



# Legal Notice for Standards

Canadian Standards Association (operating as “CSA Group”) develops standards through a consensus standards development process approved by the Standards Council of Canada. This process brings together volunteers representing varied viewpoints and interests to achieve consensus and develop a standard. Although CSA Group administers the process and establishes rules to promote fairness in achieving consensus, it does not independently test, evaluate, or verify the content of standards.

## Disclaimer and exclusion of liability

This document is provided without any representations, warranties, or conditions of any kind, express or implied, including, without limitation, implied warranties or conditions concerning this document’s fitness for a particular purpose or use, its merchantability, or its non-infringement of any third party’s intellectual property rights. CSA Group does not warrant the accuracy, completeness, or currency of any of the information published in this document. CSA Group makes no representations or warranties regarding this document’s compliance with any applicable statute, rule, or regulation.

IN NO EVENT SHALL CSA GROUP, ITS VOLUNTEERS, MEMBERS, SUBSIDIARIES, OR AFFILIATED COMPANIES, OR THEIR EMPLOYEES, DIRECTORS, OR OFFICERS, BE LIABLE FOR ANY DIRECT, INDIRECT, OR INCIDENTAL DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES, HOWSOEVER CAUSED, INCLUDING BUT NOT LIMITED TO SPECIAL OR CONSEQUENTIAL DAMAGES, LOST REVENUE, BUSINESS INTERRUPTION, LOST OR DAMAGED DATA, OR ANY OTHER COMMERCIAL OR ECONOMIC LOSS, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), OR ANY OTHER THEORY OF LIABILITY, ARISING OUT OF OR RESULTING FROM ACCESS TO OR POSSESSION OR USE OF THIS DOCUMENT, EVEN IF CSA GROUP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, INJURY, LOSS, COSTS, OR EXPENSES.

In publishing and making this document available, CSA Group is not undertaking to render professional or other services for or on behalf of any person or entity or to perform any duty owed by any person or entity to another person or entity. The information in this document is directed to those who have the appropriate degree of experience to use and apply its contents, and CSA Group accepts no responsibility whatsoever arising in any way from any and all use of or reliance on the information contained in this document.

CSA Group is a private not-for-profit company that publishes voluntary standards and related documents. CSA Group has no power, nor does it undertake, to enforce compliance with the contents of the standards or other documents it publishes.

## Intellectual property rights and ownership

As between CSA Group and the users of this document (whether it be in printed or electronic form), CSA Group is the owner, or the authorized licensee, of all works contained herein that are protected by copyright, all trade-marks (except as otherwise noted to the contrary), and all inventions and trade secrets that may be contained in this document, whether or not such inventions and trade secrets are protected by patents and applications for patents. Without limitation, the unauthorized use, modification, copying, or disclosure of this document may violate laws that protect CSA Group’s and/or others’ intellectual property and may give rise to a right in CSA Group and/or others to seek legal redress for such use, modification, copying, or disclosure. To the extent permitted by licence or by law, CSA Group reserves all intellectual property rights in this document.

## Patent rights

Attention is drawn to the possibility that some of the elements of this standard may be the subject of patent rights. CSA Group shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights is entirely their own responsibility.

## Authorized use of this document

This document is being provided by CSA Group for informational and non-commercial use only. The user of this document is authorized to do only the following:

If this document is in electronic form:

- load this document onto a computer for the sole purpose of reviewing it;
- search and browse this document; and
- print this document if it is in PDF format.

Limited copies of this document in print or paper form may be distributed only to persons who are authorized by CSA Group to have such copies, and only if this Legal Notice appears on each such copy.

In addition, users may not and may not permit others to

- alter this document in any way or remove this Legal Notice from the attached standard;
- sell this document without authorization from CSA Group; or
- make an electronic copy of this document.

If you do not agree with any of the terms and conditions contained in this Legal Notice, you may not load or use this document or make any copies of the contents hereof, and if you do make such copies, you are required to destroy them immediately. Use of this document constitutes your acceptance of the terms and conditions of this Legal Notice.



# ***Standards Update Service***

***CSA W59:24***  
***March 2024***

**Title:** *Welded steel construction*

To register for e-mail notification about any updates to this publication

- go to [www.csagroup.org/store/](http://www.csagroup.org/store/)
- click on **CSA Update Service**

The **List ID** that you will need to register for updates to this publication is **2431010**.

If you require assistance, please e-mail [techsupport@csagroup.org](mailto:techsupport@csagroup.org) or call 416-747-2233.

Visit CSA Group's policy on privacy at [www.csagroup.org/legal](http://www.csagroup.org/legal) to find out how we protect your personal information.

# CSA W59:24

## ***Welded steel construction***



*®A trademark of the Canadian Standards Association, operating as "CSA Group"*

*Published in March 2024 by CSA Group  
A not-for-profit private sector organization  
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3*

*To purchase standards and related publications, visit our Online Store at  
[www.csagroup.org/store/](http://www.csagroup.org/store/) or call toll-free 1-800-463-6727 or 416-747-4044.*

*ICS 25.160.10; 91.080.10  
ISBN 978-1-4883-4989-8*

*© 2024 Canadian Standards Association  
All rights reserved. No part of this publication may be reproduced in any form whatsoever  
without the prior permission of the publisher.*

# Contents

Technical Committee on Welding of Bridges, Buildings, and Machinery	8
Preface	12
SDG Foreword	14
<b>1 Scope</b>	<b>15</b>
<b>2 Reference publications and definitions</b>	<b>16</b>
2.1 Reference publications	16
2.2 Definitions	24
<b>3 General requirements</b>	<b>25</b>
3.1 Qualification requirements	25
3.1.1 Contractor	25
3.1.2 Welding processes	26
3.1.3 Welding procedures — Conditions of prequalification	26
3.1.4 Selection of type of groove and welding procedures	26
3.1.5 Welding procedures — Requirements for welded joints in base metals with specified toughness properties	26
3.2 Base metal	27
3.2.1 General	27
3.2.2 CSA G40.21	27
3.2.3 ASTM Standards	28
3.2.4 API Standards	29
3.2.5 ABS Standards	29
3.2.6 IACS Standards	29
3.2.7 Lloyds Standards	29
3.3 Welding terminology	29
3.4 Symbols	29
<b>4 Design of welded connections</b>	<b>29</b>
4.1 General requirements	29
4.1.1 Documents	29
4.1.2 Lamellar tearing	31
4.1.3 Requirements for welds	31
4.2 Design values	33
4.3 Effective weld area, length, throat, and fillet size	33
4.3.1 Groove welds	33
4.3.2 Fillet welds	37
4.3.3 Plug and slot welds	37
4.3.4 Minimum groove depth for partial joint penetration groove welds and minimum length and size of fillet welds	38
4.4 Details of fillet, plug, and slot welds	38
4.4.1 Fillet weld details	38
4.4.2 Plug and slot weld details	39
4.5 Welds in skewed joints	40

4.6	Fillers	41
4.7	Seal welds	41
4.8	Welds in hollow section connections	41
<b>5</b>	<b>Electrodes, workmanship, and technique</b>	<b>57</b>
5.1	General	57
5.2	Electrodes	57
5.2.1	General	57
5.2.2	Electrodes for SMAW	59
5.2.3	Electrodes and fluxes for SAW	61
5.2.4	Electrodes and shielding gas for GMAW, GTAW, MCAW, and FCAW	61
5.2.5	Electrodes, fluxes, and gases for electroslag welding and electrogas welding (ESW and EGW)	62
5.3	Preparation of material	63
5.3.1	Surface conditions	63
5.3.2	Joint preparation	63
5.3.3	Roughness requirements	63
5.3.4	Notch limitations	63
5.3.5	Inspection and repair of planar edge discontinuities	64
5.3.6	Re-entrant corners	65
5.3.7	Beam copes and weld access holes	65
5.3.8	Weld access hole dimensions	65
5.3.9	Group 4 and 5 shapes	65
5.3.10	Camber	65
5.3.11	Correction of camber	66
5.4	Assembly	66
5.4.1	Fillet weld assembly	66
5.4.2	Faying surfaces	66
5.4.3	PJP groove weld assembly	66
5.4.4	Groove weld assembly	66
5.4.5	Workmanship tolerances	67
5.4.6	Alignment	67
5.4.7	Tack welds	67
5.4.8	Temporary welds	68
5.4.9	Backing	68
5.4.10	Seal welds	68
5.4.11	Mislocated holes and slots	68
5.5	Details of welding procedures	69
5.5.1	General	69
5.5.2	Shielded metal arc welding (SMAW)	70
5.5.3	Submerged arc welding (SAW)	70
5.5.4	Gas metal arc welding (GMAW), gas tungsten arc welding (GTAW), metal-cored arc welding (MCAW), and flux-cored arc welding (FCAW)	72
5.5.5	Electroslag welding (ESW) and electrogas welding (EGW)	72
5.6	Control of distortion and shrinkage stresses	73
5.7	Preheat, interpass temperature, and heat input control	74
5.7.1	Preheat and interpass temperatures	74
5.7.2	Reduction of preheat temperatures	75
5.8	Dimensional tolerances	76

5.9	Profile of welds	76
5.10	Corrections	77
5.11	Peening	78
5.12	Stress-relief heat treatment	78
5.13	Cleaning of welds	80
5.14	Arc strikes	80
5.15	Heat shaping	80
<b>6</b>	<b>Stud welding</b>	<b>95</b>
6.1	Scope	96
6.2	General requirements	96
6.3	Stud application qualification requirements	96
6.3.1	Prequalified positions	96
6.3.2	Non-prequalified stud applications	97
6.3.3	Base material for qualification tests	97
6.3.4	Test variables to be recorded	97
6.3.5	Test specimens	97
6.3.6	Bend tests (nonthreaded studs)	97
6.3.7	Bend tests (threaded studs)	97
6.3.8	Torque tests (threaded studs)	97
6.3.9	Acceptance criteria	97
6.3.10	Replacement of end tests (threaded studs)	97
6.3.11	Test data	97
6.4	Technique and workmanship	98
6.5	Procedural controls	100
6.6	Inspection requirements and repair procedures	101
<b>7</b>	<b>Welding inspection</b>	<b>104</b>
7.1	General	104
7.1.1	Contractor's inspector	104
7.1.2	Independent third-party inspection	105
7.1.3	Availability of documents	105
7.1.4	Notification	105
7.1.5	Access	105
7.1.6	Identification	105
7.2	Inspection of materials	105
7.3	Obligations of the contractor	105
7.4	Nondestructive examination	106
<b>8</b>	<b>Radiographic and ultrasonic examination of welds</b>	<b>108</b>
8.1	Radiographic examination of welds	108
8.1.1	General	108
8.1.2	Extent of examination	108
8.1.3	Radiographic procedure	109
8.1.4	Acceptability of welds	112
8.1.5	Examination, reporting, and disposition of radiographs	112
8.1.6	Alternative radiation imaging systems	113
8.2	Ultrasonic examination of groove welds	114
8.2.1	General	114
8.2.2	Extent of examination	115

8.2.3	Personnel qualification (FA technique)	115
8.2.4	Ultrasonic equipment (FA technique)	115
8.2.5	Calibration standards (FA technique)	116
8.2.6	Equipment calibration (FA technique)	117
8.2.7	Calibration for examination (FA technique)	117
8.2.8	Testing procedure (FA technique)	118
8.2.9	Preparation and disposition of reports	120
8.2.10	Calibration of the ultrasonic unit with the IIW-Type or other approved calibration blocks	121
8.2.11	Scanning patterns for ultrasonic examination	122
8.2.12	Alternative ultrasonic systems	123

## **9 Strengthening and repair of existing structures 141**

9.1	General	141
9.2	Materials	141
9.3	Design	142
9.4	Workmanship	142
9.5	Fatigue life enhancement	143
9.5.1	Methods	143
9.5.2	Stress range increase	143
9.6	Quality	143
9.6.1	Visual inspection	143
9.6.2	Nondestructive testing	143

## **10 Details and welding procedure requirements for prequalified joints 144**

10.1	General	144
10.1.1	Prequalified complete joint penetration groove welds	144
10.1.2	Prequalified partial joint penetration groove welds	144
10.1.3	Requirements for prequalification of joints	144
10.1.4	Joint and weld designations	145
10.1.5	Postweld heat treatment	146
10.1.6	As-welded classified filler metals	146
10.2	Shielded metal arc welding (SMAW)	147
10.2.1	Prequalified complete joint penetration groove welds made by SMAW	147
10.2.2	Prequalified partial joint penetration groove welds made by SMAW	147
10.2.3	Procedures for SMAW	148
10.3	Submerged arc welding (SAW)	148
10.3.1	Prequalified complete joint penetration groove welds made by SAW	148
10.3.2	Prequalified partial joint penetration groove welds made by SAW	148
10.3.3	Parameter limitations for prequalified complete and partial joint penetration welds	149
10.3.4	Prequalified fillet welds made by submerged arc welding	150
10.4	Flux-cored arc and metal-cored arc welding (FCAW, MCAW)	150
10.4.1	Prequalified complete joint penetration groove welds made by FCAW and MCAW	150
10.4.2	Prequalified partial joint penetration groove welds made by FCAW and MCAW	151
10.4.3	Procedures for FCAW and MCAW with single electrodes	151
10.4.4	Procedures for FCAW and MCAW with parallel electrodes (twin wire single arc)	151
10.4.5	Metal transfer mode for metal-cored arc welding	152
10.4.6	Flux-cored arc welding and metal-cored arc welding	152
10.5	Gas metal arc welding spray transfer (GMAW-SP) and pulsed transfer (GMAW-P)	152
10.5.1	Prequalified complete joint penetration groove welds made by GMAW	152



10.5.2	Prequalified partial joint penetration groove welds made by GMAW	152
10.5.3	Procedures for GMAW with single electrodes	153
10.5.4	Procedures for GMAW with parallel electrodes (twin wire single arc)	154
10.5.5	Power requirements	155
10.6	Gas tungsten arc welding (GTAW)	155
10.6.1	Prequalified complete joint penetration groove welds made by GTAW	155
10.6.2	Prequalified partial joint penetration groove welds made by GTAW	155
10.6.3	Procedures for GTAW with single electrodes	156

## **11 Statically-loaded structures — Design and construction** 197

11.1	Scope	197
11.2	Base metal	198
11.3	Design provisions	198
11.3.1	Symbols	198
11.3.2	Design values	199
11.3.3	Base metal and matching electrode classification	199
11.4	Structural details	199
11.4.1	General	199
11.4.2	Combination of welds	199
11.4.3	Welds in combination with bolts	199
11.4.4	Strength under temporary loads	200
11.4.5	Eccentricity of connections	200
11.4.6	Fillet weld details	200
11.4.7	Lap joints	200
11.4.8	Transition of thickness or width	201
11.4.9	Beams and girders	201
11.4.10	Splices in compression members	201
11.4.11	Splices in tension members	202
11.4.12	T- and corner joints	202
11.4.13	Connection of components of built-up members	202
11.5	Workmanship	203
11.5.1	Termination of groove welds	203
11.5.2	Groove weld backing	203
11.5.3	Dimensional tolerances	203
11.5.4	Quality of welds	204

## **12 Cyclically-loaded structures — Design and construction** 216

12.1	Scope	216
12.2	Base metal	216
12.3	Design provisions	216
12.3.1	Symbols	216
12.3.2	Design values	217
12.3.3	Base metal and matching electrode classification	217
12.3.4	Fatigue stress provisions	217
12.4	Structural details	220
12.4.1	General	220
12.4.2	Combination of welds	220
12.4.3	Welds in combination with bolts	220
12.4.4	Strength under temporary loads	221

12.4.5	Eccentricity of connections	221
12.4.6	Fillet weld details	221
12.4.7	Lap joints	221
12.4.8	Transition of thickness or widths	222
12.4.9	Beams and girders	222
12.4.10	Splices in compression members	222
12.4.11	Splices in tension members	222
12.4.12	T- and corner joints	223
12.4.13	Connections of components of built-up members	223
12.4.14	Prohibited types of joints and welds	223
12.5	Workmanship	224
12.5.1	Termination of groove welds	224
12.5.2	Groove weld backing	224
12.5.3	Dimensional tolerances	225
12.5.4	Quality of welds	226
12.5.5	Temporary welds	227

---

Annex A (informative)	— Typical prequalified partial joint penetration groove welded joints with SMAW, FCAW, MCAW, and GMAW	258
Annex B (informative)	— Plug and slot welds, and mislocated holes and slots	261
Annex C (informative)	— Prevention of cracks	262
Annex D (informative)	— Welding symbols	264
Annex E (informative)	— Welding definitions	270
Annex F (informative)	— Geometric unsharpness and suggested report forms for examination of welds	315
Annex G (informative)	— Example of weld quality requirements	318
Annex H (normative)	— Material requirements for studs and stud base qualification requirements	319
Annex I (informative)	— Flatness of girder webs — Clause <a href="#">11</a>	327
Annex J (informative)	— Flatness of girder webs — Clause <a href="#">12</a>	331
Annex K (informative)	— Arc spot welds	342
Annex L (informative)	— Hollow structural section (HSS) connections	343
Annex M (informative)	— Strength of welds	348
Annex N (informative)	— Gas metal arc welding (GMAW)	351
Annex O (informative)	— Welding of cast steels for structural applications	358
Annex P (informative)	— Guideline and commentary on alternative methods for determining preheat	359
Annex Q (informative)	— Lamellar tearing	391
Annex R (informative)	— The fatigue life of structures and postweld methods of fatigue life enhancement	397
Annex S (informative)	— Allowable stress design	408
Annex T (informative)	— Description and intended use of electrodes for gas metal arc welding	416
Annex U (normative)	— Welding of fixed steel offshore structures	418
Annex V (informative)	— Electrode classification cross-reference	529
Annex W (informative)	— SFRS seismic welding provisions	531
Annex X (normative)	— Ultrasonic examinations of groove welds using time-corrected gain technique with manual conventional angle beam or manual phased array angle beam ultrasonic testing	549

Annex Y (normative) — Ultrasonic examinations of groove welds using time-corrected gain technique with encoded phased array ultrasonic testing 571

# ***Technical Committee on Welding of Bridges, Buildings, and Machinery***

<b>J. C. Martin</b>	CWB Group, Georgetown, Ontario, Canada <i>Category: General Interest</i>	<i>Chair</i>
<b>T. Verhey</b>	Walters Incorporated, Hamilton, Ontario, Canada <i>Category: Producer Interest</i>	<i>Vice-Chair</i>
<b>V. Andrisani</b>	CWB Group, Burlington, Ontario, Canada	<i>Non-voting</i>
<b>N. Barnes</b>	IRISNDT, Edmonton, Alberta, Canada	<i>Non-voting</i>
<b>A. Crawford</b>	Corey Nutrition Company, Fredericton, New Brunswick, Canada	<i>Non-voting</i>
<b>Y. Elmasri</b>	Walters Inc., Hamilton, Ontario, Canada	<i>Non-voting</i>
<b>R. M. Grant</b>	Grantec Engineering Consultants Inc., Hammonds Plains, Nova Scotia, Canada <i>Category: Engineering Consultant</i>	
<b>D. Hermanutz</b>	Hbndt Consulting Ltd., Beijing, BDA Yizhuang Daxing, China	<i>Non-voting</i>
<b>J. Hobbs</b>	Hobbs Material Engineering Limited, Dartmouth, Nova Scotia, Canada	<i>Non-voting</i>
<b>P. Holloway</b>	Holloway NDT & Engineering Inc., Georgetown, Ontario, Canada <i>Category: User Interest</i>	
<b>A. Jamshidi</b>	Niik Steel/Niik Group, Nanaimo, British Columbia, Canada	<i>Non-voting</i>
<b>S. Keay</b>	Hatch, St. John's, Newfoundland and Labrador, Canada <i>Category: User Interest</i>	

<b>K. Kerluke</b>	KMK & Associates Inc., Erin, Ontario, Canada <i>Category: Engineering Consultant</i>	
<b>P. King</b>	Rapid-Span Structures Ltd., Armstrong, British Columbia, Canada <i>Category: Producer Interest</i>	
<b>M. Lazarek</b>	Pario Engineering and Environmental Sciences, Concord, Ontario, Canada <i>Category: Engineering Consultant</i>	
<b>A. McCartney</b>	Echo-Tech Machine & Tool Ltd., St. Mary's, Ontario, Canada	<i>Non-voting</i>
<b>G. J. McMillan</b>	London, Ontario, Canada <i>Category: User Interest</i>	
<b>K. Mui</b>	Lincoln Electric Company, Coquitlam, British Columbia, Canada <i>Category: General Interest</i>	
<b>T. C. Nguyen</b>	Conestoga College, Cambridge, Ontario, Canada	<i>Non-voting</i>
<b>J. W. Olson</b>	POW Technologies, Ingersoll, Ontario, Canada <i>Category: Engineering Consultant</i>	
<b>J. A. Packer</b>	University of Toronto, Toronto, Ontario, Canada	<i>Non-voting</i>
<b>Z. Radonjic</b>	Pittsburgh Steel Group, Mississauga, Ontario, Canada <i>Category: Producer Interest</i>	
<b>M. Razazian</b>	Arasweld Inc., Richmond Hill, Ontario, Canada <i>Category: Engineering Consultant</i>	
<b>M. Roy</b>	Canam Group, Québec, Québec, Canada <i>Category: Producer Interest</i>	

<b>R. Sanfaçon</b>	Englobe Corp, Québec, Québec, Canada <i>Category: General Interest</i>	
<b>S. Scola</b>	CN Rail, Homewood, Illinois, USA <i>Category: User Interest</i>	
<b>K. Tousignant</b>	Dalhousie University, Halifax, Nova Scotia, Canada	<i>Non-voting</i>
<b>C. Trecartin</b>	Lorneville Mechanical Contractors Ltd., Saint John, New Brunswick, Canada	<i>Non-voting</i>
<b>V. Vaidya</b>	Techno Vogue, Beaconsfield, Québec, Canada <i>Category: User Interest</i>	
<b>T. Van Loon</b>	SELECT-SAI Inc., Green Valley, Ontario, Canada <i>Category: General Interest</i>	
<b>S. Walbridge</b>	University of Waterloo, Waterloo, Ontario, Canada <i>Category: General Interest</i>	
<b>E. J. Whalen</b>	Canadian Institute of Steel Construction (CISC-ICCA), Markham, Ontario, Canada <i>Category: General Interest</i>	
<b>R. Wright</b>	Collins Steel, Edmonton, Alberta, Canada <i>Category: Producer Interest</i>	
<b>T. Siraj</b>	CSA Group, Toronto, Ontario, Canada	<i>Project Manager</i>

### **Dedication**

This edition of CSA W59 is dedicated to the memory of Neil Paolini. Neil will be remembered by the welding community in Canada for his valuable contributions in the field of welding and structural steel. He was an active member on the CSA W59 Technical Committee for over 55 years, leading initiatives that resulted in the introduction of numerous provisions related to the advancement of welding design. Neil also played a central role in the development of CSA W47.1 and CSA S473. His work on the welding of fixed-steel offshore structures was subsequently incorporated as Annex U in CSA W59. He also served as an active member of the Canadian Welding Society (CWS), the International Institute of Welding (IIW), and the Welding Institute of Canada among others. Neil was a recipient of the CSA Award of Merit in 1996.

# Preface

This is the eleventh edition of CSA W59, *Welded steel construction*. It supersedes the previous editions published in 2018, 2013, 2003, 1989, 1984, 1982, 1977, 1970, 1946, and 1940.

The following are the most significant changes to this edition of the Standard:

- a) Clause [3](#) has been revised to add several steels to the prequalified list.
- b) Clause [5](#) has been updated to add clarification on the requirements related to hydrogen designators.
- c) Clause [7](#) has been reworked to provide clarity on roles and responsibilities for welding inspection.
- d) Clause [8](#) includes corrections related to terminology, equipment, and flaw length sizing. Calibration requirements have been revised to reflect digital instrumentation. Allowances for the use of an alternative ultrasonic technique and radiographic imaging systems have been added.
- e) In Clause [10](#), all the figures have been reworked into a new format which arranges prequalified joint-by-joint type rather than by welding process.
- f) As this Standard contains no commentary, various non-mandatory annexes have been included to generate a better understanding of certain aspects of welded steel construction. The annexes of the previous edition of this Standard have generally been reviewed for clarity. In addition,
  - i) Annex [O](#) has been added to define welding of cast steels for structural applications;
  - ii) Annex [W](#) has been added to provide additional requirements for welding consumables, welded fabrication techniques, weld repairs, demand critical welds and welding inspection for seismic-force resisting system (SFRS) of structures; and
  - iii) Annex [X](#) has been added to define an alternative ultrasonic examination technique for manual conventional and manual phased array ultrasound. New acceptance criteria were developed for equivalent sensitivity to the fixed attenuation (Clause [8.2](#)) technique.
- g) Annex [Y](#) has been added to define ultrasonic examinations of groove welds using time-corrected gain technique with encoded phased array ultrasonic testing.

This Standard was prepared by the Technical Committee on Welding of Bridges, Buildings, and Machinery and the Offshore Welding Task Group, under the jurisdiction of the Strategic Steering Committee on Construction and Civil Infrastructure, and has been formally approved by the Technical Committee.

## Notes:

- 1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
- 2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
- 3) *This Standard was developed by consensus, which is defined by CSA Policy governing standardization — Code of good practice for standardization as “substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity”. It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
- 4) *To submit a request for interpretation of this Standard, please send the following information to [inquiries@csagroup.org](mailto:inquiries@csagroup.org) and include “Request for interpretation” in the subject line:*
  - a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
  - b) *provide an explanation of circumstances surrounding the actual field condition; and*
  - c) *where possible, phrase the request in such a way that a specific “yes” or “no” answer will address the issue.*

*Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are available on the Current Standards Activities page at [standardsactivities.csagroup.org](http://standardsactivities.csagroup.org).*