

AWS D1.8/D1.8M:2016
An American National Standard



Structural Welding Code— Seismic Supplement



AWS D1.8/D1.8M:2016
An American National Standard

Approved by the
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Structural Welding Code— Seismic Supplement

3rd Edition

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Prepared by the
American Welding Society (AWS) D1 Committee on Structural Welding

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This code supplements the requirements of AWS D1.1/D1.1M, *Structural Welding Code—Steel*. This code is intended to be applicable to welded joints in Seismic Force Resisting Systems designed in accordance with the AISC Seismic Provisions. Clauses 1–7 constitute a body of rules for the regulation of welding in Seismic Force Resisting Systems. There are seven mandatory annexes in this code. A commentary of the code is included with the document.



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This standard is subject to revision at any time by the AWS D1 Committee on Structural Welding. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS D1 Committee on Structural Welding and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS D1 Committee on Structural Welding to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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Foreword

This foreword is not part of this standard but is included for informational purposes only.

This is the third edition of the AWS D1.8/D1.8M, *Structural Welding Code—Seismic Supplement*.

Editorial and technical revisions from the previous edition are indicated by underlining text. Changes in tables and figures have a single, vertical line in the margin. The following is a list of the most significant revisions from the 2009 edition:

Clause 6 entitled “Fabrication” has been reorganized for user read ability. This reorganization has required renumbering of the majority of the subclauses within Clause 6 as well as extensive reference changes throughout this supplement.

Clause 3: Doubler is now defined.

Clause 4.3: A new clause that defines when joint details for doublers are suitable for use in a prequalified WPS. The clause also states when macroetch tests are required and acceptance criteria for macroetch specimens.

Figure 4.3: A new figure that depicts the doubler to column flange joint detail was added.

5.1.1(1): The words “complete joint penetration groove weld” were added for clarification.

5.1.1(3): The words “in the groove” were added for clarification.

5.1.2: The words “in the flat position” were added for clarification.

6.2.1(2): Solid GMAW electrodes classified in AWS A5.18/A5.18M or AWS A5.28/A5.28M as ER70 or ER80 [ER48 or ER55] tensile strength have been added to the list of exempt filler metals.

6.2.1(4): AWS A5.29/5.29M E70 or E80 [E49 or E55] low alloy FCAW electrodes have been added to the list of exempt filler metals.

6.2.1(5): A new subclause added to the list of exempt filler metals for AWS A5.36/A5.36M:2012, *Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding*.

6.2.1(6): A new subclause was added to the list of exempt filler metals regarding E90 [E62] Low Alloy SMAW, FCAW, GMAW composite (metal cored) and solid electrodes, and low alloy electrode/flux SAW combinations that have been optionally tested by the filler metal manufacturer in accordance with AWS A5.20/A5.20M:2005 Clause 17.

6.2.2: Additional parameters were added to the Lowest Anticipated Service Temperature for 70 ksi, 80 ksi, and 90 ksi [490 MPa, 550 MPa, and 620 MPa] filler metals.

6.3.1.3: ER70 and ER80 [ER48 and ER55] GMAW solid electrodes were added to the list of exceptions.

6.8.1(2): For carbon steel FCAW electrodes classified with the supplemental designator “-D” the heat input range prescribed in Clause 17 of AWS A5.20/A5.20M:2005 was added to the list of acceptable heat input limits.

6.8.1(3): The tensile strength was clarified.

6.8.1(4): For low alloy electrodes classified as 90 ksi [620 MPa] tensile strength, SMAW, GMAW metal core and solid electrodes, FCAW electrodes, and SAW electrode/flux combinations were added to the list of acceptable heat input limits.

6.8.1(5): For AWS A5.36/A5.36M:2012 Clause 16 for carbon and low alloy steel FCAW and GMAW-metal core electrodes classified with the supplemental designator “-D” was added to the list of acceptable heat input limits along with a note offering further explanation.

6.12.3: A new clause regarding tack welds that attach steel backing in the protected zone.

6.14: The words “weld root” were replaced with back weld for clarification.

6.18.6: A new clause regarding the repair of mislocated holes.

6.18.7: A new clause regarding the repair of mislocated stud welds.

6.18.8: A new clause regarding the repair of mislocated screws and shot pins.

Table 6.1: The addition of parameters for 90 ksi [620 MPa] filler metal and a new footnote regarding the offset method.

Table 6.2: The addition of parameters for 90 ksi [620 MPa] filler metal. New footnotes regarding the offset method and additional parameters for LAST.

Table 6.3: AWS A5.36/A5.36M:2012 was added to the table.

Figure 6.1(B): New text depicting the figure was added for clarification.

A4: New text regarding the qualification of E90 [E62] filler metals.

Table A.2: Electrode Classification Strength E90 [E62] was added to the table.

B3: New text regarding the evaluation of E90 [E62] filler metal combinations.

B7: Additional text regarding CVN toughness for welds using 70 ksi, 80 ksi, and 90 ksi [490 MPa, 550 MPa, and 620 MPa].

E3.2: AWS A5.36/A5.36M:2012 Clause 15, Diffusible Hydrogen Test was added as an additional testing procedure option for diffusible hydrogen levels.

G10: Subclause modified for clarification.

Background. Damage sustained by welded steel moment-frame buildings in the 1994 Northridge earthquake, and extensive research conducted by the FEMA/SAC program following that earthquake, demonstrated that in order to obtain adequate performance of welded steel structures under conditions of severe earthquake-induced inelastic straining, additional controls on design, detailing, materials, workmanship, testing, and inspection are necessary. This research resulted in substantive changes to the AISC Seismic Provisions, which control the design of steel Seismic Force Resisting Systems (SFRS) designed to withstand severe inelastic straining as well as certain aspects of the materials and detailing of these systems. The provisions contained in this standard complement the AISC Seismic Provisions and are intended to ensure that welded joints that are designed to undergo significant repetitive inelastic strains as a result of earthquakes, or that are used to connect members designed to resist such inelastic strains, have adequate strength, notch toughness, and integrity to perform as intended. This code, together with AWS D1.1/D1.1M, specifies the acceptable materials, procedures, and workmanship for constructing welded joints in SFRS designed in accordance with the AISC Seismic Provisions as well as the procedures and acceptance criteria for quality control and quality assurance inspection of welded joints in the SFRS. In some regions of the U.S., with low risk of intense earthquake shaking, building codes permit design of steel Seismic Force Resisting Systems that do not conform to the requirements of the AISC Seismic Provisions. The requirements of this code apply only to the SFRS in structures designed in accordance with the AISC Seismic Provisions and need not be applied to structures not designed to those provisions.

Commentary. The Commentary is nonmandatory and is intended only to provide insight, information, and provision rationale.

Normative Annexes. These annexes address specific subjects in the code and their requirements are mandatory requirements that supplement the code provisions.

Errata. All errata to a standard shall be published in the *Welding Journal* and posted on the AWS website (www.aws.org/standards/page/errata).

Suggestions. Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, D1L Subcommittee on Seismic Provisions, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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Structural Welding Code—Seismic Supplement

1. General Requirements

1.1 Scope

The provisions of this code supplement the provisions of AWS D1.1/D1.1M, *Structural Welding Code—Steel*, and shall apply to the design, fabrication, quality control, and quality assurance of welded joints designed in accordance with the *AISC Seismic Provisions for Structural Steel Buildings*. All provisions of AWS D1.1/D1.1M for statically loaded structures shall apply to the designated welds, except as specifically modified herein.

1.2 Standard Units of Measurement

This standard makes use of both U.S. Customary Units and the International System of Units (SI). The latter are shown within brackets ([]) or in appropriate columns in tables and figures. The measurements may not be exact equivalents; therefore, each system must be used independently.

1.3 Safety Precautions

Safety and health issues and concerns are beyond the scope of this standard and therefore are not fully addressed herein. Safety and health information is available from the following sources:

American Welding Society:

- (1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*
- (2) AWS Safety and Health Fact Sheets
- (3) Other safety and health information on the AWS website

Material or Equipment Manufacturers:

- (1) Safety Data Sheets supplied by materials manufacturers
- (2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies

Work performed in accordance with this standard may involve the use of materials that have been deemed hazardous, and may involve operations or equipment that may cause injury or death. This standard does not purport to address all safety and health risks that may be encountered. The user of this standard should establish an appropriate safety program to address such risks as well as to meet applicable regulatory requirements. ANSI Z49.1 should be considered when developing the safety program.