AWS D1.8/D1.8M:2009
An American National Standard

Structural Welding Code—Seismic Supplement

American Welding Society

Approved American National Standard
ANSI

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An American National Standard

Approved by the
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Structural Welding Code—Seismic Supplement

2nd 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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Foreword

This foreword is not part of AWS D1.8/D1.8M:2009, *Structural Welding Code—Seismic Supplement*, but is included for informational purposes only.

This is the second 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 significant revisions in the 2009 edition:

(1) Subclause 1.3—Code limitations have been revised to apply to structures with minimum specified strength of 55 ksi [380 MPa].

(2) Changed Seismic Load Resisting System (SLRS) to Seismic Force Resisting System (SFRS) to be consistent with terminology as revised in AISC Seismic Provisions.

(3) Subclause 4.2—For Welded Connection Details, a new subclause on Transition Thickness and Width for butt joints has been added.

(4) Figures 4.1 and 4.2—New figures added to illustrate detail of the transition of butt joints for unequal thicknesses.

(5) Subclause 6.1.1—New section added to specify acceptability of prequalified and qualified WPS in accordance with the D1.1 code.

(6) Subclause 6.1.2—Clarified the requirement that WPS for Demand Critical Welds utilize variables that produce heat inputs within the filler metal tested heat input envelope.

(7) Subclause 6.1.3—New section adding provisions for the use of filler metals tested as described for the "-D" designator in AWS A5.20/A5.20M:2005 for Demand Critical Welds.

(8) Subclause 6.3.2—Clarified and corrected diffusible hydrogen requirements for filler metals.

(9) Subclause 6.3.5—Restricted exemptions from heat input envelope testing to LAST equal to or greater than 50°F [+10°C].

(10) Subclause 6.3.5(4)—Added an exemption from heat input envelope testing for low alloy FCAW, GMAW, and SAW electrodes that are optionally tested by the filler metal manufacturer in accordance with AWS A5.17 Clause 17 for the "-D" designator.

(11) Subclause 6.3.6—Modified to disallow exemptions from heat input envelope and classification lot testing when LAST is less than +50°F [+10°C].

(12) Subclause 6.3.8—Clarified lot control provisions for filler metals were required only for Demand Critical welds and that lot testing included both classification and heat input envelope tests.

(13) Subclause 6.13—Revised welder identification requirements to permit methods other than the use of stamps or marks on the piece.

(14) Table 6.1—Clarified so that filler metals with 20 ft·lbf [27 J] min. tested at a temperature lower than 0°F [–18°C] meet CVN Toughness Property.

(15) Table 6.2—Clarified requirement for LAST less than +50°F [+10°C] and to permit CVN tests lower than the specified temperature.

(16) Table 6.3—New table added to illustrate requirements for testing diffusible hydrogen of filler metals.

(17) Figure 6.4(B)—Revised to address weld tab removal.

(18) Subclause 6.12—Content from previous edition was moved to subclause 6.9. All subsequent subclauses were renumbered.

(19) Subclause 7.2.4—Deleted qualification of UT Technicians to FEMA requirements.

(20) Subclause 7.8—Revised to require MT of weld tab removal sites only where repaired by additional welding.

(21) Table A.2—Revised to address minimum CVN toughness.

(22) Figure A.1—Revised to allow thicker test plate for SAW.

(23) Clause B8—Provision added for applications with LAST below +50°F [+10°C].

(24) Figure B.1—Location of the CVN specimen was corrected with references to Figure B.2 and B.3.

(25) Annex C—Annex left blank to avoid confusion with the Commentary section. Contents of previous Annex C were moved to Annex D; subsequent annexes were renumbered.

(26) Subclause D3.2.3—Revised so that removal of steel backing is at the Contractor's option.

(27) Subclause D3.2.4—Revised to include a maximum depth for backgouging.

(28) Subclause D4.1—Revised so visual inspection has tighter restrictions.

(29) Subclause D4.2—Added a provision for the removal of the backing to prevent interference with testing.

(30) Figure D.1—Clarified and added tolerances.

(31) Subclause C-4.2—New commentary added on tapered transitions.

(32) Subclause C-6.3.5—Clarified acceptability of CVN tests with higher energy levels or at lower temperatures than those specified.

(33) Subclause C-6.12—Content from previous edition was moved to subclause C-6.9. All subsequent commentary subclauses were renumbered.

(34) Subclause C-6.15.4.3—Added reference to D1.1 for repairs requiring Engineer's approval and repair requirements.

(35) Figure C-6.3—Note requiring Engineer's approval for welding at k-area was removed.

(36) Subclause C-A5.2—New commentary explaining deletion of the two layer per pass requirement.

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.

Mandatory Annexes. These additions to the code are requirements that supplement the text.

Errata. It is the Structural Welding Committee's Policy that all errata should be made available to users of the code. Therefore, any significant errata will be published in the Society News Section of the AWS *Welding Journal* and posted on the AWS web site at: http://www.aws.org/technical/d1/.

Suggestions. Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS D1 Committee on Structural Welding, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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Structural Welding Code—Seismic Supplement

1. General Requirements

1.1 Applicability

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 Responsibilities

1.2.1 Engineer's Responsibilities. In addition to the items listed in AWS D1.1/D1.1M, the Engineer shall provide the following information in the Contract Documents:

(1) Connection configuration, material specifications, and part sizes required to provide the needed seismic performance (see 1.3)

(2) Identification of members that comprise the Seismic Force Resisting System (SFRS) and that are subject to the provisions of this code (see 3.1)

(3) The location of the Protected Zone for members of the SFRS (see 3.3)

(4) Welds designated as "Demand Critical" and subject to specific provisions of this code (see 3.2)

(5) Locations where the removal of backing is required (see 6.7)

(6) Locations where fillet welds are required when backing is permitted to remain (see 6.9)

(7) Locations where the removal of weld tabs is required (see 6.11.3 and 6.11.4)

(8) Locations where fillet welds are required to reinforce groove welds, or to improve connection geometry (see 6.8)

(9) Locations of access holes and the required shape, whether standard AWS D1.1/D1.1M geometry (see 6.10.1.1), standard alternate geometry (see 6.10.1.2), or a special geometry designated by the Engineer (see 6.10.1.3)

(10) The Lowest Anticipated Service Temperature (LAST) of the steel structure for structures that are not normally enclosed and maintained at a temperature of 50°F [10°C] or higher (see 3.5 and 6.3.6)

(11) Butt joints subject to tension where tapered transitions are required (see 4.2)

(12) Those joints or groups of joints in which a specific assembly order, welding sequence, welding technique, or other special precautions are required (see AWS D1.1/D1.1M subclauses 2.2.3 and 5.21)

(13) Quality Assurance Plan (QAP) for the project (see 3.4 and 7.1)

(14) Any additional provisions applicable to the specific project not governed by AWS D1.1/D1.1M or this code.

1.2.2 Contractor's Responsibilities. When this code or the Quality Assurance Plan (QAP) requires the Contractor to retain documentation, the document(s) shall be retained for at least one year after substantial completion of construction. The documents shall be made available to the Engineer, Inspector, or both when requested. When the QAP requires submittal of document(s), submittals shall be made to the Engineer and copies of submittals shall be retained by the Contractor.

1.2.2.1 AWS A5 Specification Certification. Certificates of Conformance for electrodes, fluxes, and shielding gases shall satisfy the applicable AWS A5 specification requirements.

1.2.2.2 Certification of Heat Input Envelope Testing. Certifications that filler metals used to make Demand Critical welds meet the Heat Input Envelope Testing requirements of 6.3.5 and Annex A shall be provided by the filler metal manufacturer. Should the filler metal manufacturer not supply such certifications, the