

**AASHTO/AWS D1.5M/D1.5:2015**  
**An American National Standard**

# Bridge Welding Code

A Joint Publication of  
American Association of State Highway  
and Transportation Officials



**AASHTO/AWS D1.5M/D1.5:2015  
An American National Standard**

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**Bridge Welding Code**

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**Supersedes AASHTO/AWS D1.5M/D1.5:2010**

Prepared by the  
American Welding Society (AWS) D1 Committee on Structural Welding  
AASHTO Highway Subcommittee on Bridges and Structures

Under the Direction of the  
AWS Technical Activities Committee  
AASHTO Executive Committee

Approved by the  
AWS Board of Directors  
AASHTO Board of Directors/Policy Committee

**Abstract**

This code covers the welding requirements for AASHTO welded highway bridges made from carbon and low-alloy constructional steels. This 2015 edition contains dimensions in metric SI Units and U.S. Customary Units. Clauses 1 through 7 constitute a body of rules for the regulation of welding in steel construction. The provisions for Clause 9 have been distributed throughout the D1.5 code. Clauses 8, 10, and 11 do not contain provisions, as their analogue D1.1 sections are not applicable to the D1.5 code. Clause 12 contains the requirements for fabricating fracture critical members.

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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 It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn.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 required 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 AASHTO/AWS D1.5M/D1.5:2015, *Bridge Welding Code*, but is included for informational purposes only.

The original preparation of this specification was undertaken in response to a need for a common welding specification for the fabrication of steel highway bridges across the country. Prior to its publication, the departments of highways and transportation that make up the American Association of State Highway and Transportation Officials (AASHTO) had routinely used other specifications of the American Welding Society (AWS) Structural Welding Committee, with various unique modifications, to produce contract documents suitable for the construction of bridges. The proliferation of disparate requirements resulted in the need for a single specification that could facilitate uniformity and improved economy in steel bridge fabrication, while at the same time addressing the issues of structural integrity and public safety.

The first AWS code for *Fusion Welding and Gas Cutting in Building Construction* was published in 1928. In 1934, a committee was appointed to prepare specifications for the design, construction, alteration, and repair of highway and railway bridges. The first bridge specification was published in 1936. Until 1963, there were separate AWS committees for bridges and buildings. These two committees joined in 1963 to form the Structural Welding Committee of the American Welding Society. The committee has since promulgated standards for the application of welding to the design and construction of structures.

The Federal Highway Administration of the United States Department of Transportation requires states using federal funds for the construction of welded highway bridges to conform to specified standards for design and construction. Conformance to the AWS *Specification for Welded Highway and Railway Bridges* was first specified in the third edition of the AASHTO *Standard Specifications for Highway Bridges* in 1941. In 1962, the Bureau of Public Roads, now the Federal Highway Administration (FHWA), required conformance to a Circular Memorandum, dated November 13, 1962, which transmitted additional provisions for welding A36 steel pending publication of an AWS specification which would contain certain essential provisions not then in the code. Another Circular Memorandum, dated February 11, 1965, specified requirements for CVN testing, and a further Circular Memorandum, dated August 19, 1966, modified provisions of the 1966 Edition of the AWS D2.0-66, *Specification for Welded Highway and Railway Bridges*.

In 1974, AASHTO published the first edition of the *Standard Specification for Welding of Structural Steel Highway Bridges*. The Eleventh Edition of the AASHTO *Standard Specifications for Highway Bridges*, dated 1977, directed “Welding shall conform to the requirements of the AASHTO *Standard Specifications for Welding of Structural Steel Highway Bridges* 1974 and subsequent interim specifications...” AASHTO published the Second and Third editions of the *Standard Specifications for Welding of Structural Steel Highway Bridges* in 1977 and 1981. All of the AASHTO specifications were required to be part of the Contract Documents as modifications or additions to the AWS *Structural Welding Code—Steel*. This was a cumbersome procedure.

In 1982, a subcommittee was formed jointly by AASHTO and AWS, with equal representation from both organizations, to seek accommodation between the separate and distinct requirements of bridge owners and existing provisions of AWS D1.1. The *Bridge Welding Code* is the result of an agreement between AASHTO and AWS to produce a joint AASHTO/AWS *Bridge Welding Code* for steel bridges that addresses essential AASHTO needs and makes AASHTO revisions mandatory.

The first edition of the *Bridge Welding Code*, published in 1988, provided for the qualification of welding procedures by test to assure that welds have the strength, ductility, and toughness necessary for use in redundant structures. Nonredundant fracture critical bridge members were not provided for in the first edition of the code. While qualification of welding procedures is required, a major effort has been made to specify the minimum number of tests and the simplest tests

that give reasonable assurance of required mechanical properties. Efforts are made to discourage individual States from requiring duplication of weld testing unless that testing is specified in the bid documents. Special attention is directed to avoidance of unnecessary hardening of base metal HAZs and the avoidance of hydrogen and other items that can lead to weld or base-metal cracking.

Consequently, while the D1.5-88 document has a superficial resemblance to D1.1 in its general format, there are significant differences that users should be aware of, among them the lack of provisions relating to statically loaded structures, tubular construction or the modification of existing structures. Users are encouraged to develop their own requirements for these applications or use existing documents (e.g., D1.1) with the appropriate modifications.

**Changes in Code Requirements.** Underlined text in the clauses, subclauses, tables, figures, or forms indicates a change from the 2010 edition. A vertical line in the margin of a table or figure also indicates a change from the 2010 edition.

The publication of AASHTO/AWS D1.5M/D1.5:2015 was justified by the need to monitor, revise, and update code provisions based on the needs of AASHTO member states and industry. The following is a list of the most significant revisions in the 2015 edition:

### Summary of Changes

| Clause/Table/<br>Figure/Annex | Modification  |
|-------------------------------|---|
| 2.11.3                        | Created to include groove welds in corner and T-joints. As such, this requirement was deleted from the notes for Figures 2.4 and 2.5; it was note f in the 2010 edition.  |
| 3.5.6.1                       | Modified to clarify how variation from flatness is measured.  |
| 3.5.1.7                       | Revised to include directions on how to measure combined warpage and tilt of flange.  |
| 3.6                           | Reorganized for clarification and now includes new subclauses on fillet welds, groove welds, removal of weld reinforcement, and surface finish.   |
| 3.6.2                         | Revised to clarify weld reinforcement and associated ground flush requirements.   |
| Figure 3.3                    | Created to show flange offset for tube girders.   |
| 4.1.3                         | Revised consumable requirements to establish two approaches - manufacturer quality assurance and heat or lot testing.   |
| 4.1.4                         | Revised and reorganized for the clarification of consumable certifications.   |
| 4.2.7                         | Expanded with two new subclauses on the extent of preheat and interpass.  |
| 4.10 and 4.11                 | Consolidated into new subclause 4.10.   |
| Table 4.1                     | Test requirements were extracted and placed as new Table 5.1.   |
| Clause 5                      | Revised the heat input qualification by broadening voltage limits and adding a new amperage limit table; for the production qualification method, removed prequalification-based restrictions in lieu of variable qualified by test; and removed the groove weld requirement for qualification of single-pass fillet weld procedures. |
| 5.3                           | Removed expiry limits for nonfracture critical PQRs.  |
| Table 5.1                     | Content extracted from Table 4.1 in the 2010 edition.   |
| Table 5.4                     | Modified to include qualification requirements with Figure 5.8 with the exception of EGW.   |
| Table 5.10                    | Created to indicate the amperage limits for heat input welding procedure qualification.   |
| Figure 5.8                    | Modified to include dihedral angle.   |

## Summary of Changes (Continued)

| Clause/Table/<br>Figure/Annex | Modification   |
|-------------------------------|--|
| 6.7.6.2                       | Revised to include pulsed DC.  |
| 6.7.8                         | Created to introduce phased array ultrasonic testing.  |
| 12.6.1                        | (Heat or Lot Testing) was deleted.   |
| 12.7.4                        | Revised to indicate no limits to the period of effectiveness for fillet weld soundness test and increase the period of effectiveness for PQRs from 36 months to 60 months. |
| Annex K                       | New annex that addresses phased array ultrasonic testing.  |
| C-12.6.1.1                    | Deleted.   |
| C-12.7.3                      | Deleted.   |
| C-Annex K                     | New commentary added for Annex K.  |
| Global                        | “Chemistry” replaced with “Chemical composition.”  |
| Global                        | “Grade 100” replaced with “HPS 100W.”  |

**Commentary.** The Commentary is nonmandatory and is intended only to provide insightful information into provision rationale.

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

**Informative Annexes.** These annexes are not code requirements but are provided to clarify code provisions by showing examples, providing information, or suggesting alternative good practices.

**Index.** As in previous codes, the entries in the Index are referred to by subclause number rather than by page number. This should enable the user of the Index to locate a particular item of interest in minimum time.

**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 *Welding Journal* and posted on the AWS web site at: <http://www.aws.org/technical/d1/>.

**Suggestions.** Your comments for improving AWS D1.5M/D1.5:2015, *Bridge Welding Code* are welcome. Submit comments to the Managing Director, Technical Services Division, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166; telephone (305) 443-9353; fax (305) 443-5951; e-mail [info@aws.org](mailto:info@aws.org); or via the AWS web site <<http://www.aws.org>>.



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# Bridge Welding Code

## 1. General Provisions

### 1.1 Application

**1.1.1** This code covers welding fabrication requirements applicable to welded highway bridges. The code is applicable to both shop and field fabrication of steel bridges and bridge components. The code is to be used in conjunction with the *AASHTO Standard Specification for Highway Bridges* or the *AASHTO LRFD Bridge Design Specifications*.

The code is not intended to be used for the following:

- (1) Steels with a minimum specified yield strength greater than 690 MPa [100 ksi]
- (2) Pressure vessels or pressure piping
- (3) Base metals other than carbon or low-alloy steels
- (4) Structures composed of structural tubing

Fabrication of structures or components not specifically addressed by this code shall be performed in conformance with the special provisions of the contract or in conformance with the written directives of the Engineer who may choose to reference an alternate applicable welding standard.

**1.1.2** The fundamental premise of the code is to provide general stipulations applicable to any routine bridge situation. Acceptance criteria for production welds different from those described in the code may be used for a particular application, provided they are suitably documented by the proposer and approved by the Engineer.

Such alternate acceptance criteria may be based on the evaluation of suitability for service using past experience, experimental evidence, or engineering analysis considering material type, service load effects, and environmental factors.

**1.1.3** The term *Engineer* as used in this code shall mean the State Bridge Engineer, or the Bridge Engineer's designated representative. The Engineer acts on behalf of the State or Owner and unless otherwise specified, shall

be the Owner's official representative. All references to acceptance or approval shall mean acceptance or approval by the Engineer.

**1.1.4** The term *Contractor* as used in this code indicates the party responsible for performing the work as required by the contract documents. The term Contractor is used collectively to mean contractor, manufacturer, fabricator, erector, or other party performing the work.

### 1.2 Base Metal

**1.2.1 Specified Base Metal.** The contract documents shall designate the specification and classification of base metals to be used.

**1.2.2 Approved Base Metals.** Unless otherwise specified, base metals to be welded under this code shall meet the requirements of the latest edition of AASHTO M 270M/M 270 (ASTM A709/A709M) for the grade of steel shown on the plans or described in the specifications. All Grade 345 (50) steel that is to be welded shall be Type 1, 2, or 3. Other steels may be approved by the Engineer. Thickness limitations shall not apply to bearing components.

M 270M/M 270 steels of a designated grade are essentially the same as ASTM A709/A709M steels of the same grade. The provisions of this code are not intended for use with steels having a minimum specified yield strength over 690 MPa [100 ksi].

**1.2.3 Thickness Limitations.** The provisions of this code do not apply to welding base metals less than 3 mm [1/8 in] thick. Where base metals thinner than 3 mm [1/8 in] are to be welded, the requirements of AWS D1.3/D1.3M, *Structural Welding Code—Sheet Steel*, should apply. When used in conjunction with AWS D1.3/D1.3M, the applicable provisions of this code shall be observed.