



Structural Welding Code— Reinforcing Steel

**Including Metal
Inserts and
Connections in
Reinforced Concrete
Construction**



American Welding Society



**AWS D1.4/D1.4M:2011
An American National Standard**

**Approved by the
American National Standards Institute
January 31, 2011**

Structural Welding Code— Reinforcing Steel

Including
Metal Inserts and Connections
in Reinforced Concrete
Construction

7th Edition

Supersedes AWS D1.4/D1.4M:2005

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

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This code covers the requirements for welding reinforcing steel in most reinforced concrete applications. It contains a body of rules for the regulations of welding reinforcing steel and provides suitable acceptance criteria for such welds.



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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 It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn.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, 550 N.W. LeJeune Road, Miami, FL 33126.

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Foreword

This foreword is not part of AWS D1.4/D1.4M:2011, *Structural Welding Code—Reinforcing Steel*, but is included for informational purposes only.

In 1961, the American Welding Society published its first reinforcing steel welding standard, AWS D12.1-61, *Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction*. The D12 Committee was disbanded some time after publication of the 1961 code and before publication of the 1975 edition.

The 1961 document was replaced with a greatly revised version, AWS D12.1-75, *Reinforcing Steel Welding Code*, with the format patterned after the AWS D1.1-72, *Structural Welding Code*. The 1975 code was produced by the AWS Structural Welding Committee but was not renumbered to reflect this committee change. As with ANSI/AWS D1.1, AWS D12.1-75 was designed as a self-contained code, including within it the qualification of welders and procedures, and requirements for workmanship, quality, and inspection.

The listings of materials and welding processes were revised in the D12.1-75 code. Items newly introduced were the carbon equivalent method for determining preheat, the parenthetical inclusion of metric (SI) conversions, and the two different methods of joint strength determination.

The AWS D12.1-75 document was revised and the title changed to ANSI/AWS D1.4-79, *Structural Welding Code—Reinforcing Steel*. Since the 1979 edition of ANSI/AWS D1.4, *Structural Welding Code—Reinforcing Steel*, was issued, further use by designers, engineers, and fabricators has necessitated a number of changes to the requirements; the 1992, 1998, and 2005 editions reflected these changes. This edition, AWS D1.4/D1.4M:2011, has additional revisions.

The following is a summary of the significant technical revisions in this edition:

1. Subclause 1.2.1 was revised to address precast concrete components.
2. New definitions were added under 1.5.
3. Safety information was clarified in 1.7.
4. Figure 2.1 was revised to clarify the centerline, nominal radius, and effective throat.
5. Subclause 3.2.1 was revised to address indirect butt joints.
6. Figure 3.2 was updated to illustrate degree ranges in all sketches.
7. Figures 3.3 and 3.4 were revised to restrict the gaps between bars to nothing over 1/4D or 3/16 in [5 mm], whichever is less.
8. Subclause 4.4.2 was modified to differentiate between the sum of maximum dimensions of all porosity versus maximum dimensions of any single porosity or fusion-type discontinuity.
9. New subclause 5.1.3 was added to address coated reinforcing steel and filler metal selection.
10. Subclause 5.3 was added to list requirements for maximum wind velocity and minimum ambient temperature.
11. New subclauses 5.10 and 5.11 were added to restrict electrodes used for GMAW and FCAW.
12. Subclause 5.12 was added to restrict the shielding gas used for GMAW and FCAW-G.
13. Table 5.1 was updated to meet the most current A5 specifications.
14. Clause 6 was revised to list the details for fillet weld prequalified essential variables.
15. New Table 6.1 lists the prequalified essential variables for fillet welds.
16. The essential variable requiring requalification for a change in the shape or any one type of groove was removed from Table 6.2.
17. Table 6.4 was corrected to include lap joints in indirect butt joints.
18. New Table 6.5 was added to clarify acceptance criteria for macroetch.
19. Figure 6.4 was updated.
20. All sketches in Figures 6.5 and 6.6 were redrawn for clarity.
21. New Figure 6.7 was added to illustrate welder qualification tests for fillet weld to plate.

22. Figures 7.1 and 7.2 were redrawn to increase the backing to 3/16 in [5 mm].

23. Annex B was updated.

Changes in Code Requirements. Underlined text in the subclauses, tables, or figures indicates an editorial or technical change from the 2005 edition. A vertical line in the margin indicates a revision from the 2005 edition.

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.

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 D1.4/D1.4M:2011, *Structural Welding Code—Reinforcing Steel* are welcome. Submit comments to the Managing Director, Technical Services Division, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126; telephone (305) 443-9353; fax (305) 443-5951; e-mail info@aws.org; or via the AWS web site <<http://www.aws.org>>.

Table of Contents

	Page No.
<i>Personnel</i>	v
<i>Foreword</i>	vii
<i>Table of Contents</i>	ix
<i>List of Tables</i>	xi
<i>List of Figures</i>	xi
1. General Provisions	1
1.1 Scope	1
1.2 Application	1
1.3 Reinforcing Steel Base Metal	1
1.4 Welding Processes	2
1.5 Definitions	2
1.6 Welding Symbols	2
1.7 Safety Precautions	3
1.8 Standard Units of Measurement	3
1.9 <u>Reference Documents</u>	3
2. Allowable Stresses	5
2.1 Base-Metal Stresses	5
2.2 Allowable Stresses in Welds	5
2.3 Effective Weld Areas, Lengths, Throats, and Sizes	5
3. Structural Details	9
3.1 Transition in Bar Size <u>Number</u>	9
3.2 Eccentricity	9
3.3 Joint Types	9
3.4 Direct Butt Joints	9
3.5 Indirect Butt Joints	9
3.6 Lap Joints	9
3.7 Interconnection of Precast Members	9
4. Workmanship	17
4.1 Preparation of Base Metal	17
4.2 Assembly	17
4.3 Control of Distortion, Shrinkage, and Heat	17
4.4 Quality of Welds	18
5. Technique	21
5.1 Filler Metal Requirements	21
5.2 Minimum Preheat and Interpass Temperature Requirements	21
5.3 Welding Environment	21
5.4 Arc Strikes	22
5.5 Weld Cleaning	22
5.6 Tack Welds	22
5.7 Progression of Welding	22
5.8 Welding of Coated Base Metal	22
5.9 SMAW Electrodes	22

5.10	<u>GMAW Electrodes</u>	23
5.11	<u>FCAW Electrodes</u>	23
5.12	<u>Shielding Gas</u>	23
6.	Qualification	27
6.1	General	27
6.2	WPS Qualification	27
6.3	Welder Qualification	29
6.4	Retests	31
6.5	Period of Effectiveness	31
6.6	Records	32
7.	Inspection	45
7.1	General Requirements	45
7.2	Inspection of Base Metals	45
7.3	Inspection of WPS Qualification and Equipment	45
7.4	Inspection of Welder Qualifications	45
7.5	Inspection of Work and Records	45
7.6	Obligations of the Contractor	46
7.7	Nondestructive Testing	46
7.8	Personnel Qualification	46
7.9	Radiographic Testing	47
	Annex A (Informative)—Sample Welding Forms	53
	Annex B (Informative)—Nominal Dimensions of ASTM Standard Reinforcing Bars	59
	Annex C (Informative)—Guidelines for the Preparation of Technical Inquiries for Structural Welding Committee	61
	Annex D (Informative)—Safe Practices	63
	Annex E (Informative)—Temperature-Moisture Content Charts	71
	List of AWS Documents on Structural Welding Code	73

List of Tables

Table		Page No.
2.1	Allowable Stresses in Welds	6
3.1	CJP Groove Weld Requirements for Direct Butt Joints	10
4.1	Radiographic Acceptance Criteria	18
5.1	Matching Filler Metal Requirements	24
5.2	Minimum Preheat and Interpass Temperatures	25
5.3	Permissible Atmospheric Exposure of Low-Hydrogen Electrodes	25
6.1	<u>Prequalified WPS Fillet Weld Requirements</u>	32
6.2	PQR Essential Variable Changes Requiring WPS Requalification for SMAW, GMAW, and FCAW	33
6.3	Number and Type of Tests for WPS Qualification	34
6.4	Welder Qualification—Number, Type of Test, Production Welds, and Positions Qualified	35
6.5	<u>Macroetch Acceptance Criteria</u>	36
7.1	Hole-Type Image Quality Indicator (IQI) Requirements	50

List of Figures

Figure		Page No.
2.1	Effective Throat for Flare-Groove Welds	7
3.1	Direct Butt Joints Showing Transition Between Bars of Different Sizes	10
3.2	Direct Butt Joints	11
3.3	Indirect Butt Joints	12
3.4	Lap Joints	13
3.5	Details of Joints of Anchorages, Base Plates, and Inserts	14
4.1	<u>Minimum Distance to Cold Bending Radius Tangent Points</u>	19
4.2	<u>Acceptable and Unacceptable Weld Profiles</u>	20
6.1	Direct Butt Joint Test Positions for Groove Welds	36
6.2	Indirect Butt Joint Test Positions for Flare-Groove Welds or Fillet Welds	37
6.3	Positions of Groove Welds	38
6.4	Positions of Fillet Welds	39
6.5	Full Section Tension Test Specimens for WPS Qualification Tests	40
6.6	Full Section Tension Test and Macroetch Test Specimens for Welder Qualification Tests	42
6.7	<u>Bend Test Specimen for Welder Qualification Tests</u>	43
7.1	<u>Source Position</u>	51
7.2	<u>Film Placement</u>	52
E.1	Temperature-Moisture Content Chart to be Used in Conjunction with Testing Program to Determine Extended Atmospheric Exposure Time of Low-Hydrogen Electrodes	66
E.2	Application of Temperature-Moisture Content Chart in Determining Atmospheric Exposure Time of Low-Hydrogen Electrodes	67

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Structural Welding Code—Reinforcing Steel

1. General Provisions

1.1 Scope

The code shall apply to the welding of the following:

1. Reinforcing steel to reinforcing steel, and
2. Reinforcing steel to carbon or low-alloy structural steel.

When the code is stipulated in contract documents, conformance with all provisions shall be required, except for those provisions that the Engineer or contract documents specifically modifies or exempts.

1.2 Application

1.2.1 This code shall be used in conjunction with the prescribed general building code requirements and is applicable to all welding of reinforcing steel, using the processes listed in 1.4, and performed as a part of reinforced concrete construction or in the manufacture of precast concrete components.

1.2.2 The weldments specified in this code shall not be used where impact properties are a requirement of the general specification. Impact testing requirements of welded reinforcing bars are not included in this code.

1.2.3 All references to the need for approval shall be interpreted to mean approval by the Engineer.

1.3 Reinforcing Steel Base Metal

1.3.1 Reinforcing steel base metal in this code shall conform to the requirements of the latest edition of one of the ASTM specifications listed within this paragraph. Combinations of any of these reinforcing steel base metals, when welded, shall use a WPS (welding procedure specification) qualified in conformance with Clause 6:

1. ASTM A 82/A 82M
2. ASTM A 496/A 496M
3. ASTM A615/A615M
4. ASTM A 706/A 706M
5. ASTM A 767/A 767M zinc-coated (galvanized) steel reinforcing bars that meet the requirements of ASTM A615/615M or ASTM A706/706M
6. ASTM A 775/A 775M epoxy-coated steel reinforcing bars that meet the requirements of ASTM A615/615M or ASTM A706/706M
7. ASTM A 934/A 934M epoxy-coated prefabricated steel reinforcing bars that meet the requirements of ASTM A615/615M or ASTM A706/706M

Manufacturing and testing requirements for mats and fabric are covered by the respective ASTM specification. For joining the ASTM A 82/A 82M and A 496/A 496M to other reinforcing wires, reinforcing bars, or structural steels, the Engineer shall specify filler metal and the provisions of this code shall apply.

1.3.2 When a reinforcing steel not listed in 1.3.1 is approved under the provisions of the general building code or by the Engineer, its chemical composition and carbon equivalent shall be provided and welding procedure shall be qualified in accordance with the requirements of 6.2 and all other requirements prescribed by the Engineer.

1.3.3 Base metal, other than those previously listed, shall be one of the structural steels listed in the latest edition of AWS D1.1, *Structural Welding Code—Steel*, or any steel stipulated in the contract documents or approved by the Engineer.