AWS D1.2/D1.2M:2008
An American National Standard

Structural Welding Code—Aluminum

American Welding Society

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Structural Welding Code—Aluminum

Fifth 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 covers the welding requirements for any type structure made from aluminum structural alloys, except for aluminum pressure vessels and pressure piping. Clauses 1 through 7 constitute a body of rules for the regulation of welding in aluminum construction. A commentary on the code is also 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 It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn.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 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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Dedication

In Memoriam

Paul B. Dickerson
1926–2004

This issue of AWS D1.2, *Structural Welding Code—Aluminum*, is dedicated to the memory of Paul B. Dickerson. Paul was instrumental in the inception of the first *Structural Welding Code—Aluminum* and a moving force in its growth over the years. Paul was an internationally renowned engineer, as well as an educator and mentor to many in the welding community. He was always ready to share his almost immeasurable expertise with anyone who needed help. His good nature and humor made it a joy to work with him.

Paul will be greatly missed by all of us.

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Foreword

This foreword is not part of AWS D1.2/D1.2M:2008, *Structural Welding Code—Aluminum*, but is included for informational purposes only.

In the early 1970s, interest was expressed in developing a consolidated code for the structural welding of aluminum similar to the AWS D1.1, *Structural Welding Code—Steel*. Because of the interest of both The Aluminum Association and the American Welding Society, it was decided to begin in the mid-70s the task of developing a structural welding code for aluminum. Initially, the effort was undertaken by a task force of The Aluminum Association. In 1979, this task force became a subcommittee of the AWS Structural Welding Committee and the *Structural Welding Code—Aluminum* resulted from the continued activity of that subcommittee.

The first edition of the *Structural Welding Code—Aluminum* (hereafter referred to as the *code*) represented the continuing AWS policy to provide standards for structural welding. This code is provided for the fabrication, erection and manufacturing industries as a set of rules and regulations for the welding of structural aluminum. Some of the more important aspects of this edition of the code are outlined in the following paragraphs.

Recommended joint details have been prepared for numerous complete joint penetration groove welded joints. Herein lies one of the major differences between the *Structural Welding Code—Steel* and this code. While the steel code allows for prequalified welding procedures, this code does not. This is mainly because of the many and varied possible welding conditions that can be obtained with semiautomatic welding variables most often used with aluminum and the wide range of both heat-treatable and nonheat-treatable alloys that may be welded under this code. Therefore, all of the joint details and the welding procedures used with this code shall be individually qualified and included in the Welding Procedure Specification (WPS).

Procedures and standards are outlined for several methods of nondestructive testing. Methods included are visual, radiographic and dye-penetrant. Ultrasonic testing is permitted, but the procedure and acceptance criteria shall be specified in the contract documents.

This code does not concern itself with such design considerations as the arrangements of parts, loading, and the computation of stresses for proportioning the load-carrying members of a structure and their connection. Such considerations, it is assumed, are covered elsewhere in a general code or specification, such as the *Specification for Aluminum Structures* (The Aluminum Association).

Many of the users of this code will also be users of the *Structural Welding Code—Steel*. As a result, it was felt that as much similarity as possible between the codes for steel and aluminum should be achieved. Thus, the same general format was used in the development of the 1983 and 1990 editions of the aluminum code as in the steel code. The D1.2-97 code was reorganized so that the 1990 Clauses 4 and 5 (Technique and Qualification) were merged into one new Clause 4. Furthermore, Appendix H of D1.2-90 was moved to after the Preface. Clauses 1 through 7 constitute a body of rules for the regulation of welding on aluminum structures. The 2003 edition represented a major reorganization of the D1.2-97 format. For example, Clauses 7, 8, and 9 of D1.2-97 were eliminated, and their provisions distributed throughout the code.

In this edition of D1.2/D1.2M:2008, the following major revisions have been made:

(1) Addition of design criteria for PJP groove welds for GTAW and GMAW.

(2) Addition of new alloys in Tables 3.2, 4.2, 6.2, and 6.3; new materials in Table 4.1.

(3) Revision of positions qualified in Table 3.3 for Pipe-Groove CJP.

(4) Modifications made to Figure 3.18.

(5) Addition of new Table 4.6 for Weld Appearances.

(6) Inclusion of acceptance criteria for RT in tubular connections in 5.15.2.

(7) Deletion of Table 5.3, Acceptable Undercut Values; Table 5.5, Acceptance Criteria—Class I Structures; Table 4.6, Acceptance Criteria—Class II Structures; and Table 4.7, Maximum Acceptable Porosity in Radiographs for Any 3 in Length Weld.

(8) Figure 5.8 extensively modified and renamed as Maximum Acceptable Discontinuities RT Images.

(9) Deletion of Figure 5.9, Acceptable Undercut for Total Length of Joint—Class I Tubular Structures.

(10) Inclusion of recommended partial penetration groove welded joints in Annex B.

(11) Deletion of Annex L, Reorganization.

(12) Removal of Commentary C-4.19 and C-5.14.

(13) Addition of visual radiography standards.

(14) Inclusion of standards for visual inspection of surface porosity.

All editorial and technical changes to the text are indicated by underlining. Changes to illustrations are indicated by a single vertical line.

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

Suggestions. Your comments for improving AWS D1.2/D1.2M:2008, *Structural Welding Code—Aluminum*, 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>.

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1. General Requirements

1.1 Scope

This code contains the requirements for fabricating and erecting welded aluminum structures. When this code is stipulated in the contract documents, conformance with all provisions of the code shall be required, except those provisions that the Engineer or contract documents specifically modifies or specifically exempts.

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 other sources, including, but not limited to, ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, and applicable federal, state, and local regulations.

1.1.1 Limitations. This code is not intended for specialized fabrication such as pressure vessels or pressure piping.

1.1.2 Alternate Requirements. Alternate requirements from those in this code shall be submitted to the Engineer for approval. These requirements shall be based on experience, experimental evidence, or engineering analyses, and shall consider materials, loads, and environment.

1.2 Approval

All references to the need for approval shall be interpreted to mean approval by the Building Commissioner or the Engineer. Hereinafter, the term *Engineer* shall be used, and is to be construed to mean the Building Commissioner or the Engineer.

1.3 Definitions

The welding terms used in this code shall be interpreted in conformance with the definitions given in the latest edition of AWS A3.0, *Standard Welding Terms and Definitions, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*.

1.4 Welding Symbols

Welding symbols shall be those shown in the latest edition of AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*. Special conditions shall be fully explained by added notes or details.

1.5 Safety Precautions

This technical document does not address all welding and health hazards. However, pertinent information can be found in the following documents:

(1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*

(2) Manufacturer's safety literature on equipment and materials

(3) Other pertinent documents as appropriate.

These documents shall be referred to and followed as required (also see Annex J, Safe Practices).

NOTE: This code may involve hazardous materials, operations, and equipment. The code does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices. The user should determine the applicability of any regulatory limitations prior to use.

1.6 Standard Units of Measure

This standard makes use of both U.S. Customary Units and the International System of Units (SI). The measurements may not be exact equivalents; therefore, each system shall be used independently of the other without combining in any way. The standard with the designation D1.2:2008 uses U.S. Customary Units. The standard designation D1.2M:2008 uses SI Units. The latter are shown within brackets [ ] or in appropriate columns in tables and figures.

1.7 Reference Documents

Annex A contains a list of all documents referenced in this code.