

AWS D8.8M:2014
An American National Standard

Specification for Automotive Weld Quality—Arc Welding of Steel



American Welding Society®



AWS D8.8M:2014
An American National Standard

Approved by the
American National Standards Institute
September 9, 2014

Specification for Automotive Weld Quality— Arc Welding of Steel

Supersedes AWS D8.8M:2007

Prepared by the
American Welding Society (AWS) D8 Committee on Automotive Welding

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This specification provides the minimum quality requirements for arc welding of various types of automotive and light truck components. This specification covers the arc and hybrid arc welding of coated and uncoated steels.



American Welding Society®

ISBN: 978-0-87171-857-0
© 2014 by American Welding Society
All rights reserved
Printed in the United States of America

Photocopy Rights. No portion of this standard may be reproduced, stored in a retrieval system, or transmitted in any form, including mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright owner.

Authorization to photocopy items for internal, personal, or educational classroom use only or the internal, personal, or educational classroom use only of specific clients is granted by the American Welding Society provided that the appropriate fee is paid to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, tel: (978) 750-8400; Internet: <www.copyright.com>.

Statement on the Use of American Welding Society Standards

All standards (codes, specifications, recommended practices, methods, classifications, and guides) of the American Welding Society (AWS) are voluntary consensus standards that have been developed in accordance with the rules of the American National Standards Institute (ANSI). When AWS American National Standards are either incorporated in, or made part of, documents that are included in federal or state laws and regulations, or the regulations of other governmental bodies, their provisions carry the full legal authority of the statute. In such cases, any changes in those AWS standards must be approved by the governmental body having statutory jurisdiction before they can become a part of those laws and regulations. In all cases, these standards carry the full legal authority of the contract or other document that invokes the AWS standards. Where this contractual relationship exists, changes in or deviations from requirements of an AWS standard must be by agreement between the contracting parties.

AWS American National Standards are developed through a consensus standards development process that brings together volunteers representing varied viewpoints and interests to achieve consensus. While AWS administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its standards.

AWS disclaims liability for any injury to persons or to property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this standard. AWS also makes no guarantee or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this standard available, AWS is neither undertaking to render professional or other services for or on behalf of any person or entity, nor is AWS undertaking to perform any duty owed by any person or entity to someone else. Anyone using these documents should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. It is assumed that the use of this standard and its provisions is entrusted to appropriately qualified and competent personnel.

This standard may be superseded by new editions. This standard may also be corrected through publication of amendments or errata, or supplemented by publication of addenda. Information on the latest editions of AWS standards including amendments, errata, and addenda is posted on the AWS web page (www.aws.org). Users should ensure that they have the latest edition, amendments, errata, and addenda.

Publication of this standard does not authorize infringement of any patent or trade name. Users of this standard accept any and all liabilities for infringement of any patent or trade name items. AWS disclaims liability for the infringement of any patent or product trade name resulting from the use of this standard.

AWS does not monitor, police, or enforce compliance with this standard, nor does it have the power to do so.

Official interpretations of any of the technical requirements of this standard may only be obtained by sending a request, in writing, to the appropriate technical committee. Such requests should be addressed to the American Welding Society, Attention: Managing Director, Technical Services Division, 8669 NW 36 St, # 130, Miami, FL 33166 (see Annex A). With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. These opinions are offered solely as a convenience to users of this standard, and they do not constitute professional advice. Such opinions represent only the personal opinions of the particular individuals giving them. These individuals do not speak on behalf of AWS, nor do these oral opinions constitute official or unofficial opinions or interpretations of AWS. In addition, oral opinions are informal and should not be used as a substitute for an official interpretation.

This standard is subject to revision at any time by the AWS D8 Committee on Automotive 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 D8 Committee on Automotive 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 D8 Committee on Automotive 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.

This page is intentionally blank

Personnel

AWS D8 Committee on Automotive Welding

D. L. Galiher, Chair	<i>Tower International</i>
T. Coon, 1st Vice Chair	<i>Ford Motor Company</i>
M. D. Tumuluru, 2nd Vice Chair	<i>U. S. Steel</i>
E. H. Abrams, Secretary	<i>American Welding Society</i>
G. Armstrong	<i>Yachiyo of Ontario Mfg. Inc.</i>
J. E. Beckham	<i>Chrysler Group LLC</i>
J. C. Bohr	<i>General Motors</i>
W. H. Brafford	<i>Tuffaloy Products, Incorporated</i>
J. W. Dolfi	<i>Consultant</i>
F. W. Hunt	<i>Hitachi America, Limited</i>
J. G. Hunt	<i>AET Integration, Incorporated</i>
C. Jiang	<i>AET Integration, Incorporated</i>
S. C. Kelley	<i>Arcelor Mittal</i>
D. P. Kelly	<i>Fusion Welding Solutions</i>
D. R. Kolodziej	<i>Ford Motor Company (Retired)</i>
D. F. Maatz, Jr	<i>R & E Automated Systems LLC</i>
T. W. Morrissett	<i>SDK Engineering, LLC</i>
J. S. Noruk	<i>Servo Robot Corporation</i>
W. F. Qualls	<i>Consultant</i>

Advisors to the AWS D8 Committee on Automotive Welding

E. Cross-Smith	<i>Meggitt Aircraft Braking Systems</i>
W. Doneth	<i>Fronius USA LLC</i>

AWS D8C Subcommittee on Automotive Arc Welding of Steel

J. S. Noruk, Chair	<i>Servo Robot Corporation</i>
E. H. Abrams, Secretary	<i>American Welding Society</i>
B. Allen	<i>BMW Manufacturing Corporation</i>
G. Armstrong	<i>Yachiyo of Ontario Mfg. Inc.</i>
E. Biro	<i>ArcelorMittal</i>
J. C. Bohr	<i>General Motors North America</i>
R. Carlson	<i>NAO/CRW</i>
E. Cross-Smith	<i>Meggitt Aircraft Braking Systems</i>
R. M. Dull	<i>Edison Welding Institute</i>
B. J. Farkas	<i>Maxal Inc.</i>
M. D. Gartner	<i>Midway Products Group</i>
K. W. Gerhart	<i>Edison Welding Institute</i>
M. Herbert	<i>Retired</i>
J. G. Hunt	<i>AET Integration</i>
R. A. Krause	<i>AlcoTec Wire Corporation</i>
T. Lowe	<i>Spec-Weld Technologies, Incorporated</i>
W. A. Marttila	<i>WAMcom Consulting LLC</i>
H. R. Mistry	<i>Cosma International</i>
M. P. Morgan	<i>The Lincoln Electric Company</i>
M. D. Tumuluru	<i>U.S. Steel</i>
A. Anderson	<i>ITW Welding North America's Company</i>

Advisors to the AWS D8C Subcommittee on Automotive Arc Welding of Steel

D. L. Galiher	<i>Tower International</i>
E. T. Hetrick	<i>Ford Motor Company</i>

Special Contributor

E. Boan	<i>John Deere Seeding</i>
---------	---------------------------

This page is intentionally blank

Foreword

This foreword is not part of AWS D8.8M:2014, *Specification for Automotive Weld Quality—Arc Welding of Steel*, but is included for informational purposes only.

This specification was developed by the AWS D8C Subcommittee on Automotive Arc Welding of Steel of the AWS D8 Committee on Automotive Welding.

Arc welding of truck and car frame structures with relatively thick metal parts and using the gas metal arc welding (GMAW) process is covered in AWS D8.8-97/SAE HS J1196, *Specification for Automotive and Light Truck Components Weld Quality—Arc Welding* and D8.8M: 2007 *Specification for Automotive Weld Quality—Arc Welding of Steel*. Recent changes in automotive design, caused by the desire to reduce fuel consumption and improve crash performance, have resulted in automotive structures being made of thinner and higher strength metal parts. This fact combined with the increased use of Zinc Coated Steels to reduce corrosion has made successful arc welding more difficult. This specification addresses joint geometry and workmanship requirements essential to automotive component arc welding quality. As the automotive industry is continually adopting new designs and materials, this standard is not intended to limit the user or prevent adoption of technology advancements. One objective was to prepare a specification that would be useful for the original equipment manufacturers (OEMs) and Tier suppliers of automotive components who may not have quality standards of their own. Another objective is to have the OEMs and Tier suppliers use and specify this document in order to establish common industry standards.

This fifth edition, D8.8M:2014, *Specification for Automotive Weld Quality—Arc Welding of Steel*, includes the following changes, notated with a vertical line along the side of the page:

1. Improvement of several figures and related text to depict discontinuities more realistically, make them easier to read and where possible, utilize ones already spelled out in A2.4 *Standard Symbols for Welding, Brazing, and Nondestructive Examination*.
2. Harmonize requirements for fusion and penetration across all joint types.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS D8 Committee on Automotive Welding, American Welding Society, 8669 NW 36 St, #130, Miami, FL 33166.

This page is intentionally blank

Table of Contents

	Page No.
<i>Personnel</i>	v
<i>Foreword</i>	vii
<i>List of Figures</i>	x
1. General Requirements	1
2. Normative References	1
3. Terms and Definitions	2
4. General Provisions	3
4.1 Application	3
4.2 Welding Processes	3
4.3 Limitations	4
4.4 Weld Identification and Inspection	4
4.5 Types of Weld Joints and Applicable Welds	4
5. Weld Quality Requirements	4
5.1 Weld Discontinuities	4
5.2 Dimensional Requirements	6
5.3 Weld Size	6
Annex A (Informative)—Guidelines for the Preparation of Technical Inquiries	15
List of AWS Documents on Automotive Welding	17

List of Figures

Figure	Page No.
1. Fillet Weld	2
2. Examples of Discontinuities Found in Arc Welds.	3
3. Example of Notching at End of Weld	3
4. Examples of Undercut, Melt-Through, Root Penetration, and Overlap	5
5. Fillet Welded T-Joints	7
6. Illustration of Fillet Welds—Concavity and Convexity.	8
7. Leg Length of a Lap Fillet Weld	8
8. Effective Weld Size.	9
9. Partial Joint Penetration Groove Weld	9
10. Flare-Bevel-Groove Weld	9
11. Flare-V-Groove Weld	10
12. Arc Spot Welds.	11
13. Plug Weld Profiles—A, B, and C	11
14. Plug Weld.	12
15. Single Fillet Weld in a Slot.	12
16. Double Fillet Weld in a Slot	13
17. Fillet Weld in Holes	13

Specification for Automotive Weld Quality— Arc Welding of Steel

1. General Requirements

1.1 Scope

This specification describes weld geometry and workmanship criteria essential to ensure the quality of automotive and light truck weldments. This specification covers the arc and hybrid arc welding of coated and uncoated steels.

1.2 Units of Measurement

This standard makes sole use of the International System of Units (SI).

1.3 Safety

Safety issues and concerns are addressed in this standard, although health issues and concerns are beyond the scope of this standard. 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.

2. Normative References

The following standards contain provisions which, through reference in this text, constitute mandatory provisions of this AWS standard. For undated references, the latest edition of the referenced standard shall apply. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply.

AWS Documents:¹

- (1) AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*.

¹ AWS documents are published by the American Welding Society, 8669 NW 36 St, #130, Miami, FL 33166.

(2) AWS A3.0M/A3.0, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*.

and

(3) AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification*.

3. Terms and Definitions

All of the terms in this clause are used in various parts of this document and require definition for correct interpretation of the instructions. The terms used in this specification shall be interpreted in accordance with the definitions given in the latest edition of AWS A3.0M/A3.0, *Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*. Some of the terms are listed in AWS A3.0M/A3.0 but their definitions have been enhanced to clarify their use in this document. For the purposes of this document, the following definitions apply:

burn-through. A case of excessive melt-through in which the weld pool cannot be supported resulting in a hole through the base metals joined.

effective weld length. The portion of a weld meeting all the minimum acceptance requirements of the specification. In a curved weld, the length is measured longitudinally along the axis.

gap. The distance between two base components of the joint to be welded (see Figure 1). *NOTE: This distance is typically referred to as the root opening in nonautomotive applications.*

hybrid welding. Combination of two or more welding processes applied and controlled simultaneously. Designated by HW-XXX/XXX with the dominant process listed first (e.g., HW-LBW/GMAW).

meltback. This occurs where the base metal melts back from the edge, but does not become part of the weld. This condition leaves a void between the weld deposit and the base metal (see Figure 2).

notching. A weld heat related burn back of material at the end of the joint resulting in a notch (see Figure 3).

OEM. Original Equipment Manufacturer: one producing a product from components which may or may not be bought from other manufacturers.

skip. An unwelded portion of a designated weld (see Figure 2).

tier. A rank of suppliers to an OEM.

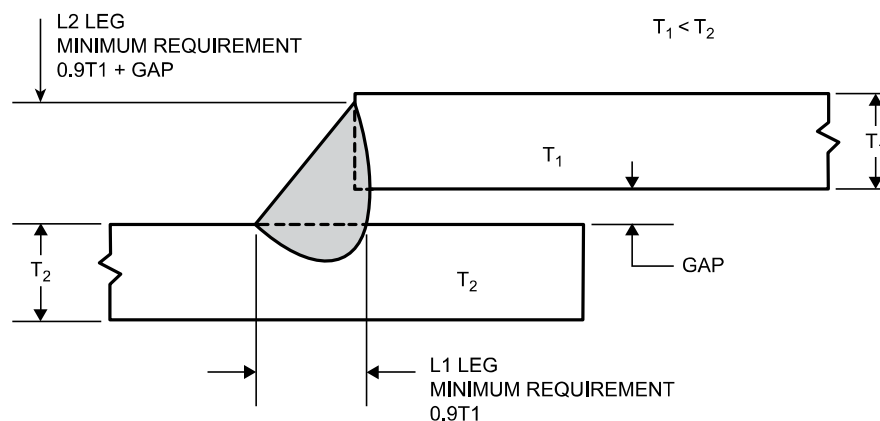


Figure 1—Fillet Weld

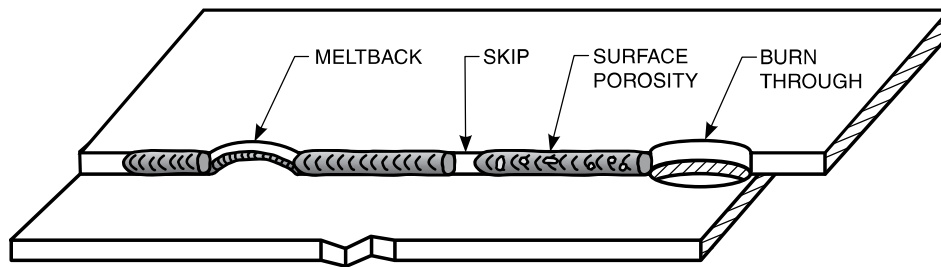


Figure 2—Examples of Discontinuities Found in Arc Welds

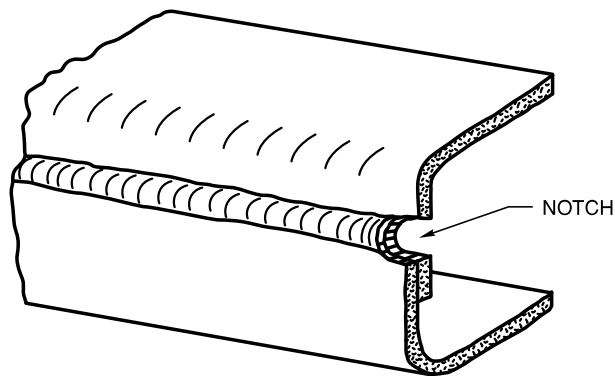


Figure 3—Example of Notching at End of Weld

4. General Provisions

4.1 Application

4.1.1 This specification provides the minimum acceptable quality requirements for arc and hybrid arc welding of coated and uncoated materials for various types of automotive and light truck components.

4.1.2 The postweld acceptance requirements contained in this document are mandatory when this specification is referenced on a product drawing, or in a contract. A product not conforming to the acceptance criteria contained in this specification shall be reworked, scrapped, or accepted by concession.

4.1.3 Products shipped and not conforming may be rejected by the customer, reworked by the customer, or scrapped.

4.1.4 Any requirements deviating from the limits of this specification shall be designated on the engineering documents.

4.1.5 Should any conflict occur between limits specified herein and those specified on the engineering documents, the latter have precedence.

4.2 Welding Processes. This specification covers the quality requirements for welds made by the shielded metal arc welding (SMAW), gas metal arc welding (GMAW), flux cored arc welding (FCAW), plasma arc welding (PAW), gas tungsten arc welding (GTAW), and hybrid arc welding processes.

4.2.1 Welding Procedures. Welding procedures list those variables (and their limits) which influence the quality of the weld. The welding process and weld procedures shall be developed and documented to demonstrate the capability to reliably produce welds on production parts over a specified range of variables. Information pertaining to welding procedure qualification may be found in AWS B2.1/B2.1M *Specification for Welding Procedure and Performance Qualification*, other AWS application codes, and OEM standards.

4.2.2 Filler Metals. Filler metals shall conform to the requirements of the appropriate AWS filler metal specification. Filler metals used to weld zinc coated steel shall be evaluated for their compatibility with zinc coatings.

4.3 Limitations

4.3.1 Surface Condition of Steel

4.3.1.1 The surface of the steel part in the weld area, at the time of welding, should be free from scale, rust, paint, lubricants, and other contaminants adversely affecting the weld quality.

4.3.1.2 Lubricants for high-pressure hydroforming applications tend to be more difficult to remove. Consult with the lubricant supplier for the recommended lubricant removal process.

4.3.2 Joint Fit

4.3.2.1 To ensure proper joint fit, all parts shall be located for maximum weld effectiveness, i.e., minimum gap and repeatable location.

4.3.2.2 To ensure consistent weld quality in fillet welds, the joint gap should not exceed $0.3 T_1$ where T_1 is the thickness of the thinnest part. Additionally, the gap should not exceed the diameter of the filler wire. This should be true for all thicknesses in the range from 2 mm to 5 mm for single arc processes. For tandem arc welding, the range from 2 mm to 5 mm material thickness would allow a maximum gap of 2.0 mm. **NOTE:** *This size gap only applies for welding done in the flat or horizontal positions.* For lap penetration joints with high power density processes such as hybrid laser, the joint gap should not exceed 0.2 mm. The specific range of gap values listed above is dependent on the welding process and joint configuration. Larger gaps than specified can adversely affect structural performance or fatigue life.

4.3.2.3 On lap joints, the edge trim (land) shall leave adequate stock so as to not restrict the ability to make a 1T-leg (T_1 = thickness of thinnest member) fillet weld.

4.4 Weld Identification and Inspection. The use of the latest edition of AWS A2.4 *Standard Symbols for Welding, Brazing, and Nondestructive Examination* shall be used for indicating all welding and inspection requirements on the engineering drawing. All weld symbols on the engineering document shall be approved by the engineering authority. Special conditions shall be fully explained by added notes or details.

4.5 Types of Weld Joints and Applicable Welds

4.5.1 Butt Joints. Applicable butt joint welds are as follows:

- (1) Square-groove welds
- (2) V-groove welds
- (3) Bevel-groove welds
- (4) U-groove welds
- (5) J-groove welds
- (6) Flare-V-groove welds
- (7) Flare-bevel-groove welds

4.5.2 T-Joints. Applicable T-joint welds are as follows:

- (1) Fillet welds

4.5.3 Lap Joints. Applicable lap joint welds are as follows:

- (1) Fillet welds
- (2) Plug welds
- (3) Slot welds
- (4) Arc spot welds

5. Weld Quality Requirements

5.1 Weld Discontinuities. If the weld bead exceeds the stated limits for the following discontinuities the weld bead is discrepant, unless otherwise specified on the engineering document.

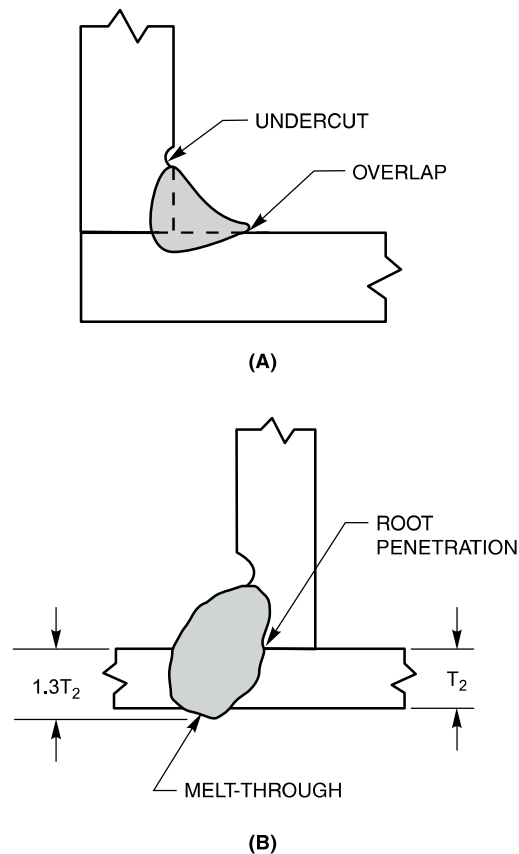


Figure 4—Examples of Undercut, Melt-Through, Root Penetration, and Overlap

5.1.1 Undercut. Undercut shall not be permitted within 13 mm of the start or end of the weld. Undercut is permitted to range from 0 to $0.2T$ over a maximum cumulative length of $1/8$ the specified weld length when material thickness exceeds 1 mm. Undercut allowables deviating from this specification shall be specified on the drawing (see Figure 4). Material less than 1 mm in thickness shall have no undercut.

5.1.2 Craters. Weld craters shall not be considered a part of the effective weld length unless they are filled and meet all the requirements of this specification.

5.1.3 Cracks. Cracks shall not be permitted.

5.1.4 Porosity

5.1.4.1 Surface Porosity. Individual pores, separated by at least their own diameter, and other scattered surface porosity shall be permitted. The total length of porosity (sum of diameters) shall not exceed 6 mm in any 25 mm of weld. The maximum pore dimension shall not exceed 1.6 mm.

5.1.4.2 Internal Porosity. Internal porosity, if evaluated, shall not exceed 15% of the area of the weld being examined.

5.1.5 Inclusions. Nonmetallic inclusions shall be considered a discontinuity, the same as porosity, the dimensions of which shall be evaluated as per 5.1.4.

5.1.6 Burn Through. Holes caused by melting through the base metal shall not be permitted (see Figure 2).

5.1.7 Meltback. Meltback in lap fillet welds shall not exceed the stock thickness in depth from plate edge at top of meltback and shall decrease to zero at the root of the joint (see Figure 2). Complete fusion shall be obtained at the root of the joint. Meltback shall be limited to 15% of the weld length.

5.1.8 Melt-Through. Melt-through shall not exceed $1.3T_2$ (see Figure 4).

5.1.9 Notching. Notching or gouging of the base metal at the ends or at the edge of the joint shall not be permitted (see Figure 3).

5.1.10 Overlap. The protrusion of weld metal beyond the weld toe is not allowed.

5.1.11 Spatter. The amount of spatter present shall not interfere with the fit or function of the part.

5.1.12 Combination of Discontinuities. The presence of more than one of the above discontinuities in any weld shall not be permitted if any one of the evaluated discontinuities (inclusions, undercut, porosity, or melt-back) is at the maximum permissible limit.

5.1.13 Metallographic Samples. Metallographic samples shall be used to determine weld fusion to side walls of a fillet weld in holes, slot welds, flared joints, and depth of fusion in arc spot, plug, slot welds and welds in holes or slots. Minimum side wall fusion shall be $0.1 T_1$ and depth of fusion on the bottom plate shall be $0.1 T_1$.

5.2 Dimensional Requirements

5.2.1 Weld Length

5.2.1.1 Unless specifically noted on the engineering documents, the effective weld length shall not be less than 90% of the specified weld length.

5.2.1.2 Any portion of a weld not meeting the individual quality requirements shall not be included in the effective weld length as defined in Clause 3.

5.2.1.3 Welds shall be permitted to be longer than specified, provided the part configuration maintains fit and function (does not interfere with part fit-up or mating).

5.2.1.4 Minimum weld length. Minimum designated weld length shall be 15 mm longer than the design weld length required because the first and last 6 mm to 8 mm can exhibit a higher incidence of poor penetration and fusion due to the ramp-up on the start and the crater fill at the end. If the customer needs the full available weld length to be considered part of the required weld, it should be agreed upon with the supplier.

5.2.2 Weld Location

5.2.2.1 All welds shall be located on or in the joint in a manner that ensures the parts are adequately joined to meet or exceed the minimum acceptance requirements of this specification.

5.2.2.2 Any portion of the weld that is off the seam shall not be included in the effective weld length.

5.2.2.3 Where a specified weld start and/or stop location is given, the start and stop points of the weld shall be within 6 mm of those shown on the drawing, as long as the part maintains fit and function.

5.3 Weld Size

5.3.1 Fillet Welds

5.3.1.1 Figures 5(A) and 5(B) identify the nomenclature which describes the cross section of a fillet welded T-joint. Figure 6 illustrates both convex and concave fillet welds in lap and T-joints.

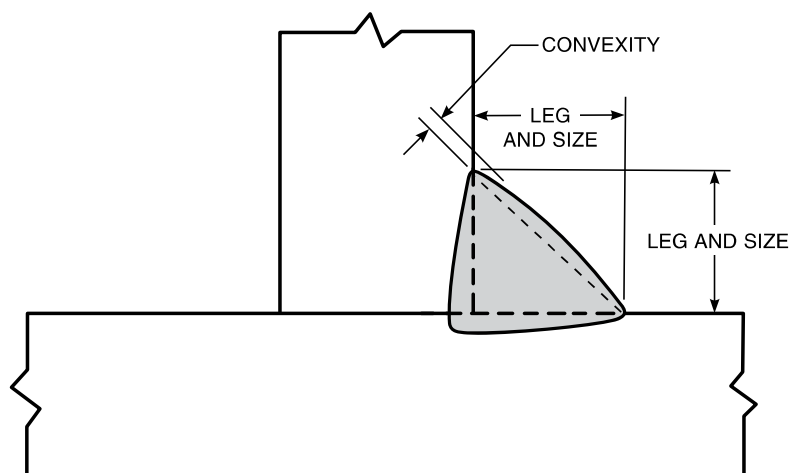
5.3.1.2 The length of the legs of a fillet weld on each side of the joint determines the fillet size. For purposes of determining the fillet leg size, only the fused portion of the leg (see Figure 7) shall be included and shall conform to the following dimensions:

- (1) The minimum leg size shall be equal to 90% of the thickness of the thinner material being welded.
- (2) When gaps are present, the leg where the gap appears must be increased by the amount of the gap (see Figure 1).

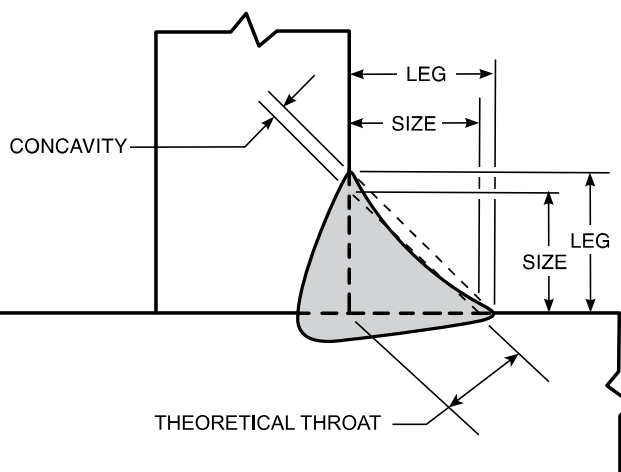
5.3.1.3 The weld throat thickness shall conform to the following:

(1) The minimum theoretical throat thickness shall not be less than 60% of the thinner metal being welded (see Figure 6).

(2) There shall be no maximum convexity or concavity requirement, provided all other requirements of this specification are in compliance.



(A) FILLET (CONVEX) WELDED T-JOINT



(B) FILLET (CONCAVE) WELDED T-JOINT

Figure 5—Fillet Welded T-Joints**5.3.2 Welds in Butt and Groove Joints**

5.3.2.1 The types of welds in butt joints are listed in 4.5.1.

5.3.2.2 The effective weld size shall be equal to the thickness of the thinner material being joined or the portion within the limits of the thickness of the thinnest sheet.

5.3.2.3 No limit shall be set on the height of the weld reinforcement (face and root), if all other provisions of this specification are in compliance (see Figure 8).

5.3.2.4 The joint penetration shall extend beyond the joint preparation into the base metal by $0.1 T_1$ minimum (see Figure 9).

5.3.2.5 Weld size and definitions for flare-bevel and flare-V-groove welds shall be used as shown in Figures 10 and 11.

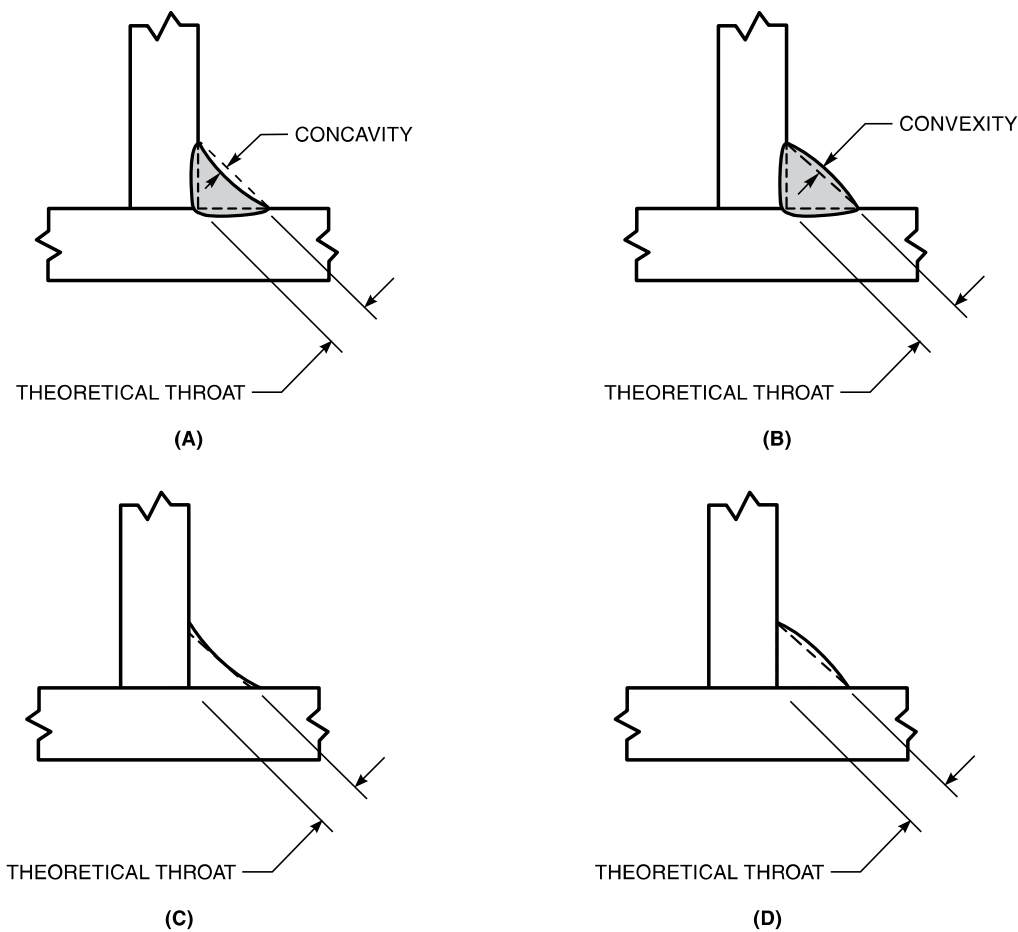


Figure 6—Illustration of Fillet Welds—Concavity and Convexity

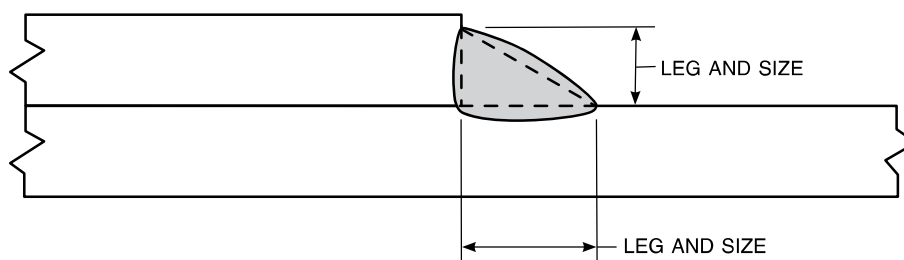


Figure 7—Leg Length of a Lap Fillet Weld

5.3.3 Arc Spot, Plug, Slot Welds, and Fillet Welds in Holes or Slots. There are many types of arc spot, plug, slot welds and fillet welds in holes or slots having different strength levels and quality requirements. Strength requirements of welds are not addressed in this standard and only geometric criteria are specified in the standard. See text and Figures 12–17 for examples of Arc Spot, Plug, and Slot Welds, and Fillet Welds in Holes and Slots.

5.3.3.1 Depth of Fusion. The minimum depth of fusion for Arc Spot Welds shall be $0.1 T_2$ (bottom member) (see Figure 12). In plug and slot welds, there shall be fusion in the weld root where the side wall meets the top face of the bottom sheet (see Figure 13). This should not be confused with fillet welded hole or slot welds.

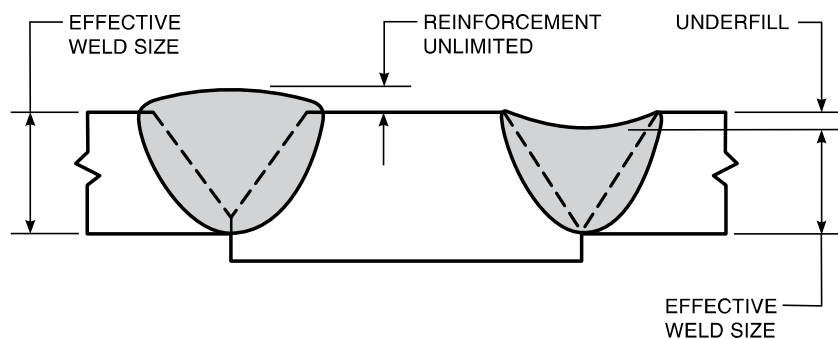


Figure 8—Effective Weld Size

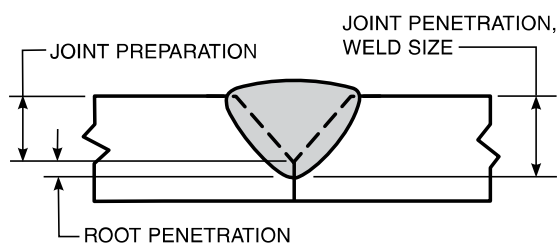
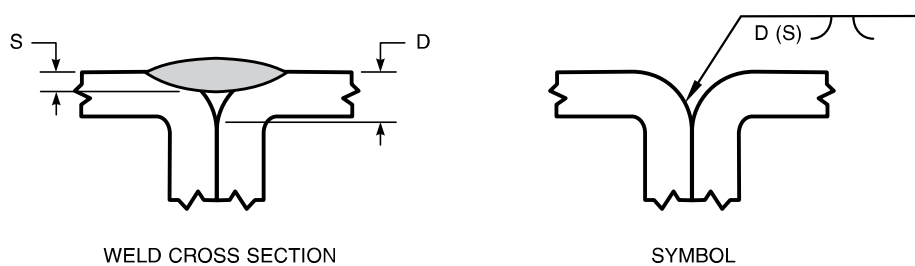


Figure 9—Partial Joint Penetration Groove Weld

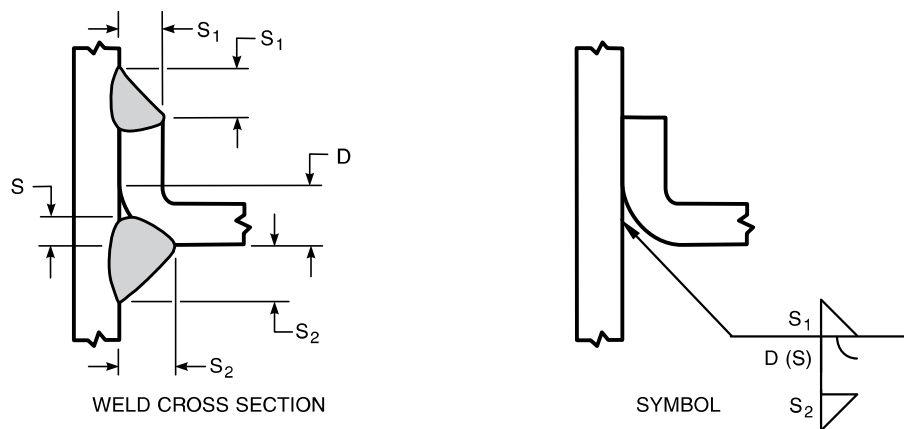


D = DISTANCE FROM POINT OF
TANGENCY TO TOP OF MEMBER

S = GROOVE WELD SIZE

Source: Adapted from AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, Figure 22(B).

Figure 10—Flare-Bevel-Groove Weld



Source: Adapted from AWS A2.4:2012, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, Figure 22(A).

Figure 11—Flare-V-Groove Weld

5.3.3.2 Depth of Fill. The effective depth of filling shall be the thickness of the thinner material being joined [see Figures 13(A) and 13(B)].

5.3.3.3 Weld Profile. The weld profile shall conform to the following provisions:

- (1) There is no maximum reinforcement as long as fit and function are maintained and
- (2) Any underfill requirement shall be specified on the drawings [see Figure 13(C)].

5.3.3.4 Weld Dimensions. The following minimum dimensions shall be observed when welding arc spot, plug, slot welds, and fillet welds in slots:

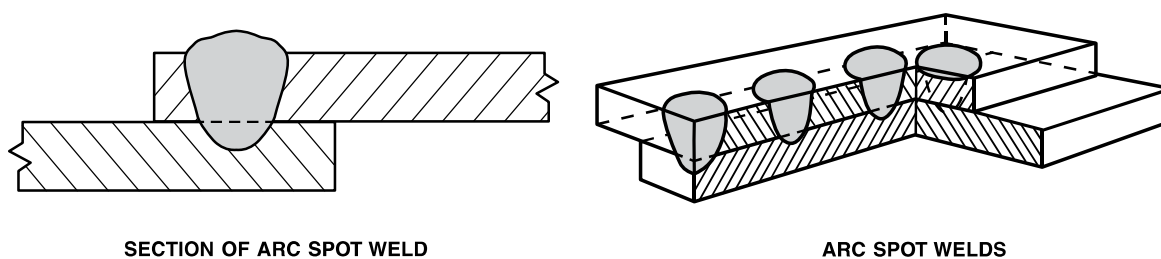
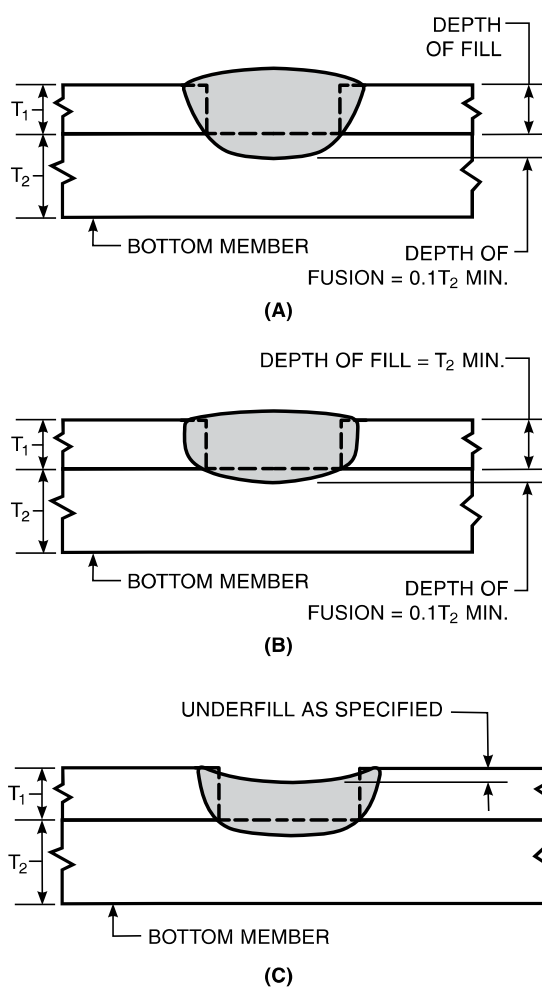
(1) *Arc spot welds.* The top diameter should be at least four times the thickness of the thinner material (T_1) being welded. The interface diameter (weld size) shall be at least four times the square root of the thinner material (expressed in mm) ($4\sqrt{T_1}$) being welded (See Figure 12).

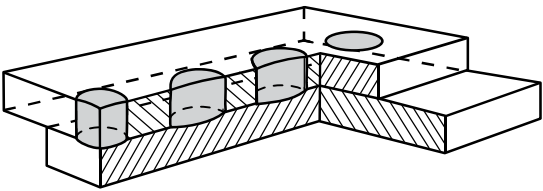
(2) *Plug welds.* The top diameter should be at least 3 mm larger than the hole size. The interface diameter (weld size) shall be at least four times the square root of the thinner material (expressed in mm) ($4\sqrt{T_1}$) where T_1 is the thickness of the thinner material being welded (see Figure 14).

(3) *Slot welds.* The length of the slot for a slot weld should not exceed ten times the thickness ($10T$) of the part containing it. The width of the slot shall be no less than the thickness of the part containing it plus 8 mm. The maximum width shall equal the minimum width plus 3 mm or 2-1/4 times the thickness of the member, whichever is greater. The depth of filling of slot or slot welds shall be equal to or greater than 90% of the thickness of the slotted material.

(4) *Fillet welds in a slot.* Single fillet welds on material thickness of 3 mm, or less, should have a slot width of at least 10 mm and a minimum slot length of 25 mm. Stock thickness of more than 3 mm for single fillet welds in slots should have a minimum slot width of 13 mm and a minimum slot length of 32 mm (see Figure 15). A double fillet weld in a slot on material thickness of 3 mm or less should have a width of at least 13 mm and a minimum length of 25 mm on each of the two sides of the slot. A double fillet weld in a slot on stock thickness of more than 3 mm should have a width of at least 16 mm and a minimum length of 32 mm on each of the two sides of the slot (see Figure 16).

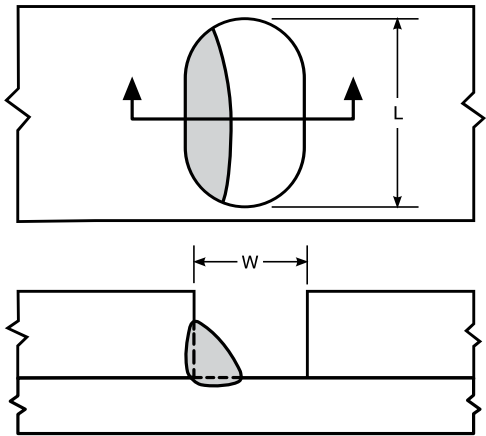
(5) *Fillet weld in a hole.* The minimum hole diameter for a fillet weld in a hole should be no less than the thickness of the part containing the hole, plus 8 mm (see Figure 17).

**Figure 12—Arc Spot Welds****Figure 13—Plug Weld Profiles—A, B, and C**



PLUG WELDS

Figure 14—Plug Weld



Metal Thickness mm	Slot Width (W) mm	Slot Length (L) mm
≤3	10	25
>3	13	32

Figure 15—Single Fillet Weld in a Slot

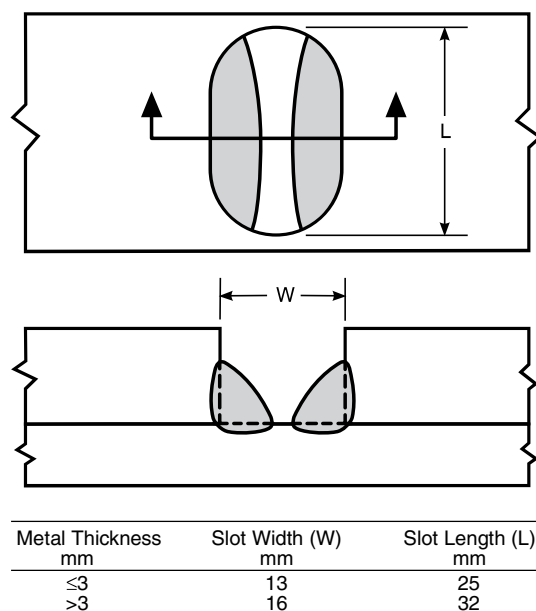


Figure 16—Double Fillet Weld in a Slot

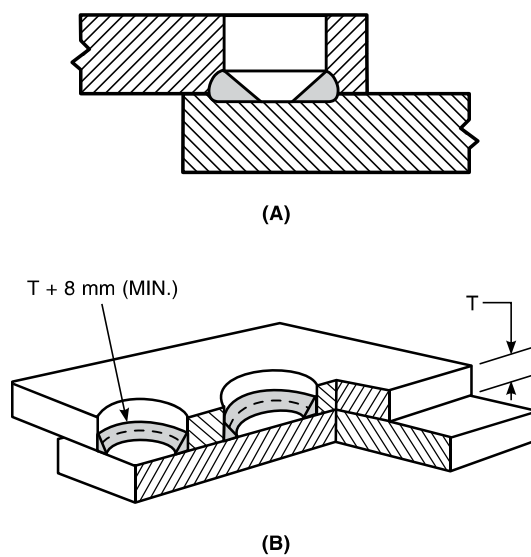


Figure 17—Fillet Weld in Holes

This page is intentionally blank

Annex A (Informative)

Guidelines for the Preparation of Technical Inquiries

This annex is not part of AWS D8.8M:2014, *Specification for Automotive Weld Quality—Arc Welding of Steel*, but is included for informational purposes only.

A1. Introduction

The American Welding Society (AWS) Board of Directors has adopted a policy whereby all official interpretations of AWS standards are handled in a formal manner. Under this policy, all interpretations are made by the committee that is responsible for the standard. Official communication concerning an interpretation is directed through the AWS staff member who works with that committee. The policy requires that all requests for an interpretation be submitted in writing. Such requests will be handled as expeditiously as possible, but due to the complexity of the work and the procedures that must be followed, some interpretations may require considerable time.

A2. Procedure

All inquiries shall be directed to:

Managing Director
Technical Services Division
American Welding Society
8669 NW 36 St, #130, Miami, FL 33166

All inquiries shall contain the name, address, and affiliation of the inquirer, and they shall provide enough information for the committee to understand the point of concern in the inquiry. When the point is not clearly defined, the inquiry will be returned for clarification. For efficient handling, all inquiries should be typewritten and in the format specified below.

A2.1 Scope. Each inquiry shall address one single provision of the standard unless the point of the inquiry involves two or more interrelated provisions. The provision(s) shall be identified in the scope of the inquiry along with the edition of the standard that contains the provision(s) the inquirer is addressing.

A2.2 Purpose of the Inquiry. The purpose of the inquiry shall be stated in this portion of the inquiry. The purpose can be to obtain an interpretation of a standard's requirement or to request the revision of a particular provision in the standard.

A2.3 Content of the Inquiry. The inquiry should be concise, yet complete, to enable the committee to understand the point of the inquiry. Sketches should be used whenever appropriate, and all paragraphs, figures, and tables (or annex) that bear on the inquiry shall be cited. If the point of the inquiry is to obtain a revision of the standard, the inquiry shall provide technical justification for that revision.

A2.4 Proposed Reply. The inquirer should, as a proposed reply, state an interpretation of the provision that is the point of the inquiry or provide the wording for a proposed revision, if this is what the inquirer seeks.

A3. Interpretation of Provisions of the Standard

Interpretations of provisions of the standard are made by the relevant AWS technical committee. The secretary of the committee refers all inquiries to the chair of the particular subcommittee that has jurisdiction over the portion of the standard addressed by the inquiry. The subcommittee reviews the inquiry and the proposed reply to determine what the response to the inquiry should be. Following the subcommittee's development of the response, the inquiry and the response are presented to the entire committee for review and approval. Upon approval by the committee, the interpretation is an official interpretation of the society, and the secretary transmits the response to the inquirer and to the *Welding Journal* for publication.

A4. Publication of Interpretations

All official interpretations will appear in the *Welding Journal* and will be posted on the AWS web site.

A5. Telephone Inquiries

Telephone inquiries to AWS Headquarters concerning AWS standards should be limited to questions of a general nature or to matters directly related to the use of the standard. The *AWS Board Policy Manual* requires that all AWS staff members respond to a telephone request for an official interpretation of any AWS standard with the information that such an interpretation can be obtained only through a written request. Headquarters staff cannot provide consulting services. However, the staff can refer a caller to any of those consultants whose names are on file at AWS Headquarters.

A6. AWS Technical Committees

The activities of AWS technical committees regarding interpretations are limited strictly to the interpretation of provisions of standards prepared by the committees or to consideration of revisions to existing provisions on the basis of new data or technology. Neither AWS staff nor the committees are in a position to offer interpretive or consulting services on (1) specific engineering problems, (2) requirements of standards applied to fabrications outside the scope of the document, or (3) points not specifically covered by the standard. In such cases, the inquirer should seek assistance from a competent engineer experienced in the particular field of interest.

List of AWS Documents on Automotive Welding

D8.1M	<i>Specification for Automotive Weld Quality—Resistance Spot Welding of Steel</i>
D8.8M	<i>Specification for Automotive Weld Quality—Arc Welding of Steel</i>
D8.9M	<i>Recommended Practices for Test Methods for Evaluating the Resistance Spot Welding Behavior of Automotive Sheet Steel Materials</i>
D8.14M	<i>Specification for Automotive Weld Quality—Arc Welding of Aluminum</i>

This page is intentionally blank

