Specification for the Qualification of Robotic Arc Welding Personnel

AWS D16.4M/D16.4:2015
An American National Standard
Abstract

This specification provides requirements for the qualification of robotic arc welding personnel at three different classifications—Operator (O), Technician (T), and Engineer (E).
Statement on the Use of American Welding Society Standards

All standards (codes, specifications, recommended practices, methods, classifications, and guides) of the American Welding Society are voluntary consensus standards that have been developed in accordance with the rules of the American National Standards Institute. When AWS 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 guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this standard available, AWS is not 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 are 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 are 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 B). 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 D16 Committee on Robotic and Automatic 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 D16 Committee on Robotic and Automatic 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 D16 Committee on Robotic and Automatic 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.
Personnel

AWS D16 Committee on Robotic and Automatic Welding

J. S. Noruk, Chair  Servo Robot Corporation
V. L. Mangold, Jr., Vice Chair  Kaysafety
D. L. Pape, 2nd Vice Chair  Wolf Robotics
C. E. Lewis, Secretary  American Welding Society
C. T. Anderson  Motoman, Incorporated
A. J. Bischoff  Hobart Brothers
J. M. Blahnik  Caterpillar, Incorporated
E. Boan  John Deere Seeding
R. E. Campbell  Banker Steel Company
E. DiMilanta  ABB, Incorporated
K. W. Gerhart  Edison Welding Institute
L. K. Gross  Milwaukee Area Technical College
T. B. Hansen  TrinityRail
D. H. Juhl  PRI Robotics, Incorporated
J. D. Lane  D & S Manufacturing
R. Maroney  AIDT-RTP
S. B. Massey  Edison Welding Institute
J. D. Percio  The Lincoln Electric Company
M. W. Perry  Consultant
J. L. Peterson  Crenlo, LLC
W. R. Polanin  Illinois Central College
D. L. Pratt  Consultant
S. P. Redig  Iowa Mold Tooling Company, Incorporated
D. P. Rhoda  Wolf Robotics
N. P. Rice  Worthington Industries
M. F. Sinfield  Naval Surface Warfare Center
P. E. Staunton  Shell
K. Summers  Miller Welding Automation
D. C. Swann  OTC DAIHEN, Incorporated
K. W. Trumbull  Genesis Systems Group
H. Volkhart  PEWO
J. W. Williamson  Fronius USA, LLC

Advisors to the AWS D16 Committee on Robotic and Automatic Welding

J. Berge  Berge Robotics
P. Davison  Robotic Industries Association
D. J. Erbe  Praxair
M. A. Garman  Kawasaki Robotics
K. V. Iyer  Larsen and Toubro Limited
H. A. Jacobson  C & G Systems
H. L. Jones, Jr.  Dominion/Virginia Power
R. W. Linn  Productive Engineering, Incorporated
T. E. Maxey  Banker Steel Company
Advisors to the AWS D16 Committee on Robotic and Automatic Welding

T. K. Merrifield  Midwest Engineering Systems, Incorporated
S. D. Nelson  Ace Precision Machining
R. F. Noch  Johnson Controls, Incorporated
G. G. Winchester  NEMA
C. L. Woodman  Automation Consultant
D. A. Wright  Wright Welding Technologies

AWS D16B Subcommittee for Robotic Arc Welding Personnel Qualification

V. L. Mangold, Jr., Chair  Kaysafety
C.E. Lewis, Secretary  American Welding Society
L. K. Gross  Milwaukee Area Technical College
J. D. Lane  D & S Manufacturing
D. L. Pape  Wolf Robotics
D. C. Swann  OTC DAIHEN, Incorporated

Advisors to the AWS D16B Subcommittee for Robotic Arc Welding Personnel Qualification

H. A. Jacobson  C & G Systems
Foreword

This foreword is not part of AWS D16.4M/D16.4:2015, Specification for the Qualification of Robotic Arc Welding Personnel, but is included for informational purposes only.

The AWS D16 Committee on Robotic and Automatic Welding was organized in 1985 to provide centralized source for the exchange of technical information between manufacturers, installers, and operators of robotic and automated equipment.

The first edition of AWS D16.4 (AWS D16.4:1999, Specification for the Qualification for Robotic Arc Welding Personnel) provided guidelines for the qualification of arc welding personnel. The second edition (AWS D16.4M/D16.4:2005) included revisions based on the experience of the certification program for robotic arc welding personnel. This edition reduced the levels of qualification from four to three and aligned education and experience requirements more realistically with those in industry.

This third edition changes the levels of qualification to Level 1—Certified Robotic and Automated Welding Operator (CRAW-O), Level 2—Certified Robotic and Automated Welding Technician (CRAW-T), and Level 3—Certified Robotic and Automated Welding Engineer (CRAW-E) from the second edition’s qualification designations of Level 1—CRAW-L1, Level 2—CRAW-O, and Level 3—CRAW-T. Those certified under the second edition certification level designations shall be grandfathered into the corresponding third edition level designation.

This third edition also includes changes to the figures from the second edition. Figures 1 and 2 have been revised and Figure 3 removed. Additional changes that have been made from the 2005 edition are represented by a vertical line in the margin.

The requirements for certification of Robotic Arc Welders are located in the QC19 document.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS D16 Committee on Robotic and Automatic Welding, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.
This page is intentionally blank
Table of Contents

Personnel ........................................................................................................................................... v
Foreword ............................................................................................................................................ vii
List of Tables ..................................................................................................................................... x
List of Figures ..................................................................................................................................... x

1. General Requirements .................................................................................................................. 1
   1.1 Scope ......................................................................................................................................... 1
   1.2 Units of Measurement ............................................................................................................. 1
   1.3 Safety ....................................................................................................................................... 1

2. Normative References ................................................................................................................... 2

3. Terms and Definitions .................................................................................................................... 2

4. Specifications for Qualification of Robotic Arc Welding Personnel .................................................. 2

Annex A (Informative)—Bibliography ................................................................................................. 9
Annex B (Informative)—Guidelines for the Preparation of Technical Inquiries ................................. 11
List of AWS Documents on Robotics and Automatic Welding .......................................................... 13
List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Performance Qualifications for Robotic Arc Welding Engineer—Level 3</td>
</tr>
<tr>
<td>4.</td>
<td>Summary of Specifications for Robotic Arc Welding Personnel</td>
</tr>
</tbody>
</table>

List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Test Specimen Components, Dimensions, and Layout</td>
</tr>
<tr>
<td>2.</td>
<td>Assembly Specifications for Test Specimens</td>
</tr>
</tbody>
</table>
1. General Requirements

1.1 Scope. This standard provides requirements for the qualification of robotic arc welding personnel. This standard does not prevent a manufacturer, fabricator, or contractor from continuing to qualify robotic welding personnel according to other standards.

Qualification is limited to those performance variables provided in Tables 1 through 4 in this standard. There are three different levels in which qualification can be achieved. The three levels acronyms are Level 1—Certified Robotic and Automated Welding Operator (CRAW-O), Level 2—Certified Robotic and Automated Welding Technician (CRAW-T), and Level 3—Certified Robotic and Automated Welding Engineer (CRAW-E).

1.2 Units of Measurement. This standard makes use of both the International System of Units (SI) and U.S. Customary Units. The latter are shown within brackets, ([ ]), or in appropriate columns in tables and figures. The measurements may not be exact equivalents; therefore, each system shall be used independently.

1.3 Safety. Safety and health issues and concerns are beyond the scope of this standard; some safety and health information is provided, but such issues are not fully addressed herein.

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.