

Specification for Qualification and Certification of Level I—Entry Welder



American Welding Society

Key Words —Entry Welder, Training
Organization, performance tests,
acceptance criteria

AWS SENSE QC10:2006

Specification for Qualification and Certification of Level I—Entry Welder

**Supersedes AWS QC-10:2004
Revision July 2008**

Prepared by the
American Welding Society (AWS) Committee on SENSE
AWS Committee on Education

Approved by the
AWS Board of Directors

Abstract

This standard defines the requirements for the American Welding Society to register a Level I—Entry Welder to the AWS SENSE program. The AWS *Schools Excelling through National Skill Standards Education* (SENSE) program began in 1993 with the award of a grant by the US Department of Education to develop a series of standards and a program for the recognition of welders based on welding performance testing and practical knowledge tests. The SENSE welder program is comprised of three levels: Level I—Entry Welder, Level II—Advanced Welder, and Level III—Expert Welder. The certification of a Level I—Entry Welder requires performance qualification (skill) and practical knowledge (written) tests. These tests require reading, computational, and manual skills to complete.



American Welding Society

550 N.W. LeJeune Road, Miami, FL 33126

International Standard Book Number: 0-87171-738-7

American Welding Society

550 N.W. LeJeune Road, Miami, FL 33126

© 2006 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 Use of AWS 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 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.

This AWS standard was 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 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.

This standard may be superseded by the issuance of new editions. Users should ensure that they have the latest edition.

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.

On occasion, text, tables, or figures are printed incorrectly, constituting errata. Such errata, when discovered, are posted on the AWS web site (www.aws.org).

Official interpretations of any of the technical requirements of this standard may only be obtained by sending a request, in writing, to the Director of Education, Technical Services Division, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126. With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. However, 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 Committee on Education. 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 Committee on Education 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 Committee on Education 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 Education Committee. A copy of these Rules can be obtained from the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

This page is intentionally blank.

Personnel

AWS Committee on Education

E. Norman, Chair	<i>Southwest Area Career Center</i>
T. Lienert, Vice Chair	<i>Los Alamos National Laboratory</i>
M. Ventura, Secretary	<i>American Welding Society</i>
A. Godley	<i>Southern Company Generation</i>
*D. Klingman	<i>The Lincoln Electric Company</i>
S. V. Houston	<i>American Technical Publishers</i>
E. Abbot	<i>Ironworkers International</i>
L. Caughron	<i>Grand River Technical School</i>
D. Cotner	<i>PA College of Technology</i>
D. P. Hamilton	<i>Sequoiah High School</i>
D. Haas	<i>Northrop Grumman</i>
M. Harris	<i>International Training Institute</i>
C. Seeger	<i>United Association</i>
B. Muehlbrant	<i>The Lincoln Electric Company</i>
G. Smith	<i>Ohio Department of Education</i>
D. Twitty	<i>Doña Ana Community College</i>
R. Vanscoy	<i>International Brotherhood of Boilermakers</i>

AWS Subcommittee on SENSE

S. V. Houston, Chair	<i>American Technical Publishers</i>
M. Maldonado, Secretary	<i>American Welding Society</i>
M. Anderson	<i>New Castle Area Career Programs</i>
L. Bower	<i>Blackhawk Technical College</i>
R. Depue	<i>Welding Consultant</i>
E. Norman	<i>Southwest Area Career Center</i>
R. Richwine	<i>Ivy Tech Community College</i>
D. Twitty	<i>Doña Ana Community College</i>
G. Smith	<i>Ohio Department of Education</i>

*Advisor

This page is intentionally blank.

Foreword

This foreword is not a part of QC10:2006, *Specification for Qualification and Certification of Level I—Entry Welder*, but is included for informational purposes only.

The AWS *Schools Excelling through National Skill Standards Education* (SENSE) program began in 1993 with the award of a grant by the U.S. Department of Education to develop a series of standards and a program for the recognition of welders based on welding performance testing and practical knowledge tests. The development of this National Skill Standard has involved the participation of the welding industry through a survey designed to determine a consensus of welder skills and competencies required for individuals seeking the development of their welding skills. The result of this industry survey was an occupational task analysis that formed the basis for guidelines for the training of welders at three levels: Level I—Entry Welder, Level II—Advanced Welder, and Level III—Expert Welder.

Three specifications were developed in the period July 1993 to July 1996:

AWS QC10-95, *Specification for Qualification and Certification of Entry Level Welders*
AWS QC11-96, *Specification for Qualification and Certification for Level II—Advanced Welder*
AWS QC12-96, *Specification for Qualification and Certification for Level III—Expert Welders*

In addition, guideline documents were developed for each level:

AWS EG2.0-95, *Guide for the Training and Qualification of Welding Personnel: Entry Level Welder*
AWS EG3.0-96, *Guide for the Training and Qualification of Welding Personnel: Level II—Advanced Welder*
AWS EG4.0-96, *Guide for the Training and Qualification of Welding Personnel: Level III—Expert Welder*

The present standard is the first in a series of revisions to the SENSE program documents and updates QC10:2004. The administration of the program has been more clearly defined emphasizing the modular nature of the guidelines and allowing for the recognition of welders who complete defined portions of the program.

Your comments for improving the *Specification for Qualification and Certification of Level I—Entry Welder* are welcome. Submit comments to the Secretary, AWS Committee on Education, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126; telephone (305) 443-9353; fax (305) 648-2396; e-mail education@aws.org; or via the AWS web site www.aws.org.

This page is intentionally blank.

Table of Contents

	Page No.
<i>Personnel</i>	v
<i>Foreword</i>vii
<i>Table of Contents</i>ix
<i>List of Tables</i>	x
<i>List of Drawings</i>	x
<i>List of Figures</i>	x
1. Scope	1
2. Referenced Document	1
3. Definitions	1
4. Requirements for Entry Welder	1
5. Welding Guidelines	2
6. Entry Welder Practical Knowledge Qualification—Written Test.....	2
7. Entry Welder Performance Qualification—Workmanship Samples and Test Plates ...	2
8. Inspection, Testing, and Acceptance Criteria.....	3
9. Documentation	3
10. Records of Welder Certification.....	3
11. Registration of Entry Welders	4
<i>Annex A: Performance Qualification Visual Inspection Results</i>	7
<i>Annex B: Face- and Root-Bend Test Results</i>	9
<i>Annex C: Breakdown of Modules and Key Indicators: Level I—Entry Welder</i>11
<i>List of AWS Documents</i>23

List of Tables

Table	Page No.
1 Level I—Entry Welder Program Structure	4
2 Entry Welder Performance Qualification Tests	5
3 Visual Inspection Criteria for Entry Welders	5
4 Acceptance Criteria for Face- and Root-Bends	6

List of Drawings

Drawing No.	Page No.
AWS EDU-1 FCAW-G/GM, FCAW-S Carbon Steel Performance Qualification	15
AWS EDU-2 GMAW Spray Transfer Carbon Steel Performance Qualification... ..	16
AWS EDU-3 GMAW-S (Short Circuiting Transfer), and GTAW Carbon Steel Performance Qualification	17
AWS EDU-4 GTAW Stainless Steel Performance Qualification	18
AWS EDU-5 GTAW Aluminum Performance Qualification... ..	19
AWS EDU-6 SMAW Carbon Steel Performance Qualification (Test Plates)... ..	20

List of Figures

Figure	Page No.
1 Face- and Root-Bend Test Specimen	21
2 Guided-Bend Test Jig... ..	21
3 Alternative Wrap-Around Guided-Bend Test Jig	22
4 Alternative Roller-Equipped Guided-Bend Jig	22

Specification for Qualification and Certification of Level I—Entry Welder

1. Scope

1.1 This standard establishes the minimum requirements for qualification and certification as a SENSE Level I—Entry Welder with the American Welding Society.

1.2 This standard specifies practical knowledge and performance tests that require a minimum level of reading, computational, and manual skills to successfully complete.

1.3 All individuals meeting the specified performance criteria at a facility that is a training organization will be listed in the AWS database of SENSE Entry Welders.

1.4 Organizations that are not training organizations may use this standard, but individuals they instruct will not be listed in the AWS database of SENSE Entry Welders.

1.5 Although a written test including questions on safety is required by this standard, this standard is not intended to address safety and health. Safety and health requirements are provided in ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, other safety and health standards, and federal, state, and local government regulations. The responsibility for safety is primarily with the welder, the training organization during training and testing, and afterwards, with the employer.

2. Referenced Document

1. EG2.0, *Guide for Training of Welding Personnel: Level I—Entry Welder*

3. Definitions

Welding terms used in this standard are defined in AWS A3.0, *Standard Welding Terms and Definitions*. Other terms are defined as follows:

competency. A set of skills, related knowledge, and attributes that allow an individual to perform a task, and that can be verified by performance and practical knowledge testing.

Entry Welder (Level I). An individual employed in this position is considered to possess a prerequisite amount of knowledge, attitude, skills, and habits required to perform routine, predictable, repetitive, and procedural tasks involving motor skills, and limited theoretical knowledge while working under close supervision.

module. The collection of training or learning activities defining a particular set of skills for a subject or group of related subjects. A module may contain one or more Units. There are 9 modules in the Level I—Entry Welder program.

unit. The collection of training or learning activities defining a particular set of skills for a single subject. A part of a module that focuses on a particular theme or topic. For example, Module 8, “Thermal Cutting Principles and Practices,” contains 4 units.

4. Requirements for Entry Welder

4.1 Trainee must be enrolled in and attending a training organization.

4.2 Trainee must be taking coursework that will develop the skills necessary to master the learning modules shown in Table 1.

4.3 Trainee may continue in the program during employment with a signed agreement between the training organization and the trainee’s employer stating how the trainee will continue in the program. (See Clause 11 for length of registration.)

4.4 Trainee must pass relevant written and performance qualification tests as specified in Clauses 6 and 7.

4.5 Test results shall be recorded as specified in Clause 9.

5. Welding Guidelines

5.1 SENSE provides the Training Organization with guidelines for multiple welding and cutting processes. The base metals used are carbon steel, stainless steel, and aluminum. Training may be conducted at three levels:

1. Level I—Entry Welder
2. Level II—Advanced Welder
3. Level III—Expert Welder

5.2 Entry Welder. The recommended guidelines for use with the Level I—Entry Welder program are found in AWS EG2.0, *Guide for the Training of Welding Personnel: Level I—Entry Welder*.

5.3 Advanced Welder. The recommended guidelines for use with the Level II—Advanced Welder program are found in AWS EG3.0, *Guide for the Training of Welding Personnel: Level II—Advanced Welder*.

5.4 Expert Welder. The recommended guidelines for creating a curriculum for use with the Level III—Expert Welder program are found in the document AWS EG4.0, *Guide for the Training of Welding Personnel: Level III—Expert Welder*.

5.5 The development or selection of curriculum materials is the responsibility of each SENSE training organization. The AWS SENSE guidelines, EG2.0, EG3.0, and EG4.0 are intended to support the development or selection of a SENSE-based curriculum suited to the capabilities of the training organization and tailored to the needs of local welding employers.

5.6 Material in Module 1: *Occupational Orientation*, Module 2: *Safety and Health of Welders*, Module 3: *Drawing and Welding Symbol Interpretation*, Module 8: *Thermal Cutting Processes*, and Module 9: *Welding Inspection and Testing*, which is common to all welding processes, will be taught in conjunction with the practical skill training. At the discretion of the instructor, any given lesson plan may include varying amounts of time for classroom and laboratory work.

6. Entry Welder Practical Knowledge Qualification - Written Test

6.1 The practical knowledge test is a written examination designed to show that the Entry Welder understands the

subject matter presented in the program. If the trainee has special needs for learning, the instructor shall administer the written test in the manner most suitable for the trainee.

6.1.1 A safety test based on ANSI Z49.1 shall be administered prior to skill training. Trainees must achieve a minimum score of 90% on the safety test before proceeding with skill training.

6.1.2 Practical knowledge testing may be administered at the completion of the whole entry-level program. Alternatively, tests may be administered at the completion of each module of training. A minimum passing grade of 75% is required for practical knowledge tests.

6.1.3 Trainees shall be allowed up to three (3) attempts to pass a written test. If a trainee fails to achieve a passing grade after three (3) attempts, they shall be retrained in that area.

7. Entry Welder Performance Qualification

7.1 Performance Qualification tests are designed to show that the Entry Welder can:

1. Read and interpret simple drawings and sketches, including welding symbols
2. Follow written procedures
3. Cut parts to proper size and fit simple assemblies
4. Pass a standard AWS visual inspection and a limited thickness SMAW qualification test in the horizontal (2G) and vertical (3G), uphill, positions (drawing AWS EDU-6) on carbon steel
5. Pass a performance qualification test (visual inspection) using GMAW-S (Short Circuiting Transfer) (drawing AWS EDU-3) on carbon steel
6. Pass a performance qualification test (visual inspection) using GMAW (Spray Transfer) (drawing AWS EDU-2) on carbon steel
7. Pass a performance qualification tests (visual inspection) using FCAW-G/GM (gas shielded) and FCAW-S (self shielded) (drawing AWS EDU-1) on carbon steel
8. Pass a performance qualification test (visual inspection) using GTAW (drawings AWS EDU-3, AWS EDU-4 and AWS EDU-5) on carbon steel, stainless steel, and aluminum

7.1.1 For each qualification test, the Entry Welder shall prepare, by flame or plasma arc cutting, the parts required in drawings AWS EDU-1 through 6.

7.1.2 For each qualification test, the Entry Welder shall assemble the parts prepared in 7.1.1, as shown in Figures 1-6.

7.1.3 The Entry Welder shall weld the assemblies using the WPS indicated on the drawing for each assembly (see Table 2).

8. Inspection, Testing, and Acceptance Criteria

8.1 All thermally cut edges/surfaces shall be visually examined and the edges/surfaces shall meet the criteria of AWS C4.1 Sample 2. After inspection, the edges/surfaces may be mechanically finished to bright metal by any suitable means.

8.2 All assemblies shall be visually examined and the welds shall meet the acceptance criteria provided in Table 3.

8.3 Single-V-groove welds in butt joints welded with the shielded metal arc welding process in the horizontal (2G) and vertical (3G), uphill, positions shall be cut to produce face- and root-bend specimens as shown in Figure 6.

8.4 Face- and root-bend specimens shall be conditioned as shown in Figure 7, and bent in a guided-bend jig similar to Figure 8, 9, or 10 in accordance with AWS B4.0, *Standard Methods for Mechanical Testing of Welds*.

8.5 Face- and root-bend specimens after bending shall meet the requirements of Table 4.

9. Documentation

9.1 Quality Manual

9.1.1 Training Organizations shall maintain and follow a quality manual that assures compliance with this specification.

9.2 Full Completion of Entry Welder Program

9.2.1 Upon completion of the requirements for Entry Welder listed in Clauses 6, 7, and 8, the successful trainee may register as an AWS SENSE certified Level I—Entry Welder.

9.2.2 For each successful trainee, the Training Organization participating in the qualification and certification of Level I—Entry Welder shall prepare and send to AWS the Record of Successful Completion form and include the following:

1. The Trainee Entry Welder's name and address
2. The actual grade on the written, closed-book tests
3. The actual grade on the safety written, closed-book test

4. The results of the visual examination of each performance qualification test

5. The results of the Face- and Root-bend tests on the SMAW test plates

9.3 Partial Completion of Entry Welder Program

9.3.1 A trainee may register as an AWS SENSE certified Level I—Entry Welder in one or more successfully completed arc welding processes (Modules 4, 5, 6, and/or 7).

9.3.2 In order to be included in the AWS database of SENSE Entry Welders as having successfully completed training in one or more arc welding process, the trainee must also have completed the following:

1. Module 1: Occupational Orientation
2. Module 2: Safety and Health of Welders
3. Module 3: Drawing and Welding Symbol Interpretation
4. Module 8: Thermal Cutting Processes (Units 1 and 3, minimum)
5. Module 9: Welding Inspection and Testing

9.3.3 For a trainee seeking recognition for partial completion of the Entry Welder Program, the Training Organization participating in the qualification and certification of Level I—Entry Welder shall prepare and send to AWS the Record of Successful Completion form and include the following:

1. The Trainee Entry Welder's name and address
2. The actual grades on the written, closed-book test for the modules or units within a module completed
3. The actual grades on the safety written, closed-book test
4. The results of the visual examination of each workmanship sample for the module(s) completed
5. The results of the Face- and Root-bend tests on the SMAW test plates if that module is completed

10. Records of Welder Certification

10.1 The Training Organization participating in the qualification and certification of Level I—Entry Welder shall send the Record of Successful Completion form for full or partial program completion to the American Welding Society.

10.2 The AWS shall enter the data into the Entry Welder database.

10.3 For successful completion of Level I—Entry Welder, the AWS will issue a SENSE completion certificate.

10.4 For successful completion of Level I—Entry Welder, the AWS will issue a certification card listing the endorsements for each arc welding process successfully completed by the trainee.

required to maintain certification by reporting welding activities.

11.2 After three (3) years a permanent record of program completion shall be archived.

11. Registration of Entry Welders

11.1 The Training Organization shall forward to AWS the Record of Successful Completion form for the completion of modules (or units within a module) of Level I—Entry Welder. AWS shall maintain records of program completion. Individuals registered in the AWS database of SENSE Entry Welders are not

11.3 If an individual with partial status completes the entire Level I—Entry Welder program during the three (3) year active period, the training organization will verify completion by sending the Record of Successful Completion form to AWS (see 10.1). The trainee will be listed as an AWS SENSE certified Level I—Entry Welder for three (3) years from the date of program completion, after which time a permanent record shall be archived.

**Table 1
Level I—Entry Welder Program Structure**

Learning Module or Unit	Competency	Verification—Qualification Test ^a			Competency Achieved by: ^a
		Written	Visual	Destructive	
Module 1	Occupational Orientation	NA	NA	NA	Instructor/Advisor observation
Module 2	Safety and Health of Welders	Yes	NA	NA	Written Test Score 90% minimum
Module 3	Drawing and Welding Symbol Interpretation	Yes	NA	NA	Written Test Score 75% minimum
Module 4	Shielded Metal Arc Welding (SMAW)	Yes	Yes	Yes	Written Test Score 75% minimum Visual Inspection Passed Destructive Test Passed
Module 5	Gas Metal Arc Welding (GMAW, GMAW-S)	Yes	Yes	NA	Written Test Score 75% minimum Visual Inspection Passed
Module 6	Flux Cored Arc Welding (FCAW-G/GM, FCAW-S)	Yes	Yes	NA	Written Test Score 75% minimum Visual Inspection Passed
Module 7	Gas Tungsten Arc Welding (GTAW)	Yes	Yes	NA	Written Test Score 75% minimum Visual Inspection Passed
Module 8	Thermal Cutting Processes	Yes	NA	NA	Written Test Score 75% minimum Visual (see below)
Unit 1	Manual Oxyfuel Gas Cutting (OFC)	Yes	Yes	NA	Included in Module 8 test Visual Inspection Passed
Unit 2	Mechanized Oxyfuel Gas Cutting (OFC)	Yes	Optional	NA	Included in Module 8 test
Unit 3	Manual Plasma Arc Cutting—PAC	Yes	Yes	NA	Included in Module 8 test Visual Inspection Passed
Unit 4	Manual Air Carbon Arc Cutting (CAC-A)	Yes	Optional	NA	Included in Module 8 test
Module 9	Welding Inspection and Testing	Yes	NA	NA	Written Test Score 75% minimum

^aSee Clause 6 for explanation of testing sequence and passing scores.

Table 2
Entry Welder Performance Qualification Tests

Performance Test	Process	Drawing No.	Procedure WPS ^a	Material	Alternate WPS
1—Performance Qualification	GMAW-S	3	AWS EDU GMAW-01	Carbon Steel	AWS-1-GMAW-S
2—Performance Qualification	FCAW-G or FCAW-GM	1	AWS EDU FCAW-01 or AWS EDU FCAW-02	Carbon Steel	ANSI/AWS B2.1-019 or ANSI/AWS B2.1-020
3—Performance Qualification	FCAW-S	1	AWS EDU FCAW-03	Carbon Steel	ANSI/AWS B2.1-027
4—Performance Qualification	GMAW	2	AWS EDU GMAW-02	Carbon Steel	AWS-2-GMAW
5—Performance Qualification	GTAW	3	AWS EDU GTAW-01	Carbon Steel	ANSI/AWS B2.1-008
6—Performance Qualification	GTAW	4	AWS EDU GTAW-02	Stainless Steel	ANSI/AWS B2.1-009
7—Performance Qualification	GTAW	5	AWS EDU GTAW-03	Aluminum (4000/5000 Series)	ANSI/AWS B2.1-015
8—Test Plate—2G	SMAW	6	AWS EDU SMAW-01	Carbon Steel	ANSI/AWS B2.1-001
9—Test Plate—3G, Uphill	SMAW	6	AWS EDU SMAW-02	Carbon Steel	ANSI/AWS B2.1-001

^a Any suitable WPS qualified to a nationally recognized code may be used.

Table 3
Visual Inspection Criteria for Entry Welders

1. There shall be no cracks or incomplete fusion.
2. There shall be no incomplete joint penetration in groove welds except as permitted for partial joint penetration groove welds.
3. The Test Supervisor shall examine the weld for acceptable appearance, and shall be satisfied that the welder is skilled in using the process and procedure specified for the test.
4. Undercut shall not exceed the lesser of 10% of the base metal thickness or 1/32 in. (0.8 mm).
5. Where visual examination is the only criterion for acceptance, all weld passes are subject to visual examination, at the discretion of the Test Supervisor.
6. The frequency of porosity shall not exceed one in each 4 in. (100 mm) of weld length and the maximum diameter shall not exceed 3/32 in. (2.4 mm).
7. Welds shall be free from overlap.

Table 4
Acceptance Criteria for Face- and Root-Bends

For acceptance, the convex surface of the face- and root-bend specimens shall meet both of the following requirements:

1. No single indication shall exceed 1/8 in. (3.2 mm), measured in any direction on the surface.
2. The sum of the greatest dimensions of all indications on the surface, which exceed 1/32 in. (0.8 mm), but are less than or equal to 1/8 in. (3.2 mm), shall not exceed 3/8 in. (9.6 mm).

Cracks occurring at the corner of the specimens shall not be considered unless there is definite evidence that they result from slag inclusions or other internal discontinuities.

Annex A

Performance Qualification

This annex is not a part of QC10:2006, *Specification for Qualification and Certification of Level I—Entry Welder*, but is included for informational purposes only.

VISUAL INSPECTION RESULTS

Name of Trainee _____

Trainee ID # _____

Sample # _____

Weld Size:

Undersize OK Oversize

Undercut:

Acceptable Rejected

Porosity:

Diameter of Largest _____

Acceptable Rejected

Overlap:

Acceptable Rejected

Penetration:

Acceptable Rejected

Appearance:

Acceptable Rejected

Cracks:

Acceptable Rejected

Name _____

(Please Print)

Date _____

Signature _____

This page is intentionally blank.

Annex B

Face- and Root-Bend Test Results

This annex is not a part of QC10:2006, *Specification for Qualification and Certification of Level I—Entry Welder*, but is included for informational purposes only.

Name of Trainee _____

Trainee ID # _____

Sample # _____

2G Face-bend:
Length of each discontinuity (Over 1/32 in.) _____ Sum _____
Accept Reject

2G Root-bend:
Length of each discontinuity (Over 1/32 in.) _____ Sum _____
Accept Reject

3G, Uphill Face-bend:
Length of each discontinuity (Over 1/32 in.) _____ Sum _____
Accept Reject

3G, Uphill Root-bend:
Length of each discontinuity (Over 1/32 in.) _____ Sum _____
Accept Reject

Name _____ Date _____
(Please Print)

Signature _____

This page is intentionally blank.

Annex C

Breakdown of Modules and Key Indicators

Level I—Entry Welder

This annex is not a part of QC10:2006, *Specification for Qualification and Certification of Level I—Entry Welder*, but is included for informational purposes only.

Module 1: Occupational Orientation

Key Indicators:

1. Prepares time or job cards, reports or records.
2. Performs house keeping duties.
3. Follows verbal instructions to complete work assignments.
4. Follows written instructions to complete work assignments.

Module 2: Safety and Health of Welders

Key Indicators:

1. Demonstrates proper use and inspection of personal protection equipment (PPE).
2. Demonstrates proper safe operation practices in work area.
3. Demonstrates proper use and inspection of ventilation equipment.
4. Demonstrates proper Hot Zone operation.
5. Demonstrates proper work actions for working in confined spaces.
6. Demonstrates proper use of precautionary labeling and MSDS information.
7. Demonstrates proper inspection and operation of equipment used for each welding and thermal cutting process used. (This is best done as a part of the process module/unit for each of the required welding or thermal cutting processes.)

Module 3: Drawing and Welding Symbol Interpretation

Key Indicators:

1. Interprets basic elements of a drawing or sketch.
2. Interprets welding symbol information.
3. Fabricates parts from a drawing or sketch.

Module 4: Shielded Metal Arc Welding (SMAW)

Key Indicators:

1. Performs safety inspections of SMAW equipment and accessories.
2. Makes minor external repairs to SMAW equipment and accessories.
3. Sets up for SMAW operations on carbon steel.
4. Operates SMAW equipment on carbon steel.

5. Makes fillet welds in all positions on carbon steel.
6. Makes groove welds in all positions on carbon steel.
7. Passes SMAW welder performance qualification test (2G and 3G, uphill, limited thickness test plates) on carbon steel.

Module 5: Gas Metal Arc Welding (GMAW-S, GMAW Spray Transfer)

Key Indicators:

1. Performs safety inspections of GMAW equipment and accessories.
2. Makes minor external repairs to GMAW equipment and accessories.

Short Circuiting Transfer

3. Sets up for GMAW-S operations on carbon steel.
4. Operates GMAW-S equipment on carbon steel.
5. Makes fillet welds in all positions on carbon steel.
6. Makes groove welds in all positions on carbon steel.
7. Passes GMAW-S welder performance qualification test on carbon steel.

Spray Transfer

8. Sets up for GMAW (spray) operations on carbon steel.
9. Operates GMAW (spray) equipment on carbon steel.
10. Makes fillet welds in the 1F and 2F positions on carbon steel.
11. Makes groove welds in the 1G position on carbon steel.
12. Passes GMAW (spray) welder performance qualification test on carbon steel.

Module 6: Flux Cored Arc Welding (FCAW-G/GM, FCAW-S)

Key Indicators:

1. Performs safety inspections of FCAW equipment and accessories.
2. Makes minor external repairs to FCAW equipment and accessories.

Gas Shielded

3. Sets up for FCAW- G/GM operations on carbon steel.
4. Operates FCAW- G/GM equipment on carbon.
5. Makes fillet welds in all positions on carbon steel.
6. Makes groove welds in all positions on carbon steel.
7. Passes FCAW-G/GM welder performance qualification test on carbon steel.

Self- Shielded

8. Sets up for FCAW- S operations on carbon steel.
9. Operates FCAW- S equipment on carbon.
10. Makes fillet welds in all positions on carbon steel.
11. Makes groove welds in all positions on carbon steel.
12. Passes FCAW- S welder performance qualification test on carbon steel.

Module 7: Gas Tungsten Arc Welding (GTAW)

Key Indicators:

1. Performs safety inspections of GTAW equipment and accessories.
2. Makes minor external repairs to GTAW equipment and accessories.

Carbon Steel

3. Sets up for GTAW operations on carbon.
4. Operates GTAW equipment on carbon steel.
5. Makes fillet welds in all positions on carbon steel.
6. Makes groove welds in all positions on carbon steel.
7. Passes GTAW welder performance qualification test on carbon steel.

Austenitic Stainless Steel

8. Sets up for GTAW operations on austenitic stainless steel.
9. Operates GTAW equipment on austenitic stainless steel.
10. Makes fillet welds in the 1F, 2F and 3F positions on austenitic stainless steel.
11. Makes groove welds, in the 1G and 2G positions on austenitic stainless steel.
12. Passes GTAW welder performance qualification test on austenitic stainless steel.

Aluminum

13. Sets up for GTAW operations on aluminum.
14. Operates GTAW equipment on aluminum.
15. Makes fillet welds in the 1F and 2F positions on aluminum.
16. Makes groove welds in the 1G position on aluminum.
17. Passes GTAW welder performance qualification test on aluminum.

Module 8: Thermal Cutting Processes

UNIT 1: MANUAL OXYFUEL GAS CUTTING (OFC)

Key Indicators:

1. Performs safety inspections of manual OFC equipment and accessories.
2. Makes minor external repairs to manual OFC equipment and accessories.
3. Sets up for manual OFC operations on carbon steel.
4. Operates manual OFC equipment on carbon steel.
5. Performs straight, square edge cutting operations in the flat position on carbon steel.
6. Performs shape, square edge cutting operations in the flat position on carbon steel.
7. Performs straight, bevel edge cutting operations in the flat and position on carbon steel.
8. Performs scarfing and gouging operations to remove base and weld metal, in flat and horizontal positions on carbon steel.

UNIT 2: MECHANIZED OXYFUEL GAS CUTTING (OFC) [e.g. TRACK BURNER]

Key Indicators:

1. Performs safety inspections of mechanized OFC equipment and accessories.
2. Makes minor external repairs to mechanized OFC equipment and accessories.
3. Sets up for mechanized OFC operations on carbon steel.
4. Operates mechanized OFC equipment on carbon steel.
5. Performs straight, square edge cutting operations in the flat position on carbon steel.
6. Performs straight, bevel edge cutting operations in the flat position on of carbon steel.

UNIT 3: MANUAL PLASMA ARC CUTTING (PAC)

Key Indicators:

1. Performs safety inspections of manual PAC equipment and accessories.
2. Makes minor external repairs to manual PAC equipment and accessories.
3. Sets up for manual PAC operations on carbon steel, austenitic stainless steel, and aluminum.
4. Operates manual PAC equipment on carbon steel, austenitic stainless steel, and aluminum.
5. Performs straight, square edge cutting operations, in the flat position on carbon steel, austenitic stainless steel, and aluminum.
6. Performs shape, square edge cutting operations in the flat position on carbon steel, austenitic stainless steel, and aluminum.

UNIT 4: MANUAL AIR CARBON ARC CUTTING (CAC-A)

Key Indicators:

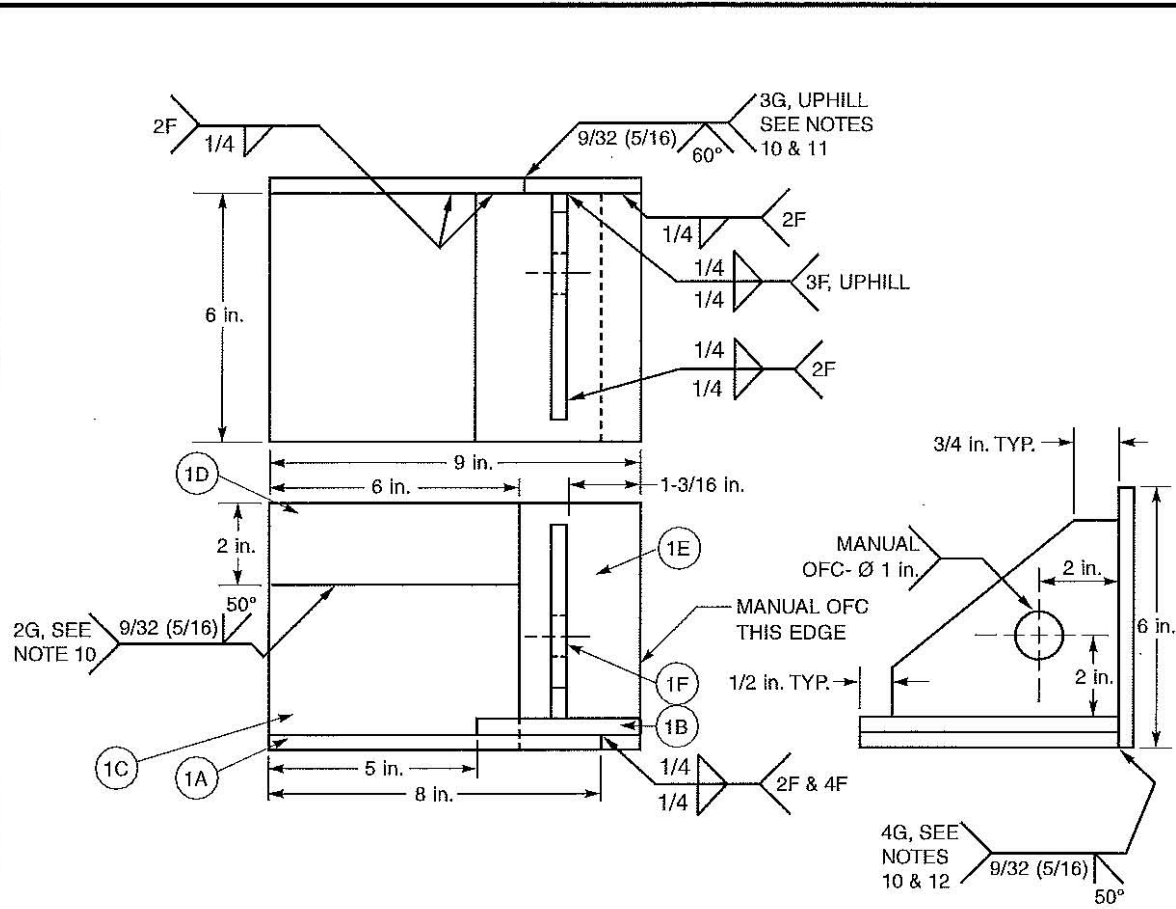
1. Performs safety inspections of manual CAC-A equipment and accessories.
2. Makes minor external repairs to manual CAC-A equipment and accessories.
3. Sets up for manual CAC-A scarfing and gouging operations on carbon steel.
4. Operates manual CAC-A equipment on carbon steel.
5. Performs scarfing and gouging operations to remove base and weld metal, in the flat and horizontal positions on carbon steel.

Module 9: Welding Inspection and Testing

Key Indicators:


1. Examines cut surfaces and edges of prepared base metal parts.
2. Examines tacks, root passes, intermediate layers, and completed welds.

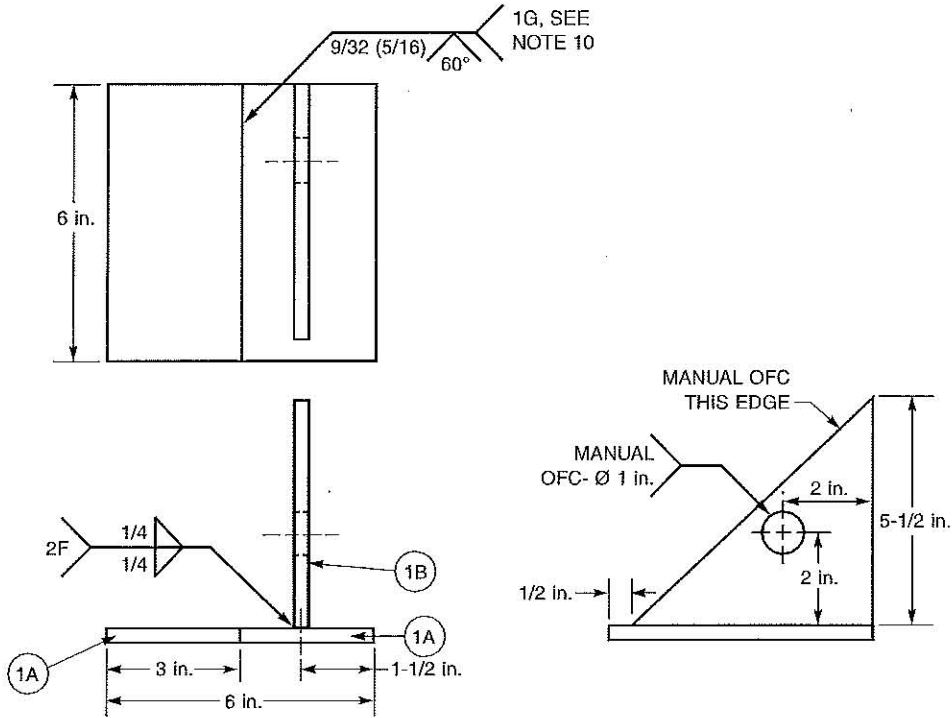
Note: Additional information may be found in AWS EG2.0 *Guide for the Training of Welding Personnel: Level I—Entry Welder*, 3.2 and 3.3.



NOTES:

1. All dimensions U.S. Customary Units unless otherwise specified.
2. 3/8 in. thickness carbon steel.
3. The welder shall prepare a bill of materials in U.S. Customary Units prior to cutting.
4. The welder shall convert the above bill of materials to S.I. Metric Units of measure.
5. All parts may be mechanically cut or machine OFC unless specified manual OFC.
6. All welds FCAW-G/GM or FCAW-S as applicable.
7. Fit and tack entire assembly on bench before attaching to positioning arm.
8. All welding to be done in position according to welding symbol.
9. Employ boxing technique where applicable.
10. Melt through not required.
11. Weld joints parts 1C and 1D to 1E.
12. Weld joints parts 1C and 1E to 1A.
13. For FCAW-G, use WPS AWS EDU FCAW-01. (See AWS QC10, Table 2.)
For FCAW-GM use WPS AWS EDU FCAW-01. (See AWS QC10, Table 2.)
For FCAW-S use WPS AWS EDU FCAW-03. (See AWS QC10, Table 2.)
14. Visual examination in accordance with requirements of AWS QC10, Table 3.

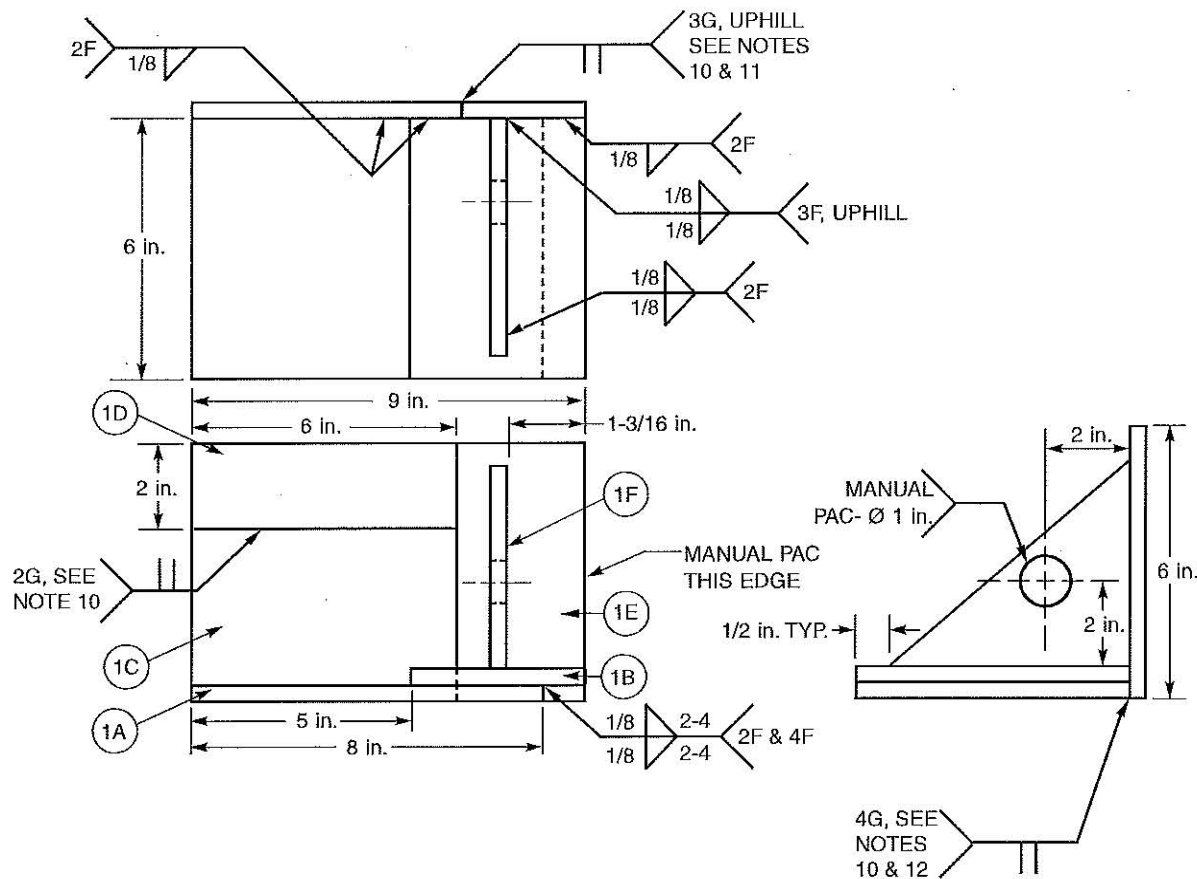
ID	QTY	SIZE	METRIC CONVERSION	 American Welding Society		
				Entry Welder Performance Qualification		
				FCAW-G/GM, FCAW-S Carbon Steel		
				DATE:	SCALE:	DWG #: AWS EDU-1
				DR BY:	Tolerances: (Unless otherwise specified) DRAWING NOT TO SCALE Fractions: ± 1/16" Angles: +10°, -5°	
				APP BY:		



NOTES:


1. All dimensions U.S. Customary Units unless otherwise specified.
2. 3/8 in. thickness carbon steel.
3. The welder shall prepare a bill of materials in U.S. Customary Units of measure prior to cutting.
4. The welder shall convert the above bill of materials to S.I. Metric Units of measure.
5. All parts may be mechanically cut or machine OFC unless specified manual OFC.
6. All welds GMAW Spray Transfer.
7. Fit and tack entire assembly on bench before welding.
8. All welding to be done in position according to welding symbol.
9. Employ boxing technique where applicable.
10. Melt through not required.
11. Use WPS AWS EDU GMAW-02, AWS QC10, Table 2.
12. Visual examination in accordance with the requirements of AWS QC10, Table 3.

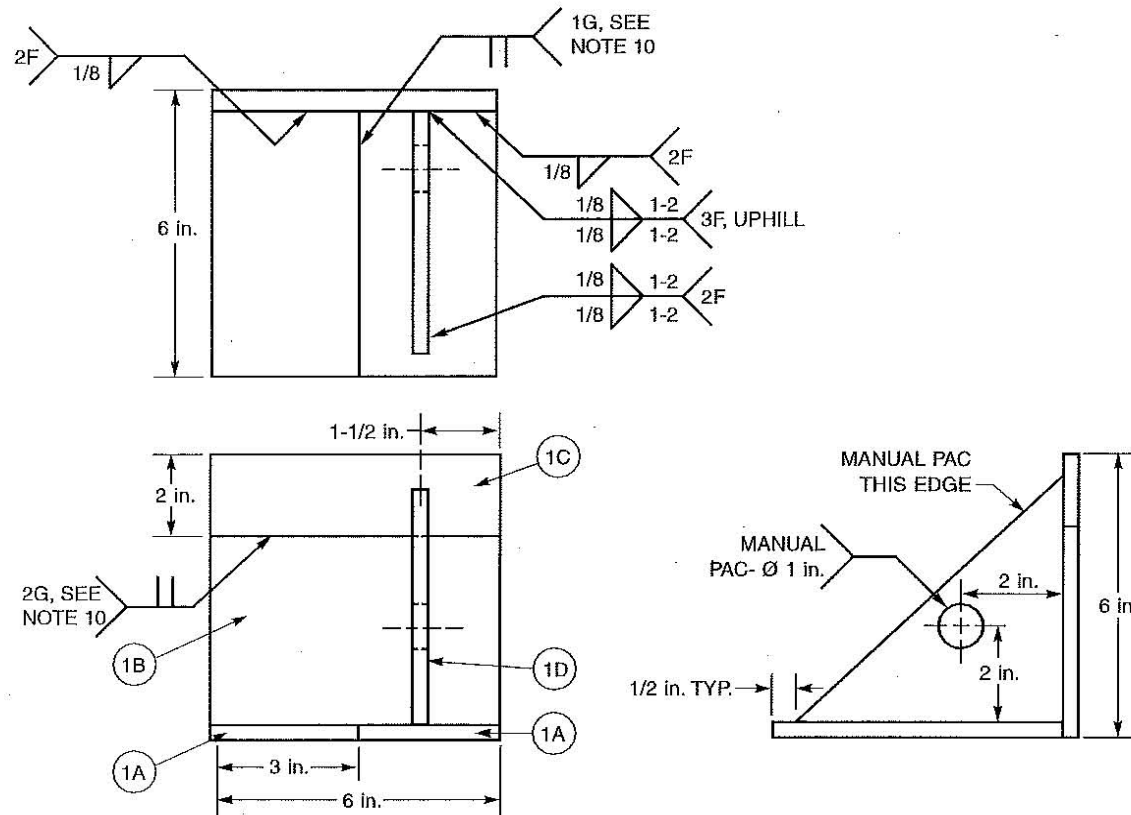
ID	QTY	SIZE	METRIC CONVERSION	American Welding Society	
				Entry Welder Performance Qualification	
				GMAW Spray Transfer, Carbon Steel	
				DATE:	SCALE: DWG #: AWS EDU-2
				DR BY:	Tolerances: (Unless otherwise specified)
				APP BY:	DRAWING NOT TO SCALE Fractions: ± 1/16" Angles: +10°, -5°



NOTES:

1. All dimensions U.S. Customary Units unless otherwise specified.
2. 10 ga.-14 ga. thickness carbon steel. Optional choice of thickness within range specified.
3. The welder shall prepare a bill of materials in U.S. Customary Units prior to cutting.
4. The welder shall convert the above bill of materials to S.I. Metric Units of measure.
5. All parts may be mechanically cut or machine PAC unless specified manual PAC.
6. All welds GMAW-S (Short Circuiting Transfer) or GTAW as applicable.
7. Fit and tack entire assembly on bench before attaching to positioning arm.
8. All welding to be done in position according to welding symbol.
9. Employ boxing technique where applicable.
10. Melt through not required.
11. Weld joints parts 1C and 1D to 1E.
12. Weld joints parts 1C and 1E to 1A.
13. For GMAW-S, use WPS AWS EDU GMAW-01. (See AWS QC10, Table 2.)
14. For GTAW use WPS AWS EDU GTAW-01. (See AWS QC10, Table 2.)
15. Visual examination in accordance with requirements of AWS QC10, Table 3.

ID	QTY	SIZE	METRIC CONVERSION	 American Welding Society		
				Entry Welder Performance Qualification		
				GMAW-S, GTAW Carbon Steel		
				DATE:	SCALE:	DWG #: AWS EDU-3
				DR BY:	Tolerances: (Unless otherwise specified) DRAWING NOT TO SCALE Fractions: ± 1/16" Angles: +10°, -5°	
				APP BY:		

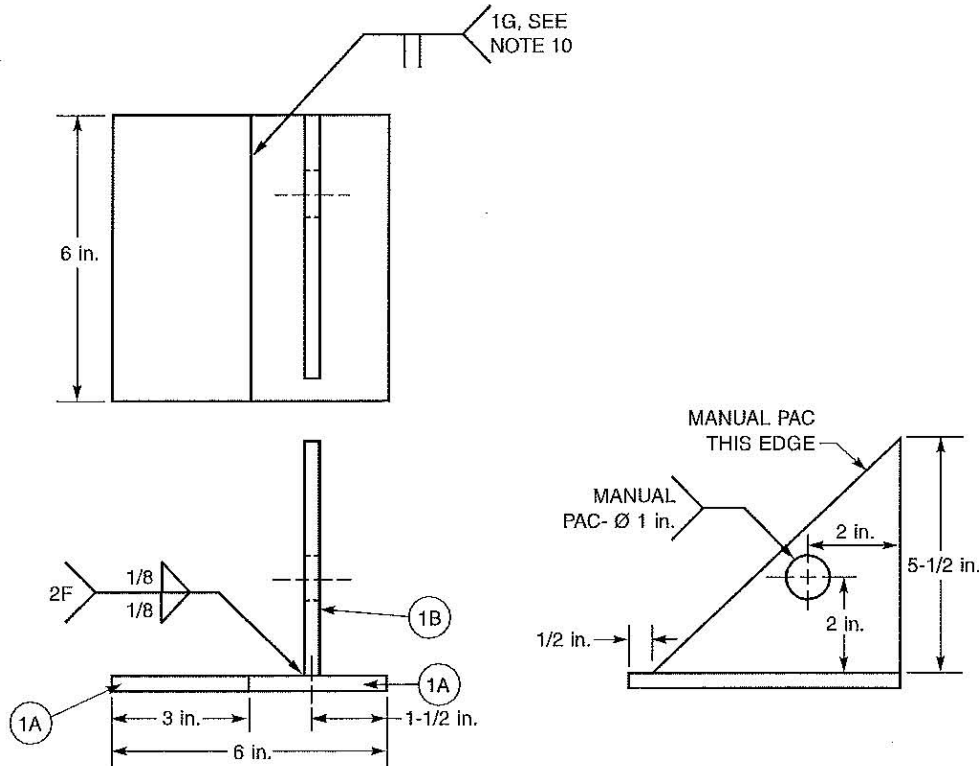


NOTES:

1. All dimensions U.S. Customary Units unless otherwise specified.
2. 10 ga.-14 ga. thickness austenitic stainless steel. Optional choice of thickness within range specified.
3. The welder shall prepare a bill of materials in U.S. Customary Units prior to cutting.
4. The welder shall convert the above bill of materials to S.I. Metric Units of measure.
5. All parts may be mechanically cut or machine PAC unless specified manual PAC.
6. All welds GTAW.
7. Fit and tack entire assembly on bench before attaching to positioning arm.
8. All welding to be done in position according to welding symbol.
9. Employ boxing technique where applicable.
10. Melt through not required.
11. Use WPS AWS EDU GTAW-04. (See AWS QC10, Table 2.)
12. Visual examination in accordance with requirements of AWS QC10, Table 3.


18

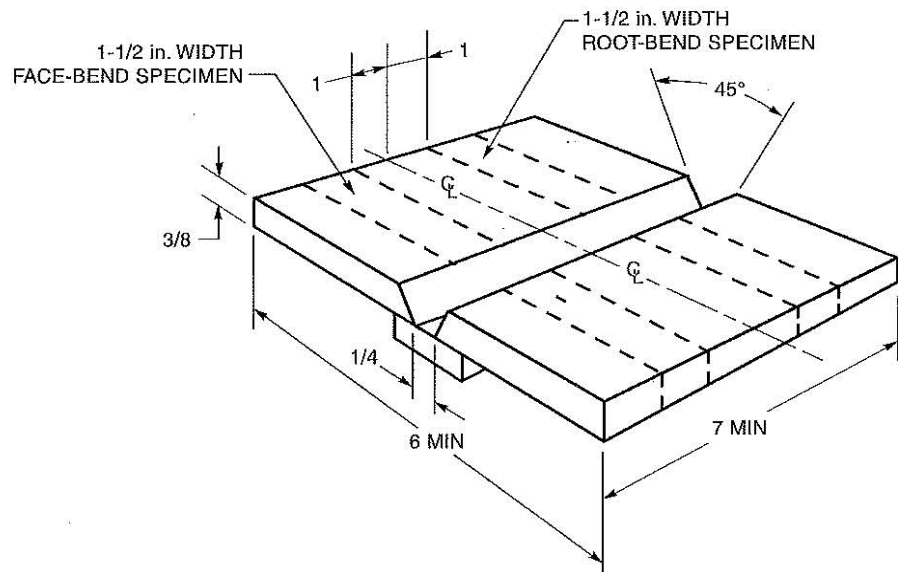
ID	QTY	SIZE	METRIC CONVERSION	American Welding Society		
				Entry Welder Performance Qualification		
				GTAW Austenitic Stainless Steel		
				DATE:	SCALE:	DWG #: AWS EDU-4
				DR BY:	Tolerances: (Unless otherwise specified)	
				APP BY:	DRAWING NOT TO SCALE	
					Fractions: ± 1/16" Angles: +10°, -5°	



NOTES:

1. All dimensions U.S. Customary Units unless otherwise specified.
2. 10 ga.-14 ga. thickness aluminum. Optional choice of thickness within range specified.
3. The welder shall prepare a bill of materials in U.S. Customary Units prior to cutting.
4. The welder shall convert the above bill of materials to S.I. Metric Units of measure.
5. All parts may be mechanically cut or machine PAC unless specified manual PAC.
6. All welds GTAW.
7. Fit and tack entire assembly on bench before attaching to positioning arm.
8. All welding to be done in position according to welding symbol.
9. Employ boxing technique where applicable.
10. Melt through not required.
11. Use WPS AWS EDU GTAW-03 for 4000/5000 Series aluminum. (See AWS QC10, Table 2.)
12. Visual examination in accordance with requirements of AWS QC10, Table 3.

ID	QTY	SIZE	METRIC CONVERSION	 American Welding Society		
				Entry Welder Performance Qualification		
				GTAW Aluminum		
				DATE:	SCALE:	DWG #: AWS EDU-5
				DR BY:	Tolerances: (Unless otherwise specified)	
				APP BY:	DRAWING NOT TO SCALE	
					Fractions: ± 1/16" Angles: +10°, -5°	

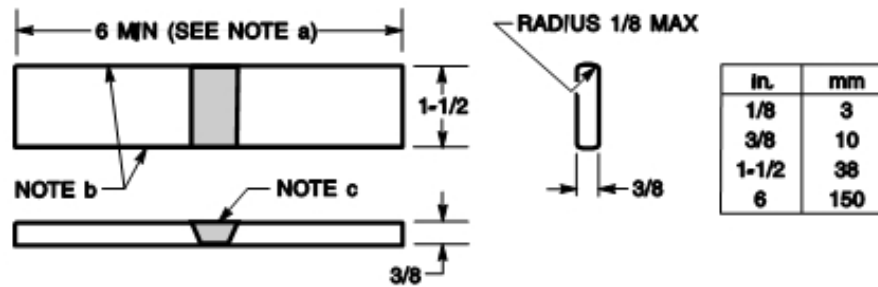


NOTES:

1. 3/8 in. thickness carbon steel material.
2. Performance Qualification #1 = 2G, Performance Qualification #2 = 3G, Uphill.
3. All welding done in position, according to applicable performance qualification requirements.
4. The backing thickness shall be 1/4 in. min to 3/8 in. max; backing width 1 in. min.
5. All parts may be mechanically cut or machine OFC.
6. Use WPS AWS EDU SMAW-01 for PQ#1-2G, and AWS EDU SMAW-02 for PQ#2-3G uphill. (See AWS QC10, Table 2.)
7. Visual examination in accordance with requirements of AWS QC10, Table 3.
8. Bend test in accordance with the requirements of QC10, Table 4.

20

ID	QTY	SIZE	METRIC CONVERSION	American Welding Society		
				Entry Welder Performance Qualification		
				SMAW Carbon Steel Test Plates		
				DATE:	SCALE:	DWG #: AWS EDU-6
				DR BY:	Tolerances: (Unless otherwise specified)	
				APP BY:	DRAWING NOT TO SCALE	
					Fractions: ± 1/16" Angles: +10°, -5°	



- Note:
- a A longer specimen length may be necessary.
 - b These edges may be oxygen cut and may or may not be machined.
 - c The weld reinforcement, and any backing, shall be removed flush with the surface of the specimen.
- Note:
1. Cut surfaces shall be smooth and parallel.

Figure 1—Face- and Root-Bend Test Specimen

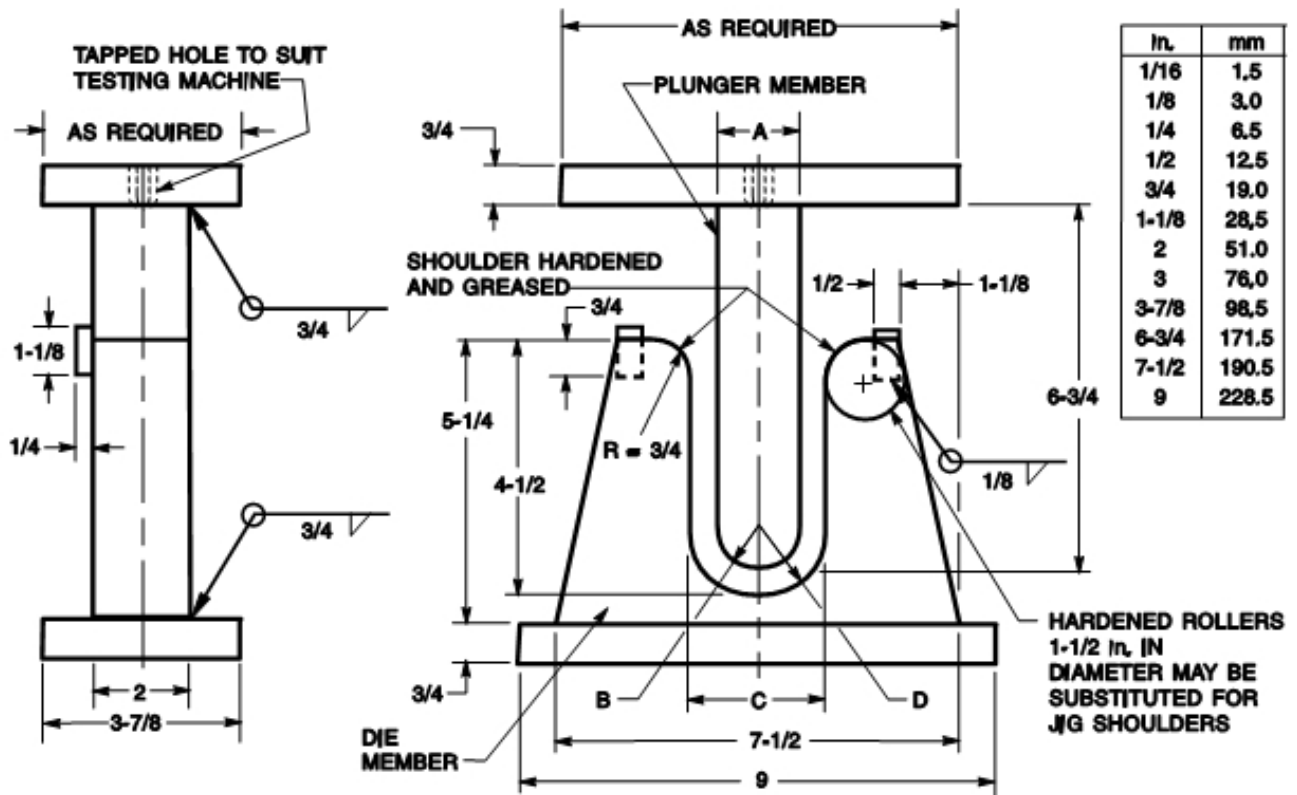


Figure 2—Guided-Bend Test Jig

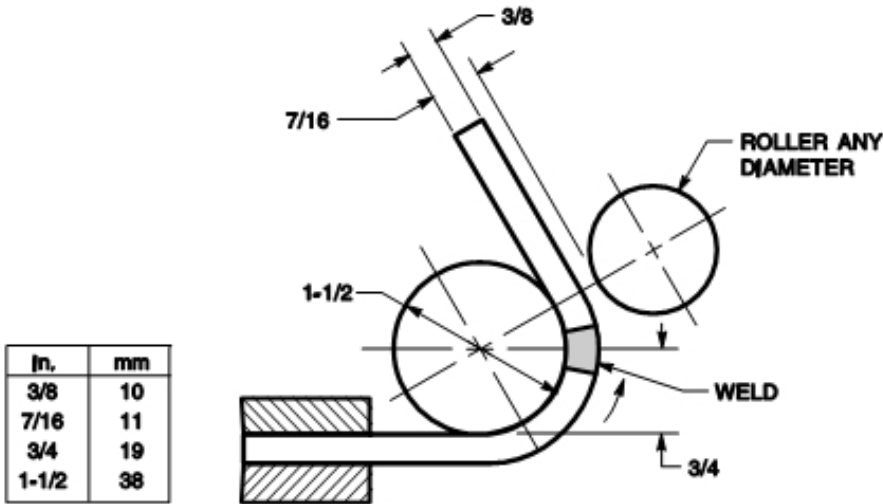


Figure 3—Alternative Wrap-Around Guided-Bend Test Jig

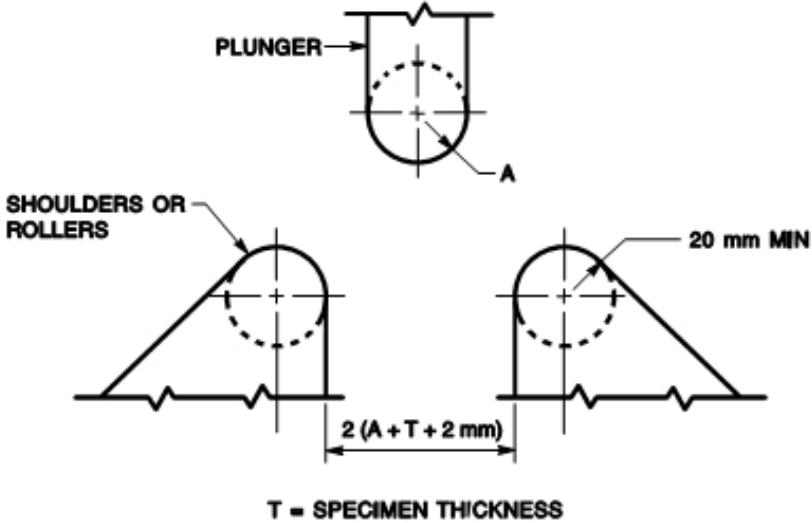


Figure 4—Alternative Roller-Equipped Guided-Bend Jig

List of AWS Documents

Designation	Title
A3.0	<i>Standard Welding Terms and Definitions</i>
B4.0	<i>Standard Methods for Mechanical Testing of Welds</i>
EG2.0	<i>Guide for the Training of Welding Personnel: Level I—Entry Welder</i>
EG3.0	<i>Guide for the Training of Welding Personnel: Level II—Advanced Welder</i>
EG4.0	<i>Guide for the Training of Welding Personnel: Level III—Expert Welder</i>
QC10	<i>Specification for Qualification and Certification of Level I—Entry Welders</i>
QC11	<i>Specification for Qualification and Certification for Level II—Advanced Welders</i>
QC12	<i>Specification for Qualification and Certification of Level III—Expert Welders</i>

This page is intentionally blank.