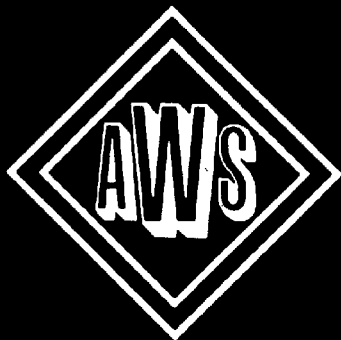


AWS QC10-95

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Specification for Qualification and Certification for Entry Level Welders



American Welding Society

Key Words — entry level welder, participating organization, performance tests, acceptance criteria, National Registry

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Specification for Qualification and Certification for Entry Level Welders

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Under the Direction of the
AWS Education Grant Committee

Approved by the
AWS Education and Certification Council

Revised January 1996

Abstract

This standard defines the requirements and program for the American Welding Society to certify entry level welders. The certification of entry level welders requires performance qualification and practical knowledge tests. These tests require a minimum of reading, computational, and manual skills to complete.



American Welding Society

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

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Foreword

(This Foreword is not a part of AWS QC10-95, *Specification for Qualification and Certification of Entry Level Welders*, but is included for information purposes only.)

In July 1993, the American Welding Society (AWS) was awarded a grant as part of the Business and Education Standards Program. This grant, from the U.S. Department of Education, was matched by an equal amount of in-kind support from the American Welding Society. Under this grant, AWS organized the Education Grant Committee, which has overseen the efforts towards a standard for the qualification and certification of the entry level welder.

This Entry Level Welder Program will form a part of the National Skill Standards Program, which is being enacted across a wide range of industries in the United States.

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 first time employment or positions as entry level welders.

The results of this industry survey were an occupational task analysis that formed the basis for curriculum guidelines to guide the training of the Entry Level Welder candidate.

This standard defines the requirements for the certification of such individuals and their entry into the National Registry of Entry Level Welders.

Comments and suggestions for improvement of this standard are welcome. They should be sent in writing to the Secretary, AWS Education Committee, American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126.

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Specification for Qualification and Certification of Entry Level Welders

1. Scope

1.1 This standard establishes the minimum requirements for an organization to participate with the American Welding Society (AWS) in the qualification and certification of entry level welders.

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 that meet the specified performance at a facility meeting **3. Requirements for Participating Organizations** will be listed in The National Registry of Entry Level Welders at the American Welding Society.

1.4 Organizations not meeting **3. Requirements for Participating Organizations** may use this standard, but individuals they certify will not be listed in the National Registry of Entry Level 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 and Cutting*, other safety and health standards, and federal, state, and local government regulations. The responsibility for safety of the Entry Level Welder is primarily with the welder, the Participating Organization during training and testing, and afterwards, with the employer.

2. Definitions

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

(1) Participating Organization - Any organization meeting **3. Requirements for Participating Organizations**.

(2) Entry Level Welder - An individual who possesses a prerequisite amount of knowledge, attitude, skills, and habits required to perform routine, predictable, repetitive, proceduralized tasks involving motor skills and limited theoretical knowledge while working under close supervision.

3. Requirements for Participating Organizations

3.1 Participating Organizations may be training-and-testing or testing-only facilities.

3.2 Participating Organizations shall maintain and follow a quality manual that assures compliance with this specification.

3.3 An application for registration as a Participating Organization shall be submitted with a cover letter signed by the Senior Official at the Facility. The cover letter shall certify to AWS that the Facility has a Quality Program which will be rigorously followed, and that the requirements of this standard will be met. If the Participating Organization is a training-and-testing organization, the letter shall also state that their curriculum follows AWS EG2.0, *Guide for Training and Qualification of Welding Personnel - Entry Level Welders*.

3.4 Test supervisors for testing-and-training or testing-only Participating Organizations should be AWS Certified Welding Inspectors.

3.5 Instructors for testing-and-training Participating Organizations should be AWS Certified Welding Educators.

3.6 Quality System Audits. Audits may be required if evidence of nonconformance with the Participating Organization's Quality Program or this specification exists.

3.6.1 Allegations of nonconformance supported by documentary evidence will be presented to the AWS Qualification and Certification Committee. The committee may require:

- 1) A written statement by the Senior Official of the Participating Organization with supporting evidence refuting the allegations, and a statement by the Senior Official of the Participating Organization that the requirements of the Participating Organization Quality Program and this specification have been met in the past, and will be met in the future, or
- 2) An on-site quality audit by an AWS Approved Assessor to verify that the requirements of the Quality Program and this specification have been and are being met.

3.6.2 If a quality audit is required by the Committee, then the Participating Organization has two options, as follows:

- 1) The Participating Organization may decline to be audited and resign from the Program, or

- 2) The Participating Organization may agree to be audited, in which case the Senior Official of the Participating Organization shall issue a purchase order to AWS for administrative fees and expenses of the assessor.

4.0 Practical Knowledge Test

4.1 The practical knowledge test is a written closed-book examination designed to show that the Entry Level Welder understands the following subjects:

Welding and Cutting Theory
Welding and Cutting Inspection and Testing
Welding and Cutting Terms and Definitions
Base and Filler Metal Identification
Base and Filler Metal Selection
Common Welding Process Variables
Electrical Fundamentals
Drawing and Welding Symbol Interpretation
Fabrication Principles and Practices
Safe Practices

4.2 A minimum passing grade of 75% is required with at least 90% of the safety questions answered correctly, with a limit of three retests.

5.0 Performance Tests

Performance tests are designed to show that the Entry Level 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 limited thickness SMAW qualification test in the horizontal (2G) and vertical (3G) positions,
- 5) Pass workmanship tests using GMAW and FCAW (Figures 1 and 2) in carbon steel, and
- 6) GTAW (Figures 3 through 5) in carbon steel, stainless steel, and aluminum sheet metal.

5.1. The Entry Level Welder shall prepare, by flame or plasma arc cutting, the parts required in Figures 1 through 5.

5.2. The Entry Level Welder shall assemble the parts prepared in 5.1, as shown in Figures 1 through 5.

5.3 The Entry Level Welder shall weld the assemblies using the WPS indicated on the drawing for each assembly. The WPSs specified are listed in Annex A.

6. Inspection, Testing, and Acceptance Criteria

6.1 All cut edges shall be visually examined and the cut surfaces shall meet the criteria of AWS C4.1 Sample 2 with grinding. After inspection, the cut surfaces may be conditioned to bright metal.

6.2 All assemblies shall be visually examined and the welds shall meet the acceptance criteria shown in Table 1.

6.3 Butt joints welded with the shielded metal arc welding process in the horizontal (2G) and vertical (3G) positions shall be cut to produce face- and root-bend specimens as shown in Figure 6.

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

6.5 Face- and root-bend specimens after bending shall meet the requirements of Table 2.

7.0 Documentation

For each successful Entry Level Welder, the Participating Organization shall prepare a report containing the following:

- 1) The Entry Level Welder's name and Social Security Number,
- 2) The actual grade on the Written Closed Book Test,
- 3) The actual grade on the Safety portion of the Written Closed Book Test,
- 4) The results of the visual examination of each workmanship test, and
- 5) The results of the face- and root-bend tests on the horizontal (2G) and vertical (3G) position SMAW performance qualification test plates.

8.0 Certification

8.1 The Participating Organization shall send the report to the American Welding Society.

8.2 The American Welding Society shall enter the data into the Entry Level Welder database and destroy the report.

9. National Registry of Entry Level Welders

The Entry Level Welder database shall function as the National Registry of Entry Level Welders.

9.1 Persons listed in the databank are not required to maintain registration by reporting welding activities. Individual registrations expire automatically after one year.

9.2 When the individual's registration expires, that individual's records shall be expunged from the databank.

Table 1

Visual Inspection Criteria for Entry Level 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 2

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 $1/8"$ (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 $1/32"$ (0.8 mm), but are less than or equal to $1/8"$ (3.2 mm), shall not exceed $3/8"$ (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

Standard Welding Procedure Specifications

- ANSI/AWS B2.1.001 Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 through 3/4 inch in the As-Welded Condition, with Backing
- ANSI/AWS B2.1.008 Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel, (M-1, Group 1), 10 through 18 Gage, in the As-Welded Condition, with or without Backing
- ANSI/AWS B2.1.009 Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel, (M-8/P-8), 10 through 18 Gage, in the As-Welded Condition, with or without Backing
- ANSI/AWS B2.1.015 Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Aluminum, (M-22 or P-22), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing
- ANSI/AWS B2.1.019 Standard Welding Procedure Specification for CO₂ Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E70T-1 and E71T-1, As-Welded Condition
- ANSI/AWS B2.1.020 Standard Welding Procedure Specification for 75% Argon 25% CO₂ Shielded Flux Cored Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E70T-1 and E71T-1, As-Welded Condition
- ANSI/AWS B2.1.027 Standard Welding Procedure Specification for Self-Shielded Flux Cored Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 through 3/4 inch Thick, E71T-11, As-Welded Condition
- AWS-1-GMAW-S Welding Procedure Specification for Gas Metal Arc Welding - Short Circuit Transfer on Carbon Steel (M-1/P-1, Group 1 or 2), 3/8 inch Thick, in the As-Welded Condition
- AWS-2-GMAW Welding Procedure Specification for Gas Metal Arc Welding - Spray Transfer on Carbon Steel (M-1/P-1, Group 1 or 2), 3/8 inch Thick, in the As-Welded Condition

AWS-5-GTAW

Welding Procedure Specification for Gas Tungsten Arc Welding of Aluminum, (M-23/P-23), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing

Annex B

Workmanship Sample

Visual Inspection

Name of Student: _____

Social Security No.: _____

Sample # _____

Size:

Under ____ OK ____ Excessive ____

Undercut:

Acceptable ____ Rejected ____

Porosity:

Diameter of Largest ____

Acceptable ____ Rejected ____

Overlap:

Acceptable ____ Rejected ____

Penetration:

Acceptable ____ Rejected ____

Appearance:

Acceptable ____ Rejected ____

Cracks:

Acceptable ____ Rejected ____

Name: _____ Date: _____
(Please Print)

Signature: _____

Annex C

Face- and Root-Bend Test Results

Name of Student: _____

Social Security No.: _____

2G Face-bend:

Length of each discontinuity (Over 1/32") _____ Sum _____

Accept _____ Reject _____

2G Root-bend:

Length of each discontinuity (Over 1/32") _____ Sum _____

Accept _____ Reject _____

3G Face-bend:

Length of each discontinuity (Over 1/32") _____ Sum _____

Accept _____ Reject _____

3G Root-bend:

Length of each discontinuity (Over 1/32") _____ Sum _____

Accept _____ Reject _____

Name: _____ Date: _____
(Please Print)

Signature: _____

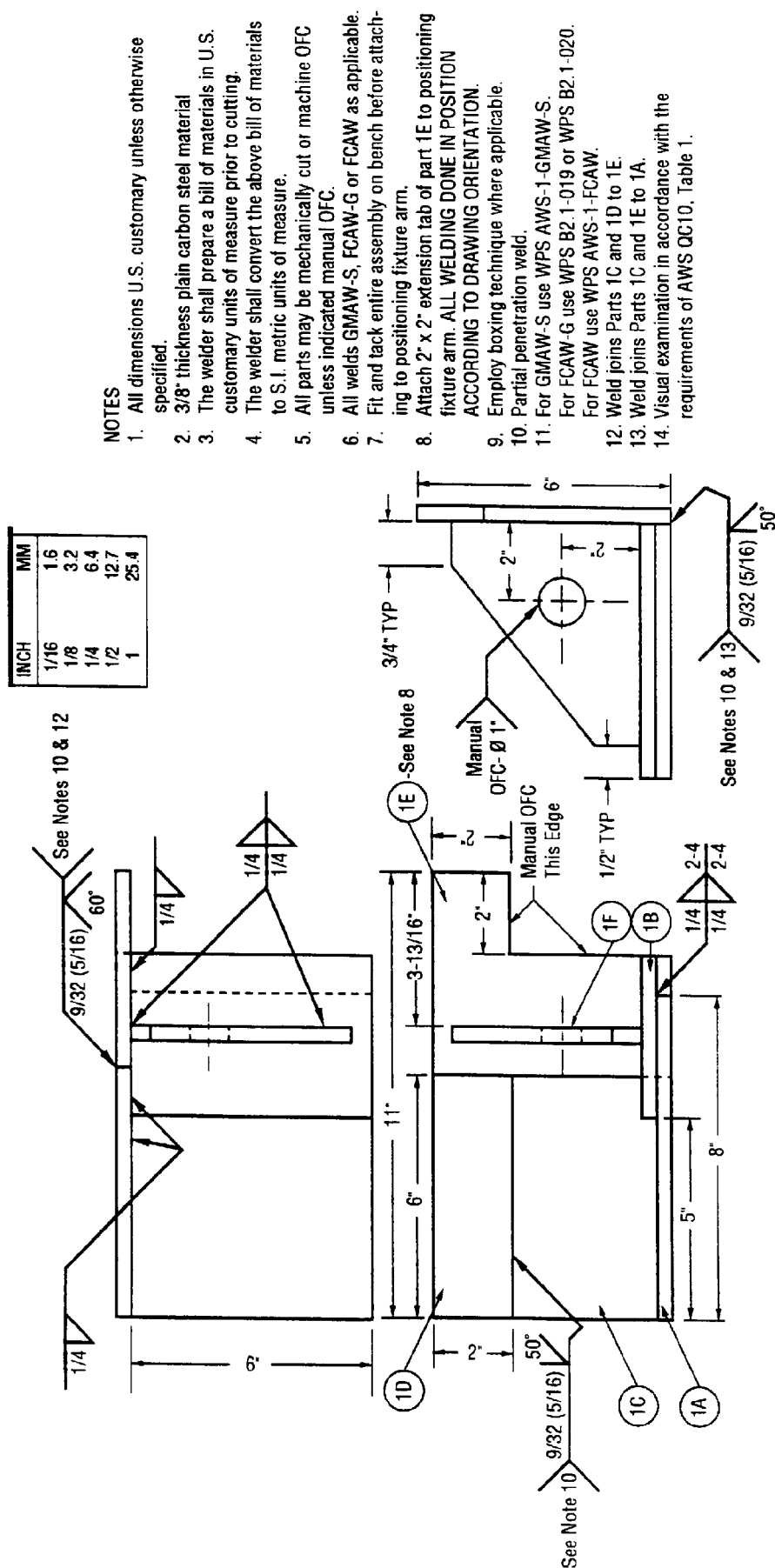


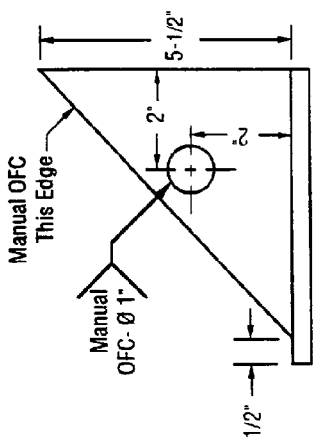
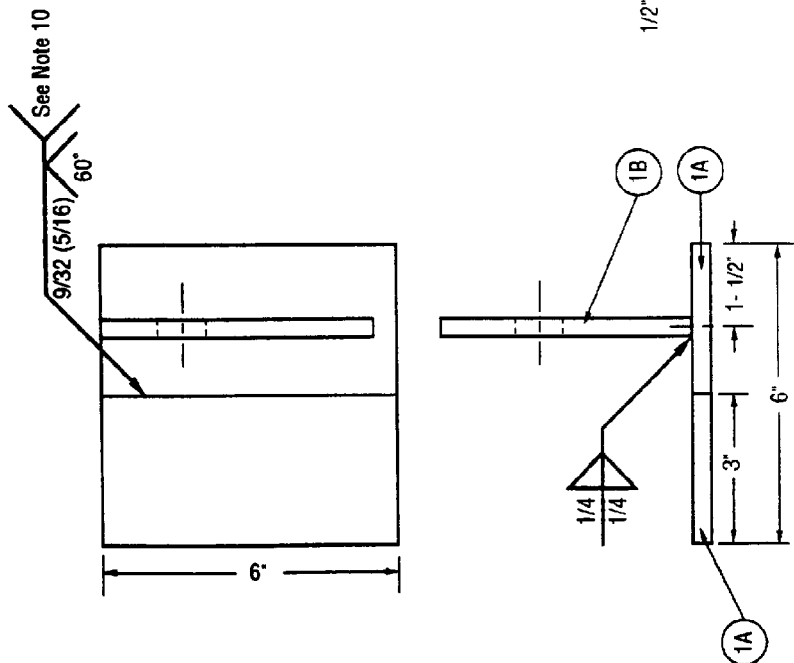
Figure 1 - GMAW-S or FCAW-G Workmanship Performance Qualification

NOTES

1. All dimensions U.S. customary unless otherwise specified.
2. 3/8" thickness plain carbon steel material
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 indicated manual OFC.
6. All welds GMAW-S, FCAW-G or FCAW as applicable.
7. Fit and tack entire assembly on bench before attaching to positioning fixture arm.
8. Attach 2" x 2" extension tab of part 1E to positioning fixture arm. ALL WELDING DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
9. Employ boxing technique where applicable.
10. Partial penetration weld.
11. For GMAW-S use WPS AWS-1-GMAW-S.
For FCAW-G use WPS B2.1-019 or WPS B2.1-020.
For FCAW use WPS AWS-1-FCAW.
12. Weld joins Parts 1C and 1D to 1E.
13. Weld joins Parts 1C and 1E to 1A.
14. Visual examination in accordance with the requirements of AWS QC10, Table 1.

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4



NOTES

1. All dimensions U.S. customary unless otherwise specified.
2. 3/8" thickness plain carbon steel material
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 DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
9. Employ boxing technique where applicable.
10. Melt through not required.
11. Use WPS AWS-2-GMAW.
12. Visual examination in accordance with the requirements of AWS QC10, Table 1.

Figure 2 - GMAW Spray Transfer Workmanship Performance Qualification

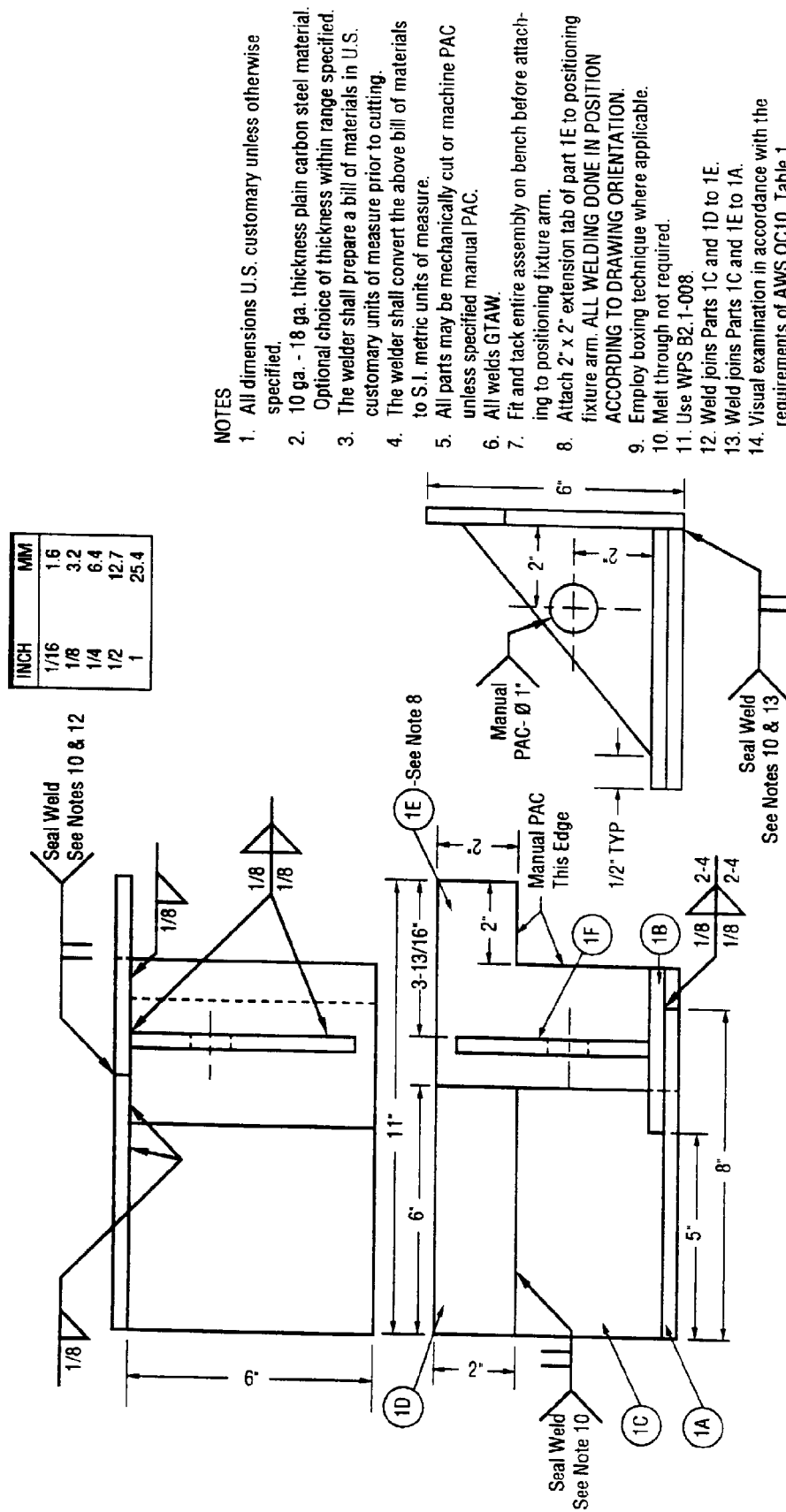
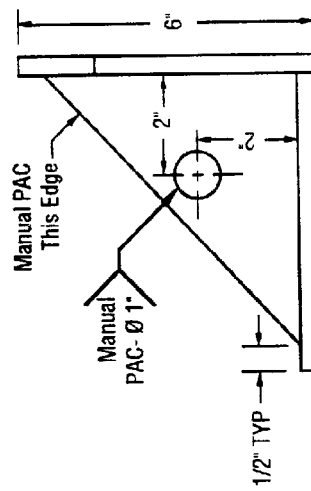
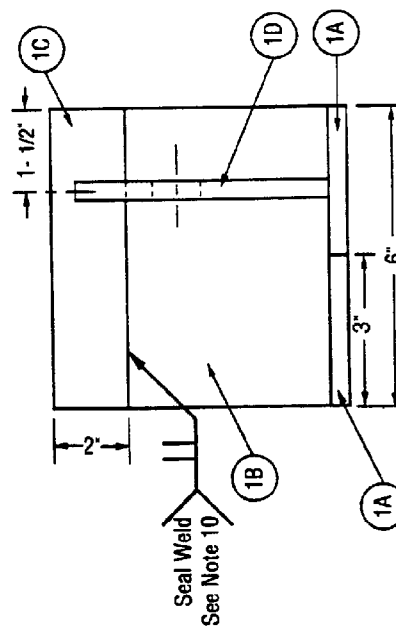
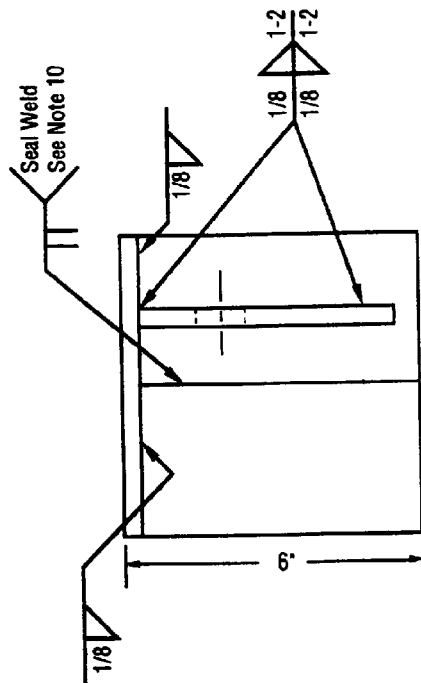


Figure 3 - GTAW Plain Carbon Steel Workmanship Performance Qualification

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

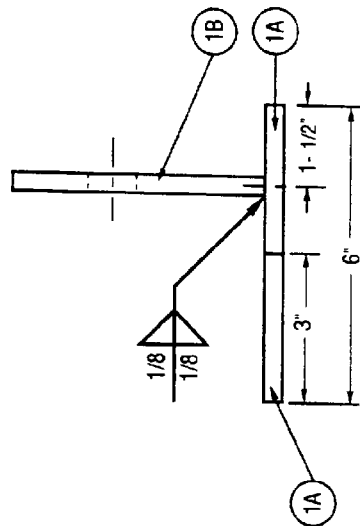
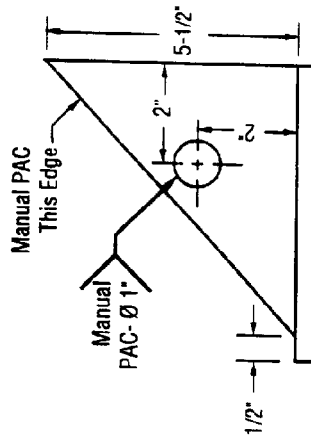
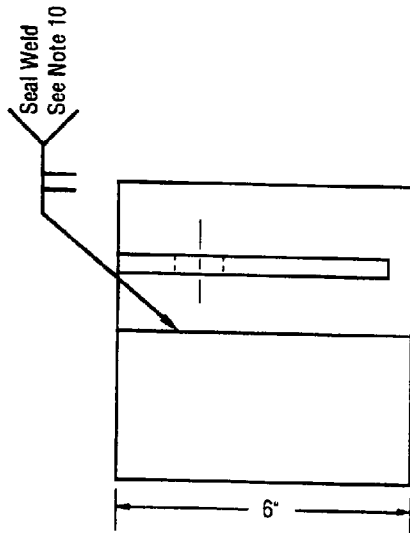


NOTES

1. All dimensions U.S. customary unless otherwise specified.
2. 10 ga. - 18 ga. thickness stainless steel material. Optional choice of thickness within range specified.
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 PAC unless specified manual PAC.
6. All welds GTAW.
7. Fit and tack entire assembly on bench before welding.
8. ALL WELDING DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
9. Employ boxing technique where applicable.
10. Melt through not required.
11. Use WPS B2.1.009.
12. Visual examination in accordance with the requirements of AWS QC10, Table 1.

Figure 4 - GTAW Stainless Steel Workmanship Performance Qualification

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4



NOTES

1. All dimensions U.S. customary unless otherwise specified.
2. 10 ga. - 18 ga. thickness aluminum material.
3. Optional choice of thickness within range specified.
4. The welder shall prepare a bill of materials in U.S. customary units of measure prior to cutting.
5. The welder shall convert the above bill of materials to S.I. metric units of measure.
6. All parts may be mechanically cut or machine PAC unless specified manual PAC.
7. All welds GMAW, spray transfer.
8. Fit and tack entire assembly on bench before welding.
9. ALL WELDING DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
10. Employ boxing technique where applicable.
11. Melt through not required.
12. Use WPS B2.1.015 for aluminum (M-22 or P-22).
13. Use WPS AWS-5-GTAW for aluminum (M-23).
14. Visual examination in accordance with the requirements of AWS QC10, Table 1.

Figure 5 - GTAW Aluminum Workmanship Performance Qualification

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

Notes:

1. 3/8" thickness plain carbon steel material.
2. Performance Qualification #1 = 2G position.
Performance Qualification #2 = 3G position.
3. All welding done in position: according to applicable performance qualification requirement.
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 B2.1.001
7. Visual examination in accordance with the requirements of QC10, Table 1.
Bend test in accordance with the requirements of QC10, Table 2.

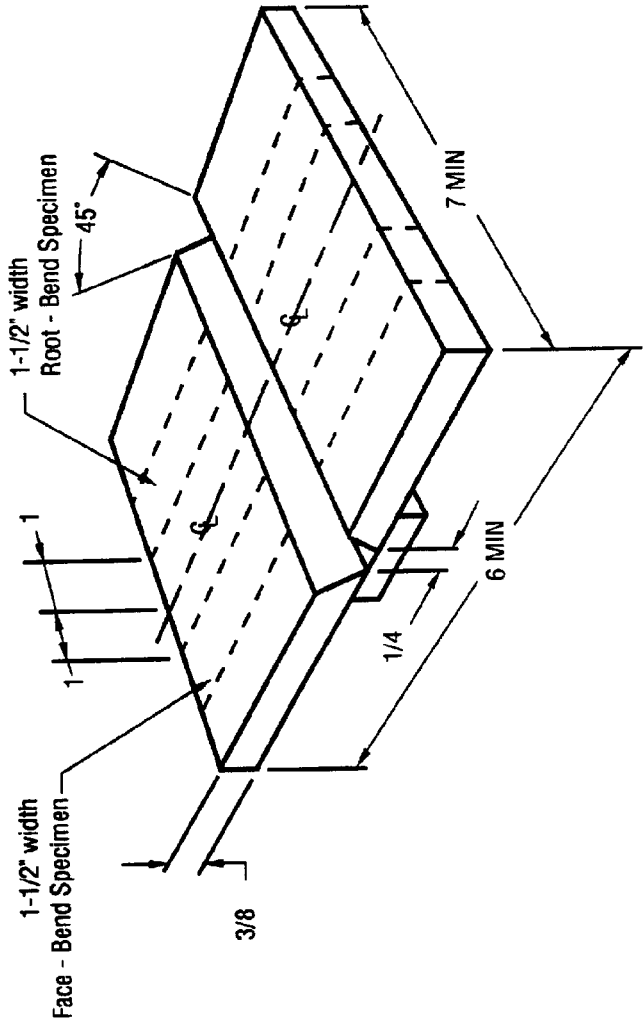


Figure 6 - SMAW Test Plates

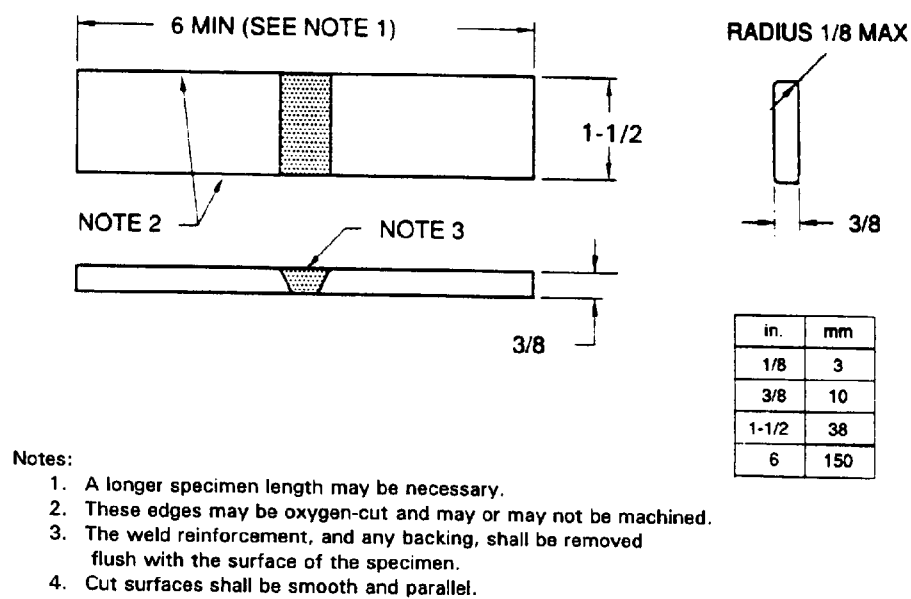


Figure 7 - Face- and Root-Bend Test Specimens

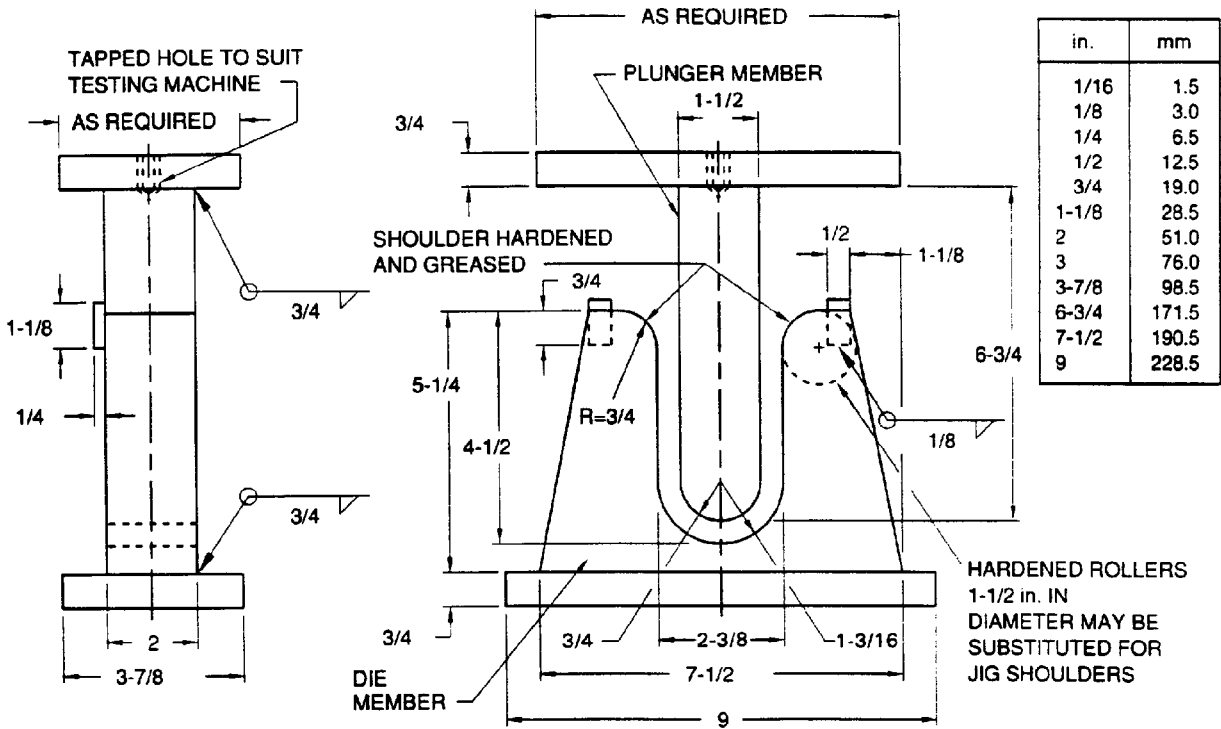


Figure 8 - Typical Guided-Bend Test Fixture

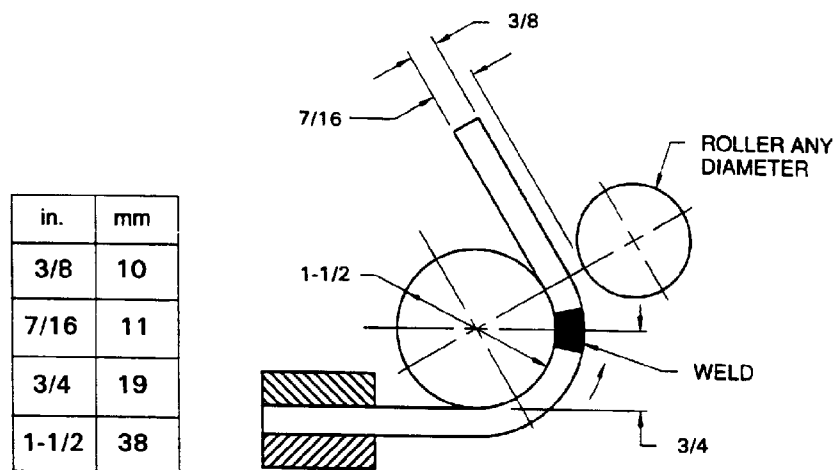


Figure 9 - Alternative Wrap Around Bend Test Fixture