
Specification for Qualification and Certification of SENSE Level II— Advanced Welders

AWS QC11:2017

Specification for Qualification and Certification of SENSE Level II—Advanced Welders

Supersedes AWS QC11:2006

Prepared by the
American Welding Society (AWS) Education Committee—Task Group on SENSE Standards

Under the Direction of the
AWS Education Committee

Approved by the
AWS Board of Directors

Abstract

This standard defines the requirements for the American Welding Society to enter a SENSE Level II—Advanced Welder into the AWS Sense Certificate Database. It also specifies the responsibilities of the training organization and the trainee in the SENSE credential process. AWS QC11 is the governing specification for AWS EG3.0, *Guide for the Training of Welding Personnel: SENSE Level II—Advanced Welders*.



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Foreword

This foreword is not part of this standard 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 voluntary standards to promote consistency and quality in welding education on a national basis. The development of these National Skill Standards involved a survey of the welding industry, skilled trades, and the welding education community, to arrive at a consensus on welder skills and competencies required by industry. The result of this survey was an occupational task analysis. This task analysis formed the basis for the development of the SENSE specifications and guidelines.

Currently, there are two levels of SENSE: Level I—Entry Welder and Level II—Advanced Welder. Both levels are designed to facilitate the implementation of a modular welder training program based on best practices.

The specifications and guidelines for SENSE Level I were revised in 2015, and SENSE Level II—Advanced Welder was modularized to facilitate implementation in a variety of welder training programs. Supplements were also developed to provide technique sheets and AWS standard welding procedure specifications (SWPSs) for SENSE workmanship and performance qualification tests. The supplements are based on AWS B2.0, *Standard Welding Procedure Specifications (SWPSs)*. In addition, AWS QC21, *Specification for AWS Accreditation of SENSE Welder Training Programs*, was added. The specifications, guidelines, and supplements for SENSE welder training and welder training program accreditation are:

AWS QC10, *Specification for Qualification and Certification of SENSE Level I—Entry Welders*
AWS EG2.0, *Guide for the Training of Welding Personnel: SENSE Level I—Entry Welders*
AWS EG2.0 Supplement, *Supplement SENSE Level I—Entry Welder Training Performance Testing Procedures*

AWS QC11, *Specification for Qualification and Certification of SENSE Level II—Advanced Welders*
AWS EG3.0, *Guide for the Training of Welding Personnel: SENSE Level II—Advanced Welders*
AWS EG3.0 Supplement, *Supplement SENSE Level II—Advanced Welder Training Performance Testing Procedures*

AWS QC21, *Specification for AWS Accreditation of SENSE Welder Training Programs*
AWS EG21, *Specification for the Qualification of SENSE Welder Training Programs*

This latest revision of AWS QC11, *Specification for Qualification and Certification of Level II—Advanced Welders*, represents the AWS Education Committee's consensus on the requirements for trainees of SENSE training organizations to receive an AWS SENSE Advanced Welder credential, and to be registered in the AWS SENSE Certificate Database.

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Specification for Qualification and Certification of SENSE Level II—Advanced Welders

1. Scope

1.1 This guide establishes the minimum requirements for trainees to receive an AWS SENSE credential for the SENSE Level II—Advanced Welder program. SENSE training organizations are free to exceed these minimum requirements.

1.2 This specification defines practical knowledge examinations and performance qualification tests that require a minimum level of reading, computational, and manipulative skills to successfully complete.

1.3 All individuals that meet the specified SENSE Level II criteria will be listed in the AWS SENSE Certificate Database provided that:

(1) the training facility is a SENSE Accredited Training Program (ATP) per the requirements of AWS QC21, *Specification for AWS Accreditation of SENSE Welder Training Programs*

(2) the required proof(s) of completion are submitted to AWS along with applicable fees.

1.4 Organizations that are not a SENSE Accredited Training Program may use this specification, but individuals they instruct will not be eligible for SENSE training certificates, nor will they be listed in the AWS SENSE Certificate Database.

1.5 Although some questions on practical knowledge examinations may pertain to safety, this specification 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*, as well as federal, state, and local government regulations. The responsibility for safety rests primarily with the trainee and the training organization during training.

2. Reference Documents

Unless specified, the latest approved edition/addenda/printing/revision applies.

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

AWS A3.0, *Standard Welding Terms and Definitions*

AWS B2, *Standard Welding Procedure Specifications (SWPSs)*

AWS B2.1, *Specification for Welding Procedures and Performance Qualification*

AWS B4.0, *Standard Methods for Mechanical Testing of Welds*

AWS B5.5, *Specification for the Qualification of Welding Educators*

AWS C4.1, *Criteria for Describing Oxygen-Cut Surfaces, and Oxygen Cutting Surface Roughness Gauge*

AWS EG2.0, *Guide for the Training of Welding Personnel: SENSE Level I—Entry Welders*

AWS EG2.0 Supplement, *Supplement SENSE Level I—Entry Welder Training Performance Testing Procedures*

AWS EG3.0: *Guide for the Training of Welding Personnel: SENSE Level II—Advanced Welders*

AWS EG3.0 Supplement, *Supplement SENSE Level II—Advanced Welder Training Performance Testing Procedures*

AWS QC5, *Standard for AWS Certification of Welding Educators*

AWS QC7, *Standard for AWS Certified Welders*

AWS QC10, *Specification for the Qualification and Certification of SENSE Level I—Entry Welder*

AWS QC11, *Specification for Qualification and Certification of SENSE Level II—Advanced Welders*

3. Definitions

The terms used in this specification are defined in AWS A3.0, *Standard Welding Terms and Definitions*. As used in this specification, the word **shall** denotes a requirement; the word **should** denotes a guideline; and the word **may** denotes a choice. The following terms are not found in AWS A3.0, *Standard Welding Terms and Definitions*, or are modified for the purposes of this specification:

acceptance criteria. Specified limits placed on characteristics of an item, process, or service as defined in governing welding standards or other contract documents.

Accredited Test Facility (ATF). A facility that applies to AWS and receives accreditation. An ATF may be a laboratory that does not perform welder qualification testing.

AWS certified welder. A welder that meets the requirements of QC7 for welder performance qualification. AWS QC7 welder certification should not be confused with AWS SENSE certification.

AWS SENSE Certificate Database. A database of trained welders who have successfully passed compulsory and optional modules in accordance with the requirements of SENSE Level I—Entry Welder, and SENSE Level II—Advanced Welder. Employers may access this database to confirm the credentials of prospective employees.

AWS SENSE Advanced Welder. An individual who has successfully completed compulsory and optional modules in accordance with the requirements of AWS QC11. An AWS SENSE advanced welder should not be confused with an AWS certified welder.

AWS SENSE Entry Welder. An individual who has successfully completed compulsory and optional modules in accordance with the requirements of AWS QC10. An AWS SENSE entry welder should not be confused with an AWS certified welder.

certification. The act of determining, verifying, and attesting to the qualification of personnel in accordance with specified requirements.

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/or practical knowledge testing.

formative assessment. A type of assessment conducted during instruction to evaluate the understanding of key concepts or evaluate performance associated with a lesson or unit of training. It helps trainees to identify areas that need additional work, and indicates where instructors need to modify teaching and learning activities to improve learning outcomes. It typically provides the basis for qualitative feedback rather than a grade based on test scores.

module. A 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 compulsory modules and optional modules in both Level I and Level II programs.

inspection. Examination or measurement to verify whether an item or activity conforms to specified requirements.

SENSE Level I—Entry Welder. 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.

SENSE Level II—Advanced Welder. An individual employed in this position is considered to possess a prerequisite amount of knowledge, attitude, skills, and habits required to perform proceduralized tasks under general supervision, and complex tasks involving the use of theoretical knowledge and motor skills under close supervision.

Standard Welding Procedure Specification (SWPS). A welding procedure specification qualified according to the requirements of AWS B2.1/B2.1M, approved by AWS, and made available for production welding by companies or individuals other than those performing the qualification test.

Technical Skills Attainment (TSA) examination. An end-of-program, multiple choice examination required by some states and school districts to demonstrate that students have attained the desired outcomes before funding can be allocated.

unit. A collection of training or learning activities defining a particular set of skills for a single subject. A part of a module that focusses on a particular theme or topic. For example, Module 5, Thermal Cutting Processes contains four (4) units.

verification. The act of reviewing, inspecting, testing, checking, auditing, or otherwise determining and documenting whether items, processes, services, and documents conform to specified requirements.

welder performance qualification test. A welding performance test made to the prescribed SWPS or WPS and that requires both visual examination and destructive testing.

Welding Procedure Specification (WPS). A document providing the required welding variables for a specific application to assure repeatability by properly trained welders and welder operators.

workmanship qualification test. A welding performance test made to the prescribed SWPS or WPS and that requires visual examination only.

4. Requirements for SENSE Level II—Advanced Welder

4.1 The trainee must be enrolled in and attending a SENSE Accredited Training Program.

4.2 A registration fee must be paid by the trainee, or on behalf of the trainee, before the results of practical knowledge exams and performance qualification tests can be recorded in the AWS SENSE Certificate Database.

4.2.1 The registration fee covers the cost of processing all SENSE certifications and endorsements.

4.2.2 Upon completion of SENSE Level I—Entry Welder, the trainee receives a SENSE ID number. The SENSE ID number is the trainee’s unique identifier for SENSE Level I—Entry Welder, and SENSE Level II—Advanced Welder.

4.2.3 The SENSE ID number can be used by the trainee to access his/her account in the AWS SENSE Certificate Database to check on SENSE credentials and update contact information.

4.2.4 Trainees may, at their discretion, provide their SENSE ID number to potential employers to verify SENSE credentials.

4.3 The trainee must successfully complete the required SENSE Level II—Advanced Welder learning modules, and a minimum of one (1) optional plate welding process module (SMAW, GMAW, GTAW, and/or FCAW).

4.4 The trainee must pass the relevant practical knowledge examinations and performance qualification tests as specified in Clauses 7 and 8.

4.5 Practical knowledge examination scores and performance qualification test results shall be recorded as specified in Clauses 13 and 14.

5. SENSE Guidelines

5.1 SENSE (Schools Excelling through National Skill Standards Education) standards provide the training organization with specifications and guidelines for implementing a welder training program based on best practices. SENSE guidelines define the essential knowledge and skills that should be taught in a welding program. Originally, training was conducted at three levels. In this new revision, training has been modularized, and condensed into two levels:

(1) Level I—Entry Welder

(2) Level II—Advanced Welder

5.2 Welder performance qualification tests previously offered in Level III—Expert Welder, are now offered as endorsements in Level II—Advanced Welder.

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

5.4 Level II—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: SENSE Level II—Advanced Welders*.

5.5 SENSE guidelines do not constitute a curriculum. The AWS SENSE EG2.0 and EG3.0 guidelines are intended to support the development or selection of a SENSE-aligned curriculum suited to the capabilities of the training organization and tailored to the needs of local employers. The development or selection of curriculum materials is the responsibility of each training organization.

6. Modular Design

6.1 AWS SENSE Level II—Advanced Welder is designed to facilitate the implementation of a modular welder training program based on best practices. It consists of compulsory and optional modules.

6.2 Trainees must successfully complete all compulsory modules listed in Table 6.1 with a minimum score of 75% on practical knowledge exams. Trainees must also complete the hands-on exercises associated with Module 5, Thermal Cutting Processes.

6.3 In addition to successfully completing the compulsory modules, trainees must successfully complete a minimum of one of the optional plate welding process module listed in Table 6.2 to be listed in the AWS SENSE Certificate Database.

6.4 Trainees may receive additional credentials for successfully completing one or more optional pipe welding process modules listed in Table 6.3, provided they complete the associated prerequisite Level I and Level II plate modules.

6.5 The optional welding fabrication module listed in Table 6.4 is intended for training organizations offering welding fabrication training in conjunction with their welding programs.

7. Level II—Advanced Welder Practical Knowledge Examinations

7.1 Each compulsory module and each optional plate module has a closed-book practical knowledge exam designed to measure a trainee's knowledge of the subject matter contained in the module. There is one (1) generic closed-book pipe practical knowledge exam that applies to all four (4) optional pipe modules. There is no practical knowledge exam for the optional Welding Fabrication module.

7.1.1 The trainee shall be listed in the AWS SENSE Certificate Database as an AWS SENSE Level I—Entry Welder before attempting SENSE Level II—Advanced Welder practical knowledge exams.

7.1.2 It is recommended that practical knowledge exams be administered at the completion of each module of training. Alternatively, they may be administered at other intervals at the discretion of the instructor and the training organization. A minimum score of 75% is required to pass practical knowledge exams.

7.1.3 All practical knowledge exams shall be administered as closed-book examinations.

7.1.4 If the trainee has special learning needs, the instructor shall arrange to have tests administered in the manner most suitable for the trainee.

7.1.5 Trainees shall be allowed up to three (3) attempts to pass a practical knowledge exam. If a trainee fails to achieve a passing grade after three (3) attempts, they shall be retrained in that module. After retraining, trainees shall be allowed an additional three (3) attempts to pass the practical knowledge exam.

7.1.5.1 The retraining process used shall be documented in the training organization's quality assurance manual.

7.1.5.2 If a trainee fails to pass the practical knowledge exam after retraining, the training organization should reevaluate the trainee's ability to continue in the program.

8. AWS SENSE Advanced Welder Performance Qualification Tests

8.1 Advanced welder performance qualification tests are designed to show that trainees can do the following:

- (1) Read and interpret drawings and sketches, including welding symbols.

Table 6.1
Level II—Advanced Welder Compulsory Knowledge Modules

Module	Prerequisite	Knowledge Exam	NDE	Destructive	Competency Achieved by
1. Trade Math	None	Yes	NA	NA	Practical knowledge exam (Score: 75% min)
2. Welding Metallurgy	None	Yes	NA	NA	Practical knowledge exam (Score: 75% min)
3. Welding Inspection & Testing Methods	Level I Welding Inspection & Testing	Yes	Yes (Visual, Liquid Penetrant)	Yes (Macroetch [Optional], Fillet Break)	Practical knowledge exam (Score: 75% min) Fillet break, liquid penetrant tests, and visual examination completed
4. Documents Governing Welding & Welding Inspection	None	Yes	NA	NA	Practical knowledge exam (Score: 75% min)
5. Thermal Cutting Processes	Level I Thermal Cutting Processes	Yes	Yes (Visual)	NA	Practical knowledge exam (Score: 75% min)

Table 6.2
Level II—Advanced Welder Optional Plate Welding Process Modules

Module	Prerequisite	Knowledge Exam	NDE	Destructive	Competency Achieved by
6. SMAW Plate	SMAW Level I	Yes	Yes (Visual)	Yes ^a	Practical knowledge exam passed (Score: 75% min) Visual examination passed Destructive test passed ^a (QC7 cert optional)
8. GMAW Plate	GMAW Level I	Yes	Yes (Visual)	Yes ^a	Practical knowledge exam passed (Score: 75% min) Visual examination passed Destructive test passed ^a (QC7 cert optional)
10. FCAW Plate	FCAW Level I	Yes	Yes (Visual)	Yes ^a	Practical knowledge exam passed (Score: 75% min) Visual examination passed Destructive test passed ^a (QC7 cert optional)
12. GTAW Plate	GTAW Level I	Yes	Yes (Visual)	Yes ^a	Practical knowledge exam passed (Score: 75% min) Visual examination passed Destructive test passed ^a (QC7 cert optional)

^a Radiographic examination (RT) accepted in lieu of bend testing.

Table 6.3
Level II—Advanced Welder Optional Pipe Welding Process Modules

Module	Prerequisite	Knowledge Exam	NDE	Destructive	Competency Achieved by
7. SMAW Pipe	SMAW Level I SMAW Level II Plate	Yes ^a	Yes (Visual)	Yes ^b	Practical knowledge exam passed (Score: 75% min) Visual examination passed Destructive test passed ^b (QC7 cert optional)
9. GMAW Pipe	GMAW Level I GMAW Level II Plate	Yes ^a	Yes (Visual)	Yes ^b	Practical knowledge exam passed (Score: 75% min) Visual examination passed Destructive test passed ^b (QC7 cert optional)
11. FCAW Pipe	FCAW Level I FCAW Level II Plate	Yes ^a	Yes (Visual)	Yes ^b	Practical knowledge exam passed (Score: 75% min) Visual examination passed Destructive test passed ^b (QC7 cert optional)
13. GTAW Pipe	GTAW Level I GTAW Level II Plate	Yes ^a	Yes (Visual)	Yes ^b	Practical knowledge exam passed (Score: 75% min) Visual examination passed Destructive test passed ^b (QC7 cert optional) Optional combination GTAW/SMAW destructive test passed ^b (GTAW root and optional first intermediate pass, remainder with SMAW) (QC7 cert optional)

^a The pipe welding knowledge exam is generic to all pipe welding processes.

^b Radiographic examination (RT) accepted in lieu of destructive testing.

Table 6.4
Level II—Advanced Welder Optional Welding Fabrication Module

Module	Prerequisite	Knowledge Exam	NDE	Destructive	Competency Achieved by
14. Welding Fabrication	— Compulsory Level II Modules — Level II SMAW, GMAW, FCAW, & GTAW Plate Modules — Minimum of one Level II pipe module if attempting pipe component.	No	Yes (Visual)	NA	Visual inspection passed

Note: The optional Welding Fabrication module requires that trainees complete all Level II-Advanced Welder plate welding process modules (SMAW, GMAW, FCAW, and GTAW). For trainees attempting the welding fabrication workmanship qualification test for both plate and pipe, they must have completed at least one pipe welding process module (SMAW, GMAW, FCAW, or GTAW), and use that process for the pipe welding component of the workmanship qualification test.

- (2) Follow written procedures as detailed in welding procedure specifications.
- (3) Cut parts to proper size, prepare edges, and fit simple assemblies.
- (4) Pass standard AWS visual examination and destructive testing.

8.2 Trainees shall successfully complete a minimum of one (1) optional plate module (module 6, 8, 10, or 12), including the corresponding practical knowledge exam, as well as the practical knowledge exams for all compulsory modules including all thermal cutting processes performance tests, in order to qualify as an AWS SENSE advanced welder. Trainees can obtain SENSE credentials for additional welding processes as desired.

8.3 Module 6 SMAW plate performance qualification tests are performed in the 3G and 4G positions on 1 in carbon steel with stainless steel electrodes. The training organization may use stainless steel base metal if desired.

8.4 Module 7 SMAW pipe performance qualification test is performed in the 6G position on 4 in to 8 in schedule 80 carbon steel pipe with or without backing ring.

8.5 Module 8 GMAW plate performance qualification tests involve spray transfer and pulsed spray transfer (GMAW-P) on carbon steel and aluminum. Trainees must complete all GMAW plate performance qualification tests to successfully complete Module 8.

8.5.1 The GMAW spray transfer carbon steel test is performed in the 1G position on 1 in material with backing.

8.5.2 The GMAW-P carbon steel tests are performed in the 3G and 4G positions on 1 in material with or without backing.

8.5.3 The GMAW spray transfer aluminum test is performed in the 1G position on 3/8 in to 1 in material with backing.

8.6 Module 9 GMAW pipe performance qualification tests involve GMAW short circuiting transfer (GMAW-S), GMAW spray transfer, and GMAW pulsed spray transfer (GMAW-P) on carbon steel. Trainees must complete all GMAW pipe performance qualification tests to successfully complete Module 9.

8.6.1 The GMAW-S pipe test is performed in the 6G position on 4 in to 8 in schedule 80 carbon steel pipe with or without backing ring.

8.6.2 The GMAW spray transfer pipe test is performed in the 1G position on 4 in to 8 in schedule 80 carbon steel pipe with a GMAW-S root and the remainder with GMAW spray transfer.

8.6.3 The GMAW-P pipe test is performed in the 6G position on 4 in to 8 in schedule 80 carbon steel pipe with backing ring, or without backing ring using GMAW-S for the root pass and the remainder with GMAW-P.

8.7 Module 10 FCAW plate performance qualification tests involve gas-shielded FCAW (FCAW-G) and self-shielded FCAW (FCAW-S) on carbon steel. Trainees must complete all FCAW plate performance qualification tests to successfully complete Module 10.

8.7.1 The FCAW-G plate tests are performed in the 3G and 4G positions on 1 in material with backing, or open root with optional backgouging by CAC-A or back grinding and back welding.

8.7.2 The FCAW-S plate tests are performed in the 3G and 4G position on 1 in material with backing, or open root with optional backgouging by CAC-A or back grinding and back welding.

8.8 Module 11 FCAW pipe performance qualification test is performed in the 6G position on 4 in to 8 in schedule 80 carbon steel pipe with backing ring, or without backing using GMAW-S for the root pass and the remainder with FCAW-G.

8.9 Module 12 GTAW plate performance qualification tests are performed on carbon steel, stainless steel, and aluminum. Trainees must complete all GTAW plate performance qualification tests to successfully complete Module 12.

8.9.1 The GTAW carbon steel plate tests are performed in the 3G and 4G positions on 3/8 in material with or without backing.

8.9.2 The GTAW stainless steel plate tests are performed in the 3G and 4G positions on 3/8 in carbon steel using stainless steel filler with backing, or without backing using backing gas. Alternatively, the joint may be welded open root with back grinding and back welding. The training organization may use stainless steel plate if desired.

8.9.3 The GTAW aluminum plate tests are performed in the 3G and 4G positions on 1/4 in to 3/8 in material with or without backing.

8.10 Module 13 GTAW pipe performance qualification tests are performed on carbon steel and stainless steel. Successful completion of both performance qualification tests is required for successful completion of Module 13. The module also includes an optional GTAW/SMAW combination test on 2.75 in schedule 180 carbon steel pipe.

8.10.1 The GTAW pipe test on carbon steel is performed in the 6G position on 4 in to 8 in schedule 80 pipe with or without backing ring.

8.10.2 The GTAW pipe test on stainless steel is performed in the 6G position on 4 in to 8 in schedule 80 carbon steel pipe using stainless steel filler metal with backing ring, or open root with backing gas. The training organization may use stainless steel pipe if desired.

8.10.3 The optional GTAW combination pipe test is performed in the 6G position on 2.75 in schedule 180 carbon steel with a GTAW root and optional first intermediate pass (hot pass), and the remainder with SMAW.

9. Welding Fabrication Workmanship Qualification Test

9.1 Module 14, Welding Fabrication, is an optional module. It is the only module that requires a workmanship qualification test instead of a welder performance qualification test.

9.1.1 In order to attempt the Welding Fabrication module and the corresponding workmanship qualification test, trainees shall complete the compulsory SENSE Level II—Advanced Welder modules as per Table 6.2. Trainees shall also complete all the SMAW, GMAW, FCAW, and GTAW plate modules as per Table 6.3.

9.1.2 The Welding Fabrication workmanship qualification test has a plate component and a pipe component. The plate component involves bending, shearing, drilling, and multiple-process welding operations. The pipe component requires cutting, beveling, and welding operations.

9.1.3 Trainees who have not successfully completed one or more pipe welding modules may attempt the welding fabrication workmanship qualification test for plate only.

9.1.4 In order to attempt the pipe component of the Welding Fabrication module, the trainee shall complete a minimum of one (1) optional pipe module. The trainee shall use that welding process to complete the pipe welding component of the Welding Fabrication workmanship qualification test.

10. SENSE Level II—Advanced Welder Endorsements

10.1 The welder performance qualification tests that were part of SENSE Level III—Expert Welder are offered as optional endorsements in SENSE Level II—Advanced Welder. They are included in the welder performance qualification tests listed as follows.

10.1.1 A 6GR position performance qualification test on 6 in to 12 in schedule 80 carbon steel pipe without backing, using SMAW with E6010 or E6011 for the root pass, and the remainder with E7018.

10.1.2 A 6G position performance qualification test on 2-1/2 in to 6 in schedule 40 carbon steel pipe using GMAW-S with ER70S-X electrodes.

10.1.3 A 6G position performance qualification test on carbon steel pipe with backing ring, or open root with backing gas, using GMAW-P and ER3XX stainless steel electrodes. The training organization may use stainless steel pipe if desired.

10.1.4 A 6G position performance qualification test on 2-1/2 in to 6 in schedule 40 aluminum pipe using GMAW-P with ER4XXX or ER5XXX electrodes.

10.1.5 A 6G position performance qualification test on 6 in schedule 80 aluminum pipe with a J-groove preparation using GMAW-P and ER4XXX or ER5XXX electrodes.

10.1.6 A 6G position performance qualification test on 2-1/2 in to 6 in schedule 40 carbon steel pipe with FCAW-S using E71T-11 or E71T-G electrodes.

10.1.7 A 6G position performance qualification test on 2-1/2 in carbon steel tubing (0.05 in–0.14 in wall thickness), or schedule 40 carbon steel pipe using GTAW with ER70S-X filler metal.

10.1.8 A 6G position performance qualification test on 2-1/2 in stainless steel tubing (0.05 in–0.14 in wall thickness) or schedule 40 stainless steel pipe using GTAW with consumable inserts and ER3XX filler metal.

10.1.9 A 6G position performance qualification test on 6 in schedule 40 aluminum pipe with a backing ring using GTAW and ER4XXX or ER5XXX filler metal.

10.1.10 A 6G position performance qualification test on 6 in schedule 40 aluminum pipe with a J-groove preparation using GTAW and ER4XXX or ER5XXX filler metal.

10.1.11 A 6G position performance qualification test on 2-1/2 in aluminum tubing (0.05 in–0.14 in wall thickness).

10.2 The training organization may specify plate and pipe WPSs for welder performance qualification tests for SENSE endorsements on nickel and nickel alloys, copper and copper alloys, magnesium and magnesium alloys, titanium and titanium alloys, as well as other materials and welding processes as necessary.

10.2.1 Trainees seeking SENSE endorsements on plate shall successfully complete the SENSE Level II compulsory modules, including the thermal cutting processes performance tests, as well as the performance qualification test(s) for the plate module(s) in the welding process(es) for which they are seeking plate endorsements.

10.2.2 Trainees seeking SENSE endorsements on pipe shall successfully complete the SENSE Level II compulsory modules including the thermal cutting processes performance tests, the performance qualification test(s) for the plate module(s) in the welding process(es) for which they are seeking pipe endorsements, and the pipe welding practical knowledge test.

11. Testing Out of SENSE Level II—Advanced Welder Optional Welding Process Modules

11.1 At the discretion of the training organization, trainees can test out of optional welding process modules by successfully completing the practical knowledge test and performance qualification test(s), provided they successfully complete the practical knowledge exams for all compulsory SENSE Level II modules, including the SENSE Level II thermal cutting performance practical tests.

11.1.1 Trainees seeking to test out of one or more SENSE Level II optional pipe welding process modules must successfully complete the pipe welding practical knowledge test and the pipe performance qualification test(s); they must also successfully complete the following:

(1) Practical knowledge exams for all compulsory SENSE Level II modules, including the SENSE Level II thermal cutting performance practical tests.

(2) Practical knowledge exam(s) and performance qualification test(s) for the corresponding SENSE Level II plate welding process modules.

11.1.2 Trainees seeking to test out of one or more SENSE Level II optional plate welding process modules, and who do not have SENSE Level I certification(s) listed in the AWS SENSE Certificate Database, must successfully complete the following:

(1) Practical knowledge exams for all compulsory SENSE Level I modules

(2) SENSE Level I thermal cutting performance practical tests (OFC and PAC minimum)

(3) Optional SENSE Level I workmanship or performance qualification test in the welding process module(s) for which Level II certification is sought.

11.2 A trainee who successfully opts out of a Level II welding process module will be listed in the AWS SENSE Certificate Database provided the training organization submits the trainee's scores to the AWS Education Services Department as specified in 13.2.1.

12. Inspection, Testing, and Acceptance Criteria

12.1 All cut edges shall be visually examined and the cut surfaces shall meet the criteria of AWS C4.1-77 Sample 2 with grinding. After visual examination, the cut surfaces may be conditioned to bright metal.

12.2 All assemblies shall be visually examined and the welds shall meet the acceptance criteria shown in Table 12.1.

12.3 Pipe joints welded in the 6G position shall be cut to produce face- and root-bend specimens as shown in Figure 12.1.

12.4 Face- and root-bend specimens shall be conditioned as shown in Figure 12.2.

12.5 For welder performance tests where the thickness of the sample is over 3/8 in, use side bends as shown in Figure 12.3.

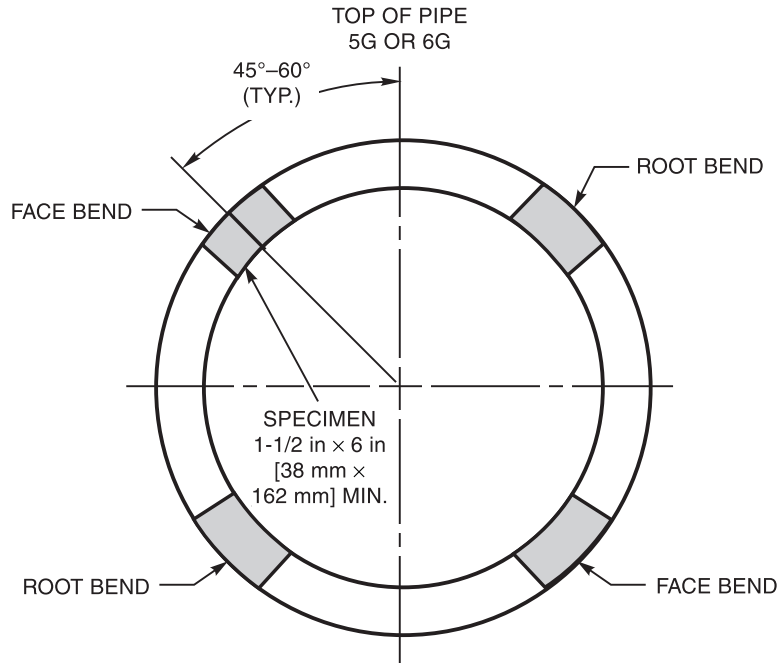
12.6 Bend specimens shall be bent in a bend fixture similar to Figure 12.4 or Figure 12.5 (guided bend test) or Figure 12.6 (wrap-around bend test) in accordance with AWS B4.0, *Standard Methods for Mechanical Testing of Welds*.

12.7 Face-, root-, or side-bend specimens shall meet the acceptance criteria listed in Table 12.2.

Table 12.1
Visual Examination Criteria for SENSE Level II—Advanced Welder

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. Acceptance criteria shall be as following:

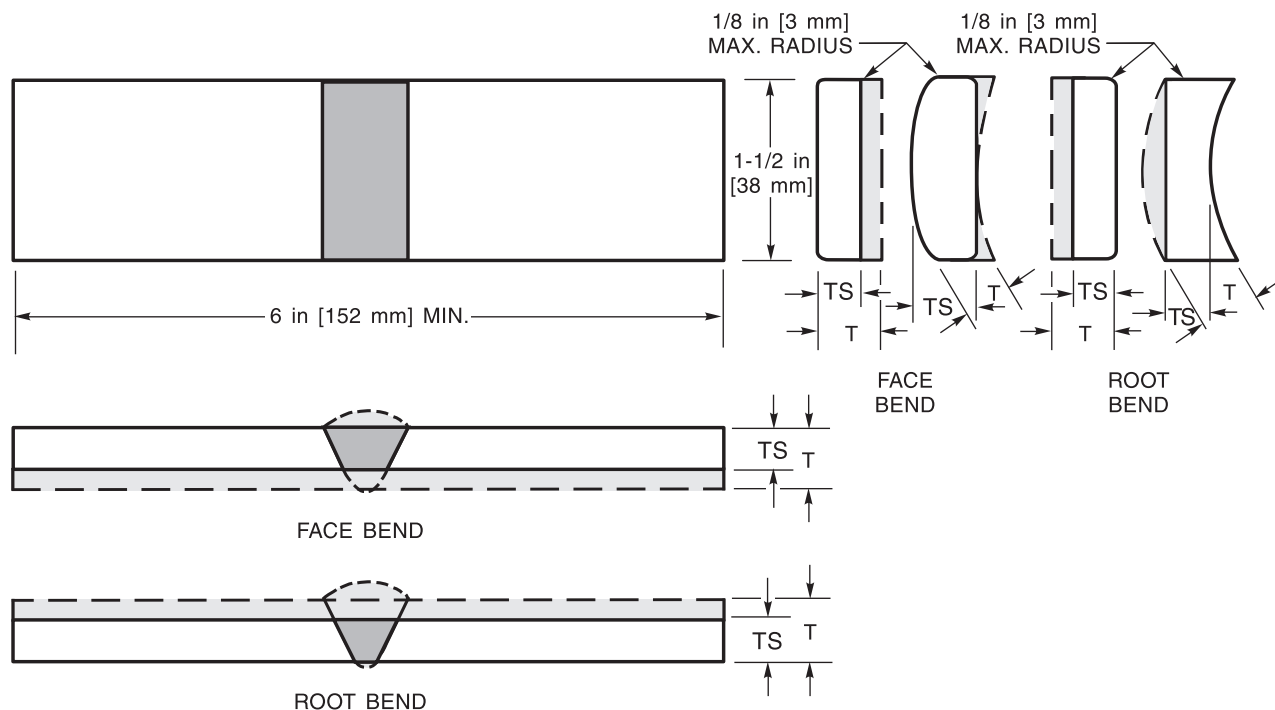
1. No cracks or incomplete fusion.
2. No incomplete joint penetration in groove welds except where partial penetration groove welds are specified.
3. Undercut depth shall not exceed the lesser of 10% of the base metal thickness or 1/32 in (0.8 mm).
4. Face reinforcement or root reinforcement shall not exceed 1/8 in (3 mm).
5. No single pore shall exceed 3/32 in (2 mm).



Notes:

1. For pipe over 3/8 in [10 mm] thick, side bends may be taken in lieu of face and root bends. For base metals which exceed 3/4 in [19 mm], side bends shall be taken.
2. See Table 5.6 for diameter and thickness limitations.

Figure 12-1—Location of 1G, 2G, 5G, and 6G Bend Specimens as per AWS B2.1

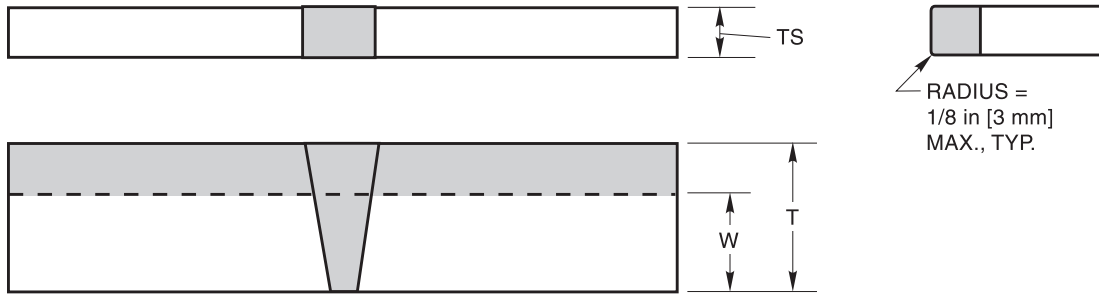


INCHES			MILLIMETERS		
Thickness of Base Materials (T)	Specimen Thickness (TS)		Thickness of Base Materials (T)	Specimen Thickness (TS)	
	All Base Metal Welded with F-23 Filler Metals	All Other Materials		All Base Metal Welded with F-23 Filler Metals	All Other Materials
1/16 to 1/8	T	T	1.5 to 3	T	T
1/8 to 3/8	1/8	T	3 to 10	3	T
Over 3/8	1/8	3/8	Over 10	3	10

Notes:

1. Weld reinforcement and backing strip or backing ring, if any, shall be removed flush with the surface of the specimen.
2. If thermal cut, the edges shall be dressed by grinding, except in M-1 materials.
3. For pipe diameters of 2 in through 4 in [51 mm through 102 mm] NPS, the width of the bend specimen may be 3/4 in [19 mm] for pipe diameters of 3/8 in to 2 in [10 mm through 51 mm]. NPS, the bend specimen width may be 3/8 in [10 mm], with an alternative (permitted for pipe 1 NPS in and less) of cutting the pipe into quarter sections, in which case the weld reinforcement may be removed and no other preparation of the specimens is required.

Figure 12.2—Transverse Face- and Root-Bend Specimens as per AWS B2.1

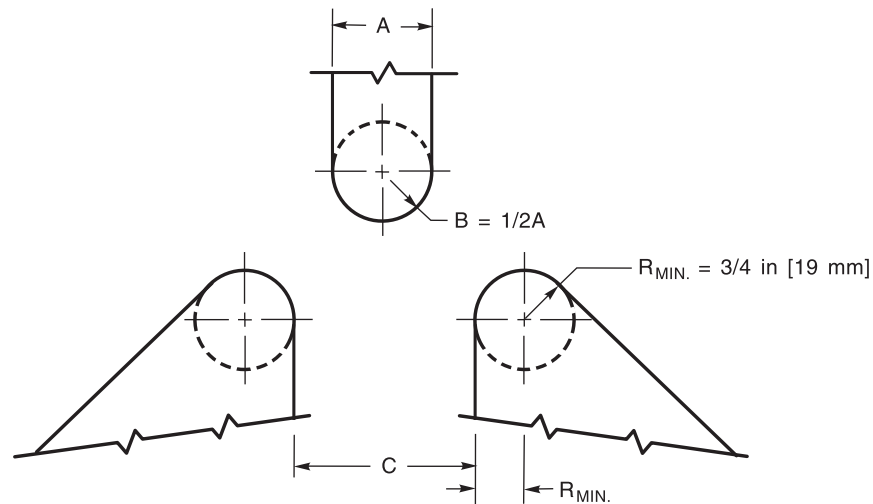


INCHES				MILLIMETERS			
Weld Thickness	Specimen Thickness (TS)			Weld Thickness	Specimen Thickness (TS)		
	All Base Metal Welded with F-23 Filler Metals	All Other M Numbers	Width of Specimen (W)		All Base Metal Welded with F-23 Filler Metals	All Other M Numbers	Width of Specimen (W)
3/8 to 1-1/2	1/8	3/8	T	10 to 38	3	10	T
Over 1-1/2	1/8	3/8	See Note 3	Over 38	3	10	See Note 3

Notes:

1. Weld reinforcement and backing strip or backing ring, if any, shall be removed flush with the surface of the specimen. If a recessed ring is used, this surface of the specimen may be machined to a depth not exceeding the depth of the recess to remove the ring, except that in such cases the thickness of the finished specimen shall be that specified above.
2. If thermal cut, the edges shall be dressed by grinding, except in M-1 materials.
3. When a side bend specimen thickness "T" exceeds 1-1/2 in [38 mm], it may be bent at full width, or it may be cut into multiple test specimens of approximately equal dimensions provided the specimens are not less than 3/4 in [19 mm] wide.

Figure 12.3—Transverse Side-Bend Specimens as per AWS B2.1



Base Metal ^b	INCHES			MILLIMETERS			
	TS ^a	A	C	Base Metal ^b	TS ^a	A	C
M-23 (as welded)				M-23 (as welded)			
M-35 except B148 and B271	<1/8	(16-1/2)TS	(18-1/2)TS + 1/16	M-35 except B148 and B271	<3	(16-1/2)TS	(18-1/2)TS + 1-1/2
All base metals welded with F-23 consumables	1/8	2-1/16	2-3/8	All base metals welded with F-23 consumables	3	50	57
M-11				M-11			
M-23 (annealed)	<3/8	(6-2/3)TS	(8-2/3)TS + 1/8	M-23 (annealed)	<10	(6-2/3)TS	(8-2/3)TS + 3
M-25	3/8	2-1/2	3-3/8	M-25	10	67	90
M-35, B148, and B271				M-35, B148, and B271			
M-24 (annealed)	≤3/8	8TS	10TS + 1/8	M-24 (annealed)	≤10	8TS	10TS + 3
M-27, M-61, and M-62				M-27, M-61, and M-62			
M-52 and M-53	≤3/8	10TS	12TS + 1/8	M-52 and M-53	≤10	10TS	12TS + 3
M-54	≤3/8	14TS	16TS + 1/8	M-54	≤10	14TS	16TS + 3
All other M-Number metals	<3/8	4TS	6TS + 1/8	All other M-Number metals	<10	4TS	6TS + 3
	3/8	1-1/2	2-3/8		10	40	63

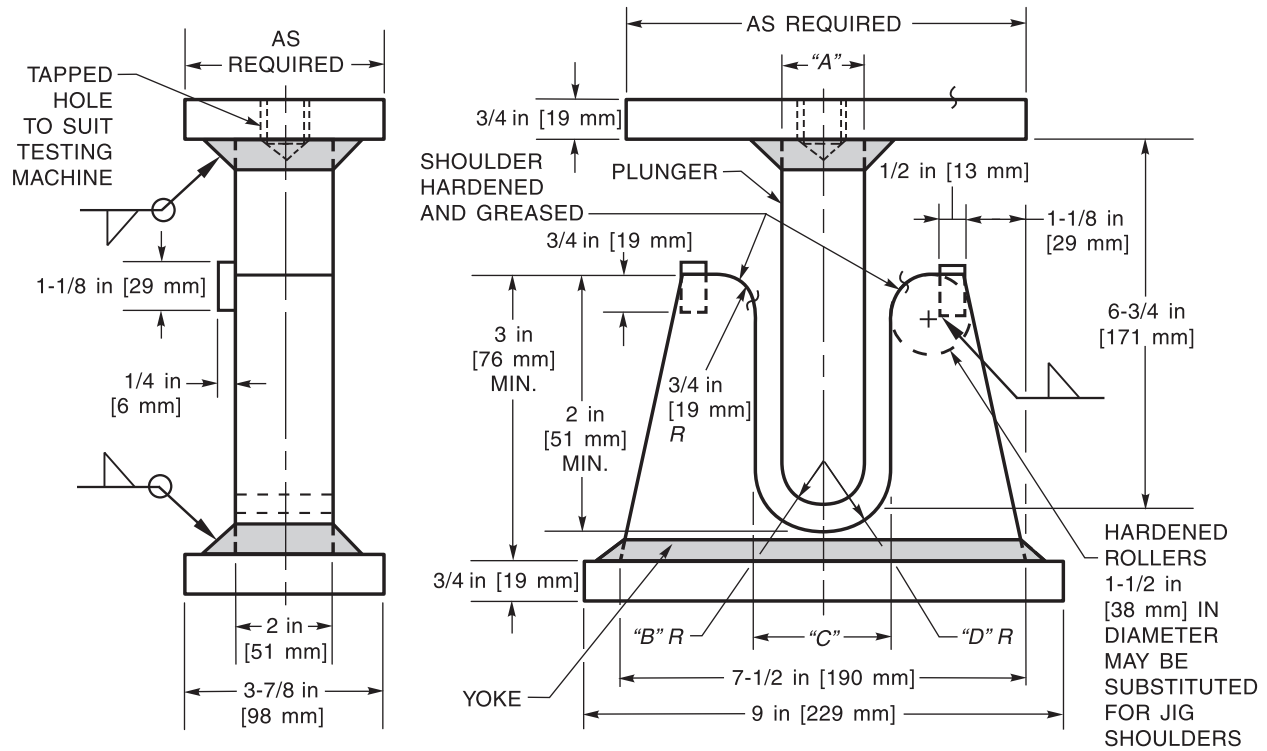
^a TS = Specimen thickness.

^b For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures A.5B and A.5C).

Notes:

1. To calculate the maximum bend diameter for any thickness specimen, use the following formula: $A = (100 TS/E) - TS$
Where A = bend diameter, E = minimum tensile elongation, and TS = test specimen thickness.
2. The shoulders of the test figure shall either be hardened rollers free to rotate or hardened and greased fixed shoulder.

Figure 12.4—Guided Bend Fixture—Bottom Ejecting Type as per AWS B2.1



	INCHES			MILLIMETERS				
	Base Metal ^b	TS ^a	A	C	Base Metal ^b	TS ^a	A	C
M-23 (as welded)					M-23 (as welded)			
M-35 except B148 and B271	<1/8	(16-1/2)TS	(18-1/2)TS + 1/16		M-35 except B148 and B271	<3	(16-1/2)TS	(18-1/2)TS + 1-1/2
All base metals welded with F-23 consumables	1/8	2-1/16	2-3/8		All base metals welded with F-23 consumables	3	50	57
M-11					M-11			
M-23 (annealed)	<3/8	(6-2/3)TS	(8-2/3)TS + 1/8		M-23 (annealed)	<10	(6-2/3)TS	(8-2/3)TS + 3
M-25	3/8	2-1/2	3-3/8		M-25	10	67	90
M-35, B148, and B271					M-35, B148, and B271			
M-24 (annealed)					M-24 (annealed)			
M-27, M-61, and M-62	≤3/8	8TS	10TS + 1/8		M-27, M-61, and M-62	≤10	8TS	10TS + 3
M-52 and M-53	≤3/8	10TS	12TS + 1/8		M-52 and M-53	≤10	10TS	12TS + 3
M-54	≤3/8	14TS	16TS + 1/8		M-54	≤10	14TS	16TS + 3
All other M-Number metals	<3/8	4TS	6TS + 1/8		All other M-Number metals	<10	4TS	6TS + 3
	3/8	1-1/2	2-3/8			10	40	63

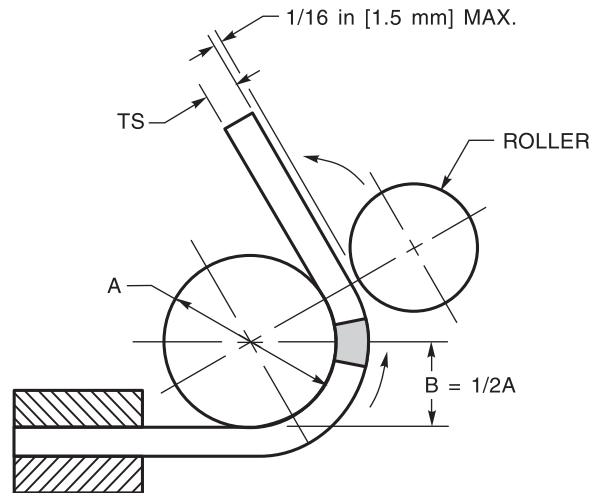
^a TS = Specimen thickness.

^b For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures A.5A and A.5C).

Notes:

- To calculate the maximum bend diameter for any thickness specimen, use the following formula: $A = (100 TS/E) - TS$
Where A = bend diameter, E = minimum tensile elongation, and TS = test specimen thickness.
- The shoulders of the test figure shall either be hardened rollers free to rotate or hardened and greased fixed shoulder.

Figure 12.5—Guided Bend Fixture—Bottom Type as per AWS B2.1



INCHES			MILLIMETERS		
Base Metal ^b	TS ^a	A	Base Metal ^b	TS ^a	A
M-23 (as welded)			M-23 (as welded)		
M-35 except B148 and B271	<1/8	(16-1/2)TS	M-35 except B148 and B271	<3	(16-1/2)TS
All base metals welded with F-23 consumables	1/8	2-1/16	All base metals welded with F-23 consumables	3	50
M-11			M-11		
M-23 (annealed)	<3/8	(6-2/3)TS	M-23 (annealed)	<10	(6-2/3)TS
M-25	3/8	2-1/2	M-25	10	67
M-35, B148, and B271			M-35, B148, and B271		
M-24 (annealed)	≤3/8	8TS	M-24 (annealed)	≤10	8TS
M-27, M-61, and M-62			M-27, M-61, and M-62		
M-52 and M-53	≤3/8	10TS	M-52 and M-53	≤10	10TS
M-54	≤3/8	14TS	M-54	≤10	14TS
All other M-Number metals	<3/8	4TS	All other M-Number metals	<10	4TS
	3/8	1-1/2		10	40

^a TS = Specimen thickness.

^b For M-26, M-81, and M-83 materials, two macroetch specimens shall be used in lieu of guided bend testing (see also Figures A.5A and A.5B).

Notes:

- To calculate the maximum bend diameter for any thickness specimen, use the following formula: $A = (100 TS/E) - TS$
Where A = bend diameter, E = minimum tensile elongation, and TS = test specimen thickness.
- The shoulders of the test figure shall either be hardened rollers free to rotate or hardened and greased fixed shoulder.

Figure 12.6—Wrap-Around Guided Bend Fixture as per AWS B2.1

**Table 12.2
Acceptance Criteria for Face-, Root-, and Side-Bends**

The convex surface of the bend test specimen shall be visually examined for surface discontinuities. For acceptance, the surface shall contain no discontinuities exceeding the following dimensions.

- 1/8 in (3 mm) measured in any direction on the surface.
- 3/8 in (10 mm)-the sum of the greatest dimensions of all discontinuities exceeding 1/32 in (1 mm), but less than or equal to 1/8 in (3 mm).
- 1/4 in (6 mm)-the maximum corner crack, except when that corner crack results from visible slag inclusion or other fusion type discontinuity; then the 1/8 in (3 mm) maximum shall apply.

Specimens with corner cracks exceeding 1/4 in (6 mm) with no evidence of slag inclusions or other fusion type discontinuity shall be disregarded, and a replacement test specimen from the original weldment shall be tested.

13. Documentation

13.1 Quality Manual

13.1.1 The SENSE training organization shall maintain and follow a quality manual that assures compliance with AWS QC11, *Specification for Qualification and Certification of SENSE Level II—Advanced Welders*, and AWS EG3.0, *Guide for the Training of Welding Personnel: SENSE Level II—Advanced Welders*.

13.2 SENSE Level II—Advanced Welder Credential

13.2.1 In order for a trainee to have their SENSE credentials listed in the AWS SENSE Certificate Database, the training organization shall submit the trainee's scores to the AWS Education Services Department. The scores shall include the following:

- (1) The actual grades on practical knowledge exams for compulsory and optional modules.
- (2) The results of the visual examination for each performance qualification test associated with each plate welding module, including the thermal cutting processes performance tests.
- (3) The results of the destructive test or radiographic examinations for all performance qualification tests associated with each plate or pipe welding process module(s).

14. Record of AWS SENSE Advanced Welder Credential

14.1 The training organization shall submit the trainee's scores to the AWS Education Services Department as specified in 13.2.1.

14.2 Trainees may verify their credentials by using their SENSE identification number that was issued when they completed the program.

15. Registration of Advanced Welders

15.1 An AWS SENSE advanced welder shall be listed in the AWS SENSE Certificate Database for three (3) years, after which time a permanent record shall be archived.

15.2 Individuals registered in the AWS SENSE Certificate Database are not required to maintain SENSE status by reporting welding activities.

16. Technical Skills Attainment (TSA) Examination

16.1 For those training organizations requiring a Technical Skills Attainment (TSA) exam, AWS will provide a multiple-choice TSA exam upon request.

17. Optional AWS QC7 Certified Welder

17.1 Trainees may seek AWS QC7 Certified Welder certification for any Level II—Advanced Welder performance qualification test, including those welder performance qualification tests associated with endorsements.

17.2 In order for trainees to receive QC7 certification, welder performance qualification tests must be administered at an AWS accredited test facility (ATF) using the applicable AWS SWPS. See Annex D for a list of applicable SWPSs.

17.3 Test results must be sent to the AWS Certification Department with the appropriate fee for each performance qualification test.

17.3.1 A copy of the trainee's AWS Certified Welder card shall be sent to the AWS Education Services Department for SENSE module completion recognition.

17.3.2 If the trainee fails to pass the QC7 certification test, they may retake the test, or they may opt to take the SENSE performance qualification test at the training organization to comply with SENSE requirements.

Annex A (Normative)

Visual Examination Results

This annex is part of this standard and includes mandatory elements for use with this standard.

Name of Student _____

Identification No. _____

Sample # _____

Groove Weld Reinforcement/Fillet Weld Convexity:

Acceptable Rejected

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 _____

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Annex B (Normative)

Bend Test Results

This annex is part of this standard and includes mandatory elements for use with this standard.

Name of Student _____

Identification No. _____

Sample # _____

Position: Plate _____ Pipe _____ Bend Type: Root Face Side

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

Accept Reject

Position: Plate _____ Pipe _____ Bend Type: Root Face Side

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

Accept Reject

Position: Plate _____ Pipe _____ Bend Type: Root Face Side

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

Accept Reject

Position: Plate _____ Pipe _____ Bend Type: Root Face Side

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

Accept Reject

Note: Radiographic examination (RT) may be used in lieu of bend testing. The RT shall conform to AWS D1.1, Section 6. The individual who interprets the NDT examination shall be qualified to NDT Level II, or III. The RT report shall be submitted with this document.

Instructor Name _____ Date _____

(Please Print)

Signature _____

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Annex C (Normative)

Level II Welding Performance Qualification Tests

This annex is part of this standard and includes mandatory elements for use with this standard.

Table C.1 provides a summary of Level II welder performance qualification tests and recommended standard welding procedure specifications (SWPSs) where applicable.

Table C.1
Recommended SWPS for SENSE Level II Performance Qualification Tests

Test/ Drawing	Process	Plate/Pipe	Material	Position	Test Thickness (inch)	SWPS ^a	SWPS Qual. Thickness (inch)
AWS 2-1	SMAW	Plate ^c	Stainless ^d	3G & 4G	1.00	B2.1-8-023	1/8–1.5
AWS 2-2	SMAW	6 in Sch 80 Pipe ^c	Steel	6G	0.43	B2.1-1-206 ^b or B2.1-1-208	1/8–1.5
AWS 2-3	GMAW-Spray	Plate w/backing	Steel	1G	1.00	B2.1-1-235	1/8–1.5
AWS 2-4	GMAW-P	Plate ^c	Steel	3G & 4G	1.00	AWS-EDU ^a	N/A
AWS 2-5	GMAW-Spray	Plate w/backing	Aluminum	1G	1/2	AWS- DU ^a	N/A
AWS 2-6	GMAW-S	4 to 8 in Sch 80 Pipe ^c	Steel	6G	0.337–0.50	AWS-EDU ^a	N/A
AWS 2-7	GMAW-S followed by GMAW-Spray	8 in Sch 80 Pipe	Steel	1G	0.50	B2.1-1-233	1/8-1.5
AWS 2-8	GMAW-P	4 to 8 in Sch 80 Pipe ^c	Steel	6G	0.337–0.50	AWS-EDU ^a	N/A
AWS 2-9	FCAW-G	Plate ^c	Steel	3G & 4G	1.00	B2.1-1-019 or B2.1-1-020	1/8–1.5
AWS 2-10	FCAW-S	Plate ^c	Steel	3G & 4G	1.00	B2.1-1-018	1/8-1.5
AWS 2-11	GMAW-S followed by FCAW-G	8 in Sch 80 Pipe ^c	Steel	6G	0.50	B2.1-1-232— option root using GTAW as per B2.1-1-207	1.8-1.5
AWS 2-12	GTAW	Plate ^c	Steel	3G & 4G	3/8	B2.1-1-002	3/16–7/8
AWS 2-13	GTAW	Plate ^c	Stainless ^d	3G & 4G	3/8	B2.1-8-024	1/16–1.5
AWS 2-14	GTAW	Plate ^c	Aluminum	3G & 4G	1/2	AWS-EDU ^a	N/A
AWS 2-15	GTAW	6 in Sch 80 Pipe ^c	Steel	6G	0.43	B2.1-1-207	1/8–1.5

(Continued)

Table C.1 (Continued)
Recommended SWPS for SENSE Level II Performance Qualification Tests

Test/ Drawing	Process	Plate/Pipe	Material	Position	Test Thickness (inch)	SWPS ^a	SWPS Qual. Thickness (inch)
AWS 2-16	GTAW	6 in Sch 80 Pipe ^c	Stainless ^d	6G	0.43	B2.1-1-212	1/16–1.5
AWS 2-17	GTAW followed by SMAW	2.75 in Sch 180 Pipe	Steel	6G	0.63	B2.1-1-209	1/8–1.5
AWS 2-18	Multi-Process Workmanship Test	Assembly	Steel	All	See drawing	As per drawing	

^a Any applicable qualified WPS may be used in lieu of recommended SWPS or AWS-EDU WPSs.

^b Downhill progression on root; all other vertical passes are uphill.

^c With or without backing.

^d Stainless filler metal on carbon steel base plate or pipe as applicable.

N/A = Not applicable.

Annex D (Normative)

Standard Welding Procedure Specifications of Level II Welding Performance Qualification Tests

This annex is part of this standard and includes mandatory elements for use with this standard.

D.1 Scope

SENSE Level II—Advanced Welder performance qualification tests shall be conducted using AWS B2 Standard Welding Procedure Specifications (SWPSs) or alternative WPSs, as described in AWS SENSE QC11, *Specification for Qualification and Certification of Level II—Advanced Welders*. AWS SWPSs are provided in AWS EG3.0 Supplement, *Supplement SENSE Level II—Advanced Welder Training Performance Testing Procedures* for educational use only.

Table D.1 shows which SWPS is recommended for each welder performance qualification test drawing in EG3.0. Additional SWPSs may be recommended in the future for use in the EG2.0 Supplement as they are qualified by the B2 Committee.

Training organizations have the option to use other governing standards and WPSs that are qualified to AWS D1 Structural Welding Codes, or other national or international standards. It is the responsibility of the training organization to specify the appropriate SWPSs, alternate WPSs and governing standard(s).

Table D.1
Recommended SWPSs for Level II Test Drawings

Test Drawing #	SWPS
AWS 2-1	B2.1-8-023
AWS 2-2	B2.1-1-206
AWS 2-2	B2.1-1-208
AWS 2-3	B2.1-1-235
AWS 2-7	B2.1-1-233
AWS 2-9	B2.1-1-019
AWS 2-9	B2.1-1-020
AWS 2-10	B2.1-1-018
AWS 2-11	B2.1-1-232
AWS 2-12	B2.1-1-002
AWS 2-13	B2.1-8-024
AWS 2-15	B2.1-1-207
AW S2-16	B2.1-8-212
AWS 2-17	B2.1-1-209

D.2 SWPS Reference Documents

Unless specified, the latest approved revision of the SWPS applies for the recommended AWS SENSE Level II—Advanced Welder welding performance qualification test. See Table D.2.

Table D.2
SWPS Reference Documents

Test No.	AWS SWPS	Title
Test 2-1	B2.1-8-023	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1) 1/8 through 1-1/2 inch Thick, As-Welded Condition</i>
Test 2-2	B2.1-1-206	<i>Standard Welding Procedure Specification (SWPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E6010 (Vertical Downhill) Followed by E7018, As-Welded or PWHT Condition; or B2.1-1-208, SWPS for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E7018, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
Test 2-3	B2.1-1-235	<i>Standard Welding Procedure Specification (SWPS) for Argon plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 through 1-1/2 inch Thick, ER70S-3, Flat Position Only, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
Test 2-7	B2.1-1-233	<i>Standard Welding Procedure Specification (SWPS) for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 2% Oxygen Shielded Gas Metal Arc Welding (Spray Transfer Mode) of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 through 1-1/2 inch Thick, ER70S-3, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
Test 2-9	B2.1-1-019	<i>Standard Welding Procedure Specification (SWPS) for CO₂ Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E70T-1 and E71T-1, As-Welded Condition; or B2.1-1-020, SWPS for 75% Ar/25% CO₂ Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E70T-1 and E71T-1, As-Welded or PWHT Condition</i>
Test 2-10	B2.1-1-018	<i>Standard Welding Procedure Specification (SWPS) for Self-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, E71T-8, As-Welded Condition</i>
Test 2-11	B2.1-1-232	<i>Standard Welding Procedure Specification (SWPS) for Argon Plus 25% Carbon Dioxide Shielded Gas Metal Arc Welding (Short Circuiting Transfer Mode) followed by Argon Plus 25% Carbon Dioxide Shielded Flux Cored Arc Welding of Carbon Steel (M-1/P-1/S-1, Groups 1 and 2), 1/8 through 1-1/2 inch Thick, ER70S-3 and E7XT-X, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
Test 2-12	B2.1-1-002	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 3/16 through 7/8 inch, in the As-Welded Condition, With or Without Backing</i>
Test 2-13	B2.1-8-024	<i>Standard Welding Procedure Specification (SWPS) SWPS for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 through 1-1/2 inch Thick, ER3XX, As-Welded Condition, Primarily Plate and Structural Applications</i>
Test 2-15	B2.1-1-207	<i>Standard Welding Procedure Specification (SWPS) SWPS for Gas Tungsten Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, ER70S-2, As-Welded or PWHT Condition, Primarily Pipe Applications</i>
Test 2-16	B2.1-8-212	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding of Austenitic Stainless Steel (M-8/P-8/S-8, Group 1), 1/16 through 1-1/2 inch Thick, ER3XX, As-Welded Condition, Primarily Pipe Applications</i>
Test 2-17	B2.1-1-209	<i>Standard Welding Procedure Specification (SWPS) for Gas Tungsten Arc Welding Followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, ER70S-2 and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications</i>

Annex E (Informative)

Guidelines for the Preparation of Technical Inquiries for the AWS Education Committees

This annex is not part of this standard but is included for informational purposes only.

E1. 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.

E2. Procedure

All inquiries shall be directed to:

Director, Education Services Department
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/subcommittee 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.

E2.1 Scope. Each inquiry shall address one single provision of the specification, 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 specification that contains the provision(s) the inquirer is addressing.

E2.2 Purpose of the Inquiry. The purpose of the inquiry shall be stated in this portion of the inquiry. The purpose can be either to obtain an interpretation of a specification's requirement, or to request the revision of a particular provision in the specification.

E2.3 Content of the Inquiry. The inquiry should be concise, yet complete, to enable the committee to quickly and fully understand the point of the inquiry. Sketches should be used when appropriate and all paragraphs, figures, and tables (or the Annex), which bear on the inquiry shall be cited. If the point of the inquiry is to obtain a revision of the specification, the inquiry must provide technical justification for that revision.

E2.4 Proposed Reply. The inquirer should, as a proposed reply, state an interpretation of the provision that is the point of the inquiry, or the wording for a proposed revision, if that is what the inquirer seeks.

E3. Interpretation of Provisions

Interpretations of specification provisions are made by the Education Committee. The secretary of the committee refers all inquiries to the chair of the particular subcommittee that has jurisdiction over the particular specification 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 development of the response, the inquiry and the response are presented to the entire Education 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.

E4. Publication of Interpretations

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

E5. Telephone Inquiries

Telephone inquiries to AWS Headquarters concerning the AWS QC11, *Specification for Qualification and Certification of SENSE Level II—Advanced Welders*, should be limited to matters directly related to the use of the specification. The AWS Board of Directors' policy 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.

E6. The Education Committee

The activities of the Education Committee regarding interpretations are limited strictly to the interpretation of specification provisions or to consideration of revisions to existing provisions. Neither AWS staff nor the committees are in a position to offer interpretive or consulting services on: (1) specific engineering problems, or (2) requirements that apply to topics outside the scope of the specification or points not specifically covered by the specification. In such cases, the inquirer should seek assistance from a competent engineer or consultant experienced in the particular field of interest.

