


**AWS B2.1:2005**  
**An American National Standard**



# **Specification for Welding Procedure and Performance Qualification**



**American Welding Society**

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**Key Words**—Welding performance qualification,  
welding procedure qualification,  
welding procedure specification,  
welding processes, filler metals, base  
metals, welding qualification variables

**AWS B2.1:2005**  
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**Approved by**  
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# **Specification for Welding Procedure and Performance Qualification**

**Supersedes AWS B2.1:2000**

Prepared by  
AWS B2 Committee on Procedure  
and Performance Qualification

Under the Direction of  
AWS Technical Activities Committee

Approved by  
AWS Board of Directors

## **Abstract**

This specification provides the requirements for qualification of welding procedure specifications, welders, and welding operators for manual, semiautomatic, mechanized, and automatic welding. The welding processes included are oxyfuel gas welding, shielded metal arc welding, gas tungsten arc welding, submerged arc welding, gas metal arc welding, flux cored arc welding, plasma arc welding, electroslag welding, electrogas welding, electron beam welding, laser beam welding, and stud arc welding. Base metals, filler metals, qualification variables, and testing requirements are also included.



**American Welding Society**

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

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## Dedication

The AWS B2 Committee on Procedure and Performance Qualification dedicates this edition of AWS B2.1, *Specification for Welding Procedure and Performance Qualification*, to the memory of Paul B. Dickerson.

Paul was an AWS Fellow and contributed unselfishly to several technical committees of the American Welding Society. He is missed by all for whom he so generously shared his prodigious knowledge and wisdom.

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<i>R. K. Wiswesser</i>	Welder Training & Testing Institute

\*Advisor

\*\* Deceased

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# Foreword

(This Foreword is not a part of AWS B2.1:2005, *Specification for Welding Procedure and Performance Qualification*, but is included for informational purposes only.)

This specification provides requirements for welding procedure and welding performance qualification. It is the intent that this specification be referenced by other documents, such as codes, standards, specifications, and contracts.

This specification defines and establishes qualification variables. The criterion for determining if a welding condition is a procedure qualification variable is whether or not a change in that condition beyond the allowable tolerance affects the properties of a sound weld to the extent that the properties may not meet the specified minimum.

Qualification requirements are based on the premise that the referencing document will specify fabrication, design, base metal, filler metal, preheat, interpass temperature, postweld heat treatment, nondestructive examination, and test requirements applicable to the product. Welding procedure and performance qualifications which meet the requirements of other documents are acceptable, provided they also meet the requirements of this specification.

## *Welding Procedure Qualification*

The purpose of a welding procedure qualification is to provide test data for assessing the properties of a welded joint. The proof of production weld soundness is determined by the type and extent of testing and examination applied to the production product. Product acceptance criteria must be detailed in the referencing document.

This specification also provides for welding procedure qualification of special test weldments by performing tests simulating service conditions, which may include impact loading, flexural loading, static loading, or cyclic loading. The details of testing and examination of special test weldments shall be specified by the referencing document.

AWS Standard Welding Procedure Specifications published by AWS may be used without performing additional procedure qualification tests when the requirements of the referencing document for the applications involved are met and no change is made beyond the specified range of variables shown in the Standard Welding Procedure. Standard Welding Procedures are not intended as a substitute for the engineering judgment which must be exercised in determining the suitability of these procedures for use on a welded assembly or connection. Welding procedures other than AWS Standard Welding Procedure Specifications must be qualified by testing to demonstrate that minimum requirements are met.

## *Welding Performance Qualification*

The purpose of welder qualification testing is to determine the ability of welders to produce a sound weld in the welding positions which will be encountered in production applications. The purpose of welding operator qualification tests is to determine the ability of welding operators to operate mechanized or automatic equipment.

Performance qualification shall be determined by mechanical or nondestructive examination of welds, or both, except that provision is made for qualification by visual examination only, when permitted by the referencing document.

## *Materials*

Base metals and filler metals have been grouped into categories that will minimize the number of qualification tests required. Substitution of one base metal or filler metal for another, even when within the allowable rules, should only be made after an evaluation of the factors involved. For some materials, additional tests may be required. Materials not listed require separate qualification.

A vertical line in the margin indicates a revision from the 2000 edition.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, AWS B2 Committee on Procedure and Performance Qualification, American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

Official interpretations of any of the technical requirements of this standard may only be obtained by sending a request, in writing, to the Managing Director, Technical Services Division, American Welding Society. A formal reply will be issued after it has been reviewed by the appropriate personnel following established procedures.

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# Table of Contents

	Page No.
<i>Personnel</i> .....	v
<i>Foreword</i> .....	vii
<i>List of Tables</i> .....	x
<i>List of Figures</i> .....	xi
1. General Provisions.....	1
1.1 Scope.....	1
1.2 References.....	1
1.3 Terms and Definitions.....	1
1.4 Responsibilities.....	3
1.5 Effective Date.....	3
1.6 Safety Precautions.....	3
2. Procedure Qualification.....	5
2.1 General.....	5
2.2 Standard Welding Procedure Specifications.....	5
2.3 Welding Procedures Qualified by Employer.....	7
2.4 Evaluation of Test Weldments.....	8
2.5 Qualification Thickness Limitations.....	8
2.6 Special Test Weldment Acceptance Criteria.....	11
2.7 Pipe and Plate Groove Test Weldments and Acceptance Criteria.....	11
2.8 Fillet Test Weldments and Acceptance Criteria.....	13
2.9 Cladding Test Weldment and Acceptance Criteria.....	17
2.10 Hardfacing Test Weldment and Acceptance Criteria.....	17
2.11 Stud Welds and Acceptance Criteria.....	18
2.12 Sheet Metal Weldment and Acceptance Criteria.....	19
2.13 Welding Procedure Specification Data.....	20
2.14 Procedure Qualification Variables.....	22
3. Performance Qualification.....	29
3.1 General.....	29
3.2 Qualification by Standard Test.....	31
3.3 Qualification by Workmanship Test.....	31
3.4 Test Weldments.....	33
3.5 Examination Procedures and Acceptance Criteria.....	35
3.6 Performance Qualification Variables.....	37
<i>Mandatory Annexes</i> .....	45
<i>Annex I—Basis for Establishing a Standard Welding Procedure Specification (WPS)</i> .....	45
<i>Annex II—Illustrations—Weld Position, Test Specimens, and Text Fixtures</i> .....	47
<i>Annex III—Filler Metal Grouping</i> .....	65
<i>Annex IV—Base Metal Grouping</i> .....	69
<i>Annex V—Radiographic Examination Procedure</i> .....	245
<i>Nonmandatory Annexes</i> .....	249
<i>Annex A—Example Performance Qualification Test Record</i> .....	249
<i>Annex B—Macroetch Procedure</i> .....	251
<i>Annex C—Guidelines for Preparation of Technical Inquiries for AWS Technical Committees</i> .....	253
<i>List of AWS Documents on Welding Procedure and Performance Qualification</i> .....	255

# List of Tables

<b>Table</b>	<b>Page No.</b>
2.1	Test Methods Required for Procedure Qualification ..... 9
2.2	Thickness and Size Limitations for Fillet Welds for Procedure Qualification ..... 9
2.3	Thickness Limitations of Plate and Pipe for Groove Welds for Procedure Qualification ..... 10
2.4	Thickness Limitations for Cladding and Hardfacing for Procedure Qualification ..... 10
2.5	Thickness Limitations for Procedure Qualification—Sheet Metal Groove Welds ..... 10
2.6	Minimum Shear Strength for Aluminum Fillet Welds ..... 16
2.7	Minimum Tensile Load Requirements for Aluminum Stud Welds ..... 19
2.8	Minimum Torque Requirements for Steel Stud Welds ..... 19
2.9	Minimum Torque Requirements for Aluminum Stud Welds ..... 19
3.1	Examination Requirements for Performance Qualification ..... 30
3.2	Number of Bend Tests for Performance Qualification ..... 31
3.3	Allowable Base Metals for Performance Qualification ..... 33
3.4	Allowable Filler Metals for Performance Qualification ..... 33
3.5	Position Limitations for Performance Tests ..... 34
3.6	Limitations for Performance Qualification on Groove Welds in Pipe and Tube ..... 40
3.7	Limitations for Performance Qualification in Plate Groove Welds ..... 40
3.8	Limitations for Performance Qualification in Pipe Fillet Welds ..... 43
3.9	Limitations for Performance Qualification in Sheet Metal ..... 44
III-1	Grouping of Welding Electrodes and Rods for Qualification ..... 66
III-2	Classification of Ferrous Weld Metal for Procedure Qualification ..... 67
IV-1	Listing of Base Metal Specifications—Ferrous Alloys ..... 70
IV-1	Listing of Base Metal Specifications—Nonferrous Alloys ..... 105
IV-2	M-Number Listing of Base Metals—Ferrous Alloys ..... 128
IV-2	M-Number Listing of Base Metals—Nonferrous Alloys ..... 187
IV-3	Listing of Base Metal Specifications—Iron Castings ..... 242
V-1	Acceptable Linear Discontinuities for Radiographic Examination ..... 246
V-2	Acceptable Rounded Discontinuities for Radiographic Examination ..... 247

## List of Figures

Figure	Page No.
2.1	Welding Procedure Selection Criteria.....6
2.2	Location of Groove Weld Test Specimens—Pipe ..... 11
2.3	Location of Test Specimens for Welded Box Tubing..... 12
2.4	Location of Tension, Longitudinal Bend, and Toughness Specimens—Plate and Sheet ..... 13
2.5	Location of Tension, Toughness, and Transverse Bend Specimens—Plate and Sheet ..... 14
2.6	Location of Fillet Weld Shear Test and Macroetch Specimens ..... 15
2.7	Fillet Weld Break Test and Macroetch Specimens for Procedure Qualification ..... 16
2.8	Location of Cladding Test Specimens ..... 17
2.9	Location of Hardfacing Test Specimens ..... 18
3.1	Selection of Performance Qualification Method—Workmanship Test or Standard Test ..... 30
3.2	Typical Workmanship Test Weldments ..... 32
3.3	Location of 1G, 2G, 5G, and 6G Bend Specimens—Pipe Groove Weldment ..... 35
3.4	Location of Bend Specimens—Combined Pipe Positions 2G and 5G ..... 36
3.5	Location of Bend Specimens for Box Tube ..... 37
3.6	Location of Transverse Bend Specimens—Plate Groove Weldment ..... 38
3.7	Location of Longitudinal Bend Specimens—Plate Groove Test Weldment ..... 38
3.8	Location of Fillet Test Specimens—Plate ..... 39
3.9	Location of Fillet Test Specimens—Alternate Weldment—Plate ..... 41
3.10	Location of Fillet Test Specimens—Pipe ..... 41
3.11	Location of Fillet Test Specimens—Alternate Weld—Pipe ..... 42
3.12	Location of Cladding Specimens—Plate ..... 42
3.13	Location of Test Specimen—Hardfacing Test Weldment—Plate ..... 43
II-1A	Welding Test Positions—Groove, Cladding, and Hardfacing Welds ..... 48
II-1B	Limits of Welding Positions—Groove, Cladding, and Hardfacing Welds ..... 49
II-1C	Welding Test Positions—Fillet Welds ..... 50
II-1D	Limits of Welding Positions—Fillet Welds ..... 51
II-1E	Welding Positions—Stud Welds ..... 52
II-2A	Transverse Face and Root Bend Specimens ..... 53
II-2B	Longitudinal Face and Root Bend Specimens ..... 54
II-2C	Transverse Side Bend Specimens ..... 54
II-3A	Reduced Section Tension Specimen—Rectangular ..... 55
II-3B	Reduced Section Tension Specimen—Round ..... 56
II-3C	Alternate Tension Specimen for Pipe 3 in. O.D. or Less ..... 56
II-3D	Alternate Tension Specimen for Pipe 2 in. O.D. or Less ..... 57
II-4A	Weld Cladding Side Bend Specimens ..... 58
II-4B	Weld Cladding and Hardfacing Chemical Analysis Specimens ..... 58
II-5A	Guided Bend Fixture—Bottom Ejecting Type ..... 59
II-5B	Guided Bend Fixture—Bottom Type ..... 60
II-5C	Guided Bend Fixture—Wrap-Around ..... 61
II-5D	Stud Weld Bend Test Fixture ..... 62
II-5E	Stud Weld Torque Test Fixture ..... 62
II-5F	Stud Weld Tension Test Fixture ..... 63
V-1	Rounded Indication Charts for Radiographic Examination ..... 249
A-1	Example of a Performance Qualification Test Record ..... 252

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# Specification for Welding Procedure and Performance Qualification

## 1. General Provisions

### 1.1 Scope

This specification provides requirements for the qualification of welding procedures. It also provides requirements for the performance qualification of welders and welding operators.

This specification is intended for use where referenced by a product or fabrication code, specification, contract document, or internal documents such as quality control or quality assurance manuals. The requirements imposed by the Referencing Document (see 1.3.2 Supplemental Definitions) supersede the requirements of this specification.

This specification is intended for use with the following welding processes:

OFW	=	Oxyfuel Gas Welding
SMAW	=	Shielded Metal Arc Welding
GTAW	=	Gas Tungsten Arc Welding
SAW	=	Submerged Arc Welding
GMAW	=	Gas Metal Arc Welding
FCAW	=	Flux Cored Arc Welding
PAW	=	Plasma Arc Welding
ESW	=	Electroslag Welding
EGW	=	Electrogas Welding
EBW	=	Electron Beam Welding
LBW	=	Laser Beam Welding
SW	=	Stud Arc Welding

Appropriate metric conversions are included for all dimensions. However, the customary units are standard units, and the metric units are for information only. It is intended that inspection of qualification test welds is to be accepted based on the U.S. customary dimensions, not on the metric conversion values of these dimensions.

### 1.2 References

- (1) AWS A3.0, *Standard Welding Terms and Definitions*<sup>1</sup>
- (2) AWS B4.0, *Standard Methods for Mechanical Testing of Welds*<sup>1</sup>
- (3) AWS D1.4, *Structural Welding Code—Reinforcing Steel*<sup>1</sup>
- (4) AWS D11.2, *Guide for Welding Iron Casting*<sup>1</sup>
- (5) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*<sup>1</sup>
- (6) ASME Boiler and Pressure Vessel Code<sup>2</sup>
- (7) ASTM E 165, *Standard Test Method for Liquid Penetrant Examination*<sup>3</sup>

### 1.3 Terms and Definitions

**1.3.1** The welding terms used in this specification are defined in AWS A3.0, *Standard Welding Terms and Definitions*.

**1.3.2 Supplemental Definitions.** Some AWS A3.0, *Standard Welding Terms and Definitions*, exceptions to AWS A3.0 terms, and additional terms as used in this specification are defined below.

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1. AWS standards are published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.
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