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**Standard Welding
Procedure Specification
(SWPS) for Gas Tungsten
Arc Welding with
Consumable Insert Root
followed by Shielded
Metal Arc Welding of
Carbon Steel (M-1/P-1,
Group 1 or 2), 1/8 in
[3 mm] through 1-1/2
in [38 mm] Thick, INMs-
1, ER70S-2, and E7018,
As-Welded or PWHT
Condition, Primarily
Pipe Applications**

Site License



AWS B2.1-1-211:2023
An American National Standard

Approved by the
American National Standards Institute
February 27, 2023

**Standard Welding Procedure Specification (SWPS) for
Gas Tungsten Arc Welding with Consumable Insert Root
followed by Shielded Metal Arc Welding of Carbon Steel
(M-1/P-1, Group 1 or 2), 1/8 in [3 mm] through 1-1/2 in
[38 mm] Thick, INMs-1, ER70S-2, and E7018, As-Welded
or PWHT Condition, Primarily Pipe Applications**

4th Edition

Revises AWS B2.1-1-211:2001 (R2012)

Prepared by the
American Welding Society (AWS) B2 Committee on Procedure and Performance Qualification

Under the Direction of the
AWS Technical Activities Committee

Approved by the
AWS Board of Directors

Abstract

This standard contains the essential welding variables for carbon steel in the thickness range of 1/8 in [3 mm] through 1-1/2 in [38 mm], using manual gas tungsten arc welding with consumable insert root, followed by shielded metal arc welding. It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for groove welds. This SWPS was developed primarily for pipe applications.



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This standard is subject to revision at any time by the AWS B2 Committee on Procedure and Performance Qualification. It must be reviewed every five years, and if not revised, it must be either reaffirmed or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS B2 Committee on Procedure and Performance Qualification and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS B2 Committee on Procedure and Performance Qualification to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

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J. Alston	<i>Jefferson Lab</i>
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J. J. Sekely	<i>Welding Services, Incorporated</i>
M. L. Thomas	<i>Rocky Mountain Testing, LLC</i>
R. K. Wiswesser	<i>Welder Training & Testing Institute</i>

Advisors to the AWS B2 Committee on Procedure and Performance Qualification

E. W. Beckman	<i>Consultant</i>
M. Bernasek	<i>C-SPEC</i>
H. R. Castner	<i>Edison Welding Institute (retired)</i>
B. J. Hable	<i>Ford Motor Company</i>
K. Y. Lee	<i>DNV</i>
B. B. MacDonald	<i>Consultant</i>
C. D. Morell	<i>U.S. Nuclear Regulatory Commission (retired)</i>
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D. T. Braun	<i>Southside Virginia Community College</i>
M. W. Bumgarner	<i>Bumgarner Consulting, LLC</i>
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J. J. Fluckiger	<i>Custom Quality Solutions</i>
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T. A. Mihalik	<i>International Training Institute</i>
T. C. Mueller	<i>Motion Engineering Ltd.</i>
J. L. Pasqua	<i>Salco Products</i>
A. B. Rigato	<i>Pacific Northwest National Laboratory</i>
W. M. Ruof	<i>Bechtel Plant Machinery, Incorporated</i>

Advisors to the AWS B2D Subcommittee on Standard Welding Procedure Specifications

M. Bernasek	<i>C-SPEC</i>
H. R. Castner	<i>Edison Welding Institute (retired)</i>
K. Y. Lee	<i>DNV</i>
C. D. Morell	<i>U.S. Nuclear Regulatory Commission (retired)</i>
F. A. Schweighardt	<i>Airgas</i>
T. J. White	<i>Consultant</i>
G. M. Wisbrock, Jr.	<i>Consultant</i>

Foreword

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

The American Welding Society generates Standard Welding Procedure Specifications (SWPSs) for industry through the cooperative efforts of the AWS B2 Committee on Procedure and Performance Qualification, the AWS B2D Subcommittee on Standard Welding Procedure Specifications, and the AWS B2G Subcommittee on Procedure Qualification Records. The Welding Procedures Committee (WPC) of the Welding Research Council (WRC) originally managed the procedure qualification records in support of AWS Standard Welding Procedure Specifications and was formally transitioned to the AWS B2G Subcommittee on Procedure Qualification Records in 2019.

The need for pretested welding procedures that are supported by adequate test data and that satisfy the technical requirements for the commonly used construction codes and specifications has been expressed by many individuals and organizations. The purpose of a welding procedure qualification is to provide test data for assessing the properties of a weld joint.

This Standard Welding Procedure Specification is an outgrowth of the coordinated work of the AWS B2G Subcommittee on Procedure Qualification Records and the AWS B2 Committee on Procedure and Performance Qualification. The AWS B2G Subcommittee on Procedure Qualification Records has provided the data documented on the Summary of Procedure Qualification Records.

The welding terms used in this specification shall be interpreted in accordance with the definitions given in the latest edition of AWS A3.0M/A3.0, *Standard Welding Terms and Definitions*. Welding symbols shall be those shown in the latest edition of AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*.

The AWS B2 Committee on Procedure and Performance Qualification was formed in 1979 to provide welding standards concerning the subject of qualification. The primary document developed by this committee is AWS B2.1/B2.1M, *Specification for Welding Procedure and Performance Qualification*. This document established the foundation and framework for Standard Welding Procedure Specifications (SWPSs). The first two SWPSs were published in 1990. Since then, SWPSs are continuing to be developed and published by the American Welding Society.

A vertical line in the margin or underlined text in clauses, tables, or figures indicates an editorial or technical change from the previous 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, 8669 NW 36 St., # 130, Miami, FL, 33166.

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Standard Welding Procedure Specification (SWPS)

Gas Tungsten Arc Welding with Consumable Insert Root followed by Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 in [3 mm] through 1-1/2 in [38 mm] Thick, INMs-1, ER70S-2, and E7018, As-Welded or PWHT Condition, Primarily Pipe Applications

Supporting PQR Numbers: 001002, 001007, 001010, 001013, 001014, 001015, 001017, 001024, 001038, 005031, 200266, 200267, 200268, 200269, 200270, 200272, 200273, 200274, 200275, 200530, 200531, 200532, 200534, 200535, 200625, 200626, 200627, 200628, 200629, 200630, 200631, 200632, 200633, 200634, 200635, 200636, 200637, 200638, 200639, 200708, 200709, 200710, 200711, 200712, 200713, 200728, 200835, 200850, 200851, 200852, 001A, 002A, 003B, 004A, 029A, 030A

Requirements for Application of SWPSs

Scope. The data to support this Standard Welding Procedure Specification (SWPS) have been derived from the above listed Procedure Qualification Records (PQRs), which were reviewed and validated under the auspices of the AWS B2G Subcommittee on Procedure Qualification Records. This SWPS is not valid using conditions and variables outside the ranges listed. The American Welding Society considers that this SWPS presents information for producing an acceptable weld using the conditions and variables listed. The user needs a significant knowledge of welding and accepts full responsibility for the performance of the weld and for providing the engineering capability, qualified personnel, and proper equipment to implement this SWPS.

Application. This SWPS is to be used only as permitted by AWS B2.1/B2.1M, *Standard for Welding Procedure and Performance Qualification*, and the applicable fabrication document(s) [such as code, specification, or contract document(s)]. The fabrication document(s) should specify the engineering requirements such as design, need for heat treatment, fabricating tolerances, quality control, and examination and tests applicable to the end product.

User's Responsibility. A SWPS does not replace or substitute for fabrication codes, specifications, contract requirements, or capability and judgment on the part of the user. A SWPS is to be used only as permitted by the applicable fabrication code, specification, or contract document. The ability to produce production welds having properties suitable for the application depends upon supplementing the SWPS with appropriate performance qualification tests and sound engineering judgment. The user is responsible for the quality and performance of the final product in accordance with the provisions of the fabrication document(s).

Supplementary Instructions. To adapt this SWPS to a specific application, a user may issue supplementary instructions. Such instructions may consist of tighter fit-up tolerances, higher minimum preheat temperature or any other instructions necessary to produce a weldment that meets the requirements of the fabrication document(s). These instructions shall not be less restrictive than provided in the SWPS.

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

Standard Welding Procedure Specification (SWPS)

Safety. Safety and health issues and concerns are beyond the scope of this standard and therefore are not addressed herein. Safety and health information is available from the following sources:

American Welding Society:

- (1) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*
- (2) AWS Safety and Health Fact Sheets
- (3) Other safety and health information on the AWS website

Material or Equipment Manufacturers:

- (1) Safety Data Sheets supplied by materials manufacturers
- (2) Operating Manuals supplied by equipment manufacturers

Applicable Regulatory Agencies:

Work performed in accordance with this standard may involve the use of materials that have been deemed hazardous and may involve operations or equipment that may cause injury or death. This standard does not purport to address all safety and health risks that may be encountered. The user of this standard should establish an appropriate safety program to address such risks as well as to meet applicable regulatory requirements. ANSI Z49.1 should be considered when developing the safety program.