

**Standard Welding Procedure
Specification (SWPS) for
Gas Tungsten Arc Welding
(Consumable Insert Root)
followed by Shielded Metal
Arc Welding of Chromium-
Molybdenum Steel (M-5A/
P-5A), IN521, ER90S-B3, and
E9018-B3, 1/8 inch [3 mm]
through 1/2 inch [13 mm]
Thick, As-Welded Condition;
1/8 inch [3 mm] through
1-1/2 inch [38 mm] Thick,
PWHT Condition, Primarily
Pipe Applications**

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AWS B2.1-5A-226:2022
An American National Standard

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American National Standards Institute
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2nd Edition

Revises AWS B2.1-5A-226:1999 (R2009)

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 chromium-molybdenum steel in the thickness range of 1/8 inch [3 mm] through 1/2 inch [13 mm] in the as-welded condition; or 1/8 inch [3 mm] through 1-1/2 inch [38 mm] in the post-weld heat treated (PWHT) condition, using manual gas tungsten arc welding with a 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 standard welding procedure specification (SWPS) was developed primarily for pipe applications.



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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, Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying*. The AWS designation for welding gases should be those shown in the latest edition of AWS A5.32M/A5.32 (ISO 14175 MOD), *Welding Consumables—Gases and Gas Mixtures for Fusion Welding and Allied Processes*.

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.

The following changes are included in this revision of the previous edition:

The format has been updated, column titles were added and current heading terminology incorporated, the safety clause was revised, a standard units of measure clause was added, the metric table was deleted, conversions were updated and added to the text and joint details, existing footnotes were updated and new footnotes were added, introductory text to joint details was updated, the weld symbols were deleted, and an annex on requesting an official interpretation was included.

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 (Consumable Insert Root) followed by Shielded Metal Arc Welding of Chromium-Molybdenum Steel, (M-5A/P-5A), IN521, ER90S-B3, and E9018-B3, 1/8 inch [3 mm] through 1/2 inch [13 mm] Thick, As-Welded Condition; 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, PWHT Condition, Primarily Pipe Applications

Supporting PQR Numbers: 200704, 200705, 200706, 200716, 200717, 200718, 200719, 200740, 200741, 200742, 200743, 200744, 200745, 200797, 200827, 200836, 200838

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.

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*