

**Standard Welding
Procedure Specification
(SWPS) for Shielded
Metal Arc Welding of
Carbon Steel (M-1/P-1,
Group 1 or 2) 1/8 inch
[3 mm] through 1-1/2
inch [38 mm] Thick,
E7018, in the As-Welded
or PWHT Condition,
Primarily Plate and
Structural Applications**

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An American National Standard

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American National Standards Institute
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**Standard Welding Procedure Specification (SWPS) for
Shielded Metal Arc Welding of Carbon Steel (M-1/P-1,
Group 1 or 2) 1/8 inch [3 mm] through 1-1/2 inch
[38 mm] Thick, E7018, in the As-Welded or PWHT
Condition, Primarily Plate and Structural Applications**

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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 inch [3 mm] through 1-1/2 inch [38 mm], using manual 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 fillet and groove welds. This SWPS was developed primarily for plate and structural 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 and the Welding Research Council have joined in a cooperative effort to generate standard welding procedures for industry. 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 Welding Procedures Committee of the Welding Research Council and the AWS B2 Committee on Procedure and Performance Qualification. The Welding Procedures Committee 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 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.

This SWPS is the first revision of AWS B2.1-1-016-94R. All references to ASME “S” material numbers have been deleted from this edition. A Standard Units of Measure clause was added and the Safety clause was updated. Metric conversions have been updated and Annex A on requesting an official interpretation on an AWS standard is 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, B2 Committee on Procedure and Performance Qualification, American Welding Society, 8669 NW 36 St, # 130, Miami, FL 33166.

Standard Welding Procedure Specification (SWPS)

Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 1/8 inch [3 mm] through 1-1/2 inch [38 mm] Thick, E7018, in the As-Welded or PWHT Condition, Primarily Plate and Structural Applications

Welding Research Council—Supporting PQR Numbers:
001021, 001022, 008001, 106004, 106005, 200116, 200117, 200118, 200119,
200120, 200121, 200122, 200123, 200124, 200125, 200126, 200516, 200702,
500006, 500007, 500008, 500023, 500024 500029, 001A, 002A

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 Welding Research Council. 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:

Standard Welding Procedure Specification (SWPS)

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.

Standard Welding Procedure Specification (SWPS)

LIMITATIONS

This procedure is not qualified for Notch Toughness applications.

WELDING PROCESS

Welding Process: SMAW (Shielded Metal Arc Welding)
Method of Application: Manual

BASE METALS

Base Metal:¹ Carbon Steel, M-1 or P-1, Group 1 or 2 to M-1 or P-1, Group 1 or 2
Thickness Range: 1/8 in [3 mm] through 1-1/2 in [38 mm] for groove welds,
1/8 in [3 mm] minimum for fillet welds
Diameter: Groove Welds: 1 in [25 mm] minimum
Fillet Welds: all diameters
Coating: Uncoated

FILLER METALS

Filler Metal Specification:¹ AWS A5.1/A5.1M or ASME SFA 5.1
A Number 1, F Number 4
Classification: E7018
Deposit Thickness Range: 1-1/2 in [38 mm] maximum plus reinforcement for groove welds,
1/8 in [3 mm] through 1-1/2 in [38 mm] fillet weld size for fillet welds

JOINT DESIGNS

Joint Design: See Figure 1
Backing: When required by Figure 1
Backing Material:¹ Carbon Steel, M-1 or P-1, Group 1, 2, or 3. Nonmetallic or nonfusing metal retainers are not permitted.

POSITIONS

Permitted Positions: All, except as noted
Vertical Progression: Uphill

PREHEAT AND INTERPASS TEMPERATURES

Preheat Temperature:² 50°F [10°C] Minimum
Interpass Temperature:² 50°F [10°C] Minimum, 500°F [260°C] Maximum
Preheat Maintenance: Continuous or special heating not required

¹ M and P numbers for base metal and F and A numbers for filler metal and weld metal, respectively, are as detailed in AWS B2.1/B2.1M or ASME *Boiler and Pressure Vessel Code*, Section IX.

² Preheat and interpass temperatures must be sufficient to prevent crack formation. Temperatures above the minimum shown may be required for base metals with specified carbon content greater than 0.25%, for highly restrained welds or to meet the requirements of the fabrication document(s).

