AWS B2.1-1-004:2002 (R2013)
An American National Standard

Standard Welding Procedure Specification (SWPS) for

Gas Metal Arc Welding (Short Circuiting Transfer Mode) of Carbon Steel (M-1, Group 1), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing

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Approved by the
American National Standards Institute
June 10, 2002
Reaffirmed: March 7, 2013

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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 welding carbon steel in the thickness range of 18 through 10 gauge, using semiautomatic gas metal arc welding (short circuiting transfer mode). It cites the base metals and operating conditions necessary to make the weldment, the filler metal specifications, and the allowable joint designs for fillet welds and groove welds.

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Foreword

This foreword is not part of AWS B2.1-1-004:2002 (R2013), *Standard Welding Procedure Specification (SWPS) for Gas Metal Arc Welding (Short Circuiting Transfer Mode) of Carbon Steel (M-1, Group 1), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing*, 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 Welding Procedure and Performance Qualification. The Welding Procedures Committee has provided the test data documented by a 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*. Welding symbols shall be those shown in the latest edition of AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*. The A5.32 designation for welding gases should be those shown in the latest edition of AWS A5.32/A5.32M, *Specification for Welding Shielding Gases*.

The AWS B2 Committee on Welding 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, *Standard for Welding Procedure and Performance Qualification*. This document established the foundation and framework for Standard Welding Procedure Specifications.

The first two Standard Welding Procedure Specifications were published in 1990. Since then SWPSs are continuing to be developed and published by the American Welding Society.

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 Doral Blvd., Suite 130, Doral, FL 33166.

Standard Welding Procedure Specification (SWPS)

Gas Metal Arc Welding (Short Circuiting Transfer Mode) of Carbon Steel (M-1, Group 1), 18 through 10 Gauge, in the As-Welded Condition, with or without Backing

Welding Research Council—Supporting PQR Numbers: 092A, 093A, 094A, 095A, 096B, 097A, 098A, 099A, 100A, 101A, 102B, and 103A

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 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.

Safety. Safety precautions shall conform to the latest edition of ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society.

This specification may involve hazardous materials, operations, and equipment. The specification does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices. The user should determine the applicability of any regulatory limitations prior to use.

Standard Welding Procedure Specification (SWPS)

LIMITATIONS

This procedure is not qualified for Notch Toughness or PWHT applications.

WELDING PROCESSES

Welding Process:	GMAW-S (Gas Metal Arc Welding)
Method of Application:	Semiautomatic
Mode of Metal Transfer:	Short Circuiting Transfer Mode

BASE METALS

Base Metal:[1]	Carbon Steel, M-1, Group 1 to M-1, Group 1
Thickness Range:[2]	Groove Weld: 18 ga. (0.0478 in.) through 10 ga (0.1345 in.)
	Fillet Weld: 18 ga. (0.0478 in.) through 10 ga. (0.1345 in.)
Coating:	Uncoated

FILLER METALS

Filler Metal Specification:[1]	AWS A5.18
A-Number or Chemical Composition:	A Number None, ER70S-6
F-Number:	F Number 6
Classification:	ER70S-6
Supplementary Filler Metal:	Not permitted
Supplementary Powder:	Not permitted
Deposit Thickness Range:	Groove Weld: Sheet metal thickness plus reinforcement, maximum
	Fillet Weld Leg: Sheet metal thickness, minimum
Maximum Bead Thickness:	Sheet metal thickness plus reinforcement

JOINT DESIGNS

Joint Designs:	See Figure 1
Backing:	Optional
Backing Material:	Carbon Steel, M-1. Nonmetallic or nonfusing metal retainers are not permitted.

POSITIONS

Welding Positions:	All
Vertical Progression:	Uphill or Downhill

[1] M numbers for base metal and F and A numbers for filler metal and weld metal, respectively, are as detailed in AWS B2.1.
[2] See the applicable ASTM Specification for base metal thickness tolerances.