

**Standard  
Welding Procedure  
Specification (WPS) for  
Shielded Metal Arc  
Welding of Carbon Steel,  
(M-1/P-1, Group 1 or 2),  
3/16 through 3/4 inch, in the  
As-Welded Condition,  
With Backing**



**American Welding Society**

**Keywords**—Welding procedure specification, base metal, allowable joint designs, filler metal, carbon steel, plate and pipe, manual shielded metal arc welding

**ANSI/AWS B2.1.001-90**  
**An American National Standard**

**Approved by**  
**American National Standards Institute**  
**December 18, 1989**

**Standard Welding Procedure**  
**Specification (WPS)**  
**Shielded Metal Arc Welding of Carbon Steel,**  
**(M-1/P-1, Group 1 or 2),**  
**3/16 through 3/4 inch, in the**  
**As-Welded Condition, With Backing**

Prepared by  
AWS Committee on Welding Qualification

Under the Direction of  
AWS Technical Activities Committee

Approved by  
AWS Board of Directors

**Abstract**

This standard contains the essential welding variables for carbon steel plate and pipe in the thickness range of 3/16 through 3/4 in., 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.



**American Welding Society**

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\*Advisor

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## Foreword

(This Foreword is not a part of the ANSI/AWS B2.1.001-90, *Standard Welding Procedure Specification*, but is included for information 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 Welding Procedure Specification is an outgrowth of the coordinated work of the Welding Procedures Committees of WRC and the Committee on Welding Qualification of AWS. The Welding Procedures Committee has provided the test data documented on Procedure Qualification Records, which are available from the Welding Research Council.

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

The AWS Committee on Welding 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.

Comments on this publication will be most welcome. They should be addressed to: Secretary, AWS Committee on Welding Qualification, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135.

## Standard Welding Procedure Specification (WPS)

### Shielded Metal Arc Welding of Carbon Steel (M-1/P-1, Group 1 or 2), 3/16 through 3/4 inch, in the As-Welded Condition, with Backing.

#### Welding Research Council<sup>1</sup> — Supporting PQR Numbers: 001A, 002A

#### Application

The data to support this Standard Welding Procedure Specification (WPS) have been derived from two or more Procedure Qualification Records (PQR's) completed according to the requirements in AWS B2.1 under the auspices of the Welding Research Council. This Standard WPS is not valid using conditions and variables outside the ranges listed. The American Welding Society considers that this Standard WPS 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 Standard Welding Procedure Specification.

The referencing fabrication code or specification and the engineering requirements are intended to specify any requirements related to design, need for heat-treatment, fabricating, tolerances, quality control, safe welding and

testing practices, and examinations and tests applicable to the end product.

A Standard WPS does not replace or substitute for fabrication codes, specifications, contract requirements, or capability and judgement on the part of the user. A Standard WPS 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 Standard WPS with appropriate performance qualification tests and sound engineering judgment.

A Standard WPS may be supplemented by attached or referenced information and instructions that may be necessary to make an acceptable weldment.

Safety precautions shall conform to the latest edition of ANSI/ASC Z49.1, *Safety in Welding and Cutting*, 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.

1. Welding Research Council, 345 East 47th Street, New York, NY 10017

## Standard Welding Procedure Specification (WPS)

|                                         |                                                                                                                                                                             |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PROCESS:</b>                         | SMAW (Shielded Metal Arc Welding)<br>Manual                                                                                                                                 |
| <b>BASE METAL:</b>                      | Carbon Steel <sup>2</sup> , M-1 or P-1, Group 1 or 2 to<br>M-1 or P-1, Group 1 or 2                                                                                         |
| <b>BASE METAL THICKNESS RANGE:</b>      | Groove Weld: 3/16 through 3/4 in.<br>Fillet Weld: 3/16 in. minimum                                                                                                          |
| <b>WELD METAL THICKNESS RANGE:</b>      | Groove Weld: 3/16 through 3/4 in., plus<br>reinforcement<br>Fillet Weld Leg: 3/16 through 3/4 in.                                                                           |
| <b>MAXIMUM WELD BEAD THICKNESS:</b>     | 1/4 in.                                                                                                                                                                     |
| <b>BACKING:</b>                         | Yes                                                                                                                                                                         |
| <b>BACKING MATERIAL:</b>                | Carbon Steel <sup>2</sup> , M-1 or P-1, Group 1, 2, or 3                                                                                                                    |
| <b>ALLOWABLE JOINT DESIGNS:</b>         | See Figure 1                                                                                                                                                                |
| <b>WELDING POSITIONS:</b>               | All                                                                                                                                                                         |
| <b>VERTICAL WELDING PROGRESSION:</b>    | Up                                                                                                                                                                          |
| <b>NOTCH TOUGHNESS:</b>                 | Not Qualified for Notch Toughness Applications                                                                                                                              |
| <b>PREHEAT TEMPERATURE:</b>             | 50°F minimum, 350°F maximum                                                                                                                                                 |
| <b>INTERPASS TEMPERATURE:</b>           | 50°F minimum, 350°F maximum                                                                                                                                                 |
| <b>PREHEAT TEMPERATURE MAINTENANCE:</b> | Continuous or special heating not required                                                                                                                                  |
| <b>POSTWELD HEAT-TREATMENT:</b>         | None (not qualified for PWHT)                                                                                                                                               |
| <b>TECHNIQUE:</b>                       | Beads: Stringer or weave<br>Peening: No<br>Cleaning: Joint shall be dry prior to welding<br>Initial Cleaning: Mechanical or chemical<br>Interpass Cleaning: Mechanical only |
| <b>SINGLE OR MULTIPLE ELECTRODE:</b>    | Single                                                                                                                                                                      |
| <b>SINGLE OR MULTIPLE PASS:</b>         | Either                                                                                                                                                                      |
| <b>FILLER METAL SPECIFICATION:</b>      | ANSI/AWS A5.1<br>ASME SFA 5.1<br>AWS/ASME <sup>2</sup> A Number 1, F Number 4                                                                                               |
| <b>PULSED POWER WELDING:</b>            | No                                                                                                                                                                          |
| <b>CONSUMABLE INSERT:</b>               | No                                                                                                                                                                          |

2. As detailed in AWS B2.1 and ASME Section IX.

## Standard Welding Procedure Specification (WPS)

### WELDING PARAMETERS:

| BEADS                | FILLER METAL*  |            | CURRENT           | AMPERES           |
|----------------------|----------------|------------|-------------------|-------------------|
|                      | Classification | Dia. (in.) | Type and Polarity | Groove and Fillet |
| Tack<br>Root<br>Fill | E7016          | 3/32       | DCEP              | 65/110            |
|                      |                | 1/8        | DCEP              | 110/150           |
|                      |                | 5/32       | DCEP              | 140/200           |
| Tack<br>Root<br>Fill | E7018          | 3/32       | DCEP              | 70/115            |
|                      |                | 1/8        | DCEP              | 115/165           |
|                      |                | 5/32       | DCEP              | 150/220           |

\*Note: Care of the electrodes prior to use shall be as recommended by the electrode manufacturer to ensure that the low hydrogen characteristics are maintained.

COMPANY NAME \_\_\_\_\_

In the name of the Company stated above, I accept full responsibility for the application of this Standard WPS for use with \_\_\_\_\_

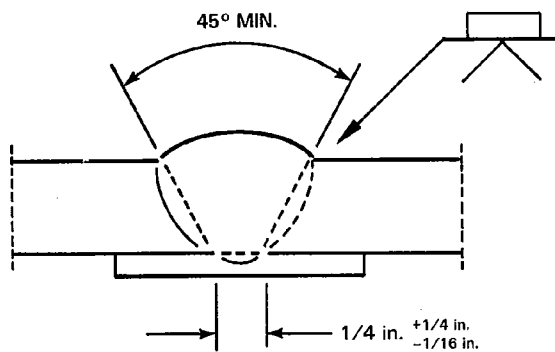
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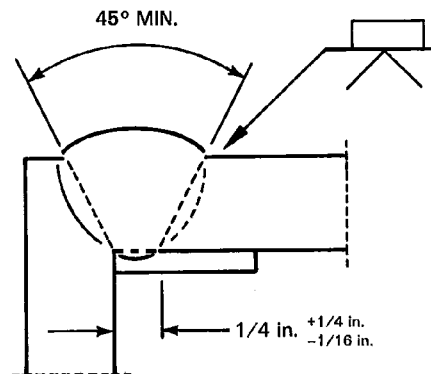
## Standard Welding Procedure Specification (WPS)

Fillet Welds: All Joints

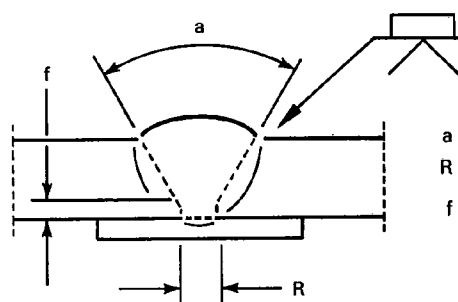
Groove Welds: For plate, flat products, and structural shapes, see Joints 1, 2, and 3.  
For pipe and other tubular products, see Joint 3.



JOINT 1



JOINT 2



$a = 75^\circ \pm 15^\circ$   
 $R = 3/16 \text{ in. } +5/16 \text{ in. } -1/16 \text{ in.}$   
 $f = 1/16 \text{ in. } +1/16 \text{ in. } -1/16 \text{ in.}$

JOINT 3

### Figure 1 — Allowable Joint Designs

| Metric Conversions |      |     |     |
|--------------------|------|-----|-----|
| in.                | mm   | °F  | °C  |
| 1/16               | 1.6  | 50  | 10  |
| 3/32               | 2.4  | 350 | 175 |
| 1/8                | 3.2  |     |     |
| 5/32               | 4.0  |     |     |
| 3/16               | 4.8  |     |     |
| 1/4                | 6.4  |     |     |
| 1/2                | 12.7 |     |     |
| 3/4                | 19.0 |     |     |