

**Standard  
Welding Procedure  
Specification (WPS) for  
Shielded Metal Arc  
Welding of Carbon Steel to  
Austenitic Stainless Steel, (M-1 to M-8 or P-8),  
10 through 18 Gauge,  
in the As-Welded Condition,  
With or Without Backing**



**American Welding Society**

**Keywords** — Welding procedure specification,  
base metals, allowable joint designs,  
sheet metal, electrode, carbon steel,  
stainless steel, manual shielded  
metal arc welding

**ANSI/AWS B2.1.014-91**  
**An American National Standard**

Approved by  
American National Standards Institute  
August 27, 1991

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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 to austenitic stainless steel in the thickness range of 10 through 18 gauge 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 welds and groove welds.



**American Welding Society**

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This standard is subject to revision at any time by the AWS Welding Qualification Committee. It must be reviewed every five years and if not revised, it must be either reapproved or withdrawn.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 Welding Qualification Committee 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 Welding Qualification Committee 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, 550 N.W. LeJeune Road, P. O. Box 351040, Miami, Florida 33135.

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The Committee offers special thanks to G. R. Olejniczak and the National Training Fund for the Sheet Metal and Air Conditioning Industry for their significant contribution in making qualifications of these procedures possible.

## Foreword

(This Foreword is not a part of ANSI/AWS B2.1.014-91, *Standard Welding Procedure Specification (WPS)*, 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 tested welding procedures, that are supported by adequate 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 Committee of WRC and the Committee on Welding Qualification of AWS. Procedure Qualification Records (PQR's) supporting Standard WPS's need not be maintained by the employer and are not provided by AWS. These PQR's are on file at the Welding Research Council. It is the intent that Standard WPS's will make retention and continual review of PQR's by owners, regulatory bodies, inspection agencies and clients unnecessary.

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, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*.

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, American Welding Society, 550 NW LeJeune Road, P.O. Box 351040, Miami, FL 33135.

## **Standard Welding Procedure Specification (WPS)**

### **Shielded Metal Arc Welding of Carbon Steel to Austenitic Stainless Steel, (M-1 to M-8 or P-8), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing**

**Welding Research Council<sup>1</sup> —**  
**Supporting PQR Numbers: 200B, 201B, 202A, 203A, 204A, 205B, 206B,**  
**207B, 208A, 209A, 210A, 211B**

#### **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 judgement.

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)                                                                                                                                                                                                                          |
| <b>METHOD OF APPLICATION:</b>                  | Manual                                                                                                                                                                                                                                                     |
| <b>BASE METAL:</b>                             | Carbon Steel to Austenitic Stainless Steel, <sup>2</sup> M1 to M-8 or P-8                                                                                                                                                                                  |
| <b>BASE METAL THICKNESS RANGE:<sup>3</sup></b> | Groove Weld: M-1, 18 ga. (0.0478 in.) through 10 ga. (0.1345 in.)<br>M/P-8, 18 ga. (0.0500 in.) through 10 ga. (0.1406 in.)<br>Fillet Weld: M-1, 18 ga. (0.0478 in.) through 10 ga. (0.1345 in.)<br>M/P-8, 18 ga. (0.0500 in.) through 10 ga. (0.1406 in.) |
| <b>WELD METAL THICKNESS RANGE:</b>             | Groove Weld: Base metal thickness plus reinforcement, maximum<br>Fillet Weld Leg: Base metal thickness, minimum                                                                                                                                            |
| <b>MAXIMUM WELD BEAD THICKNESS:</b>            | Base metal thickness plus reinforcement                                                                                                                                                                                                                    |
| <b>BACKING:</b>                                | Optional                                                                                                                                                                                                                                                   |
| <b>BACKING MATERIAL:</b>                       | Carbon Steel or Austenitic Stainless Steel, <sup>2</sup> M-1, M-8 or P-8                                                                                                                                                                                   |
| <b>ALLOWABLE JOINT DESIGNS:</b>                | See Figure 1                                                                                                                                                                                                                                               |
| <b>WELDING POSITION:</b>                       | All                                                                                                                                                                                                                                                        |
| <b>VERTICAL WELDING PROGRESSION:</b>           | Optional                                                                                                                                                                                                                                                   |
| <b>PREHEAT TEMPERATURE:</b>                    | 50°F minimum, 120°F maximum                                                                                                                                                                                                                                |
| <b>INTERPASS TEMPERATURE:</b>                  | 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 A5.4<br>ASME SFA 5.4<br>AWS/ASME <sup>2</sup> F Number 5, A Number 8                                                                                                                                                                              |
| <b>CURRENT (Type and Polarity):</b>            | DCEP (E309-15)<br>DCEP or DCEN (E309-16)                                                                                                                                                                                                                   |

2. As detailed in AWS B2.1 and ASME B&PV Code, Section IX.

3. See ASTM Specification for base metal thickness tolerances.

## Standard Welding Procedure Specification (WPS)

### WELDING PARAMETERS:

| Base Metal | FILLER METAL   |            | AMPERES |        |
|------------|----------------|------------|---------|--------|
|            | Classification | Dia. (in.) | Groove  | Fillet |
| 18 ga. }   | E309-15/16     | 3/32 max   | 55-60   | 55-60  |
| 17 ga. }   |                |            | 57-67   | 57-67  |
| 16 ga. }   |                |            | 59-69   | 59-74  |
| 15 ga. }   |                |            | 61-71   | 61-81  |
| 14 ga. }   |                |            | 63-73   | 63-88  |
| 13 ga. }   |                |            | 65-75   | 65-95  |
| 12 ga. }   |                |            | 67-77   | 67-102 |
| 11 ga. }   |                |            | 69-79   | 69-109 |
| 10 ga.     | E309-15/16     | 1/8 max    | 70-80   | 70-115 |

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

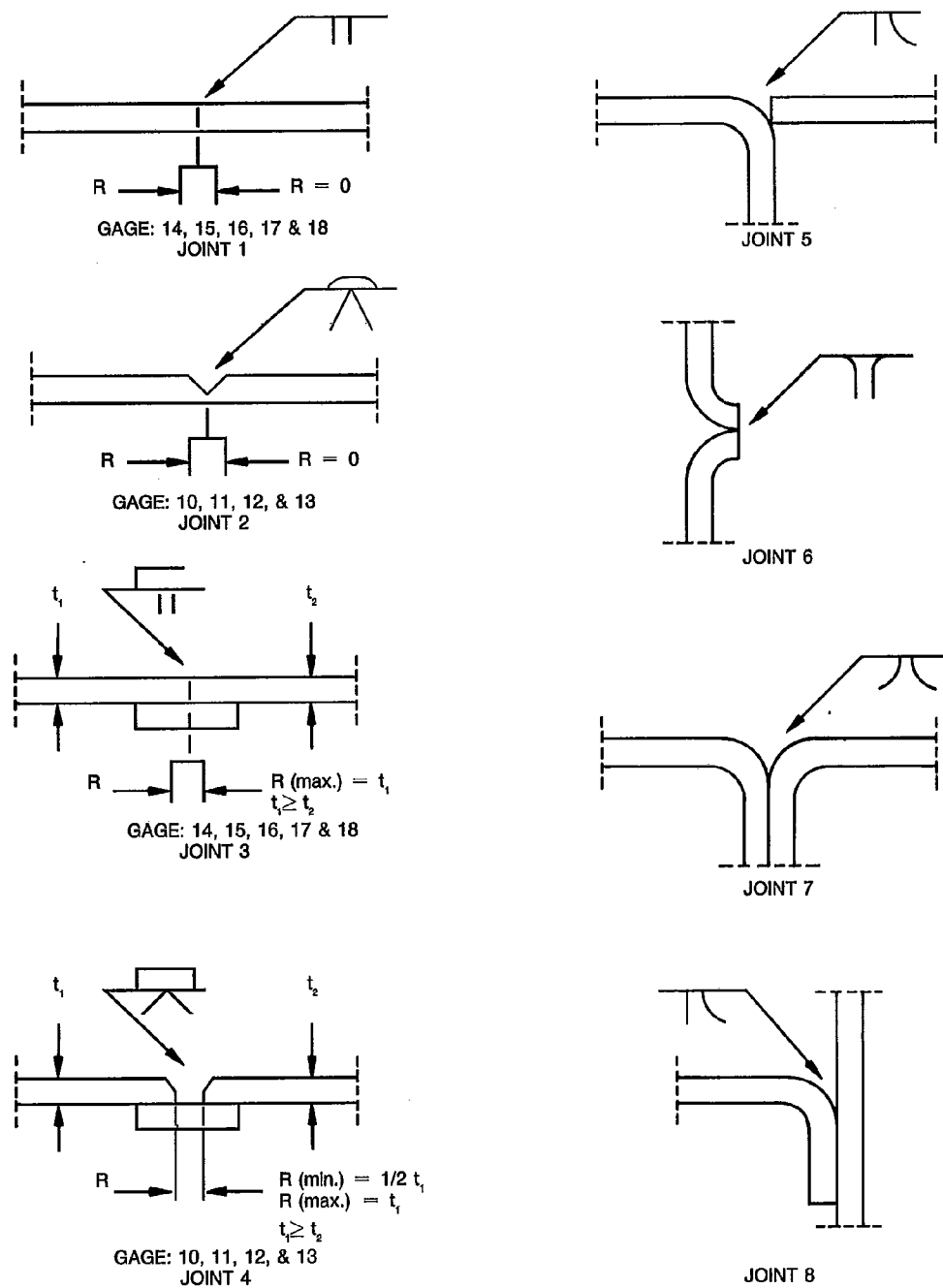
In the name of the Company stated above, I accept full responsibility for the application of this Standard WPS for use with

\_\_\_\_\_  
Fabrication Document

Dated \_\_\_\_\_

DATE \_\_\_\_\_ APPROVED BY \_\_\_\_\_ TITLE \_\_\_\_\_

# Standard Welding Procedure Specification (WPS)



**Figure 1 — Allowable Joint Designs**

## Standard Welding Procedure Specification (WPS)

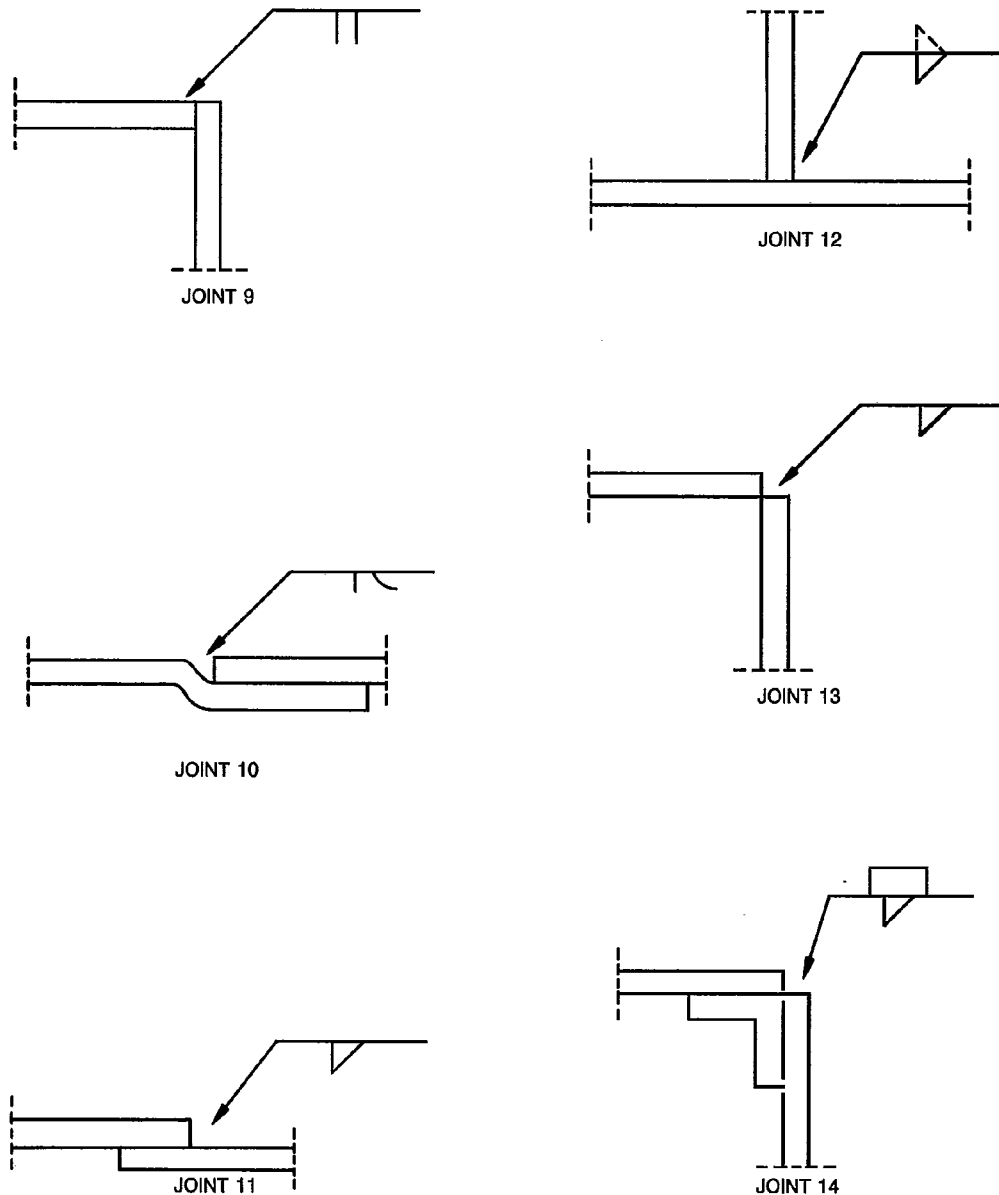


Figure 1 (Continued) — Allowable Joint Designs

## Standard Welding Procedure Specification (WPS)

Metric Conversions

| in.    | mm    | °F  | °C  |
|--------|-------|-----|-----|
| 0.0478 | 1.214 | 50  | 10  |
| 0.0500 | 1.270 | 120 | 50  |
| 0.1345 | 3.416 | 350 | 175 |
| 0.1406 | 3.571 |     |     |
| 3/32   | 2.4   |     |     |
| 1/8    | 3.2   |     |     |

## AWS Welding Procedure and Performance Qualification Documents

| AWS Designation | Title                                                                                                                                                                                                               |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| B2.1-84         | Standard for Welding Procedure and Performance Qualification                                                                                                                                                        |
| B2.1.001-90     | Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2) 3/16 through 7/8 inch in the As-Welded Condition, with or without Backing                          |
| B2.1.002-90     | Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel, (M-1/P-1, Group 1 or 2), 3/16 through 7/8 inch in the As-Welded Condition, with or without Backing                           |
| B2.1.003-90     | Standard Welding Procedure Specification for Gas Metal Arc Welding of Galvanized Steel, 10 through 18 Gage, in the As-Welded Condition, with or without Backing                                                     |
| B2.1.004-90     | Standard Welding Procedure Specification for Gas Metal Arc Welding of Carbon Steel, (M-1, Group 1), 10 through 18 Gage, in the As-Welded Condition, with or without Backing                                         |
| B2.1.005-90     | Standard Welding Procedure Specification for Gas Metal Arc Welding of Austenitic Stainless Steel, (M-8 or P-8), 10 through 18 Gage, in the As-Welded Condition, with or without Backing                             |
| B2.1.006-90     | Standard Welding Procedure Specification for Gas Metal Arc Welding of Carbon Steel to Austenitic Stainless Steel, (M-1 to M-8 or P-8), 10 through 18 Gage, in the As-Welded Condition, with or without Backing      |
| B2.1.007-90     | Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Galvanized Steel, 10 through 18 Gage, in the As-Welded Condition, with or without Backing                                                  |
| B2.1.008-90     | Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel, (M-1, Group 1), 10 through 18 Gage, in the As-Welded Condition, with or without Backing                                      |
| B2.1.009-90     | Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Austenitic Stainless Steel, (M-8/P-8), 10 through 18 Gage, in the As-Welded Condition, with or without Backing                             |
| B2.1.010-90     | Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Carbon Steel to Austenitic Stainless Steel, (M-1 to M-8 or P-8), 10 through 18 Gage, in the As-Welded Condition, with or without Backing   |
| B2.1.011-91     | Standard Welding Procedure Specification for Shielded Metal Arc Welding of Galvanized Steel, 10 through 18 Gauge, in the As-Welded Condition, with or without Backing                                               |
| B2.1.012-91     | Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel, (M-1, Group 1), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing                                   |
| B2.1.013-91     | Standard Welding Procedure Specification for Shielded Metal Arc Welding of Austenitic Stainless Steel, (M-8 or P-8), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing                       |
| B2.1.014-91     | Standard Welding Procedure Specification for Shielded Metal Arc Welding of Carbon Steel to Austenitic Stainless Steel, (M-1 to M-8 or P-8), 10 through 18 Gauge, in the As-Welded Condition with or without Backing |
| B2.1.015-91     | Standard Welding Procedure Specification for Gas Tungsten Arc Welding of Aluminum, (M-22 or P-22), 10 through 18 Gauge, in the As-Welded Condition, with or without Backing                                         |

For additional information, contact the Order Department, American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135, phone 1-800-334-9353.