

ANSI/AWS B2.1.006-90
An American National Standard

**Standard
Welding Procedure
Specification (WPS) 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**



American Welding Society

Keywords—Welding procedure specification, base metal, allowable joint designs, filler metal, austenitic stainless steel, carbon steel, semiautomatic gas metal arc welding

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Approved by
American National Standards Institute
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Standard Welding Procedure
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Gas Metal Arc Welding of Carbon Steel to
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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 gage, using semiautomatic gas 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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Foreword

(This Foreword is not a part of the ANSI/AWS B2.1.006-90, *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 Committee 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, American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135.

Standard Welding Procedure Specification (WPS)

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

**Welding Research Council¹ —
Supporting PQR Numbers: 116A, 117A, 118A, 121A,
122A, 123A, 124A, 125A, 126A, 127B**

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)

PROCESS:	GMAW (Gas Metal Arc Welding) Semiautomatic, Short Circuiting Transfer Mode
BASE METAL:	Carbon Steel to Austenitic Stainless Steel ² , M-1 to M-8 or P-8
BASE METAL THICKNESS RANGE:³	Groove Weld: M-1, 18 ga. (0.0478 in.) through 10 ga. (0.1345 in.) M/P-8, 18 ga. (0.0500 in.) through 10 ga. (0.1406 in.) Fillet Weld: M-1, 18 ga. (0.0478 in.) through 10 ga. (0.1345 in.) M/P-8, 18 ga. (0.0500 in.) through 10 ga. (0.1406 in.)
WELD METAL THICKNESS RANGE:	Groove Weld: Base metal thickness plus reinforcement, max. Fillet Weld Leg: Base metal thickness, min.
MAXIMUM WELD BEAD THICKNESS:	Base metal thickness plus reinforcement
BACKING:	Optional
BACKING MATERIAL:	Carbon Steel or Austenitic Stainless Steel ² , M-1, M-8 or P-8
ALLOWABLE JOINT DESIGNS:	See Figure 1
WELDING POSITIONS:	All
VERTICAL WELDING PROGRESSION:	Optional
PREHEAT TEMPERATURE:	50°F minimum, 120°F maximum
INTERPASS TEMPERATURE:	350°F maximum
PREHEAT TEMPERATURE MAINTENANCE:	Continuous or special heating not required
POSTWELD HEAT-TREATMENT:	None (not qualified for PWHT)
TECHNIQUE:	Beads: Stringer or weave Peening: No Cleaning: Joint shall be dry prior to welding Initial Cleaning: Mechanical or chemical Interpass Cleaning: Mechanical only
SINGLE OR MULTIPLE ELECTRODE:	Single
SINGLE OR MULTIPLE PASS:	Either
CONTACT TUBE TO WORK PIECE DISTANCE:	1/2 in. nominal
FILLER METAL SPECIFICATION:	ANSI/AWS A5.9 ASME SFA 5.9 AWS/ASME ² F Number 6, A Number 8
GAS:	Torch Shielding: Helium plus Argon and Carbon Dioxide Composition: 90% Helium, 7-1/2% Argon, 2-1/2% Carbon Dioxide Gas Nozzle Size: 1/2 in. diameter minimum (I.D.) Flow Rate: 20 to 40 ft ³ /h Root Shielding Gas: None Trailing Gas: None

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

3. See ASTM Specification for base metal thickness
tolerances.

Standard Welding Procedure Specification (WPS)

CURRENT (Type and Polarity):

DCEP

WELDING PARAMETERS:

Base Metal	FILLER METAL		AMPERES		Volts
	Classification	Dia. (in.)	Groove	Fillet	
18 ga.	ER309	0.035	65/90	70/90	16/19
17 ga.	ER309	0.035	70/95	76/93	16/19
16 ga.	ER309	0.035	75/100	81/96	16/19
15 ga.	ER309	0.035	80/105	87/100	16/19
14 ga.	ER309	0.035	85/110	92/104	17/20
13 ga.	ER309	0.035	90/115	98/108	17/20
12 ga.	ER309	0.035	95/120	103/112	17/20
11 ga.	ER309	0.035	100/125	109/116	17/20
10 ga.	ER309	0.035	105/130	115/120	17/20

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)

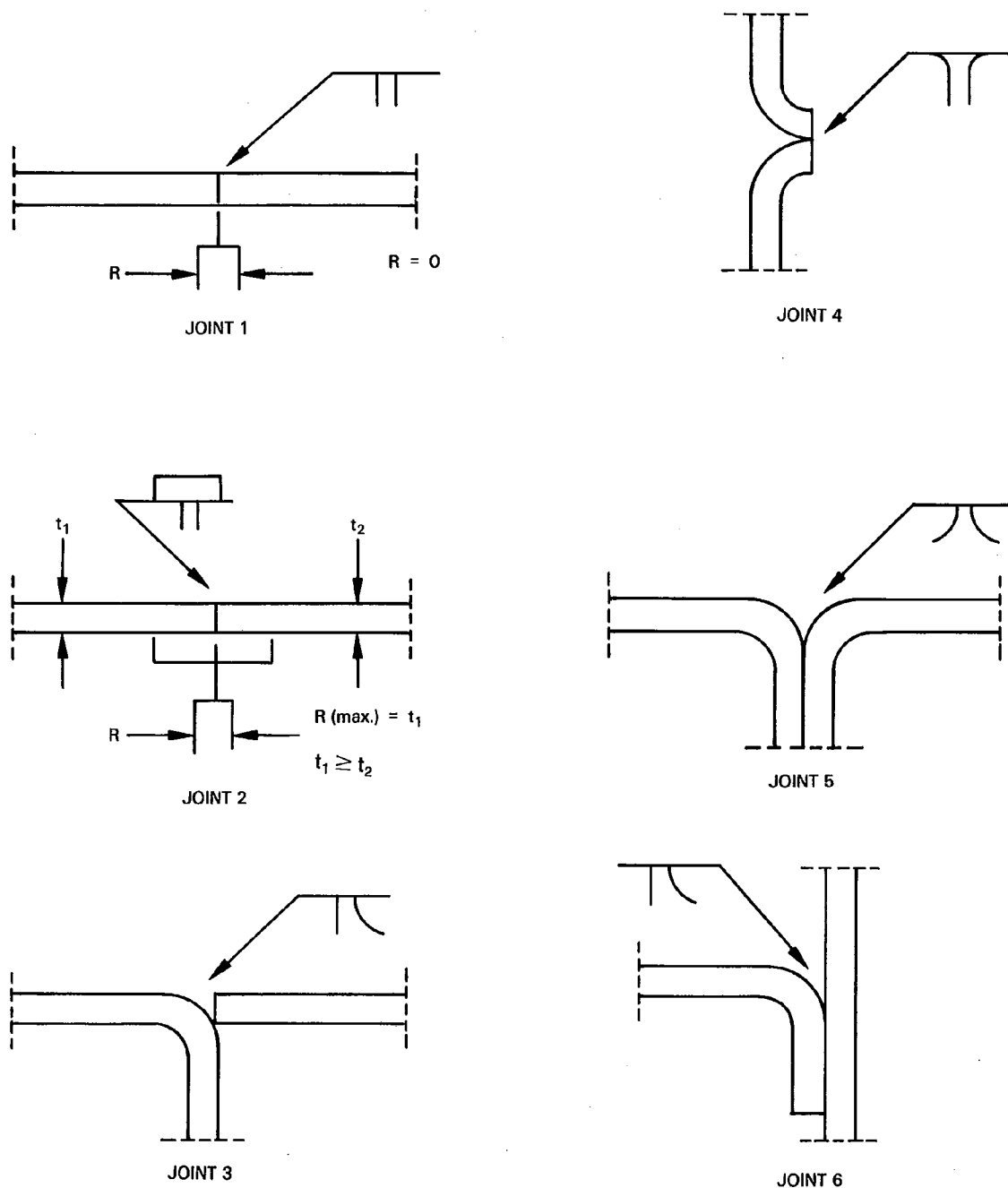


Figure 1 — Allowable Joint Designs

Standard Welding Procedure Specification (WPS)

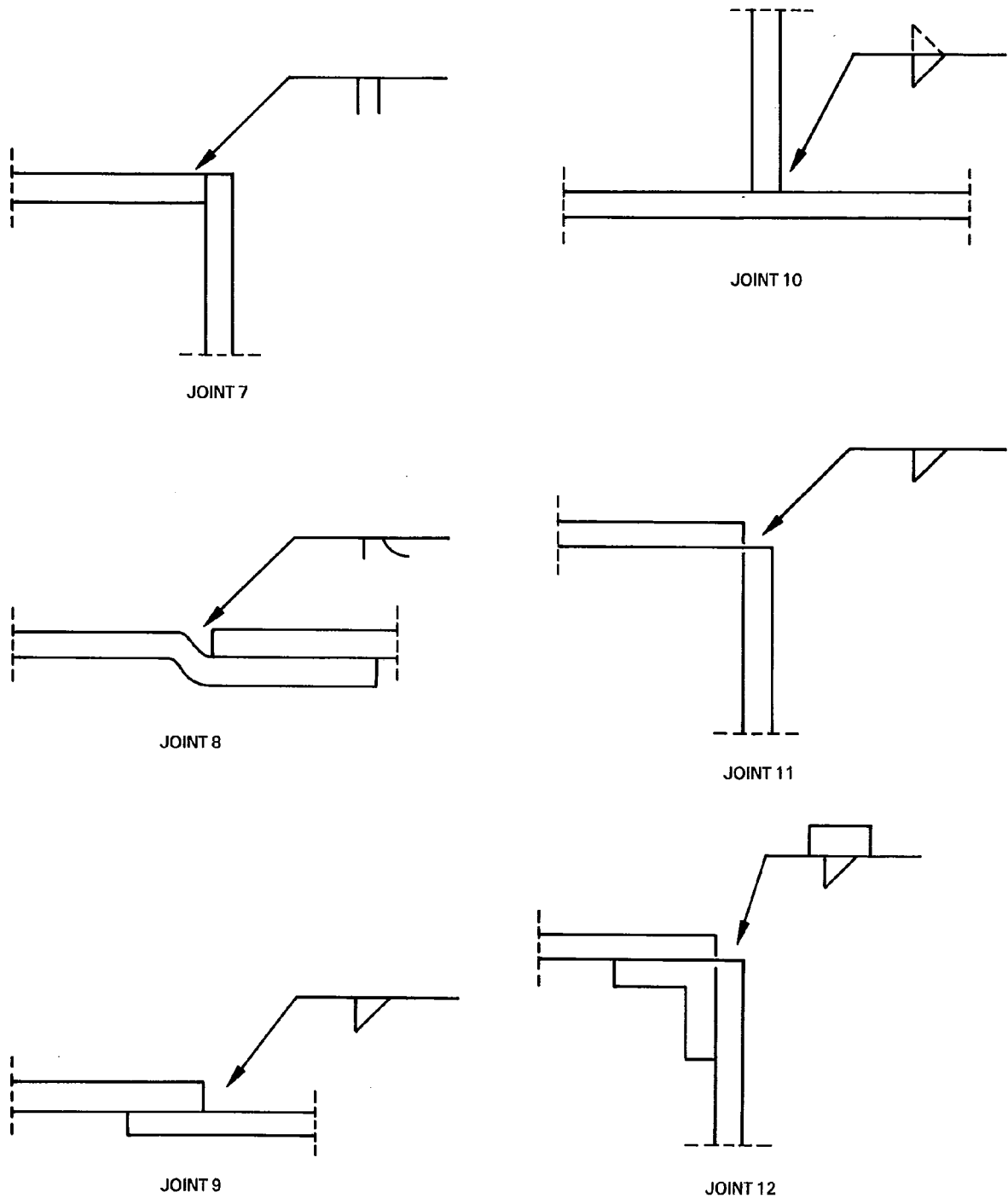


Figure 1 (Continued) — Allowable Joint Designs

Standard Welding Procedure Specification (WPS)

Metric Equivalents

in.	mm	°F	°C	ft ³ /h	L/min
0.0350	0.889	50	10	20	9.4
0.0478	1.214	120	49	40	18.9
0.0500	1.270	350	117		
0.1345	3.416				
0.1406	3.571				
1/2	12.7				
5/8	15.9				