# Supplement C— Welder Performance Qualification Sheet Metal Test Requirements

American Welding Society

**Key Words** — AWS Certified Welders, sheet metal welding, welders, welder certification, welder qualification

**AWS QC7-93, Supplement C**

# Welder Performance Qualification Sheet Metal Test Requirements

Developed by
AWS Qualification and Certification Committee

Under the Direction of
AWS Education and Certification Council

Approved by
AWS Board of Directors
April 4, 1994

## Abstract

This Supplement C to AWS Standard QC7, *Standard for AWS Certified Welder Program,* describes testing administrated by Accredited Test Facilities to the requirements of AWS QC4-89, *Standard for Accreditation of Test Facilities for AWS Certified Welder Program.* The welder performance testing for this Supplement was developed using ANSI/AWS D9.1, *Sheet Metal Welding Code,* as reference.

**American Welding Society**
550 N.W. LeJeune Road, Miami, Florida 33126

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# Foreword

(This Foreword is not a part of Supplement C to AWS QC7-93, *Standard for AWS Certified Welders*, but is included only for information.)

The American Welding Society (AWS) Certified Welder Program is established to identify all elements necessary to implement a National Registry of Certified Welders. Four key elements are identified:

(1) Welder performance qualification standards
(2) Standard welding procedure specifications
(3) Accredited performance qualification test facilities
(4) AWS welder certification requirements

Supplement C, *Welder Performance Qualification Sheet Metal Test Requirements* and AWS QC7-93, *Standard for AWS Certified Welders*, contain the criteria for AWS Certified Welder Program and the AWS National Registry of Welders. Public listing or disclosure is at the option of the individual welder. It is expected that all four elements outlined above will allow the transfer of welder qualification from employer to employer. This potential transfer of welder qualification can affect financial savings to the welding industry.

The purpose of the QC7-93 is to document the ability of welders to deposit sound welds in accordance with standardized requirements and to impose sufficient controls on the documentation and maintenance of certification to allow transfer between employers without requalification, where allowed by Standard or Contract documents.

Supplement C shall be used in conjunction with AWS QC7-93. This Supplement C is not a standard unto itself and shall be considered only as a supplementary part of AWS QC7-93. The intent of this supplement is to provide welder performance test data to the industry that all employers may use without retesting each welder.

This supplement does not apply to employers that conduct welder qualification tests for their own employees in accordance with ANSI/AWS D9.1, *Sheet Metal Welding Code*. Supplement C to AWS QC7-93 specifies requirements intended to provide an *alternative* welders certification method to comply with the requirements of ANSI/AWS D9.1.

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# Supplement C
# Welder Performance Qualification
# Sheet Metal Test Requirements

## C1. Scope

This Supplement C to AWS QC7-93, *Standard for AWS Certified Welders*, specifies requirements intended to provide an alternative welders certification method. The rules for performance qualification are defined in ANSI/AWS D9.1, *Sheet Metal Welding Code*. When the term certified welder is used it shall also denote "welding operator."

**C1.1 Program.** The administrative rules for the American Welding Society (AWS) Certified Welder Program and the requirements for maintenance of certification are provided in AWS QC7-93, *Standard for AWS Certified Welders*. Test facilities participating in the program are required to meet AWS QC4, *Standard for Accreditation of Test Facilities for AWS Certified Welder Program*.

**C1.2 Exclusion.** Neither AWS QC7-93 nor this Supplement C prevents or supersedes a Contractor from continuing to qualify welders in accordance with ANSI/AWS D9.1 or other standards. Employers may impose supplementary requirements in addition to this standard.

**C1.3 Limitation.** Welders participating in the AWS Certified Welder Program shall be limited to those welding essential variables defined in the applicable Performance Tests Descriptions.

**C1.4 Safety Precautions.** This document is not intended to address safety and health matters regarding the training of certified welders. This document only covers the rules of certification of welders to AWS QC7-93.

## C2. Definitions

The terms used in this Supplement C are defined in AWS QC7-93 and ANSI/AWS A3.0, *Standard Welding Terms and Definitions*, except as follows:

**Employer.** The term is used collectively to mean contractor, fabricator, erector or manufacturer.

## C3. Responsibilities Regarding AWS Certified Welders

**C3.1 Employer Responsibility.** The employers of AWS Certified Welders are responsible for the work performed by their employees. The employers may accept the AWS certification without additional testing or may add requirements as deemed necessary to meet their particular need.

**C3.2 Employer Obligation.** Companies who employ AWS certified welders should be fully aware of the provisions of the AWS QC7-93 standard and of this Supplement C.

**C3.2.1** Employers should specifically note the extent of qualification as stated on the AWS welder certification card.

**C3.2.2** The employer shall obtain a copy of the Performance Qualification Test Record from the AWS Qualification and Certification Department.

**C3.2.3** The welders current status shall be checked with the Qualification and Certification Department.

**C3.2.4** The employer shall maintain a record of performance for all welders during their periods of employment. The backup record to be filed with the employer's certification shall be the completed Performance Test Description and Limitation of Variables form prepared by the Accredited Test Facilities. A suggested certification record is shown in Form QC-WFC1, Welder Qualification Test Record.

**C3.2.5** The Employer is responsible for all work performed by their employees; and therefore, should verify that the qualification(s) apply to each employee's work.

**C3.2.6** The use of these qualifications may require the approval of the Engineer or Owner. The employer shall obtain such approval when required.

**C3.3 Qualification and Certification Department Responsibilities.** The Qualification and Certification Department shall complete the responsibilities defined in AWS QC7-93, 3.3.

**C3.4 Test Facility Responsibilities.** The Test Facility is responsible for safety and health matters during testing at that location in addition to other requirements stated herein.

## C4. Provisions for Testing

**C4.1 Welding Procedure Specification (WPS).** The WPSs incorporated in this Supplement C shall be used to qualify welders to this standard. The WPSs in this supplement are for qualification of welders. Production welding procedures shall be provided by employers in accordance with AWS D9.1.

**C4.2 Test Facilities.** The Test Facilities for this AWS Welder Certification program shall comply with the requirements of AWS QC7-93, 4, Provisions for Testing. The Test Facility shall have been accredited according to AWS QC4, *Standard for Accreditation of Test Facilities for AWS Certified Welder Program.*

## C5. Certification Requisites

### C5.1 Test Control

**C5.1.1** Performance qualification test coupons shall be welded in accordance with a written WPS and the Performance Test Description.

**C5.1.2** Performance Test Descriptions include welding variables and define the limits of qualification for each test.

### C5.2 Test Supervisor

**C5.2.1** Qualification testing shall be performed under the direction of a person designated as the Test Supervisor in accordance with AWS QC4, *Standard for Accreditation of Test Facilities for AWS Certified Welder Program.*

**C5.2.2** The Test Supervisor shall be responsible for the performance qualification in accordance with this Supplement C.

**C5.2.3** If during qualification testing, the Test Supervisor determines that the welder does not exhibit the skill to perform the test satisfactorily, the test may be terminated.

**C5.2.4** The Test Supervisor may allow a welder to retest immediately or may require additional training or practice prior to retesting in accordance with C7, Retests.

**C5.2.5** The Test Supervisor shall be responsible for enforcement of test shop safety rules, procedures, and cleanliness, as established by the Test Facility QA Manual.

**C5.3 Test Facility.** The Test Facility conducts the qualification tests and prepares the test reports. The American Welding Society issues the certification.

## C6. Performance Test

**C6.1 Identification.** The applicant shall be assigned an identification letter, symbol or number, and this identifier shall be marked on the test materials and records.

**C6.2 Verification.** Prior to the initiation of welding, the applicant's photographic identification shall be verified by the Test Supervisor.

**C6.3 Safety Equipment.** The applicant shall use personal safety equipment applicable for the welding process. The safety requirements of the Accredited Test Facility shall conform to the requirements of ANSI/ASC Z49.1.

**C6.4 Machine Adjustment.** Before starting the qualification test, the welder shall adjust the machine settings to meet those of the WPS.

**C6.5 Material Check.** The base material and filler metal identifications shall be verified by the Test Supervisor prior to tack welding.

**C6.6 Fit-Up.** The applicant shall assemble the specified test assembly(ies) for welding in accordance with the WPS. The test assembly shall be verified by the Test Supervisor. The Test Supervisor shall inspect each test assembly prior to welding in accordance with AWS D9.1.

**C6.7 Assembly Control.** The Test Supervisor shall witness the placing of each test assembly in the specified welding position and shall mark the test assembly, or secure it, so that it remains in the specified position until welding has been completed.

**C6.8 Positioning.** All cleaning, grinding, chipping of slag or other in-process operations shall be performed

with the test assembly in the specified welding position. Evidence of removal of the test assembly or movement from the original location, except by accidental means (subject to concurrence by the Test Supervisor), shall be cause for test termination.

**C6.9 Eye Correction.** The Test Supervisor shall note the use of and type of eye correction on the Welder Qualification Test Record. The welder's certification card shall also reflect eye correction use.

**C6.10 Power Tools.** Any use, or lack of use, of power tools shall be noted on the Welding Qualification Test Record by the Test Supervisor.

## C7. Examination Methods and Acceptance Standards

**C7.1** All additional tests required by ANSI/AWS D9.1 shall be conducted under the supervision of the Test Supervisor.

**C7.2 Visual Examination.** The test plates shall meet the visual acceptance criteria for performance testing as defined in ANSI/AWS D9.1. The visual examination shall be performed by a current CWI without aid of magnification.

## C8. Retests

If the welder performance test fails to meet the requirements a retest of each test failed may be allowed under the following conditions:

**C8.1 Immediate Retest.** No more then three immediate retests shall be permitted. The retest specimens shall meet all of the specified requirements.

**C8.2 Retest after Further Training or Practice.** A retest may be made, provided there is evidence that the welder has had further training or practice. A complete retest of the types and positions failed shall be made.

## C9. Documentation of Welder Performance Qualification

The performance qualification data and results of the examination and testing shall be recorded on QC-WF1C. Records of applicants that meet the requirements shall be processed in accordance with AWS QC7-93.

## C10. Period of Effectiveness

**C10.1** The period of certification is twelve months. The period begins on the date of completion of the examination results and signature by the Test Supervisor. Thereafter, the certification shall be considered as remaining in effect indefinitely unless:

(1) the welder is not engaged in a given welding process for which the welder is certified for a period exceeding twelve months unless otherwise specified by ANSI/AWS D9.1, or

(2) there is some specific reason to question the welder's ability.

**C10.2** Indefinite certification in accordance with C10 may be maintained by documenting the use of the welding process in accordance with C12, Maintenance of Certification.

## C11. Identification/Certification Documents

The welder certification card is issued by AWS in accordance with AWS QC7-93.

## C12. Maintenance of Certification

Welders may maintain their certification indefinitely by verifying the use of the welding process(es). The use of the process(es) shall be verified by the welder submitting completed forms required in AWS QC7-93, 11, Maintenance and Certification each year as a minimum. Such forms shall be postmarked prior to the expiration of certification. The certification expiration date is extended for a period of 12 months, as defined in ANSI/AWS D9.1 from the date of the last use of the process(es), as documented on Form QC-WF3A, received and accepted by the AWS Qualification and Certification Department.

After the certification period has expired, without the welder using the process, a single test need be made only in any thickness for each process in which the welder is qualified. Successful completion of such test restores all of the previous qualifications for the process tested.

## C13. Renewal of Certification

Renewal of certifications shall be in accordance with AWS QC7-93, 12, Renewal of Certification.

## C14. Revocation

The AWS Certification of a welder may be revoked in accordance with the administrative procedures defined in AWS QC7-93, 13, Revocation.

# WELDER AND WELDING OPERATOR PERFORMANCE QUALIFICATION TEST RECORD

## Qualification Test Performed

Name _____
I.D. No. _____
Date of Test _____
Test Position _____
Shield gas used _____
Eye correction used _____ Yes _____ No
Power tools used _____ Yes _____ No

WPS Number _____
Base Metal _____
Gauge _____
Square groove (butt joint) _____
Code ANSI/AWS D9.1
Performance Test Description No. _____

## Essential Variables Qualified by Test

Type of base metal _____
Thickness _____ Min _____ Max

Uncoated Sheet _____ Yes _____ No
Coating material on sheet _____ Yes _____ No
Backing material _____
Filler metal specification _____
Filler Metal Classification _____

Welding process _____
Method of application
_____ Manual _____ Semiautomatic
_____ Automatic
Mode of transfer (GMAW) _____
Welding Current _____ ac _____ dcen _____ dcep
Shield gas used _____
Positions qualified _____ Flat _____ Horizontal
_____ Vertical _____ Overhead

## Visual Inspection Results

| Condition | Acceptable | Unacceptable |
|---|---|---|
| Complete fusion | _____ | _____ |
| Complete joint penetration | | |
| Maximum face and root reinforcement — 1/8 in. | _____ | _____ |
| No more than one visible pore per in. of weld | _____ | _____ |
| Maximum pore or inclusion size — 0.25 t | _____ | |
| where t = base metal thickness | _____ | _____ |
| No undercut exceeding 0.15 t for t less | _____ | |
| than or equal to 0.187 in. | _____ | _____ |
| No undercut exceeding 0.25 t for t greater | _____ | |
| than 0.187 in. | _____ | _____ |
| No cracks | _____ | _____ |

Date Tested _____

Test Facility _____

Test Facility No. _____

Signed By _____
Test Supervisor

AWS CWI No. _____

Date Signed _____

Form QC-WF1C

## MAINTENANCE OF CERTIFICATION

Name _____ I.D. # _____

Enter date of last use of each of the following process(es):

SMAW _____ FCAW _____ GTAW _____

GMAW _____ SAW _____ Other _____

**CERTIFICATION IS EXTENDED FROM DATE INDICATED ABOVE**

Employer/Test Supervisor/Customer (circle one) Verification: We certify that the above named welder used the processes on the dates indicated.

Print Name _____ Title _____

Company Name _____ Phone _____

Signature _____ Date _____

**WE RECOMMEND SENDING "U.S. MAIL, RETURN RECEIPT REQUESTED."**

Form QC-WF3A—Maintenance of Certification

## AWS QC7-93 Supplement C
## Performance Test Description C-1
## GMAW 18 Gauge Coated Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A526 CQ G90 or A527 LFQ G90 **Coating Type:** Galvanized
**Material Form:** Sheet — 3" x 6" **Thickness:** 18 Gauge
**Filler Metal:** ANSI/AWS A5.18, Class ER-70S-X (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 4G
**Vertical Welding Progression:** Not applicable
**Welding Procedure Specification (WPS) No.:** QC7-93, C-1-O
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Electrode Extension:** 1/4 to 1/2 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** Gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Galvanized or uncoated carbon steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge and thinner **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.18, (F Number 6)
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Positions:** All groove and fillet **Vertical Welding Progression:** Up or down

# Welding Procedure Specification (WPS)

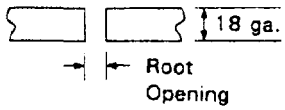
**WPS Number** C-1 **Supported by PQR No.(s)** WRC[1], 047A, 050A, 051B, 052B[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

## Variables

**Base metal** ANSI/ASTM A526CQ G90 or A527LFQ G90, galvanized
**Metal thickness** 18 Gauge (0.0516 in., 1.31 mm)
**Coating type** Galvanized G90
**Joint preparation** *Shall be free of loose scale, rust, grease or foreign matter*
**Backing material** None
**Position of welding** 4G Overhead **Welding Progression:** N/A
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.18
**Filler metal class** ER70S-X (F Number 6)
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 1/2 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 75% Argon, 25% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

## Joining Procedure

| Filler Metal Size | Welding Power | | | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| | Current Range | Wire Feed Speed (Reference) | Voltage Range | | |
| in. | Ampere | ipm | Volts | | |
| 0.035 | 50–130 | 100–230 | 15–17 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-2
### GMAW 18 Gauge Coated Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A526 CQ G90 or A527 LFQ G90 **Coating Type:** Galvanized
**Material Form:** Sheet — 3" x 6" **Thickness:** 18 Gauge
**Filler Metal:** ANSI/AWS A5.18, Class ER-70S-X (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 3G
**Vertical Welding Progression:** Down
**Welding Procedure Specification (WPS) No.:** QC7-93, C-2-V
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Electrode Extension:** 1/4 to 1/2 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** Gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Galvanized or uncoated carbon steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge and thinner **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.18, (F Number 6)
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Positions:** Flat, horizontal and vertical groove and fillet **Vertical Welding Progression:** Up or down

# Welding Procedure Specification (WPS)

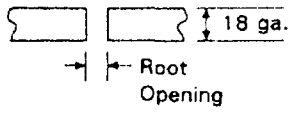
**WPS Number** C-2 **Supported by PQR No.(s)** WRC[1], 047A, 050A, 051B, 052B[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

## Variables

**Base metal** ANSI/ASTM A526CQ G90 or A527LFQ G90, galvanized
**Metal thickness** 18 Gauge (0.0516 in., 1.31 mm)
**Coating type** Galvanized G90
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 3G Vertical **Welding Progression:** Down
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.18
**Filler metal class** dcep
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 1/2 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 75% Argon, 25% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

## Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Wire Feed Speed (Reference) ipm | Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 50–130 | 100–230 | 15–17 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-3
### GMAW Coated Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A526 CQ G90 or A527 LFQ G90 **Coating Type:** Galvanized
**Material Form:** Sheet — 3" x 6" **Thickness:** 18 Gauge
**Filler Metal:** ANSI/AWS A5.18, (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 1G
**Vertical Welding Progression:** Not applicable
**Welding Procedure Specification (WPS) No.:** QC7-93, C-3-F
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Electrode Extension:** 1/4 to 1/2 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** Gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Galvanized or uncoated carbon steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge and thinner **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.18, (F Number 6)
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Positions:** Flat groove and fillet **Vertical Welding Progression:** Not applicable

## Welding Procedure Specification (WPS)

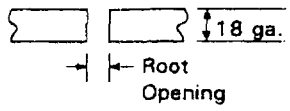
**WPS Number** C-3 **Supported by PQR No.(s)** WRC[1], 047A, 050A, 051B, 052B[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

### Variables

**Base metal** ANSI/ASTM A526CQ G90 or A527LFQ G90, galvanized
**Metal thickness** 18 Gauge (0.0516 in., 1.31 mm)
**Coating type** Galvanized G90
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 1G Flat **Welding Progression:** N/A
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.18
**Filler metal class** ER70S-X
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 1/2 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 75% Argon, 25% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

### Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Welding Power: Wire Feed Speed (Reference) ipm | Welding Power: Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 50–130 | 100–230 | 15–17 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-4
### GMAW Coated Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A526 CQ G90 or A527 LFQ G90 **Coating Type:** Galvanized
**Material Form:** Sheet — 3" x 6" **Thickness:** 10 Gauge
**Filler Metal:** ANSI/AWS A5.18, Class ER-70S-X (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 4G
**Vertical Welding Progression:** Not applicable
**Welding Procedure Specification (WPS) No.:** QC7-93, C-4-O
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Electrode Extension:** 1/4 to 1/2 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** Gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Galvanized or uncoated carbon steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge to 0.276 in. **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.18, (F Number 6)
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Positions:** All groove and fillet **Vertical Welding Progression:** Up or down

# Welding Procedure Specification (WPS)

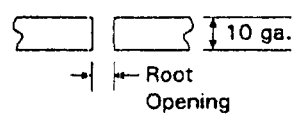
**WPS Number** C-4 **Supported by PQR No.(s)** WRC[1], 048A, 049A, 053A, 054B, 055B[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

## Variables

**Base metal** ANSI/ASTM A526CQ G90 or A527LFQ G90, galvanized
**Metal thickness** 10 Gauge (0.1382 in., 3.51 mm)
**Coating type** Galvanized G90
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 4G Overhead **Welding Progression:** N/A
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.18
**Filler metal class** ER70S-X
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 1/2 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 75% Argon, 25% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

## Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Welding Power: Wire Feed Speed (Reference) ipm | Welding Power: Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 75–150 | 120–280 | 18–20 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-5
### GMAW Coated Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A526 CQ G90 or A527 LFQ G90 **Coating Type:** Galvanized
**Material Form:** Sheet — 3" x 6" **Thickness:** 10 Gauge
**Filler Metal:** ANSI/AWS A5.18, Class ER-70S-X (F Number 6)
**Weld Joint Detail:** square butt, root opening (R) = 0 - 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 3G
**Vertical Welding Progression:** Down
**Welding Procedure Specification (WPS) No.:** QC7-93, C-5-V
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Electrode Extension:** 1/4 to 1/2 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** Gas metal arc welding (GMAW) — semiautomatic/Automatic transfer mode — short circuiting
**Base Metal:** Galvanized or uncoated carbon steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge to 0.276 in. **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.18, (F Number 6)
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Positions:** Flat, horizontal and vertical groove and fillet **Vertical Welding Progression:** Up or down

## Welding Procedure Specification (WPS)

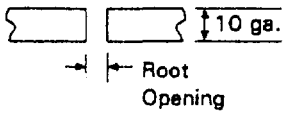
**WPS Number** C-5 **Supported by PQR No.(s)** WRC[1], 048A, 049A, 053A, 054B, 055B[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

### Variables

**Base metal** ANSI/ASTM A526CQ G90 or A527LFQ G90, galvanized
**Metal thickness** 10 Gauge (0.1382 in., 1.31 mm)
**Coating type** Galvanized G90
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 3G Vertical **Welding Progression:** Down
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.18
**Filler metal class** ER70S-X
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 1/2 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 75% Argon, 25% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

### Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Welding Power: Wire Feed Speed (Reference) ipm | Welding Power: Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 75–150 | 120–280 | 18–20 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-6
### GMAW Coated Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A526 CQ G90 or A527 LFQ G90 **Coating Type:** Galvanized
**Material Form:** Sheet — 3" x 6" **Thickness:** 10 Gauge
**Filler Metal:** ANSI/AWS A5.18, Class ER-70S-X (F Number 6)
**Weld Joint Detail:** square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 1G
**Vertical Welding Progression:** Not applicable
**Welding Procedure Specification (WPS) No.:** QC7-93, C-6-F
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Electrode Extension:** 1/4 to 1/2 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** Gas Metal Arc Welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Galvanized or uncoated carbon steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or Without
**Groove Weld Thickness:** 16 Gauge to 0.276 in. **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.18, (F Number 6)
**Current:** dcep **Shielding Gas:** 75% Argon, 25% Carbon dioxide
**Positions:** Flat groove and fillet **Vertical Welding Progression:** Not applicable

## Welding Procedure Specification (WPS)

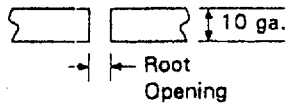
**WPS Number** C-6 **Supported by PQR No.(s)** WRC[1], 048A, 049A, 053A, 054B, 055B[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

### Variables

**Base metal** ANSI/ASTM A526CQ G90 or A527LFQ G90, galvanized
**Metal thickness** 10 Gauge (0.1382 in., 3.51 mm)
**Coating type** Galvanized G90
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 1G Flat **Welding Progression:** N/A
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.18
**Filler metal class** ER70S-X
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 1/2 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 75% Argon, 25% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

### Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Wire Feed Speed (Reference) ipm | Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 75–150 | 120–280 | 18–20 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-7
### GMAW Stainless Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A167 or A240, Type 3xx **Coating Type:** None
**Material Form:** Sheet — 3" x 6" **Thickness:** 18 Gauge
**Filler Metal:** ANSI/AWS A5.9, Class ER-3xx (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 4G
**Vertical Welding Progression:** Not applicable
**Welding Procedure Specification (WPS) No.:** QC7-93, C-7-O
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Electrode Extension:** 1/4 to 3/8 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Chromium and chromium nickel steel (uncoated) (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge and thinner **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.9, (F Number 6)
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Positions:** All groove and fillet **Vertical Welding Progression:** Up or down

## Welding Procedure Specification (WPS)

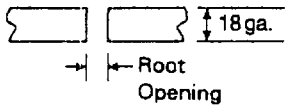
**WPS Number** C-7 **Supported by PQR No.(s)** WRC[1], 068A, 070A, 074A, 075B, 076A
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

### Variables

**Base metal** ANSI/ASTM A167 or A240 type 3XX
**Metal thickness** 18 Gauge (0.0500 in., 1.27 mm)
**Coating type** None
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 4G Overhead **Welding Progression:** N/A
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.9
**Filler metal class** ER-3XX
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 3/8 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

### Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Welding Power: Wire Feed Speed (Reference) ipm | Welding Power: Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 60–100 | 120–210 | 16–19 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-8
### GMAW Stainless Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A167 or A240, Type 3XX **Coating Type:** None
**Material Form:** Sheet — 3" x 6" **Thickness:** 18 Gauge
**Filler Metal:** ANSI/AWS A5.9, Class ER-3XX (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 2G
**Vertical Welding Progression:** Down
**Welding Procedure Specification (WPS) No.:** QC7-93, C-8-V
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Electrode Extension:** 1/4 to 3/8 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — Short circuiting
**Base Metal:** Chromium and chromium nickel steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge and thinner **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.9, (F Number 6)
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Positions:** Flat, horizontal and vertical groove and fillet **Vertical Welding Progression:** Up or Down

## Welding Procedure Specification (WPS)

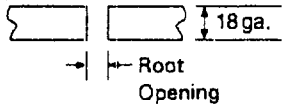
**WPS Number** C-8 **Supported by PQR No.(s)** WRC[1], 068A, 070A, 074A, 075A, 076A[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

### Variables

**Base metal** ANSI/ASTM A167 or A240 Type 3XX
**Metal thickness** 18 Gauge (0.0500 in., 1.27 mm)
**Coating type** None
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 3G Vertical **Welding Progression:** Down
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.9
**Filler metal class** ER-3XX
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 3/8 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

### Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Wire Feed Speed (Reference) ipm | Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 60–100 | 120–210 | 16–19 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-9
### GMAW Stainless Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A167 or A240 Type 3XX **Coating Type:** None
**Material Form:** Sheet — 3" x 6" **Thickness:** 18 Gauge
**Filler Metal:** ANSI/AWS A5.9, Class ER-3XX (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 1G
**Vertical Welding Progression:** Not applicable
**Welding Procedure Specification (WPS) No.:** QC7-93, C-9-F
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Electrode Extension:** 1/4 to 3/8 in.
**Test Required:** Visual inspection per ANSI/AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Chromium to chromium nickel steel (uncoated) (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge and thinner **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.9, (F Number 6)
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Positions:** Flat groove and fillet **Vertical Welding Progression:** Not applicable

## Welding Procedure Specification (WPS)

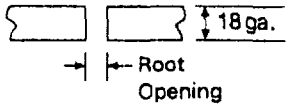
**WPS Number** C-9 **Supported by PQR No.(s)** WRC[1], 068A, 070A, 074A, 075A, 076A[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

### Variables

**Base metal** ANSI/ASTM A167 or A240 Type 3XX
**Metal thickness** 18 Gauge (0.0500 in., 1.27 mm)
**Coating type** None
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 1G Flat **Welding Progression:** N/A
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.9
**Filler metal class** ER-3XX
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 3/8 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

### Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Wire Feed Speed (Reference) ipm | Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 60–100 | 120–210 | 16–19 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7 Supplement C
### Performance Test Description C-10
### GMAW Stainless Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A167 or A240 Type 3XX **Coating Type:** None
**Material Form:** Sheet — 3" x 6" **Thickness:** 10 Gauge
**Filler Metal:** ANSI/AWS A5.9, Class ER-3XX (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 - 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 4G
**Vertical Welding Progression:** Not applicable
**Welding Procedure Specification (WPS) No.:** QC7-93, C-10-O
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Electrode Extension:** 1/4 to 3/8 in.
**Test Required:** Visual inspection per AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Chromium and chromium nickel steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge to 0.281 in. **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.9, (F Number 6)
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Positions:** All groove and fillet **Vertical Welding Progression:** Up or Down

# Welding Procedure Specification (WPS)

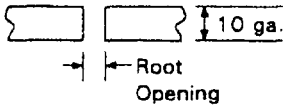
**WPS Number** C-10 **Supported by PQR No(s)** WRC[1], 071B, 072B, 073A, 077A, 078A, 079A[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

## Variables

**Base metal** ANSI/ASTM A167 or A240, Type 3XX
**Metal thickness** 10 Gauge (0.1406 in., 2.57 mm)
**Coating type** None
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 4G Overhead **Welding Progression:** N/A
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.9
**Filler metal class** ER3XX
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 3/8 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

## Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Welding Power: Wire Feed Speed (Reference) ipm | Welding Power: Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 100–150 | 210–330 | 16–29 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-11
### GMAW Stainless Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A167 or A240 Type 3XX **Coating Type:** None
**Material Form:** Sheet — 3" x 6" **Thickness:** 10 Gauge
**Filler Metal:** ANSI/AWS A5.9, Class ER-3XX (F Number 6)
**Weld Joint Detail:** Square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 3G
**Vertical Welding Progression:** Down
**Welding Procedure Specification (WPS) No.:** QC7-93, C-11-V
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Electrode Extension:** 1/4 to 3/8 in.
**Test Required:** Visual inspection per AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Chromium and chromium nickel steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge to 0.281 in. **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.9, (F Number 6)
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Positions:** Flat, horizontal and vertical groove and fillet **Vertical Welding Progression:** Up or Down

## Welding Procedure Specification (WPS)

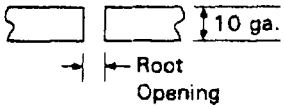
**WPS Number** C-11 **Supported by PQR No.(s)** WRC[1], 071B, 072B, 073A, 077A, 078A, 079A[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

### Variables

**Base metal** ANSI/ASTM A167 or A240, Type 3XX
**Metal thickness** 10 Gauge (0.1406 in., 2.57 mm)
**Coating type** None
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 3G Vertical **Welding Progression:** Down
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.9
**Filler metal class** ER3XX
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 3/8 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

### Joining Procedure

| Filler Metal Size in. | Welding Power: Current Range Ampere | Wire Feed Speed (Reference) ipm | Voltage Range Volts | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| 0.035 | 100–150 | 210–330 | 16–20 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017.
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).

## AWS QC7-93 Supplement C
### Performance Test Description C-12
### GMAW Stainless Steel

**Code:** ANSI/AWS D9.1
**Welding Process:** Semiautomatic gas metal arc welding (GMAW) **Transfer Mode:** Short circuiting
**Base Material:** ASTM A167 or A240 Type 3XX **Coating Type:** None
**Material Form:** Sheet — 3" x 6" **Thickness:** 10 Gauge
**Filler Metal:** ANSI/AWS A5.9, Class ER-3XX (F Number 6)
**Weld Joint Detail:** square butt, root opening (R) = 0 – 1/2 t. Where t = base metal thickness
**Backing:** None
**Welding Position(s):** 1G (Flat, See AWS D9.1, Fig 2 (A))
**Vertical Welding Progression:** Not applicable
**Welding Procedure Specification (WPS) No.:** QC7-93, C-12-F
**Welding Technique:** Single pass
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Electrode Extension:** 1/4 to 3/8 in.
**Test Required:** Visual inspection per AWS D9.1

### Limits of Welder Qualification

**Code:** ANSI/AWS D9.1
**Welding Process:** gas metal arc welding (GMAW) — semiautomatic/automatic transfer mode — short circuiting
**Base Metal:** Chromium and chromium nickel steel (See ANSI/AWS D9.1)
**Material Form:** Sheet **Backing:** With or without
**Groove Weld Thickness:** 16 Gauge to 0.281 **Fillet Weld Size:** Unlimited
**Pipe and Tubing:** Not applicable
**Filler Metal:** ANSI/AWS A5.9, (F Number 6)
**Current:** dcep **Shielding Gas:** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Positions:** Flat groove and fillet **Vertical Welding Progression:** Not applicable

# Welding Procedure Specification (WPS)

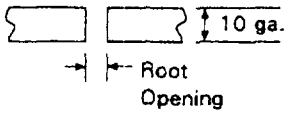
**WPS Number** C-12 **Supported by PQR No.(s)** WRC[1], 071B, 072B, 073A, 077A, 078A, 079A[2]
**WPS Rev. No.** Original **WPS Rev. Date** January 1994

**Code Reference** ANSI/AWS D9.1, Sheet Metal Welding Code

## Variables

**Base metal** ANSI/ASTM A167 or A240, Type 3XX
**Metal thickness** 10 Gauge (0.1406 in., 2.57 mm)
**Coating type** None
**Joint preparation** Shall be free of loose scale, rust, grease or foreign matter
**Backing material** None
**Position of welding** 1G Flat **Welding Progression:** N/A
**Welding process** GMAW
**Manual, semiautomatic, or automatic** Semiautomatic
**Filler metal spec.** ANSI/AWS A5.9
**Filler metal class** ER3XX
**Electrical Characteristics** dcep **Electrode Extension** 1/4 to 3/8 in.
**Mode of transfer** Short circuit
**Shielding gas/combination** 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
**Gas flow (CFH)** 20–40 CFH

## Joining Procedure

| Filler Metal Size | Welding Power | | | Speed of Travel | Joint Detail |
|---|---|---|---|---|---|
| | Current Range | Wire Feed Speed (Reference) | Voltage Range | | |
| in. | Ampere | ipm | Volts | | |
| 0.035 | 100–150 | 210–330 | 16–20 | As Required |   Note: Root Opening = 0-1/2t |

[1]Welding Research Council, 345 East 47th Street, New York, New York 10017
[2]Also on file at AWS Headquarters (Qualification and Certification Dept.).