AWS QC7-93
Supplement C

Welder Performance Qualification Sheet Metal Test Requirements
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.
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American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126

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*Advisor
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/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 concurrency 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 than 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-WFIC. 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

<table>
<thead>
<tr>
<th>Name</th>
<th>WPS Number</th>
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<tbody>
<tr>
<td>I.D. No.</td>
<td>Base Metal</td>
</tr>
<tr>
<td>Date of Test</td>
<td>Gauge</td>
</tr>
<tr>
<td>Test Position</td>
<td>Square groove (butt joint)</td>
</tr>
<tr>
<td>Shield gas used</td>
<td>Code</td>
</tr>
<tr>
<td>Eyewear correction used</td>
<td>ANSI/AWS D9.1</td>
</tr>
<tr>
<td>Power tools used</td>
<td>Performance Test Description No.</td>
</tr>
</tbody>
</table>

Essential Variables Qualified by Test

<table>
<thead>
<tr>
<th>Type of base metal</th>
<th>Welding process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>Method of application</td>
</tr>
<tr>
<td>Uncoated Sheet</td>
<td>Manual</td>
</tr>
<tr>
<td>Coating material on sheet</td>
<td>Semiautomatic</td>
</tr>
<tr>
<td>Backing material</td>
<td>Automatic</td>
</tr>
<tr>
<td>Filler metal specification</td>
<td>Mode of transfer (GMAW)</td>
</tr>
<tr>
<td>Filler Metal Classification</td>
<td>Welding Current</td>
</tr>
<tr>
<td></td>
<td>ac</td>
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<tr>
<td></td>
<td>dce</td>
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<td>dce</td>
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<tr>
<td></td>
<td>dcep</td>
</tr>
<tr>
<td></td>
<td>Shield gas used</td>
</tr>
<tr>
<td></td>
<td>Positions qualified</td>
</tr>
<tr>
<td></td>
<td>Flat</td>
</tr>
<tr>
<td></td>
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<tr>
<th>Condition</th>
<th>Acceptable</th>
<th>Unacceptable</th>
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<tr>
<td>Complete fusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete joint penetration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum face and root reinforcement — 1/8 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No more than one visible pore per in. of weld</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum pore or inclusion size — 0.25 t</td>
<td></td>
<td></td>
</tr>
<tr>
<td>where t = base metal thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No undercut exceeding 0.15 t for t less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>than or equal to 0.187 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No undercut exceeding 0.25 t for t greater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>than 0.187 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No cracks</td>
<td></td>
<td></td>
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</tbody>
</table>

Date Tested ________________________________

Signed By ________________________________

Test Facility ______________________________

AWS CWI No. ______________________________

Test Facility 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
Electrode Extension: 1/4 to 1/2 in.
Shielding Gas: 75% Argon, 25% Carbon dioxide
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
Groove Weld Thickness: 16 Gauge and thinner
Pipe and Tubing: Not applicable
Filler Metal: ANSI/AWS A5.18, (F Number 6)
Current: dcep
Back: With or without
Filler Weld Size: Unlimited
Positions: All groove and fillet
Shielding Gas: 75% Argon, 25% Carbon dioxide
Vertical Welding Progression: Up or down
Welding Procedure Specification (WPS)

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


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

<table>
<thead>
<tr>
<th>Filler Metal Size</th>
<th>Welding Power</th>
<th>Joint Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.</td>
<td>Current Range</td>
<td>Wire Feed Speed (Reference)</td>
</tr>
<tr>
<td></td>
<td>Ampere</td>
<td>ipm</td>
</tr>
<tr>
<td>0.035</td>
<td>50-130</td>
<td>100-230</td>
</tr>
</tbody>
</table>

Note: Root Opening = 0-1/2t

1Welding Research Council, 345 East 47th Street, New York, New York 10017.
2Also 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: ddeep
Electrode Extension: 1/4 to 1/2 in.
Shielding Gas: 75% Argon, 25% Carbon dioxide
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
Groove Weld Thickness: 16 Gauge and thinner
Back: With or without
Pipe and Tubing: Not applicable
Fillet Weld Size: Unlimited
Filler Metal: ANSI/AWS A5.18, (F Number 6)
Current: ddeep
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)  WRC1, 047A, 050A, 051B, 052B2
WPS Rev. No.  Original  
WPS Rev. Date  January 1994

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  deep
Electrical Characteristics  deep  
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

<table>
<thead>
<tr>
<th>Filler Metal Size (in.)</th>
<th>Welding Power</th>
<th>Speed of Travel</th>
<th>Joint Detail</th>
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</thead>
<tbody>
<tr>
<td>0.035</td>
<td>Current Range (Ampere)</td>
<td>Wire Feed Speed (Reference) (ipm)</td>
<td>Voltage Range (Volts)</td>
</tr>
<tr>
<td>50–130</td>
<td>100–230</td>
<td>15–17</td>
<td>As Required</td>
</tr>
</tbody>
</table>

18 ga. Root Opening

Note: Root Opening = 0-1/2t

1Welding Research Council, 345 East 47th Street, New York, New York 10017.
2Also 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   Shielding Gas: 75% Argon, 25% Carbon dioxide
Current: dcep
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
Groove Weld Thickness: 16 Gauge and thinner
Pipe and Tubing: Not applicable
Filler Metal: ANSI/AWS A5.18, (F Number 6)
Current: dcep
Positions: Flat groove and fillet   Backing: With or without
Fillet Weld Size: Unlimited    Shielding Gas: 75% Argon, 25% Carbon dioxide
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, semi-automatic, 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

<table>
<thead>
<tr>
<th>Filler Metal Size</th>
<th>Welding Power</th>
<th>Joint Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.</td>
<td>Current Range</td>
<td>Wire Feed Speed (Reference)</td>
</tr>
<tr>
<td></td>
<td>Ampere</td>
<td>ipm</td>
</tr>
<tr>
<td>0.035</td>
<td>50–130</td>
<td>100–230</td>
</tr>
</tbody>
</table>

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: dc  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: dc  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', 048A, 049A, 053A, 054B, 055B'
WPS Rev. No. Original  WPS Rev. Date January 1994


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
Back ing 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 deep
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

<table>
<thead>
<tr>
<th>Filler Metal Size in.</th>
<th>Welding Power</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Current Range</td>
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<tr>
<td>0.035</td>
<td>75–150</td>
</tr>
</tbody>
</table>

Note: Root Opening = 0-1/2t

2Also 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: deep  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: deep
Positions: Flat, horizontal and vertical groove and fillet  Shielding Gas: 75% Argon, 25% Carbon dioxide
Vertical Welding Progression: Up or down
Welding Procedure Specification (WPS)

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


Variables

Base metal ANSI/ASTM A526CQ G90 or A527LFO 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 deep 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 | Wire Feed Speed (Reference) | Voltage Range | Speed of Travel | Joint Detail |
| 0.035                | 75–150        | 120–280        | 18–20         | As Required    |

Note: Root Opening = 0-1/2t

1Welding Research Council, 345 East 47th Street, New York, New York 10017.
2Also 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: deep 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) Shielding Gas: 75% Argon, 25% Carbon dioxide
Current: deep Vertical Welding Progression: Not applicable
Positions: Flat groove and fillet
# Welding Procedure Specification (WPS)

**WPS Number**: C-6  
**Supported by PQR No.(s)**: WRC 1, 048A, 049A, 053A, 054B, 055B

**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 A527LFO 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**:  
  - **DCP**: 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

<table>
<thead>
<tr>
<th>Filler Metal Size (in.)</th>
<th>Welding Power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Range</td>
</tr>
<tr>
<td>0.035</td>
<td>75–150</td>
</tr>
</tbody>
</table>

![Diagram]

**Note**: Root Opening = 0–1/2t

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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)
Back: Sheet
Groove Weld Thickness: 16 Gauge and thinner
Pipe and Tubing: Not applicable
Filler Metal: ANSI/AWS A5.9, (F Number 6)
Current: dcep
Fillet Weld Size: Unlimited
Shielding Gas: 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
Vertical Welding Progression: Up or down

Positions: All groove and fillet
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 D1.1, 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 deep  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

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
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</tr>
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<tbody>
<tr>
<td>in.</td>
<td>Current Range</td>
<td>Wire Feed Speed (Reference)</td>
<td>Voltage Range</td>
<td>Speed of Travel</td>
<td>Joint Detail</td>
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<td>Ampere</td>
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<td>Volts</td>
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<tr>
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<td>60–100</td>
<td>120–210</td>
<td>16–19</td>
<td>As Required</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)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
Groove Weld Thickness: 16 Gauge and thinner
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

Backings: With or without
Fillet Weld Size: Unlimited

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) WRC¹, 068A, 070A, 074A, 075A, 076A²
WPS Rev. No. Original  WPS Rev. Date January 1994


Variables

Base metal ANSI/ASTM A167 or A240 Type 3XX
Metal thickness 16 Gauge (0.0500 in., 1.27 mm)
Coating type None
Joint preparation Shall be free of loose scale, rust, grease or foreign matter
Backer 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 dc ep  Electrode Extension 1/4 to 3/8 in.
Mode of transfer Short circuit
Shielding gas/combo 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
Gas flow (CFH) 20–40 CFH

Joining Procedure

<table>
<thead>
<tr>
<th>Filler Metal Size in.</th>
<th>Welding Power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Range</td>
</tr>
<tr>
<td>0.035</td>
<td>60–100 Ampere</td>
</tr>
</tbody>
</table>

¹Welding Research Council, 345 East 47th Street, New York, New York 10017.
²Also 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
Groove Weld Thickness: 16 Gauge and thinner
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
Back: With or without  Unlimited
Filler Weld Size: Unlimited
Positions: Flat groove and fillet
Vertical Welding Progression: Not applicable
Welding Procedure Specification (WPS)

WPS Number  C-9
Supported by PQR No.(s)  WRC¹, 068A, 070A, 074A, 075A, 076A²
WPS Rev. No.  Original
WPS Rev. Date  January 1994


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  deep  Electrode Extension  1/4 to 3/8 in.
Mode of transfer  Short circuit
Shielding gas/comboination  90% Helium, 7.5% Argon, 2.5% Carbon dioxide
Gas flow (CFH)  20–40 CFH

Joining Procedure

<table>
<thead>
<tr>
<th>Filler Metal Size (in.)</th>
<th>Current Range (Ampere)</th>
<th>Wire Feed Speed (Reference: ipm)</th>
<th>Voltage Range (Volts)</th>
<th>Speed of Travel</th>
<th>Joint Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.035</td>
<td>60–100</td>
<td>120–210</td>
<td>16–19</td>
<td>As Required</td>
<td></td>
</tr>
</tbody>
</table>

Note: Root Opening = 0–1/2t

¹Weirding Research Council 345 East 47th Street, New York, New York 10017.
²Also 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
Back: 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: deep  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  Shielding Gas: 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
Filler Metal: ANSI/AWS A5.9, (F Number 6)  Vertical Welding Progression: Up or Down
Current: deep  Positions: All groove and fillet
Welding Procedure Specification (WPS)

WPS Number C-10 Supported by PQR No(s) WRC1, 071B, 072B, 073A, 077A, 078A, 079A2
WPS Rev. No. Original WPS Rev. Date January 1994


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 deep 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

<table>
<thead>
<tr>
<th>Filler Metal Size in.</th>
<th>Current Range (Ampere)</th>
<th>Wire Feed Speed (Reference) (ipm)</th>
<th>Voltage Range (Volts)</th>
<th>Speed of Travel</th>
<th>Joint Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.035</td>
<td>100–150</td>
<td>210–330</td>
<td>16–29</td>
<td>As Required</td>
<td></td>
</tr>
</tbody>
</table>

Note: Root Opening = 0–1/2t

1Welding Research Council, 345 East 47th Street, New York, New York 10017.
2Also 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
Back: 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
Groove Weld Thickness: 16 Gauge to 0.281 in.
Pipe and Tubing: Not applicable
Filler Metal: ANSI/AWS A5.9, (F Number 6)
Current: dcep

Positions: Flat, horizontal and vertical groove and fillet

Back: With or without
Fillet Weld Size: Unlimited

Shielding Gas: 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
Vertical Welding Progression: Up or Down
Welding Procedure Specification (WPS)

WPS Number C-11 Supported by PQR No.(s) WRC¹, 071B, 072B, 073A, 077A, 078A, 079A²
WPS Rev. No. Original WPS Rev. Date January 1994


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

<table>
<thead>
<tr>
<th>Filler Metal Size</th>
<th>Current Range</th>
<th>Wire Feed Speed (Reference)</th>
<th>Voltage Range</th>
<th>Speed of Travel</th>
<th>Joint Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.</td>
<td>Ampere</td>
<td>ipm</td>
<td>Volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.035</td>
<td>100–150</td>
<td>210–330</td>
<td>16–20</td>
<td>As Required</td>
<td></td>
</tr>
</tbody>
</table>

¹Welding Research Council, 345 East 47th Street, New York, New York 10017
²Also 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
Material Form: Sheet — 3" x 6"
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
Groove Weld Thickness: 16 Gauge to 0.281
Pipe and Tubing: Not applicable
Filler Metal: ANSI/AWS A5.9, (F Number 6)
Current: dcep
Back: With or without
Fillet Weld Size: Unlimted
Shielding Gas: 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
Vertical Welding Progression: Not applicable
Positions: Flat groove and fillet
Welding Procedure Specification (WPS)

WPS Number C-12
Supported by PQR No.(s) WRC¹, 071B, 072B, 073A, 077A, 078A, 079A²
WPS Rev. No. Original
WPS Rev. Date January 1994


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 deep
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

<table>
<thead>
<tr>
<th>Filler Metal Size in.</th>
<th>Welding Power</th>
<th>Joint Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Range</td>
<td>Wire Feed Speed (Reference)</td>
</tr>
<tr>
<td>0.035</td>
<td>100–150 Ampere</td>
<td>210–330 ipm</td>
</tr>
</tbody>
</table>

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