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 administered 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.
Statement on Use of AWS Standards

All standards (codes, specifications, recommended practices, methods, classifications, and guides) of the American Welding Society are voluntary consensus standards that have been developed in accordance with the rules of the American National Standards Institute. When AWS standards are either incorporated in, or made part of, documents that are included in federal or state laws and regulations, or the regulations of other governmental bodies, their provisions carry the full legal authority of the statute. In such cases, any changes in those AWS standards must be approved by the governmental body having statutory jurisdiction before they can become a part of those laws and regulations. In all cases, these standards carry the full legal authority of the contract or other document that invokes the AWS standards. Where this contractual relationship exists, changes in or deviations from requirements of an AWS standard must be by agreement between the contracting parties.

International Standard Book Number: 0-87171-445-0

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

© 1994 by American Welding Society. All rights reserved
Printed in the United States of America

Note: The primary purpose of AWS is to serve and benefit its members. To this end, AWS provides a forum for the exchange, consideration, and discussion of ideas and proposals that are relevant to the welding industry and the consensus of which forms the basis for these standards. By providing such a forum, AWS does not assume any duties to which a user of these standards may be required to adhere. By publishing this standard, the American Welding Society does not insure anyone using the information it contains against any liability arising from that use. Publication of a standard by the American Welding Society does not carry with it any right to make, use, or sell any patented items. Users of the information in this standard should make an independent, substantiating investigation of the validity of that information for their particular use and the patent status of any item referred to herein.

With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. However, such opinions represent only the personal opinions of the particular individuals giving them. These individuals do not speak on behalf of AWS, nor do these oral opinions constitute official or unofficial opinions or interpretations of AWS. In addition, oral opinions are informal and should not be used as a substitute for an official interpretation.

This standard is subject to revision at any time by the AWS Qualification and Certification Committee. It must be reviewed every five years and if not revised, it must be either reapproved or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS Qualification and Certification Committee and the author of the comments will be informed of the Committee’s response to the comments. Guests are invited to attend all meetings of the AWS Qualification and Certification Committee to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Qualification and Certification Committee. A copy of these Rules can be obtained from the American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126.
Personnel

AWS Committee on Qualification and Certification

C. E. Pepper, Chairman
R. K. Wiswesser, 1st Vice Chairman
J. F. Harris, 2nd Vice Chairman
L. P. Connor, Secretary
E. M. Beck*  
W. F. Behnke  
E. R. Bohnart  
H. Chapman  
H. F. Clark II  
A. L. Collin*  
P. R. Evans  
H. W. Goser  
W. L. Green*  
J. E. Greer  
M. L. Houle*  
W. H. Kennedy  
R. E. Long  
S. P. Martin  
R. D. Messer  
A. L. Petroski  
R. R. Picard  
S. L. Raymond  
T. Schlaflly*  
S. W. Scott*  
R. M. Simons*  
W. F. Uhrick*  
R. F. Waite  
F. G. DeLaurier, Ex-Officio  
L. G. Kvidahl, Ex-Officio  
R. J. Dybas, Ex-Officio  
J. C. Papritan, Ex-Officio

Oak Ridge Nat’l Laboratory  
Welder Training and Testing Institute  
Centerior Energy  
American Welding Society  
Law Engineering Incorporated  
Ford Motor Company/Sterling Plant  
Miller Electric Manufacturing Company  
Consultant  
Fluor Daniel, Incorporated  
Consulting Engineer  
B&W Nuclear Technologies  
Stupp Brothers Bridge and Iron Company  
Retired, Ohio State University  
Moraine Valley Community College  
Consultant  
Canadian Welding Bureau  
Consultant  
General Dynamics Land Systems  
Exxon Chemical  
Valmet Paper Machinery  
ASEA Brown Boveri  
National Training Fund/Sheet Metal Workers  
AIISC  
Westinghouse Hanford Company  
Washington Public Supply System  
Welding Management Consultants  
Consultant  
American Welding Society  
American Welding Society President  
General Electric  
Ohio State University

*Advisor
AWS Subcommittee on Certification of Welders/Welding Operators

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization/Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. K. Wiswesser</td>
<td>Chairman - Welder Training and Testing Institute</td>
</tr>
<tr>
<td>J. H. Balch</td>
<td>National Pipeline Welding School</td>
</tr>
<tr>
<td>H. Chapman</td>
<td>Consultant</td>
</tr>
<tr>
<td>H. F. Clark, II</td>
<td>Fluor Daniel Incorporated</td>
</tr>
<tr>
<td>A. L. Collin*</td>
<td>Consulting Engineer</td>
</tr>
<tr>
<td>D. H. Delk</td>
<td>United States Air Force</td>
</tr>
<tr>
<td>P. R. Evans</td>
<td>B&amp;W Nuclear Technologies</td>
</tr>
<tr>
<td>H. W. Goser</td>
<td>Stupp Brothers Bridge and Iron Company</td>
</tr>
<tr>
<td>R. L. Harris*</td>
<td>Consultant</td>
</tr>
<tr>
<td>R. E. Long</td>
<td>Consultant</td>
</tr>
<tr>
<td>R. D. Messer</td>
<td>Exxon Chemical</td>
</tr>
<tr>
<td>J. S. Pawluk*</td>
<td>Western Nevada Community College</td>
</tr>
<tr>
<td>C. E. Pepper</td>
<td>Oak Ridge National Laboratory</td>
</tr>
<tr>
<td>A. L. Petroski</td>
<td>Valmet Paper Machinery</td>
</tr>
<tr>
<td>L. C. Pratt</td>
<td>Ingalls Shipbuilding</td>
</tr>
<tr>
<td>S. L. Raymond</td>
<td>National Training Fund/Sheet Metal Workers</td>
</tr>
<tr>
<td>M. L. Slaton*</td>
<td>The Pritchard Corporation</td>
</tr>
<tr>
<td>L. D. Smith</td>
<td>Beloit Corporation/Paper Machinery Division</td>
</tr>
<tr>
<td>W. E. Strate</td>
<td>Strate Welding Supply Company</td>
</tr>
<tr>
<td>W. F. Urbick</td>
<td>Welding Management Consultants</td>
</tr>
</tbody>
</table>

*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.
# Table of Contents

<table>
<thead>
<tr>
<th>Personnel</th>
<th>iii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>v</td>
</tr>
</tbody>
</table>

C1. Scope .................................................................................................................. 1  
C1.1 Program ............................................................................................................. 1  
C1.2 Exclusion ........................................................................................................... 1  
C1.3 Limitation .......................................................................................................... 1  
C1.4 Safety Precautions ............................................................................................ 1  

C2. Definitions ............................................................................................................. 1  

C3. Responsibilities Regarding AWS Certified Welders ............................................. 1  
C3.1 Employer Responsibility ..................................................................................... 1  
C3.2 Employer Obligation ........................................................................................... 1  
C3.3 Qualification & Certification Department Responsibilities .................................... 2  
C3.4 Test Facility Responsibilities ............................................................................ 2  

C4. Provisions for Testing ........................................................................................... 2  
C4.1 Welding Procedure Specification (WPS) .............................................................. 2  
C4.2 Test Facilities ...................................................................................................... 2  

C5. Certification Requisites ......................................................................................... 2  
C5.1 Test Control ......................................................................................................... 2  
C5.2 Test Supervisor .................................................................................................... 2  
C5.3 Test Facility .......................................................................................................... 2  

C6. Performance Test .................................................................................................... 2  
C6.1 Identification ....................................................................................................... 2  
C6.2 Verification .......................................................................................................... 2  
C6.3 Safety Equipment ............................................................................................... 2  
C6.4 Machine Adjustment ......................................................................................... 2  
C6.5 Material Check .................................................................................................... 2  
C6.6 Fit-Up ................................................................................................................... 2  
C6.7 Assembly Control ............................................................................................... 2  
C6.8 Positioning .......................................................................................................... 2  
C6.9 Eye Correction ..................................................................................................... 3  
C6.10 Power Tools ...................................................................................................... 3  

C7. Examination Methods and Acceptance Standards ................................................ 3  

C8. Retests .................................................................................................................... 3  
C8.1 Immediate Retest ............................................................................................... 3  
C8.2 Retest After Further Training or Practice .......................................................... 3  

C9. Documentation of Welder Performance Qualification ........................................... 3  

C10. Period of Effectiveness ........................................................................................ 3  

vi
C11. Identification/Certification Documents ................................................................. 3
C12. Maintenance of Certification .................................................................................. 3
C13. Renewal of Certification ....................................................................................... 3
C14. Revocation ............................................................................................................. 3

Forms

QC-WF1C — Welder Qualification Test Record .......................................................... 4
QC-WF3A — Maintenance of Certification ................................................................. 5

List of Performance Test Descriptions

C-1 GMAW — 18 Gauge Coated Steel ......................................................................... 6
C-2 GMAW — 18 Gauge Coated Steel ......................................................................... 8
C-3 GMAW — 18 Gauge Coated Steel ......................................................................... 10
C-4 GMAW — 10 Gauge Coated Steel ........................................................................ 12
C-5 GMAW — 10 Gauge Coated Steel ........................................................................ 14
C-6 GMAW — 10 Gauge Coated Steel ........................................................................ 16
C-7 GMAW — 18 Gauge Stainless Steel .................................................................... 18
C-8 GMAW — 18 Gauge Stainless Steel .................................................................... 20
C-9 GMAW — 18 Gauge Stainless Steel .................................................................... 22
C-10 GMAW — 10 Gauge Stainless Steel .................................................................. 24
C-11 GMAW — 10 Gauge Stainless Steel .................................................................. 26
C-12 GMAW — 10 Gauge Stainless Steel .................................................................. 28
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 welder's 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 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-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 __________________________ | WPS Number __________________________ |
| I.D. No. _________________________ | Base Metal ____________________________ |
| Date of Test ____________________ | Gauge ________________________________ |
| Test Position ___________________ | Square groove (butt joint) ____________ |
| Shield gas used __________________ | Code ____________________________ ANSI/AWS D9.1 |
| Eye correction used ______ Yes ______ No | Performance Test Description No. ____________ |
| Power tools used ______ Yes ______ No |

### Essential Variables Qualified by Test

<p>| Type of base metal | Welding process ____________________________ |</p>
<table>
<thead>
<tr>
<th>Thickness ______ Min ______ Max</th>
<th>Method of application ____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncoated Sheet ______ Yes ______ No</td>
<td>Semi-automatic ____________________________</td>
</tr>
<tr>
<td>Coating material on sheet ______ Yes ______ No</td>
<td>Automatic ____________________________</td>
</tr>
<tr>
<td>Backing material</td>
<td>Mode of transfer (GMAW) ____________________________</td>
</tr>
<tr>
<td>Filler metal specification</td>
<td>Shield gas used ____________________________</td>
</tr>
<tr>
<td>Filler Metal Classification</td>
<td>Positions qualified ____________________________</td>
</tr>
<tr>
<td></td>
<td>Flat ______ Horizontal ______ Vertical ______ Overhead</td>
</tr>
</tbody>
</table>

### Visual Inspection Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>Acceptable</th>
<th>Unacceptable</th>
</tr>
</thead>
<tbody>
<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 than or equal to 0.187 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No undercut exceeding 0.25 t for t greater than 0.187 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No cracks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Date Tested __________________________ | Signed By __________________________ |
| Test Facility ________________________ | Test Supervisor __________________________ |
| Test Facility No. ____________________ | 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: deep  
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: deep  
Positions: All groove and fillet  
Shielding Gas: 75% Argon, 25% Carbon dioxide  
Vertical Welding Progression: Up or down
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: deep
Mode of transfer Short circuit
Shielding gas/combination 75% Argon, 25% Carbon dioxide
Gas flow (CFH) 20–40 CFH

<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></td>
<td>Ampere</td>
</tr>
<tr>
<td>0.035</td>
<td>50–130</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-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: 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
Groove Weld Thickness: 16 Gauge and thinner
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
Backing: With or without
Fillet Weld Size: Unlimited
WPS Number C-2

Supported by PQR No(s) WRC1, 047A, 050A, 051B, 052B, 053B, 054B, 055B, 056B

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/combinations 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>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>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-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: 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
Groove Weld Thickness: 16 Gauge and thinner
Pipe and Tubing: Not applicable
Filler Metal: ANSI/AWS A5.18, (F Number 6)
Current: deep
Positions: Flat groove and fillet
Shielding Gas: 75% Argon, 25% Carbon dioxide
Vertical Welding Progression: Not applicable

Backing: With or without
Fillet Weld Size: Unlimited
Welding Procedure Specification (WPS)

WPS Number C-3  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 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 deep  Electrode Extension 1/4 to 1/2 in.
Mode of transfer Short circuit
Shielding gas/composition 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>Welding Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.</td>
<td>Current Range</td>
<td>Wire Feed Speed (Reference)</td>
</tr>
<tr>
<td>0.035</td>
<td>50–130</td>
<td>100–230</td>
</tr>
</tbody>
</table>

Note: Root Opening = 0-1/2t

*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-4-0
Welding Technique: Single pass
Current: deep
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  
Back: With or without
Groove Weld Thickness: 16 Gauge to 0.276 in.
Pipe and Tubing: Not applicable
Fillet Weld Size: Unlimited
Filler Metal: ANSI/AWS A5.18, (F Number 6)
Current: deep
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
Backing material None
Position of welding 4G Overhead  Welding Progression: N/A
Weiding process GMAW
Manual, semiautomatic, or automatic Semiautomatic
Filler metal spec. ANSI/AWS A5.18
Filler metal class ER70S-X

Electrical Characteristics deep
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>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>75–150</td>
<td>120–280</td>
</tr>
</tbody>
</table>

Note: Root Opening = 0-1/2t

'Welding Research Council, 345 East 47th Street, New York, New York 10017.
"Also on file at AWS Headquarters (Qualification and Certification Dept.).
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  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: dce  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' 048A, 049A, 053A, 064B, 055B\\nWPS Rev. No. Original WPS Rev. Date January 1994


Variables

<table>
<thead>
<tr>
<th>Base metal</th>
<th>ANSI/ASTM A526CQ G90 or A527LFO G90, galvanized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal thickness</td>
<td>10 Gauge (0.1382 in., 1.31 mm)</td>
</tr>
<tr>
<td>Coating type</td>
<td>Galvanized G90</td>
</tr>
<tr>
<td>Joint preparation</td>
<td>Shall be free of loose scale, rust, grease or foreign matter</td>
</tr>
<tr>
<td>Backing material</td>
<td>None</td>
</tr>
<tr>
<td>Position of welding</td>
<td>3G Vertical</td>
</tr>
<tr>
<td>Welding Progression:</td>
<td>Down</td>
</tr>
<tr>
<td>Welding process</td>
<td>GMAW</td>
</tr>
<tr>
<td>Manual, semiautomatic, or automatic</td>
<td>Semiautomatic</td>
</tr>
<tr>
<td>Filler metal spec.</td>
<td>ANSI/AWS A5.18</td>
</tr>
<tr>
<td>Filler metal class</td>
<td>ER70S-X</td>
</tr>
<tr>
<td>Electrical Characteristics</td>
<td>deepest</td>
</tr>
<tr>
<td>Electrode Extension</td>
<td>1/4 to 1/2 in</td>
</tr>
<tr>
<td>Mode of transfer</td>
<td>Short circuit</td>
</tr>
<tr>
<td>Shielding gas/comboination</td>
<td>75% Argon, 25% Carbon dioxide</td>
</tr>
<tr>
<td>Gas flow (CFH)</td>
<td>20–40 CFH</td>
</tr>
</tbody>
</table>

Joining Procedure

<table>
<thead>
<tr>
<th>Filler Metal Size</th>
<th>Filler Metal Size</th>
<th>Welding Power</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>75–150</td>
<td>120–280</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-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)
Current: deep  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, 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 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

**Mode of transfer**: Short circuit

**Shielding gas/combination**: 75% Argon, 25% Carbon dioxide

**Gas flow (CFH)**: 20–40 CFH

### Jointing Procedure

<table>
<thead>
<tr>
<th>Filler Metal Size (in.)</th>
<th>Current Range (Ampere)</th>
<th>Wire Feed Speed (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>75–150</td>
<td>120–280</td>
<td>16–20</td>
<td>As Required</td>
<td></td>
</tr>
</tbody>
</table>

Note: Root Opening = 0-1/2t

---

2. Also on file at AWS Headquarters (Qualification and Certification Dept.).
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-7-0
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 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
Groove Weld Thickness: 16 Gauge and thinner
Pipe and Tubing: Not applicable
Filler Metal: ANSI/AWS A5.9, (F Number 6)
Current: deep
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*, 068A, 070A, 074A, 075B, 076A
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
Backinng 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

<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>Voltage Range</td>
</tr>
<tr>
<td></td>
<td>Ampere</td>
<td>Wire Feed Speed (Reference)</td>
</tr>
<tr>
<td>0.035</td>
<td>60–100</td>
<td>120–210</td>
</tr>
</tbody>
</table>

Note: Root Opening = 0–1/2 in.

*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: 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 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) Shielding Gas: 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
Current: deep Vertical Welding Progression: Up or Down
Positions: Flat, horizontal and vertical groove and fillet
Welding Procedure Specification (WPS)

WPS Number C-8 Supported by PQR No.(s) WRC', 068A, 070A, 074A, 075A, 076A
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 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 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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Range</td>
</tr>
<tr>
<td></td>
<td>Ampere</td>
</tr>
<tr>
<td>0.035</td>
<td>60-100</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-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

**Positions:** Flat groove and fillet

**Backing:** With or without  
**Fillet Weld Size:** Unlimited

**Vertical Welding Progression:** Not applicable
Welding Procedure Specification (WPS)

WPS Number: C-9
Supported by PQR No.(s): WRC, 068A, 070A, 074A, 075A, 076A

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
- **Mode of transfer**: Short circuit

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>60–100</td>
<td>120–210</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 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: dc 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
Filler Metal: ANSI/AWS A5.9, (F Number 6)
Current: dc deep  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)

**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 material
- **Backing material**: None
- **Position of welding**: 4G Overhead
- **Weaving process**: GMAW
- **Filler metal spec.**: ANSI/AWS A5.9
- **Filler metal class**: ER3XX
- **Electrical Characteristics**: Deep
- **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>Welding Power</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>Current Range</td>
<td>Ampere</td>
<td>ipm</td>
<td>Volts</td>
<td>As Required</td>
</tr>
<tr>
<td>0.035</td>
<td>100–150</td>
<td>210–330</td>
<td>16–29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Root Opening = 0-1/2t*

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
WPS Number C-11

Supported by PQR No.(s) WRC. 071B, 072B, 073A, 077A, 078A, 079A*

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, semi-automatic, or automatic Semi-automatic

Filler metal spec. ANSI/AWS A5.9

Filler metal class ER3XX

Electrical Characteristics dcnp

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>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>0.035</td>
<td>100–150</td>
<td>210–330</td>
</tr>
</tbody>
</table>

Note: Root Opening = 0-1/2t


*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 A157 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): 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: 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
Groove Weld Thickness: 16 Gauge to 0.281 Backing: With or without
Pipe and Tubing: Not applicable Fillet Weld Size: Unlimited
Filler Metal: ANSI/AWS A5.9, (F Number 6) Shielding Gas: 90% Helium, 7.5% Argon, 2.5% Carbon dioxide
Current: deep Vertical Welding Progression: Not applicable
Positions: Flat groove and fillet
Welding Procedure Specification (WPS)

WPS Number: C-12
Supported by PQR No.s: WRC: 071B, 072B, 073A, 077A, 078A, 079A

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, semi-automatic, or automatic: Semi-automatic

Filler metal spec.: ANSI/AWS A5.9

Filler metal class: ER3XX

Electrical Characteristics:

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>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>100-150</td>
<td>210-330</td>
</tr>
</tbody>
</table>

Note: Root Opening = 0-1/2t

*Welding Research Council, 345 East 47th Street, New York, New York 10017

*Also on file at AWS Headquarters (Qualification and Certification Dept.)