



Supplement F— Chemical Plant and Petroleum Refinery Piping



American Welding Society



Keywords — AWS Certified Welders, welders,
welder certification, welder
qualification, chemical plant,
petroleum refinery

**AWS QC7-93 Supplement F
Chemical Plant and Petroleum
Refinery Piping**

**AWS QC7-93
Standard for
AWS Certified Welders**

Prepared by
AWS Qualification and Certification Committee

Under the Direction of
AWS Education and Certification Council

Approved by
AWS Board of Directors

Abstract

This Supplement F to AWS standard QC7-93 describes testing administered by Accredited Test Facilities to the requirements of AWS QC4. The welder performance testing for this Supplement was developed using ANSI/ASME B31.3, *Chemical Plant and Petroleum Refinery Piping*, and ASME *Boiler and Pressure Vessel Code*, Section IX, *Welding and Brazing Qualifications* as reference.



American Welding Society

550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135

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Foreword

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

This standard contains the criteria for AWS Certified Welder Program and the AWS National Registry of Welders. Listing on the AWS National Registry of Welders is at the option of the individual welder.

This Supplement F should be used in conjunction with AWS QC7-93, *Standard for AWS Certification of Welders*. This Supplement is not a standard unto itself and shall be considered only as a supplementary part of AWS QC7-93.

This Supplement F to AWS QC7-93, specifies requirements intended to provide an *option* for employers to certify welders.

Comments and suggestions for the improvement of this standard are welcome. They should be sent to the Secretary, Qualification and Certification Committee, American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135.

Official interpretations of any of the technical requirements of this standard may be obtained by sending a request, in writing, to the Director of Qualification and Certification Department, American Welding Society. A formal reply will be issued after it has been reviewed by the appropriate personnel following established procedures.

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Forms

- QC-WF1A — Welder Qualification Test Record
- QC-WF3A — Maintenance of Certification

List of Performance Test Descriptions

- F1 For SMAW: No Pipe Access Restrictions, unlimited positions, 3/4 in. T maximum
- F2 For SMAW: Restricted or unrestricted access in unlimited positions, 3/4 in. T maximum

Supplement F

Chemical Plant and Petroleum Refinery Piping

F1. Scope

Supplement F of AWS QC7-93, *Standard for AWS Certified Welders*, was developed using as references ANSI/ASME B31.3, *Chemical Plant and Petroleum Refinery Piping* and ASME Boiler and Pressure Vessel Code, Section IX, *Welding and Brazing Qualifications*. American Welding Society makes no assessment of WPS or PQR compliance with either of these standards nor of their usability in production welding.

F1.1 Program. The rules for the American Welding Society (AWS) Certified Welder Program are provided in AWS QC7-93. Test Facilities participating in the program are required to meet AWS QC4, *Standard for Accreditation of Test Facilities for AWS Certified Welder Program*.

F1.2 Exclusion. AWS QC7-93 or this Supplement does not prevent or supersede an employer from continuing to qualify welders in accordance with ASME B31.3 or other standards. Employers may impose additional requirements in addition to this standard, as they deem necessary.

F1.3 Limitation. Welders participating in the American Welding Society Certified Welder Program shall be limited to those welding essential variables defined in the applicable Performance Tests Descriptions.

F1.4 Safety Precautions. Safety precautions shall conform to the latest edition of ANSI/ASC Z49.1, *Safety in Welding and Cutting*, published by the American Welding Society.

F2. Definitions

The terms used in this Supplement are as defined in ANSI/AWS A3.0-89, *Standard Welding Terms and Defi-*

nitions, AWS QC7-93, and ASME B31.3, except as noted.

F3. Responsibilities Regarding AWS Certified Welders

F3.1 Employer Responsibility. The employers of AWS Certified Welders are responsible for the work performed by the employees, and to determine that certification records (WPS/PQR) conform to the requirements of the welding to be performed. Acceptance of AWS certification by either the owner or the inspector, is the responsibility of the employer.

F3.2 Employers Obligation. Companies who employ AWS certified welders should be fully aware of the provisions of the AWS QC7-93 and this Supplement.

F3.2.1 Employers should specifically note the extent of qualification as stated on the AWS Welder Certification Card.

F3.2.2 Employers may obtain a copy of the records required by this supplement from the AWS Q&C Department.

F3.2.3 The welders' current status shall be checked with the Q&C Department.

F3.2.4 The employer shall maintain a record of performance for each welder during their period(s) of employment.

F3.2.5 The employer is responsible for all work performed by their employees and therefore should verify that the welders' qualification(s) apply to the employer's work.

F3.2.6 The use of previous qualifications require the approval of the Inspector (see paragraph 325.5 of ASME

B31.3). The employer is responsible for obtaining such approval.

F3.2.7 The employer or a company representative shall witness as co-supervisor of the qualification test.

F3.3 Q&C Department Responsibilities. The Q&C Department shall complete the responsibilities defined in AWS QC7-93, 3.3.

F4. Provisions for Testing

F4.1 Welding Procedure Specification (WPS). The WPS's referenced in this Supplement were qualified using ASME Section IX as a reference. The welding of the test pipe(s) for the AWS Welder Certification program shall be performed in accordance with WPS's referenced in the Performance Test Description contained in this Supplement. Providing written WPS's for *production welding* applications is the employer's responsibility, as defined in ASME B31.3, paragraph 328.2.

F4.2 Test Facilities. The test facilities for the AWS Welder Certification program shall comply with the criteria of AWS QC7-93, 4, Provisions for Testing.

F5. Certification Requisites

F5.1 Test Control

F5.1.1 Welder qualification tests shall be performed in accordance with the written WPS's and the Performance Test Description.

F5.1.2 Performance Test Descriptions shall include the welding variables for each test.

F5.1.3 Each Performance Test Description shall define the limits of qualification of each test based on the requirements of ASME Section IX.

F5.2 Test Responsibility

F5.2.1 Qualification testing shall be performed under the direction of a person designated as the Test Supervisor, who shall be a current AWS Certified Welding Inspector (CWI) in accordance with AWS QC1, *Standard for Qualification and Certification of Welding Inspectors*.

F5.2.2 The Test Supervisor shall be responsible for the performance qualification in accordance with this Supplement.

F5.2.3 At any time during qualification testing, if the Test Supervisor determines that the welder does not exhibit the skill necessary to perform the test satisfactorily, the test may be terminated.

F5.2.4 The Test Supervisor may allow a welder to retest immediately or may require additional training or practice prior to retesting in accordance with F8. Retests.

F5.2.5 The Test Supervisor shall be responsible for the enforcement of the test shop safety rules, procedures, and housekeeping as required by the Test Facility QA Manual.

F5.2.6 The employer, or a company representative, shall witness as co-supervisor of the qualification test.

F6. Performance Test

F6.1 Identification. The applicant shall be assigned an identifying letter, symbol or number coded to the applicant and this identifier shall be marked on test materials and records to identify the applicant.

F6.2 Verification. Prior to the initiation of welding, the applicant's photographic identification shall be checked and verified by the Test Supervisor.

F6.3 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 and shall be followed by the welder.

F6.4 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.

F6.5 Machine Adjustment. Before starting the qualification test, the welder shall adjust the machine settings to meet those of the WPS.

F6.6 Material Check. The base material and filler metal identifications shall be verified by the Test Supervisor prior to tack welding.

F6.7 Preparation of Pipe Coupons. All applicants taking the Performance Test (F2) for unlimited qualification shall be required to prepare (by manual thermal cutting) their own coupons in the horizontal fixed (5G) and vertical fixed (2G) positions. Smoothness of cut surface shall be evaluated without grinding. The AWS C4.1-77, *Surface Roughness Guide for Oxygen Cutting*, Sample #3, shall be the acceptance criteria. Maximum allowable tolerance (squareness) across the pipe shall be no greater than 1/8 in. as verified by the Test Supervisor.

F6.8 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.

F6.9 Position Control. The Test Supervisor shall witness the placement of each test assembly in the specified

welding position and shall mark the test assembly or secure it in such a manner that it remains in the specified position until welding has been completed.

F6.10 Repositioning of the Test Pipe. The test pipe shall not be repositioned prior to completion of the test. 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.

F6.11 Power Tools. Any use, or lack of use, of power tools shall be noted on the Welding Qualification Test Record by the Test Supervisor.

F7. Examination Methods and Acceptance Standards

F7.1 Visual Examination. The test pipe(s) shall meet the visual acceptance criteria defined in ASME B31.3 Table K 341.3.2A, Acceptance Criteria For Welds, normal fluid service, girth groove. The visual examination shall be performed by a Test Supervisor.

F7.2 Mechanical Testing. The mechanical testing and acceptance criteria shall comply with ASME Section IX (QW302.1). The Test Supervisor shall interpret the test results.

F7.3 Radiographic Examination. Radiographic examination (when allowed and used as an alternate to mechanical testing) shall meet the acceptance criteria as defined in ASME Section IX (QW302.2). The personnel performing the radiographic examination shall be qualified to a written practice prepared in accordance with ASNT SNT-TC-1A, Level I or Level II. The personnel interpreting the film shall be qualified to Level II.

F8. Retests

In case the welder performance test fails to meet the requirements of one or more test welds, a retest may be allowed under the following conditions:

F8.1 Immediate Retest. An immediate retest may be made consisting of two welds of each type and position that the welder failed. All retest specimens shall meet all of the specified requirements when examined by the same method(s) used in examination of the failed part(s).

F8.2 Retest After Further Training. An additional retest may be made, provided there is documented evidence that the welder has had further training. A com-

plete retest of the types and positions failed, shall be made.

F9. Documentation of Welder Performance Qualifications

The welder performance qualification data and the results of the examination and testing shall be recorded on Form QC-WF1A, contained herein. Records of applicants that meet the requirements shall be processed in accordance with AWS QC7-93.

F10. Period of Effectiveness

The initial certification is valid for six months from the date of completion of the examination results and signature by the Test Supervisor. Thereafter, the certification may be considered as remaining in effect indefinitely (see F12) unless (1) the welder is not engaged in the given welding process for which the welder is certified for a period exceeding six months, or (2) there is some specific reason to question the welder's ability.

F11. Welder Certification Card

The Welder Certification Card is issued by AWS in accordance with AWS QC7-93.

F12. Maintenance of Certification

Welders may maintain their certification indefinitely by the use of documented verification of performance in qualified welding process(es). The welder must submit completed form QC-WF3 as a minimum, covering each process for which qualified, and covering *each* six month period. The date of certification expiration is extended for six months from the date of the *last use of the process(es)*, as verified on the form received, and accepted by the AWS Q&C Department. Form submittals must be in accordance with QC7-93, 11, Maintenance of Certification.

F13. Renewal of Certification

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

F14. Revocation

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

AWS QC7-93 Supplement F
Performance Test Description — F1
SMAW of Pipe With No Access Restrictions, Unlimited Positions

Test No. B33 – SM – F3/4 – T-A-NAR

Welding Process: Shielded Metal Arc Welding (SMAW)

Base Material: ANSI/ASTM A 106 Grade B, 5 in. NPS Schedule 80

Material Form: Pipe

Filler Material: ANSI/AWS A5.1, Class E-6010/11 (GP.F3) root; Class E-7018 (GP.F4) fill

Weld Joint Detail: See WPS No. F100

Backing: None (Melt-through)

Welding Positions: One horizontal axis, fixed pipe (5G), and Vertical axis, fixed pipe (2G)

Vertical Welding Progression: Upward

Welding Procedure Specification (WPS) No.: F100

Test Required: Visual (Table K341.2A of ASME B31.3), plus guided bends for each pipe (2G positions; 2 side bends; 5G position; 4 side bends). Radiography may be used in lieu of bends (ASME Sect IX, QW 304, QW 302.2).

Limits of Welder Qualification

Code: ASME B31.3

Type: Limited Qualification: No Pipe Access Restrictions, Unlimited Positions

Welding Process: Shielded Metal Arc Welding (SMAW)

Base Material: Group P — Numbers 1 through 11

<u>Filler Metal:</u>	<u>Backing Required</u>	<u>Weld Thickness Range, in.</u>
Group F4	Yes	1/16 – 1/2
Group F3 & Lower	No	1/16 – 3/4

Fillet Weld Size: Unlimited size

Positions: ALL

Vertical Welding Progression: Upward

Access Restrictions: Greater than 5 in. clearance required from the pipe joint in all directions

Pipe/tube Dia.: 2-7/8 in. outside diameter and larger

Material Form: As listed in ASME B31.3: Pipe, tubing, plate, etc.

AWS QC7-93 Supplement F
Performance Test Description — F2
SMAW of Pipe With Restricted or Unrestricted Access, Unlimited Positions.
Test No. B33 – Sm – F 3/4 – T-A-AR

Welding Process: Shielded Metal Arc Welding (SMAW)

Base Material: ANSI/ASTM A 106 Grade B, 5 in. NPS Schedule 80

Material Form: Pipe

Filler Material: ANSI/AWS A5.1, Class E-6010/11 (GR, F3) root; Class E-7018 (GR,F4) fill.

Weld Joint Detail: See WPS No. F100 and "Restricted Test Assembly"

Backing: None (Melt-through)

Thermal Cutting Positions: (2G) vertical axis fixed pipe; and, (5G) horizontal axis fixed pipe

Thermal Cut Test Acceptance Criteria: In the manual "as-cut" condition, the end of the bevel shall not be more than 1/8 in. out of square with the pipe wall, the minimum acceptable surface will be per sample #3 of the AWS C4.1-G *Oxygen Cutting Surface Roughness Gauge*, and the bevel must be smooth and uniform without grinding or touch up.

Welding Positions: Restricted Access: One horizontal axis, fixed-pipe (5GR) and one vertical axis, fixed-pipe (2GR), — See "Restricted" Test Assemblies.

Vertical Welding Progression: Upward

Welding Procedure Specification (WPS) No: F100

Test Required: Visual (Table K341.24 of ASME B31.3), plus guided bends for each pipe (2G positions: 2 sidebend; 5G position: 4 sidebends). Radiography may be used in lieu of bends (ASME Sect IX, QW 302.2 and QW 304).

Limits of Welder Qualification

Code: ASME B31.3

Type: Unlimited Qualification: Restricted and Unrestricted Access, Unlimited Positions

Welding Process: Shielded Metal Arc Welding (SMAW)

Base Material: Group P — Numbers 1 through 11

<u>Filler Metal:</u>	<u>Backing Required</u>	<u>Weld Thickness Range, in.</u>
Group F4	Yes	1/16 – 1/2
Group F3 & Lower	No	1/16 – 3/4

Fillet Weld Size: Unlimited Size

Positions: ALL

Vertical Welding Progression: Up

Access Restrictions: With or Without

Pipe/tubing Dia.: 2-7/8 in. Outside Diameter and Larger

Material Form: As listed in ASME B31.3: Pipe, tubing, plate, etc.

AWS QC7-93 — Supplement F
WELDER QUALIFICATION TEST RECORD

Eye Correction Used: Yes No

Type of Eye Correction: Eye glasses
 Contact lenses
 Magnifiers

Name _____

Identification # _____

Welder _____

Reference Code/Specification _____

Qualified with AWS WPS No. _____

Supplement No. _____

Test Description _____

Process(es) Manual _____

Semi-Automatic Automatic Machine

Test base metal specification _____

to _____

Thickness _____

Material number (M or P Number) _____

to _____

Pipe Diameter _____

Shielding Gas _____

Flow Rate _____

Power tools used? _____

AWS filler metal classification _____

F No. _____

Size _____

Backing Yes No
 Double Welded or Single Welded
 Current AC DC
 Position(s): 1G 2G 3G 4G 5G 6G
 2GR 5GR 6GR

Open Root Yes No
 Short circuiting arc (GMAW) Yes No
 Back Purging Yes No
 Vertical Progression: Root Up Down
 Fill Up Down
 Access Restricted During Test Yes No

TEST RESULTS

Visual test results – cut quality NA Pass Fail Bend test results NA Pass Fail
 Visual test results – weld quality Pass Fail Radiographic test results NA Pass Fail

PROCESS(es) QUALIFIED FOR _____

POSITION(s) QUALIFIED FOR:

Groove:

Pipe 1G 2G 5G 6G 6GR (T) Min _____ Max _____ Diameter Range _____
 Plate 1G 2G 3G 4G (T) Min _____ Max _____

Consumable Insert Backing type Open Root Access: Restricted
 Unrestricted

Fillet:

Pipe 1F 2F 4F 5F (T) Min _____ Max _____
 Plate 1F 2F 3F 4F (T) Min _____ Max _____

Vertical Up Down Weld Deposit Min _____ Max _____
 Single Side Double side

The above named person is qualified for the welding process(es) used in this test within the limits of essential variables shown above. I hereby certify that I was not involved in the training of the above named individual as a welder:

Date Tested _____

Signed by _____

Test Supervisor

Test Facility _____

AWS CWI No. _____

Test Facility No. _____

Date Signed _____

Signed by _____

Corporate Representative

Title

AWS QC7, Supplement F (CONFORMANCE WPS)
 Welding Proc. Spec. No. F100
 Revision No. — Orig.
 Welding Process(es) SMAW

PQR No. (s) 1005*
 Date 09/20/91
 Type (s) MANUAL

FOR ASME/ANSI B31.3 SPECIFICATION

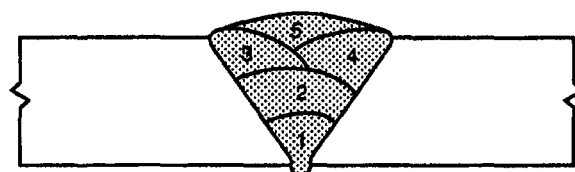
Page 1

BASE METALS		
P-No.** 1	Group Nos. 1 or 2	to P-Nos. 1 Group Nos. 1 or 2
Thickness Range:		
Base Metal:	Groove 1/16 TO 3/4 in.	Fillet ALL THICKNESS
Pipe Dia Range:	Groove ALL DIAMETERS	Fillet ALL DIAMETERS
FILLER METALS (QW-404)	SMAW	SMAW
F-No.**	3	4
A-No.**	1	1
Spec.	SFA-5.1	SFA-5.1
AWS No. (Class)	E6010	E7018
Size of filler metal, in.	3/32 – 1/8	3/32 – 1/8
Deposit weld, in.	0.160 MAX	0.590 MAX
Metal Range: Groove		
Consumable Insert	NONE	NONE
JOINTS (QW-402)		Retainers: NONE
Joint Design: SINGLE-VEE		Backing Material (Type) F3: NONE
Backing: NONE		F4: REQUIRED

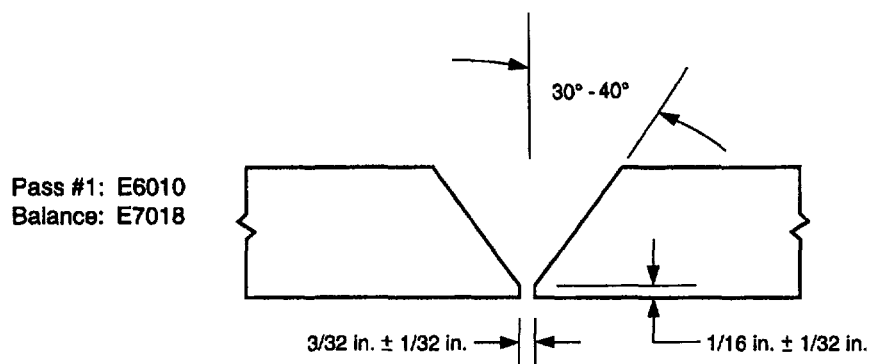
*On file at AWS Headquarters (Q&C Dept)

** Refer to ASME Boiler & Pressure Vessel Code, Section IX

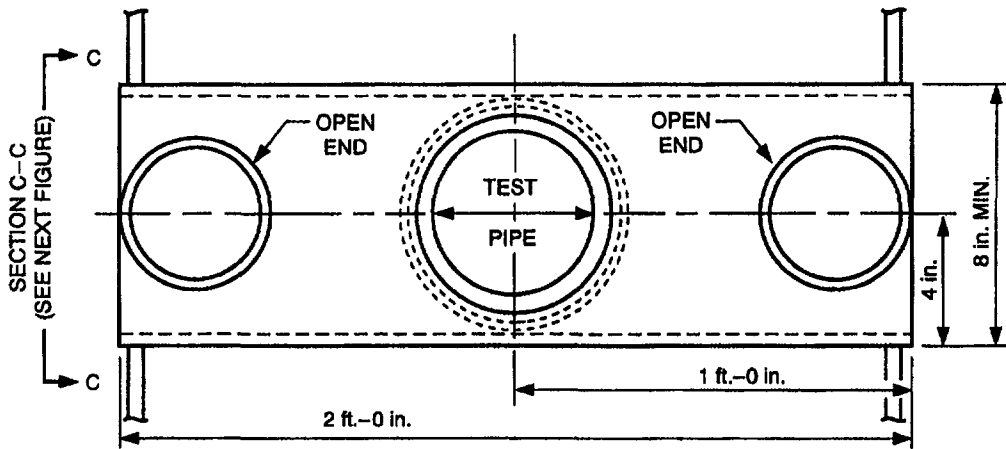
TYPICAL PASS SEQUENCE



JOINT GEOMETRY

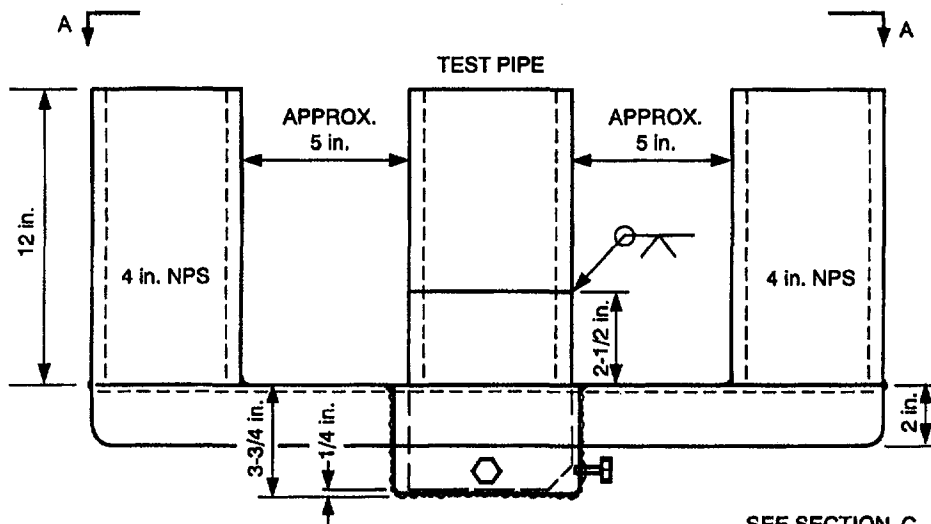


POSITIONS Position(s) of Groove: ALL POSITIONS Welding Progression: Up		POSTWELD HEAT TREATMENT — NONE					
PREHEAT Preheat Temp. Min.: 50°F Interpass Temp. Max: 650°F Preheat Maintenance: NONE		Shielding Gas: NONE					
ELECTRICAL CHARACTERISTICS Current AC or DC: DC Polarity EP Amps (Range): 50-130 Volts (Range): 20-30 FOR F3 Filler Amps (Range): 80-145 Volts (Range): 20-30 FOR F4 Filler							
TECHNIQUE String or Weave Bead: STRING OR WEAVE Orifice or Gas Cup Size: NONE Initial & Interpass cleaning (Brush, Grind, etc): POWER BRUSHING OR GRINDING Method of Back Gouging: NONE ALLOWED Multi or Single Pass (per side): MULTIPLE Multi or Single Electrodes: SINGLE Travel Speed (Range): 1-12 IPM Peening: NONE Maximum Weld Bead Thickness: 1/2 in.							
Weld Layer(s)	Process	Filler Metal		Current		Volt Range	Travel Speed Range
		Class	Dia.	Type Polar.	Amp Range		
PASS #1 OR	SMAW	E6010	3/32"	DC-EP	50-75	20-30	2-12 IPM
PASS #1	SMAW	E6010	1/8"	DC-EP	80-130	20-30	1-12 IPM
PASS #2 — MAX	SMAW	E7018	3/32"	DC-EP	80-100	20-30	1-12 IPM
OR							
PASS #2 MAX	SMAW	E7018	1/8"	DC-EP	90-145	20-30	1-12 IPM



PLAN VIEW A-A

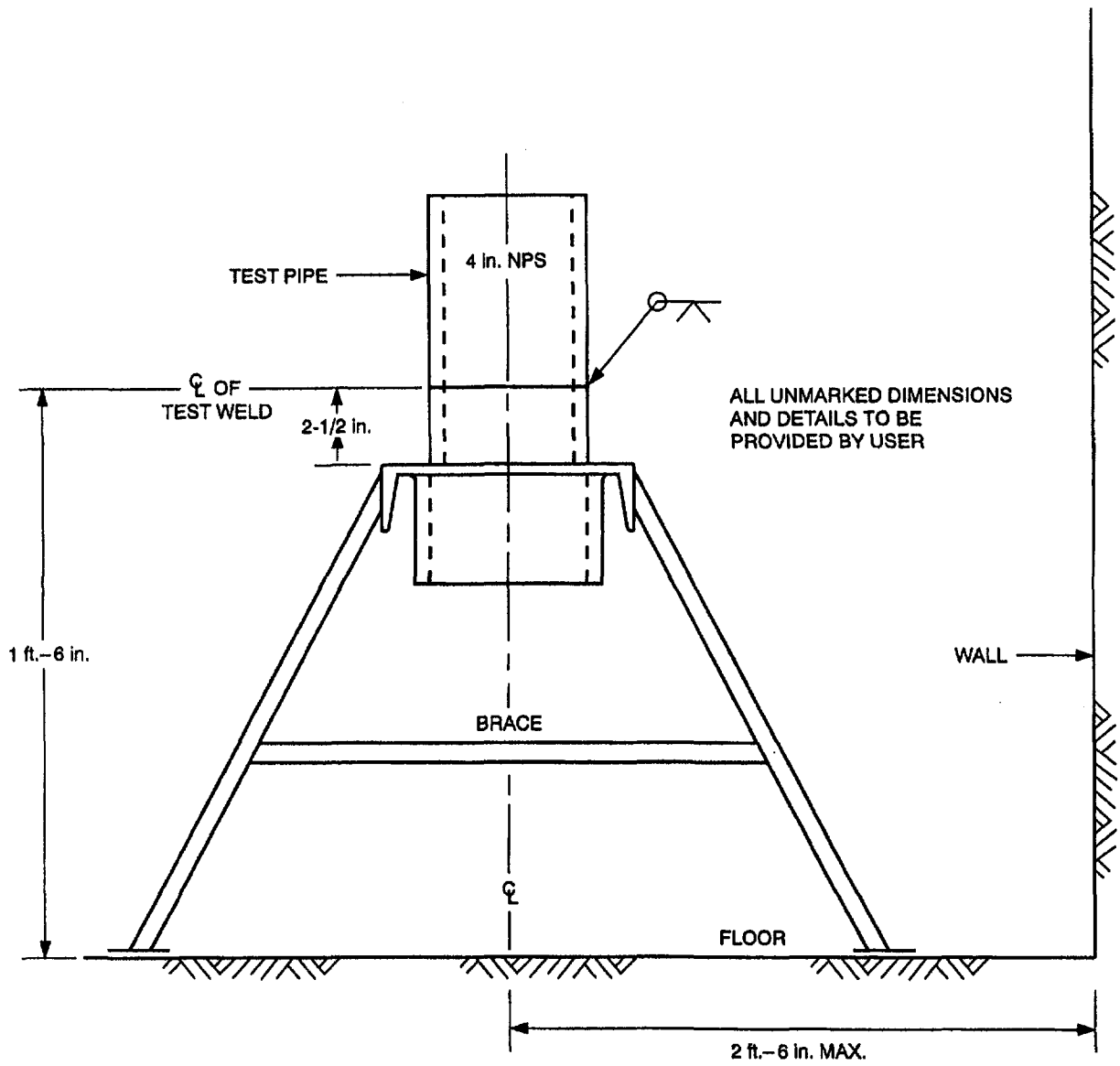
NOTE: TEST FACILITY CAN BE DESIGNED AS DESIRED, BUT MUST COMPLY WITH DIMENSIONS OF SETUP.



SEE SECTION C-C FOR TEST ASSEMBLY VIEW

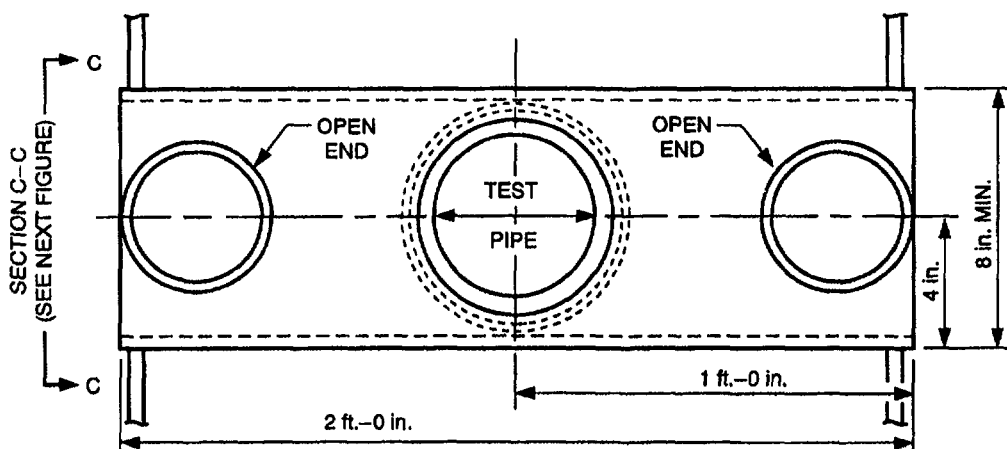
ELEVATION VIEW B-B

2GR Restricted — Test Assembly



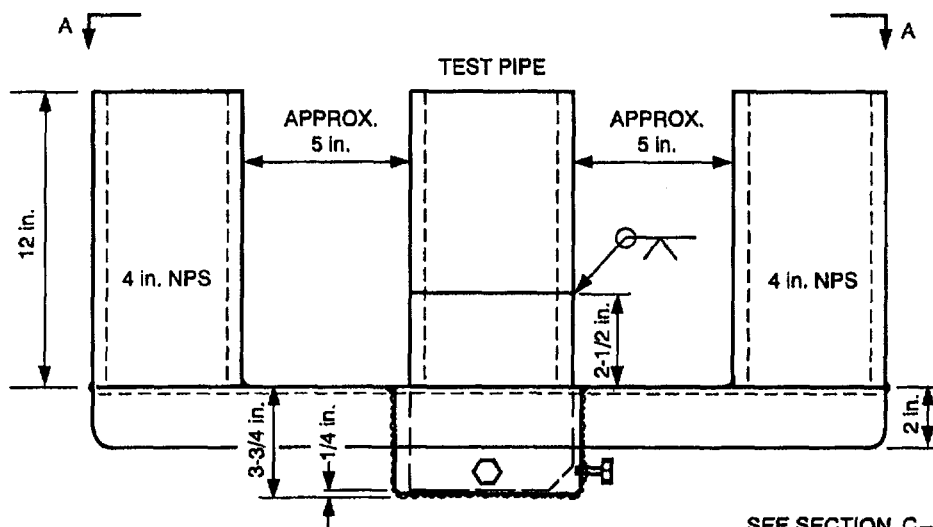
SECTION C-C SIDE VIEW

2GR Restricted — 2GR Position Test Assembly



PLAN VIEW A-A

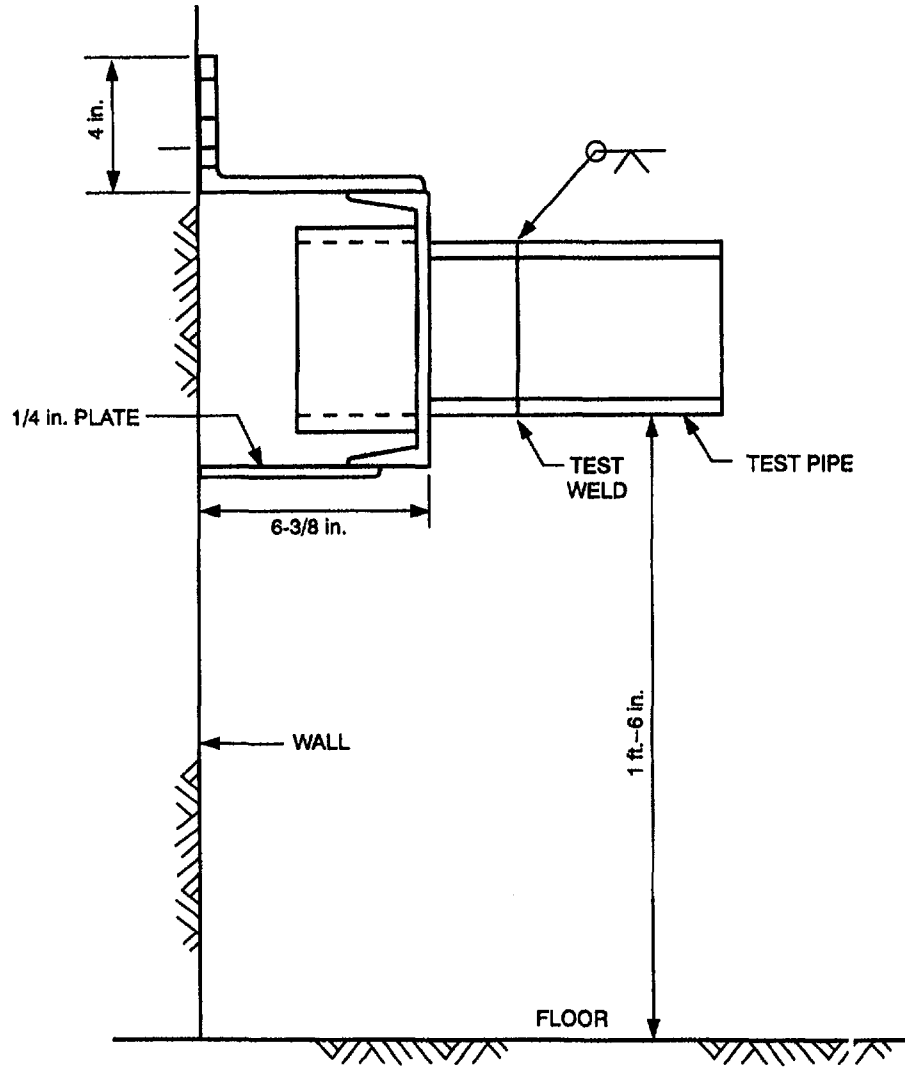
NOTE: TEST FACILITY CAN BE DESIGNED AS DESIRED, BUT MUST COMPLY WITH DIMENSIONS OF SETUP.



ELEVATION VIEW B-B

SEE SECTION C-C FOR TEST ASSEMBLY VIEW

5GR Restricted — Test Assembly



SECTION C-C SIDE VIEW

5GR Restricted — 5GR Position Test Assembly

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

