

# WELDING CODE EXAM

## SPRING 2012

Directions: *Answer the following AWS D1.1 Code Exam questions by filling in the correct lettered bubble on a green 50 question #882-E Scan-tron.*

1. The AWS D1.1 Welding Structural Steel Code states that are welding joints must be \_\_\_\_\_ prior to performing a welding procedure:
  - a. Free of loose scale
  - b. Free of grease
  - c. Free of moisture
  - d. All of the above are correct

### 5.15 Preparation of Base Metal

Surfaces on which weld metal is to be deposited shall be smooth, uniform, and free from fins, tears, cracks, and other discontinuities which would adversely affect the quality or strength of the weld. Surfaces to be welded, and surfaces adjacent to a weld, shall also be free from loose or thick scale, slag, rust, moisture, grease, and other foreign material that would prevent proper welding or produce objectionable fumes. Mill scale that can withstand vigorous wire brushing, a thin rust-inhibitive coating, or antispatter compound may remain with the following exception: for girders in cyclically loaded structures, all mill scale shall be removed from the surfaces on which flange-to-web welds are to be made.

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2. Identify the correct statement below:
  - a. Arc strikes should be avoided on any base metal
  - b. Arc strikes shall be ground smooth
  - c. Arc strikes shall be checked for soundness
  - d. All of the above are correct

### 5.29 Arc Strikes

Arc strikes outside the area of permanent welds should be avoided on any base metal. Cracks or blemishes caused by arc strikes shall be ground to a smooth contour and checked to ensure soundness.

3. Identify the correct AWS Welding Code statement:
- a. Weld cleaning is optional
  - b. Weld cleaning is required before welding over previously deposited metal
  - c. Weld cleaning also includes removing the slag from the weld-ment
  - d. All of the above are correct

### 5.30 Weld Cleaning

**5.30.1 In-Process Cleaning.** Before welding over previously deposited metal, all slag shall be removed and the weld and adjacent base metal shall be cleaned by brushing or other suitable means. This requirement shall apply

4. All hermetically sealed low hydrogen welding electrodes (E7018 H4R –A1) should be kept in an electrode oven at least:
- a. 125 degree F
  - b. 250 degree F
  - c. 327 degree F
  - d. 412 degree F

**5.3.2.1 Low-Hydrogen Electrode Storage Conditions.** All electrodes having low-hydrogen coverings conforming to AWS A5.1 and AWS A5.5 shall be purchased in hermetically sealed containers or shall be baked by the user in conformance with 5.3.2.4 prior to use. Immediately after opening the hermetically sealed container, electrodes shall be stored in ovens held at a temperature of at least 250°F [120°C]. Electrodes shall be rebaked no more than once. Electrodes that have been wet shall not be used.

5. Welder A states that he/she can perform a requalification retest up to four times when performing a welding qualification test at the job site. Welder B states that Welder A is wrong, and the welding code states that the welder must be trained and practice before being retested. Which is the correct answer?
- a. Welder A
  - b. Welder B
  - c. Both Welder A and B
  - d. Neither Welder A or B

**4.33.1.4 Exception—Failure of a Requalification Retest.** No immediate retest shall be allowed after failure of a requalification retest. A retest shall be allowed only after further training and practice per 4.33.1.2.

6. Identify the correct statement below:  
 Welder A states that the groove weld joint B-U2a is designated for the SMAW process.  
 Welder B states that the tolerances for "as fit up" is +1/4" for the root opening and +10 degrees for the included angle.
- Welder A is correct
  - Welder B is correct
  - Both welder A and B are correct
  - Neither welder A or B are correct

Single-V-groove weld (2) Butt joint (B)		Tolerances	
		As Detailed (see 3.13.1)	As Fit-Up (see 3.13.1)
		$R = +1/16, -0$	$+1/4, -1/16$
		$\alpha = +10^\circ, -0^\circ$	$+10^\circ, -5^\circ$

  

Welding Process	Joint Designation	Base Metal Thickness (U = unlimited)		Groove Preparation		Allowed Welding Positions	Gas Shielding for FCAW	Notes
		T <sub>1</sub>	T <sub>2</sub>	Root Opening	Groove Angle			
SMAW	B-U2a	U	—	R = 1/4	$\alpha = 45^\circ$	All	—	e, j
				R = 3/8	$\alpha = 30^\circ$	F, V, OH	—	e, j
				R = 1/2	$\alpha = 20^\circ$	F, V, OH	—	e, j
GMAW FCAW	B-U2a-GF	U	—	R = 3/16	$\alpha = 30^\circ$	F, V, OH	Required	e, j
				R = 3/8	$\alpha = 30^\circ$	F, V, OH	Not req.	e, j
				R = 1/4	$\alpha = 45^\circ$	F, V, OH	Not req.	e, j
SAW	B-L2a-S	2 max.	—	R = 1/4	$\alpha = 30^\circ$	F	—	j
SAW	B-U2-S	U	—	R = 5/8	$\alpha = 20^\circ$	F	—	j

**Figure 3.4 (Continued)—Prequalified CJP Groove Welded Joint Details**

7. Welder A states that Figure 3.4 uses a backing bar to hold the root opening within specification. Welder B states that the root opening can be determined by the number of degree's of the included angle. Identify the correct statement below:
- Welder A is correct
  - Welder B is correct
  - Both welder A and B are correct
  - Neither welder A or B are correct

8. Table 5.8 – The minimum fillet weld size on 5/16" plate states:
- 5/16" plate requires a 1/8" fillet weld
  - 5/16" plate requires a 3/16" fillet weld
  - 5/16" plate requires a 5/16" fillet weld

**Table 5.8**  
**Minimum Fillet Weld Sizes (see 5.14)**

Base-Metal Thickness (T) <sup>a</sup>		Minimum Size of Fillet Weld <sup>b</sup>	
in	mm	in	mm
T ≤ 1/4	T ≤ 6	1/8 (Note c)	3 (Note c)
1/4 < T ≤ 1/2	6 < T ≤ 12	3/16	5
1/2 < T ≤ 3/4	12 < T ≤ 20	1/4	6
3/4 < T	20 < T	5/16	8

<sup>a</sup> For nonlow-hydrogen processes without preheat calculated in conformance with 4.8.4, T equals thickness of the thicker part joined; single-pass welds shall be used.

For nonlow-hydrogen processes using procedures established to prevent cracking in conformance with 4.8.4 and for low-hydrogen processes, T equals thickness of the thinner part joined; single-pass requirement shall not apply.

<sup>b</sup> Except that the weld size need not exceed the thickness of the thinner part joined.

<sup>c</sup> Minimum size for cyclically loaded structures shall be 3/16 in [5 mm].

9. What is the maximum electrode diameter for a groove weld in the vertical position (Table 3.7)?
- 5/16"
  - 1/4"
  - 3/16"
  - 5/32"
10. What is the maximum diameter E-7018 electrode that can be used for a root pass weld in the flat position (Table 3.7)?
- 3/32 inch
  - 1/8 inch
  - 5/32 inch
  - 3/16 inch

**Table 3.7**  
**Prequalified WPS Requirements<sup>1</sup> (see 3.7)**

Variable	Position	Weld Type	SMAW	SAW <sup>d</sup>			GMAW/ FCAW <sup>e</sup>
				Single	Parallel	Multiple	
Maximum Electrode Diameter	Flat	Fillet <sup>a</sup>	5/16 in [8.0 mm]	1/4 in [6.4 mm]			1/8 in [3.2 mm]
		Groove <sup>a</sup>	1/4 in [6.4 mm]				
		Root pass	3/16 in [4.8 mm]				
	Horizontal	Fillet	1/4 in [6.4 mm]	1/4 in [6.4 mm]			1/8 in [3.2 mm]
		Groove	3/16 in [4.8 mm]	Requires WPS Qualification Test			
	Vertical	All	3/16 in [4.8 mm] <sup>b</sup>	Shaded area indicates nonapplicability.			3/32 in [2.4 mm]
Overhead	All	3/16 in [4.8 mm] <sup>b</sup>	5/64 in [2.0 mm]				
Maximum Current	All	Fillet	Within the range of recommended operation by the filler metal manufacturer	1000 A	1200A	Unlimited	Within the range of recommended operation by the filler metal manufacturer
	All	Groove weld root pass with opening		600A	700A		
				900A			
				1200A			
		Groove weld fill passes		Unlimited			
Groove weld cap pass	Unlimited						
Maximum Root Pass Thickness <sup>d</sup>	Flat	All	3/8 in [10 mm]	Unlimited			3/8 in [10 mm]
	Horizontal		5/16 in [8 mm]				5/16 in [8 mm]
	Vertical		1/2 in [12 mm]				1/2 in [12 mm]
	Overhead		5/16 in [8 mm]				5/16 in [8 mm]
Maximum Fill Pass Thickness	All	All	3/16 in [5 mm]	1/4 in [6 mm]	Unlimited		1/4 in [6 mm]
Maximum Single Pass Fillet Weld Size <sup>c</sup>	Flat	Fillet	3/8 in [10 mm]	Unlimited			1/2 in [12 mm]
	Horizontal		5/16 in [8 mm]	5/16 in [8 mm]	5/16 in [8 mm]	1/2 in [12 mm]	3/8 in [10 mm]
	Vertical		1/2 in [12 mm]	Shaded area indicates nonapplicability.			1/2 in [12 mm]
	Overhead		5/16 in [8 mm]				5/16 in [8 mm]
Maximum Single Pass Layer Width	All (for GMAW/ FCAW) F & H (for SAW)	Root opening > 1/2 in [12 mm], or	Shaded area indicates nonapplicability.	Split layers	Laterally displaced electrodes or split layer	Split layers	Split layers
		Any layer of width w		Split layers if w > 5/8 in [16 mm]	Split layers with tandem electrodes if w > 5/8 in [16 mm]	If w > 1 in [25 mm], split layers	(Note e)

<sup>a</sup> Except root passes.

<sup>b</sup> 5/32 in [4.0 mm] for EXX14 and low-hydrogen electrodes.

<sup>c</sup> See 3.7.3 for requirements for welding unpainted and exposed ASTM A 588.

<sup>d</sup> See 3.7.2 for width-to-depth limitations.

<sup>e</sup> In the F, H, or OH positions for nontubulars, split layers when the layer width w > 5/8 in [16 mm]. In the vertical position for nontubulars or the flat, horizontal, vertical, and overhead positions for tubulars, split layers when the width w > 1 in [25 mm].

<sup>f</sup> Shaded area indicates nonapplicability.

<sup>1</sup> GMAW-S shall not be prequalified.

11. What is the maximum allowed amperage (current) for Vertical Up welding with the SMAW process? Refer to Table 3.7

- a. 150 amperes
- b. 250 amperes
- c. 350 amperes
- d. 500 amperes
- e. Follow the manufacturer's recommended specifications

12. What is the minimum preheat and inter-pass temperature for welding 7/8 inch thick ASTM A710 Grade A Class 2 plate?

- a. none
- b. 300 degrees F
- c. 225 degrees F
- d. 150 degrees F
- e. 50 degrees F

**Table 3.2 (Continued)**  
**Prequalified Minimum Preheat and Interpass Temperature (see 3.5)**

C a t e g o r y	Steel Specification	Welding Process	Thickness of Thickest Part at Point of Welding		Minimum Preheat and Interpass Temperature		
			in	mm	°F	°C	
B (Cont'd)	ASTM A 573	Grade 65					
	ASTM A 588						
	ASTM A 595	Grades A, B, C					
	ASTM A 606						
	ASTM A 618	Grades Ib, II, III					
	ASTM A 633	Grades A, B Grades C, D					
	ASTM A 709	Grades 36, 50, 50S, 50W, HPS 50W					
	ASTM A 710	Grade A, Class 2 (>2 in [50 mm])					
	ASTM A 808						
	ASTM A 913 <sup>b</sup>	Grade 50					
	ASTM A 992						
	ASTM A 1008 HSLAS	Grade 45 Class 1 Grade 45 Class 2 Grade 50 Class 1 Grade 50 Class 2 Grade 55 Class 1 Grade 55 Class 2					
	ASTM A 1008 HSLAS-F	Grade 50		1/8 to 3/4 incl.	3 to 20 incl.	32 <sup>a</sup>	0 <sup>a</sup>
	ASTM A 1011 HSLAS	Grade 45 Class 1 Grade 45 Class 2 Grade 50 Class 1 Grade 50 Class 2 Grade 55 Class 1 Grade 55 Class 2	SMAW with low- hydrogen electrodes, SAW, GMAW, FCAW	Over 3/4 thru 1-1/2 incl.	Over 20 thru 38 incl.	50	10
	ASTM A 1011 HSLAS-F	Grade 50		Over 1-1/2 thru 2-1/2 incl.	Over 38 thru 65 incl.	150	65
	ASTM A 1018 HSLAS	Grade 45 Class 1 Grade 45 Class 2 Grade 50 Class 1 Grade 50 Class 2 Grade 55 Class 1 Grade 55 Class 2		Over 2-1/2	Over 65	225	110
	ASTM A 1018 HSLAS-F	Grade 50					
	ASTM A 1018 SS	Grade 30 Grade 33 Grade 36 Grade 40					
	API 5L	Grade B Grade X42					
	API Spec. 2H	Grades 42, 50					
	API 2MT1	Grade 50					
	API 2W	Grades 42, 50, 50T					
	API 2Y	Grades 42, 50, 50T					
	ABS	Grades AH 32 & 36 DH 32 & 36 EH 32 & 36					
	ABS	Grades A, B, D, CS, DS Grade E					



13. If a welder is qualified on a CJP Groove weld test coupon (plate) in the vertical welding position (3G), in which is he or she also qualified?
- Production pipe welding of butt joints
  - Production pipe fillet welds
  - Production box tube of butt joints
  - Production plate welding of fillet welds
  - All of the above

**Table 4.1**  
**WPS Qualification—Production Welding Positions Qualified by Plate, Pipe, and Box Tube Tests (see 4.4)**

Qualification Test	Production Plate Welding Qualified				Production Pipe Welding Qualified					Production Box Tube Welding Qualified						
	Weld Type	Positions	Groove CJP	Groove PJP	Fillet <sup>1</sup>	Butt Joint		T-, Y-, K-Connections		Fillet <sup>1</sup>	Butt Joint		T-, Y-, K-Connections		Fillet <sup>1</sup>	
						CJP	PJP	CJP	PJP		CJP	PJP	CJP	PJP		
P L A T E	CJP Groove <sup>a</sup>	1G	F	F	F	P <sup>b</sup>	P <sup>b</sup>			F	F	F			F	
		2G	F, H	F, H	F, H	(F, H) <sup>b</sup>	(F, H) <sup>b</sup>			F, H	F, H	F, H			F, H	
		3G	V	V	V	V <sup>b</sup>	V <sup>b</sup>			V	V	V			V	
		4G	OH	OH	OH	OH <sup>b</sup>	OH <sup>b</sup>			OH	OH	OH			OH	
	Fillet <sup>a</sup>	1F			F					F					F	
		2F			F, H					F, H					F, H	
		3F			V					V					V	
		4F			OH					OH					OH	
	Plug/Slot	Qualifies Plug/Slot Welding for Only the Positions Tested														
	T U B E S	CJP Groove	1G Rotated	F	F	F	P <sup>b</sup>	F		F	F	P <sup>b</sup>	F		F	F
2G			F, H	F, H	F, H	(F, H) <sup>b</sup>	F, H		F, H	F, H	(F, H) <sup>b</sup>	F, H		F, H	F, H	
5G			F, V, OH	F, V, OH	F, V, OH	(F, V, OH) <sup>c</sup>	F, V, OH		F, V, OH	F, V, OH	(F, V, OH) <sup>c</sup>	F, V, OH		F, V, OH	F, V, OH	
(2G + 5G)			All	All	All	All <sup>d</sup>	All	All <sup>e</sup>	All <sup>e</sup>	All	All <sup>e</sup>	All	All <sup>f</sup>	All <sup>g</sup>	All <sup>g, h</sup>	All
6G			All	All	All	All <sup>d</sup>	All	All <sup>e</sup>	All <sup>e</sup>	All	All <sup>e</sup>	All	All <sup>f</sup>	All	All <sup>g, h</sup>	All
6GR		All <sup>d</sup>	All	All	All <sup>d</sup>	All	All <sup>e</sup>	All	All	All <sup>e</sup>	All	All <sup>f</sup>	All	All	All	
Fillet		1F Rotated			F					F					F	
		2F			F, H					F, H					F, H	
		2F Rotated			F, H					F, H					F, H	
		4F			F, H, OH					F, H, OH					F, H, OH	
	5F			All					All					All		

CJP—Complete Joint Penetration

PJP—Partial Joint Penetration

<sup>a</sup> Qualifies for a welding axis with an essentially straight line, including welding along a line parallel to the axis of circular pipe.

<sup>b</sup> Qualifies for circumferential welds in pipes equal to or greater than 24 in [600 mm] nominal outer diameter.

<sup>c</sup> Production butt joint details without backing or backgouging require qualification testing of the joint detail shown in Figure 4.25(A).

<sup>d</sup> Limited to prequalified joint details (see 3.12 or 3.13).

<sup>e</sup> For production joints of CJP T-, Y-, and K-connections that conform to either Figure 3.8, 3.9, or 3.10 and Table 3.6, use Figure 4.27 detail for testing. For other production joints, see 4.13.4.1.

<sup>f</sup> For production joints of CJP T-, Y-, and K-connections that conform to Figure 3.6, and Table 3.6, use Figures 4.27 and 4.29 detail for testing, or, alternatively, test the Figure 4.27 joint and cut macroetch specimens from the corner locations shown in Figure 4.29. For other production joints, see 4.13.4.1.

<sup>g</sup> For production joints of PJP T-, Y-, and K-connections that conform to Figure 3.5, use either the Figure 4.25(A) or Figure 4.25(B) detail for testing.

<sup>h</sup> For matched box connections with corner radii less than twice the chord member thickness, see 3.12.4.1.

<sup>i</sup> Fillet welds in production T-, Y-, or K-connections shall conform to Figure 3.2. WPS qualification shall conform to 4.12.

14. Section 4.33 Retest section applies to which of the following individuals?

- Tack Welders
- Welders
- Welding Operators
- All of the above are correct

### 4.33 Retest

When a welder, welding operator or tack welder either fails a qualification test, or if there is specific reason to question their welding abilities or period of effectiveness has lapsed, the following shall apply:

15. What is the minimum thickness groove weld a “qualified” welder may weld in production if the welder is qualified using 1 inch thick groove weld test coupon? (Table 4.11)

- Unlimited thickness
- 1 inch
- 1/2 inch
- 1/8 inch
- none of the above

**Table 4.11  
Welder and Welding Operator Qualification—Number and Type of Specimens and  
Range of Thickness and Diameter Qualified (Dimensions in Inches) (see 4.19.2.1)**

(1) Test on Plate		Number of Specimens <sup>a</sup>					Qualified Dimensions					
Production Groove or Plug Welds		Face Bend <sup>b</sup> (Fig. 4.12)	Root Bend <sup>b</sup> (Fig. 4.12)	Side Bend <sup>b</sup> (Fig. 4.13)	Macro-etch	Nominal Plate, Pipe or Tube Thickness Qualified, in						
Type of Test Weld (Applicable Figures)	Nominal Thickness of Test Plate (T) in					Min.	Max.					
Groove (Fig. 4.31 or 4.32)	3/8	1	1	(Note c)	—	1/8	3/4 max <sup>d</sup>					
Groove (Fig. 4.21, 4.22, or 4.30)	3/8 < T < 1	—	—	2	—	1/8	2T max <sup>d</sup>					
Groove (Fig. 4.21, 4.22, or 4.30)	1 or over	—	—	2	—	1/8	Unlimited <sup>d</sup>					
Plug (Fig. 4.38)	3/8	—	—	—	2	1/8	Unlimited					
Production Fillet Welds (T-joint and Skewed)		Number of Specimens <sup>a</sup>					Qualified Dimensions		Dihedral Angles Qualified <sup>b</sup>			
Type of Test Weld (Applicable Figures)	Nominal Test Plate Thickness, T, in	Fillet Weld Break	Macro-etch	Side Bend <sup>b</sup>	Root Bend <sup>b</sup>	Face Bend <sup>b</sup>	Nominal Plate Thickness Qualified, in		Min.	Max.		
Groove (Fig. 4.31 or 4.32)	3/8	—	—	(Note c)	1	1	1/8	Unlimited	30°	Unlimited		
Groove (Fig. 4.31 or 4.32)	3/8 < T < 1	—	—	2	—	—	1/8	Unlimited	30°	Unlimited		
Groove (Fig. 4.21, 4.22, or 4.30)	≥ 1	—	—	2	—	—	1/8	Unlimited	30°	Unlimited		
Fillet Option 1 (Fig. 4.37)	1/2	1	1	—	—	—	1/8	Unlimited	60°	135°		
Fillet Option 2 (Fig. 4.33)	3/8	—	—	—	2	—	1/8	Unlimited	60°	135°		
Fillet Option 3 (Fig. 4.20) [Any diam. pipe]	> 1/8	—	1	—	—	—	1/8	Unlimited	30°	Unlimited		
(2) Tests on Pipe or Tubing <sup>f</sup>		Number of Specimens <sup>a</sup>							Qualified Dimensions		Nominal Plate, Pipe or Tube Wall Thickness Qualified <sup>d</sup>	
Production CJP Groove Butt Joints		1G and 2G Positions Only			5G, 6G and 6GR Positions Only				Nominal Pipe or Tube Size Qualified, in		Nominal Plate, Pipe or Tube Wall Thickness Qualified, in	
Type of Test Weld	Nominal Size of Test Pipe, in	Nominal Test Thickness, in	Face Bend <sup>b</sup>	Root Bend <sup>b</sup>	Side Bend <sup>b</sup>	Face Bend <sup>b</sup>	Root Bend <sup>b</sup>	Side Bend <sup>b</sup>	Min.	Max.	Min.	Max.
Groove	≤ 4	Unlimited	1	1	(Note c)	2	2	(Note c)	3/4	4	1/8	3/4
Groove	> 4	≤ 3/8	1	1	(Note c)	2	2	(Note c)	(Note e)	Unlimited	1/8	3/4
Groove	> 4	> 3/8	—	—	2	—	—	4	(Note e)	Unlimited	3/16	Unlimited



16. What is the allowable atmospheric exposure of low hydrogen electrode for E9018-X for Table 5.1 using column A criteria?

- a. one hour
- b. three hours
- c. four hours
- d. nine hours
- e. None of the above

**Table 5.1**  
**Allowable Atmospheric Exposure of**  
**Low-Hydrogen Electrodes**  
**(see 5.3.2.2 and 5.3.2.3)**

Electrode	Column A (hours)	Column B (hours)
<u>A5.1</u>		
E70XX	4 max.	
E70XXR	9 max.	Over 4 to 10 max.
E70XXHZR	9 max.	
E7018M	9 max.	
<u>A5.5</u>		
E70XX-X	4 max.	Over 4 to 10 max.
E80XX-X	2 max.	Over 2 to 10 max.
E90XX-X	1 max.	Over 1 to 5 max.
E100XX-X	1/2 max.	Over 1/2 to 4 max.
E110XX-X	1/2 max.	Over 1/2 to 4 max.

Notes:

1. Column A: Electrodes exposed to atmosphere for longer periods than shown shall be redried before use.
2. Column B: Electrodes exposed to atmosphere for longer periods than those established by testing shall be redried before use.
3. Electrodes shall be issued and held in quivers, or other small open containers. Heated containers are not mandatory.
4. The optional supplemental designator, R, designates a low-hydrogen electrode which has been tested for covering moisture content after exposure to a moist environment for 9 hours and has met the maximum level allowed in AWS A5.1/A5.1M, *Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding*.

17. What is the AWS Electrode specification of a suitable FCAW filler material for joining ASTM 871 Grade 65 steel in Table 4.9?
- AWS A5.5
  - AWS A5.23
  - AWS A5.18
  - AWS A5.29

**Table 4.9**  
**Code-Approved Base Metals and Filler Metals Requiring Qualification per Clause 4**

Specification	Base Metal				Matching Strength Filler Metal			Base Metal Thickness, T		Minimum Preheat and Interpass Temperature	
	Minimum Yield Point/Strength		Tensile Range		Process	AWS Electrode Specification	Electrode Classification	in	mm	°F	°C
	ksi	MPa	ksi	MPa							
ASTM A 871 Grades 60, 65	60	415	75 min.	520 min.	SMAW	A5.5	E8015-X, E8016-X, E8018-X				
	65	450	80 min.	550 min.	SAW	A5.23	F8XX-EXXX-XX, F8XX-ECXXX-XX				
					GMAW	A5.28	ER80S-XXX, E80C-XXX				
					FCAW	A5.29	E8XTX-X, E8XTX-XC, E8XTX-XM				
ASTM A 514 (Over 2-1/2 in [65 mm])	90	620	100-130	690-895	SMAW	A5.5	E10015-X, E10016-X, E10018-X, E10018M	Up to 3/4	Up to 20	50	10
ASTM A 709 Grades 100, 100W (Over 2-1/2 in to 4 in [65 to 100 mm])	90	620	100-130	690-895	SAW	A5.23	F10XX-EXXX-XX, F10XX-ECXXX-XX	Over 3/4 thru 1-1/2	Over 20 thru 38	125	50
ASTM A 710 Grade A, Class 1 ≤ 3/4 in [20 mm]	80-85	550-585	90 min.	620 min.	GMAW	A5.28	ER100S-XXX, E100C-XXX	Over 1-1/2 thru 2-1/2	Over 38 thru 65	175	80
ASTM A 710 Grade A, Class 3 ≤ 2 in [50 mm]	75-80	515-550	85 min.	585 min.	FCAW	A5.29	E10XTX-XC, E10XTX-XM	Over 2-1/2	Over 65	225	110
ASTM A 514 (2-1/2 in [65 mm] and under)	100	690	110-130	760-895	SMAW	A5.5	E11015-X, E11016-X, E11018-X, E11018M				
ASTM A 517	90-100	620-690	105-135	725-930	SAW	A5.23	F11XX-EXXX-XX, F11XX-ECXXX-XX				
ASTM A 709 Grades 100, 100W (2-1/2 in [65 mm] and under)	100	690	110-130	760-895	GMAW	A5.28	ER110S-XXX, E110C-XXX				
					FCAW	A5.29	E11XTX-XC, E11XTX-XM				

18. Which of the following FCAW electrode classifications is code approved for question #17?
- E8010-X
  - E8XTX-X
  - ER70S
  - F8XX-ECXXX-XX
  - None of the above are correct

19. Which of the following methods cannot be used to remove unacceptable work on quenched and tempered steels?
- a. oxy-fuel gas gouging
  - b. air-arc gouging
  - c. chipping
  - d. grinding

### **5.7 Heat Input Control for Quenched and Tempered Steels**

When quenched and tempered steels are welded, the heat input shall be restricted in conjunction with the maximum preheat and interpass temperatures required. Such considerations shall include the additional heat input produced in simultaneous welding on the two sides of a common member. The preceding limitations shall be in conformance with the producer's recommendations. Oxygen gouging of quenched and tempered steel shall be prohibited.

20. What is the maximum thickness groove weld (Table 4.11) a welder may weld in production if the welder is qualified using 3/8 inch thick groove weld test coupon?

- a. 1 inch
- b. 1/2 inch
- c. 1/8 inch
- d. 3/4 inch

**Table 4.11  
Welder and Welding Operator Qualification—Number and Type of Specimens and  
Range of Thickness and Diameter Qualified (Dimensions in Inches) (see 4.19.2.1)**

(1) Test on Plate		Number of Specimens <sup>a</sup>					Qualified Dimensions					
Production Groove or Plug Welds		Face Bend <sup>b</sup> (Fig. 4.12)	Root Bend <sup>b</sup> (Fig. 4.12)	Side Bend <sup>b</sup> (Fig. 4.13)	Macro-etch	Nominal Plate, Pipe or Tube Thickness Qualified, in						
Type of Test Weld (Applicable Figures)	Nominal Thickness of Test Plate (T) in					Min.	Max.					
Groove (Fig. 4.31 or 4.32)	3/8	1	1	(Note c)	—	1/8	3/4 max <sup>d</sup>					
Groove (Fig. 4.21, 4.22, or 4.30)	3/8 < T < 1	—	—	2	—	1/8	2T max <sup>d</sup>					
Groove (Fig. 4.21, 4.22, or 4.30)	1 or over	—	—	2	—	1/8	Unlimited <sup>d</sup>					
Plug (Fig. 4.38)	3/8	—	—	—	2	1/8	Unlimited					
Production Fillet Welds (T-joint and Skewed)		Number of Specimens <sup>a</sup>					Qualified Dimensions		Dihedral Angles Qualified <sup>b</sup>			
Type of Test Weld (Applicable Figures)	Nominal Test Plate Thickness, T, in	Fillet Weld Break	Macro-etch	Side Bend <sup>b</sup>	Root Bend <sup>b</sup>	Face Bend <sup>b</sup>	Nominal Plate Thickness Qualified, in		Min.	Max.		
Groove (Fig. 4.31 or 4.32)	3/8	—	—	(Note c)	1	1	1/8	Unlimited	30°	Unlimited		
Groove (Fig. 4.31 or 4.32)	3/8 < T < 1	—	—	2	—	—	1/8	Unlimited	30°	Unlimited		
Groove (Fig. 4.21, 4.22, or 4.30)	≥ 1	—	—	2	—	—	1/8	Unlimited	30°	Unlimited		
Fillet Option 1 (Fig. 4.37)	1/2	1	1	—	—	—	1/8	Unlimited	60°	135°		
Fillet Option 2 (Fig. 4.33)	3/8	—	—	—	2	—	1/8	Unlimited	60°	135°		
Fillet Option 3 (Fig. 4.20) [Any diam. pipe]	> 1/8	—	1	—	—	—	1/8	Unlimited	30°	Unlimited		
(2) Tests on Pipe or Tubing <sup>f</sup>		Number of Specimens <sup>a</sup>							Nominal Pipe or Tube Size Qualified, in		Nominal Plate, Pipe or Tube Wall Thickness <sup>d</sup> Qualified, in	
Production CJP Groove Butt Joints		1G and 2G Positions Only			5G, 6G and 6GR Positions Only				Nominal Pipe or Tube Size Qualified, in			
Type of Test Weld	Nominal Size of Test Pipe, in	Nominal Test Thickness, in	Face Bend <sup>b</sup>	Root Bend <sup>b</sup>	Side Bend <sup>b</sup>	Face Bend <sup>b</sup>	Root Bend <sup>b</sup>	Side Bend <sup>b</sup>	Min.	Max.	Min.	Max.
Groove	≤ 4	Unlimited	1	1	(Note c)	2	2	(Note c)	3/4	4	1/8	3/4
Groove	> 4	≤ 3/8	1	1	(Note c)	2	2	(Note c)	(Note e)	Unlimited	1/8	3/4
Groove	> 4	> 3/8	—	—	2	—	—	4	(Note e)	Unlimited	3/16	Unlimited

21. What is the minimum thickness groove weld (Table 4.11) a welder may weld in production if the welder is qualified using 1 inch thick groove weld test coupon?
- Unlimited thickness
  - 1 inch
  - 1/2 inch
  - 1/8 inch
  - none of the above
22. What is the correct definition of "Engineer" per AWS D1.1 Code?
- A duly designated individual who acts for and in behalf of the owner
  - A duly designated person who acts for and in behalf of the project manager
  - A duly designated individual who acts for and in behalf of the owner on all matters within the scope of the code.
  - A duly designated individual who acts for and in behalf of the project manager on all matters within the scope of the code.
  - None of the above
23. What are the limitations of the AWS D1.1 Welding Code?
- 1/16" plate thickness and 100 KSI steels
  - 1/8" plate thickness and 100 KSI steels
  - 1/4" plate thickness and 100 KSI steels
  - 5/16" plate thickness and 100 KSI steels
24. Which of the following documents below is referenced when changing the welding electrode consumable on a job site?
- PQR document
  - WQR document
  - WPS document
  - Both a and c would be referenced when changing electrode consumables
25. The ASTM A514 Steel on 2" plate requires what classification of the SMAW electrodes?  
*Hint: Table 4.9*
- E-80XX-XX
  - E-9010-XX
  - E-10018-XX
  - E-11018-XX
  - E-12015-XX

The End

**Please write your name and date on the scantron,  
and then return the exam and scantron!**