

AWS API-M:2006



Study Guide

for

API Standard 1104 Welding of Pipelines and Related Facilities

TWENTIETH EDITION



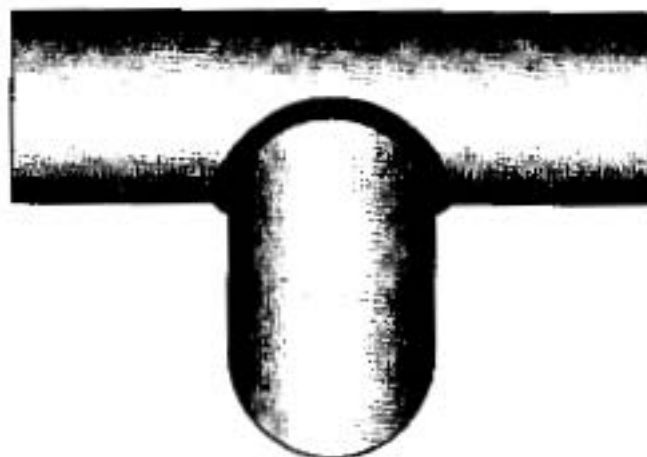
American Welding Society

Table 1.1
Processes and Techniques

Process	Manual	Semi-automatic	Mechanized	Automatic
Shielded metal arc welding (SMAW)	1			
Submerged arc welding (SAW)		2	1	
Gas tungsten arc welding (GTAW)	1		2	
Gas metal arc welding (GMAW)		1	2	2
Flux-cored arc welding (FCAW)		1	2	
Plasma arc welding (PAW)	1		2	
Oxyacetylene welding (OAW)	1			
Flash butt welding (FW)				1

1. Common applications used in industry.
2. Nontypical applications requiring additional equipment.

connection (see Study Guide Figure 5.1), assembling two pipes in the form of a T (see Study Guide Section 6.3); the other is a fillet weld qualification (see Study Guide Figure 5.2), where two pipes are assembled so they overlap (with one pipe tightly sleeved over the other to create a lap joint).



✓ Figure 5.1—Branch-on-Pipe Connection



✓ Figure 5.2—Fillet Weld Qualification

5.8.1 Preparation

Testing requires four specimens from the fillet welded pipes, cut at 90 intervals (see API 1104 Figure 10) beginning at the bottom of the pipe, which in the T-joint is also called the crotch.

As with the butt joints, if the pipe is smaller than 2.375 in. (60.3 mm), two pipe joints must be welded to obtain the required number of specimens. In this case, two specimens will be cut 180 apart in each of the two pipes.

5.8.2 Method

Note that the specimens cut from the pipe must be long enough so they can be clamped effectively for breaking. They may be broken by any convenient method.

APPENDIX B—IN-SERVICE WELDING**B.1 General**

"In-service" means operating. This appendix applies to in-service pipelines in which crude petroleum, petroleum products, or fuel gases are pressurized and/or flowing. Work on such pipelines involves special safety considerations to prevent leaks and explosions. Therefore, only fillet welds are possible in an in-service setting. If any conflict arises between the main body of API 1104 and this appendix, the appendix should govern.

Welding or installing accessories or attachments on in-service pipelines entails two major concerns: burn-through for thin-walled piping, and hydrogen cracking. Although API 1104 Appendix B explains how to prevent both of these problems, its major focus is on hydrogen cracking. Study Guide Table B.1 shows the three major causes of hydrogen cracking.

Table B.1
Causes of Hydrogen Cracking

Condition	Cause of Condition	Preventive Measures
Hydrogen in the weld	Presence of moisture and other impurities	Proper cleaning, preheating, and use of low-hydrogen electrodes and processes
Development of a crack-susceptible microstructure	Large grain growth, due to heating followed by rapid cooling of the weldment	Preheating, control of heat input, and/or use of a temper-bead deposition sequence
Tensile stress	Poor fit-up, and internal stresses in normal operation	Proper fit-up, to minimize stress concentration at the weld root

B.2 Qualification of In-Service Welding Procedures

This appendix applies the requirements for developing a welding procedure in API 1104 Section 5 to in-service welding, and provides additional procedure specifications and essential variables.

B.2.1 Procedure Specification

Refer to API 1104 Section 5 for the general requirements for developing a welding procedure specification.

B.2.1.1 Specification Information

Section B2.1.1 of this appendix presents the additional procedure specification requirements for in-service welding of fillet welds that are not in API 1104 Section 5.

EXERCISE QUESTIONS—SECTION 1

1.1 What topics does API 1104 cover?

- A. Gas welding of butt welds
- B. Arc welding of fillet and socket welds
- C. Welding carbon and low-alloy steel piping
- D. Welding petroleum pipelines
- E. All of the above

1.2 Which nondestructive testing method is specified in API 1104?

- A. Nick-break test
- B. Bend test for butt welds only
- C. Radiographic examination
- D. Metallurgical evaluation
- E. All of the above

1.3 Which welding process(es) is specifically mentioned for use with API 1104?

- A. Flash butt
- B. Submerged arc
- C. Oxyacetylene
- D. Gas metal arc
- E. All of the above

1.4 SI units are acceptable to use with API 1104.

- A. True, as long as each system is used independent of one another
- B. False
- C. True, as long as the inspector places the inch pound value in parenthesis
- D. True, as long as the metric values are used in conjunction with the inch pound values
- E. The inspector should use codes published in either SI or inch pound units

EXERCISE QUESTIONS—SECTION 2

- 2.1 Which of the referenced codes is published by a foreign society?
- A. ASTM E 164
 - B. API Spec 5L
 - C. AWS A5.28
 - D. BSI BS 7448
 - E. none of the above
- 2.2 Which organization publishes most of the NDE specifications cited in API 1104?
- A. API
 - B. ASNT
 - C. ASTM
 - D. AWS
 - E. NACE
- 2.3 Which organization publishes most of the filler metal specifications for API 1104?
- A. AWS
 - B. ASNT
 - C. ASTM
 - D. BSI
 - E. NACE
- 2.4 Which organization publishes a document on personnel certification in NDE used by API 1104?
- A. API
 - B. ASNT
 - C. AWS
 - D. BSI
 - E. NACE

EXERCISE QUESTIONS—SECTION 3

- 3.1 The term that best describes a detectable irregularity in a weld is:
- A. defect
 - B. imperfection
 - C. indication
 - D. concavity
 - E. ridge
- 3.2 API 1104 identifies which of the following organization's standards for definition of welding terms?
- A. API
 - B. ASNT
 - C. AWS
 - D. BSI
 - E. NACE
- 3.3 What process uses equipment that controls only the filler metal feed?
- A. Roll welding
 - B. Submerged arc welding
 - C. Gas tungsten arc welding
 - D. Semiautomatic welding
 - E. Root bead welding
- 3.4 The process where the pipe remains stationary during welding is called:
- A. automatic welding
 - B. position welding
 - C. roll welding
 - D. root bead welding
 - E. semiautomatic welding
- 3.5 What does the term 'roll' welding mean?
- A. Welding with an all position welding electrode only
 - B. Welding is carried out with pipe assembly rotated
 - C. Applies only when welding is done with a semiautomatic process
 - D. Welding is carried out with pipe assembly stationary
 - E. Welding done without a welding procedure

EXERCISE QUESTIONS—SECTION 4

4.1 API 1104 applies to pipe welding that conforms to which specifications?

- A. AWS 5.28
- B. BSI BS 7448
- C. API Specification 5L
- D. Applicable ASTM specifications
- E. Both C and D

4.2 Once opened, filler metals and fluxes shall be:

- A. in any convenient container
- B. protected from deterioration and excessive changes in moisture
- C. in the original manufacturers opened shipping container
- D. in ambient air
- E. special plastic bags

4.3 What determines the tip size for gas welding equipment?

- A. Manufacturer's instructions
- B. Trial and error
- C. Welding procedure
- D. Engineering drawing
- E. Pressure of the gas

4.4 Shielding gases used to shield the arc should never be:

- A. an inert type gas
- B. gas mixtures
- C. field intermixed
- D. kept in containers in which they are supplied
- E. both A and B above

4.5 Filler metals that are coated shall be protected from:

- A. dust
- B. strong magnetic fields
- C. excessive ultraviolet rays
- D. excessive changes in moisture
- E. none of the above

EXERCISE QUESTIONS—SECTION 5

- 5.1 API 1104 groups base metals into three groups based on their minimum yield strength. Which of the following is defined as Group a?
- A. Less than 42 000 psi
 - B. Less than or equal to 42 000 psi
 - C. Greater than 65 000 psi
 - D. Greater than 42 000 psi and less than 65 000 psi
 - E. Greater than 85 000 psi
- 5.2 When qualifying a welding procedure with metals with specified minimum yield strengths greater than 42 000 psi, what is the minimum number of tensile tests required?
- A. None
 - B. One
 - C. Two
 - D. Four
 - E. More than four
- 5.3 When preparing a tensile specimen for testing:
- A. cut a 1/8 in. notch into each side of the weld
 - B. machine or grind all reinforcements smooth
 - C. cut a transverse notch into the weld
 - D. weld reinforcement should not be removed on either side
 - E. bend the specimen in a guided bend jig
- 5.4 AWS Specification A5.20 is used for welding:
- A. pipe in both uphill and downhill positions
 - B. pipe in 2G position only
 - C. root pass welding only
 - D. electrodes in group 3
 - E. both A and B above are correct
- 5.5 When performing a nick break test, the exposed area of fracture shall be at least how wide?
- A. 1/2 in.
 - B. 3/4 in.
 - C. 5/8 in.
 - D. 1-1/2 in.
 - E. A dimension is not specified

- 5.6 API 1104 has grouped base material into three distinct groups. In group 'b' the specified minimum yield strength is:
- A. less than or equal to 42 000 (290 MPa) pounds per square inch
 - B. greater than 42 000 psi (290 MPa) but less than 65 000 psi (448 MPa)
 - C. greater than 42 000 psi (290 MPa) but less than 68 000 psi (469 MPa)
 - D. greater than 289.58 MPa but less than 448.16 MPa
 - E. both B and D
- 5.7 When conducting a procedure qualification on materials with an outside diameter of 135 mm and a wall thickness of 10 mm, the number of tensile test(s) required is/are:
- A. two
 - B. one
 - C. none are required
 - D. four
 - E. none of the above
- 5.8 When preparing a tensile specimen for testing:
- A. weld reinforcement should be removed on either side
 - B. the specimen must be machined
 - C. may be oxygen cut with no further preparation provided sides are parallel and smooth
 - D. weld reinforcement should not be removed on either side
 - E. both C and D
- 5.9 AWS Specification A5.1 and A5.5 are used for welding:
- A. using the SMAW process
 - B. pipe in 2G position only
 - C. root pass welding only
 - D. electrodes in groups 1 – 2 – 3
 - E. both A and D above
- 5.10 When performing a nick-break test, the exposed area of fracture shall show complete penetration and fusion. The greatest dimension of any gas pocket(s) shall not exceed:
- A. 1/16 in. wide maximum
 - B. the combined area shall not exceed 2% of the exposed surface area
 - C. 5/8 in. wide maximum
 - D. 1/2 in. wide maximum
 - E. both A and B are correct

5.11 Carbon steel electrodes for flux cored arc welding can be found in what specification?

- A. AWS A3.0
- B. AWS A5.20
- C. API 5L
- D. ASTM E 164
- E. All of the above

EXERCISE QUESTIONS—SECTION 6

- 6.1 A welder shall be requalified whenever which of the following occurs?
- A. A change from vertical uphill to vertical downhill
 - B. A change of filler metal classification from Group 1 to Group 3
 - C. A change from one process to another
 - D. A change in shielding gas mixture
 - E. All of the above
- 6.2 Which of the following is not specified as a requirement for visual weld inspection?
- A. Free from cracks
 - B. Inadequate penetration
 - C. Free of burn-through
 - D. Filler wire protrudes less than 1/8 in. into inside of pipe
 - E. Neat appearance
- 6.3 For multiple qualification, a welder shall be required to:
- A. make a butt weld in the fixed position
 - B. layout, cut, fit and weld a full-sized branch-on-pipe connection
 - C. join pipes greater than 4.5 in. OD
 - D. demonstrate nondestructive testing skills
 - E. both A and B
- 6.4 When mechanized or semiautomatic welding is used, filler wire protruding into the inside of the pipe:
- A. is not permitted
 - B. length of protrusion shall not exceed 1/16 in.
 - C. length of protrusion shall not exceed 0.79 mm
 - D. shall be kept to a minimum
 - E. both B and C above
- 6.5 For welder qualification on 0.500 in. wall pipe greater than 4-1/2 in. in diameter, but less than or equal to 12-3/4 in. in diameter, the number of destructive test specimens required are:
- A. 4
 - B. 6
 - C. same as procedure qualification
 - D. 16
 - E. depends on the wall thickness of the pipe

- 6.6 In branch-on-pipe connection qualification, the finished weld:
- A. shall exhibit a neat, uniform appearance
 - B. shall exhibit no burn-through
 - C. no nick-break test is required
 - D. shall not contain any burn-through exceeding 1/4 in.
 - E. both A and D above
- 6.7 How many root-bend specimens are required to qualify a welder on 8 in. OD pipe with a wall thickness less than or equal to 12.7 mm?
- A. None
 - B. 1
 - C. 2
 - D. 3
 - E. 4
- 6.8 What is the total number of test specimens required to qualify a welder for 8 in. OD pipe with wall a thickness less than or equal to 12.7 mm?
- A. 2
 - B. 3
 - C. 4
 - D. 5
 - E. 6

EXERCISE QUESTIONS—SECTION 7

7.1 Who shall decide when weather conditions are suitable for welding?

- A. The project engineer
- B. The company
- C. The supervisor of welding
- D. The contractor
- E. The quality assurance head

7.2 For position welding, the maximum face reinforcement permitted is:

- A. no more than the thickness of the pipe
- B. depends on the amount of pipe offset
- C. 1/16 in. maximum
- D. 1/16 in. minimum
- E. up to the welders' discretion

7.3 When pipe is welded above ground, the working clearance around the pipe should not be less than:

- A. 450 mm
- B. 400 mm
- C. 18 in.
- D. 16 in.
- E. B and D above

7.4 Which of the following are acceptable means for welders to identify their work?

- A. Stenciling their identification symbol adjacent to the weld
- B. Recording their identification symbol on a weld "map"
- C. Writing their identification symbol adjacent to the weld using a permanent marker
- D. Recording their identification on a traveler
- E. Any of the above methods as prescribed by the owner or owner's representative

7.5 Pipe ends of the same thickness should not be offset by more than:

- A. 1/16 in.
- B. 1/32 in.
- C. 1/8 in.
- D. 1/4 in.
- E. no offset is permitted

Exercise Questions— API 1104 20th Edition- Section #8

Inspection and Testing of Production Welds

8.1 Who determines the frequency of inspection?

- A. the welder
- B. the chief inspector
- C. the quality assurance head
- D. the company
- E. the contractor

8.2 What should be included in the documentation of qualification for inspection personnel?

- A. education and experience
- B. training
- C. qualification examination results
- D. A, B and C above
- E. weld inspection reports

8.3 How often shall Levels I and II NDT personnel be recertified?

- A. every year
- B. every 2 years
- C. at least every 3 years
- D. at the chief inspector's option
- E. as specified in the contract

8.4 Who determines the type of inspection to be done?

- A. the welder
- B. the inspector
- C. the QC Manager
- D. the company
- E. None of the above

8.5 Which of the following destructive or nondestructive testing methods may not be used?

- A. visual inspection
- B. radiographic testing
- C. trepanning
- D. penetrant testing
- E. bend testing

8.6 Nondestructive testing personnel, other than visual inspection personnel, shall be qualified in accordance with which of the following?

- A. ASNT RP SNT-TC-1A & ACCP
- B. ASME Section V
- C. ASTM 265E
- D. any recognized national certification program
- E. A & D above

8.7 How often must Level III nondestructive testing personnel be re-certified?

- A. every year
- B. every two years
- C. every three years
- D. every four years
- E. every five years

EXERCISE QUESTIONS—SECTION 9

- 9.1 Incomplete fusion shall be considered a defect when the length of an individual indication exceeds:
- A. 1/8 in.
 - B. 25% of wall thickness
 - C. 1/4 in.
 - D. 1.0 in.
 - E. no incomplete fusion is permitted
- 9.2 Porosity is:
- A. evidence of gas trapped in the cooling metal
 - B. generally a spherical indication
 - C. is considered a defect if a single pore is larger than 1/8 in.
 - D. of the types P, CP, HB
 - E. all of the above
- 9.3 Which of the following apply to an ESI?
- A. A nonmetallic solid trapped in the weld metal
 - B. Broken slag lines
 - C. An indication usually found at the fusion zone
 - D. A nonmetallic solid trapped between the weld metal and base metal
 - E. All of the above
- 9.4 What are the results when a portion of the root bead has been blown into the pipe?
- A. Rapid uphill vertical welding
 - B. Nonmetallic solids in the base metal
 - C. Excessive travel speed
 - D. Burn-through
 - E. Excessive pipe wall thickness
- 9.5 Which of the following apply to star cracks?
- A. Caused by vibrations during welding
 - B. Caused by metal contractions during solidification
 - C. Caused by inclusions
 - D. Generally weaken the weld excessively
 - E. Are usually ground out and repaired
- 9.6 The maximum width of an isolated slag inclusion in a weld on a pipe whose outside diameter is 6.625 in. is:
- A. 1/16 in.
 - B. 1/8 in.
 - C. 1/2 in.
 - D. 1.59 mm
 - E. both B and D above

9.7 The maximum length of a crater crack is:

- A. 1/8 in.
- B. 5/32 in.
- C. no cracks are allowed
- D. 1/2 the width of the bead
- E. craters in welds cannot crack

9.8 When using ultrasonic testing, linear indications buried within the weld are unacceptable if they:

- A. exceed 2 in. in aggregate length in a continuous 12 in. length of weld
- B. exceed 5/32 in.
- C. have an aggregate length that exceeds 8% of the weld length
- D. exceed 6% of the weld length
- E. both A and C above

9.9 When visually inspecting a pipe weld you measure some undercut at the face of the weld. The undercut mechanically measures 1/64 in. deep and approximately 6 in. long. The undercut is:

- A. not acceptable
- B. must first be checked against radiograph measurements
- C. unacceptable because it exceeds 2 in.
- D. acceptable
- E. undercut cannot be produced on face side of weld

9.10 Linear indications are those indications whose:

- A. length is more than three times its width
- B. length is equal to its width
- C. length is more than four times its width
- D. width is equal to its length
- E. length is less than its width

EXERCISE QUESTIONS—SECTION 10

- 10.1 Upon visual detection of a weld crack, what should the inspector do?
- A. Send it to production for repair
 - B. Have it removed from the line—unless permitted by 9.3.10
 - C. Submit it for additional nondestructive testing
 - D. A and C above
 - E. Send it to the company representative
- 10.2 Repaired welds should:
- A. meet the standards of acceptability of Section 9
 - B. be examined by the company representative
 - C. be submitted for radiographic inspection
 - D. ground smooth with a minimum of metal removal
 - E. be reinspected by a Level III inspector
- 10.3 Which of the following are required in a weld repair procedure?
- A. Method of defect removal
 - B. Preheat requirements
 - C. Specification information contained in 5.3.2
 - D. Welding process or processes
 - E. All of the above are required
- 10.4 Defects other than cracks may be repaired:
- A. with prior company authorization if the defect is in the root
 - B. with prior company authorization if the defect is in the filler beads
 - C. with prior company authorization if the defect is in the cover pass
 - D. without using a qualified welding repair procedure
 - E. A and B above
- 10.5 Cracked welds may be repaired provided which of the following criteria are met?
- A. The length of the crack is less than 8% of the weld length
 - B. The weld is made by a qualified welder
 - C. A complete repair procedure has been developed and documented
 - D. All of the above
 - E. B and C above

EXERCISE QUESTIONS—SECTION 11

- 11.1 Who must agree on the radiographic procedure to be used?
- A. The inspector and the welder
 - B. The company and the radiographer
 - C. The company and the welder
 - D. The company and the CWI
 - E. The company and the radiographic contractor
- 11.2 Ultrasonic testing personnel Level III:
- A. are permitted to calibrate equipment
 - B. are permitted to interpret test results
 - C. may be required to demonstrate skills for the company representative
 - D. shall develop the application technique and approve testing procedure
 - E. all of the above
- 11.3 Using the ISO IQI, the image quality indicator used to test a CJP weld in a pipe with a 0.432 in. wall thickness is identified by what number?
- A. 10
 - B. 11
 - C. 12
 - D. 15
 - E. 17
- 11.4 Using the ASTM E 747 IQI, the essential wire diameter to use for a CJP weld in a pipe wall thickness of 0.55 in. is:
- A. 0.008 in.
 - B. 0.010 in.
 - C. 0.013 in.
 - D. 0.016 in.
 - E. 0.020 in.
- 11.5 What conditions must be considered when using ultrasonic testing on in-service welds?
- A. The scope of use for ultrasonic testing is at the option of the inspector
 - B. Pipe seams are not required to be ground flush
 - C. Results are nonuniform from unit to unit
 - D. Surface imperfections can interfere with its use
 - E. Surfaces must be coated prior to testing

- 11.6 A radiographic test method using gamma radiation is being used to test a weld. When wire type image quality indicators are used, the image of the essential diameter shall be:
- A. the thickness of the image quality indicator
 - B. clear with the image quality indicator visible next to the weld
 - C. clear across the entire area of interest
 - D. the image quality indicator does not have to be visible on the film.
 - E. wire type image quality indicators are not permitted in API 1104
- 11.7 Who shall interpret the radiographic film of production welds?
- A. Level I radiographer
 - B. Level I or Level II radiographer
 - C. The welding inspector
 - D. Level II or Level III radiographer
 - E. The CWI
- 11.8 What is the diameter of the essential wire required for a radiograph of 0.750 in. steel with an ISO IQI?
- A. 0.013 in. (0.33 mm)
 - B. 0.020 in. (0.51 mm)
 - C. 0.016 in. (0.41 mm)
 - D. 0.025 in. (0.64 mm)
 - E. 0.010 in. (0.25 mm)
- 11.9 A weld was made on a pipe that had a wall thickness measurement of 12.7 mm. What is the essential diameter of an ASTM E 747 image quality indicator used for this radiograph?
- A. 0.013 in. (0.33 mm)
 - B. 0.020 in. (0.51 mm)
 - C. 0.016 in. (0.41 mm)
 - D. 0.025 in. (0.64 mm)
 - E. 0.010 in. (0.25 mm)
- 11.10 The abbreviation DWE/SWV stands for:
- A. double-wall exposure for single-wall viewing
 - B. double-wall exposure for double-wall viewing
 - C. single wall exposure for single-wall viewing
 - D. double-wall exposure on shielded weld V grooves
 - E. double-weld exposure for single welded viewing

EXERCISE QUESTIONS—SECTION 12

- 12.1 For mechanized pipe welding, the use of a lineup clamp:
- A. must be used
 - B. must be of the internal type
 - C. must be of the external type
 - D. is optional, as required
 - E. must be specified in the procedure
- 12.2 Which of the following is not an essential variable for a WPS using mechanized welding processes?
- A. Pipe wall thickness
 - B. Direction of welding
 - C. Postweld cleaning
 - D. Welding process
 - E. Pipe diameter
- 12.3 Radiographic testing of welds made by mechanized processes shall be in accordance with:
- A. Section 6.4
 - B. Section 11.1
 - C. Section 13.9
 - D. Section 9.3.10
 - E. Section 8
- 12.4 In mechanized welding, the travel speed:
- A. is recorded in millimeters only
 - B. need not be addressed if current and volts are recorded
 - C. is recorded in in. only
 - D. must be recorded for each pass
 - E. both A and C above
- 12.5 Of the following, which is not considered an essential variable in a mechanized welding procedure?
- A. A change from V groove to U groove
 - B. A change from a 1/8 in. filler wire to a 1/16 in. filler wire
 - C. An increase in time between the fill pass and the cap pass
 - D. An increase in the range of gas flow rates
 - E. A change in plasma gas orifice diameter

EXERCISE QUESTIONS—SECTION 13

- 13.1 How many test specimens are required for qualifying a flash butt weld procedure?
- A. 24 total for 19 in. OD pipe
 - B. 32 total for 29 in. OD pipe
 - C. 40 total for 32 in. OD pipe
 - D. 4 tensile strength specimens required for all sizes
 - E. All of the above
- 13.2 Which of the following is not an essential variable for flash butt welds?
- A. Welding position
 - B. Axial speed tolerances
 - C. Pipe material
 - D. Filler metal
 - E. Pipe wall thickness
- 13.3 As a minimum all completed flash butt welds shall:
- A. be heated above the Ac3 temperature
 - B. use controlled cooling
 - C. use strip recorder to document heat treating
 - D. be heat treated again if out of specified temperature ranges
 - E. all of the above
- 13.4 Which of the following methods is not specified in a flash butt weld repair procedure?
- A. Grinding
 - B. Chipping
 - C. Gouging
 - D. Surface etching
 - E. All of the above
- 13.5 When should NDT be performed on a flash butt weld?
- A. Immediately after welding
 - B. After flash removal and heat treatment
 - C. Before final heat treatment
 - D. After mechanical testing
 - E. Not specified
- 13.6 When evaluating a nick break specimen that was preformed on a flash butt weld, the maximum size slag inclusion allowed is:
- A. 1/2 in. in length
 - B. 1/32 in. in depth
 - C. 1/2 in. in width
 - D. 1/8 in. in length or width
 - E. both A and C above

- 13.7 Procedure qualification tests for a flash butt weld are being performed on a pipe that has an outside diameter of 20 in. What is the total number of specimens that will be tested?
- A. 16
 - B. 24
 - C. 40
 - D. 32
 - E. 28
- 13.8 In flash butt welding all of the following are essential variables except:
- A. a change from flat to vertical welding
 - B. a change in welding current tolerance
 - C. a change from steel pipe to stainless pipe
 - D. a change from a 6 mm wall pipe to a 10 mm wall pipe
 - E. a change in filler metal diameter
- 13.9 A single ISI in a flash butt weld shall not exceed:
- A. 3/8 in. in length
 - B. 1/2 in.
 - C. 1/8 in. in length
 - D. 1/16 in. in length
 - E. no ISI is allowed
- 13.10 What is the maximum permissible outside weld reinforcement for a flash butt weld?
- A. 1/16 in. (2mm)
 - B. Unlimited
 - C. 1/32 in. (1 mm)
 - D. 1/8 in. (3 mm)
 - E. To be determined by testing

EXERCISE QUESTIONS—APPENDIX A

- A1. No pipeline failures are known to have originated from stress corrosion cracking in a girth weld.
- A. True
 - B. False
 - C. True if CO_2 exceeds historical level
 - D. True if H_2S exceeds historical level
 - E. False if CO_2 exceeds historical level
- A2. Acceptance limits for buried slag in a girth weld is:
- A. lesser of $t/4$ or 0.25 in. in width and lesser of $t/4$ or 0.25 in. in length
 - B. lesser of $t/4$ or 0.25 in. in width and 0.25 in. in length
 - C. lesser of $t/4$ or 0.25 in. in width and $t/4$ in length
 - D. lesser of $t/4$ or 0.25 in. in width and $4t$ in length
 - E. $t/4$ in width and $2t$ in length
- A3. The maximum depth for an un-repaired arc burn is:
- A. $1/64$ in.
 - B. $1/32$ in.
 - C. $1/16$ in.
 - D. $3/32$ in.
 - E. $1/8$ in.
- A4. Which of the following is used to determine the maximum axial design stresses for a pipeline?
- A. A visual weld inspection
 - B. A stress analysis
 - C. A tensile test
 - D. A nick break test
 - E. A chemical analysis
- A5. What type of test is required to use the alternative girth weld acceptance criteria?
- A. The CTOD fracture toughness test
 - B. The CVN toughness test
 - C. The nick break test
 - D. The tensile test
 - E. The guided bend test

EXERCISE QUESTIONS—APPENDIX B

- B1. The two main concerns with welding on in-service pipelines are:
- A. burn through and hydrogen cracking
 - B. weld cooling rates and weld sequence
 - C. yield strength of pipe material and fittings
 - D. tensile strength of pipe and weld sequence
 - E. fit up and weld sequence
- B2. For an encirclement Tee:
- A. the circumferential welds should be completed before beginning the longitudinal seams
 - B. circumferential welds need not be made
 - C. the longitudinal seams should be completed before beginning the circumferential welds
 - D. weld sequencing is not necessary on tees
 - E. circumferential welds at the end of tee shall be welded at the same time
- B3. All welders performing repair work should be familiar with the safety precautions associated with cutting and welding on piping that contains or has contained crude petroleum, petroleum products, or fuel gases. Additional guidance can be found in:
- A. ANSI Z49.1
 - B. API RP 2201
 - C. API RP 1570
 - D. AWS A3.0
 - E. API 510
- B4. For branch and sleeve welds, each macro-section test specimen:
- A. should be ground on both sides to at least 600 grit finish and etched
 - B. should be ground on both sides to at least 300 grit finish and etched
 - C. should smooth at least one face to at least 600 grit finish and etched
 - D. should smooth at least one face to at least 300 grit finish and etched
 - E. shall be machined cut
- B5. For in-service welder qualification for longitudinal seam welds on pipe with a 0.375 in. wall thickness, the type and number of test specimens are:
- A. one tensile, one nick-break, and two side bends
 - B. two tensile, two nick-break, and two side bends
 - C. two tensile, two nick-break, two root bends, and two face bends
 - D. one tensile, one nick-break, one root bend, and one face bend
 - E. two tensile, and four side bends

- B6. For in-service fillet welds, specified minimum yield strength is:
- A. an essential variable
 - B. not an essential variable
 - C. is an essential variable if pipe and fitting yield strength is less than or equal to 42 000 psi
 - D. is an essential variable if pipe and fitting yield strength is greater than 42 000 psi but less than 65 000 psi
 - E. is considered an essential variable if pipe and fitting yield strength is greater than 65 000 psi
- B7. When the maximum allowable heat input to avoid burning through is insufficient to provide adequate protection against hydrogen cracking an alternative precaution is:
- A. a temper bead deposition sequence may be used
 - B. an increase in travel speed is necessary
 - C. decrease the voltage to ensure a wetter puddle
 - D. decrease the amperage to ensure a wetter puddle
 - E. an increase in cooling rate is necessary
- B8. When qualifying a procedure for in-service welding, the face bend test for branch and sleeve welds should not be tested:
- A. less than 24 hours after welding
 - B. more than 24 hours after welding
 - C. less than 48 hours after welding
 - D. more than 24 hours after welding
 - E. when temperature of test specimen exceeds 125°F

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