ASME PCC-2 Study Guide

Practice Questions for API 570 Exam

This following is a Study Guide that helps you learn the details of ***ASME PCC-2, Repair of Pressure Equipment & Piping - 2018 Edition****. There will probably be about 5-12 questions from this document on your API exam. We do* ***NOT*** *spend much time in class discussing this publication. So, it is important that you become familiar with this content in your personal study sessions.*

The questions in this Guide are list in the order of the Repair Topics. An answer key is provided at the end of the Guide. We suggest you read the specific Repair Topic a couple of times before answering the questions. Do this Study Guide multiple times prior to your API exam! ***Your Goal … be able to score 85+% on this guide! Questions highlighted in Yellow are Open Book Questions!***

Good News! The majority of the PCC-2 questions will be Open Book!

Article 201: Butt-Welded Insert Plates

1. An insert plate is being used to repair a large diameter pipe that has experienced localized corrosion. Which of the following is correct? **This may have more than one correct answer, select all answers that apply.**

   A. The repair plate must be the same material as the pipe.
   B. The repair plate should be the same material as the pipe.
   C. The repair plate must have the same P-Number as the pipe's material.
   D. The repair plate should have the same P-Number as the pipe's material.

2. The thickness of a butt-welded insert plate:

   A. should be as thick as the current thickness of the pipe.
   B. must be as thick as the current thickness of the pipe.
   C. should be as thick as the nominal thickness of the pipe.
   D. must be as thick as the nominal thickness of the pipe.

3. A 1.125" thick rectangular insert plate is being install in a large pipe per ASME PCC-2. What is the minimum allowed corner radius?

   A. 1" C. 6"
   B. 3" D. 12"

4. A square insert plate that is 0.625" thick is being install in a pipe in accordance with ASME PCC-2. What is the minimum allowed corner radius?

   A. 1" C. 6"
   B. 3" D. 12"

5. A rectangular insert plate that is 3/8" thick is being install per ASME PCC-2. What is the minimum allowed corner radius?

   A. 1" C. 3"
   B. 2" D. Unspecified radius

6. A 1.5" thick insert plate is being install in a large diameter carbon steel pipe. The new welds will ***not*** be post weld heat treated. Per ASME PCC-2, what is the minimum dimension for patch plate *(length, width or diameter)?*

   A. 12" C. 18"
   B. 15" D. 24"

7. A carbon steel 0.750" thick insert plate is being install per ASME PCC-2? The new welds will ***not*** be post weld heat treated. What is the minimum dimension for patch plate *(length, width or diameter)?*

   A. 6" C. 12"
   B. 9" D. 15"

8. A round 0.500" thick insert plate is being install per ASME PCC-2? The new welds will be post weld heat treated. What is the minimum diameter for patch plate?

   A. 6" C. 18"
   B. 12" D. 24"

9. When installing an insert patch, the structural stability of the pipe may be affected in which of following situations?

   A. Any unsupported plate with a cutout in 300 series SS pipe
   B. Unsupported plates with a large repair cutout
   C. Adding an insert plate which includes a branch connection
   D. Replacing a stiffener ring for a pipe in vacuum service

10. A 4 NPS *(4.5" OD)* branch connection is being installed on a large diameter carbon steel pipe using a new insert plate. The branch-to-pipe weld is ***not*** post-weld-heat-treated. What is the minimum size *(diameter)* of insert plate allowed by ASME PCC-2?

    A. 9" C. 12"
    B. 10.5" D. 16.5"

11. A 16 NPS *(16" OD)* branch connection is being installed on a large diameter flare line using a new insert plate. The branch-to-shell weld is ***not*** post-weld-heat-treated. What is the minimum size *(diameter)* of insert plate allowed by ASME PCC-2?

    A. 22" C. 28"
    B. 24" D. 32"

12. A round insert patch is installed in a pipe. The standard bevel for the pipe and the repair patch is:

    A. 15 - 30 degrees.
    B. 22.5 – 37.5 degrees.
    C. 25 - 35 degrees.
    D. 33 – 45 degrees.

13. A rectangular insert patch is cold rolled to the proper curvature of a large diameter pipe. The insert plate should be appropriately heat treated if the fiber elongation from cold rolling exceeds:

    A. 0.5% elongation.
    B. 1% elongation.
    C. 2.5% elongation.
    D. 5% elongation.

14. When an insert plate is used for a repair, the maximum amount of misalignment allowed is:

    A. 1/16".
    B. 1/8".
    C. 3/16".
    D. based on the applicable construction code.

15. An insert plate is used for a pipe repair. The misalignment exceeds what is allowed. The edge of the insert plate shall be tapered. The length of the taper must ***not*** be less than:

    A. 2 x's the offset.
    B. 3 x's the offset.
    C. 3".
    D. 6".

16. A rectangular carbon steel insert patch is installed in a pipe. Which of the following is correct? **This may have more than one correct answer, select all answers that apply.**

    A. Weld procedure qualification should meet the applicable construction code.
    B. Welder qualification should meet the applicable construction code.
    C. Recommended to use low-hydrogen electrodes.
    D. The weld must be a double-welded design.

17. Which of the following is ***not*** a potential concern when installing carbon steel insert plates?

    A. Cracking
    B. Distortion
    C. Embrittlement
    D. Flat spot

18. An insert plate is used to repair a pipe. There is no way to weld from the inside. So, this will be a one-sided weld. What welding process is recommended for the root pass?

    A. GMAW
    B. GTAW
    C. SAW
    D. SMAW

19. An insert plate is used to repair a pipe. There is no way to weld from the inside. What welding process is ***not*** recommended for welding any pass?

    A. All GMAW transfer modes
    B. GMAW Globular mode
    C. GMAW Short-circuit mode
    D. GMAW Spray mode

20. An insert patch that is 0.500" thick is installed in a pipe. The maximum undercut allowed for the patch weld is:

    A. 0.031".
    B. 0.050".
    C. 0.062".
    D. 0.100".

21. An insert patch that is 0.375" thick is installed in a pipe. Per ASME PCC-2, the minimum spacing allowed between this new weld and an existing non-PWHT'd circumferential weld is:

    A. 1.5".
    B. 3".
    C. 6".
    D. 8".

22. An 0.750" thick insert patch is installed in a pipe. Per ASME PCC-2, the minimum spacing allowed between this new weld and an existing non-PWHT'd weld is:

    A. 6".
    B. 8".
    C. 10".
    D. 12".

23. A 1.500" thick insert patch is installed in a large diameter pipe. Per ASME PCC-2, the minimum spacing allowed between this new weld and an existing non-PWHT'd welds is:

    A. 6".
    B. 8".
    C. 10".
    D. 12".

24. A 1.500" thick insert patch is installed in a large diameter pipe. The adjacent existing weld was previously post-weld heat treated. Per ASME PCC-2, the minimum spacing allowed between this new weld and the existing PWHT'd welds is:

    A. 3".
    B. 6".
    C. 10".
    D. 12".

25. An insert plate is used to repair a large pipe. It is impractical to avoid an existing longitudinal weld. The insert plate should intersect the existing weld at an angle ***not*** less than:

    A. 10 degrees.
    B. 22.5 degrees.
    C. 30 degrees.
    D. 45 degrees.

26. A 0.750" thick insert patch is installed in a large pipe. The insert plate stops at an existing longitudinal weld. It intersects the existing weld at 90 degrees. Per ASME PCC-2, what is the minimum distance to be cut the existing weld beyond the new insert plates welds?

    A. 6"
    B. 9"
    C. 12"
    D. 18"

27. The insert plate stops at an existing weld. It intersects the existing longitudinal weld at 90 degrees. How must all of the replaced existing welds be examined?

    A. 100% RT or UT at completion
    B. 100% RT or MT at completion
    C. 100% RT or UT at completion or MT or PT both sides at the completion of weld
    D. 100% MT or PT on root pass and completion of weld

28. An insert plate is used to repair a pipe. Postweld heat treatment of the insert plate:

    A. is always required.
    B. must be done if required by the applicable construction code.
    C. if done should always be at a temp above the lower transformation temperature.
    D. is never recommended due to potential distortion of the shell.

29 An insert plate is used to repair a pipe. The extend of NDE for all the new welds shall be:

    A. Spot RT or UT.
    B. Full RT or UT.
    C. 100% MT or PT on the root pass, hot pass and final pass.
    D. RT or UT in accordance with the applicable construction code.

30. An insert plate is used to repair a pipe. UT of 100% of the new welds will be performed. What else is recommended?

    A. UT procedure is qualified to ASNT SNT-TC-1A
    B. UT technician is qualified to API 2201
    C. MT or PT the root pass
    D. MT or PT the root & final passes

31. An insert plate is used to repair a pipe. Spot RT of will be performed on the new welds. What else is recommended?

    A. MT or PT only the root pass for single-groove welds
    B. MT or PT the root & final pass single-grooves welds
    C. MT or PT only the root pass for double-grooves welds
    D. Spot UT to confirm RT results

32. An insert plate is used to repair a pipe. RT/UT is not required on the construction code on these new welds. What does PCC-2 recommend? **This may have more than one correct answer, select all answers that apply.**

    A. The pipe shall be pressure tested
    B. If practical, the pipe should be pressure tested per the construction code
    C. NDE can always be used in lieu of a pressure test
    D. NDE can be used in lieu of a pressure test if pressure testing is not practical

33. An insert plate is used to repair a pipe. A pressure test will be performed. Testing should be:

    A. completed prior to the application of coatings or insulation.
    B. completed prior to the application of insulation. But can be done after coatings.
    C. done at a pressure that 150% of vessel MAWP.
    D. always performed with water and not air.

ASME PCC-2 Study Guide

Practice Questions for API 570 Exam

Article 206: Full Encirclement Sleeves

1. Per PCC-2, a Type A full-encirclement sleeve:

   A. is designed to contain internal pressure.
   B. is designed only as reinforcement of a corroded area.
   C. has ends that are fillet-welded to the pipe.
   D. has longitudinal welds that are fillet welded.

2. Per PCC-2, a Type B full-encirclement sleeve: **This may have more than one correct answer, select all answers that apply.**

   A. is designed to contain internal pressure.
   B. is designed only as reinforcement of a corroded area.
   C. has ends that are fillet-welded to the pipe.
   D. has longitudinal welds that are fillet welded.

3. A sleeve repair is performed on a piping system that is subject to pressure or thermal cycles. Which of following is required?

   A. Must be designed as a Type B sleeve
   B. The joint efficiency used in the sleeve design cannot exceed 0.25
   C. The hardness of the welds shall not exceed 150 Brinell
   D. A fatigue evaluation should be performed

4. Per PCC-2, the minimum thickness of a Type A full-encirclement sleeve shall be:

   A. 2/3rd of the adjacent pipe wall thickness.
   B. at least the thickness of the adjacent pipe wall.
   C. 25% thicker than the thickness of the adjacent pipe wall.
   D. 50% thicker than the thickness of the adjacent pipe wall.

5. Per PCC-2, the minimum thickness of a Type B full-encirclement sleeve is being calculated. What joint efficiency should be used in the calculations for the longitudinal weld? *(the weld is **not** examined with UT)*

   A. 0.75
   B. 0.80
   C. 0.90
   D. 1.0
   E. *"I HAVE NO IDEA !!!"*

"E" may be true for you, but won't count on your test!

6. Per PCC-2, the calculations to use for determining the minimum thickness of a full encirclement sleeve, are found in:

   A. API 579.
   B. ASME Sect VIII.
   C. ASME PCC-1.
   D. the applicable construction code.

7. Per PCC-2, a full-encirclement sleeve shall extend past the defect by:

   A. 1".
   B. 2".
   C. 3".
   D. 4".
   E. 4 times the sleeve thickness.

8. A 0.625" full-encirclement Type B sleeve is installed on a pipe that is 0.500" thick. The gap between the sleeve and pipe is 0.020". What is the minimum size of fillet-welds at the end of the sleeve?

   A. 0.500"
   B. 0.520"
   C. 0.545"
   D. 0.625"
   E. 0.645"
   F. 0.750"

9. What is the maximum allowed undercut on the circumferential fillet-weld of a full-encirclement sleeve?

   A. 0"
   B. 1/32"
   C. 1/16"
   D. Per applicable construction code

10. What is one potential problem with the Type B sleeve?

    A. Determining joint efficiency of circumferential welds
    B. Determining the number of potential stress cycles
    C. Pressure buildup between sleeve and pipe
    D. Undetected corrosion that goes through pipe wall

11. Per PCC-2, what are ways to minimize pressure buildup between the pipe and a Type B sleeve? **This may have more than one correct answer, select all answers that apply.**

    A. Fill space with hardenable material.
    B. Fill space with a liquid like water.
    C. Hot tap pipe, so annulus between pipe and sleeve is pressurized by product.
    D. Minimize the volume in the space by having a tight-fitting sleeve.

12. Per PCC-2, a detailed fatigue analysis shall be performed when, over the life of a repair sleeve, there are how many pressure cycles? *(Each cycle has a change of pressure that exceeds 20% of design pressure.)*

    A. > 100
    B. > 200
    C. > 400
    D. > 1000

13. Per PCC-2, a detailed fatigue analysis shall be performed when, over the life of a repair sleeve, there are how many temperature cycles? *(Each cycle has a difference of at least 100°F between the sleeve and inner pipe.)*

    A. ≥ 100
    B. ≥ 200
    C. ≥ 400
    D. ≥ 1000

14. When a fatigue analysis is required for the design of a split sleeve, the analysis should be done in accordance with:

    A. API 579.
    B. API 652.
    C. ASME PCC-1.
    D. ASME Section XIII.
    E. EIEIO – FFS.

15. Per PCC-2, when installing any split sleeve (Type A or B), which of the following statements are correct? **This may have more than one correct answer, select all answers that apply.**

    A. The gap between the pipe and sleeve must be filled with hardenable filler material.
    B. Pipe area covered by the sleeve should be cleaned to bare metal.
    C. No gap is allowed between the pipe and sleeve.
    D. The maximum gap between the pipe and sleeve is 3/32".
    E. A fatigue analysis must be always be performed.

16. When installing a Type B split sleeve, which of the following statements are correct? **This may have more than one correct answer, select all answers that apply.**

    A. If using filler material before welding, ensure it does not extrude to the weld areas.
    B. The longitudinal weld can be either a butt-weld or fillet-weld.
    C. The longitudinal weld shall be a butt-weld that is fused to the pipe.
    D. The longitudinal weld shall be a butt-weld that uses a backing strip.
    E. The longitudinal weld shall be a butt-weld.
    F. The sleeve should be vented during the final closure weld.

17. When installing a Type A split sleeve, which of the following statements are correct?

    A. The longitudinal weld can be either a butt-weld or fillet-welded lap joint.
    B. The longitudinal weld shall be a butt-weld that is fused to the pipe.
    C. The longitudinal weld shall be a butt-weld that uses a backing strip.
    D. The longitudinal weld shall be a butt-weld.

18. PCC-2 recommends that during the sleeve installation, the pipe's pressure shall be lowered to:

    A. 0 psig *(depressured).*
    B. 25-50 psig.
    C. 25–50% of MAWP.
    D. 25-50% of operating pressure.
    E. 50-80% of MAWP.
    F. 50-80% of operating pressure.

19. The longitudinal weld of a Type A sleeve shall be examined by:

    A. MT or PT.
    B. MT or PT or UT.
    C. MT or PT or UT or RT.
    D. UT or RT.

20. Circumferential welds of a Type B sleeve shall be examined by: *(delayed cracking is not an issue)*

    A. MT or PT of only final pass.
    B. MT or PT of root pass and final pass.
    C. MT or PT or UT of only final pass.
    D. MT or PT or UT of root pass and final pass.

21. Delayed cracking is an issue during the installation of a split sleeve. NDE should be used to examine the circumferential welds after waiting:

    A. 4 hrs.
    B. 8 hrs.
    C. 12 hrs.
    D. 24 hrs.
    E. 48 hrs.

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Practice Questions for API 570 Exam

Article 209: Alternatives to PWHT

1. PWHT is used in ferritic welds to: **This may have more than one correct answer, select all answers that apply.**

   A. diffuse hydrogen.
   B. increase grain size.
   C. provide tempering.
   D. reduce hardness.

2. PWHT of ferritic materials is performed at a temperature that is:

   A. below the lower transformation temperature.
   B. between the lower and upper transformation temperature.
   C. above the upper transformation temperature.
   D. above the casting temperature.

3. During repairs to carbon steel pipe, when might using a PWHT alternatives ***not*** be a good idea?

   A. If material is subject to reheat cracking
   B. If PWHT is a requirement from the construction code
   C. If PWHT is specified because of a process service, i.e caustic
   D. On larger diameter piping

4. What is one type of alternative to PWHT?

   A. Peening
   B. Elevated preheat temp
   C Elevated interpass temp
   D. Elevated preheat maintenance temp

5. What is one type of alternative to PWHT?

   A. API - Applied Pressure Induction
   B. Bead Cross-over Welding
   C. MSTS – Minimum Stress Through Saturation
   D. Stress Control Welding
   E. Temper Bead Welding

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Practice Questions for API 570 Exam

Article 210: <u>In-Service Welding on CS Components</u>

1. What are the primary technical concern(s) when performing In-Service welding? **This may have more than one correct answer, please select all answers that apply.**

   A. Burn through
   B. Carburization
   C. Coking
   D. Hydrogen Cracking

2. Which of the following is correct concerning in-service welding on materials less than the 0.250" thick?

   A. Welding machine should operate at less than 15 amps
   B. Electrode diameter should not exceed 0.094"
   C. Requirements detailed in API 2102 should be followed
   D. Never perform in-service welding on materials ≤ 0.250"

3. Which is ***<u>not</u>*** a factor in Hydrogen Cracking of welds?

   A. Allowable stress of the base metal
   B. Hydrogen … Duh!
   C. Residual tensile stresses from welding
   D. Weld microstructure

4. Crack-susceptible microstructures typically have a microstructure high in:

   A. Austenitic structure.
   B. Ductility.
   C. Hardness.
   D. Toughness.

5. For in-service welding, how is high microstructure hardness controlled?

   A. Preheat and PWHT temperatures
   B. Rod size and Shielding Gas
   C. Ferrite Equivalence and Preheat Temperature
   D. Carbon Equivalence and the Cooling Rate

6. Why does likelihood of hydrogen cracking increase with in-service welding? *(compared to out-of-service welding)*

   A. The process on the other side causes coking which causes high carbon in the weld.
   B. The process on the other side causes rapid cooling.
   C. With field welding, it is difficult to achieve adequate shielding of the weld.
   D. Vibrations in the field causes molecular compaction which creates hard zones.

7. During in-service welding, which of the following is used to minimize microstructure hardness? **This may have more than one correct answer, please select all answers that apply.**

   A. Low Hydrogen Electrodes
   B. Argon gas
   C. Special weld procedures
   D. Preheat

8. During in-service welding, which of the following is correct?

   A. High heat input lowers likelihood of burn-through & minimizes microstructure hardness.
   B. High heat input increases likelihood of burn-through & minimizes microstructure hardness.
   C. Low heat input lowers likelihood of burn-through & minimizes microstructure hardness.
   D. Low heat input increases likelihood of burn-through & increases microstructure hardness.

9. When welding on thinner materials it may be necessary to use a smaller diameter rod. What are the potential results? **This may have more than one correct answer, select all that apply.**

   A. Less likely to burn-through
   B. More likely to burn-through
   C. Less likely to form weld microstructure that is susceptible to hydrogen cracking
   D. More likely to form weld microstructure that is susceptible to hydrogen cracking

10. During in-service welding, if there is an increase in the process flow rate the likelihood of:

    A. burn-through increases.
    B. H_2 cracking increases.
    C. forming austenitic structure increases.
    D. forming microstructure soft zones increases.

11. During in-service welding, if there is a decrease in the process flow rate the likelihood of:

    A. burn-through increases.
    B. H_2 cracking increases.
    C. forming austenitic structure increases.
    D. forming microstructure hard zones increases.

12. Which is difficult to perform with In-Service welding?

    A. Controlled deposition welding
    B. Minimizing risk of burn-through
    C. PWHT
    D. Temper-bead welding

13. A weld procedure is being qualified for In-Service welding. Which of the following is considered an Essential Variable for the qualification test? **This may have more than one correct answer, select all that apply.**

    A. Bevel Angle
    B. Carbon Equivalence
    C. Cooling Rate
    D. Peening

14. A weld procedure is being qualified for In-Service welding. Which of the following is considered an Essential Variable for the qualification test? **This may have more than one correct answer, select all that apply.**

    A. Deposition Sequence
    B. Welding Position
    C. Postweld Backout
    D. Welding Current

15. An in-service welding procedure is being qualified for weld metal buildup. The test coupon wall thickness is 3/8". What bend tests should be conducted?

    A. Bends tests are not needed
    B. 4 Face Bends
    C. 2 Face Bends and 2 Side Bends
    D. 2 Face Bends and 2 Root Bends or 4 Side Bends

16. An in-service welding procedure is being qualified for an attachment weld. The test coupon wall thickness is 5/8". What bend tests should be conducted?

    A. Bends tests are not used to qualify an attachment weld procedure
    B. 4 Face Bends
    C. 2 Face Bends and 2 Side Bends
    D. 2 Face Bends and 2 Root Bends or 4 Side Bends

17. An in-service welding procedure is being qualified for weld metal buildup. The test coupon wall thickness is 3/4". What bend tests should be conducted?

    A. Bends tests are not needed
    B. 4 Face Bends
    C. 2 Face Bends and 2 Side Bends
    D. 2 Face Bends and 2 Root Bends or 4 Side Bends

18. An in-service welding procedure is being qualified. Which of the following is correct? **This may have more than one correct answer, select all that apply.**

    A. Hardness test are done in accordance with ASTM EIEIO-50
    B. At least 4 sets of hardness readings are required
    C. Each set of hardness readings should have at least 5 Vickers hardness readings
    D. Each set of hardness readings should have at least 5 Rockwell hardness readings
    E. The hardness readings should be taken in the small-grain HAZ

19. An in-service welding procedure is being qualified for an attachment weld. In the bend tests, what is the acceptance criteria for flaws in the weld or HAZ?

    A. No flaw that exceeds 1/16" *(0.063")*
    B. No flaw that exceeds 1/8" *(0.125")*
    C. No flaw that exceeds the lesser of 1/16" or the one-half the wall thickness
    D. No flaw that exceeds the lesser of 1/8" or the one-half the wall thickness

20. When In-Service welding is performed it should be examined with NDE in accordance with the applicable construction or post-construction code. If hydrogen cracking is a concern, the in-service welds should be examined:

    A. within 1 hour of the completion of the weld.
    B. within 12 hours of the completion of the weld.
    C. after a delay of 6-24 hours after the completion of the weld.
    D. after a delay of 24-72 hours after the completion of the weld.

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Practice Questions for API 570 Exam

Article 211: Weld Buildup, Weld Overlay & Clad Repairs

1. Weld Overlay refers to adding:

   A. weld metal to carbon steel or low alloy materials to restore base metal thickness.
   B. corrosion resistant weld metal *(alloy)* to carbon steel or low alloy materials.
   C. alloy weld metal to carbon steel or low alloy materials to restore alloy cladding.
   D. weld passes in a specific method to temper the previous passes.

2. Weld metal buildup is performed on a corroded steel pipe. The tensile strength of the electrode used for this repair, should:

   A. greater than or equal the allowable stress of the pipe.
   B. greater than or equal the yield stress of the pipe.
   C. greater than or equal 95% of the tensile strength of the pipe.
   D. greater than or equal the tensile strength of the pipe.

3. What are common electrodes that are used when performing SS weld overlay on carbon steel base metal?

   A. Type 309
   B. Type 310
   C. Type 309 followed by Type 308
   D. Type 308 followed by Type 309

4. What is one potential problem when using weld overlayed areas in equipment that operates in cyclic temperature?

   A. Differential rates of thermal expansion
   B. Lack of fusion
   C. Polythionic stress cracking
   D. Thermal carburization

5. Prior to performing Back Cladding, the existing cladding shall be:

   A. checked for thickness on both sides of the weld within 6" of the new weld.
   B. checked for disbonding on both sides of the weld within 12" of the new weld.
   C. etched with nitric acid.
   D. removed a minimum of 1/4" from the edge of the plate.

6. The Back Cladding weld cap height shall ***not*** exceed:

   A. height of the cladding.
   B. 1/16".
   C. 1/8".
   D. lesser of 10% of the wall thickness or 1/32".

7. SS weld overlay is performed on a 5% Cr pipe that is 0.5" thick. There are some weld repairs needed to the 5 Cr material prior to performing the weld overlay. What should be done after the 5 Cr repairs are completed, but before the weld overlay is performed?

   A. Nothing, overlay!
   B. Preheat to 500 °F
   C. PWHT
   D. UT flaw detection to check for delayed cracking

8. SS weld overlay is performed on a CS pipe that is 0.5" thick. There are some weld repairs needed to the base material prior to performing the weld overlay. What should be done after the carbon steel repairs are completed, but before the weld overlay is performed?

   A. No addition work is needed prior to performing weld overlay
   B. Preheat to 500 °F
   C. PWHT
   D. Use Metallography to determine if grain structure is appropriate

9. SS weld overlay is performed on a large CS pipe that is 1.625" thick. There are some weld repairs needed to the base material prior to performing the weld overlay. What should be done after the carbon steel repairs are completed, but before the weld overlay is performed?

   A. No addition work is needed prior to performing weld overlay
   B. Preheat to 300 °F
   C. PWHT
   D. Use Metallography to determine if grain structure is appropriate

10. SS weld overlay is performed on a pipe that has a 7% Cr base material that is 1.0" thick. PWHT heat will need to be performed. The final PWHT:

    A. may be substituted with a 300 °F preheat.
    B. must be done prior to the weld overlay.
    C. must be done after to the weld overlay is complete.
    D. may be done after the 1st layer of weld overlay or when the overlay is completed.

11. Weld buildup is performed on a CS pipe. After welding, the repair area:

    A. may be examined by NDE *(MT, PT, etc.)*.
    B. may be examined by NDE *(MT, PT, etc.)* in accordance with appropriate code.
    C. must be examined by NDE *(MT, PT, etc.)*.
    D. must be examined by NDE *(MT, PT, etc.)* in accordance with appropriate code.

12. Weld buildup is performed on a CS pipe that is ½" thick. After welding, the repair area:

    A. should be examined by RT.
    B. should be examined by UT flaw detection.
    C. should be examined by RT or UT flaw detection.
    D. shall be examined by RT or UT flaw detection.

13. Existing SS overlay on a carbon steel base is eroded and will be repaired. The damaged overlay is removed. Prior to applying the new overlay, the carbon steel surface should be examined using:

    A. a copper sulfate solution to verify the complete removal of the stainless steel.
    B. sulfuric acid to etch the CS to verify the complete removal of the HAZ.
    C. metallography to assure embrittled areas have been removed.
    D. WFMPT to assure H_2S cracking has not occurred.

14. Multilayer SS weld overlay is being performed. What should be done after the 1st layer is welded?

    A. Examine with MT
    B. Examine with PT
    C. Raise the temperature to 500 °F for 1 hour to assist in out gassing hydrogen
    D. Nothing, just weld the 2nd layer

Article 212: Fillet Weld Patches

1. Per PCC-2, a fillet-welded patch is acceptable provided the:

    A. process temperature does not exceed 650°F.
    B. process temperature does not exceed 800°F.
    C. process pressure does not exceed 350 psig.
    D. process pressure does not exceed 1000 psig.
    E. the equipment is not subject to temper-embrittlement.

2. A pipe wall is cracked. Per PCC-2, which of the following is correct?

    A. A fillet-weld patch can never be used to cover a crack.
    B. The crack must be removed, area prepped and rewelding to original thickness.
    C. The crack must be removed. The area is prepped & rewelding to original thickness, or the ground down area can be evaluated as a locally thinned area.
    D. A fillet weld patch may be used if the crack growth has stopped.

3. A fillet-welded patch covering a corroded area on a pipe:

    A. should extend into sound metal by 6".
    B. must be the same thickness as the pipe wall.
    C. should be of the same or similar material as the pipe wall.
    D. in alloy service must be the same material as the pipe wall.

4. The minimum thickness of a fillet-welded patch is:

    A. the thickness of the pipe wall loss.
    B. the nominal thickness of the pipe wall.
    C. twice the nominal thickness of the pipe wall.
    D. based on the calculated needed size of the attachment welds.

5. A fillet welded patch must overlap sound metal by:

    A. 1".
    B. 2".
    C. the greater or 2T or 2".
    D. the greater of 2T of 4".

6. Per PCC-2, the minimum radius on a patch plate is:

    A. 1".
    B. 2".
    C. 3".
    D. 6".

7. A large diameter pipe with internal pressure has a corroded area on the inside wall. Per PCC-2, if a fillet welded patch is used, it:

   A. can be used on the inside or the outside of the pipe.
   B. must actually cover the corroded area whether inside or outside of the pipe.
   C. must be placed on the outside of the pipe.
   D. normally is placed on the outside of the pipe.

8. A locally thinned area on the inside of a pipe is repaired using an external fillet welded patch. Per PCC-2, which of the following is correct?

   A. The patch must have rounded corners with a minimum radius of 1".
   B. The patch thickness must not exceed the pipe wall thickness.
   C. If damage is expected to be through-wall, a fillet weld patch is not allowed.
   D. If damage is expected to be through-wall, the engineer must consider possible corrosion between the pipe wall and inside of patch.

9. A fillet welded patch is installed on a 10' diameter flare line. The pipe wall thickness is 0.750". Per PCC-2, how far must this patch be from an existing fillet welded patch?

   A. 3" C. 13.5"
   B. 5.5" D. 19"

10. A fillet welded patch is installed on a 72" diameter pipe near a branch connection. The pipe wall thickness is 0.500". Per PCC-2, if the patch does not extend to the branch connection, how far must this patch be set back from the branch?

    A. 4" C. 12"
    B. 8.5" D. 14.5"

11. A fillet welded patch is installed on a large diameter pipe near a branch connection with a repad. Which of the following is correct?

    A. Patch can be contoured to the repad & welded to the pad with a full penetration weld.
    B. Patch can be contoured to the repad & fillet welded 1" away from the repad fillet weld.
    C. Patch must be set back from the repad by the greater of 2T or 3".
    D. The repair patch can never be attached to the existing repad.

12. When designing a fillet welded patch per PCC-2, the joint efficiency used in the calculation is:

    A. 0.45. C. 0.70.
    B. 0.55. D. same as the joint efficiency of the equipment.

13. When rolling a fillet welded patch to the shape of the pipe, the plate must be stress relieved if the patch's fiber elongation exceeds:

    A. 0.35%. C. 3.5%.
    B. 2%. D. 5%.

14. A fillet welded patch is installed a large diameter pipe. The patch should be fitted tightly to the pipe surface. The maximum separation between the patch and the plate is:

    A. 1/32".
    B. 1/16".
    C. 1/8".
    D. 3/16".

15. Welding procedures and welders used on a fillet welded patch should be qualified to the requirements of the appropriate equipment code or:

    A. ASME Sect IX.
    B. API 579.
    C. API 1104.
    D. AWS D1.1.

16. Before welding a fillet welded patch, how much of the paint & rust should be removed?

    A. 1.5" band, weld will be centered in the clean band.
    B. 6" band, weld will be centered in the clean band.
    C. 1.5" width on either side of the future weldment.
    D. 6" width on either side of the future weldment.

17. Prior to welding a fillet welded patch, any existing butt welds covered the patch should be:

    A. ground flush.
    B. ground flush and examined with either MT or PT.
    C. examined with either RT or UT.
    D. visually examined and caps tapered with weld metal to achieve a 3:1 taper.

18. A fillet welded patch should be should have a vent. What is the purpose of the vent?

    A. To provide indication if the equipment wall has through-wall damage.
    B. To provide a vent during welding.
    C. To provide a vent during welding and postweld heat treating.
    D. To provide a spot to put extra UT grease.

19. The fillet welds on a fillet welded patch are normally examined with:

    A. MT or PT.
    B. RT.
    C. UT.
    D. Light hammer taps.

20. Lifting lugs were used on a fillet weld patch for a large pipe. After patch installation, the lugs were removed. Which is correct concerning the area of the removed fillet welds?

    A. No need for any special examination.
    B. Need to be examined visually. Indications should be further examined with MT or PT.
    C. Need to be examined with either MT or PT.
    D. Need to be examined with UT.

21. Which of the following is correct concerning a pressure test of a fillet weld patch?

    A. Testing shall be performed prior to application of patch coatings.
    B. Testing can be performed after application of patch coatings, but before insulation.
    C. Testing of patch should be performed at 1.5 times the design pressure.
    D. Testing is not required, since welds have been examined by NDE.

ASME PCC-2 Study Guide

Practice Questions for API 570 Exam

Article 304: Flaw Excavation & Weld Repair

1. When grinding out a flaw, overloading the grinding wheel can cause: **This may have more than one correct answer, select all correct answers**

   A. formation of untempered martensite structure.
   B. formation of tempered austenite.
   C. shallow surface cracks.
   D. wheel residue to be impregnated in the finished material.

2. When grinding out a flaw, uneven and rough finishes could result in a failure by:

   A. erosion.
   B. fatigue.
   C. galvanic corrosion.
   D. liquid-metal embrittlement.

3. When removing a flaw, rotary files should be considered for use on:

   A. all alloyed materials.
   B. austenitic materials.
   C. chrome alloys.
   D. nickel alloys.
   E. titanium alloys. *(do I hear P-53's?)*

4. A flaw is removed by grinding on a carbon steel material. This grinding wheel should:

   A. not be used again.
   B. examined with PT for cracking.
   C. only be used in the future on the same materials *(ASTM # & grade)*.
   D. only be used in the future on the materials with the same P#.
   E. not be used on austenitic stainless materials.

5. An austenitic SS is contaminated with residue from a grinding wheel that was previously used on Carbon Steel materials. What is a possible future problem?

   A. Fatigue
   B. Hard microstructures
   C. Surface pitting
   D. Wet H_2S cracking

6. What should be done prior to grinding out stress corrosion cracks in stainless steel?

   A. Qualify the amount of heat input
   B. Qualify the grinding wheel type
   C. Select a quick cutting tool like a rotary file
   D. Select a wide cutting tool to distribute the heat input

7. Repairs are being made to a pipe that has experienced caustic cracking. To prevent additional cracking, which of the following should be considered during the repairs? **This may have more than one correct answer, select all correct answers**

   A. Clean the area with appropriate cleaning procedures
   B. Preheat
   C. Pre-PWHT
   D. Use flaw-removal methods that generate lower heat

8. When removing flaws, flapping is:

   A. a technique that is commonly used to smooth large rough areas.
   B. a technique that is commonly used prior to adding a hot tap.
   C. good for quickly removing deep linear flaws.
   D. good only for removal of superficial surface blemishes.

9. When removing a flaw, what is one potential problem when using thermal gouging?

   A. Brittle heat-affected zones may be created
   B. Oxidation residue may damage the gouged area
   C. Residue left in some alloys will cause future surface pitting
   D. Stress corrosion cracking may occur

10. A small crack is going to be removed by grinding. Which of the following is correct?

    A. The excavated area must be repaired with weld-buildup.
    B. When performing weld buildup in this area, the GTAW process must be used.
    C. If weld buildup is not used, the edges of the excavated area must have a 3:1 taper.
    D. The edges of the excavated area must always have a 3:1 taper.

11. Thermal gouging is used to remove a flaw. What needs to be done prior to welding?

    A. Remove an additional 1/32" of material by a type of grinding
    B. Remove an additional 1/16" of material by a type of grinding
    C. Acid-etch the remaining surface to look for hard microstructures
    D. Caustic-etch the remaining surface to look for hard microstructures

12. A surface crack is going to be removed. Prior to grinding, what technique may be used to prevent the crack from growing during the crack-removal grinding?

    A. Drill the ends of the crack
    B. Drill small holes along the crack at a spacing that does not exceed $\frac{1}{2}$"
    C. Peen the ends of the crack.
    D. Peen the entire crack

Article 305: <u>Flange Repair & Conversion</u>

1. Deep corrosion has occurred on a flange-facing. After re-machining, the remaining thickness will ***<u>not</u>*** be adequate for the pressure design rating. Which of the following is correct?

   A. The flange must be replaced.
   B. Must either replace the flange or weld build-up & re-machine the flange face.
   C. Could weld build-up & re-machine the flange face, or add a split-ring to the back of the existing flange.
   D. Could add a split-ring to the back of the existing flange, or use bolts with higher tensile strength.
   E. Could evaluate the reduced thickness per API 580.

2. Weld build-up of a flange facing is required. What is suggested by ASME PCC-2 that will help prevent future distortion of the flange that is the result of residual welding stresses?

   A. PWHT prior weld build-up
   B. PWHT after weld build-up but prior to re-machining
   C. PWHT after re-machining
   D. PWHT both after welding and after re-machining
   E. Use a temper-bead welding procedure for the weld build-up

3. When refinishing a flange face, the minimum finished height of a raised face flange is:

   A. 0.031".
   B. 0.060".
   C. 0.100".
   D. 0.250".

4. What is maximum flange face finish specified in ASME B16.5 for a ring joint flange?

   A. 63 micro-inch
   B. 125-micro-inch
   C. 250 micro-inch
   D. 500 micro-inch

5. What is standard flange face finish specified in B16.5 for a raised face flange?

   A. 63 micro-inch
   B. 125-micro-inch
   C. 125-250 micro-inch
   D. 250-500 micro-inch

6. Per B16.5, a refinished raised face flange, should have a *"groove density"* of:

   A. 10-25 grooves per inch.
   B. 25-35 grooves per inch.
   C. 35-45 grooves per inch.
   D. 45-55 grooves per inch.

7. Which of the following is correct about converting a ring-joint flange to a raised-face flange?

   A. This flange type cannot be converted to a raised face flange.
   B. If converting to a raised face flange, the weld material must match the base material.
   C. The *"R"* marking must be removed or defaced.
   D. The *"R"* marking must be changed to *"RF"*.

8. An existing flange has damage on the flange facing. Weld build-up and re-machining of the flange facing is required. Which of following statements is correct concerning any NDE? **This may have more than one correct answer, select all correct answers.**

   A. Only NDE needed is the visual exam of the re-machined surface.
   B. If welds are susceptible to cracking, MT or PT should be done after each weld pass.
   C. MT or PT must be performed on the final weld pass.
   D. MT or PT must be performed after the surface area is re-machined.

9. Any repaired flange should be:

   A. given a leak test prior to being placed in service or an initial service leak test.
   B. marked with a *"RF"* indicated as a repaired flanged.
   C. re-machined per the ASME Sect VIII Div 2 Article 6 requirements.
   D. checked for delayed cracking.

ASME PCC-2 Study Guide

Practice Questions for API 570 Exam

Article 306: Mechanical Clamps

1. Mechanical clamps are typically used to:

   A. hold pipe in place during repairs or fabrication.
   B. hold a spring support.
   C. seal growing cracks.
   D. seal a leak.

2. The annular space between a mechanical clamp and the repaired surface:

   A. might be filled with epoxy or sealant.
   B. must have a spacing that does not exceed 1/16".
   C. shall be left empty *(unfilled).*
   D. should be filled with refractory in cold services.

3. A non-structural clamp is:

   A. one designed to contain the leak and weight of the piping load.
   B. one designed only to contain the leak.
   C. not allowed in any Piping Class.
   D. not allowed in only Class 1 piping.

4. In which of the following situations can a mechanical structural clamp ***not*** be used?

   A. Crack going around a circumferential weld
   B. Crack going along a longitudinal weld
   C. Gasket leak of a set of flanges
   D. Leaking Class 1 piping

5. A mechanical clamp with sealants may ***not*** be effective in which of the following services?

   A. High-temperature services
   B. Low-temperature services
   C. Pressures exceeding 150 psig
   D. Vacuum services

6. Sometimes a mechanical clamp can create new future problems. These include. **This may have more than one correct answer, select all correct answers.**

   A. Clamped flanges may now have degradation of covered bolting. *(Corrosion or cracking)*
   B. Clamped flanges may now have an increased temperature causing bolts to yield.
   C. Clamped area causes flow restriction that increases process velocity & erosion.
   D. Leaking process in annular area over pressures the clamp due to increase temperature from sunshine.
   E. Welded clamps in hot service may crack due to differential thermal expansion rates

7. A mechanical clamp is being designed for leaking hot pipe. Which of the following is ***not*** an important design consideration?

   A. Maximum Pressure
   B. Maximum Temperature
   C. Engineer's birthday
   D. Load *(weight)* of the clamp
   E. Differential expansion or contraction

8. Localized corrosion is occurring around an entire circumferential weld. A mechanical clamp is used repair this weld. This clamp:

   A. should be designed using higher alloy than the pipe.
   B. must have annular area between pipe & clamp filled with epoxy to stop the corrosion.
   C. can rely on clamp friction to prevent line separation.
   D. shall have a locking mechanism or strong back to prevent line separation.

9. Mechanical clamps covering a pin-hole leak, should be designed with which of the following?

   A. Epoxy filled annular area
   B. Strong-backs
   C. Vent
   D. Welded ends

10. The vent on a mechanical clamp is used for which of the following reasons? **This may have more than one correct answer, select all correct answers.**

    A. Vent area during assembly
    B. Vent annular area prior to clamp removal
    C. Place often used to inject sealant in the annular area
    D. Used as a repad's "*weep-hole*" to indicate pipe wall has a through wall failure

11. A pipe has a pin-hole leak and will be repaired with a mechanical clamp. What are potential problems that can occur when injecting sealant in the annular space between the pipe wall and mechanical clamp? **This may have more than one correct answer, select all correct answers.**

    A. The sealant leaks out the ends of the clamp
    B. The external pressure on the pipe collapses the pipe wall
    C. Sealant seeps into pipe causing problems with downstream components
    D. The sealant plugs the leak

12. Per PCC-2, in which of the following situations does a special analysis have to be performed prior to installing a mechanical clamp?

    A. Elbow on pipe
    B. Expansion joint
    C. Flanges
    D. Weld pin-holes

13. A mechanical clamp is used to cover a pipe leak. Which of the following is correct? **This may have more than one correct answer, select all correct answers.**

    A. Annulus between clamp and pipe should be pressure tested.
    B. A wrap may be used to stop the leak prior to installing the clamp.
    C. The ends of the clamp may be welded to the pipe.
    D. The clamp vent should be plugged with grease.

ASME PCC-2 Study Guide

Practice Questions for API 570 Exam

Article 501: Pressure Testing & Tightness Testing

1. All other testing methods should be considered prior to performing a:

   A. hydrotest.
   B. in-service Leak test.
   C. pneumatic test.
   D. tightness test.

2. What is the primary purpose of a pressure test?

   A. Ensure gross integrity of pressure equipment
   B. Ensure overall tightness of pressure equipment
   C. Substitute for a code required PWHT
   D. Provides something to do for a bored API inspector.

3. What is the primary purpose of a tightness test?

   A. Ensure bolts have appropriate thread engagement
   B. Ensure overall leak tightness
   C. Validate quality of welds
   D. Ensure that threaded pipe has at least 4 threads of engagement

4. Hydrotesting can provide some:

   A. embrittlement of welds.
   B. fatigue resistance.
   C. reduction of MDMT.
   D. mechanical stress relieving.

5. How does hydrotesting provide some stress relief?

   A. At local regions of high stress, a localized yielding occurs. So, after the test, this area has a localized region of compressive stresses.
   B. At local regions of high stress, a localized fatiguing occurs. So, after the test, this area has a localized region of lower tensile stresses.
   C. Throughout the equipment yielding occurs. So, after the test, the equipment has nothing but compressive stresses.
   D. That's crazy! A pressure test does NOT relief stresses!

6. What can reduce or eliminate the benefits of the stress-relief occurring during a hydrotest?

   A. Operating at elevated pressure
   B. Operating at elevated temperature
   C. Operating at a vacuum
   D. Operating with a high concentration of C_3H_8

7. When might an in-service leak test be considered?

   A. After replacing a 100' of 10 NPS pipe.
   B. After a turnaround on a piping system that operates with 5% H_2S.
   C. After installing an insert patch.
   D. After an outage on a cooling water piping system.

8. What is the purpose of a pressure test? **This may have more than one correct answer, please select all answers that apply.**

   A. Improve MDMT
   B. Support the new conditions of a rerate
   C. Support needed recertification of integrity
   D. Validate integrity after a repair or alteration

9. When should a hydrotest ***not*** be done? **This may have more than one correct answer, please select all answers that apply.**

   A. Structure cannot support weight of liquid
   B. Piping with Teflon lining
   C. A hydrotest will be inconvenient to perform
   D. Traces of remaining liquid may contaminate the operating process
   E. Piping with refractory lining

10. A test device to perform a localized test, like hydrotesting just one weld, instead of testing an entire piping system, is:

    A. never allowed in PCC-2.
    B. allowed only to prevent having to do a pneumatic test.
    C. allowed if the other system welds have already been tested.
    D. allowed only if the pipe is made from higher alloys.

11. Per PCC-2, during a pressure test, the metal temperature should be:

    A. ≥ freezing.
    B. ≥ MDMT.
    C. ≥ MDMT + 10°F.
    D. ≥ MDMT + 30°F.

12. The ductile-to-brittle transition temperature of a material may be altered on some pipe when the pipe is operated above:

    A. 500 psig.
    B. a ph of 9.0.
    C. 700°F.
    D. 250 ppm of chloride.

13. What materials are most subject to changes in the ductile-to-brittle transition temperature? ***Note:*** In API 570 this is change is called temper-embrittlement.

    A. Carbon Steels
    B. Low Chromes
    C. High chromes
    D. Nickel alloys

14. Which of the requirements apply to pressure gauges used for a pressure test? **This may have more than one correct answer, please select all answers that apply.**

    A. All test gauges should be calibrated.
    B. Should have a pressure range that is not more the six times the test pressure.
    C. Gauges should be located at the high point of the vessel or pipe system being tested.
    D. All gauges used in pressure tests shall have a digital display.
    E. All gauges should meet requirements of ASME PTC 19.2 or similar.

15. For a specific hydrotest, the owner decides a relief device is needed to prevent any overpressure. The hydrotest pressure is 200 psig. Per PCC-2, what is the maximum set pressure for this relief device?

    A. 205 psig
    B. 210 psig
    C. 220 psig
    D. 250 psig

16. For a specific hydrotest, the owner decides a relief device is needed to prevent any overpressure. The hydrotest pressure is 600 psig. Per PCC-2, what is the maximum set pressure for this relief device?

    A. 610 psig
    B. 650 psig
    C. 660 psig
    D. 690 psig

17. What problem is created when the welds are painted prior to the pressure test?

    A. The paint may completely plug a pin-hole during the test.
    B. Painted surfaces make it more difficult to see a leak.
    C. Paint may contaminate the process.
    D. Paint materials may contaminate the hydrotest water.

18. Per PCC-2, when hydrotesting an austenitic SS pipe the membrane stress shall ***not*** exceed:

    A. 90% of the material's yield stress.
    B. 100% of the material's yield stress.
    C. 90% of the material's tensile stress.
    D. 100% of the material's tensile stress.

19. Per PCC-2, which of the following applies to the testing liquid? **This may have more than one correct answer, please select all answers that apply.**

    A. Salt water or brackish water should not be used.
    B. Water should be free from microbes.
    C. Water should not have sediments.
    D. Chloride content shall always be less than 25 ppm.

20. Per PCC-2, during a hydrotest, the hydrotest pressure is reached and held. Then the pressure is reduced for the visual inspection. What is the minimum hold time while the equipment is at its maximum pressure?

    A. 10 minutes
    B. 15 minutes
    C. 30 minutes
    D. 60 minutes

21. Per PCC-2, when a pneumatic test is performed, what is the preferred testing medium?

    A. Air
    B. Operational Gas
    C. Natural Gas
    D. Nitrogen

22. What problem is created when performing a pneumatic test with air? **This may have more than one correct answer, please select all answers that apply.**

    A. If a hydrocarbon system being tested is not clean, an explosive mixer may be created.
    B. High dew-point air when compressed will cause moisture to condense.
    C. Chlorides are likely to condense
    D. Compressed air has considerably more energy than compressed nitrogen.

23. Per PCC-2, when a pneumatic test is performed, the maximum allowed stored energy for the test shall ***not*** exceed:

    A. 2 lb of TNT.
    B. 200 ft-lbs.
    C. 200,000 ft-lbs.
    D. 200,000,000 ft-lbs.
    E. USA National Debt in ft-lbs.

24. For a specific pneumatic test, a relief device is needed to prevent any overpressure. The test pressure is 60 psig. Per PCC-2, what is the maximum set pressure for this relief device?

    A. 65 psig
    B. 66 psig
    C. 70 psig
    D. 80 psig

25. For a specific pneumatic test, a relief device is used to prevent any overpressure. The test pressure is 120 psig. Per PCC-2, what is the maximum set pressure for this relief device?

    A. 125 psig
    B. 130 psig
    C. 132 psig
    D. 144 psig

26. When performing a pneumatic test, the amount of stored energy should be converted to equivalence of which of the following?

    A. Grains of Gunpower
    B. Number of Grenades
    C. Ounces of Uranium
    D. Pounds of TNT

27. When performing a pneumatic test, what is the 1st step pressure?

    A. Raise pressure to the lesser of 10 psig or 10% of test pressure.
    B. Raise pressure to the lesser of 25 psig or 25% of test pressure.
    C. Raise pressure to the lesser of 50 psig or 35% of test pressure.
    D. Raise pressure to the lesser of 50 psig or 50% of test pressure.

28. A pneumatic test is being done. No leaks were discovered in the 1st pressure step. What should be done in the first part of the 2nd testing step? Increase pressure to the:

    A. lesser of Step 1 pressure plus 50 psig or 35% of test pressure.
    B. greater of Step 1 pressure plus 50 psig or 35% of test pressure.
    C. lesser of Step 1 pressure plus 75 psig or 50% of test pressure.
    D. greater of Step 1 pressure plus 75 psig or 50% of test pressure.

29. A pneumatic test is being performed. The equipment is at 50% of test pressure and no leaks are discovered. What should be done to complete raising the pressure to the test pressure?

    A. Increase pressure in 10% increments of test pressure. Hold for 5 min. at each step.
    B. Increase pressure in 10% increments of test pressure. Hold for 10 min. at each step.
    C. Increase pressure in 20% increments of test pressure. Hold for 5 min. at each step.
    D. Increase pressure in 20% increments of test pressure. Hold for 10 min. at each step.

30. A 150 psig pneumatic test is being performed on a large piping system. The amount of stored energy in this test is about 25,000,000 ft-lbs of energy. This is equivalent to how many pounds of TNT?

    A. 0.2 lbs
    B. 0.8 lbs
    C. 10.7 lbs
    D. 16.8 lbs
    E. 328 lbs
    F. 4100 lbs

31. A pneumatic test with nitrogen is being performed on a large piping system. During the test the amount of stored energy is equivalent to 70 lbs of TNT. If during the test, the piping fails by brittle fracture, how far could pipe fragments fly?

    A. 60 feet
    B. 140 feet
    C. 310 feet
    D. 1320 feet *(quarter mile)*

Article 502: <u>NDE in Lieu of Pressure Testing</u>

1. Why is NDE sometimes a better option than a pressure test?

    A. Caustic Service: Any residual testing water may react with the caustic to cause stress corrosion cracking.
    B. Creep Service: Small flaws that are acceptable may cause a failure during the test.
    C. Cyclic Service: Large flaws may be missed in a pressure test, but may grow during repeated pressure tests.
    D. Any Service: The stored-up energy from a hydrotest can cause a catastrophic failure.

2. Why is NDE sometimes a better option than a pressure test? **This may have more than one correct answer, please select all answers that apply.**

    A. Cost. A test may be practical but alternative NDE maybe less expensive.
    B. Skill. A pressure test requires more skill to perform than NDE.
    C. Structural Integrity. NDE can usually give a better indication of overall integrity.
    D. Timing. NDE is usually much quicker than a pressure test.

3. Why is pressure testing preferred for new construction? **This may have more than one correct answer, please select all answers that apply.**

    A. Can blunt the flaw tips *(reduces stress-multiplying effects of sharp notches)*
    B. Often finds gross fabrication deficiencies
    C. Provides a mechanical stress relief.
    D. Provides 100% assurance the equipment will not fail once it is placed in service.

4. The pressure equipment *(vessel or piping)* was hydrotested after construction. Periodic future hydrotests are:

   A. recommended in order to blunt any new in-service cracking.
   B. recommended in order to provide operations more assurance of equipment integrity.
   C. not recommended since it provides minimal new info on equipment integrity.
   D. not recommended since a there are many safety issues pertaining to a hydrotest.

5. When is a hydrotest inadvisable for equipment than has previously been in-service? **This may have more than one correct answer, please select all answers that apply.**

   A. Anytime a pneumatic test could be performed
   B. Hydrotest fluids react adversely with any residual process fluids
   C. When the cost to perform a hydrotest exceeds equipment rate of return.
   D. Foundations or support structure is inadequate for the water weight.
   E. When equipment linings or coatings could mask a leak.

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Answers with References

201: Butt-welded Insert Plates

1.	B,D	3.2	
2.	C	3.3	
3.	C	3.4	
4.	B	3.4	
5.	D	3.4	
6.	B	3.6.1	*(See Calc)*
7.	B	3.6.1	*(See Calc)*
8.	A	3.6.1 & 3.4	*(See Calc)*
9.	B	3.7	
10.	A	3.8(b)	*(See Calc)*
11.	C	3.8(b)	*(See Calc)*
12.	C	Fig 201-3.5-1	
13.	D	4.1.3	
14.	D	4.1.5	
15.	B	4.1.5	
16.	A,B,C	4.2.1, 4.2.3 & 4.2.4	
17.	C	4.2.7	
18.	B	4.2.8	
19.	C	4.2.8	
20.	A	4.2.9	*(See Calc)*
21.	C	4.3.1(a)	
22.	C	4.3.1(b)	*(See Calc)*
23.	D	4.3.1(b)	*(See Calc)*
24.	A	4.3.3	
25.	C	4.4.1	
26.	A	4.4.1 & Fig 201-3.8-2	
27.	C	4.4.2 & Fig 201-3.8-2	
28.	B	4.5.1	
29.	D	5.1	
30.	C	5.1	
31.	B	5.2	
32.	B,D	6.1	
33.	A	6.4	

201 Calcs

6. Less of 12t *(12 x 1.5)* or 15 = 18 or 15 = 15"
7. Less of 12t *(12 x 0.75)* or 15 = 9 or 15 = 9"
8. Diameter = 2 Radius = 2 x 3 = 6"
10. Noz ≤ 12" OD: 2 x OD = 2 x 4.5 = 9"
11. Noz > 12" OD: 6 + Noz + 6 = 6 + 16 + 6 = 28"
20. Less of 1/32 or 10%tw = 0.031 or 0.050 = 0.031"
22. Greater of 10 or 8tw *(8 x 0.75)* = 10 or 6 = 10"
23. Greater of 10 or 8tw *(8 x 1.5)* = 10 or 12 = 12"
24. 2 tw = 2 x 1.5 = 3"

206: Full Encirclement Sleeves

1.	B	1.1.1	
2.	A,C	1.1.2	
3.	D	2.4	
4.	A	3.1	
5.	B	3.2	
6.	D	3.3	
7.	B	3.4	
8.	E	3.5.a & Fig 206-3.5-1	*(See Calc)*
9.	A	3.5.B	
10.	C	3.6	
11.	A,C,D	3.6	
12.	C	3.8.a	
13.	B	3.8.b	
14.	A	3.8.b	
15.	B,D	4.1	
16.	A,E,F	4.2 & 4.4 & Fig 206-1.1.2-1	
17.	A	4.4	
18.	B	4.5	
19.	B	5.2	
20.	B	5.3	
21.	D	5.3	

206 Calcs

8. FW = Ts +G = 0.625 + 0.020 = 0.645"

209: Alternative to PWHT

1.	A,C,D	1.2(a)
2.	A	1.2(b)
3.	C	2.5
4.	B	4.1
5.	E	4.2.1

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210: In-Service Welding on CS

1.	A,D	1.0 (2nd & 3rd ¶)
2.	B	1.0 (2nd ¶)
3.	A	1.0 (3rd ¶)
4.	C	1.0 (3rd ¶)
5.	D	1.0 (3rd ¶)
6.	B	1.0 (4th ¶)
7.	A,C,D	1.0 (4th ¶)
8.	B	1.0 (5th ¶)
9.	A,D	1.0 (5th ¶)
10.	B	2.6
11.	A	2.6
12.	C	2.7
13.	B,C	4.1.1.2 & 4.1.1.3
14.	A,C,D	4.1.1.7, 4.1.1.9 & 4.1.1.11
15.	B	Table 210-4.2.1-1
16.	B	Table 210-4.2.1-1
17.	C	Table 210-4.2.1-1
18.	C	4.2.1.2
19.	D	4.2.1.4(a)
20.	D	5.2

211: Buildup,O'lay & Clad Repair

1.	B	1.5.1
2.	D	3.5
3.	C	3.6
4.	A	3.8.1
5.	D	4.4.2
6.	B	Fig 211-4.4.1-1(b)
7.	C	4.5.3
8.	A	4.5.3
9.	C	4.5.3
10.	D	4.7.3
11.	B	5.1.2
12.	C	5.1.2
13.	A	5.2
14.	B	5.3.1

212: Fillet Weld Patches

1.	A	1.e	
2.	D	2.c.1	
3.	C	3.1.b	
4.	D	3.1.c	
5.	A	3.1.d	
6.	C	Fig 1-1	
7.	D	3.1.e	

212: Fillet Weld Patches *(cont)*

8.	D	3.1.f	
9.	C	3.3.a	*(See Calc)*
10.	B	3.3.a	*(See Calc)*
11.	A	3.3.b	
12.	B	3.4.a	
13.	D	3.5.a	
14.	D	4.c	
15.	A	4.d	
16.	C	4.e.1	
17.	B	4.e.2	
18.	C	4.g	
19.	A	5.a	
20.	C	5.b	
21.	A	6.d	

212 Calcs

9. $L = 2\sqrt{Rt} = 2\sqrt{60 \times 0.75} = 13.42''$

10. $L = 2\sqrt{Rt} = 2\sqrt{36 \times 0.5} = 8.5''$

304: Flaw Excavation

1.	A,C	2.2.1
2.	B	2.2.1
3.	D	2.2.1
4.	E	2.2.2
5.	C	2.2.2
6.	A	2.2.3
7.	A,D	2.2.3
8.	D	2.5.1
9.	A	2.6.1
10.	C	3.1
11.	B	3.3
12.	A	4.1.1

305: Flange Repair

1.	C	2.3
2.	B	2.4
3.	A	3.1
4.	A	3.3.2.b
5.	C	3.3.2.c
6.	D	3.3.2.c
7.	C	4.5.3
8.	B,D	5.2
9.	A	6

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306: Mechanical Clamps

1.	D	1.0	
2.	A	1.0	
3.	B	1.0	
4.	B	2.2 & 2.2.c	
5.	A	3.1	
6.	A,B,E	3.3.a/d/e	
7.	C	3.8.a/b/c	
8.	D	3.9.a	
9.	C	3.10	
10.	A,B,C	3.10.b	
11.	B,C	3.12 & 3.13	
12.	B	3.14	
13.	B,C	4.5 & 4.6	

501: Pressure Testing

1.	C	2.d	
2.	A	3.1	
3.	B	3.1	
4.	D	3.2.c	
5.	A	3.2.c	
6.	B	3.2.c	
7.	D	3.2.f	
8.	B,C,D	3.4.a	
9.	A,D,E	3.4.1.a/b/c	
10.	C	3.4.3.a.1	
11.	D	6.1.b	
12.	C	6.1.b.2	
13.	B	6.1.b.2	
14.	A,C,E	6.1.e	
15.	C	6.1.h	*(See Calc)*
16.	B	6.1.h	*(See Calc)*
17.	A	6.1.k	
18.	B	6.1.n.2	
19.	A,B,C	6.1.t.5&6	
20.	A	6.1.t.8	
21.	D	6.2.b	
22.	A,B	6.2.b	
23.	D	6.2.e	
24.	C	6.2.i	*(See Calc)*
25.	C	6.2.i	*(See Calc)*

501: Pressure Testing *(cont)*

26.	D	6.2.m
27.	B	6.2.1. Step 1 .a
28.	B	6.2.1. Step 2 .a
29.	A	6.2.1. Step 3 .a
30.	D	App 501-II-1 *(See Calc)*
31.	B	Table 510-III-2-1

501 Calcs

15. Lesser of: Test + 50 or 1.1 of Test = 200 + 50 = 250 or 1.1 x 200 = 220, *Ans 220 psig*
16. Lesser of: Test + 50 or 1.1 of Test = 600 + 50 = 650 or 1.1 x 600 = 660, *Ans 650 psig*
24. Greater of: Test + 10 or 1.1 of Test = 60 +10 = 70 or 1.1 x 60 = 66, *Ans 70 psig*
25. Greater of: Test + 10 or 1.1 of Test = 120 + 10 = 130 or 1.1 x 120 = 132, *Ans 132 psig*
30. 25,000,000/1,488617 = 16.8 lbs TNT

502: NDE in Lieu of Pressure Test

1.	C	1.2.a
2.	A	1.2.c
3.	A,B,C	1.5.1.c/d/e
4.	C	1.7
5.	B,D,E	2.3.1/2/4

SDG