API 572 Study Guide
Practice Questions

*This following is a study aid that you can use to learn the details and content of **API RP-572, Inspection of Pressure Vessels**. There will be about 15-25 questions from this document on the API 510 exam. We do not spend time in class discussing this publication. So it is important that you become familiar with this content in your personal study sessions. Note! The study guide does not at this time have any questions for API 572 Appendix A. There will be some questions from Appendix A on the API exam.*

The questions in this study aid are in the same order as API 572. An answer key will be provided in class. It's helpful to read a few pages of API 572 and then answer the questions associated with these pages. We suggest that you do this study guide at least twice prior to the API exam.

1. Most pressure vessels are subjected to internal or external pressure that exceeds:

   a) 5 psig.
   b) 15 psig.
   c) 25 psig.
   d) 50 psig.

2. External pressure is usually caused by a vacuum or by using a _____ vessel.

3. Vessel shell rings are normally made by:

   a) rolling plate at ambient temperatures.
   b) rolling plate at elevated temperatures.
   c) rolling plate at either elevated or ambient temperatures.
   d) forging.
   e) casting and machining.

4. Shells constructed with multi-layers (a number of thin cylindrical sections) are normally used for vessels having:

   a) high design temperatures.
   b) high design pressures.
   c) exotic materials.
   d) a small diameter.

5. Match the material with the service:

A.	Carbon Steel	_____	Cooling Water
B.	Copper Alloys	_____	Sea Water
C.	Titanium	_____	Most Common Material

6. What is the primary purpose for installing a lining on the inside of a vessel?

   a) Resist corrosion
   b) Improve heat transfer
   c) Improve fluid flow by decreasing the friction inside the vessel
   d) Minimized effort to clean vessel at future turnarounds

7. When is a pressure vessel shell normally made from an alloy material?

   a) Corrosive service
   b) High operating pressures
   c) High operating temperatures
   d) Either high operating pressure or high operating temperature

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8. List four types of Metallic Liners.

a) _____ c) _____

b) _____ d) _____

9. What are the two primary purposes for non-metallic liners?

a) Resist erosion, insulate to reduce shell temperature
b) Insulate to reduce shell temperature, resist thermal expansion
c) Resist corrosion, resist thermal expansion
d) Resist stress corrosion cracking, insulate to reduce shell temperature
e) Beautify the facility, improve rate of heat transfer

10. What is the most common feature of vessels that operate with a vacuum?

a) Internally braces
b) Stiffening rings
c) Refractory lining
d) Hemispherical heads

11. An optionally part of an exchanger that is used to protect the tubes at the inlet nozzle is called a(n):

a) baffle.
b) demister mat.
c) impingement plate.
d) strip lining.

12. What code is often used when constructing vessels that operate at high pressures?

a) ASME B&PV Code Section VIII Division 1.
b) ASME B&PV Code Section VIII Division 2
c) API/ASME Vessel Code.
d) TEMA

13. What codes are used when constructing a heat exchanger that is used in the petrochemical industry?

a) API 660, ASME Section VIII, TEMA
b) API 661, ASME Section VIII, TEMA
c) API 660, API 661, TEMA
d) API 660, API 661,. ASME Section VIII,

14. All vessel manufacturers that build vessels to ASME Section VIII must have:

a) an API 510 inspector on staff.
b) access to an AWS inspector.
c) a written quality-control manual.
d) a machine capable of making dished heads.

15. The vessel manufacturer stamps the vessel with the code symbol "U". What is the meaning of a this code stamp?

a) All applicable requirements of the ASME Code have been met
b) All requirements of the U-Section in the ASME Code have been met
c) Vessel has been hydrotested
d) Vessel has been radiographed
e) Vessel wall is of uniform thickness

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16. A vessel should be maintained in accordance with the:

    a) construction code.
    b) latest edition of ASME Section VIII.
    c) code that was last used to rate the vessel.
    d) pre-2000 edition of ASME Section VIII.

17. An inspector should be familiar with any _____ that govern the inspection and maintenance of pressure vessels.

18. List the 2 basic reasons for inspection of pressure vessels

    1) _____

    2) _____

19. List the 3 basic forms of deterioration

    1) _____

    2) _____

    3) _____

20. The corrosion rate resulting from corrosion-erosion is often:

    a) higher than the corrosion rate from corrosion without erosion.
    b) lower than the corrosion rate from corrosion without erosion.
    c) higher in stagnant areas.
    d) uniform throughout the whole vessel.

21. List process conditions that that could change the corrosion rate.

    1) _____

    2) _____

    3) _____

    4) _____

    5) _____

22. What metallurgies are most affected by CUI?

    a) Carbon steel and low chromes
    b) Carbon steel and all chromes
    c) Carbon steel and stainless steels
    d) Carbon steel, chromes and stainless steels

23. List the temperature range where CUI is most prevalent:

    1) Carbon Steels _____ ^{o}F
    2) Stainless Steels _____ ^{o}F

24. Insulated carbon steel vessels may be subject to CUI if operating:

    a) above the lower-transformation temperature.
    b) below the upper transformation.
    c) in an intermittent service.
    d) above 700 ^{o}F.

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25. Which of the following methods is **NOT** used to detect CUI?

a) Weld quality RT
b) Profile RT
c) Guided-wave UT
d) Electromagnetic methods
e) Visual inspection after removal of insulation

26. Which deterioration mechanism can cause direction grooving?

a) Erosion
b) Oxidation
c) Sulfidation
d) Temper-embrittlement

27. List four common areas where corrosion-erosion can occur.

1) _____
2) _____
3) _____
4) _____

28. Match up the corrosion mechanism with the applicable material. *(SCC = stress corrosion cracking)*

A)	Chloride SCC	_____	Alkaline systems
B)	Polythionic SCC	_____	Non-stress relieved carbon steel
C)	Caustic SCC	_____	Stainless steel
D)	Amine SCC	_____	Operating temperatures over 400 ^{o}F
E)	Carbonate SCC	_____	Sensitized stainless steel

29. When checking for cracks, which of the following inspection techniques is useful **only** for surface or near-surface cracks?

a) Acoustic emission
b) Eddy current
c) Radiography
d) UT angle beam

30. What is a useful technique to use to evaluate the vessel cladding from outside surface of the vessel?

a) Acoustic emission
b) Eddy current
c) Profile radiography
d) UT thickness gauging

31. During an internal inspection, operating deposits are found in a specific section of the vessel. The inspector must:

a) have all deposits removed.
b) determine the cause of the deposits.
c) determine if corrosion is occurring under the deposits.
d) record the volume of the deposits.

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32. Which deterioration mechanism is caused by cyclic stresses?

a) Creep
b) Fatigue
c) Graphitization
d) Temper-embrittlement

33. Which of the following vessels is most susceptible to fatigue?

a) Coke drum
b) Crude column
c) FCCU regenerator
d) Hydrotreater reactor

34. What is a common cause for high-cycle fatigue?

a) Low operating temperatures
b) High operating temperatures
c) High operating pressures
d) Excess vibrations from mechanical equipment

35. Cracking occurring in deaerators is attributed to:

a) corrosion fatigue.
b) mechanical fatigue.
c) thermal fatigue.
d) velocity fatigue.

36. A prime location for thermal fatigue is at:

a) circumferential welds.
b) dissimilar welds.
c) stainless steel welds.
d) chrome welds.

37. What NDE method checks for cracks by increasing the vessel pressure above its normal operating pressure?

a) Acoustic emission
b) Eddy current
c) Guided wave UT
d) MFL

38. Why is it difficult to find fatigue cracking?

a) Fatigues cracks are very tight
b) It is very difficult to predict the location of fatigue cracking
c) The growth rate of fatigue cracks is very slow
d) It takes many cycles to initate the crack, but relatively few cycles to propagate the crack all the way through the vessel wall.

39. List the three primary factors of creep:

1) _____
2) _____
3) _____

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40. Creep cracking begins to occur in 1-¼ chrome steels at temperatures above _____ °F.

41. At high temperatures:

    a) atomic hydrogen reacts to form water.
    b) atomic hydrogen reacts to form hydrocarbons.
    c) molecular hydrogen disassociates to form atomic hydrogen.
    d) molecular hydrogen disassociates to form water.

42. Which of the following can permeate steel (migrate through the steel)?

    a) Atomic hydrogen
    b) Atomic hydrogen and molecular hydrogen
    c) Atomic hydrogen and atomic helium
    d) Molecular hydrogen and helium

43. Susceptibility to HTHA attack increases as:

    a) chrome content increases.
    b) nickel content increases.
    c) metal grain size decreases.
    d) metal grain size increases.

44. Susceptibility to HTHA attack increases as:

    a) operating temperature decreases.
    b) operating pressure decreases.
    c) carbon content increases.
    d) molybdenum content increases.

45. HTHA can occur in 1-¼ chrome steels at temperatures above _____ °F.

46. What publication provides safe operation limits for steels operating in hydrogen service?

    a) ASME Section II
    b) ASME Section VIII
    c) API 579
    d) API 941
    e) API 2201

47. High temperature sulfidation can begin to occur at temperatures above _____ °F.

48. High temperature sulfide attack usually appears as:

    a) cracks.
    b) localized thinned areas.
    c) pits.
    d) uniform corrosion.

49. A partial buried vessel should be inspected for soil-to-air corrosion. To perform this inspection, the soil should be excavated:

    a) 1 to 2 inches.
    b) 3 to 6 inches.
    c) 6 to 12 inches.
    d) 12 to 36 inches.

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50. Small living organisms are the cause of biological corrosion. There are various ways that these living organisms cause the actual corrosion to occur. Which of the following is **NOT** a way biological corrosion occurs?

a) Hydrogen normally slows down the corrosion rate on the external surface. Organisms consumes (reacts with) hydrogen. Since less hydrogen is now available, the corrosion rate to increase.
b) Creates an electrolytic concentration cell
c) Creates by-products that are corrosive
d) Creates atomic nitrogen. Atomic nitrogen reacts with iron to form iron nitrate.

51. What is a common micro-organism in soils that can cause biological corrosion?

a) amoebas
b) chloride-reducing bacteria
c) sulfate-reducing bacteria
d) oxygen-reducing parasites

52. Changes in a metal's microstructure can be caused by:

a) improper heating and cooling.
b) excessive thermal expansion.
c) operating at cold temperatures.
d) pressure cycles.

53. Match up the deterioration mechanism with the applicable description.

A)	Decarburization	_____	Selective leaching of a material in an alloy
B)	Graphitization	_____	Loss of carbon near surface of ferrous material
C)	Dealloying	_____	A metallurgical change that occurs to Cr-Mo alloys due to operating at high temperatures
D)	Temper Embrittlement	_____	Conversion of carbides to carbon nodules

54. What two factors cause decarburization in ferrous materials?

a) Low operating temperatures, and numerous pressure cycles
b) High operating temperature, and numerous pressure cycles
c) Low operating temperatures, and a process that reacts with carbon
d) High operating temperature, and a process that reacts with carbon

55. Which of the following is **NOT** a problem caused by decarburization?

a) Material strength decreases
b) Material toughness decreases
c) Hardness of material increases
d) Fatigue strength decreases

56. Decarburization is found using:

a) metallography.
b) straight beam UT.
c) penetrant testing.
d) MFL.

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57. What materials are most susceptible to Graphitization?

a) Carbon steel and carbon – ½ molybdenum steel
b) Carbon steel and low chromes (through 5% chrome)
c) Carbon steel and all chromes
d) High nickel alloys
e) Stainless steels

58. Graphitization occurs when a susceptible material is subject to:

a) many temperature cycles.
b) a prolonged exposure to temperatures above 450°F.
c) a prolonged exposure to temperatures above 825°F.
d) atomic hydrogen.

59. Which type of graphitization is most likely to lead to a mechanical failure?

a) Localized graphitization
b) Random graphitization
c) Uniform graphitization
d) Spot graphitization

60. In some water services, dezincification can occur in which materials?

a) Brass
b) Bronze
c) Monel
d) Alloy 20

61. What materials are most susceptible to temper embrittlement?

a) Carbon steel and carbon – ½ molybdenum steel
b) Carbon steel and low chromes (through 5% chrome)
c) Low chromes
d) All chromes
e) Stainless steels

62. Temper embrittlement is caused when a susceptible material is subject to:

a) low temperatures.
b) a prolonged exposure to temperatures above 750°F.
c) a prolonged exposure to temperatures above 1100°F.
d) atomic hydrogen.

63. Brittle fracture is usually not a concern when using:

a) carbon steels.
b) low chromes.
c) thin-wall materials.
d) post-weld heat treat materials.

64. When do most brittle failures in pressure vessels occur?

a) During the vessel's first winter weather
b) During the first hydrotest
c) After prolong exposure to temperatures above 250°F.
d) After the first pressure cycle

65. Brittle failures initiate at a notch or stress concentration. Most often, this the initiating point is a:

a) tee joint or angle joint, e.g. nozzle-to-shell weld, tray ring weld.
b) stamping in the vessel component.
c) lamination in the plate.
d) welding flaw.

66. Which of the following deterioration mechanisms can be corrected by annealing the steel?

a) Decarburization
b) Dealloying
c) Temper embrittlement
d) HTHA

67. The most common method to check for freeze damage is by:

a) visual inspection.
b) eddy current examination.
c) digital UT.
d) angle beam UT.

68. Hydriding of titanium alloys is caused when the material absorbs:

a) hydrogen.
b) oxygen.
c) nitrogen.
d) zinc.

69. Which of the following is **NOT** a potential result of an improper heat treatment?

a) High residual stresses
b) Increased density of material
c) Hard zones in material
d) Soft zones in materials
e) Increased material strength
f) Decreased material strength
g) Increased susceptibility to cracking

70. When setting the inspection interval for the internal inspection, an interval is selected so that at the next inspection:

a) the wall thickness is not less than the minimum required thickness.
b) at least 0.100" of corrosion allowance remains.
c) at least 25% of the current corrosion allowance should still remain.
d) at least 50% of the current corrosion allowance should still remain.

71. One important factor in developing an inspection plan for the next inspection is to occasionally check the:

a) Operating department's equipment records.
b) Maintenance department's equipment records.
c) Financial department's equipment records.
d) Environmental department's equipment records.

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72. Before performing a vessel inspection, which of the following activities does the inspector **NOT** need to do?

    a) Review past inspection records.
    b) Check with Operations to determine whether there were any abnormal operating conditions.
    c) Review the equipment construction details.
    d) Review the vessel's service conditions
    e) Determine what is being offered as the "daily special" at the local lunch café.

73. A vessel has a refractory lining. During the internal inspection, an small area of damaged refractory is found. It is now important to:

    a) replace the refractory with superior materials.
    b) remove enough of the refractory to determine the condition of the base metal.
    c) remove the damaged refractory plus 50% more to determine the base metal condition.
    d) remove and replace all the refractory in the entire vessel.

74. All NDE tools should be:

    a) calibrated daily.
    b) calibrated weekly.
    c) rated for the appropriate gaseous atmosphere.
    d) certified by UL-142.

75. When performing a PT examination inside an exchanger shell, what is one potential problem?

    a) Residual penetrant can cause crevice corrosion
    b) Residual penetrant can cause steel to become anodic
    c) Vapors from the exam can displace air
    d) It is more difficult to prepare the shell for the exam as compared to other NDE methods

76. Ladders and platforms should be inspected:

    a) only with a visual examination.
    b) by visual examination and UT.
    c) by visual examination and RT.
    d) by visual examination and hammer-testing.

77. Small depressions on platforms are of concern since these can:

    a) collect and hold water, potentially causing accelerated corrosion.
    b) create a tripping hazard.
    c) create flexing that could cause a fatigue failure.
    d) be rather ugly and prevent your facility from achieving *API's Petrochemical Facility of the Yea*r award.

78. Crevice corrosion is **NOT** common at which of the following locations?

    a) Under nuts on anchor bolts
    b) At repad-to-shell welds
    c) Where handrail supports slip into platform sleeves
    d) Between exchanger shell and cradle support

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79. Which of the following is usually **NOT** a cause of large cracks in a concrete foundations?

a) High temperature.
b) Excessive settlement.
c) Poor design.
d) Poor materials.

80. Small hair-like cracks in concrete foundations:

a) should always be caulked.
b) should always be repaired with a cement material similar to the original material.
c) should be further examined by hammer-testing.
d) are usually not a serious concern.

81. A distorted anchor bolt is usually the result of:

a) serious foundation settlement.
b) selecting the wrong material for the anchor bolt.
c) using an anchor bolt of insufficient diameter.
d) using an anchor bolt of insufficient length.

82. What examination method is normally used to examine in-service anchor bolts?

a) Visual
b) UT
c) Eddy current
d) Hammer-testing
e) Acid etching

83. What is the best way to prevent external corrosion on structural steel?

a) Painting
b) Fireproofing
c) Galvanizing
d) Insulation

84. What is a good way to check for disbanded fireproofing?

a) Visual examination
b) UT
c) Eddy current
d) Hammer-testing with light taps
e) Sledge hammer-testing with a 25 lb sledge hammer

85. What is one important item to check during an External inspection of an exchanger?

a) Surface temperature at the inlet and outlets
b) The floating end of the exchanger is free to slide on it's support
c) Determine the fluid flow rate through both the shell side and tube side of the exchanger
d) Measure the clearance between the shell and the ground

86. Guy wires supporting tall vessels should be examined using:

a) visual examination.
b) UT.
c) profile RT.
d) acoustic emission.

87. Guy wire clips should be placed at a spacing of at least:

a) 3”.
b) 6”.
c) 3 guy wire diameters.
d) 6 guy wire diameters.

88. Which of the following would be most affected if a vessel foundation experiences excessive settlement?

a) Stiffener rings
b) Relief devices
c) Nozzles with attached piping
d) Manways
e) Top head

89. What should be done if shell distortion is found at a nozzle?

a) Check for cracking on all nozzle welds
b) Check the hardness of nozzle welds and nozzle components
c) Check thickness by taking UT readings on a 2” grid on all nozzle components and on the distorted area of the shell.
d) Only note the distortion in your inspection report

90. Catalytic reformer vessels may have creep damage if the operating temperature is above _____ ^{o}F

91. The grooves on an existing ring-joint flange should be checked for _____.

92. Grooves on existing stainless steel flanges should be checked for:

a) stress corrosion cracking.
b) temper embrittlement.
c) dealloying.
d) corrosion fatigue.

93. Existing slip-on flanges should be checked for:

a) chloride cracking.
b) creep.
c) crevice corrosion.
d) graphitization.

94. Vessel grounding connections are primarily needed to provide a path for electrical current from:

a) a lighting strike or from a welding machine.
b) a lighting strike or from static electricity.
c) a welding machine or from an electrical short.
d) an electrical short or from static electricity.

95. The maximum permitted resistance-to-ground for a vessel grounding system is:

a) 0.5 ohms.
b) 5.0 ohms.
c) 10 ohms.
d) 25 ohms.
e) 50 ohms.

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96. Which of the following coating failures is easily missed during a visual examination?

a) Film lifting
b) Blisters
c) Rust spots

97. Where are two likely areas where paint failures occur?

a) Top heads and nozzles
b) Weld seams and nozzles
c) Top heads and moist crevices
d) Weld seams and moist crevices
e) Nozzles and moist crevices

98. What two on-stream NDE techniques may be able to locate moist insulation?

a) Real-time RT and Thermography
b) Real-time RT and MFL
c) Neutron back scatter and Thermography
d) Neutron back scatter and MFL
e) Neutron back scatter and Real-time RT
f) Thermography and MFL

99. Pit depth is normally measured with a _____.

100. The minimum number of TML's required for a routine vessel is at least _____ thickness reading(s) on each shell ring, and _____ thickness reading(s) on each head.

101. A vessel operates in a cyclic temperature service. The vessel support-to-vessel welds should be checked using MT or PT to check for:

a) stress corrosion cracking.
b) fatigue cracking.
c) polytheonic cracking.
d) HTHA.

102. Which of the following is **NOT** a significant factor in atmosphere corrosion?

a) vessel operating pressure
b) relative humidity
c) chemical vapors
d) metal surface temperature

103. In a caustic storage vessel, caustic embrittlement is **least** likely at:

a) heating coil connections.
b) areas of high stress.
c) internal baffles or vortex breakers.
d) nozzles.

104. Caustic that seeps through a crack will often leave a:

a) brown residue.
b) white salt.
c) yellow sticky deposit.
d) black hard residue.

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105. A vessel contains an acid corrodent. The areas directly below the liquid level are likely to be subject to:

a) hydrogen blistering.
b) HTHA.
c) temper embrittlement.
d) graphitization.
e) caustic cracking.

106. Blisters on a vessel shell can be easily detected with:

a) UT.
b) RT.
c) visual exam using a flashlight beam perpendicular to the shell.
d) visual exam using a flashlight beam parallel to the shell.

107. Small blisters can be easily detected by:

a) feeling the surface with your fingers.
b) hammer testing.
c) MT or PT.
d) magnetic flux leakage.

108. Why is wet fluorescent magnetic particle testing often used to detect certain types of cracking?

a) Easier to perform than other types of MT
b) Requires less effort to qualify the NDE examiner as compared to dry MT
c) More sensitive technique as compared to dry MT
d) Equipment to perform the exam is less expensive than what is needed for other MT exams

109. **Tough question!** The temperature of a hot-spot on a refractory lined vessel should be periodically checked. Which of the following is **NOT** an acceptable method for checking the temperature?

a) Portable thermocouple
b) Thermography
c) Temperature indicating crayons.
d) Place your hand on surface for exactly 1 second. Calculate the vessel temperature based on the depth of the 3rd degree burns on your hand.

110. A hot-spot has developed on a refractory lined carbon steel vessel. During the next internal inspection the wall at the hot-spot should be metallurgically examined whenever the metal temperature has exceeded:

a) 450 °F.
b) 750 °F.
c) 850 °F.
d) 1100 °F.

111. Normal vessel cleaning methods, like steam cleaning, usually are adequate to meet the inspector's needs for an internal inspection. Extra cleaning such as abrasive-grit or water blasting may be required when inspecting for:

a) localized thin areas.
b) deep pitting.
c) stress corrosion cracking.
d) thermal fatigue cracking.

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112. An internal inspection will be performed on a vessel. What is the **initial** step to be performed?

a) Collect all necessary inspection tools
b) Check the vessel permitting requirements
c) Collect the necessary personnel protective equipment
d) Read the previous inspection reports

113. Sulfidation is a common concern at the:

a) top of the crude unit's fractionating column.
b) bottom of the crude unit's fractionating column.
c) top of a hydrotreater reactor.
d) bottom of a hydrotreater reactor.

114. A vessel subject to wet hydrogen sulfide or cyanide environments is susceptible to.

a) cracks in the base metal.
b) cracks in the weld and heat affected zones.
c) localized thin areas (LTA's).
d) extensive pitting.

115. If sludge settles on the bottom head of a vessel, what corrosion mechanism is likely to occur?

a) Stress corrosion cracking
b) Dealloying
c) Concentration cell corrosion
d) Sludgitization

116. If steam is injected into a vessel, a likely place for corrosion is on the:

a) inlet nozzle.
b) vessel wall opposite the nozzle.
c) vessel wall directly below the nozzle.
d) vessel's anchor bolts. *(once again proving it is difficult to come up with 3 wrong answers!)*

117. When a reboiler is used with a tower (fractionating column), a common place for corrosion is:

a) the inlet to the reboiler.
b) top head of the tower.
c) at the tower where the hot process returns.
d) at the tower where the cold process returns.

118. What is the normal cause of corrosion associated with reboilers?

a) Hot process decomposes to form acids
b) Hot process decomposes to form polytheonic caustic
c) Increased velocity of returning process causes erosion
d) Deposits in the process cause oxygen pitting

119. Most cracks that occur in a vessel occur at _____.

120. Exchangers in cooling water service have the highest corrosion rates where the:

a) velocity is the highest.
b) velocity is the lowest.
c) ph is the highest.
d) water temperature is the highest.

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121. An impingement plate is installed on an exchanger bundle. What area is most susceptible to corrosion?

a) Exchanger shell near the impingement plate
b) Tubesheet
c) Tubes near the impingement plate
d) Inlet nozzle

122. During an internal inspection:

a) at least 10% of all welds should be checked with either MT or PT.
b) 100% of the internal surface should be cleaned.
c) thickness readings should be taken at suspect locations.
d) hammer-testing should be performed on all nozzles.

123. List 4 major areas where cracks occur in vessels made of low chromes *(i.e. 1-1/4 & 2-1/4 Cr).*

a) _____

b) _____

c) _____

d) _____

124. A very effective means to find cracks is by using:

a) MFL.
b) red dye PT.
c) dry particle MT.
d) wet fluorescent particle MT.

125. Which of the following steels is most likely to crack?

a) Steels with a tensile strength lower than 70,000 psi
b) Steels with a yield strength above 20,000 psi.
c) Coarse-grain steels
d) Fine-grain steels

126. Normally tower (column) trays are inspected using:

a) only a visual examination.
b) visual examination and UT.
c) visual examination and some type of crack detection NDE method.
d) visual examination, UT and some type of crack detection NDE method.

127. Often corrosion will occur on the shell of an exchanger at the location of the baffles. An easy way to find this corrosion is by:

a) spot UT.
b) visual examination.
c) eddy current testing.
d) shining a flashlight beam parallel to the shell.

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128. Areas directly above the liquid level in vessels containing acidic corrodents s are subject to:

a) caustic embrittlement.
b) hydrogen blistering.
c) graphitization.
d) creep.
e) fatigue.
f) dealloying.

129. How can small blisters easily be found?

a) Feel metal surface with your fingers
b) Visual examination
c) Hammer-testing
d) Spot UT readings

130. Existing exchanger shells sometimes become out of round making it difficult to reinsert the bundle. What is the most common cause of exchanger shell out-of-roundness?

a) Over pressure
b) Elevated temperature
c) Metal fatigue
d) Creep
e) Welding repairs to the shell
f) Meteor strike

131. Vessels containing amines are subject to:

a) oxygen pitting.
b) oxidation.
c) cracking.
d) caustic embrittlement.
e) dew point corrosion.

132. Deaerators used for boiler feedwater are subject to:

a) pitting.
b) localized thinned areas.
c) uniform corrosion.
d) cracking.
e) dealloying.

133. Loose or cracked metallic linings can be found using:

a) light taps with a hammer.
b) visual inspection.
c) MT.
d) acoustic emission.

134. Bulged linings are often the indication of a _____ in the liner.

135. Whenever there are indications that a metallic liner has leaked, it is important to determine the:

a) thickness of the liner.
b) displacement of the bulged area.
c) condition of the base metal under the liner.
d) the identification of the welder who previously installed the liner.

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136. What type of weld metal overlay is often used for hydrotreater reactors?

a) Low chromes
b) High chromes
c) Austenitic stainless steel
d) Stabilized austenitic stainless steel
e) High nickel alloys

137. What are the two primary purposes for refractory linings?

1) _____

2) _____

138. A break or void in a paint coating is called a:

a) blister.
b) film lift off.
c) holiday.
d) voidea.
e) lamination.

139. A common tool used to find breaks in a pipe coating is:

a) acoustic emission.
b) eddy current.
c) MFL (magnetic flux leakage).
d) spark testing.

140. Spark testing is being performed on a coating. What happens if the voltage on a spark tester exceeds the dielectric strength of the coating?

a) Coating will become magnetic
b) Strength of the coating bond increases
c) A hole is "blown" in the coating
d) Coating will crack
e) Creates a nuclear chain reaction that will destroy the entire universe

141. A common tool used to inspect refractory is a _____.

142. Extra metal thickness in a vessel is:

a) sometimes used as nozzle reinforcement.
b) always considered extra corrosion allowance.
c) always clearly identified on a U-1 form.
d) never allowed.

143. When a refractory lining cracks, what is a common problem that occurs to the base metal?

a) Dew point corrosion
b) Dealloying
c) Excessive thermal stress
d) Brittle failure

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144. What method is often used to detect metallurgical changes to the base metal?

a) Tension tests
b) Bend tests
c) Metallography
d) Flash radiography
e) Impact tests

145. What method is often used to detect carburization and decarburization?

a) Tension tests
b) Bend tests
c) Metallography
d) Hardness testing
e) Impact tests

146. It is recommended **NOT** to hammer test vessels that are _____.

147. Which of the following is **NOT** a purpose of a pressure test?

a) Validate vessel MDMT
b) Assure equipment tightness
c) Assure equipment integrity
d) Redistribute stresses at discontinuities

148. What is the most important concern when hydrotesting a large in-service vessel?

a) Rope off an area equal to 1000 sq. ft. for every 1' of vessel height
b) Provide multiple calibrated pressure gauges
c) Assure the water used has less than 50 ppm of particulates
d) Assure vessel foundation and supports are adequate for the hydrotest weight

149. Acoustic emission testing is especially useful on:

a) vessels of simplistic design.
b) vessels where internal inspections are difficult to perform.
c) large vessels.
d) heat exchangers.

150. A pneumatic pressure test is performed on a large vessel. What is one way to determine the location of remote leaks?

a) Block-in the vessel and see if the pressure drops
b) UT leak detector
c) Binoculars
d) Thermography

151. A vessel is being vacuum tested. What is one negative aspect of a vacuum test?

a) Location of leak is not easily identified
b) There are additional safety precautions as compared to a hydrotest
c) Creating the vacuum requires expensive equipment
d) The vacuum must be held for 24 hours

152. An in-service vessel has a shell thickness of 2.5". The minimum metal temperature allowed during a pressure test is:

a) 10°F.
b) 30°F.
c) 60°F.
d) 10°F. above the vessel MDMT.
e) 30°F. above the vessel MDMT.

153. An in-service vessel has a shell thickness of 1.25". The minimum metal temperature allowed during a pressure test is:

a) 10°F.
b) 30°F.
c) 60°F.
d) 10°F. above the vessel MDMT.
e) 30°F. above the vessel MDMT.

154. When performing a pneumatic pressure test, the requirements of which code should be followed?

a) ASME B&PV Section I
b) ASME B&PV Section V
c) ASME B&PV Section VIII
d) ASME B31.3
e) API 579
f) API 2201

155. A shell-side pressure test is being performed on an exchanger with a floating head bundle. The bundle is in the shell and the channel cover is removed. This test will show overall bundle integrity and can be used to specifically locate which of the following leaks?

a) Stationary tubesheet roll leaks
b) Floating head tubesheet roll leaks
c) Floating head gasket leak.
d) Leaking tubes
e) The exact location of any leak cannot be determined with this test

156. A tube-side pressure test is being performed on an exchanger with a floating head bundle. The bundle is in the shell and the piping connected to a bottom shell nozzle is removed. This test will show overall bundle integrity and can be used to specifically locate which of the following leaks?

a) Stationary tubesheet roll leaks
b) Floating head tubesheet roll leaks
c) Floating head gasket leak.
d) Leaking tubes
e) The exact location of any leak cannot be determined with this test

157. A tube-side pressure test is being performed on an exchanger with a floating head bundle. The bundle is outside the shell and a test head is bolted to the stationary tubesheet. This test will show overall bundle integrity and can be used to specifically locate which of the following leaks?

a) Stationary tubesheet roll leaks
b) Floating head tubesheet roll leaks
c) Floating head gasket leak.
d) Leaking tubes
e) Roll leaks on both ends, tube leaks, and floating head gasket leaks
f) The exact location of any leak cannot be determined with this test

158. During a bundle pressure test, a leaking tube is discovered. The inspection results indicate that the other tubes are acceptable for a future operational run. The leaking tube is normally:

a) replaced in kind.
b) replaced with improved metallurgy.
c) plugged.
d) removed.
e) rerolled.

159. During a bundle pressure test, a tube roll-leak is discovered. The inspection results indicate that the other tubes are acceptable for a future operational run. The leaking tube is normally:

a) replaced in kind.
b) replaced with improved metallurgy.
c) plugged.
d) removed.
e) rerolled.

160. Before applying a hydrotest to the shell-side of a carbon steel bundle, it is important to:

a) determine whether the tubes are thick enough for the external pressure.
b) determine how far an area should be roped off..
c) assure that all tubes have been seal-welded at the tubesheet.
d) check the chloride content of the water.

161. Before applying a high-pressure hydrotest to a bundle, it is important to:

a) connect a PRV to prevent excessive pressure.
b) have multiple pressure gauges connected for the test.
c) assure that all tubes have been seal-welded at the tubesheet.
d) determine whether the tubesheet is thick enough for the pressure.

162. A shell has a minimum thickness of 0.352" and has a corrosion allowance of 0.125". The total thickness needed is 0.477", so the designer orders 0.500" plate. The extra 0.023" is usually consider extra corrosion, but often the designer uses the "extra" metal *(and the extra is no longer extra)*:

a) in the design of vessel stiffening.
b) in the design of nozzle reinforcement.
c) to improve the joint efficiency.
d) to minimize the number of RT's..

163. Which of the following components usually does **NOT** have a specified minimum thickness?

a) Top head
b) Nozzle reinforcement
c) Metallic liner
d) Platform handrail
e) Internal baffle

164. If a jurisdiction requires a vessel repair to meet the National Board Inspection Code, what stamp would have to be used by the Repair Organization?

a) A
b) U
c) UV
d) R
e) VR

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165. A corroded shell area that has an area of 2.5 ft^2 is built-up with weld metal. How should the repair area normally be inspected?

a) Visual examination
b) Visual examination and either MT or PT
c) Visual examination and spot UT
d) Visual examination and eddy current

166. When removing a crack in a vessel using flame or arc gouging:

a) care must be taken to prevent the crack from growing.
b) the craftsman must be qualified in accordance with ASME B&PV Section IX.
c) the base metal should only be a P1 or P-3 material.
d) the crack length cannot be greater than allowed in API 579.

167. A crack in a vessel is removed. The groove:

a) must always be filled with weld metal of the same metallurgy as the base metal.
b) should be filled with weld metal of a higher alloy than the base metal.
c) should be filled with weld metal of the same tensile strength as the base metal.
d) should be filled with weld metal of a higher tensile strength than the base metal.
e) can be left unfilled provided adequate wall thickness remains and edges are blended.

168. Stairway treads that have been worn smooth:

a) can be roughened by placing weld beads on the worn surface.
b) should always be replaced.
c) are acceptable provided the tread thickness is adequate.
d) should be repaired with epoxy based materials.