



pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION

Study Guide

for

Pennsylvania

Aboveground Storage Tank

Certification Exams

HOW TO USE THIS STUDY GUIDE

This study guide is intended to help you prepare for the technical portion of Pennsylvania's aboveground storage system tank handler and inspector certification examinations. There is a separate study guide to help you prepare for the administrative examination. The study guide consists of an extensive list of questions. All of the questions based on material in a specific document are grouped together. After each question, the section in the reference document where the answer to the question can be found is given in parentheses. The process of reading the question, finding the answer in the reference document, and writing the answer in your study guide will help you learn the necessary information to pass the certification examinations.

The certification exams will include the material covered in these study questions. The only difference is that the exams will be in multiple choice format. You should be thoroughly familiar with the material in this study guide before you enter the examination room. You may not refer to the study guide or any other reference material while you are taking the technical portion of your certification examination(s).

Although there are many different aboveground tank handler certification categories in Pennsylvania, there are only eight different examinations that may be taken. The relationship between the certification categories and examinations is as follows:

EXAM CODE LETTERS	CERTIFICATION CATEGORIES
AC	ACVL
AE	AMEX
AF	AFMX
AN	AMNX
AR	AMR, AFR
AS	AMMX
IA	IAF, IAM
TL	TL (aboveground and underground)

For a description of the certification categories and the certification requirements for each category, refer to Pennsylvania Code Title 25, Chapter 245.110-113.

This study guide contains questions that are applicable to all eight certification examinations. Some of the exam code letters listed in the above table are printed to the left of each study guide question. These exam code letters identify the certification examinations which may contain questions related to the study guide question. For example, if the letters AE and AF appear next to a study guide question, then the information covered in the study guide question may appear in the AE and the AF examinations. If you are taking either of these exams, you should know the answer to this study guide question. If you are preparing for the AC or AR examinations, you may skip this question as the material is not relevant to the examinations you will be taking.

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American National Standards Institute

ANSI Z117.1: Safety Requirements for Confined Spaces

The following study guide questions are taken from the American National Standards Institute standard Z117.1 entitled “Safety Requirements for Confined Spaces” (2016 edition).

AC, AE, TL 1. What are the characteristics of a confined space? (ANSI, Z117.1-2016. Section 2.5)

AC, AE, TL 2. What is the definition of a hazardous atmosphere? (ANSI, Z117.1-2016. Section 2.14)

AC, AE, TL 3. What is the definition of a permit required confined space? (ANSI, Z117.1-2016. Section 2.24)

AC, AE, TL 4. What is the definition of qualified person? (ANSI, Z117.1-2016. Section 2.26)

- AC, AE, TL 5. What conditions can cause confined spaces to become unsafe? (ANSI, Z117.1-2016. Section E3.2)
- a)
 - b)
 - c)
 - d)
- AC, AE, TL 6. What six factors should be considered when performing the hazard identification process? (ANSI, Z117.1-2016. Section 3.2.1 to 3.2.6)
- a)
 - b)
 - c)
 - d)
 - e)
 - f)
- AC, AE, TL 7. What is the intent of the permit system for confined space entry? (ANSI, Z117.1-2016. Section E5.1)

- AC, AE, AF, AR 8. Testing should be conducted to identify hazardous atmospheres before entry is permitted into a confined space. What tests should be conducted? In what order should the tests be performed? (ANSI, Z117.1-2016. Section E6.1)
- AF, AR 9. What are acceptable limits within a confined space for each of the following? (ANSI, Z117.1-2016. Section 6.3.1.1 to 6.3.1.3))
- Oxygen:
- Flammability:
- Toxicity:
- AR, TL 10. Which national code describes requirements for electrical equipment to be used in hazardous locations? (ANSI, Z117.1-2016. Section 12.4)
- AF, AR, TL 11. When an employer arranges to have employees of another employer (contractor) perform work that requires confined space entry, what information must the employer give the contractor about the confined space? (ANSI, Z117.1-2016. Section 17.1)

American Petroleum Institute

API 12D: Specification for Field Welded Tanks

The following study guide questions are taken from the American Petroleum Institute Specification 12D “Specification for Field Welded Tanks for the Storage of Production Liquids” (Twelfth Edition, June 2017).

- | | | |
|----|----|---|
| IA | 1. | To what types of tanks does this specification document apply? (API 12D-17, Section 1.1) |
| IA | 2. | What types of petroleum product are normally stored in these tanks? (API 12D-17, Section 1.1) |
| IA | 3. | What segment of the petroleum industry normally uses these tanks? (API 12D-17, Section 1.1) |
| IA | 4. | What is a “double-welded butt joint?” (API 12D-17, Section 3.1) |

IA 5. What is a “single-welded lap joint?” (API 12D-17, Section 3.4)

IA 6. What is a “fillet weld?” (API 12D-17, Section 3.6)

IA 7. What is a “tack weld?” (API 12D-17, Section 3.9)

IA 8. What type(s) of welds should be used to attach the tank bottom to the tank shell?
(API 12D-17, Section 5.5.4)

IA 9. What type(s) of welds should be used to join tank shell plates? (API 12D-17, Section 5.6.2)

- IA 10. What type(s) of welds should be used on roof joints? (API 12D-17, Section 5.7.3)
- IA 11. What type(s) of welds should be used to attach non-frangible tank roofs to the tank shell?
(API 12D-17, Section 5.7.4)
- IA 12. What type(s) of welds should be used to attach a frangible tank roof to the tank shell?
(API 12D-17, Section 5.7.5)
- IA 13. What are the minimum dimensions specified for a tank extended-neck cleanout?
(API 12D-17, Section 5.8)
- IA 14. How are baffles attached to the tank bottom? (API, 2D-17, Section 5.12)

IA 15. A completed tank shall be tested by filling with water. For how long must the tank remain filled with water? (API 12D-17, Section 7.3.1)

IA 15. A completed tank shall be tested by filling with water. For how long must the tank remain filled with water? (API 12D-17, Section 7.3.1)

IA 16. Where should toeboards be installed? How high should the toeboard be? (API 12D-17, Section B.5)

IA 16. Where should toeboards be installed? How high should the toeboard be? (API 12D-17, Section B.5)

American Petroleum Institute

API 12P: Specification for Fiberglass Reinforced Plastic Tanks

The following study guide questions are taken from American Petroleum Institute Specification 12P, entitled “Specification for Fiberglass Reinforced Plastic Tanks” (Fourth Edition, February 2016).

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|--------|----|---|
| IA, AN | 1. | To which types of tanks does this specification apply? (API 12P, Section 1.1) |
| | | |
| IA, AN | 2. | What happens to FRP material when it is exposed to high temperatures? What precautions should be taken to deal with potential exposure to high temperatures? (API 12P, Section 1.1) |
| | | |
| IA | 3. | What are acceptable polymer resins to use in tank construction? (API 12P, Section 4.2) |
| | | |
| IA | 4. | What should be the maximum working pressure of a standard design tank? (API 12P, Section 5.1.1) |

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| IA, AN | 5. | What is the minimum shell thickness allowed for the chop-spray, filament wound and chop-hoop methods of constructing tank shells? (API 12P, Section 5.2 & 5.3) |
| IA, AN | 6. | The laminate comprising the structural components of a non-metallic tank should consist of four layers. What are these four layers called? What function does each layer serve? (API 12P, Section 5.4.1) |
| IA, AN | 7. | What is the minimum acceptable laminate thickness for fully supported tank bottoms 12 feet in diameter or less? For tanks greater than 12 feet in diameter? (API 12P, Section 5.7) |
| IA, AN | 8. | What is the minimum diameter of a manway for a tank constructed according to this document? (API 12P, Table 2) |
| IA, AN | 9. | How much more than the empty weight of the tank should the lifting lugs (as a set) be able to hold? (API 12P, Section 5.14) |

- IA 10. What should be laminated to the tank bottom directly below the thief hatch? (API 12P, Section 5.16)
- IA, AN 11. Is emergency venting normally required for FRP tanks? Why or why not? (API 12P, Section 6.2)
- IA, AN 12. What are five obvious defects that should not be present on FRP tanks? (API 12P, Section 7.1.4)
- a)
 - b)
 - c)
 - d)
 - e)

- IA, AN 13. What size pits are acceptable in the inside surface of the tank as long as they are covered with sufficient resin to assure coverage of the inner surface reinforcement? What other type of imperfection is permissible? (API 12P, Section 7.1.4)
- IA, AN 14. What is the minimum duration for a hydrostatic test? (API 12P, Section 7.2.3)
- IA, AN 15. To what level should the tank be filled during a hydrostatic test? (API 12P, Section 7.2.4)
- IA, AN 16. If defects are discovered during the hydrostatic test, they must be repaired and the tank retested. What is the minimum duration for the retest? (API 12P, Section 7.2.6)
- IA, AN 17. How is the degree of cure of a laminate determined? (API 12P, Section 7.3.3)

- IA, AN 18. What type of test can be conducted to determine incomplete curing of laminate on external surfaces and secondary bond surfaces? What is the procedure for conducting this test? (API 12P, Section 7.3.5)
- IA, AN 19. What information must be incorporated on a raised metal label and securely attached to the tank? (API 12P, Section 8.1)
- IA, AN 20. What are acceptable materials to use as a base for supporting vertical, flat bottom tanks? (API 12P, Section B.1)
- IA, AN 21. How may a tank skid be used when handling a tank? (API 12P, Section B.2)

American Petroleum Institute

API 12R1: Recommended Practice for Setting, Maintenance, Inspection, Operation and Repair of Tanks in Production Service

The following study guide questions are taken from American Petroleum Institute Recommended Practice 12R1 “Recommended Practice for Setting, Maintenance, Inspection, Operation and Repair of Tanks in Production Service” (Fifth Edition, October 1, 1997).

- AE 1. What is the definition of an “atmospheric pressure tank?” (API 12R1-97, Section 3.5)
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- AC 2. What is the minimum shell-to-shell spacing for personnel access between tanks?
(API 12R1-97, Section 4.1.3)
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- AC 3. What should the foundation sub-base for a tank consist of? (API 12R1-97, Section 4.1.5)
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- AC 4. What should be done if the sub-base is not sufficiently impermeable to prevent the
migration of fluids into soils below the tank? (API 12R1-97, Section 4.1.5)

- AC 5. How should the sub-base be graded? Why should it be graded this way? (API 12R1-97, Section 4.1.5)
- AC 6. What should the foundation base for a tank consist of? (API 12R1-97, Section 4.1.6)
- AC 7. What is the purpose of “seep holes?” (API 12R1-97, Section 4.1.8)
- AC 8. Under what conditions should seep holes be provided? (API 12R1-97, Section 4.1.8)
- AE 9. When sacrificial anode cathodic protection is used to protect the inside of a tank used in corrosive fluid or sour gas service, what will be the effect on the anode if the tank does not have an internal coating? (API 12R1-97, Section 4.4.4)

- AE 10. What will be the effect of higher operating temperatures on sacrificial anodes? (API 12R1-97, Section 4.4.4)
- AE 11. What types of materials should be used for vent piping if hydrogen sulfide is present in the system? (API 12R1-97, Section 4.4.7)
- AE 12. At what point in the vent line must pressure-vacuum valves be located? (API 12R1-97, Section 4.4.10)
- AE 13. How far away from sources of vapor release from tanks without dikes should operations that may temporarily create a source of ignition be kept? (API 12R1-97, Section 5.1.10)
- AE 14. For what purpose may steel downcomer pipes be used? (API 12R1-97, Section 5.1.14)

AC 15. How large a volume should dikes or firewalls be constructed to contain? (API 12R1-97, Section 3.2)

AC 16. If a pipe drain is used, it should be provided at what point in the dike? (API 12R1-97, Section 5.2.2)

IA 17. What are 10 factors that should be evaluated when determining the suitability of an existing tank for continued service, change in service or making decisions about the future use of the tank? (API 12R1-97, Section 6.1.2)

1.)

2.)

3.)

4.)

5.)

6.)

7.)

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10.)

- IA 18. What are three internal techniques for determining tank bottom corrosion rates?
 (API 12R1-97, Section 6.6.1.2(a))
- a)
- b)
- c)
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- IA 19. What are three external techniques for determining tank bottom corrosion rates?
 (API 12R1-97, Section 6.6.1.2(b))
- a)
- b)
- c)
-
- IA 20. What is the minimum physical coverage required for measurements conducted to determine
 corrosion rates? (API 12R1-97, Section 6.6.3)
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- IA 21. What techniques should be used to examine completed repairs of butt welds?
 (API 12R1-97, Section 7.4.2(b))

- IA 22. What techniques should be used to examine completed repairs of fillet welds?
(API 12R1-97, Section 7.4.2(c))
- IA 23. What should be done with regards to leak detection when a tank bottom is replaced from
inside the tank? (API 12R1-97, Section 7.8)
- IA 24. What should be the duration of a hydrostatic test performed on an altered or reconstructed
tank? (API 12R1-97, Section 7.10.1)
- AE, IA 25. What should be the duration of a hydrostatic test performed on a repaired tank?
(API 12R1-97, Section 7.10.2)

American Petroleum Institute

API 1631: Interior Lining and Periodic Inspection of Underground Storage Tanks

The following study guide questions are taken from American Petroleum Institute Recommended Practice 1631 entitled “Interior Lining and Periodic Inspection of Underground Storage Tanks” (Fifth Edition, June 2001).

- | | | |
|----|----|---|
| TL | 1. | What does this recommended practice provide? (API 1631-2001, Section 1.1) |
| TL | 2. | What should tank lining contractors certify to the tank owner with regard to the training of employees and subcontractors? (API 1631-2001, Section 4.2.2) |
| | a) | |
| | b) | |
| | c) | |
| | d) | |
| TL | 3. | Why must the coefficients of thermal expansion of the coating and the tank shell be compatible? (API 1631-2001, Section 4.3.3) |

- TL 4. If no manway exists, what are the minimum dimensions for an opening to permit entry into the tank? (API 1631-2001, Section 6.1.1)
- TL 5. During what part of the tank lining operation must purging, air ventilation and testing be performed? (API 1631-2001, Section 5.6.1)
- TL 6. What tools should be used to cut an opening into a tank? What tools must NOT be used until the tank has been cleaned and sandblasted? (API 1631-2001, Section 6.1.4)
- TL 7. Personnel entering a tank should be equipped with: (API 1631-2001, Section 6.2.6.1-6.2.6.3)
- What type of breathing apparatus?
- What type of boots and gloves?
- What type of protective clothing?

- TL 8. What are three toxic materials likely to be found in petroleum storage tanks? (API 1631-2001, Sections 6.3.4.1-6.3.4.3)
- a)
- b)
- c)
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- TL 9. What must be done with sludge removed from the bottom of the tank? (API 1631-2001, Section 7.1)
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- TL 10. A steel tank inspection should identify those areas where corrosion has taken place and metal thickness has been reduced to _____ or less. (API 1631-2001, Section 7.3.3.1)
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- TL 11. A tank may be lined if it has no perforations larger than _____ inches, except under the gauging opening where the perforation may be no larger than _____ inches. (API 1631-2001, Section 7.3.3.4)

- TL
12. A tank may be lined if it has fewer than ____ perforations in a one square-foot area and fewer than ____ perforations in a 500 square-foot area. (API 1631-2001, Section 7.3.3.4)
- TL
13. Under what ambient conditions should grit blasting not be conducted? (API 1631-2001, Section 7.4.2.2)
- TL
14. What type of blast is required to prepare the tank shell surface for lining? (API 1631-2001, Section 7.4.2.4)
- TL
15. Within how many hours after blast cleaning a steel tank must the liner material be applied? (API 1631-2001, Section 7.4.2.4)

- TL 16. Prior to the application of lining material, a steel reinforcing plate should be installed under what two openings of the tank? What should be the minimum dimensions of this reinforcing plate? (API 1631-2001, Section 8.3.1)
- TL 17. What shall be issued if a heater is used to accelerate the curing process? (API 1631-2001, Section 8.2.3)
- TL 18. What should be the nominal thickness of the interior tank coating? (API 1631-2001, Section 8.2.4)
- TL 19. How shall the tank lining be tested after it has cured thoroughly? (API 1631-2001, Section 8.5.1)

- TL
20. If a hole was cut in the tank in order to enter it, a steel cover plate should be used to seal the tank opening. How much should this steel cover plate overlap the tank opening on each side? (API 1631-2001, Section 9.1.2)
- TL
21. Before the excavation is backfilled, what should be done to ensure that the storage tank is tight? (API 1631-2001, Section 9.3.1)

American Petroleum Institute
*API 2003: Protection Against Ignitions Arising out of Static,
Lightning, and Stray Currents*

The following study guide questions are taken from American Petroleum Institute Recommended Practice 2003 entitled “Protection Against Ignitions Arising out of Static, Lightning and Stray Currents” (Eighth Edition, September 2015).

- | | |
|---------------|---|
| AE, AF,
AR | 1. What are four conditions that must be present for an electrostatic charge to be a source of ignition? (API 2003-15, Section 4.1.1) |
| | a) |
| | b) |
| | c) |
| | d) |
| AE, AF,
IA | 2. How can brush discharges be eliminated? (API 2003-15, Section 4.1.4.3) |
| AE, AF | 3. What is a “spark promoter?” (API 2003-15, Section 4.5) |
| AE, AR | 4. On what four factors does the probability of a vapor-air mixture being flammable depend? (API 2003-15, Section 4.1.5.1) |
| | a) |
| | b) |
| | c) |
| | d) |

- | | | |
|---------------|-----|---|
| AE, AR | 5. | What is a “low-vapor-pressure product?” What are some examples of these products? (API 2003-15, Section 3.1.12) |
| AE, AR | 6. | What is an “intermediate-vapor-pressure product?” What are some examples of these products? (API 2003-15, Section 3.1.11) |
| AE, AR | 7. | What is a “high-vapor-pressure product?” What are some examples of these products? (API 2003-15, Section 3.1.10) |
| AE, AF,
AR | 8. | What is “grounding?” (API 2003-15, Section 3.1.8) |
| AE, AF,
AR | 9. | What is “bonding?” (API 2003-15, Section 3.1.2) |
| AE, AF | 10. | What is "dissipation"? (API 2003-15, Section 4.1.3) |

- AE, AF,
AR
11. Owners shall ensure that tank trucks and tank cars have a properly operating _____ system. (API 2003-15, Section 4.2.13(e))
- AR
12. What is the ignition hazard associated with the use of steam jets to clean a tank? (API 2003-15, Section 4.5.7.2/4.5.7.1)
- AR
13. Why is a CO₂ jet an effective static generator? Should CO₂ fire extinguishers be used to inert flammable atmospheres? (API 2003-15, Section 4.5.7.2)
- AF, IA
14. What two items should bonding shunts on open floating-roof tanks connect? What is the primary purpose of these bonding shunts? (API 2003-15, Section 4.5.8.1)
- AF, IA
15. What are the two usual forms of bonding used on internal floating-roof tanks? (API 2003-15, Section 4.5.8.1)

- AE, AF 16. Charge generation greatly increases if a _____ is placed in a piping system. (API 2003-15, Section 4.6.3.1)
- AE, AR, IA 17. Does artificial grounding of metallic tanks in contact with the ground by means of driven ground rods affect the probability that a tank will be struck by lightning? Does artificial grounding reduce the possibility of ignition of tank contents? (API 2003-15, Section 5.4.1)
- AE, AC 18. Do metallic tanks that do not rest directly on the ground but are connected to grounded piping systems require additional grounding to provide for the safe dissipation of lightning strokes? For what reason may supplemental grounding be required? (API 2003-15, Section 5.4.1)
- AE, AR 19. What types of tanks are considered to be well protected from ignition damage or damage by direct-stroke lightning because all metallic components are in contact? (API 2003-15, Section 5.4.2.1)
- AE, AR 20. What type of tank cannot be considered to be protected from direct-stroke lightning? (API 2003-15, Section 5.4.2.1)

- IA 21. What are five precautionary measures that can be taken to minimize the risk associated with lightning strikes? (API 2003-15, Section 5.4.2.1)
- AE, AR 22. What type of tank is inherently protected against lightning by the Farraday-cage effect? (API 2003-15, Section 5.4.2.3)
- IA 23. What are four possible sources of stray currents? (API 2003-15, Section 6.2)
- a)
- b)
- c)
- d)

- AE 24. What type of static charge generating process is of particular importance to the petroleum industry? (API 2003-15, Appendix A.2)
- AE 25. What factors affect the rate of generation of static charges in liquids? (API 2003-15, Appendix A.3)
- AE 26. What factor greatly influences the accumulation of static charges? (API 2003-15, Appendix A.4)
- AE 27. What is an incendive spark? (API 2003-15, Appendix A.6.4)

- AE 28. What is a nonincendive spark? (API 2003-15, Appendix A.6.4)
- AE, IA 29. Bonding is an electrical connection between two conducting bodies. How does bonding prevent sparking? (API 2003-15, Appendix A.8.2)
- AE 30. Is low resistance in bond wires necessary? Why or why not? (API 2003-15, Appendix A.8.2)
- AE, IA 31. What will grounding prevent? What type of static charge accumulation will grounding NOT prevent? (API 2003-15, Appendix A.8.3)

AE 32. What techniques can be used to reduce the rate of generation of static charges in liquid hydrocarbon products? (API 2003-15, Appendix A.8.4)

IA 33. If the atmosphere in a vapor space is in the flammable range, how can this hazard be reduced? (API 2003-15, Appendix A.8.6)

American Petroleum Institute
API 2009: Safe Welding, Cutting, and Hot Work Practices in
The Petroleum and Petrochemical Industries

The following study guide questions are taken from American Petroleum Institute Publication 2009 entitled “Safe Welding, Cutting, and Hot Work Practices in the Petroleum and Petrochemical Industries” (Seventh Edition, February 2002).

AE, AF, 1. What is meant by the term “competent person?” (API 2009-2002, Section 3.3)
AR

AE, AF, 2. What is meant by the term “lower flammable limit?” (API 2009-2002, Section 3.11)
AR

AE, AF, 3. What is meant by the term “exposure limit?” (API 2009-2002, Section 3.5)
AR

AE, AF, 4. What is meant by the term “confined space?” (API 2009-2002, Section 3.4)
AR, TL

- | | |
|-------------------|---|
| AE, AF,
AR, TL | 5. What is meant by the term “hot work?” What are some activities usually considered to be hot work? (API 2009-2002, Section 3.8) |
| AR | 6. What must be done if the object on which hot work is to be performed cannot be moved and if all the fire hazards cannot be removed? (API 2009-2002, Section 4.1) |
| AR | 7. What are seven precautions that should be taken to prevent electrical hazard exposure for personnel? (API 2009-2002, Section 5.11) |
| AE, AR,
TL | 8. Many flammability meters require oxygen levels to be at a minimum of what percent in order to provide proper readings? (API 2009-2002, Section 7.2) |
| AE, AF | 9. What precautions should be taken before welding or cutting is performed above or near oily surfaces? (API 2009-2002, Section 9.3) |
| AE, AF | 10. What are five ways to reduce exposure to welding fumes? (API 2009-2002, Section 5.4.1) |

- AE, AF,
AR
11. Except in inert spaces, what should the concentration of flammable vapors be in order to permit entry into a confined space? (API 2009-2002, Section 9.3)
- AE, AR
TL
12. What hazards to personnel might welding or cutting operations create inside a confined space? (API 2009-2002, Section 9.4)
- AR, TL
13. If SCBA respiratory protection is not required, within what range must the oxygen content of the confined space be when personnel are present? What must the concentration of toxic vapors and gases be? (API 2009-2002, Section 9.4)
- AF, AR
14. Under what circumstances is a fire watch person required? What equipment should fire watch personnel have readily available? (API 2009-2002, Section 6.5)
- AE, AF,
AR
15. When should a hot work permit be obtained? (API 2009-2002, Section 8.2)

AE, AF,
AR

16. What information and conditions should be included in a hot work permit? (API 2009-2002, Section 8.2)

a)

b)

c)

d)

e)

f)

g)

h)

i)

j)

k)

m)

AR

17. What must the concentration of flammable vapors be in order to allow hot work to occur? (API 2009-2002, Section 9.3)

- AR 18. An “inspection of internals” should be conducted prior to beginning hot work. What is the purpose of the inspection? What areas should be inspected? (API 2009-2002, Section 10.3)
- IA 19. What two procedures may be used to perform welding on the outside surface of a vessel that has not been gas freed? (API 2009-2002, Section 12.3)
- a)
- b)
- AE, IA 20. What are four precautions that must be taken prior to welding or hot tapping a pipe that is in operation? (API 2009-2002, Section 12.2)
- a)
- b)
- c)
- d)

American Petroleum Institute

API 2015: Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks

The following questions were taken from the American Petroleum Institute's Publication 2015, "Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks" (Eighth Edition, January 2018).

- | | |
|-------------------------------------|--|
| AC, AE,
AF, AN,
AR, AS | 1. What type of information does this standard provide? To what types of tanks does it apply? (API 2015-18, Section 1.1) |
| AE, AF,
AR | 2. What is "bonding"? (API 2015-18, Section 3.5) |
| AC, AE,
AF, AN,
AR, AS,
TL | 3. What is a "confined space?" What is a "permit-required confined space"? (API 2015-18, Section 3.8, 3.8.3) |
| AE, AF,
AR, TL | 4. Should a situation develop that is more hazardous than allowed by the confined space entry permit, what shall entrants do? (API 2015-18, Section 7.2.1) |

- AE, TL 5. Written plans for tank work should include the testing of the tank atmosphere by a qualified person. What are three things that should be measured when testing is conducted? (API 2015-18, Section 7.1.2)
- AE, AF,
AR, TL 6. What shall entrants require during entry into a confined space? (API 2015-18, Section 6.3.5.1)
- AF, AN,
AR, TL 7. Must an entry permit be issued for a worker to enter an inert atmosphere for test purposes? (API 2015-18, Section 10.1.2)
- AR, TL 8. What are four categories of hazards a person may encounter during petroleum tank entry and cleaning? (API 2015-18, Section 7.1.1)
- a)
- b)
- c)
- d)
- AR, TL 9. Before a tank is opened, all residual product should be pumped or drained off to the lowest possible level. To accomplish this task when working with heavy or viscous products, it may be advisable to flush the tank with what substances? (API 2015-18, Section C.2.3)

AE, AR,
AS, TL

10. When preparing a tank for entry, what is the next step to take after emptying the tank? (API 2015-18, Section C.2.4)

AF, AN,
AR, TL

11. What are the four requirements for personal protective equipment for workers entering a tank to clean it? (API 2015-18, Section 8.1.1)

AC, AF,
AE, AS,
TL

12. What three types of atmospheric tests (measurements) must be conducted before a tank is entered? In what order should these tests be performed? (API 2015-18, Section 6.3.1, 7.1.2)

a)

b)

c)

AF, AR,
AN, TL

13. When vapor freeing (purging) a tank, where should measurements (tests) of vapor levels around the exterior of the tank be conducted? (API 2015-18, Section 6.3.4)

AF, AN,
AR, TL

14. Prior to permitting vertical entry into a tank, how should the internal atmosphere be tested to assure that flammable and toxic vapors have not stratified in the tank? (API 2015-18, Section 6.3.5.5)

AS, AR,
TL

15. What information must be recorded on the entry permit? Where must this permit be posted? (API 2015-18, Section 10.2)

AF, AR,
TL

16. How long should the ventilation system be shut down before testing the interior of a tank that has been mechanically ventilated? (API 2015-18, Section 6.3.5.3)

AR, TL

17. When should tanks that have contained lead additives be tested for lead-in-air? (API 2015-18, Section 7.4.3.3)

AF, AR,
TL

18. What should a worker do if clothing becomes contaminated with tank sludge that contains toxic substances? (API 2015-18, Section 7.4.3.7)

AR, TL

19. Tanks that were previously cleaned but have been closed and inactive shall be considered _____confined space. (API 2015-18, Section 10.1.3)

AE, TL

20. What are 10 responsibilities of an attendant monitoring a confined space entry?
(API 2015-18, Section 9.4.2)

a)

b)

c)

d)

e)

f)

g)

h)

i)

j)

AE, AF,
AR, TL

21. What should be the level of flammable vapors in a tank where hot work is being done?
(API 2015-18, Section 11.2.3.1)

AC, AC,
AE, AN,
AR, AS,
TL

22. What are the three elements of the fire triangle, which are necessary for fire or explosion to occur? (API 2015-18, Section A.1.3.2)

AR, AS,
TL

23. Why is the elimination of ignition sources difficult? (API 2015-18, Section A.1.3.2.3)

AE, AF,
AN

24. Gasoline vapors are heavier than air. Because of this, how can gasoline vapors flow? How far can they travel? (API 2015-18, Section A.1.3.2.2)

AF, AR,
TL

25. Which two elements of the fire triangle are desirable to eliminate for safe work inside a tank? (API 2015-18, Section A.1.3.2.2, A.1.3.2.3)

AR, TL

26. When entering a tank that contains or has contained aromatic hydrocarbons, a qualified person shall assure that workers use _____ (API 2015-18, Section 7.4.5.3)

AE, AR,
AS

27. Why is it a mistake to believe that a tank where the gasoline vapor/air mixture is in the rich range is safe to enter? (API 2015-18, Section A.1.5.1)

AF, AR,
TL

28. How can flammable and toxic vapors be present in a tank, even after it has been thoroughly purged? (API 2015-18, Section A.1.5.2)

AR, TL

29. How can steam cleaning be related to the release of vapors from a tank? (API 2015-18, Section A.1.5.2)

AC, AF,
AN, AR,
TL

30. To what two hazards might a person entering an oxygen-deficient atmosphere be exposed? (API 2015-18, Section A.1.2.4)

a)

b)

AE, AF,
AR, TL

31. When calibrating an oxygen meter, to what level shall a qualified person adjust the meter in fresh air? (API 2015-18, Section E.2.3)

AC, AF,
AE, AN,
AR, AS,
TL

32. What is the reading on an oxygen analyzer that indicates the oxygen content is below the breathing range (oxygen deficient) and respiratory equipment must be worn? What is the reading in which entry must not occur, even with respiratory equipment? (API 2015-18, Section A.1.2.4)

AN, AR,
TL

33. What are five reasons why a tank may be oxygen deficient? (API 2015-18, Section 7.2.2)
- a)
 - b)
 - c)
 - d)
 - e)

AF, AS

34. What percent oxygen constitutes an oxygen enriched atmosphere? (API 2015-18, Section 7.2.3.1)

AR

35. Above what oxygen level does petroleum industry practice prohibit entry into tanks? (API 2015-18, Section 7.2.3)

- AR, TL
36. Death or brain damage can occur within minutes of breathing in an oxygen deficient atmosphere. Do workers in an oxygen deficient atmosphere without respiratory equipment usually notice that they are not getting enough oxygen? (API 2015-18, Section A.1.2.4)
- AR, TL
37. What must entrants do if oxygen levels in the tank differ from those allowed by the entry permit? (API 2015-18, Section 7.2.1)
- AF, AN,
AR, AS,
TL
38. What are four ways that toxic substances can enter the body? (API 2015-18, Section A.1.6.2)
- a)
 - b)
 - c)
 - d)
- AE, AN,
AR, AS,
TL
39. What type of toxic effects are produced by irritants? (API 2015-18, Section A.1.6.2.1)
- AE, AN,
AR, AS,
TL
40. What type of toxic effects are produced by “corrosives?” (API 2015-18, Section A.1.6.2.2)

AE, AN,
AR, AS,
TL

41. What type of toxic effects are produced by “chronically toxic substances?” (API 2015-18, Section A.1.6.2.4)

AF, AE,
AS, AN,
AR, TL

42. What compounds in petroleum hydrocarbons have been determined to have the potential to cause cancer? (API 2015-18, Section 7.4.5)

AF, AR,
TL

43. Hydrogen sulfide is an extremely toxic flammable gas. The following questions all relate to hydrogen sulfide: (API 2015-18, Section A.1.7)
- a) What is its color?
 - b) What is its odor?
 - c) Is it heavier or lighter than air?
 - d) What tends to happen to hydrogen sulfide during the refining process?
 - e) At low concentrations, can it be detected by smell?
 - f) At high concentrations, can it be detected by smell? Why or why not?

AF, AR,
TL

44. The atmosphere in any tank that contains sour crude stocks or sulfur-containing products should be considered _____.

AF, AR,
AS, TL

45. By what routes of exposure can toxic lead alkyls enter the body? (API 2015-18, Section A.1.8.3)

AF, AR,
AN, TL

46. When the potential exists for exposure to toxic and harmful dusts, the need for appropriate precautionary measures to mitigate and control exposure, and requirements for respiratory protection and protective clothing for entrants is determined and implemented by whom? (API 2015-18, Section A.1.9)

AF, AR,
AS, TL

47. Under what circumstances do most organic lead poisonings occur? (API 2015-18, Section A.1.8.3)

AE, AF,
AR, TL

48. What are the four steps that must be taken in order to properly isolate tanks or lines equipped with cathodic protection? (API 2015-18, Section 5.3.4)
- a)
 - b)
 - c)
 - d)

AF, AN,
AR, TL

49. What makes a venturi-type eductor different from other types of blowers or educators? (API 2015-18, Section B.3.1.1)

AF, AN,
AR, TL

50. Vapors and gases released to the atmosphere shall be discharged at what height?
(API 2015-18, Section B.2.2.1)

AF, AN,
AS, AR

51. What are three factors to consider in the selection of an effective vapor freeing method for a tank? (API 2015-18, Section 5.5.3)

AF, AR,
TL

52. What are four methods that may be used to vapor free a tank? (API 2015-18, Section 5.5.2)

a)

b)

c)

d)

AF, AR,

53. Why is it important to avoid release of vapor near ground level during ventilation and cleaning operations? (API 2015-18, Section B.1.2)

AE, AR,
AS, TL

54. A vacuum truck is to be used to remove sludge from a storage tank. (API 2015-18, Section A.1.4.3)

1. Where should the truck be located?
2. Where should vacuum truck tank exhaust vapors be discharged?
3. What should be done to the suction and discharge hoses?

AE, AR,
AS, TL

55. What type of lights should be avoided, if possible, when there is a potential of flammable vapors exceeding 10 percent of the lower flammable limit? (API 2015-18, Section A.1.4.5)

AF, AR,
AS, TL

56. Requirements for electrical equipment to be used in and around tanks that have contained flammable liquids are contained in which publication? (API 2015-18, Section A.1.4.5)

AR, TL

57. In what tanks can pyrophoric iron sulfide deposits often be found? (API 2015-18, Section 5.4.8)

AR, TL

58. How can pyrophoric deposits be controlled so that they do not become a potential source of ignition? (API 2015-18, Section A.1.4.8)

AS, AR, TL	59. What type of ventilation must be provided when entrants are working inside tanks? (API 2015-18, Section 10.5.1.2)
AR, TL	60. If a flammable vapor analyzer indicates a reading of zero, are toxic vapor levels below the permissible exposure limit? (API 2015-18, Section E.4.1.1)
AR, TL	61. What will happen if a flammable vapor analyzer is used to monitor a tank that has been inerted? (API 2015-18, Section E.3.2)
AR, TL	62. What must the written entry permits attest before anyone may enter a tank? (API 2015-18, Section 10.2.1.1)
AE, AR, TL	63. What are five conditions that require the entry permit to be cancelled? (API 2015-18, Section 10.2.2.5) <ul style="list-style-type: none"> a) b) c) d) e)

AR, TL

64. What protective equipment must workers use while cleaning tanks that contained lead additives? (API 2015-18, Section A.1.8.3)

AF

65. What are some components of external floating roof tanks? (API 2015-18, Section A.3.2)

American Petroleum Institute
API 2202: Dismantling and Disposing of Steel From
Aboveground Leaded Gasoline Storage Tanks

The following study guide questions are taken from American Petroleum Institute Publication 2202, entitled “Dismantling and Disposing of Steel From Aboveground Leaded Gasoline Storage Tanks” (Third Edition, January 1991).

- | | |
|--------------------------|--|
| AF, AR | 1. What is the scope of this document? (API 2202-91, Section 1.1) |
| | |
| AR, TL | 2. In unlined tanks, where does the greatest amount of organic and inorganic lead contamination occur? Why is this? (API 2202-91, Section 1.2) |
| | |
| AE, AR,
TL | 3. What are some of the indications (symptoms) of exposure to lead compounds above permissible exposure limits? (API 2202-91, Section 1.3) |
| | |
| AC, AE,
AF, AR,
TL | 4. What are three ways that lead antiknock compounds can enter the body? (API 2202-91, Section 2.1.2)

a)

b)

c) |
| | |
| AF, AR | 5. How can dust produced by cold-cutting or abrasive blasting operations be reduced? (API 2202-91, Section 2.1.3) |

- AR, TL 6. When workers are inside the tank during dismantling, how should excessive scale be removed? (API 2202-91, Section 2.2.1)
- AF, AR 7. Under what condition is positive-pressure air-supplied respiratory protective equipment not needed when flame cutting operations are conducted from within a tank? (API 2202-91, Section 2.3.1)
- AF, AR 8. What safeguard can be used to warn users or purchasers of steel that has been in contact with lead antiknock compounds? What document should also be provided to users or purchasers of this steel? (API 2202-91, Section 4.1.3)

NOTE: After cleaning and removal, small underground (shop built) tank openings should be plugged or capped. A 1/8 inch vent hole shall be maintained in one plug or cap to prevent excessive differential pressure during transportation or temporary storage of used tanks.

American Petroleum Institute

API 2207: Preparing Tank Bottoms for Hot Work

The following study guide questions are taken from American Petroleum Institute Publication 2207 entitled, “Preparing Tank Bottoms for Hot Work” (Seventh Edition, June 2017).

- | | |
|---------------|---|
| AF, AR,
IA | 1. Prior to beginning hot work on a tank bottom, safety inspections should be conducted to determine the oxygen content of the tank. What is the acceptable range of oxygen content? (API 2207-17, Section 4.1.5) |
| AR, IA | 2. As part of the general precautions for tank bottom hot work, what safety equipment should be available and ready for instant use? (API 2207-17, Section 4.1.7) |
| AF, AR,
IA | 3. What must be done in order to weld on steel that has been in contact with leaded gasoline without using supplied-air respiratory equipment? (API 2207-17, Section 4.2.7) |
| AF, AR,
IA | 4. Where should grounding leads from a welding machine be attached? (API 2207-17, Section 4.2.12) |

- AF, AR
5. In what position should compressed gas cylinders used for cutting operations be kept? Where should these cylinders be located? (API 2207-17, Section 4.2.13)
- AF, IA
6. Small openings are sometimes made in the tank bottom in areas where hot work is to be performed. What is the purpose of these openings? (API 2207-17, Section 5.2.1)
- AF, AR
7. Small openings are sometimes made in the tank bottom in areas where hot work is to be performed. What equipment should be used to make these openings? What type of drilling machine is NOT recommended? (API 2207-17, Section 5.2.1)
- AF, AR, IA
8. If minor repairs are to be performed on a tank bottom where flammable vapors are suspected to be present under the tank bottom, what procedure may be used to prevent ignition of the vapors? (API 2207-17, Section 6.2)
- a)
 - b)
 - c)
 - d)
 - e)

AF, AR,
IA

9. If major repairs are to be performed on a tank bottom where flammable vapors are suspected to be present under the tank bottom, what procedure may be used to prevent ignition of the vapors? (API 2207-17, Section 6.3)
- a)
 - b)
 - c)
 - d)
 - e)
 - f)

AF, AR

10. When using water flooding to displace flammable liquids and vapors from beneath a tank bottom, how high should the earthen dike be that surrounds the tank? How far away should the dike be from the tank shell? (API 2207-17, Section 6.3.2)

AF, IA

11. What methods may be used when performing sectional work on tank bottoms? (API 2207-17, Section 6.6.2)

American Petroleum Institute

API 2350: Overfill Protection for Storage Tanks In Petroleum Facilities

The following study guide questions are taken from American Petroleum Institute Recommended Practice 2350 entitled, “Overfill Protection for Storage Tanks In Petroleum Facilities” (Fourth Edition, May 2012).

AE, AF,
AN

1. What is the scope of this document? (API 2350-12, Section 1.1)

AE, AF,
AN

2. What is a “high-high tank alarm?” (API 2350-12, Section 3.22)

AE, AF,
AN

3. What is a “critical high level?” (API 2350-12, Section 3.13)

AE, AF

4. What is an "independent alarm"? (API 2350-12, Section 3.25)

AE, AF,
AN

5. What is the “maximum working level” for a tank? (API 2350-12, Section 3.31)

- AE, AN 6. What are the four factors that provide the best protection against tank overfill? (API 2350-12, Section 4.1.1)
- AE, AF 7. At what type of facility are level detectors not required? (API 2350-12, Section 4.4.5.2)
- AE, AF,
AN 8. How must product transfer be monitored for tanks in fully automated operation at an unattended facility? (API 2350-12, Section 4.4.5.4.4)
- AE, AF,
IA 9. How does a high-high tank alarm accomplish overfill protection? (API 2350-12, Section 5.1.2.1)
- AE, AF,
IA 10. What is the AOPS level, and how is it determined? (API 2350-12, Section 4.4.2.4)

AE, AF,
IA

11. What should be the criteria for determining the point at which the high-high tank level detector is located? (API 2350-12, Section 4.4.2.2)

AE, AF

12. What four functions must an AOPS perform when product in the tank has reached the AOPS level? (API 2350-12, Section 5.5)

a)

b)

c)

d)

AE, AF,
IA

13. How often should system electronic integrity tests be conducted at unattended facilities to ensure proper operation of the tank level alarm system? (API 2350-12, Section 4.5.4.2)

AE, AF,
IA

14. What type of liquid level detectors are used in cone roof tanks? (API 2350-12, Table C. 1)

AE, AF,
IA

15. What are three minimum levels of concern that must be established for each tank? (API 2350-12, Section 4.4.2)

a)

b)

c)

AE, AF,
IA

16. What is the minimum distance between the critical high level and the high-high tank level?
(API 2350-12, Section 4.4.2.2)

American Petroleum Institute

API 620: Design and Construction of Large, Welded, Low-Pressure Storage Tanks

The following study guide questions are taken from American Petroleum Institute Standard 620 entitled, “Design and Construction of Large, Welded, Low-Pressure Storage Tanks” (Twelfth Edition, October 2013).

- AE 1. What is meant by the term “edge of reinforcement” with regard to openings in the wall of a tank? (API 620-13, Section 5.14.5)
- AE, AF 2. The minimum distance allowed between the outer edge of an opening reinforcement and any significant discontinuity in the curvature of the tank walls is _____ inches or _____ the nominal thickness of the wall plate, whichever is greater. (API 620-13 Section 5.14.5)
- AE, AF 3. What is the minimum number of manhole openings that must be provided in order to afford access to the interior of the tank for inspection and repair? (API 620-13, Section 5.15)
- AE, AF 4. What is the minimum size allowed for an inspection manhole? (API 620-13, Section 5.15)
- AE, AF 5. When certain conditions are met, single openings in tanks do not require additional reinforcement. What are three such conditions described in this document? (API 620-13, Section 5.16.2.1)
- a)
- b)
- c)

- AE, AF,
IA
6. Under certain conditions, two or more adjacent tank openings may require combined reinforcement. What are two such conditions mentioned in this document? (API 620-13, Section 5.17.1)
- a)
- b)
- AE, AF,
IA
7. When adjacent tank openings are provided with combined reinforcement, what is the minimum distance required between any two of these openings? (API 620-13, Section 5.17.2)
- AE, AF,
IA
8. What must a reinforced flush-type shell connection be preassembled into in order to perform thermal stress relief? (API 620-13, Section 5.27.3)
- AE, AF
9. What is the maximum “out-of-plumbness” allowed between the top and bottom of the shell for tanks with cylindrical sidewalls? (API 620-13, Section 6.5.2.1)
- AC, AF
10. If a tank foundation includes a concrete ringwall, how level must the top of the foundation be? (API 620-13, Section 6.5.6.2)
- AE, AF
11. Immediately before any welding operation, how should the surface to be welded be prepared? What type of film is not considered detrimental to the welding operation? (API 620-13, Section 6.10.1)

- AF, IA 12. How should the reverse side of double-welded butt joints be prepared prior to welding? Why must this be done? (API 620-13, Section 6.10.3)
- AF 13. What are three weather related conditions under which welding must not be done? (API 620-13, Section 6.11)
- a)
- b)
- c)
- IA 14. To ensure that weld grooves are completely filled so that the surface of the weld metal at any point does not fall below the surface of the adjoining plate, weld metal may be built up as reinforcement on each side of the plate. What is the maximum thickness of reinforcement allowed for a vertical joint where the plate thickness is .5 inch? For a horizontal joint where the plate thickness is 1.25 inches? (API 620-13, Section 6.12.1, Table 6-3)
- NOTE: The values in Table 6-3 are applicable only if the joint is not to be radiographically examined. Compare the values in Table 7-1, Section 7.15.1.1*
- AF, IA 15. When merging weld with plate surfaces, the maximum permissible undercutting of longitudinal or meridional butt joints is _____. (API 620-13, Section 6.13)

- AF, IA 16. What are the criteria for a weld to be acceptable by visual inspection? (API 620-13, Section 7.15.5.3)
- a)
- b)
- c)
- d)
- AF, IA 17. Before hydrostatic testing of a tank, what method must be used to inspect the attachment welding around all openings and their reinforcements in the walls of the tank? (API 620-13, Section 7.18.2.2)
- AF, IA 18. To test reinforcement plate welds, _____ pounds per square inch of pneumatic pressure should be applied. (API 620-13, Section 7.18.2.3)
- AF, IA 19. Before hydrostatic testing of a tank, what method shall be used to test all bottom plate joints in cases where the tank bottom rests directly on the tank grade? What alternate method can be used? (API 620-13, Section 7.18.2.4)

- AE, AF 20. Safety and relief valves 1/2 inch and larger must be marked with certain information. This information should include: (API 620-13, Section 9.6.1.1)
- a)
 - b)
 - c)
 - d)
 - e)
 - f)
- AC 21. The lowest footing course for a concrete tank foundation should be bedded directly against the sides of the excavation when the sides are self-supporting. What steps should be taken just before the concrete is poured to prepare the excavation? (API 620-13, Section C.8.2)
- AC 22. How far beyond steel baseplates should the tops of concrete foundations project? (API 620-13, Section C.8.4)
- AC 23. Except for the tops of concrete pedestal and wall foundations, how far below final grade should exposed concrete surfaces be smooth finished? (API 620-13, Section C.8.5)
- AC 24. What should be done as a final check on the adequacy of the tank foundation during the hydrostatic test? (API 620-13, Section C.11)

American Petroleum Institute

API 650: Welded Steel Tanks for Oil Storage

The following study guide questions are taken from American Petroleum Institute Standard 650 entitled, “Welded Steel Tanks for Oil Storage” (Twelfth Edition, March 2013 with Addendums 1 (9/2014), 2 (1/2016), and 3 (8/2018)).

AC, AE,
AF, IA 1. To what types of tanks does this standard apply? (API 650-13, Section 1.1.1)

AF, IA 2. What is a butt weld? (API 650-13, Section 5.1.1.1)

AF, IA 3. What is a fillet weld? (API 650-13, Section 5.1.1.4)

AE, AF,
IA 4. What is a tack weld? (API 650-13, Section 5.1.1.8)

AF, IA 5. What is the size of the groove weld based on? (API 650-13, Section 5.1.2.1)

- AF, IA 6. What is the minimum size of fillet welds on plates 5mm (3/16") thick? (API 650-13, Section 5.1.3.3)
- AF, IA 7. What type of weld is used for joining ring sections? (API 650-13, Section 5.1.5.8)
- AF, IA 8. What are the requirements for horizontal shell joints? (API 650-13, Section 5.1.5.3)
- AF, IA 9. What is the minimum nominal thickness required for bottom plates? (API 650-13, Section 5.4.1)
- AF, IA 10. Bottom plates of sufficient size shall be ordered so that when trimmed, there is a projection of _____ beyond the outside edge of the weld attaching the bottom to the shell plate. (API 650-13, Section 5.4.2)

- AF, IA 11. How shall isolated radial loads on the tank shell be distributed? (API 650-13, Section 5.6.1.5)
- AE, AF, IA 12. What is the largest flanged or threaded nozzle that can be installed in a tank shell without reinforcement? (API 650-13, Section 5.7.2.1)
- AF, IA 13. If work is expected to be carried on through the roof manhole opening while the tank is in use, what must be done to the roof structure around the manhole? (API 650-13, Section 5.8.4)
- AE, AF, IA 14. What is the purpose of stiffening rings (wind girders)? (API 650-13, Section 5.9.1.1)
- AE, AF, IA 15. If a stiffening ring is to be formed or built up, what is the minimum nominal thickness of the steel plate that should be used? (API 650-13, Section 5.9.3.1)

- AF 16. If material needs straightening, how should this be accomplished? (API 650-13, Section 6.1.1.2)
- AF 17. After tank bottom plates are laid out and tacked together, in what sequence should they be welded together? (API 650-13, Section 7.2.2.1)
- AF 18. What is the maximum misalignment allowed for vertical shell joints when the plate thickness is greater than 5/8 inch? (API 650-13, Section 7.2.3.1)
- AF 19. What is the maximum misalignment allowed for vertical shell joints when the plate thickness is less than or equal to 5/8 inch? (API 650-13, Section 7.2.3.1)
- AF 20. For horizontal butt joints on the tank shell, what percentage of the upper plate thickness may project beyond the face of the lower plate? What is the maximum projection allowed for this type of joint? What is the maximum projection allowed if the upper plate is less than 5/16 inch thick? (API 650-13, Section 7.2.3.2)

- AF 21. What type of weld procedure must be used when the shell plate thickness is greater than 1.5 inches thick? What is the maximum thickness allowed for a single weld pass? (API 650-13, Section 7.2.3.5)
- AF, IA 22. What are five ways that the initial weld pass inside the shell may be tested? (API 650-13, Section 7.2.4.1)
- AF, IA 23. When conducting vacuum testing of weld seams, what is the indicator that porosity is present in the seam? (API 650-13, Section 8.6.9)
- AF, IA 24. What vacuum should be maintained within the vacuum box when testing weld seams using vacuum testing? (API 650-13, Section 8.6.3)
- AF, IA 25. What are three methods that may be used to test newly welded bottom joints? (API 650-13, Section 7.3.3)

- AF, IA 26. When testing reinforcement plate welds, how much pressure should be applied between the tank shell and the reinforcement plates? (API 650-13, Section 7.3.4)
- AF, IA 27. If water is not available to test the shell of a completed tank, what are two procedures that may be used to test the tank shell? (API 650-13, Section 7.3.6)
- AF 28. How may pinhole leaks in tank bottom joint be repaired? (API 650-13, Section 7.4.2)
- AF 29. If a defect is discovered after a tank is filled with water, where must the water level be relative to the defect being repaired? (API 650-13, Section 7.4.4)
- AE, AF 30. What is the maximum out-of-plumbness allowed for the top of the tank shell relative to the bottom of the shell? (API 650-13, Section 7.5.2)

- AF, IA 31. What is the maximum deviation (peaking) allowed on vertical weld joints? What tool shall be used to measure peaking? (API 650-13, Section 7.5.4)
- AE, AF, IA 32. What is the maximum deviation (banding) allowed on horizontal weld joints? What tool shall be used to measure banding? (API 650-13, Section 7.5.4)
- AC 33. Where a concrete ringwall is provided under the shell, how level must the top of the ringwall be within any 30 feet of the circumference? How level must the top of the ringwall be over the total circumference? (API 650-13, Section 7.5.5.2)
- AC 34. Where a concrete ringwall is not provided under the tank shell, how level must the foundation under the shell be within any 10 feet of the circumference? How level must the foundation under the shell be over the total circumference? (API 650-13, Section 7.5.5.2)
- AF, IA 35. When should measurements to check a newly constructed tank against specifications be conducted? (API 650-13, Section 7.5.1)

- AF, IA 36. For what types of weld joints is radiographic inspection required? (API 650-13, Section 8.1.1)
- AF 37. For what types of weld joints is radiographic inspection NOT required? (API 650-13, Section 8.1.1)
- AF 38. What is the minimum weld length that each radiograph must clearly show? (API 650-13, Section 8.1.2.8)
- AC, AN,
AS, AF 39. What are eight general methods that can be used to improve subgrade support conditions beneath an aboveground tank? (API 650-13, Section B.2.4)
- a)
 - b)
 - c)
 - d)
 - e)
 - f)
 - g)
 - h)

- AC 40. What are the specific characteristics listed in this document for fill material used to replace objectionable material or to raise the grade to a suitable height? (API 650-13, Section B.2.5)
- AC, AF,
AS, IA 41. How much higher than the surrounding ground should the surface on which the tank bottom rests be located? (API 650-13, Section B.3.1)
- AC, AN,
AS, AF 42. What are three reasons for having the surface on which the tank bottom rests higher than the surrounding ground? (API 650-13, Section B.3.1)
- a)
b)
c)
- AC, AN,
AS, AF 43. What type of material is recommended for the surface on which the tank bottom plates will rest? What types of materials should be avoided? (API 650-13, Section B.3.2)
- AC, AN,
AS, IA 44. The finished tank grade should be crowned from its outer periphery to its center. What are two reasons for doing this? (API 650-13, Section B.3.3)
- AC, AN,
AS 45. Under what conditions may satisfactory foundations for aboveground tanks be constructed from earth materials? (API 650-13, Section B.4.1.1)

AC, AN,
AS

46. What are four things that an acceptable earth foundation should accomplish? (API 650-13, Section B.4.1.1)
- a)
 - b)
 - c)
 - d)

AC, AN,
AS

47. What are five advantages of a concrete ringwall? (API 650-13, Section B.4.2.1) Which of these advantages also apply to a crushed stone or gravel ringwall? (API 650-13, Section B.4.3.1)
- a)
 - b)
 - c)
 - d)
 - e)

AC, AF,
IA

48. What should be the minimum thickness of a concrete ringwall? (API 650-13, Section B.4.2.2)

AC, AF

49. When designing a concrete ringwall, what forces should the ringwall be reinforced against? (API 650-13, Section B.4.2.3)

- AC, IA 50. What should be considered when the ringwall width exceeds 18 inches? (API 650-13, Section B.4.2.3)
- AC 51. What type of aboveground tank foundation should be used when the soil bearing loads must be distributed over an area larger than the tank area? What may be required for proper tank support? (API 650-13, Section B.4.4.1)
- AC 52. If an anchored tank is not properly designed, its shell can be susceptible to tearing. What should be the relationship between the strength of the anchorage attachments and the yield strength of the anchors? (API 650-13, Section 5.12)
- AC, AF,
AE 53. What is the maximum spacing allowed between tank anchors? (API 650-13, Section 5.12.3)
- AC, AE,
AF 54. What is the minimum diameter allowed for anchor bolts? (API 650-13, Section 5.12.6)

AC, AF,
IA

55. What are seven general requirements for undertank leak detection systems? (API 650-13, Section I.2)

a)

b)

c)

d)

e)

f)

g)

AS, AF

56. Appendix M specifies additional requirements for tanks operating in what temperature range? (API 650-13, Section M.1.1)

American Petroleum Institute

API 651: Cathodic Protection of Aboveground Petroleum Storage Tanks

The following study guide questions are taken from American Petroleum Institute Recommended Practice 651 entitled, “Cathodic Protection of Aboveground Petroleum Storage Tanks” (Fourth Edition, 2014).

AC, AE,
AS

1. At which electrode of an electrochemical cell does oxidation (corrosion) occur? (API 651-14, Section 3.2)

AC, AE,
AS, TL

2. What is “cathodic protection?” (API 651-14, Section 3.7)

AC, AE,
AS, TL, IA

3. What is a “continuity bond?” (API 651-14, Section 3.11)

AC, AE,
AS, TL

4. What is meant by “electrical isolation?” (API 651-14, Section 3.17)

AC, AE,
AS

5. What is a “galvanic anode?” (API 651-14, Section 3.25)

AC, AE,
AS

6. What is meant by “structure-to-electrolyte voltage?” (API 651-14, Section 3.47)

AE, AS,
TL

7. What are four major factors that influence the severity of internal corrosion? (API 651-14, Section 4.3)

a)

b)

c)

d)

AE, AC,
AS

8. What are four factors that can limit the effectiveness or even preclude the use of cathodic protection on aboveground tank bottoms? (API 651-14, Section 5.1.4)

a)

b)

c)

d)

AC, AE

9. A concrete tank pad, constructed on a stable, properly prepared subsoil can eliminate what three things? (API 651-14, Section 5.3.3.1)
- a)
 - b)
 - c)

AC

10. What is the most common material used as a pad beneath storage tank bottoms? (API 651-14, Section 5.3.2)

AE, AC,
AS

11. When a native soil pad is to be used beneath an aboveground tank, what characteristics of the soil can be measured to conduct a corrosion analysis of the site? (API 651-14, Section 5.3.7.1)

AC, AE,
TL

12. Why are thick-film, laminated, and chemical- and corrosion-resistant linings primarily installed in tanks? (API 651-14, Section 5.4.4)

AC, AE,
AF, AS

13. When cathodic protection is successfully applied to a tank bottom, the metal surface being protected acts as the _____ of an electrochemical cell. (API 651-14, Section 6.1)

AC, AE,
AF, AS

14. How do galvanic cathodic protection systems supply the current required to stop corrosion? (API 651-14, Section 6.2.1)

AE, AC

15. What are the advantages of a sacrificial anode (galvanic) cathodic protection system? (API 651-14, Section 6.2.2)

a)

b)

c)

d)

e)

f)

AC, AE,
TL

16. Why can secondary containment liners in a dike render a cathodic protection system ineffective? (API 651-14, Section 5.4.3.3)

AE, AC

17. What are the disadvantages of a sacrificial anode (galvanic) cathodic protection system? (API 651-14, Section 6.2.3)

a)

b)

c)

d)

e)

AE, AC,
AS

18. What are the advantages of an impressed current cathodic protection system? (API 651-14, Section 6.3.2)

a)

b)

c)

d)

AE, AC,
AS

19. What are the disadvantages of an impressed current cathodic protection system? (API 651-14, Section 6.3.3)

a)

b)

c)

d)

e)

f)

g)

AC, AF

20. A sand cushion is placed on top of an old steel tank bottom and a new steel bottom is installed without providing any corrosion prevention measures for the new steel bottom. What will be the likely fate of the new steel bottom? (API 651-14, Section 7.2.4.3)

AC, AF,
AS, IA

21. What are some advantages and disadvantages of impermeable membrane secondary containment systems? (API 651-14, Section 7.2.5)

AC, AF,
AS

22. Sacrificial anodes intended for use in soil environments are packaged in what kind of backfill? What is the purpose of the backfill? (API 651-14, Section 7.3.5.1.3)

AC, AS

23. What two factors determine the number of sacrificial anodes required to provide cathodic protection for aboveground storage tanks? (API 651-14, Section 7.3.5.1.4)

a)

b)

AC, AS

24. In impressed current systems, what types of anodes are generally preferred for soil installations? (API 651-14, Section 7.3.5.2.1.2)

AC, AS

25. How are current requirement tests for impressed current cathodic protection systems conducted? (API 651-14, Section 7.3.5.2.2.2)

AC, AS

26. What are three generally accepted criteria for determining if adequate cathodic protection has been achieved? (API 651-14, Section 8.2.2)

- AS, IA 27. What is the standard method of determining the effectiveness of cathodic protection?
(API 651-14, Section 8.3.1)
- AS 28. How should packaged galvanic anodes be installed? (API 651-14, Section 9.2.1)
- AE, AC,
AS, IA 29. Why must the coke breeze backfill around impressed current anodes be correctly installed?
(API 651-14, Section 9.3.1.3)
- AE, AC,
AS, IA 30. What is the weak point in all anodes? (API 651-14, Section 9.3.1.3)
- AE, AC 31. How can impressed current anodes be installed when bedrock is encountered at a shallow
depth? (API 651-14, Section 9.3.2.2)

- AE, AC 32. What can be done to improve the current distribution to the center of tank bottoms?
(API 651-14, Section 9.3.2.3)
- AC, AE,
AS, IA 33. To what should the negative lead of a cathodic protection rectifier be connected?
(API 651-14, Section 9.3.4.3)
- AC, AE,
AS, IA 34. What will happen if the positive and negative output leads from an impressed current
cathodic protection rectifier are reversed? (API 651-14, Section 9.3.4.3)
- AC, AE,
AS 35. What can happen if underground wire attached to the positive rectifier terminal is not
completely insulated? (API 651-14, Section 9.3.5.1)
- IA 36. How much product should be in a tank when a cathodic protection potential survey is
conducted? (API 651-14, Section 11.1.2)

AC, AE,
AS, IA

37. What is the recommended frequency of cathodic protection surveys? (API 651-14, Section 11.3.1.2)

AC, AE,
AS, IA

38. What is the recommended frequency for checking sources of impressed current? (API 651-14, Section 11.3.2.2)

AE, AS, IA

39. How long should records related to the effectiveness of cathodic protection be retained? (API 651-14, Section 11.4.7)

American Petroleum Institute

API 652: Lining of Aboveground Petroleum Storage Tank Bottoms

The following study guide questions are taken from American Petroleum Institute Recommended Practice 652 entitled “Lining of Aboveground Petroleum Storage Tank Bottoms” (Fourth Edition, September 2014).

TL, AE 1. What is a *holiday* in the tank lining industry? (API 652-14, Section 3.18)

TL 2. What fraction of an inch is a *mil*? (API 652-14, Section 3.20)

TL	<p>3. What are six common mechanisms of internal storage tank bottom corrosion? (API 652-14, Section 4.1)</p> <p>a)</p> <p>b)</p> <p>c)</p> <p>d)</p> <p>e)</p> <p>f)</p>
IA	<p>4. What is the minimum thickness of tank bottom steel plate that may necessitate the application of an internal lining? (API 652-14, Section 5.2)</p>
IA, TL	<p>5. What effect can an inadequate tank foundation have on a tank lining? (API 652-14, Section 5.4)</p>
IA, TL	<p>6. How does the existence of a prior lining influence the decision to apply a new lining? (API 652-14, Section 10.5)</p>

AF, AN
IA, TL

7. How do the prior contents of the tank affect the lining process? (API 652-14, Section 7.2)

AE, AN,
TL

8. What are four items that should be considered when determining the need for the application of linings to the bottom of aboveground tanks? (API 652-14, Section 5, 6.5)

a)

b)

c)

d)

AN, TL

9. What is the service life of a tank bottom lining? How might service life be affected by a change in the product stored in the tank? (API 652-14, Section 6.5.5)

TL

10. What is the thickness of a *thin film*? What is the thickness of a *thick film*? (API 652-14, Section 6.1)

- AE, TL 11. Thin film linings are generally applied to what types of tanks? (API 652-14, Section 6.2.1)
- TL 12. What types of materials are generally used for thin film linings? (API 652-14, Section 6.2.1)
- TL 13. What common substance must all lining materials be resistant to? (API 652-14, Section 6.2.1)
- TL 14. What are the principal advantages of thin film systems? (API 652-14, Section 6.2.2)
- TL 15. What materials are commonly used to reinforce thick film systems? (API 652-14, Section 6.4)

TL 16. What are three advantages of thick film, reinforced linings? (API 652-14, Section 6.4)

a)

b)

c)

TL 17. What are the principal disadvantages of thick film linings? (API 652-14, Section 6.3.3)

TL 18. In addition to corrosion, what other two factors should be considered when selecting a tank bottom lining? (API 652-14, Section 6.1)

a)

b)

- TL
19. Surface preparation is a critical part of the lining operation. What two surface finishes are generally specified? Why should the area where the lining is to be applied be "framed"? (API 652-14, Section 7.1)
- a)
- b)
- TL
20. Before abrasive blasting is conducted, what must be removed from the area to be lined? What procedures are typically used to accomplish this? (API 652-14, Section 7.2)
- AE, AF,
IA, TL
21. What is the preferred technique for repairing perforations in a steel tank bottom? (API 652-14, Section 7.3)
- AE
22. Which API standard should be consulted for information on tank bottom repair? (API 652-14, Section 7.3)

- TL 23. What temperature and relative humidity conditions must be met in order for abrasive blasting and lining application to be performed? (API 652-14, Section 8.3)
- TL 24. What is the typical anchor pattern required in order for tank linings to adhere properly to the steel tank bottom? What is the relationship between anchor pattern and thickness of the lining? (API 652-14, Section 7.5)
- TL 25. Why is it important to follow manufacturer specifications for primer coat thickness? (API 652-14, Section 8.1)
- TL 26. What can be the result of excessive film thickness? (API 652-14, Section 8.4)

TL 27. How may forced curing of a tank lining be accomplished? (API 652-14, Section 8.5)

TL 28. What document contains information concerning lining inspection equipment and procedures? (API 652-14, Section 9.3)

IA, TL 29. What equipment should be used to conduct holiday testing of lining films greater than 20 mils thick? What equipment should be used for holiday testing of lining films 20 mils thick or less? (API 652-14, Section 9.3.4)

TL, IA

30. What must be established before deciding how to repair a lining? (API 652-14, Section 10.6.2.1)

TL

31. What are two basic tank lining repair methods, and when is each used? (API 652-14, Section 10.6.2)

a)

b)

TL

32. High performance internal tank lining materials can present health hazards to workers if not handled properly. What document contains the information necessary to properly handle a specific material? What information does this document contain? (API 652-14, Section 12.4)

a)

b)

c)

d)

e)

American Petroleum Institute

API 653: Tank Inspection, Repair, Alteration, and Reconstruction

The following study guide questions are taken from American Petroleum Institute Standard 653 entitled “Tank Inspection, Repair, Alteration and Reconstruction” (Fifth Edition, November 2014).

AC, AE,
IA 1. To what types of tanks does this standard apply? (API 653-14, Section 1.1.1)

AC, AE,
IA 2. In case of apparent conflicts between the requirements of API 650 and API 653, which standard shall govern? (API 653-14, Section 1.1.2)

AE, IA 3. What is meant by the term *alteration*? What are some examples of major alterations? (API 653-14, Section 3.1, 3.21)

IA 4. What is the "breakover point"? (API 653-14, Section 3.5)

AE, AR,
IA 5. What is meant by the term *repair*? What are some examples of repairs? (API 653-14, Section 3.27)

- IA 6. What conditions would necessitate the repair or replacement of a roof plate? (API 653-14, Section 4.2.1.2)
- IA 7. What possibility must be given particular attention when inspecting pipe columns supporting fixed roofs? (API 653-14, Section 4.2.2.1)
- IA 8. When a tank is to undergo a change in service, what are five factors that should be considered when evaluating the roof and roof-to-shell junction? (API 653-14, Section 4.2.4)
- a)
- b)
- c)
- d)
- e)
- IA 9. When determining controlling thicknesses in shell courses, widely scattered pits may be ignored provided that two conditions are met. What are these two conditions? (API 653-14, Section 4.3.2.2)
- a)
- b)
- IA 10. What are some typical forms of shell distortion? (API 653-14, Section 4.3.5.1)

AC, IA

11. Do temperature cracks in concrete seriously affect the strength of the concrete foundation?
What can temperature cracks in concrete eventually result in? (API 653-14, Section 4.5.1.2)

AC, AE,
IA

12. What are the 12 historical causes of tank bottom leakage listed in this document?
(API 653-14, Section 4.4.2)

a)

b)

c)

d)

e)

f)

g)

h)

i)

j)

k)

l)

IA

13. What problems are indicated by distortion of anchor bolts and excessive cracking of the concrete in which they are embedded? (API 653-14, Section 4.5.3)

IA

14. Below what shell thickness is the potential for failure due to brittle fracture minimal? What can be done to gain assurance against brittle fracture? (API 653-14, Section 5.3.5, 5.3.6)

IA

15. What are thirteen factors that should be considered when determining inspection intervals for storage tanks? (API 653-14, Section 6.2.1)

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)
- k)
- l)
- m)

IA

16. How often should routine in-service inspections be conducted? (API 653-14, Section 6.3.1.2)

IA

15. What are thirteen factors that should be considered when determining inspection intervals for storage tanks? (API 653-14, Section 6.2.1)

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)
- k)
- l)
- m)

IA 16. How often should routine in-service inspections be conducted? (API 653-14, Section 6.3.1.2)

- IA 17. What can be determined by performing external ultrasonic thickness measurements of the tank shell? Can ultrasonic thickness measurements be conducted while the tank is in service? (API 653-14, Section 6.3.3.1)
- IA 18. When ultrasonic thickness measurements are used to assess the tank condition, what is the maximum interval for making the measurements when the corrosion rate is not known? (API 653-14, Section 6.3.3.2)
- IA 19. What are three main purposes of an internal inspection? (API 653-14, Section 6.4.1.1)
- a)
 - b)
 - c)
- IA 20. Once a corrosion rate is determined, the inspection interval should be set to ensure that the minimum bottom plate thickness at the time of the next inspection is not less than the minimum thickness specified in Table 4-1 of the document. What is the minimum inspection interval when: (API 653-14, Section 6.4.2.1 and Table 6-1)
- The tank bottom/foundation design has no means for detection and containment of a bottom leak?
 - The tank bottom/foundation design includes means for containing and detecting bottom leaks?
 - The tank bottom has a reinforced lining greater than .05 inch thick that has been applied in accordance with API 652?
- IA 21. Even when corrosion rate information is available, what is the maximum internal inspection interval allowed? (API 653-14, Section 6.4.2.1.1)

- IA 22. What should be the maximum internal inspection interval when corrosion rates are not known and similar service experience is not available? (API 653-14, Section 6.4.2.1.1)
- IA 23. What three types of records must be kept concerning aboveground tanks? (API 653-14, Section 6.8)
- a)
- b)
- c)
- IA 24. What information must general inspection reports include? (API 653-14, Section 6.9.2)
- AF, IA 25. What type of weld joint must be used when reconstructing a tank shell? (API 653-14, Section 8.2.2)
- AE, AF,
IA 26. What should be the minimum dimension for a replacement shell plate? (API 653-14, Section 9.2.2.1)
- AE, AF,
IA 27. What are acceptable shapes for replacement shell plates? (API 653-14, Section 9.2.2.1)

- AF, IA 28. Prior to welding new vertical joints, what must be done to existing horizontal welds that contact the new vertical joint? (API 653-14, Section 9.2.2.2)
- AF, IA 29. When installing a replacement shell plate, which joints (vertical or horizontal) should be welded first? (API 653-14, Section 9.2.2.2)
- AF 30. What type of joint should be used to install shell replacement plates? (API 653-14, Section 9.2.3.1)
- AF, IA 31. How far from the edge of a weld joint in the annular plate ring or sketch plate must the edge of any vertical weld attaching a replacement plate be? (API 653-14, Section 9.2.3.3)
- IA 32. When the thickness of replacement shell plate is less than .5 inch, what is the minimum allowable distance between an existing vertical weld joint and the vertical weld on the replacement plate? (API 653-14, Figure 9-1)
- AF, IA 33. What may be used for the closure of holes caused by the removal of existing shell openings or by the removal of severely corroded areas? (API 653-14, Section 9.3.2)

- AF, IA 34. What two items must be entirely removed prior to installation of a repair plate? (API 653-14, Section 9.3.2.2)
- AF, IA 35. How can lack of fusion in a weld be repaired? (API 653-14, Section 9.6.1)
- AF, IA 36. How should unacceptable surface defects, such as arc strikes, discovered in or adjacent to welded joints be repaired? (API 653-14, Section 9.6.5)
- AE, AF 37. In a replacement shell penetration larger than NPS 4, what should be the diameter of the insert plate? (API 653-14, Section 9.8.6)
- AE, AF, IA 38. If a new tank bottom is installed above an existing bottom, the spacing between existing welds around penetrations and the new bottom-to-shell weld may not meet API 650 requirements. What are three ways of altering the penetrations to meet API 650? (API 653-14, Sections 9.9.2 through 9.9.2.3)
- AE, AF, IA 39. What areas constitute the “critical zone” for repairs to tank bottoms? (API 653-14, Section 3.10)

- AE, AF,
IA
40. What types of repairs are NOT allowed in the tank bottom critical zone? (API 653-14, Section 9.10.1.2)
- AE, AF,
IA
41. What types of repairs are allowed in the tank bottom critical zone? (API 653-14, Section 9.10.1.2)
- AC, AF
42. When replacing an entire tank bottom, what type of material should be used as a cushion between the old and new bottoms? (API 653-14, Section 9.10.2.1.1)
- AF
43. When replacing an entire tank bottom, what procedures must be followed when installing and attaching the new bottom to the existing shell? (API 653-14, Section 9.10.2.1.2)
- AC, AF
44. When replacing an entire tank bottom, what should be done with voids in the foundation below the old tank bottom? (API 653-14, Section 9.10.2.1.3)
- AF, IA
45. What should be the minimum thickness of new roof plates for a supported cone roof? (API 653-14, Section 9.11.2.1)

- AF, IA 46. What should be the nominal thickness of new roof plates for self-supporting roofs? (API 653-14, Section 9.11.3.1)
- IA 47. To minimize evaporation losses and reduce potential hazard to the workers when replacing floating roof perimeter seals, what is the maximum amount of a roof seal system that should be removed from an in-service tank at one time? (API 653-14, Section 9.13.1)
- AF 48. What should be the minimum height of tank liquid above a hot tap location? (API 653-14, Section 9.14.1.2)
- AF, IA 49. What type of electrode should be used for hot tap welding? (API 653-14, Section 9.14.1.3)
- AF, IA 50. What defects in shell plate preclude the installation of hot taps? (API 653-14, Section 9.14.1.5)
- AF, IA 51. Hot taps are not permitted where the heat of welding may cause _____ (API 653-14, Section 9.14.1.6)

- AF 52. When preparing for a hot tap installation, how many shell thickness measurements shall be made? Where should they be made? (API 653-14, Section 9.14.3.2)
- AF 53. After completing the welding portion of the hot tap procedure, what pressure should be used to test the nozzle prior to mounting the hot tap machine? (API 653-14, Section 9.14.5.3)
- AR, IA 54. When dismantling a tank, into what size pieces may roof, shell and bottom plates be cut? (API 653-14, Section 10.3.1)
- AF, AR, IA 55. When bottom plates are to be reused, how should they be cut? (API 653-14, Section 10.3.2.1)
- AF, AR, IA 56. When roof plates are to be reused, how should they be cut? How should roof supporting structures be dismantled? (API 653-14, Section 10.3.4)
- AF, AR 57. If an entire tank bottom is to be reused in a reconstructed tank, how should the bottom be separated from the existing shell if there is no existing butt welded annular ring? (API 653-14, Section 10.3.2.2)

- AF, AR,
IA
58. When shell plates are to be dismantled and reused, what are three ways in which they can be cut? (API 653-14, Section 10.3.3.1)
- a)
- b)
- c)
- AF, AR,
IA
59. If shell stiffening rings are removed, what must be done to the temporary attachment points? (API 653-14, Section 10.3.3.2)
- AF, AR,
IA
60. If a tank shell is to be dismantled for reuse with a new bottom, where should the shell be cut from the existing bottom? (API 653-14, Section 10.3.3.3)
- AF, AR,
IA
61. When can the existing shell-to-bottom weld connection be reused in a reconstructed tank? (API 653-14, Section 10.3.3.3)
- AF, IA
62. What provisions should be made with regard to joint alignment during the reconstruction of a tank? (API 653-14, Section 10.4.2.1)
- AF, IA
63. What should be done with tack welds used in the assembly of vertical joints on the tank shell when the joints are welded manually? What should be done with tack welds when such joints are welded with a submerged-arc process? (API 653-14, Section 10.4.2.7)

- AF, IA 64. What should be done with primer coatings on surfaces to be welded? (API 653-14, Section 10.4.2.8)
- AF, IA 65. Which should be welded first: bottom plate joints or shell-to-bottom joints? (API 653-14, Section 10.4.3.2)
- AF, IA 66. What is the maximum allowable vertical butt joint misalignment when the plate thickness is 5/8 inch thick or less? (API 653-14, Section 10.4.4.1)
- IA 67. What is the maximum out-of-plumbness allowed for the top of the tank shell relative to the bottom of the shell? (API 653-14, Section 10.5.2.1)
- IA 68. What is the maximum peaking allowed when using a horizontal sweep board 36 inches long? (API 653-14, Section 10.5.4)
- AF, IA 69. At what interval must the welder's identification mark be stamped along completed weld joints? (API 653-14, Section 11.2.2)

- IA 70. What are five nondestructive examination procedures that can be applied to aboveground tanks? (API 653-14, Section 12)
- a)
 - b)
 - c)
 - d)
 - e)
- AF, IA 71. What method of nondestructive examination should be used to detect shell plate laminations when adding a hot tap connection? (API 653-14, Section 12.1.2.1)
- AE, AF, IA 72. What type of nondestructive examination should be used to examine completed welds attaching a nozzle neck to the tank shell? (API 653-14, Section 12.1.2.3)
- AF, IA 73. What type of nondestructive examination should be used to examine completed repairs of butt welds? How much of the weld should be examined? (API 653-14, Section 12.1.3.2)
- AF, IA 74. How should the first pass of the shell-to-bottom weld be inspected? How long should this procedure take? (API 653-14, Section 12.1.6.1)
- AF, IA 75. What should be the minimum diagnostic length of a radiograph of a weld? (API 653-14, Section 12.2.1.7)

- IA 76. What should be done if a radiograph of the intersection of a new and an old weld determines that the old weld is unacceptable by current standards? (API 653-14, Section 12.2.2)
- AF, IA 77. What is the minimum duration of a hydrostatic test for a reconstructed tank? For a tank that has undergone major repairs? (API 653-14, Section 12.3.2)
- AF, IA 78. What is a requirement for new vertical and horizontal shell butt-welds? (API 653-14, Section 12.2.1.6)
- AF, IA 79. Major repairs and major alterations to a tank may require a full hydrostatic test. What are six examples of the type of work that is considered a major repair or major alteration? (API 653-14, Section 3.21)
- a)
 - b)
 - c)
 - d)
 - e)
 - f)
- AF, IA 80. Where on the tank must an air leak test be conducted? (API 653-14, Section 12.4)

AF, IA, AN, AC	81. When surveying for tank settlement during a hydrostatic test, what is the minimum number of measurement points? (API 653-14, Section 12.5.2)
AC	82. During hydrostatic testing, when should the final settlement measurement be taken? (API 653-14, Section 12.5.3)
IA	83. During storage tank operations, how frequently should tank settlement measurements be conducted? (API 653-14, Section B.1.1)
AC	84. What are three approaches that can be used to correct tank shell and bottom settlement? (API 653-14, Section B.1.3) a) b) c)
AC, IA	85. Internal measurements of tank bottom settlement can be made in an out-of-service tank by measuring along the tank diameter. What should be the maximum spacing of these measurements? (API 653-14, Figure B.2)
AC	86. Uniform tank settlement does not induce stresses in the tank structure. However, where can problems arise when a tank undergoes uniform settlement? (API 653-14, Section B.2.2.1)
AC, AN	87. Which type of settlement poses the most severe threat to the structural integrity of a tank shell and bottom? (API 653-14, Section B.2.2.4)

American Society of Mechanical Engineers

ASME RTP-1-2017: Reinforced Thermoset Plastic Corrosion Resistant Equipment

The following study guide questions are taken from American Society of Mechanical Engineers publication ASME RTP-1-2000, entitled "Reinforced Thermoset Plastic Corrosion Resistant Equipment" (2017 Edition).

- | | | |
|----|----|--|
| AN | 1. | What is the minimum diameter of a manway? (ASME RTP-1, Section 4-510) |
| AN | 2. | When reinforcing materials are cut to facilitate placement around an installed nozzle, how must the joints be aligned? (ASME RTP-1, Section 4-600) |
| AN | 3. | What conditions will cause a tank to be declared in "critical service"? (ASME RTP-1, Section 1-210) |
| AN | 4. | A vessel used in critical service should have design strength properties of what percentage of those specified elsewhere in ASME RTP-1? (ASME RTP-1, Section 1-220) |
| AN | 5. | What credentials must the individual have who is responsible for certifying the fabricator's design report? (ASME RTP-1, Section 1-310) |
| AN | 6. | An RTP vessel should be inspected for damage before it is removed from the delivery vehicle. What should be done if damage is observed? (ASME-RTP-1, Appendix NM9-200) |

- AN 7. What are four types of damage that should be checked for during the inspection conducted prior to unloading the RTP vessel from the delivery vehicle? (ASME-RTP-1, Appendix NM9-200)
- a)
- b)
- c)
- d)
- AN 8. The support base surface for an RTP vessel should be nonporous and free of cracks, depressions, and vertical projections. In addition: (ASME-RTP-1, Appendix NM9-300)
- What type of finish is often applied to the concrete surface?
- How flat should the support base for an RTP tank be?
- What is the maximum size allowed for local irregularities?
- AN 9. What should be the composition, compression deflection range, and thickness of the tank cushioning pad? (ASME RTP-1, Appendix NM9-300)
- AN 10. How should flat-bottom RTP vessels be secured in place? Why is this? (ASME-RTP-1, Appendix NM9-300)

- AN 11. How should RTP vessel nozzles that will be below the liquid level be joined to piping? (ASME-RTP-1, Appendix NM9-300)
- AN 12. How should valves that are attached to RTP vessel nozzles be installed? Why is this necessary? (ASME-RTP-1, Appendix NM9-300)
- AN 13. If a vessel fabricator has not specified the type of flanged connections to be used, what are seven recommendations for flanged connection contained in this document? (ASME-RTP-1, Appendix NM9-300)
- a)
 - b)
 - c)
 - d)
 - e)
 - f)
 - g)

NACE International

NACE SP0187: Design Considerations for Corrosion Control of Reinforcing Steel in Concrete

The following study guide questions are taken from the NACE International Standard Recommended Practice entitled “Design Considerations for Corrosion Control of Reinforcing Steel in Concrete” (NACE Standard SP0187, 2017 edition).

- | | |
|----|---|
| AC | 1. Reinforcing steel in concrete is normally protected against corrosion by a stable oxide film. What are three conditions that may destroy this oxide film? (NACE SP0187, Section 1.2.3)

a)

b)

c) |
| AC | 2. What is the effect of concrete permeability on the corrosion of reinforcing steel? What are some factors in the concrete mix design that can reduce the permeability of the concrete? (NACE SP0187, Section 6.3) |
| AC | 3. What effect does the addition of air-entraining admixtures have on the concrete mix and the cured concrete? (NACE SP0187, Section 7.2.1) |

- AC 4. Which accelerating admixture for concrete should only be used with caution when steel is present in the concrete? (NACE SP0187, Section 7.2.2)
- AC 5. What is the function of water-reducing admixtures? (NACE SP0187, Section 7.2.4)
- AC 6. Careful attention to placement details and design of a workable concrete mix should produce what qualities in the finished concrete? (NACE SP0187, Section 5.1.2)
- AC 7. How can the concrete's resistance to penetration of chloride and other aggressive ions be improved? (NACE SP0187, Section 7.4)

- AC
8. What is necessary to ensure the integrity of concrete when in place and to minimize possible damage to coated reinforcement? (NACE SP0187, Section 11.2.1)
- AC
9. Concrete cover on the steel reinforcement can play an important role in protecting the steel from corrosion. What are two steps that can be taken to ensure proper placement of the reinforcing steel before the concrete is poured? (NACE SP0187, Section 11.2.1)
- a)
- b)
- AC
10. What does proper consolidation of the concrete help to avoid? Why is this important in reducing corrosion on reinforcing steel? (NACE SP0187, Section 11.2.3)

PA Department of Environmental Protection

Technical guidance 257-3120-001: Evaluation of Underground Storage Tank Liners

The following study guide questions are taken from the PA DEP Technical Guidance 257-3120-001, "Evaluation of Underground Storage Tank Liners" (October 2003).

- | | | |
|----|----|---|
| TL | 1. | When must an initial UST lining inspection take place? After the initial inspection, what is the time frame for subsequent periodic inspections? (PA DEP, General Section) |
| TL | 2. | What is the minimum size of a hole cut into a tank to permit entry? (PA DEP, Section I) |
| TL | 3. | When a lining inspection is performed by a Professional Engineer (PE), which PA DEP certifications must be possess or be supervised by a certified person who does? (PA DEP, General Section) |
| TL | 4. | What reference publication(s) must be used for an invasive UST lining inspection? (PA DEP, Requirements Section) |
| TL | 5. | How may a video camera be used in the lining inspection process? (PA DEP, Requirements Section) |
| TL | 6. | How are UST thin wall areas defined in this document? (PA DEP, Section III) |

- TL 7. What shall be done to tanks that do not meet the average thickness requirement of 75%? (PA DEP, Section III)
- TL 8. After the inspection is finished and the tank opening has been closed and sealed, what type of test must be performed on the tank? (PA DEP, Section III)
- TL 9. What percentage of the tank lining must be visible for inspection? (PA DEP, Page 7)

Pennsylvania Department of Labor and Industry

Titles 34 and 37: Flammable and Combustible Liquids Regulations

The following study guide questions are taken from Department of Labor and Industry regulations in 34 Pa. Code Chapters 14 and 14a, and 37 Pa. Code Chapter 14. As of April 13, 1998, the Department of Labor and Industry has taken over the administration of this code from the Pennsylvania Fire Marshal. Also, Philadelphia and Pittsburgh have their own flammable and combustible liquid codes which should be consulted before doing work in these cities.

- | | | |
|-------------------|----|--|
| AN, AF,
AS, AE | 1. | What is the definition of "inflammable"? (Flammable & Combustible Liquids regulations, Title 34, Section 14.1) |
| AC, AF,
AS | 2. | If end failure of a horizontal tank may endanger adjacent property, how must the tank be positioned? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.1 (b)) |
| AC, AF,
IA | 3. | What is the minimum shell to shell distance allowed for tanks storing flammable or combustible liquids? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.2 (a)) |
| AC, AF,
AS, IA | 4. | What is the minimum distance allowed between tanks storing unstable liquids? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.2 (d)) |
| AN, AF,
AS, AE | 5. | What effect does heating have on the volatility of a liquid? (Flammable & Combustible Liquids regulations, Title 34, Section 14.6(c)) |

- AF, AS, IA 6. What factors determine the required venting capacity of a tank? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.25 (c))
- AF, AS, IA 7. How shall tanks and piping be tested prior to being placed in use? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.26(a))
- AC, AF,
AN, AS 8. The area surrounding a tank or group of tanks may be provided with a drainage system to prevent accidental discharge of liquid from endangering adjoining property or reaching waterways. In what areas is this drainage system NOT allowed to discharge? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.6 (b)(3))
- AC, AF 9. What should be the capacity of a diked area surrounding tanks with fixed roofs containing liquids with boil over characteristics? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.6 (c)(2))
- AC, AF,
IA 10. When earthen walls are used to construct a dike, what is the minimum width of the top of the dike when the dike wall is three feet or more in height? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.6 (c)(3))

- AC, AF,
IA
11. What is the maximum allowable height of a dike wall above interior grade? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.6 (c)(3))
- AC, AF,
AN, IA
12. Can a building wall be used as part of a dike wall? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.6 (c)(3))
- AN, IA
13. To what specifications must non-steel tanks be built? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.7 (b)(1))
- AE, AS
14. Where vent piping for tanks storing class I liquids is located adjacent to buildings or public ways, what is the minimum height above adjacent ground level that vapors may be discharged? What is the minimum distance required between vent openings and building openings? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.8 (c)(1))
- AS
15. How far above maximum flood stage must the top of a vertical tank extend? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.212 (a))

- AS 16. When is anchoring (or some other method of keeping the tank from floating) required for aboveground horizontal tanks located in flood areas? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.212 (b))
- AS 17. What should be done with tank vents or other openings which are not liquid tight on horizontal tanks in flood areas? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.212 (b))
- AS, AE 18. What categories of aboveground storage tanks are exempt from emergency venting requirements? (Flammable & Combustible Liquids regulations, Title 34, Section 14a.8(b))
- AC 19. Where must tank vaults constructed at a retail fuel distribution facility be located? Where may vaults constructed at non-retail fuel distribution facilities be located? (Flammable & Combustible Liquids regulations, Title 37, Section 14.2 (a))
- AC 20. How much of a tank can be outside a vault? (Flammable & Combustible Liquids regulations, Title 37, Section 14.2 (b))

- AC 21. What is the minimum thickness allowed for the concrete walls and floor of the vault?
(Flammable & Combustible Liquids regulations, Title 37, Section 14.2 (b))
- AC 22. How must the top of an above grade vault be constructed? Why is this so? (Flammable &
Combustible Liquids regulations, Title 37, Section 14.2 (b))
- AC 23. What criteria must vaults meet with regard to liquid tightness? (Flammable & Combustible
Liquids regulations, Title 37, Section 14.2 (b))
- AC 24. Can multiple tanks share the same vault? What structure may adjacent vaults share?
(Flammable & Combustible Liquids regulations, Title 37, Section 14.2(e))
- AC 25. Each vault must be equipped with a liquid detection system. What must happen when liquid
is detected? (Flammable & Combustible Liquids regulations, Title 37, Section 14.2 (h))
- AC 26. How high above grade level must vents provided for normal venting of tanks in vaults be?
(Flammable & Combustible Liquids regulations, Title 37, Section 14.2 (j))

- AC, AS 27. What are the rules for emergency vents on tanks inside vaults? (Flammable & Combustible Liquids regulations, Title 37, Section 14.2(k))
- AC 28. To what standard must tanks designed for use within vaults be tested? What maximum capacity is allowed? (Flammable & Combustible Liquids regulations, Title 37, Section 14.2 (p))
- AC 29. Tanks in above grade vaults must meet minimum set back distances. (Flammable & Combustible Liquids regulations, Title 37, Section 14.2 (q))
- What is the minimum distance required between the tank and any building on the same property?
- What is the minimum distance required between the tank and the nearest side of a public way?
- What is the minimum distance required between the tank and any property line that may be built upon?
- NOTE: In addition to the above, the Pennsylvania Underground Utility Line Protection Act (Act 187 of 1996) requires notification by excavators, designers or any person preparing to disturb the earth's surface anywhere in Pennsylvania. Contractors must call the One Call System (1-800-242-1776) not less than three nor more than 10 working days in advance of beginning excavation or demolition work.*
- AC 30. What should be installed to protect aboveground tanks from collision? (Flammable & Combustible Liquids regulations, Title 37, Section 14.6 (3))

National Fire Protection Association

NFPA 30: Flammable and Combustible Liquids Code

The following study guide questions are taken from the National Fire Protection Association “Flammable and Combustible Liquids Code” (NFPA 30, 2018 edition).

- | | | |
|-----------------------|----|---|
| AS, IA | 1. | What is the definition of an “atmospheric tank”? (NFPA 30, Section 3.3.52.2) |
| | | |
| AE, AF,
AN, AS | 2. | What is the definition of "emergency relief venting"? (NFPA 30, Section 3.3.61.1) |
| | | |
| AF, AN,
AR, AS, IA | 3. | What is meant by the term "fugitive emissions"? (NFPA 30, Section 3.3.22) |
| | | |
| AS, IA | 4. | What is the definition of a “low-pressure tank”? (NFPA 30, Section 3.3.52.3) |
| | | |
| AS, IA | 5. | What is the definition of a “pressure vessel”? (NFPA 30, Section 3.3.44) |

- AN, AS 6. What is meant by the term “protection for exposures”? (NFPA 30, Section 3.3.46)
- AS, IA 7. What is the definition of a “secondary containment tank”? (NFPA 30, Section 3.3.52.5)
- AE, AS, IA 8. What is the definition of a "cryogenic fluid"? (NFPA 30, Section 3.3.14)
- AF, AR,
AS, TL 9. What is the definition of a “stable liquid”? (NFPA 30, Section 3.3.33.3)
- AF, AR,
AS, TL 10. What is the definition of an “unstable liquid”? (NFPA 30, Section 3.3.33.4)

AF, AN,
AR, AS, IA

11. What is the NFPA definition of “ventilation”? (NFPA 30, Section 3.3.62)

AF, AR,
AS, TL

12. What is the definition of “boiling point”? (NFPA 30, Section 3.3.5)

AF, AR,
AS, TL

13. What is the definition of “flash point”? (NFPA 30, Section 3.3.21)

AF, AR,
AS, TL

14. What is the definition of “vapor pressure”? (NFPA 30, Section 3.3.55)

AF, AR,
AS, TL

15. What is the definition of a “class I flammable liquid”? (NFPA 30, Section 4.3.1)

AF, AR,
AS, TL

16. What is the definition of a “combustible liquid”? (NFPA 30, Section 3.3.33.1)

AN, IA

17. Unlined concrete tanks may be used for liquids with a minimum of what gravity? (NFPA 30, Section 21.4.1.2)

AS

18. Vapor detectors in vaults shall be located no higher than _____ above the lowest point of the vault. (NFPA 30, Section 25.15.3)

AN, IA

19. For a tank storing stable liquids and operating at pressures of 2.5 psig or less, what is the minimum distance allowed between the tank shell and a property line that can be built upon? (NFPA 30, Table 22.4.1.1(a))

AS

20. Table 22.4.1.1(a) & (b) in NFPA 30 is used to determine the minimum spacing between an aboveground tank shell and the nearest important building. In order to correctly determine the spacing, what four items must be known? (NFPA 30, Table 22.4.1.1(a) & (b))

a)

b)

c)

d)

- AC, AS, IA 21. When remote impounding is used for control of spillage from aboveground tanks, what is the minimum slope required away from the tank? Over what distance must this slope be maintained? (NFPA 30, Section 22.11.1.1)
- AC, AS, IA 22. When remote impounding is used for control of spillage from aboveground tanks, and the impoundment area is filled to capacity, what is the minimum distance allowed between the liquid and any property line that can be built upon or any tank? (NFPA 30, Section 22.11.1.4)
- AS, IA 23. When calculating the required capacity of a diked area that contains several tanks, how do you take into account the volume of the smaller tanks? (NFPA 30, Section 22.11.2.2.1)
- AC, AN,
IA 24. Except where special provisions have been made, what is the maximum interior height of a dike wall above the interior grade of the diked area? (NFPA 30, Section 22.11.2.5(1))
- AC, AS, IA 25. What is the minimum distance allowed between the shell of aboveground tanks and the toe of the interior dike wall? (NFPA 30, Section 22.11.2.5(3))

- AC, AS, IA 26. What is the minimum distance allowed between the outside base of a dike surrounding an aboveground tank and any property line that is or can be built upon? (NFPA 30, Section 22.11.2.3)
- AF, IA 27 What does adequate venting of an atmospheric storage tank prevent? (NFPA 30, Section 21.4.3.1)
- AE, AS, IA 28. What information must be stamped on each commercially made tank venting device? (NFPA 30, Section 22.7.3.10)
- AS 29. How shall vent pipe outlets for tanks storing class I liquids adjacent to buildings or public ways be located? (NFPA 30, Section 27.8.1.1)
- AE, AS, IA 30. As a general rule, manifolding of vent piping should be avoided. What are three special purposes that may require vent piping to be manifolded? (NFPA 30, Section 27.8.1.4.1)
- a)
- b)
- c)

- AE, AF,
AN, AS,
IA
31. In order to be able to separate a tank from its piping in an emergency, what must be provided at each opening in an aboveground tank through which liquid can normally flow? (NFPA 30, Section 22.13.1)
- AE, AF,
AS, IA
32. Each opening below liquid level in an aboveground tank through which liquid does NOT normally flow must be equipped with a liquid tight closure. What are some examples of the type of hardware that can be used to meet this requirement? (NFPA 30, Section 22.13.2)
- AF, AN,
AS, AE, IA
33. In order to control static electricity, what must be done with metallic equipment? What must be done with non-metallic equipment? (NFPA 30, Section 6.5.4)
- AS, IA
34. What are three acceptable methods of overfill prevention for aboveground tanks at terminals receiving Class I liquids from mainline pipelines or marine vessels? (NFPA 30, Section 27.7.1.1)
- a)
- b)
- c)
- AE, AS,
IA, AF
35. What are three things that must be included in the written procedures to prevent overfilling of aboveground tanks? (NFPA 30, Section 21.7.1.4)
- a)
- b)
- c)

AE, AF,
AN, AS,
IA

36. If loading and unloading is done through a common pipe system, a check valve is not required. However, what type of valve is required? Where should this valve be located? (NFPA 30, Section 27.6.7)

AE, AF,
IA

37. If the piping test procedures in ASME B31 are not followed, what procedures should be used to test piping before it is covered, enclosed or placed in use? (NFPA 30, Section 27.7)

AF, AS,
AN, IA

38. How long must a hydrostatic or pneumatic test of piping that has not yet been covered or enclosed last? (NFPA 30, Section 27.7.1.1)

National Fire Protection Association

NFPA 326: Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair

The following study guide questions are taken from National Fire Protection Association (NFPA) publication 326 entitled “Safeguarding of Tanks and Containers for Entry, Cleaning or Repair (2015 edition).”

TL, AR 1. What is the definition of bonding? (NFPA 326, Section 3.3.3)

TL, AR 2. What is the definition of an unstable (reactive) liquid? (NFPA 326, Section 3.3.28)

AR, TL 3. What should be done before beginning cleaning work on tanks or containers that might be under pressure? (NFPA 326, Section 4.1.11)

National Fire Protection Association

NFPA 70: National Electrical Code

The following study guide questions are taken from National Fire Protection Association Publication 70, entitled “National Electrical Code” (2017 edition).

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|----|----|--|
| IA | 1. | What is the definition of <i>bonding</i> ? (NFPA 70, Article 100) |
| IA | 2. | What is the definition of <i>ground</i> ? (NFPA 70, Article 100) |
| IA | 3. | The area classifications listed in Table 515.3 are based on what premise? (NFPA 70, Article 515.3) |
| IA | 4. | Under what condition can nonmetallic conduit or approved cable be used for underground wiring? (NFPA 70, Article 515.8(c)) |

IA 5. What is the classification of an area within 10 feet of the shell, ends or roof of an aboveground tank? (NFPA 70, Article 515, Table 515.3)

IA 6. What is the classification of an area extending five feet in all directions from the open end of an aboveground tank vent? (NFPA 70, Article 515, Table 515.3)

National Institute for Occupational Safety and Health

NIOSH 87-113: A Guide to Safety in Confined Spaces

The following study guide questions are taken from National Institute for Occupational Safety and Health (NIOSH) publication no 87-113 entitled “A Guide to Safety in Confined Spaces” (July 1987).

- | | | |
|----------------|----|--|
| AR, TL | 1. | What are three characteristics that can be used to identify a confined space? How many of these characteristics must be present for an area to be considered a confined space? (NIOSH, Page 1) |
| | | a) |
| | | b) |
| | | c) |
| AF, AR, TL | 2. | What three types of hazardous atmospheres can result from the lack of natural air movement in a confined space? (NIOSH, Page 4) |
| | | a) |
| | | b) |
| | | c) |
| AF, AN, AR, TL | 3. | Most substances in a confined space should be considered hazardous. What are three possible sources for toxic substances in a confined space? (NIOSH, Page 6) |
| | | a) |
| | | b) |
| | | c) |

AF, AN,
AR, TL

4. When testing a confined space for the presence of a hazardous atmosphere, what areas of the confined space must be tested? Why is this so? (NIOSH, Page 7)

NOTE: A related publication (NIOSH 80-106) states that “Entry into a confined space is prohibited until initial testing of the atmosphere has been done from the outside.”

AF, AN,
AR, TL

5. What must be done before workers enter a confined space that has been found to be oxygen deficient, or containing toxic gases or vapors. (NIOSH, Page 7)

AF, AR,
TL

6. What is meant by the term “isolation of a confined space”? What are some common ways that isolation of a confined space can be accomplished? (NIOSH, Page 9)

AR, TL

7. What type of respirators should be used in confined spaces where there is not enough oxygen? (NIOSH, Page 10)

AR, TL

8. What are more than 50 percent of the workers who die in confined spaces attempting to do? (NIOSH, Page 12)

Occupational Safety and Health Administration

29CFR1910

The following study guide questions are taken from Occupational Safety and Health Administration regulations found in 29CFR1910 (Revised as of July 1, 2013).

- AC, AN 1. What are six elements that must be included in an emergency action plan? (OSHA, 29CFR1910.38(c))
- a)
- b)
- c)
- d)
- e)
- f)

- AC 2. When must protection against the effects of noise exposure be provided? (OSHA, 29CFR1910.95(a))

NOTE: You do not need to be an audiologist to answer this question. The point of the question is that when a certain level of noise is exceeded, protection is required.

- AC 3. What should be done when employees are subjected to sound levels exceeding those referred to in the regulations? (OSHA, 29CFR1910.95(b)(1))

- AN, AC 4. Adequate precautions shall be taken to prevent the ignition of flammable vapors. What are potential sources of ignition for flammable vapors? (OSHA, 29CFR1910.106(b)(6))

AC 5. What types of materials are involved in each of the following classes of fire? (OSHA, 29CFR1910.155(c)(8 to 11))

Class A:

Class B:

Class C:

Class D:

AC, AF, AS 6. What types of information must be provided on each Safety Data Sheet (SDS)? (OSHA, 29CFR1910.1200(g)(2)(i to xii))

a)

b)

c)

d)

e)

f)

g)

h)

i)

j)

k)

l)

AC, AF, AS 7. What is the definition of a "responsible party"? (OSHA, 29CFR 1910.1200(c))

AC, AF,
AS

8. What is a "self-reactive chemical"? (OSHA, 29CFR 1910.1200B.8.1)

AC, AF,
AS

9. What is an "oxidizing liquid"? (OSHA, 29CFR 1910.1200B.13)

Petroleum Equipment Institute
*PEI RP200: Recommended Practices for Installation of
Aboveground Storage Systems for Motor Vehicle Fueling*

The following study guide questions are taken from Petroleum Equipment Institute publication RP200-13 entitled “Recommended Practices for Installation of Aboveground Storage Systems for Motor Vehicle Fueling” (2013 edition).

- | | |
|----|---|
| AS | 1. To which types of tanks do the recommended practices in this document apply? (PEI RP200-13, Section 1.3) |
| | |
| AS | 2. What type of a plan may be required by federal regulations if a facility could reasonably be expected to discharge product to navigable waters? (PEI RP200-13, Section 1.8) |
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| AS | 3. From whom should approval of aboveground storage facilities be sought? What other agencies may be involved in granting approvals for aboveground tank installations? (PEI RP200-13, Section 1.9) |
| | |
| AS | 4. How must aboveground tanks be positioned with regard to property lines and buildings? (PEI RP200-13, Section 2.3) |

- AS 5. How much space should be provided between tanks to allow for passage and inspection? (PEI RP200-13, Section 2.4)
- AE, AS 6. When aboveground tanks are installed at retail service stations, they are typically required to be separated by substantial distances from which parts of the facility? (PEI RP200-13, Section 2.6)
- AS 7. In general, how do requirements for commercial fleet facilities differ from requirements for retail service stations? (PEI RP200-13, Section 2.7)
- AS 8. What traffic flow characteristics are desirable for the off-loading area for an aboveground tank? (PEI RP200-13, Section 2.10)

- AS 9. How shall aboveground tanks be protected from vandalism and accidental damage? (PEI RP200-13, Section 2.13)
- AS 10. Where should aboveground tanks be located with regard to underground utilities or overhead power lines? (PEI RP200-13, Section 2.15)
- AS 11. When the ability of the soil beneath an aboveground tank to bear the weight of the fully loaded tank is questionable, what are three solutions that a storage system designer should consider? (PEI RP200-13, Section 3.3)
- a)
- b)
- c)
- AS 12. When constructing an aboveground tank foundation, what are appropriate materials to use for the base course? (PEI RP200-13, Section 3.5)
- AS 13. How can a suitable foundation for vertical tanks be constructed? (PEI RP200-13, Section 3.6)

- AS 14. Where is a sand cushion typically used when installing an aboveground tank? (PEI RP200-13, Figure 3.2)
- AS 15. How high above the surrounding ground surface should the surface on which a vertical tank bottom rests be located? (PEI RP200-13, Section 3.6)
- AS 16. What materials may be used for constructing saddle supports for horizontal tanks? (PEI RP200-13, Section 3.7)
- AS 17. After setting a horizontal tank, how should any residual tilt be corrected? (PEI RP200-13, Section 3.7)
- AS 18. Under what circumstances should the saddle supports for horizontal tanks have two-hour fire protection? (PEI RP200-13, Section 3.7)

- AS, AE 19. When tank saddles are not seal-welded to the tank shell, what materials should be used to isolate the tank shell from the saddle support? What materials are NOT acceptable? (PEI RP200-13, Section 3.7.1)
- AS 20. Aboveground tanks located in what type of area must be protected against flotation? (PEI RP200-13, Section 3.9)
- AE, AS 21. What is the purpose of constructing dikes around aboveground tanks and associated piping? (PEI RP200-13, Section 4.1)
- AS 22. What should be the minimum volumetric capacity of a diked area? Can local jurisdictions require additional capacity? (PEI RP200-13, Section 4.2)
- AS 23. Within the diked area, what should be the slope from the tank to the dike base? (PEI RP200-13, Section 4.7)

- AS 24. What are appropriate materials for construction of dike walls? (PEI RP200-13, Section 4.3)
- AS 25. What types of materials may be used to form an impervious barrier on the walls and bottom of a diked area? (PEI RP200-13, Section 4.4)
- AS, AE 26. How should piping and conduit be routed with respect to the dike walls and floor? What should be done if penetration through the dike wall is absolutely unavoidable? (PEI RP200-13, Section 4.5)
- AS 27. What is the usual minimum distance between the outside base of the dike and any property line? (PEI RP200-13, Section 4.6)
- AS 28. Where should drainage control points for diked areas be located? (PEI RP200-13, Section 4.7)

- AS 29. What is the definition of “special enclosure” when referring to a flammable liquid storage tank? (PEI RP200-13, Section 5.10)
- AS 30. What types of forces should tank vaults be designed to resist? (PEI RP200-13, Section 5.2)
- AS 31. For vaults located aboveground, roofs should be constructed of materials weaker than materials used for construction of the walls and floor. Why is this? (PEI RP200-13, Section 5.2)
- AS 32. What type of safety procedures must be followed when entering a tank vault? (PEI RP200-13, Section 5.3)
- AE, AS 33. What are three requirements for normal tank vents for tanks installed inside of vaults? (PEI RP200-13, Section 5.4)
- a)
- b)
- c)
- AS 34. How should tank vaults be protected from vehicular collision? (PEI RP200-13, Section 5.8)

- AS 35. Under what circumstance can a tank designed for use underground be used for aboveground storage? (PEI RP200-13, Section 6.1)
- AS 36. Underwriters Laboratories standard 142 prescribes requirements for what type of tanks? (PEI RP200-13, Section 6.2.1)
- AE, AS 37. What items should be checked for damage or imperfections prior to installation? (PEI RP200-13, Section 6.4)
- AS 38. How should tanks be handled at the job site? (PEI RP200-13, Section 6.5 and WARNING)

NOTE: In addition to the above, the Pennsylvania Underground Utility Line Protection Act (Act 187 of 1996) requires notification by excavators, designers or any person preparing to disturb the earth's surface anywhere in Pennsylvania. Contractors must call the One Call System (1-800-242-1776) not less than three nor more than ten working days in advance of beginning excavation or demolition work.

- AE, AS 39. What are two methods that should NOT be used to dispense product from aboveground tanks? (PEI RP200-13, Section 7.2)
- a)
- b)
- AE, AS 40. In remote pumping systems, does the supply piping operate under pressure, suction or gravity? (PEI RP200-13, Section 7.2)

- AS 41. At which tank openings should fire valves be installed? (PEI RP200-13, Section 7.3)
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- AE, AS 42. How many block valves should a piping system contain? (PEI RP200-13, Section 7.4)
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- AS 43. Under what condition will a pressure regulating valve installed underneath a suction pump allow product to flow? (PEI RP200-13, Section 7.2.1, Figure 7.2)
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- AE, AS 44. If a pressure regulating valve is installed in a suction pumping system, what is the maximum dispensing hose length allowed? Why is this? (PEI RP200-13, Section 7.2.1)
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- AE, AS 45. External fire valves should be constructed of what material? (PEI RP200-13, Section 7.3)

- AE, AS 46. What does an anti-siphon valve prevent? Where should it be located? (PEI RP200-13, Section 7.5)
- AS, AE 47. Which portions of aboveground piping should be equipped with a pressure relief device? (PEI RP200-13, Section 7.7)
- AS 48. How close to the tank bottom should an internal fill tube be installed? (PEI RP200-13, Section 8.2.1)
- AS, AE 49. Should gasoline and diesel tanks share the same fill piping? (PEI RP200-13, Section 8.2.1)
- AS 50. What should be installed on the fill pipe if deliveries are to be made directly into the top of the tank? (PEI RP200-13, Section 8.2.2)
- AS 51. What is the leading cause of product release from aboveground tanks? (PEI RP200-13, Section 8.2.3)

- AS 52. At what liquid level in an aboveground tank should an overfill alarm sound? At what liquid level should flow into the tank be stopped? (PEI RP200-13, Section 8.2.3)
- AS 53. When gauging systems are installed in aboveground tanks, what type of cover should be provided for the tank opening? (PEI RP200-13, Section 8.4)
- AE, AS 54. What is the maximum normal operating pressure for an aboveground tank? What is the maximum pressure allowed under emergency venting conditions? (PEI RP200-13, Section 8.5)
- AE, AS 55. Why is normal venting necessary? What features may normal tank vents also include? (PEI RP200-13, Section 8.5.1, Figure 8-3)
- AE, AS 56. What do emergency vents provide for? Where are emergency vents required? (PEI RP200-13, Section 8.5.2)
- AE, AS 57. What are acceptable materials for aboveground piping? (PEI RP200-13, Section 9.2)
- AS 58. What piping material should not be used for diesel fuel? (PEI RP200-13, Section 9.2)

- AS 59. How should underground piping associated with an aboveground tank be sloped? (PEI RP200-13, Section 10.4)
- AS 60. In traffic areas, piping trenches for underground piping should be deep enough to allow for what thickness of bedding material? What thickness of compacted backfill material and paving? (PEI RP200-13, Section 10.4)
- AS 61. When galvanic cathodic protection is applied to underground steel piping, what must be done to submerged pumps, dispensers, tanks and other metallic components that are NOT intended to be protected by the galvanic cathodic protection system? (PEI RP200-13, Section 11.5)
- NOTE: When impressed current cathodic protection is used, all metallic components should be electrically continuous.*
- AS 62. What three items should tank coatings be inspected for prior to installing the tank? (PEI RP200-13, Section 11.3)
- AC 63. What is the minimum number of anodes needed when protecting a tank bottom with cathodic protection? (PEI RP200-13, Table 11-2)
- AS 64. What type of leak detection should be installed on underground pressurized piping? (PEI RP200-13, Section 12.2.3)
- AS 65. Why is it important to control vapor emissions during fuel transfer operations? (PEI RP200-13, Section 12.3)

- AS 66. Why should sensing devices used in interstitial spaces be easily accessible? (PEI RP200-13, Section 12.2.1)
- AS 67. What are four ways of performing volumetric methods of release detection? (PEI RP200-13, Section 12.2)
- AS 68. In addition to state and local electrical codes, aboveground tank installations should conform to national electrical codes as well. What abbreviation is commonly used to refer to the national electrical code? What organization publishes the national electrical code? (PEI RP200-13, Section 13.1)
- AS 69. In the national electrical code, what is the distinction between Division 1 and Division 2 locations? (PEI RP200-13, Section 13.2)
- AS 70. What is an “emergency shut-off?” Where is it located? What does it do? (PEI RP200-13, Section 13.4)
- AS 71. What should be used to protect vertical tank bottoms that rest directly on soil or concrete? (PEI RP200-13, Section 11.3.1)
- AS 72. What should be done to electrical conduits entering or leaving classified areas to prevent the migration of fumes or vapors? (PEI RP200-13, Section 13.5)

- AS 73. What is an “intrinsically safe” device? (PEI RP200-13, Section 13.6)
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- AS 74. What should be done to protect aboveground tanks from lightning and static discharge? (PEI RP200-13, Section 13.7)
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- AS 75. What type of gauge is recommended when conducting an air-and-soap test? What should be the maximum limit of the gauge? What should be used to prevent over-pressurization of the tank? (PEI RP200-13, Section 6.6.2)
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- AS 76. When conducting an air-and-soap test, what is it that indicates the presence of a leak? (PEI RP200-13, Section 6.6.3)
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- AS 77. What is the maximum recommended pressure for testing vertical aboveground tanks? For testing horizontal aboveground tanks? (PEI RP200-13, Section 6.6.3)

Snyder Industries, Inc.

Guidelines For Use and Installation

The following study guide questions are taken from a Snyder Industries, Inc. publication entitled, "Guidelines For Use and Installation" (Rev. B 10/13/16).

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| AN | 1. | When should a tank first be inspected? (Snyder, Section 3.1) |
| | | |
| AN | 2. | How should vertical tanks greater than 2,000 gallons be moved? (Snyder, Section 4.3.2) |
| | | |
| AN | 3. | How should insulated tanks be moved? (Snyder, Section 4.4.1) |
| | | |
| AN | 4. | What advantages does the installation of a sand mound support under a vertical flat bottom tank have? (Snyder, Section 5.2.1) |
| | | |
| AN | 5. | What characteristics of the tank must be taken into account when designing and installing the piping system? (Snyder, Section 5.3.2) |

- AN 6. After all fittings are installed and all connections to the tank have been made, fill the tank with water and hold for what period of time in order to identify any leaks? (Snyder, Section 5.4.1)
- AN 7. When installing threaded bulkhead fittings on factory prepared openings, where should the gaskets be installed? (Snyder, Section 6.1.2)
- AN 8. When installing bolted flange fittings on non-metallic tanks, where should the gaskets be installed? (Snyder, Section 6.3.2)
- AN 9. If down pipes are installed, at what interval must they be supported? (Snyder, Section 7.3.1)
- AN 10. For what purpose is the lateral restraint system on flat bottom non-metallic tanks designed? (Snyder, Section 8.1.1)
- AN 11. What are four items that should be inspected on a periodic basis? (Snyder, Section 9.1.1)
- a)
- b)
- c)
- d)

Steel Structures Painting Council

Steel Structures Painting Manual (Vol 1)

The following study guide questions are taken from the Steel Structures Painting Manual Volume 1, entitled “Good Painting Practice” (Fifth Edition, 2016).

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| IA, TL | 1. | How do chromate pigments inhibit corrosion? (SSPC Vol 1, 1-18) |
| IA, TL | 2. | What are seven properties of films that may be desirable in any given use? (SSPC Vol 1, 1-19) |
| IA, TL | 3. | What effect can leafing or plate-like pigments have in a barrier coating? (SSPC Vol 1, 1-17) |
| TL | 4. | Liquid-applied organic coatings must contain _____ for film formation. (SSPC Vol 1, 1-24) |
| TL | 5. | When preparing a surface for lining, what should be done before initiating blast cleaning? (SSPC Vol 1, 2-2) |
| TL | 6. | What functions do coatings used as linings of steel tank interiors serve? (SSPC Vol 1, 4-18) |
| TL | 7. | What is the process called in which iron or steel is immersed in acidic solutions to remove oxide or scale? (SSPC Vol 1, 2-4) |
| TL | 8. | For purposes of this chapter of the SSPC book, what is the term “protective coating used as a lining” limited to? (SSPC Vol 1, 4-18) |

- TL 9. When blasting or spraying is being done, what type of breathing apparatus should be worn? (SSPC Vol 1, 6-10, 6-15)
- TL 10. When applying a coating by spray, in what areas do excessive thicknesses of the coating material tend to accumulate? How can such areas be eliminated? (SSPC Vol 1, 4-19)
- TL 11. What are the three most critical factors in coating selection? (SSPC Vol 1, 4-19)
- a)
- b)
- c)
- TL 12. After a first coating has been applied, it is often good practice to brush one or more coats on welds, edges or any area that is not ideally fabricated. What is this brushing of specific areas called? (SSPC Vol 1, 3-3, 4-25)

Steel Structures Painting Council

Steel Structures Painting Manual

The following study guide questions are taken from the Steel Structures Painting Manual Volume 2, entitled “Systems and Specifications” (2012).

- | | | |
|--------|----|---|
| IA, TL | 1. | What is the definition of solvent cleaning? (SSPC Vol 2, SP1, Section 2.1) |
| TL | 2. | What should be done to prepare a surface before solvent cleaning? (SSPC Vol 2, SP1, Section 3.1) |
| TL | 3. | What should be done to a surface after it has been solvent cleaned? (SSPC Vol 2, SP1, Section 3.2) |
| IA, TL | 4. | What procedure does SSPC standard SP5 address? (SSPC Vol 2, SP5, Section 1.1) |
| IA, TL | 5. | What is the definition of a white metal blast cleaned surface? (SSPC Vol 2, SP5, Section 2.1) |
| IA, TL | 6. | What are some of the variations in appearance of a white metal blast cleaned surface that do not affect surface cleanliness? (SSPC Vol 2, SP5, Section 2.1.1) |

- IA, TL 7. What is meant by the term *surface profile*? (SSPC Vol 2, SP5, Section A7)
- IA, TL 8. What determines the allowable minimum/maximum height of a surface profile? (SSPC Vol 2, SP5, Section A7)
- IA, TL 9. Where would you find a listing of the typical maximum profile heights achieved with commercial abrasive media? (SSPC Vol 2, SP5, Section A7)
- IA, TL 10. Surface imperfections can cause premature coating failure when the service is severe. What tends to happen to coatings applied to sharp edges and projections? What other surface features can be difficult to properly cover and protect? (SSPC Vol 2, SP5, Section A4)
- IA, TL 11. What can happen when freshly cleaned steel is exposed to moisture, contamination or a corrosive atmosphere? (SSPC Vol 2, SP5, Section A10)
- TL 12. How much warmer than the dew point should a steel surface that is being dry blast cleaned be? (SSPC Vol 2, SP5, Section A11)

- IA, TL 13. What is meant by the term *near-white blast cleaning*? (SSPC Vol 2, SP10, Section 2.1)
- IA, TL 14. How much staining is allowed on a near-white blast cleaned surface? What may this staining consist of? (SSPC Vol 2, SP10, Section 2.1)
- IA, TL 15. What "unit area" should be used when evaluating the extent of surface staining? (SSPC Vol 2, SP10, Section 2.1)
- IA, TL 16. What are the two primary functions of blast cleaning before application of a coating? (SSPC Vol 2, SP10, Section A1)
- a)
- b)
- IA, TL 17. What is the hierarchy of blasting standards? (SSPC Vol 2, SP10, Section A1)
- TL 18. What surface preparation should be done when a surface is to be re-coated? (SSPC Vol 2, PA1, Section 5.2.4)

- TL
19. Below what temperature should chemically cured coatings not be applied? (SSPC Vol 2, PA1, Section 11.5)
- TL
20. If new paint is to be applied over old paint, what type of test should be done if the composition of the original paint system is unknown? What procedures should this test include? (SSPC Vol 2, PA Guide #4, Section 5.2)

Underwriters Laboratories Inc.

UL 142: Steel Aboveground Tanks for Flammable and Combustible Liquids

The following study guide questions are taken from Underwriters Laboratories Standard for Safety #142, entitled “Steel Aboveground Tanks for Flammable and Combustible Liquids” (Ninth edition, 2006).

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|---------------|----|--|
| AE, AF | 1. | What is the minimum thickness allowed for the flanged section of a pressed steel fitting? (refer to No. 3 of Figure 7.1 for an illustration of this type of fitting) (UL 142, Table 7.4) |
| | | |
| AE, AF,
IA | 2. | What is the minimum length of thread required for threaded pipe connections that are 2.5 to 3.5 inches in diameter? (UL 142, Table 7.4) |
| | | |
| AE, AF,
IA | 3. | What is the minimum length of thread required for a threaded pipe connection that is one inch in diameter? (UL 142, Table 7.4) |
| | | |
| AE, AF | 4. | Each primary containment tank and each compartment of a compartment tank shall have provision for what kinds of venting? (UL 142, Section 8.1) |
| | | |
| AE, AF,
IA | 5. | The interstitial space of a secondary containment tank shall have provisions for what type of venting? (UL 142, Section 8.1.2) |

- AE, AF 6. According to UL 142, if a horizontal steel aboveground tank has a diameter of six feet, what is the maximum length of the tank? (UL 142, Section 13.1.2)
- AE, AF 7. Under what condition would the flanged flat head of horizontal tank more than 72 inches in diameter need an additional brace welded to the tank head? (UL 142, Section 13.3.3)
- AE, AF,
IA 8. According to UL 142, what is the minimum diameter allowed for a vertical cylindrical steel tank that is 20 feet tall? (UL 142, Section 15.1.1)
- AE, AF,
IA 9. What is the maximum allowable shell height for a vertical cylindrical steel tank constructed according to UL 142? (UL 142, Section 15.1.2)

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For more information, visit
www.dep.pa.gov, Search: Storage Tanks.