

5 BOILERS AND UNFIRED PRESSURE VESSELS

ANSWERS—QUIZ 1

1. a
2. b
3. b
4. c
5. c
6. The basic cause of furnace and related boiler explosion is the uncontrolled ignition of an excessive accumulation of fuel-air mixture within the furnace combustion chambers or ancillary areas.
7. A boiler is a closed vessel in which water is heated by combustion of fuel or heat from other sources. The heat forms steam, hot water, or high-temperature water under pressure.
8. Prompt cleaning is important because soot gathers moisture rapidly, thus contributing to deterioration of a boiler's metal surfaces.
9. When wetting down an ash pile, start at the outside and move toward the center, because a jet of water driven directly at the center of a hot ash pile can cause it to explode.
10. When cleaning a boiler, employees should wear hard hats, safety goggles, approved dust masks, protective footwear, and heavy, leather-palmed gloves.
11. High-temperature water is water kept in a closed system under high pressure so that it remains in liquid form rather than turning into steam.
12. When equipment or piping does fail in HTW systems, it usually does so because of operating errors or mechanical forces (such as the water hammer, thermal expansion, and thermal shock), and because of faulty materials.
13. The following policies should be observed:
 - Establish a testing and servicing program in which operating controls, safety controls, and safety and relief valves are tested and maintained regularly.
 - To prevent damage to the valve seats, make sure that safety and relief valves are always tested under pressure (on the boiler).
 - Have repairs made immediately upon any indication of malfunction or leakage of operating controls, safety controls, or safety and relief valves. Never operate a boiler with a malfunctioning safety or relief valve.
- Have a service organization check and service the boiler during the heating season as well as perform the normal out-of-season servicing.
- Keep a boiler log. This ensures that necessary tests, maintenance, and services are performed and that records are available.

ANSWERS—QUIZ 2

1. a
2. a
3. b
4. b
5. a
6. The NB Code provides rules and guidelines for inspection of boilers and pressure vessels after installation, repair, alteration, derating, and rerating.
7. Workers in confined spaces can face the following hazards:
 - toxic materials already in the confined space or introduced later
 - insufficient oxygen
 - heat from fire, hot gases or liquids, or inadvertent heating
 - startup of agitators or setting the confined space itself in motion
8. To detect very small leaks, a small amount of ammonia is released inside the vessel and compressed air is then applied until a maximum pressure of 50 percent of the working pressure is attained. A swab soaked in hydrochloric acid is passed over all seams and other suspect areas. Leakage will be indicated by a white vapor, formed by the contact of escaping ammonia and the acid.
9. Opening an autoclave with pressure in it will cause the door to be flung open with explosive violence.
10. A pressure vessel's log should include:
 - blueprints
 - manufacturer's data reports and instructions
 - design data, including location of dimensional checkpoints
 - installation information
 - records of process changes
 - vessel's historical profile, including records of repairs and conditions found during inspections

ANSWERS—CASE STUDY

1. Before anyone enters a pressure vessel, make sure that is properly drained, ventilated, and cleaned. Next, test the vessel's atmosphere for gases and oxygen content. Check for toxic atmosphere and explosivity. Disconnect and blank all connecting pipelines, or close, lock out, and tag valves on the line. All power-driven devices, such as agitators, must be positively disconnected, locked out, and tagged.
2. Using forced ventilation for confined spaces may be safer than requiring employees to wear respiratory protection. Air can be blown in until tests of the exhaust and of the interior of the enclosed vessel show that the space is safe for entry. Or air can be continuously sucked out from the bottom by venturi action. Tests should be repeated at intervals to make sure that conditions remain safe while employees are in the vessel.
3. Employees should wear safety harnesses attached to lifelines when entering any vessel. An observer should be stationed outside the vessel who can signal for more help if needed.