

15.0.0 ♦ BOILER WATER TREATMENT

The water used in a boiler must be kept clean for efficient operation. Never add dirty or rusty water to a boiler. Hard water may eventually interfere with the efficient operation of a boiler. For this reason, hard water should be chemically treated with water softeners before being used. Scale, corrosion, fouling, and foaming can all cause boiler problems. Scale deposits on heating surfaces increase boiler temperatures and lower operating efficiency. Corrosion can damage metal surfaces, resulting in metal fatigue and failure. Fouling

clogs nozzles and pipes with solid materials, thereby restricting circulation and reducing the heat transfer efficiency. Foaming results in overheating and can cause water impurities to be carried along with the steam into the system.

There are various chemical and mechanical methods of water treatment used to help prevent problems caused by water impurities. At a minimum, proper water treatment includes blow-down, pH control, and the addition of chemicals to neutralize other contaminants. The specific methods and devices used for water treatment are covered in *HVAC Level Four*.

Review Questions

- The amount of latent heat required to vaporize, or evaporate, 5 pounds of water into steam is ____ Btus.
 - 970
 - 1,114
 - 1,294
 - 4,850
- The latent heat of condensation is defined as ____.
 - the heat removed during the change of state from steam to water
 - the heat gained during the change of state from water to steam
 - the heat lost in changing water to ice
 - any heat added after ice changes to water
- The majority of maintenance attention in a steam system is generally devoted to the ____.
 - piping system
 - pressure regulating valves
 - steam traps
 - heat exchangers
- Steam boilers ____.
 - have exactly the same type of controls as hot water boilers
 - are entirely filled with water
 - must operate at extreme pressures only
 - are partially filled with water
- A boiler with a maximum operating pressure of 75 psi would be classified as a ____ boiler.
 - high-pressure
 - low-pressure
 - process
 - medium-pressure
- A ____ assembly is generally installed between the boiler and an external pressure gauge to protect the gauge from contacting raw steam.
 - strainer
 - siphon
 - heat exchanger
 - trap
- Steam-to-water heat exchangers designed for potable hot water use are of ____ construction.
 - stainless steel
 - aluminum
 - hermetically sealed
 - double-walled
- Mechanical steam traps take advantage of the difference in density between steam and ____.
 - air
 - steam condensate
 - gases
 - debris

Review Questions

9. When a bypass line around a trap is installed to facilitate maintenance activities and allow the system to continue operating, a _____ valve should be used to allow manual balancing of flow.
 - a. gate
 - b. pressure reducing
 - c. globe
 - d. vacuum breaker
10. Bimetallic steam traps function based on a difference in _____ between condensate and steam.
 - a. air volume
 - b. temperature
 - c. weight
 - d. pressure
11. The three basic diagnostic methods for steam systems, especially traps, are _____.
 - a. pressure, temperature, and time
 - b. temperature, flow, and sound
 - c. current, pressure, and sound
 - d. sight, sound, and temperature
12. The condensate receiver tank is equipped with a _____ to maintain and ensure a sufficient supply of water for the boiler is available.
 - a. flash reservoir
 - b. float-actuated makeup water valve
 - c. thermodynamic trap
 - d. vacuum pump
13. When more than one condensate line is connected to a flash tank, each line should be equipped with its own _____.
 - a. check valve
 - b. pressure reducing valve
 - c. condensate pump
 - d. sight glass
14. Collected flash steam is generally discharged into a _____.
 - a. floor drain
 - b. vacuum pump
 - c. boiler
 - d. low-pressure main
15. When the condensate return line is above the boiler water line, it is called the _____ line.
 - a. steam
 - b. Hartford loop
 - c. dry return
 - d. wet return
16. Most two-pipe steam systems use a _____.
 - a. mechanical condensate return
 - b. gravity condensate return
 - c. fixed-orifice trap
 - d. very long startup cycle
17. In a vacuum return system, _____ can cause excessive vacuum pump operation.
 - a. too much condensate
 - b. low steam pressure
 - c. air leaks
 - d. heat exchangers
18. Operating steam boilers at pressures significantly lower than their design operating pressure increases the likelihood of _____.
 - a. leaks
 - b. thermal shock
 - c. water droplet carryover
 - d. trap damage
19. Steam system piping that is too large causes _____.
 - a. excessive pressure drop
 - b. some trap failures
 - c. high installation costs and greater heat loss
 - d. condensate pump overload
20. Steam supply piping for a system designed to operate at 5 psi should generally be designed for a pressure drop no greater than _____ psi.
 - a. 0.3
 - b. 2
 - c. 5
 - d. 10