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Continuing Education Course #045
Geothermal Heat Pumps for Small Buildings

1. GSHP compressors are made for which capacity?
 - a. Single Stage
 - b. Dual Stage
 - c. Variable Stage
 - d. All of the above
2. The refrigerant of choice for the future is:
 - a. R-410A
 - b. R-11
 - c. R-12
 - d. R-22
3. R-22 refrigerant circulates at higher pressure than R-410A.
 - a. True
 - b. False
4. In heating mode, the compressor receives cold refrigerant vapor, and compresses it to:
 - a. Cold Liquid
 - b. Hot Liquid
 - c. Hot Vapor
 - d. None of the above.
5. In cooling mode, the refrigerant circulation path reverses, so that the coaxial heat exchanger becomes a condenser.
 - a. True
 - b. False
6. Gay-Lussac's Law states that when gas molecules are compressed, temperature drops.
 - a. True
 - b. False
7. The working water-to-air GSHP R-410A Refrigerant Temperature for heat mode is:
 - a. 60-80 degrees
 - b. 90-110 degrees
 - c. 130-150 degrees
 - d. 190-200 degrees
8. Workers refer to all-in-one condensers as evaporators or evap coils.
 - a. True
 - b. False

9. Retrofitting an existing condenser to use R-410A is simple and recommended.
- a. True
 - b. False
10. The second law of Thermodynamics is:
- a. A system cannot cool to absolute zero.
 - b. Heat is a form of energy that must be conserved.
 - c. Entropy causes heat to flow from a higher temperature to a lower temperature.
 - d. Energy cannot be created or destroyed, but only change form.
11. A GSHP heat exchanger maximizes thermal transfer between loop water and refrigerant in a coaxial tube.
- a. True
 - b. False
12. A typical GSHP operating COP is:
- a. 1.0 to 1.5
 - b. 3.0 to 4.5
 - c. 5.0 to 6.5
 - d. None of the above
13. A GSHP with an EER of 20.0 for Entering Water Temperature of 77 degrees is temporarily using warmer EWT of 80 degrees. Operating EER will temporarily be:
- a. 20.0
 - b. >20.0
 - c. <20.0
 - d. None of the above.
14. The organization that tests GSHPs for Energy Star rating is:
- a. ASHRAE
 - b. ACCA
 - c. ASME
 - d. AHRI
15. Air conditioning EER is always smaller than Heating COP.
- a. True
 - b. False
16. A four ton GSHP has cooling capacity of how many BTU / hour?
- a. 12,000
 - b. 20,000
 - c. 32,000
 - d. 48,000
17. A method to address indoor humidity in a GSHP process is:
- a. Control the compressor to run in the slower first stage speed in AC mode
 - b. Control the Air Handler to vary cubic feet per minute output.
 - c. Install a dehumidifier system near the coil and blower fan
 - d. All of the above
18. Which factor does not affect the location of a GSHP in a basement utility area?
- a. Ease of installation and access maintenance.
 - b. Closeness to the ground loop and air handler

- c. Absence of high humidity and no freezing
 - d. Proximity to the electric meter & panel box circuit breakers
19. The PE license qualifies engineers to charge R-410A line set systems.
- a. True
 - b. False
20. A flush cart is used to:
- a. Remove debris from the inside of a ground loop
 - b. Remove air from the inside of a ground loop
 - c. Insert the water and antifreeze solution into the ground loop
 - d. All of the above
21. The Flow Controller Pumping System involves consideration of:
- a. Elevation difference for deepest section of the closed loop vs. the GSHP
 - b. Frictional head loss within the loop, GSHP and interior piping
 - c. Electrical use that contributes to the overall system's COP
 - d. Items b. and c. above
22. GSHP control panel timers may include all but this one:
- a. Supply air timer
 - b. Opposing call timer
 - c. Low water density timer
 - d. Second stage timer
23. If scaling occurs at a desuperheater coil, clean with:
- a. Phosphoric acid
 - b. Sulfuric acid
 - c. Hydrochloric acid
 - d. 5% Bleach solution
24. Water-to-Water GSHPs have smaller BTU output capacity than Water- to-Air.
- a. True
 - b. False
25. Console GSHPs present challenges for:
- a. Noise and vibration
 - b. Air circulation beyond the one conditioned room
 - c. Loop Flow Control for multiple units in a single building
 - d. All of the above
26. College HVAC labs can train students on GSHPs with simulated loop water sources.
- a. True
 - b. False
27. GSHP development remains the same throughout the years, with no improvement in COP/EER.
- a. True
 - b. False
28. VRV stands for:
- a. Velocity Rate of Vortex
 - b. Variable Refrigerant Volume

- c. Velocity of Refrigerant Volume
- d. Vibration Rate Variable

29. Skills well suited to GSHP applications include:

- a. Building and excavating construction experience
- b. Energy flow knowledge
- c. Mechanical and electrical system operation
- d. All of the above

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