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Continuing Education Course #355
Reliability in Mission Critical Applications
Part II – Mechanical Systems

1. True or False, in theory all components will eventually fail.
- a. True
- b. False

2. True or False, Zero degrees Fahrenheit is absolute zero.
- a. True
- b. False

3. How many BTUs/hr is a 4-ton air conditioning unit rated at?
- a. 4
- b. 48,000
- c. 12,000
- d. Both B & C

4. True or False, a 3-ton cooling system can cool 5 kW of heat load.
- a. True
- b. False

5. True or False, A phase diagram is used to identify at a specific temperature and pressure, what state a refrigerant is in.
- a. True
- b. False

6. In general, at a low temperature and high pressure a substance will have a tendency to be:
- a. Steam
- b. A solid
- c. A vapor
- d. Very stressed out

7. Which of the following happens when a substance transitions from gas to liquid?
- a. A large flash of light occurs
- b. A complicated chemical reaction takes place
- c. Heat is absorbed
- d. Heat is released

8. True of False, in the refrigeration cycle, the condenser coil is where the refrigerant transitions from hot gas to liquid.
- a. True
- b. False

9. What does the term Dx stand for?

- a. Delta Change
- b. Direct transfer
- c. Direct Exchange
- d. Dog tags

10. True or False, Chilled water and Direct Exchange systems are the only types of cooling systems available.
- a. True
- b. False

11. The name of a component(s) that provides chilled water to a series of air handlers:
- a. A chiller
- b. An air compressor
- c. A pump
- d. Both A & C

12. True or False, a water cooled chiller will typically reject the condenser water heat to a cooling tower?
- a. True
- b. False

13. True or False, if a chilled water system has a heat load of 200-tons, five (5) 50-ton chillers are needed to provide N+1 chilled water to the air handlers?
- a. True
- b. False

14. If the heat load is 400-tons, if sized equally, what size do each of the chillers need to be for five (5) chillers to provide N+1 redundancy?
- a. 500-ton chillers
- b. 250-ton chillers
- c. 100-ton chillers
- d. 50-ton chillers

15. If the heat load is 100-tons, how many 30-ton CRAC units are needed to provide "N" cooling?
- a. 1
- b. 4
- c. 8
- d. 125

16. Assuming 'nominal' capacities of CRAH units in a given application (at 1-ton = ~3.5 kW), if the heat load in a data center is 140 kW, how many 20-ton CRAH units are needed to provide N+1 redundancy?
- a. One (1) unit
- b. Three (3) units
- c. Eight (8) units
- d. Thirty (30) units

17. True or False, a dry cooler is an air cooled unit, typically used in conjunction with a closed glycol based system to reject the heat of compression associated with AC units located elsewhere?
- a. True
- b. False

18. True or False, a 2N system as described in this course is not considered fault tolerant?
- a. True
- b. False

19. What is the name of a component/accessory to a down flow CRAH unit that allows the air to be ducted directly from the ceiling plenum to the unit?

- a. A cavity sleeve
- b. A plenum extension
- c. A piece of plastic
- d. A turnpike extension

20. According to this course, what is a major reason to configure a chilled water system with supply and return system pipe loops?

- a. it sounds really neat
- b. it's a cheaper alternative to a header design
- c. it allows the system to function with sections of the distribution taken out of service temporarily for maintenance and/or repair of the loop
- d. your client will be impressed with how technically savvy you sound when you suggest it

21. True or False, supply and return loops are effective in a single looped system and achieve their intent with or without isolation valves?

- a. True
- b. False

22. What is the name of the air conditioning unit in a 'hybrid 2N' scenario that can function on either chilled water or via Dx piping to a condenser?

- a. A dedicated source heat pump
- b. A dual source unit
- c. A duet circuit
- d. Dueling banjos

23. What mechanical system related to the generator design should be considered with respect to reliability.

- a. The air compressors
- b. the generators' fuel system
- c. The security cameras
- d. The equipment housekeeping pad

24. True or False, a dual circuit CRAH unit can cool by receiving chilled water from two (2) different chilled water plants?

- a. True
- b. False

25. What is a great way to provide '2N Redundancy' to a mechanical design when a "campus" or non-dedicated house chilled water system is available?

- a. By using dual source units
- b. By designing Dx CRAC units in an N configuration
- c. By designing a dedicated chilled water plant and avoiding the shared/campus system
- d. By proposing and installing temporary "move & cool" type units