

TEST BOOKLET
BOC 2002 – Optimizing HVAC Controls for Energy Efficiency
Edition 2.00

TEST INSTRUCTIONS

The test consists of 20 multiple choice questions. A period of 1 hour is available for the test, but it will not be strictly timed. This is an open book test. You may use any notes or handout materials of your own. You will work independently to answer the questions. Teaming up with a classmate is not permitted. Mark all answers only on the ANSWER SHEET. Make no marks in the TEST BOOKLET.

Select only one answer by circling the corresponding letter on the ANSWER SHEET. Where it appears that two answers may be correct, choose the one better answer. There are no questions that require the circling of more than one choice.

Below are some sample questions:

Example #1: Electric motors typically have an efficiency of approximately.

- A. 95% to 99%
- B. 78% to 93%
- C. 50% to 75%
- D. 40% to 48%

Standard motors are approximately 78% to 93% efficient, depending on size. High efficiency electric motors can have very high efficiencies, but even these special motors exceed 95% in only very large sizes. While there are specialized motors that can exceed 95%, this is not typical. The answer should be marked by drawing a circle around letter “B” on the ANSWER SHEET.

Example #2: In the past, asbestos fibers were commonly used in numerous building materials, including which of the following:

- A. Pipe Insulation
- B. Furnishings
- C. Window coverings, such as drapes
- D. All of the above.

While all three could have contained asbestos, it was commonly used in only one of these--pipe insulation. The answer should be marked by drawing a circle around letter “A” on the ANSWER SHEET.

Note: In the preceding example question, only pipe insulation was included as a material that commonly contained asbestos. That does not mean that only pipe insulation contained asbestos. It should be understood that the items covered in this test have been chosen to sample the operator's knowledge.

BEGINNING OF TEST
Edition 2.00

Mark all answers on *only* the ANSWER SHEET. Make *no* marks in the BOOKLET.

- 1. Which of the following is an example of a controlled device in a control system?**
 - A. Room temperature sensor
 - B. Freeze stat
 - C. Duct smoke detector
 - D. Outside air damper

- 2. Optimal start (OS) is a control strategy that saves energy in what way?**
 - A. Starts the building HVAC early in the day regardless of weather conditions.
 - B. Schedules the building start times based on historic occupancy schedules.
 - C. Adjusts the HVAC system start time based on peak load demand and occupancy schedules.
 - D. Adjusts the HVAC system start time based on actual loads conditions and occupancy schedules.

- 3. The sequence of operation (SoO) should include, but is not limited to, which the following?**
 - A. Equipment operational settings for occupied and unoccupied modes
 - B. Maintenance schedules for equipment and systems
 - C. Security system settings to control access to the building during occupied and unoccupied modes
 - D. Settings for commissioning of the building

- 4. What steps can a building operator take to verify correct operation of the sequence of operation (SoO)?**
 - A. Adjust fan belt tension and replace air filters per the maintenance schedule
 - B. Follow a written procedure for functionally testing the systems and equipment, and apply it consistently
 - C. Take no action if the building was commissioned in the past year
 - D. Survey occupants about satisfaction with thermal comfort and air quality

- 5. In a chilled water air conditioning system:**
 - A. Resetting the condenser water to a lower temperature, increases chiller operating efficiency.
 - B. Delivering cooler condenser water temperature decreases the energy requirements for the cooling tower fans.
 - C. In cooler climates, evaporator water can be maintained at a lower temperature and you reduce energy costs.
 - D. All of the above.

- 6. Which term best describes a building automation control product that carefully guards knowledge about its technology or how it works?**

 - A. Connectable system
 - B. Open system
 - C. Interoperable system
 - D. Proprietary system

- 7. What is the general term for a component of a control system that detects such things as temperature, humidity, pressure and flow?**

 - A. Sensor
 - B. Damper
 - C. Analog point
 - D. Digital point

- 8. Functional testing of the sequence of operation can include which of the following?**

 - A. Physical observation of equipment operation
 - B. Use of the Building Automation System to trend log actual operating conditions
 - C. Use of data loggers
 - D. All of the above

- 9. Which diagnostic method will help the operator determine the operating schedule of supply fans?**

 - A. Trend logs of heating hot water supply temperature
 - B. Trend logs of outdoor air temperature
 - C. Trend log start/stop schedule of fan motors
 - D. Review building occupancy schedule

- 10. Which statement best describes the “Warm-Up” mode of systems operation?**

 - A. System or equipment operation during the transition from the occupied mode to the unoccupied mode of operation
 - B. System or equipment operation when the building is unoccupied.
 - C. System or equipment operation during a demand response condition.
 - D. System or equipment operation during the transition from unoccupied to occupied mode of operation

- 11. Which of the following strategies is generally not effective in Utility Demand Response programs?**

 - A. Increase cooling setpoints
 - B. Economizer cooling
 - C. Global dimming of lighting systems
 - D. Thermal energy storage systems

- 12. The internal sequence of operation for equipment safety controls can be found in which of the following documents?**

 - A. Building commissioning report

- B. Building plans and specifications
- C. Operations and maintenance manuals
- D. Energy codes and standards

13. For optimum efficiency in single zone systems:

- A. Open the outside air damper to minimum position during the warm-up mode of operation.
- B. Set minimum position of the outside air damper for the maximum anticipated ventilation requirement
- C. Use demand ventilation controls with CO₂ sensors to control outside air damper position based on occupant density.
- D. Operate the supply fan at a continuous speed regardless of heating or cooling demand.

14. When a floor in the building is occupied by a new tenant, what control system check would be advisable for the building operator to take to ensure optimal operation?

- A. Revise the operating schedule for the building.
- B. Verify in the control software for the floor that the schedule accurately reflects the new tenant's operating hours
- C. Visit the new tenant's space after hours to confirm the schedule is accurate.
- D. Verify in the control software the number of full-time occupants in the space.

15. What component of the control system should be checked following a power outage?

- A. Location of the outside air temperature sensor
- B. Control tubing if the system is pneumatic
- C. Calibration of air flow sensors
- D. Time clock is accurate

16. What is the purpose of an adjustable speed drive or variable frequency drive?

- A. It replaces pneumatic valve operators.
- B. It adjusts the speed of fans and pumps to meet building load requirements.
- C. It adjusts the speed at which a space can recover from a temperature setback for morning warm-up periods.
- D. It maintains the appropriate building power quality.

17. A "Direct Digital Controller"

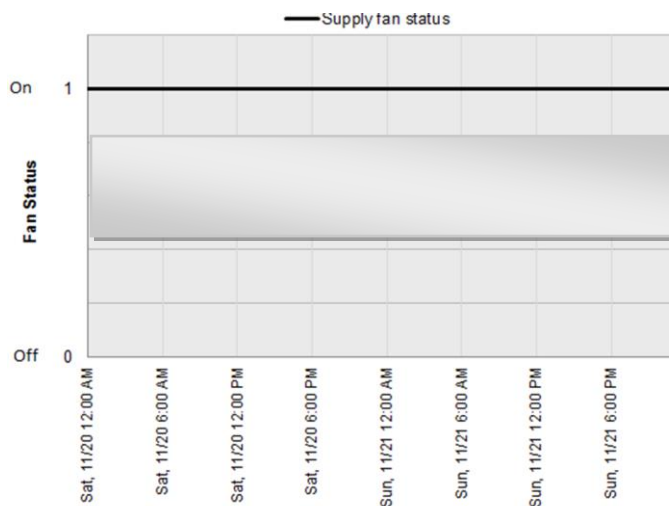
- A. Is normally just a stand alone, non-network controller.
- B. Has the ability to network with many different controllers.
- C. Is always a BacNet device.
- D. Needs updating and factory calibration every 3-6 months.

18. Economizer controls reduce air conditioning costs by:

- A. Using cool outside air to cool the building, when cooling is called for within the zone, and shutting down the mechanical cooling equipment.
- B. Using mechanical cooling as the first stage to cool the zone.
- C. Reducing air conditioning costs by utilizing cool outside air and running the compressor refrigeration circuit as much as possible.
- D. Turning on the compressor, while bringing in the minimum amount of fresh outside air into the building.

19. The graph below documents the operation of a supply fan on/off status for a weekend period. If the building is unoccupied on the weekend, what operational adjustments might the building operator recommend to save energy?

- A. Schedule fan off on weekends
- B. Setback space temperature setpoints during the weekend
- C. Verify fan operating schedules match occupancy
- D. All of the above



20. The purpose of an automated fault detection and diagnosis (FDD) system on a rooftop packaged air unit with an economizer is to:

- A. Open and close the outside air damper
- B. Override the control system when the economizer fails
- C. Monitor the operation of the economizer and send notification of a fault
- D. Repair a faulty economizer

END OF TEST

Please return the Test Booklet and your Answer Sheet to Administrator.