

TEST BOOKLET
BOC 1010 – Energy Efficient Ventilation Strategies and High Performance Heating & Cooling Equipment
Edition 2.0

TEST INSTRUCTIONS

The BOC 1010 test consist of 20 multiple choice questions. A period of one hour is available for the exam, but it will not be strictly timed. This is an open book test. You may use any notes or handout materials of your own. 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 – P 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 examination have been chosen to sample the operator's knowledge.

BEGINNING OF TEST

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

1. **Do displacement ventilation systems require the installation of a raised access floor? Select the best answer.**
 - A. Yes
 - B. Yes, except when displacement diffusers are placed at the ceiling level
 - C. No, never
 - D. No, but “low-throw” floor diffusers can be installed in a raised floor that perform similar to a displacement ventilation system

2. **Which of the following best describes the temperature and pollutant distribution in a displacement ventilation system?**
 - A. Cool and polluted air in the lower zone, warm and polluted air in the upper zone
 - B. Uniform temperature and pollutant concentration from floor to ceiling
 - C. Cool and fresh air in the lower zone, warm and polluted air in the upper zone
 - D. Warm and polluted air in the lower zone, cool and fresh air in the upper zone

3. **What is the normal range of supply temperature and discharge velocity for displacement ventilation diffusers?**
 - A. 55-57 °F, \leq 50 fpm
 - B. 55-57 °F, \geq 200 fpm
 - C. 61-68 °F, \leq 50 fpm
 - D. 61-68 °F, \geq 200 fpm

4. **In a more severe heating (cold weather) climate, how should the displacement ventilation system be operated during heating conditions?**
 - A. A separate heating system is required in more severe heating climates.
 - B. Use moderate heating supply air temperatures with higher airflow rates.
 - C. Control room air stratification should be about 3 °F.
 - D. Control room air stratification should be greater than 5 °F.

5. **Which of the following functions requires, on average, the most airflow?**
 - A. Space cooling
 - B. Structural cooling
 - C. Health
 - D. Bodily cooling

6. Which of the following is NOT typically controlled in automated windows in a mixed-mode system?
- A. Ventilation requirements
 - B. Daytime comfort
 - C. Nighttime cooling
 - D. Indoor acoustics
7. Surveys are showing higher satisfaction with which aspect of the indoor environment, in mixed-mode buildings?
- A. General satisfaction
 - B. Thermal comfort
 - C. Air quality
 - D. All of the above
8. Which statement best describes what surveys are finding about what occupants think about air movement in buildings?
- A. Many more people want more air movement than less, in both seasons.
 - B. There are frequent complaints about excessive air movement (drafts) in buildings.
 - C. People only like air movement when they are feeling really hot.
 - D. People associate air movement with a broken air distribution system.
9. What statement about the new ASHRAE Std. 55 (adaptive thermal comfort standard) is NOT true?
- A. The standard is based on extensive field studies done in real buildings around the world.
 - B. Research considered forms of behavioral, physiological and psychological adaptation.
 - C. The adaptive comfort standard universally applies to all climates and building types.
 - D. The adaptive standard was created because people preferred a wider range of conditions in naturally ventilated buildings.
10. For the same cooling load and airflow rate, how would the amount of stratification (vertical temperature difference) in the space provided by a UFAD system compare to the stratification provided by a DV system?
- A. UFAD stratification would be greater.
 - B. UFAD stratification would be less.
 - C. They would be the same, since both provide well-mixed conditions.
 - D. They both provide the same amount of stratification.
11. What is the typical pressure in a pressurized underfloor plenum?
- A. 0.05 in. H₂O
 - B. 0.5 in. H₂O
 - C. 1.0 in. H₂O
 - D. 2.0 in. H₂O

- 12. To maximize the benefits related to high performance HVAC systems, the control systems must _____.**
- A. alert operators whenever a piece of equipment turns on or off.
 - B. maintain constant temperature and pressure setpoints.
 - C. automatically adjust system parameters to maximize efficiency based on actual heating and cooling loads.
 - D. allow building occupants to continually monitor system performance and provide direct feedback to the building operators.
- 13. When evaluating different types of HVAC equipment, the primary metric that a building owner should consider is**
- A. the first cost of the equipment.
 - B. the cost of energy used per year to operate the equipment.
 - C. the annual maintenance cost related to the equipment.
 - D. the life-cycle cost of the equipment.
- 14. What technique can owners use to help them compare different HVAC equipment options?**
- A. Require equipment vendors to include a total cost of ownership analysis in their proposals.
 - B. Minimize the number of equipment vendors under consideration.
 - C. Limit the equipment options under consideration to those that are used in similar buildings in the area.
 - D. Solicit input from the building occupants.
- 15. When specifying HVAC equipment, what factor(s) can owners reasonably specify that will help maximize the energy performance of the system (besides the minimum acceptable full load energy efficiency)?**
- A. Minimum service clearance
 - B. Minimum part load energy efficiency, at a variety of conditions
 - C. Maximum degradation in full load energy efficiency over the life of the equipment
 - D. Maximum simultaneous heating and cooling with other building systems
- 16. How does installation of high-performance HVAC equipment help building owners satisfy local and federal building codes?**
- A. The equipment is more energy efficient than minimum code requirements.
 - B. The equipment uses advanced technologies, which don't require code compliance.
 - C. The equipment does not use refrigerants, which can harm the environment.
 - D. Use of the equipment requires full-time operating staff, which is a code requirement.

- 17. Which technique do most building energy managers use to verify that their building energy performance goals are being met?**
- A. Install the highest efficiency HVAC equipment available on the market, and replace the equipment when higher efficiency equipment becomes available.
 - B. Periodically interview the building occupants.
 - C. Hire outside service contractors to perform preventive maintenance on major equipment.
 - D. Continually measure energy usage, and compare to past performance and expected performance.
- 18. Which of the following is an operations and maintenance strategy to optimize airside controls in high performance buildings?**
- A. Oxygen trim control
 - B. Thermal energy storage
 - C. Maximum deadband
 - D. Night Venting
- 19. True or False. A building's intrinsic thermal mass can be used to reduce peak cooling loads by circulating cool nighttime air to pre-cool the building prior to daily occupancy, when the ambient nighttime temperatures are low enough.**
- A. True
 - B. False
- 20. Select the statement that is true about operations and maintenance practices**
- A. Opportunities for improved operations often require engineering analysis.
 - B. The energy waste attributed to poor O&M is insignificant.
 - C. O&M programs require capital improvements in order to lower energy bills.
 - D. Sound O&M practices extend equipment life and lead to fewer occupant complaints.

END OF TEST