

CHAPTER 17A – Electric Heating Systems & HVAC (Heating Ventilation and Air-Conditioning Systems)

Review

Note: Refer to the *CEC* or the blueprint package as necessary.

1. What does HVAC stand for? ____ **Heating Ventilation and Air-Conditioning**_____
2. Define space heating and provide examples that commonly use space heating systems.

Space heating heats and area, central furnace and radiators are examples of this.

3. Define surface heating and provide examples that commonly use surface heating systems.

Surface heating heats an object like a heated driveway, vessel or pipe trace system.

4. Refer to image 9A-19 and list at least 5 components or conditions in the circuit that will prevent the compressor from starting.

More than 5 can be found.

- **Blown fuse/s**
- **Faulty contactor coil**
- **Tripped overload**
- **Faulty extra-low voltage control transformer**
- **CS or CR control relay coil or contact failure**
- **Operator error (System simply set to off position)**
- **LP1 open or failure**
- **T open or failure**
- **HP open or failure**
- **LP2 open or failure**

5. What CEC rules list requirements for hazardous locations that reference ventilation requirements for a spray booth.

CEC rules 20-300 to 20-314 list requirements for hazardous locations referencing ventilation requirements for a spray booth.

A spray booth must include an interlock to ensure that the operation of the spraying equipment can only be possible once the system proves airflow. To prove air flow, a differential pressure switch is mounted to the ventilation pipe. Once sufficient air is flowing an electrical contact in the pressure switch will close powering a solenoid valve. The solenoid operates an air valve that provides the system air needed to operate the spraying equipment.

This can not be done using auxiliary contacts from the motor control circuit. Why? If the belt on the fan were to break the spray booth will lose all ventilation but electrically all controls and contacts would still be in the fan running state.

6. When replacing control equipment connected to a BAS (building automation system) what

are the most important things to consider.

If the Components are addressable need will to be configured prior.

Replacement equipment must be exact match,

- model #
- version
- firmware updates

BAS programing will be required to remove and/or re-address from the system programing.

Manufacture specific system training is needed to properly support complex systems and components. Most are proprietary systems with custom software needed to access.

7. Refrigeration is a method of removing energy in the form of heat from an object.

See Refrigeration.

8. Match the following items by inserting the appropriate letter from column 2 in the blank in column 1.

- | | |
|--|---------------------------|
| a. This device raises the energy level of the refrigerant. | B. Compressor |
| b. The refrigerant condenses here as heat is removed. | C. Condenser |
| c. This is a metering device. | D. Expansion valve |
| d. The refrigerant absorbs energy here in the form of heat. | A. Evaporator |

See Refrigeration.

9. Name three types of condensers.

- Air-cooled units
- Water-cooled units
- Evaporative cooling units

See Condenser.

10. A 230-volt, single-phase hermetic compressor with an FLA of 21 and an LRA of 250 requires a disconnect switch with a rating of 5 horsepower.

See CEC Rule 28-704 and Table 45.

11. A motor-compressor unit with a rating of 32 amperes is protected from overloads by a separate overload relay selected to trip at not more than 44.8 ampere(s).

$$32 \times 140\% = 44.8 \text{ A}$$

See **Special Terminology | Air-Conditioning and Refrigeration Equipment Motor-Compressor Overload Protection** and *CEC Rule 28-710 a)*.

- 12. Should the electrician be required to furnish overload protection for a motor–compressor refrigeration unit, he or she can meet the requirements of *Rule 28-306* by selecting fuses sized at not more than 125% of the motor–compressor rated-load current.**

See *CEC Rule 28-710 b)*.

- 13. Does the *CEC* permit the disconnect switch for a large rooftop air-conditioner to be mounted inside the unit? Give the appropriate reference.**

No; *CEC Rule 28-604 5) 6)*

- 14. Where the nameplate of an air-conditioning unit specifies the minimum ampacity required for the supply conductors, must the electrician increase this ampacity by 25% to determine the correct ampacity for the conductors that will supply the air-conditioning unit? Explain.**

No; the 25% oversize has already been taken into consideration.

See **Electrical Requirements for Air-Conditioning and Refrigeration Equipment**.

- 15. Where appliances are required to be bonded, what section of the *CEC* would you refer to for specific grounding requirements?**

Section 10

- 16. Which current rating of an air-conditioning unit is greater? (Circle the letter of the correct answer.)**

a. Rated-load current

b. Branch-circuit selection current

See **Special Terminology**.

- 17. How many cooling system roof units are there?**

Four units

See Drawing A5.

- 18. Who shall supply and physically install the air-conditioning equipment?**

Heating contractor

