

# Human Comfort and System Selection

## Review Questions

Which of the following factors affects a customer's level of comfort?

- a. Air movement.
- b. Humidity.
- c. Temperature.
- d. All of the above.

# Heat Transfer and the Basic Refrigeration Cycle

## Review Questions

The three processes that transfer heat energy are conduction, convection and \_\_\_\_\_

- a. Concentration.
- b. Radiation.
- c. Refraction.
- d. Static pressure.

Heat transfer that occurs when substances of different temperatures are in contact with each other is called \_\_\_\_\_.

- a. Concentration.
- b. Conduction.
- c. Convection.
- d. Radiation.

What is the primary danger to people near an accidental refrigerant release or spill?

- a. Blurred vision caused by the refrigerant vapor coming in contact with the eyes.
- b. Changes in weather patterns caused by global warming.
- c. Damage to the food chain caused by decreased ozone levels in the stratosphere.
- d. Suffocation caused by the heavier refrigerant displacing the oxygen in the air.

The maximum temperature at which refrigerant may be stored is \_\_\_\_\_°F when the container is no more than \_\_\_\_\_% full of liquid.

- a. 120°F 60%
- b. 125°F 60%
- c. 125°F 80%
- d. 135°F 80%

Boiling of refrigerant occurs in which system component?

- a. Compressor.
- b. Condenser.
- c. Evaporator.
- d. Metering device.

When the heat load on an evaporator increases, what is the effect on the system?

- a. Suction pressure decreases and discharge pressure increases.
- b. Suction pressure increases and discharge pressure decreases.
- c. Suction pressure and discharge pressure both decrease.
- d. Suction pressure and discharge pressure both increase.

What is the primary function performed by the thermal expansion valve?

- a. It maintains the correct superheat in the hot vapor leaving the compressor.
- b. It maintains the correct superheat in the suction vapor leaving the evaporator.
- c. It maintains the proper subcooling level in the liquid refrigerant.
- d. It prevents flash vapor bubbles from developing in refrigerant entering the evaporator.

# System Components

## Review Questions

Which component pumps the refrigerant through the system and raises the vapor temperature?

- a. Accumulator.
- b. Compressor.
- c. Condenser.
- d. Evaporator.

When is crankcase heat most needed?

- a. Early in the morning during the cooling cycle.
- b. When the compressor is operating in very cold winter weather.
- c. When the compressor is operating in very humid conditions.
- d. When the compressor is off.

What tool should be used to shorten a capillary tube?

- a. A pair of pliers with side-cutter edges.
- b. A small tubing cutter.
- c. Any tube cutter approved for use on refrigerant tubing.
- d. A triangular or knife-edge file.

Which pressure in a TEV is the opening pressure?

- a. Bulb pressure.
- b. Evaporator pressure.
- c. Spring pressure.
- d. A combination of spring and bulb pressure.

What is the typical storage life of modern refrigerants?

- a. 5 to 10 years.
- b. 10 to 20 years.
- c. 20 to 30 years.
- d. Modern refrigerants have an indefinite storage life.

Which of the following should be used to leak-test refrigerant tubing?

- a. Compressed air.
- b. Dry nitrogen.
- c. Oxygen.
- d. Water.

Voltage supplied to a motor may vary from the rated voltage by \_\_\_\_\_%.

- a. +0%, -0%
- b. +0%, -10%
- c. +10%, -0%
- d. +10%, -10%

What is one of the most important reasons for using electronic controls in HVACR systems?

- a. The clean air act of 1990 mandates their use.
- b. They are less expensive than the controls they replace.
- c. They are lighter in weight than the controls they replace.
- d. They make decisions based on many inputs.

Some electromechanical thermostats must be connected to both sides of the transformer in order to power the \_\_\_\_\_.

- a. Cooling anticipator.
- b. Display lights on the sub-base.
- c. Heat anticipator.
- d. Microprocessor.

What problem is likely to occur if a proper trap is not used on the condensate drain for a draw-through unit?

- a. Condensate water will not drain properly and will back up above the primary drain.
- b. Conditioned supply air will escape through the condensate drainpipe.
- c. Ice will accumulate on the evaporator coil.
- d. Stress on the connection fitting at the evaporator will cause the pipe to crack.

The auxiliary drain from an overflow pan must\_\_\_\_\_.

- a. Be connected to the primary condensate drain line using an approved P-trap.
- b. Be terminated at some conspicuous location so that an overflow is readily noticed.
- c. Have a diameter of at least 1 in.
- d. Never be insulated.

Which of the following statements a about packaged unit installation is true?

- a. Packaged heat pumps are intended for rooftop installations only.
- b. Packaged heat pumps are more difficult to install than split systems.
- c. Packaged heat pumps are not available for use in commercial applications.
- d. The pad used to support a packaged heat pump should not make contact with the building.

Why must you exercise special care when you bend soft drawn refrigerant tubing?

- a. Any distortion of the tubing diameter creates a restriction to refrigerant flow that reduces system capacity.
- b. Copper flakes can come loose from the interior surfaces of the tubing if it is overbent.
- c. Overbending the tubing makes it difficult to slide on closed cell insulation.
- d. The refrigerant flow rate increases if tubing is overbent, making oil return impossible.

The evacuation of a refrigerant circuit is considered complete when a vacuum of \_\_\_\_\_ can be maintained.

- a. 200 microns.
- b. 350 microns or less.
- c. 500 microns or less.
- d. 1,000 microns.

What voltage is measured between any two legs in a delta connected 240-V three-phase distribution panel?

- a. 208 V.
- b. 240 V.
- c. 277 V.
- d. 380 V.

# Reading Electrical Schematics

## Review Questions

Which of the following statements about understanding wiring diagrams is not true?

- a. Electricity always follows the path of least resistance.
- b. Every circuit must have a load that consumes power in exchange for work.
- c. Every circuit must have a power source.
- d. Schematics are always shown with the circuits energized.

In wiring diagrams, solid heavy lines usually indicate \_\_\_\_\_.

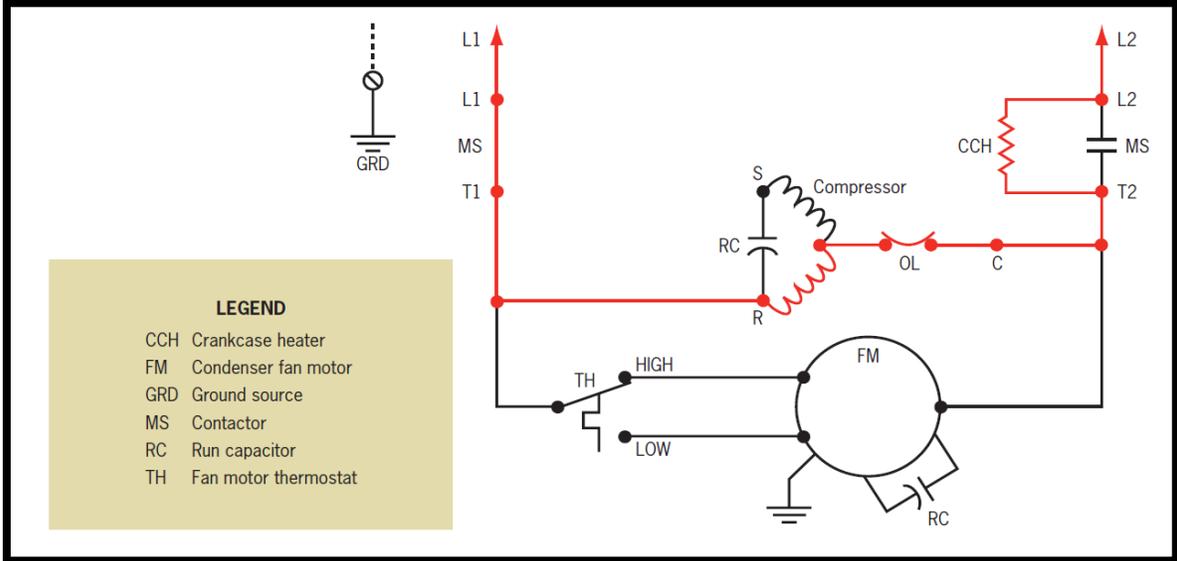
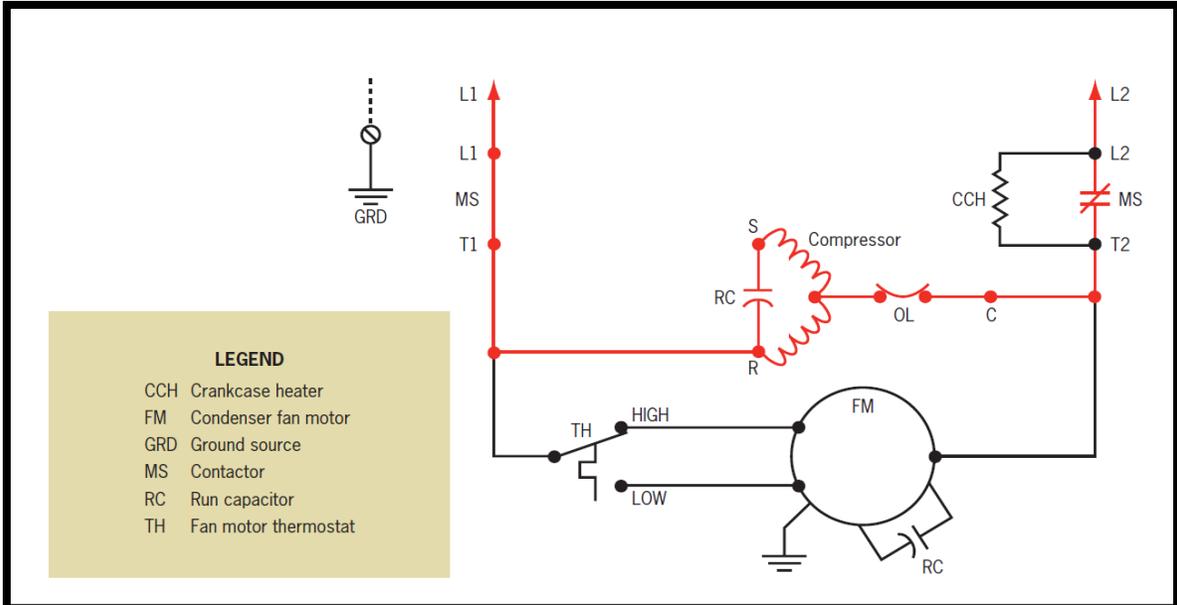
- a. Factory-installed line-voltage wiring
- b. Factory-installed low-voltage wiring
- c. Field-installed line-voltage wiring
- d. Field-installed low-voltage wiring

In wiring diagrams, dashed or dotted lines usually indicate \_\_\_\_\_.

- a. Factory-installed wiring
- b. Field-installed wiring
- c. Non-insulated wiring
- d. Shielded cable

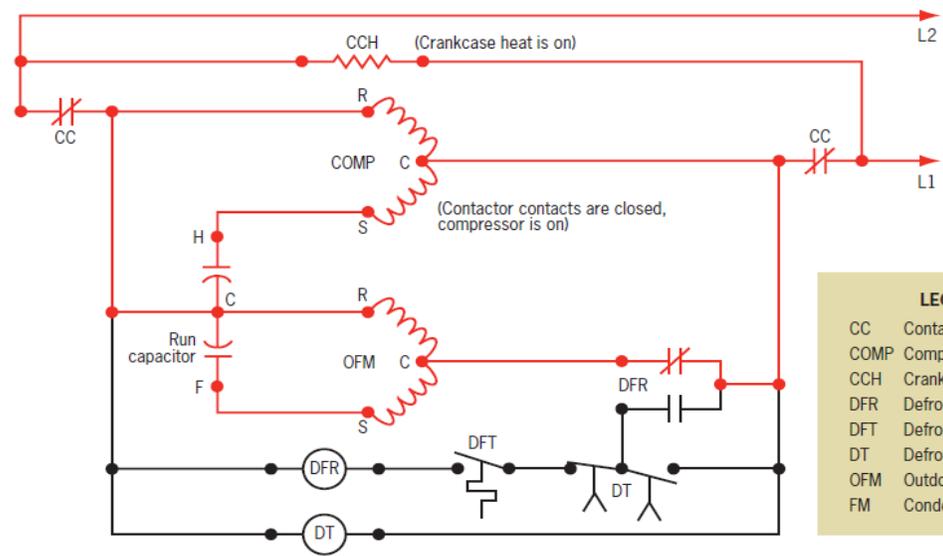
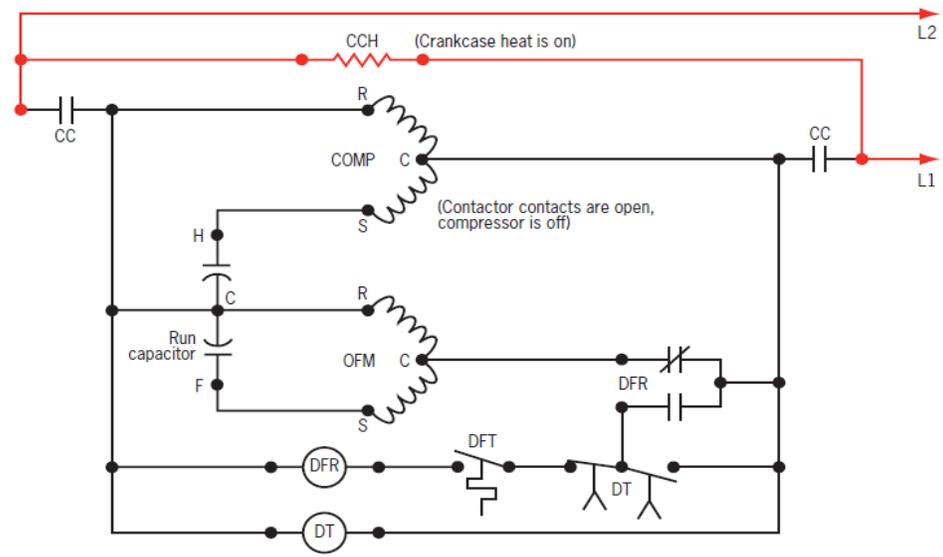
Refer to the figure below to determine which of the following statements about the circuit shown is true.

- a. An outdoor thermostat controls the crankcase heater.
- b. The crankcase heater is energized when the compressor is running.
- c. The crankcase heater is energized when the contactor contacts are open.
- d. The crankcase heater is energized when the contactor contacts are closed.



Refer to the figure on the following slide to determine which of the following statements about the circuit shown is true.

- a. The compressor runs whenever voltage is supplied to L1 and L2.
- b. The crankcase heater is energized whenever voltage is supplied to L1 and L2.
- c. The crankcase heater is energized only when the compressor is running.
- d. The outdoor fan motor starts 30 to 60 seconds after the compressor motor starts.



**LEGEND**

|      |                     |
|------|---------------------|
| CC   | Contactor           |
| COMP | Compressor          |
| CCH  | Crankcase heater    |
| DFR  | Defrost relay       |
| DFT  | Defrost thermostat  |
| DT   | Defrost timer       |
| OFM  | Outdoor fan motor   |
| FM   | Condenser fan motor |

Which of the following types of wiring diagrams is best suited for troubleshooting electric circuits?

- a. Installation diagram.
- b. Ladder schematic.
- c. Pictorial diagram.
- d. Point-to-point diagram.

The use of ground fault circuit interrupter (GFCI) is especially important when \_\_\_\_\_

- a. Apprentice workers are asked to use power tools.
- b. More than one electric tool is plugged into an outlet.
- c. The cord of an electric tool is frayed or cracked.
- d. Work is being done on wet surfaces.

What critical first step must be taken to begin the troubleshooting process?

- a. Check all fuses for continuity.
- b. Check for grounded motor windings.
- c. Check relay and contactor housing for stuck switches.
- d. Check that the correct voltage is being supplied to the equipment.

Which of the following low-voltage wires is typically used to carry power to the thermostat subbase?

- a. Green.
- b. Red.
- c. White.
- d. Yellow.

Which terminal designation on the thermostat subbase typically is used for the cooling circuit?

- a. G
- b. R
- c. W
- d. Y

A small voltage reading across a closed set of contacts in an energized circuit indicates that the \_\_\_\_\_

- a. Contacts are in good condition.
- b. Contacts are pitted.
- c. Motor capacitor is defective.
- d. Wrong voltage is supplied to the unit.

An acceptable capacitance reading for a run capacitor is \_\_\_\_\_ the microfarad rating printed on the capacitor.

- a. Equal to or up to 10% more than
- b. Equal to or up to 20% more than
- c. Plus or minus 10% of
- d. Plus or minus 20% of

If a pressure at a given point in an R-410A system is 354 psig and the tubing temperature at that point is 98° F, what does a T-P chart like the one shown here tell you?

- a. The refrigerant is liquid and subcooled 10°F.
- b. The refrigerant is vapor and superheated 10°F.
- c. The refrigerant is saturated.
- d. More information is needed to answer the question.

| Temperature (°F) | Pressure, psig |      |
|------------------|----------------|------|
|                  | R-410A         | R-22 |
| 41               | 120            | 70   |
| 42               | 123            | 72   |
| 43               | 125            | 73   |
| 44               | 127            | 75   |
| 45               | 130            | 76   |
| 108              | 354            | 220  |
| 112              | 374            | 233  |
| 116              | 395            | 246  |
| 118              | 406            | 253  |

What heat quantity equals one ton of total cooling load on the evaporator?

- a. 7,500 Btuh.
- b. 10,000 Btuh.
- c. 12,000 Btuh.
- d. 15,000 Btuh.

Which of the following is measured to determine the total resistance to airflow in a ductwork system?

- a. Current draw of the compressor.
- b. External static pressure at the air handler or furnace.
- c. Power input to the electric heater.
- d. Temperature rise across the electric heater.

What is the maximum face velocity for air leaving a supply register?

- a. 300 ft/min.
- b. 450 ft./min.
- c. 500 ft/min.
- d. 700 ft/min.

What gas must be purged through a refrigerant circuit to prevent the formation of oxides whenever brazing is being done?

- a. Any HFC.
- b. Dry nitrogen.
- c. Filtered air.
- d. Oxygen.

What certification is required before a technician is permitted to work on air-conditioning and heat-pump systems?

- a. ARI 77-88 certification.
- b. EPA section 608 certification.
- c. EPA section 609 certification.
- d. Journeyman or Master Mechanical tradesman license.