TradeMasters
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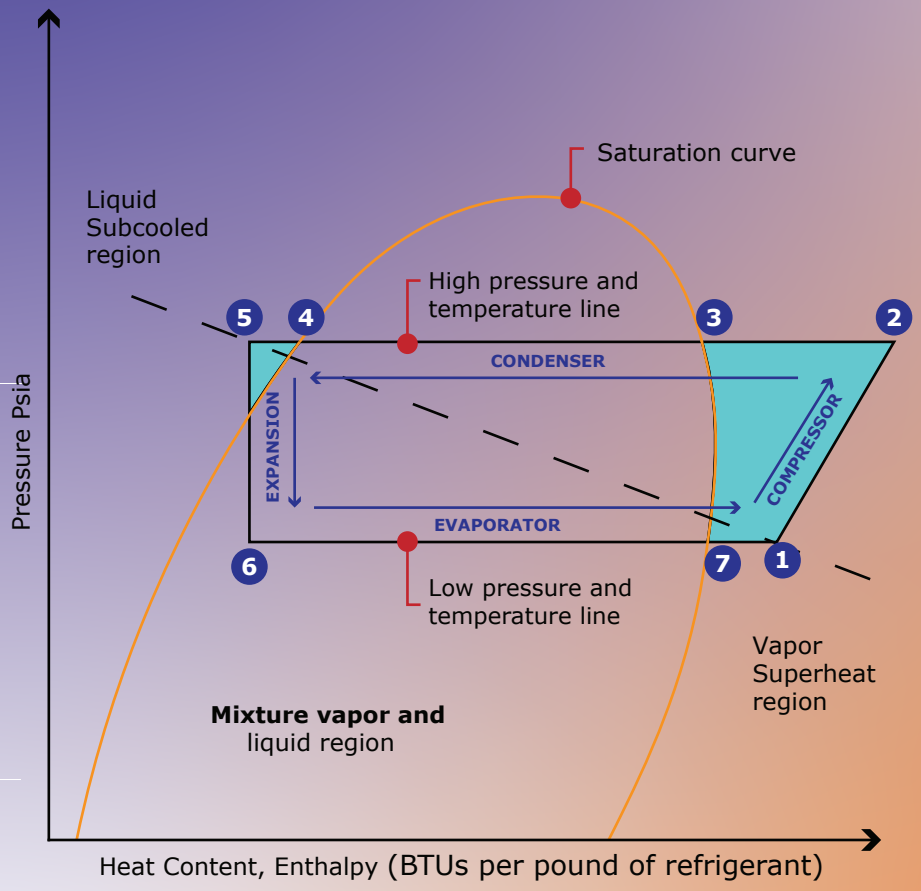
313 Course Compendium

Fourth Edition, 2025

Certificate of Qualification (CofQ)
Examination Preparation for
313A Refrigeration and Air Conditioning Systems Mechanic
313D Residential Air Conditioning Systems Mechanic



By
Sam Bilamjian
Chris Budd

Welcome!

Our trade of Refrigeration and Air Conditioning is a vast and diverse universe. If a technician lived for five hundred years, he or she may just learn it all. Of course, this is impossible and not required to be great at what you do. Because each and every one of us is a specialist. We do not think of ourselves this way. Imagine a tree whereby each branch represents a sector of our trade. We would have the industrial branch, the commercial branch, the residential branch … and so on. Also, each branch would have leaves, one for installing, one for maintenance, one for repairs … etc. Each of us works on our own branches and leaves on any given day. But seldom do we see the tree in its entirety.

So why the analogy? It is because you have invested a considerable amount of time and energy into becoming proficient on the branches but are now facing exam questions about more of the tree.

On behalf of your Instructors at the TradeMaster Workshop, thank you for trusting us with providing you with our unique way to complete mastery over C of Q exam questions for both the 313A and 313D trade licenses.

Expect to be immersed in a teaching and learning experience that is unparalleled in industry. You are going to enjoy some traditional 'time tested and true' in-class learning techniques, combined with state of the art technological advancements in remote 'studio-based' teaching. We have packed it all in for you: formal structure, repeating themes, clear expectations, expert mentorship, group fun, teacher paced learning, student paced learning, and of course, hun-dreds upon hundreds of questions to challenge you in a near game-style format. We hope you are excited to learn because we intend to ignite your screen and 'weaponize' your cell phone! When you are finished, we believe you will come to see the difference between online-learn-ing, and learning … online.

See you in class,

TradeMasters Chris and Sam

Cofounders

Table of Contents

CHAPTER 1

313A & 313D - Section 1

1. An example of pure refrigerant is:

A. R-502
B. R-12
C. R-404A
D. R-407C

2. Surface area of an air-cooled condenser typically larger than the surface area of the evaporator coil, because condensers: Figure CC-T10-01

A. Operate at higher ambient temperatures
B. Must reject the heat picked up by the discharge line
C. Must, in addition to rejecting the heat absorbed by the evaporator, also reject the heat of the liquid line
D. Must, in addition to rejecting the heat absorbed by the evaporator, also reject the heat picked up in the suction line and, the heat of compression

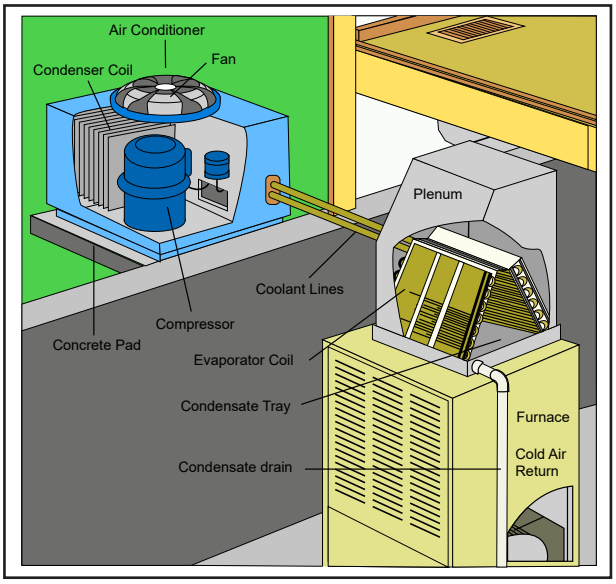


Figure CC-T10-01

3. Refrigerating an object is the result of:

A. Some of its heat energy being destroyed
B. Heat energy removed from the object
C. Cooling energy is added to the object
D. The speed of the molecules increasing in the object

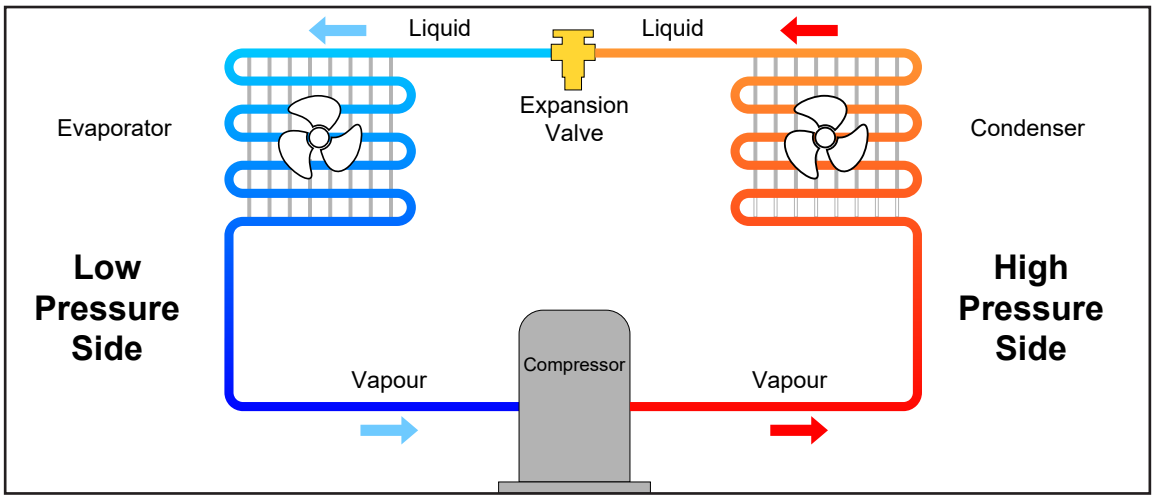


Figure CC-T10-03

41. If the motor pulley is twice the diameter of the blower pulley, the blower speed would be:

A. 1/4 the motor speed
B. 1/2 half the motor speed
C. Equal to the motor speed
D. 2 times the motor speed

Figure CC-T50-01

42. A manufacture's nameplate on air conditioning unit indicates a cooling capacity of 90,000 BTU/h. What is the nominal tonnage?

A. 5.0 ton
B. 6.5 ton
C. 7.5 ton
D. 9.0 ton

43. How much refrigerant should be added to a newly installed AC system if the condensing unit is pre charged for a 25-feet line set, your line set is 55-feet and, the manual requires 0.8 ounces of refrigerant for each additional foot of line set?

A. 1 lb 5 ounces
B. 1 lb 8 ounces
C. 2 lbs
D. 2 lb 8 ounces

44. -460°F is equivalent to:

A. Zero degrees Kelvin
B. Zero Degrees Rankine
C. Absolute zero temperature
D. All the above

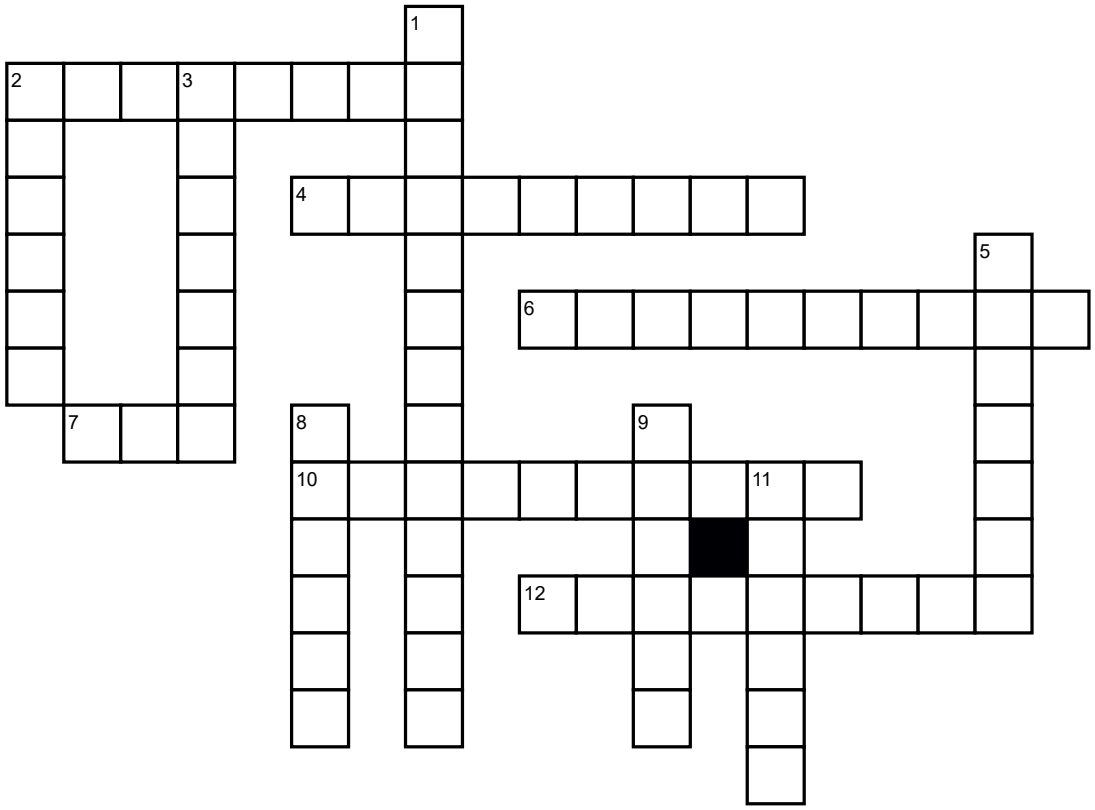
45. One kilo Watt of energy is equal to _____ BTUs.

A. 3.413
B. 29.28
C. 0.2928
D. 3,413

46. One ton of refrigeration is equal to:

A. Equal to 12,000 BTUs per day
B. The amount of heat necessary to melt 1 ton of ice in a 24-hour period
C. The compression ratio of the compressor in a refrigeration system
D. The amount of cooling that the evaporator can deliver in an hour

Solve this crossword. Note that some words are merges, such as: Counterclockwise, Airconditioning, Gasmeter, Heatpumps, Airwasher, Airproving, Highlimit, Wetbulb.



Across

2. Always remember to re-install _____ valves before evacuating a system.
4. As DB temp decreases, RH _____.
6. _____ refrigerants act as a single pure refrigerant.
7. _____ seat service valves to facilitate refrigerant flow when removing refrigerant from a system.
10. The Suction line connects the _____ to the compressor.
12. A full _____ cylinder is usually pressurized to 250 PSI.

Down

1. If you remove vapor from a cylinder of R404a, _____ occurs.
2. If water leaks out of the ducts where there is a steam humidifier, it is likely because _____ air temperature is too low.
3. Evacuation time can be _____ by Increasing the size of hoses, and the space temperature?
5. Always _____ a heat exchanger if it has a hole in it.
8. One would take a psychrometer reading in the _____ air of an HRV.
9. Always consider _____ air when installing exhaust fans.
11. A full _____ cylinder is usually pressurized to 2200 PSI.

313A & 313D - Section 3

1. An example of a mixture refrigerant is: Figure CC-T02-25

A. R-12
B. R-22
C. R-134A
D. R-502

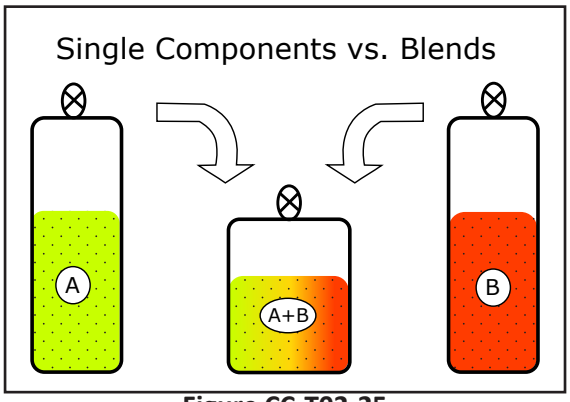


Figure CC-T02-25

2. A heat pump reversing valve will have the following configuration:

A. Pilot on top and main valve vertical
B. Pilot on bottom and main valve horizontal
C. Pilot on top and main valve horizontal
D. Pilot vertical and main valve vertical

3. A reversing valve in a heat pump:

A. Will be energized in heating mode
B. Will be energized in cooling mode
C. Is connected to thermostat terminals Y, W, and C
D. Reverses refrigerant flow in the compressor

4. Refer to Appendix G (Symptoms of Abnormal Conditions). For a heat pump running in heating mode, a high discharge pressure can be a result of: Figure CC-T20-03

A. Frosted outdoor coil
B. Undersized ductwork
C. Burnt out reversing valve coil
D. Low compressor speed

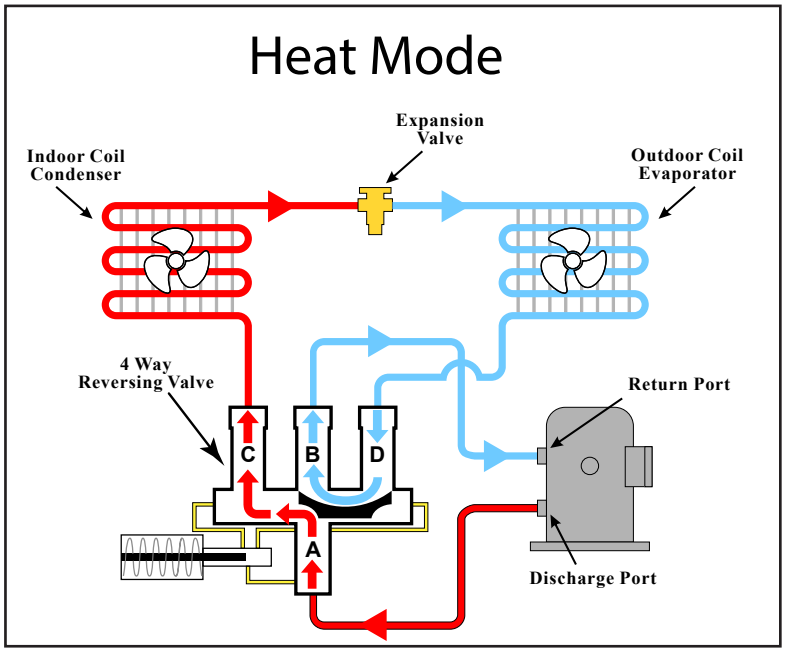


Figure CC-T20-03

51. Choose the most likely skin surface leading to electrocution. Figure CC-TS-27

A. Dry skin
B. Wet skin
C. Open wound
D. Bare feet

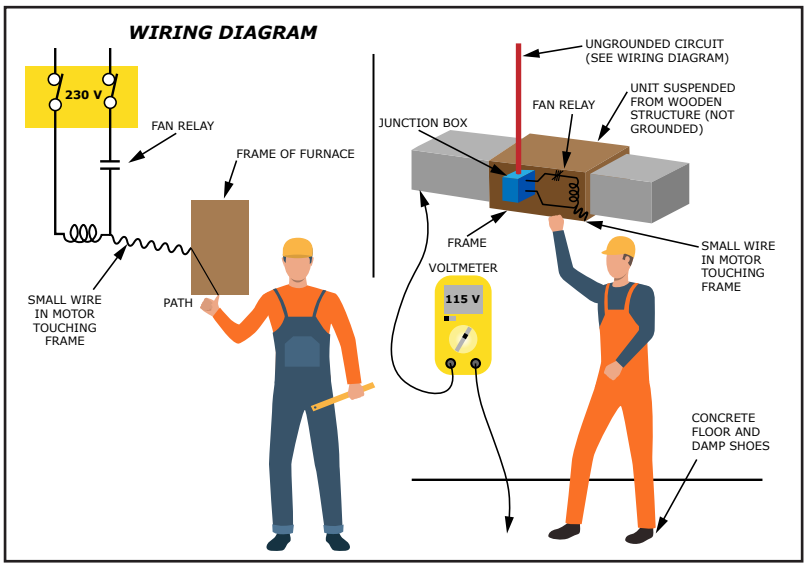


Figure CC-TS-27

52. A 120 volts AC circuit protected with a _____ is the most dangerous when an electrical shock is sustained at one of its loads.

A. Ground Fault Circuit Protection device
B. 1-amp fuse
C. 10-amp fuse
D. 15-amp fuse

53. GFCI receptacles protect occupants from:

A. Excess circuit amp draw
B. Circuit amps leaking to ground
C. Excess circuit volts
D. Partially shorted loads

54. One should not fill a refrigerant recovery cylinder past _____ of its liquid level, at 70°F.

A. 60%
B. 70%
C. 80%
D. 90%

55. What is the ratio of height to least lateral dimension required for a scaffold not to be tied to a structure? Figure A3-TS-03

A. 2:1
B. 3:1
C. 4:1
D. 5:1

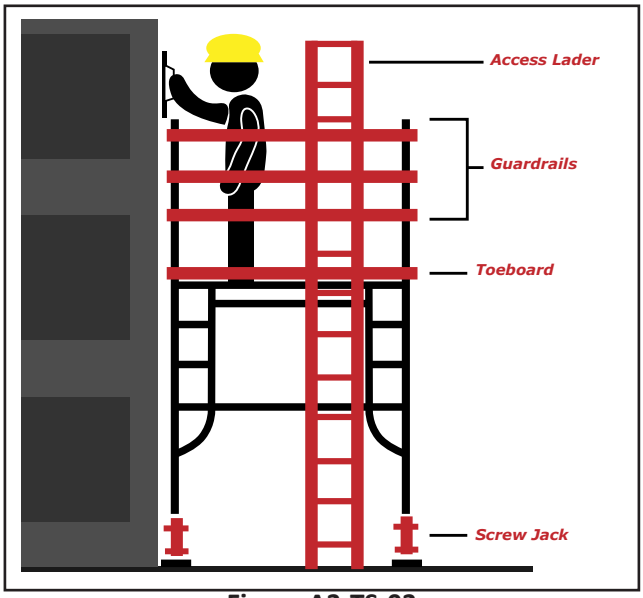


Figure A3-TS-03

6. Refrigerant in a condenser: Figure CC-T14-01

A. De-superheats
B. Changes from a vapor to a liquid
C. Sub-cools
D. All the above

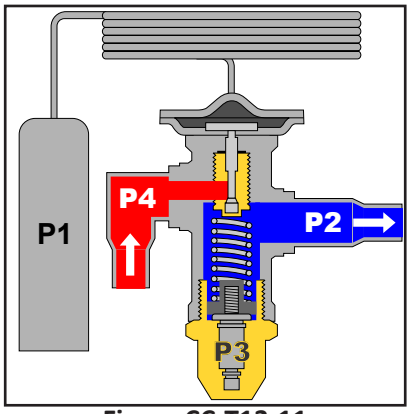


Figure CC-T13-11

7. On a system with a water-cooled condenser, which has a water regulating valve which is sticking closed:

A. High side pressure will reduce
B. High side pressure will increase
C. High side pressure will remain unchanged
D. Refrigerant in the condenser will tend to condense at a faster rate

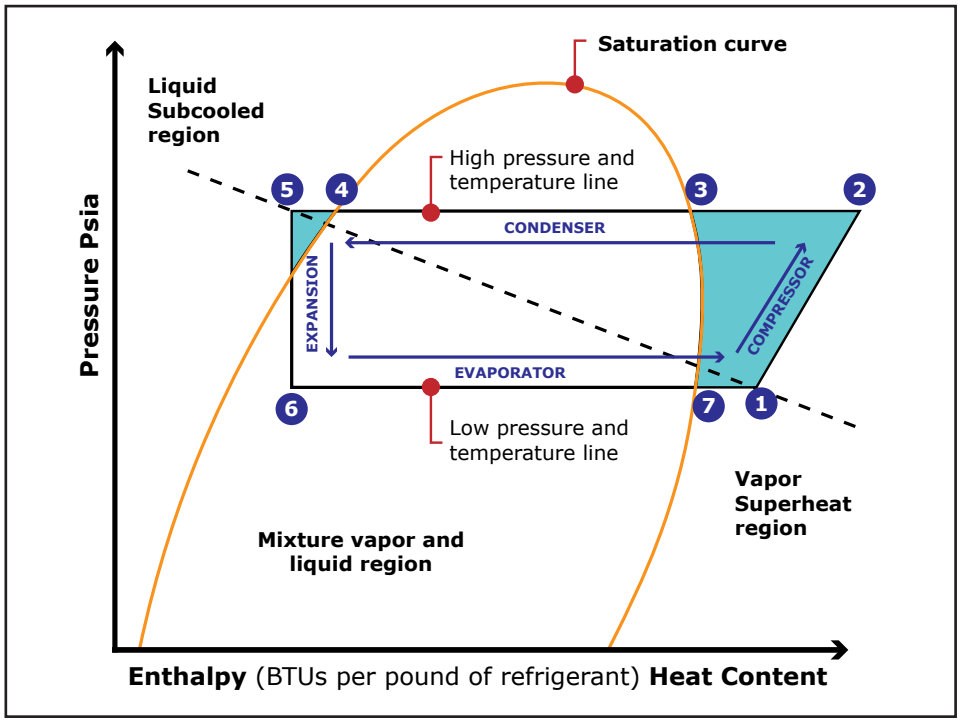


Figure CC-T14-01

8. Refer to Appendix G (Symptoms of Abnormal Conditions). Which condition will lead to reduced suction pressure?

A. Closed air grills in the home
B. Dirty air filters
C. Undersized air ducts
D. All the above

9. Condenser coils tend to back up with liquid if:

A. There are higher than normal ambient temperatures
B. Airflow across the evaporator is increased
C. The metering device is too restrictive
D. System Refrigerant levels are too low

67. Suction and discharge lines should always slope: Figure CC-T40-12

A. When horizontal, in the direction of refrigerant flow for good oil return
B. When horizontal, in the direction of refrigerant flow for good refrigerant return
C. When vertical, in the direction of refrigerant flow for good oil return
D. When vertical, in the direction of refrigerant flow for good refrigerant return

68. If a system has a NON-BLEED type TXV what should be installed?

A. A crankcase heater
B. A thermostat with auto changeover
C. A hard start kit for the compressor
D. A liquid line solenoid valve

69. The cooling anticipator is? Figure CC-T40-14

A. Adjustable, energized during a call for cooling, and parallel with the R and Y
B. Adjustable, energized during a call for cooling, and series with R and Y
C. Non-Adjustable, energized during stand-by for cooling, and in series with R and Y
D. Non-Adjustable, energized during stand-by for cooling, and parallel with R and Y

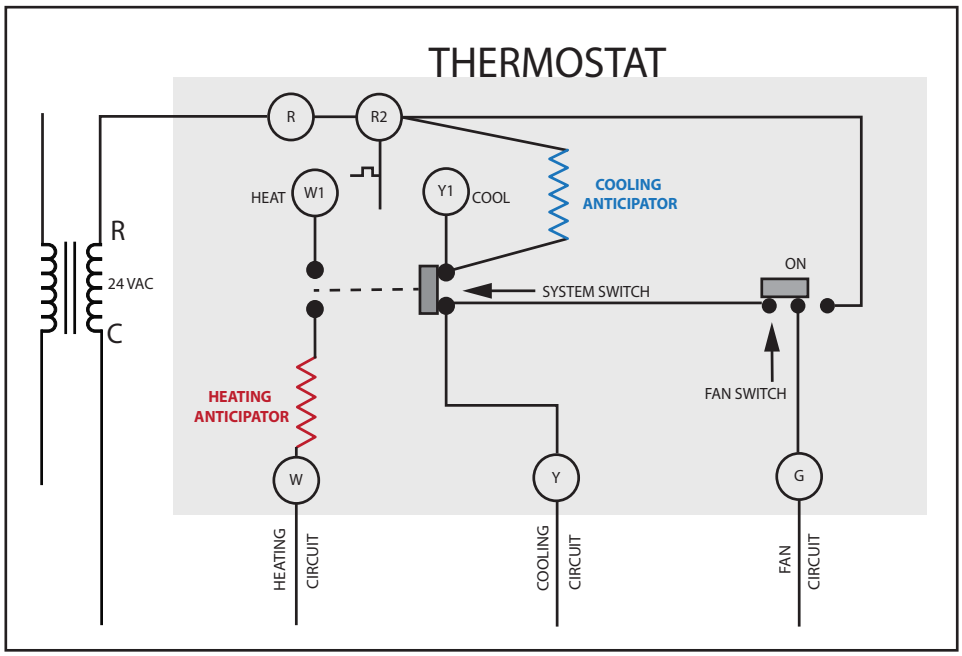


Figure CC-T40-14

70. Where is the sight glass/moisture indicator located?

A. Upstream of the liquid line filter drier
B. Between the liquid line filter drier and LLSV
C. Between the LLSV and the TEV
D. Between the TEV and the distributor

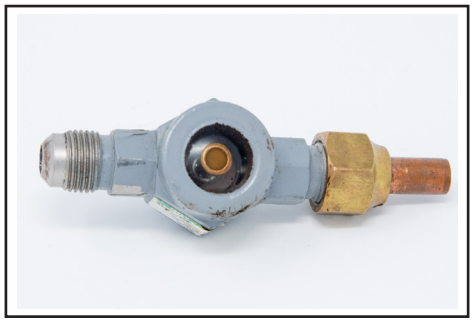


Figure CC-T40-15

17. Liquid-refrigerant floodback into the compressor is least likely in the case of:

A. Defrost clock or heater not operating, causing an iced coil
B. Dirty or blocked evaporator coil
C. Loose TXV bulb on evaporator outlet
D. Undercharging the system with refrigerant

18. Referring to Appendix E: Diagram 1 - Cooler Controls, what component is connected to terminals 3 & X of the electro-mechanical defrost time clock? Figure A3-T41-02

A. Defrost timer motor?
B. Defrost termination solenoid
C. Defrost heater
D. Evaporator fan motor

Figure A3-T41-02

19. Referring to Appendix E: Diagram 1 - Cooler Controls, a draw through unit cooler is still partially iced up after defrost has terminated. Where should the termination stat be located, relative to air flow? Figure A3-T41-03

A. Near coil outlet
B. Near coil inlet
C. Near the coil bottom
D. Near the coil top

20. Referring to Appendix E: Diagram 1 - Cooler Controls, the evaporator fan motor continues to run during the defrost cycle. What is done?

A. Replace the defrost time clock
B. Adjust the defrost heater set point
C. Replace the compressor contactor
D. Adjust the defrost termination thermostat

21. Referring to Appendix E: Diagram 1 - Cooler Controls, when replacing a defective defrost timer on a walk-in freezer system, which terminals are the defrost circuit, refrigeration circuit and the termination thermostat connected to, respectively?

A. 1, 2 and X
B. 2, 1 and N
C. 3, 4 and X
D. 4, 3 and N

Figure A3-T41-03

12. When suction vapour superheat goes up, compressor's Effective Capacity:

A. Increases
B. Decreases
C. Stays the same
D. Is not affected by suction vapour superheat

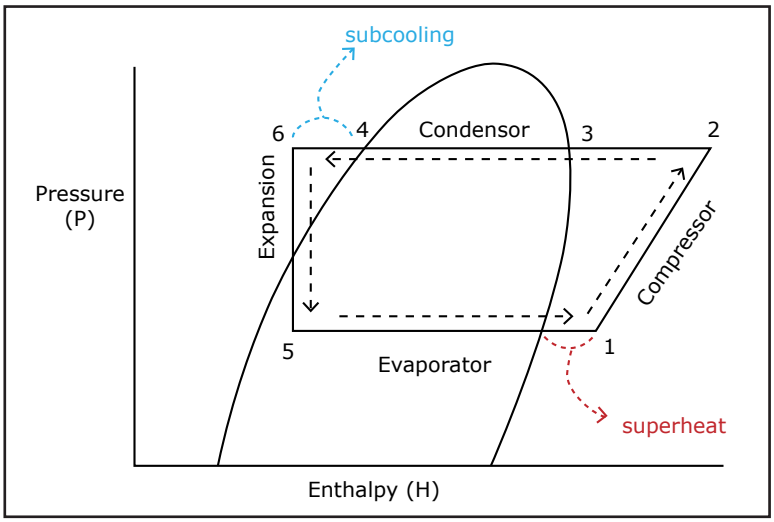


Figure A3-T40-29

13. When there is a drop in suction pressure, compressor Effective Capacity:

A. Increases
B. Stays the same
C. Decreases
D. Is not affected by suction

14. Which one of the following is a direct indicator to a restricted filter-drier?

A. Lower liquid levels in the sight glass
B. Temperature or pressure difference across the filter-drier
C. Higher evaporator temperatures
D. Lower evaporator temperatures

15. When sizing an exhaust fan for a building, what should be considered? Figure A3-T50-14

A. Make-up air unit
B. Building space pressurization
C. Gas fueled appliances
D. All the above

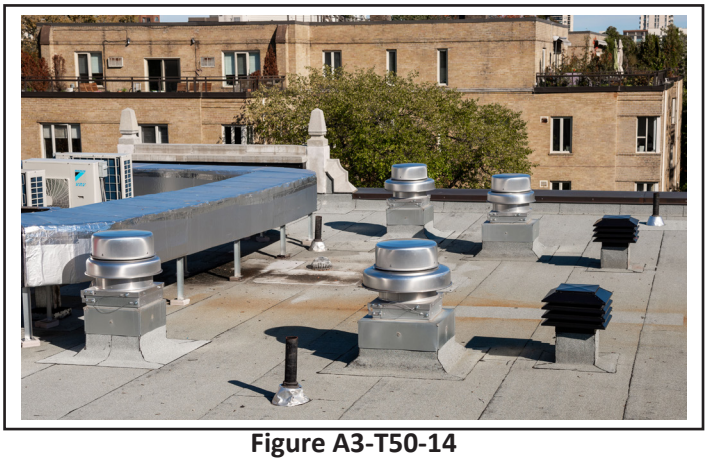


Figure A3-T50-14

42. A Low-pressure control on an R-404a refrigeration system is set to cut-in at 40°F with an 18 PSI differential. What is the cut-out point of the control? Figure A3-T66-18

A. 12.0 PSI
B. 22.0 PSI
C. 67.1 PSI
D. 82.1 PSI

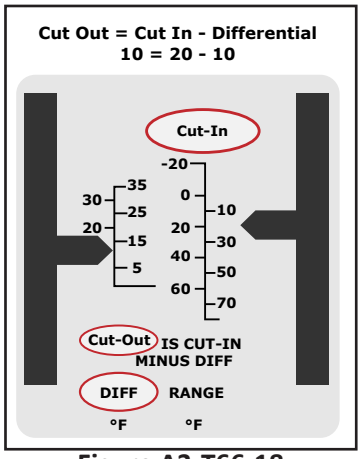


Figure A3-T66-18

43. The end of a duct measuring 24 inches wide and 12 inches high is to receive a grill. Before installing the grill, five velocity readings were taken at the end of the duct: (550 fpm), (520 fpm), (500 fpm), (480 fpm), (530 fpm), If the grill has a 75% free area, what will be the air flow through the grill after installation?

A. 256 cfm
B. 516 cfm
C. 774 cfm
D. 1032 cfm

44. On a multiple evaporator system using R-507 and EPR valves with all the evaporators at -20°F, except one at 20°F, what is the 20°F EPR valve set at? Figure A3-T66-20

A. 17.9 PSIG
B. 46.2 PSIG
C. 58.8 PSIG
D. 73.3 PSIG

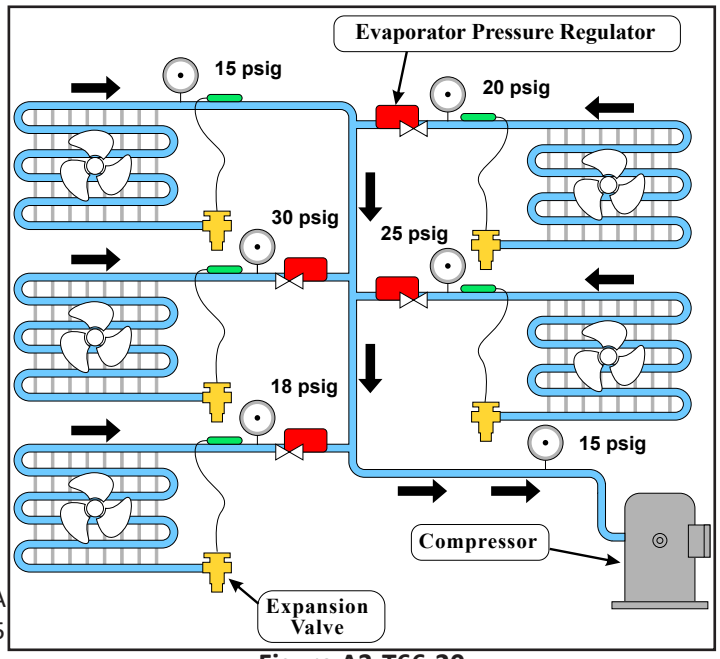


Figure A3-T66-20

45. On a R-134A system with a 20°F evaporator temperature differential, what is the Low-pressure control set at to maintain a box temperature of 36°F to 40°F?

A. Cut in 33.1 psia and cut out 30.4 PSIA
B. Cut-in is 33.1 PSIG and cut-out is 29.5 PSIG
C. Cut-in is 35.0 PSIA and cut-out is 15.7 PSIA
D. Cut-in is 35.0 PSIG and cut-out is 15.7 PSIG

46. A 208 V rated refrigerated fixture has 4 evaporator fan motors rated at 9 W each; plus 2 defrost heaters rated at 6 A each; plus 6 fluorescent lights rated at 40 W each, plus 1 strip mullion heater rated at 3 A. What is the minimum circuit breaker required?

A. 15 A
B. 20 A
C. 30 A
D. 40 A

Diagram 2: 230VAC Electric Defrost

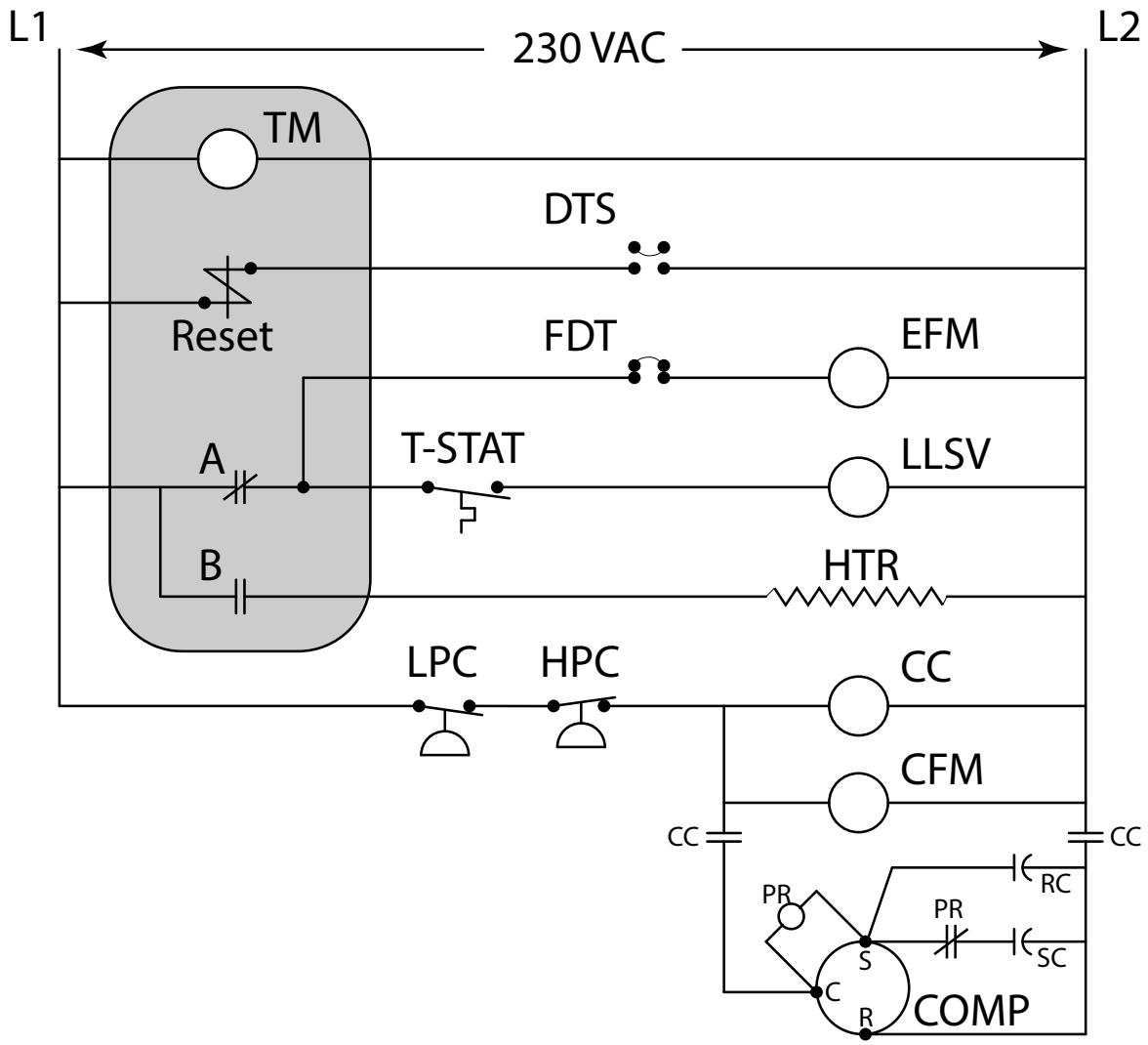


Diagram 2 - 230VAC Electric Defrost

Section 08 - Questions A3-T41-09 to 21