



313 Course Compendium

Second Edition, 2021

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



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. We will not be satisfied until you are confident and prepared to successfully pass your licensing exam. Our guarantee merits repeating here:

If you are successful in our course but do not pass your C of Q, you may take our course again for free.

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, hundreds 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-learning, and learning ... online.

See you in class,

TradeMasters Chris and Sam

Cofounders

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CHAPTER 1: 313A & 313D (COMMON CORE)

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22. S2 What is the predominant heat transfer method of the heat exchanger in a forced-air residential furnace?

- A. Conduction
- **B.** Radiation
- C. Convection
- D. Transmission

23. S2 Which of the following is an Azeotrope refrigerant?

- A. Ternary blend having similar pressure temperature characteristics
- B. Binary blend having similar pressure temperature characteristics
- C. A single component refrigerant
- D. Ammonia

24. S2 Which type of refrigerant will tend to fractionate when vapour charging?

- A. A single component refrigerant
- B. A binary blend refrigerant, zeotrope
- C. A ternary blend refrigerant, azeotrope
- D. A natural refrigerant

25. S2 The procedure for storing recovery cylinders is:

- A. Secured, horizontal, caps in place and below 125°F
- B. Secured caps in place, vertical and below 125°F
- C. Secured, caps in place, vertical and above 125°F
- D. Below 125°F, caps in place and in a vertical position

26. S2 Refrigerant Recovery Cylinders will have which of the following markings on them?

- A. Tare weight, water capacity maximum fill weight of 100%
- B. DOT OR TC, Water capacity and recertification every 5 years
- C. Recertification date every 15 years
- D. Notice to remove refrigerant as a vapour only

27. S2 Used oil from a refrigerant system, shall be.

- A. Placed into a recycling container for recycling
- B. Disposed of
- C. Left in the system
- D. Left on the roof

28. S2 Which method is used to add a blended refrigerant to a system holding charge?

- A. Add as liquid until system pressures is at 10 in, Hg
- B. Add as vapor until system pressures is at 20 in, Hg
- C. Add as liquid until system pressures is 1 PSIG
- D. Add as vapor until system pressures is 1 PSIG





49. S3 What condition do you have, if upon pulling a vacuum, the micron level rises and maintains 5,000 microns?

A. Leak

- B. Moisture present
- C. Leak and moisture present
- D. No concern

50. S3 Proper cleaning procedure of an air-cooled condenser is:

- A. Adjust pressure setting of the pressure washer and aim towards fin outlet
- B. Flush with acid solution
- C. Blow off debris and oil with liquid refrigerant
- D. Tunnel dry

51. S3 After cutting copper pipe, the pipe is,

- A. To be free and clean of nitrogen
- B. To be placed in a horizontal location to prevent any debris from entering
- C. To be reamed and deburred with a tool of dissimilar material
- D. To be coated with oil

52. S3 A CSCR compressor, having a TEV attempts a restart and the overload open. What is the cause?

- A. Burned out run capacitor
- B. Thermostat not calling
- C. Shorted start capacitor
- D. Crankcase heater is working

End of Section 3





22. S5 Heat pump has a time and temperature defrost termination. You find that the outside coil has no ice on it, but unit still in defrost. What is the definitive problem?

- A. Too cold outside
- B. Defrost termination timer is defective
- C. Defrost termination thermostat in welded
- D. Unit is calling for cooling

23. S5 On start-up, a split heat pump system has excessive discharge pressure on the heating cycle. What is done?

- A. Increase the air volume at the indoor coil
- B. Increase the condenser fan motor speed
- C. Decrease the air volume at the indoor coil
- D. Decrease the air volume at the outdoor coil

24. S5 How much heat energy is delivered to the heated space for every one-Watt/hour that is consumed by a heat pump?

- A. Less than 1 Watt/hour
- B. More than 1 Watt/hour
- C. Approximately 1 Watt/hour
- D. Dependent on the size of the structure

25. S5 The Coefficient Of Performance COP of a heat pump in the heating mode is:

- A. The difference between Total Heat of Rejection and Heat of Compression
- B. The ratio of the Total Heat of Rejection to the Heat of Compression
- C. The ratio of heat rejected by the condenser to the energy consumed by the compressor
- D. The difference between Heat of Compression and Net Refrigeration Effect

26. S5 The Coefficient Of Performance COP of a heat pump in the cooling mode is:

- A. The difference between Total Heat of Rejection and Heat of Compression
- B. The ratio of the Net Refrigeration Effect to the Heat of Compression
- C. The ratio of the Total Heat of Rejection to the Heat of Compression
- D. The difference between Heat of Compression and Net Refrigeration Effect

27. S5 The Coefficient Of Performance COP of a heat pump system operating in the heating mode is ______ the COP of the same heat pump system operating in the cooling mode.

- A. Lower
- B. Higher
- C. The same as
- D. Not comparable to



Figure CC-T21-08

Chapter 1: 313A & 313D (Common Core) - Section 6

1. S6 The maximum pressure adjustment to be used, when brazing acetylene should not exceed:

- A. 15 PSI
- B. 45 PSI
- C. 100 PSI
- D. 125 PSI

2. S6 What does a hydrometer measure?

- A. The relative density of gasses
- B. The relative density of liquids
- C. The specific volume of gasses
- D. The specific volume of liquids

3. S6 A rectifier is a device that changes voltage into

- A. Single-phase; three-phase
- B. Three-phase; single-phase
- C. AC; DC
- D. DC; AC

4. S6 A scenario in which a TXV bulb senses vapor one instant and liquid the next and rapidly opens and closes the valve is called:

- A. Surging
- B. Hunting
- C. Gliding
- D. Throttling

5. S6 Where is the line from an external equalizer installed?

- A. Tee'd into the suction line, upstream the TEV sensing bulb
- B. Tee'd into the suction line, downstream the TEV sensing bulb
- C. Tee'd into a return bend on the evaporator
- D. It replaces the TEV sensing bulb at the evaporator outlet



Figure CC-T03-37



Figure CC-T03-38



Figure CC-T13-13

38. S6 The contactor of a part-winding-start motor chatters at start up. What is the likely cause if the motor and contactor coil are in the same electrical circuit?

- A. Decrease in line voltage, increase in motor current
- B. Decrease in line voltage, decrease in contactor coil current
- C. Increase in line voltage, increase in contactor coil current
- D. Increase in line voltage, decrease in motor current



Figure CC-T35-30

Chapter 2: 313A (Level 3) Section 7

1. S7 To pressure test an isolated semi-hermetic compressor after reassembly and installation in a system, pressure test with nitrogen to:

- A. Maximum operating pressure of low side components
- B. Maximum operating pressure of high side components
- C. 1800 PSIG
- D. 125 PSIG

2. S7 The compression ratio of a system is 7:1. What are the operating pressures?

- A. Suction is 25 PSIG and discharge is 175 PSIG
- B. Suction is 30 PSIG and discharge is 300 PSIG
- C. Suction is 45 PSIG and discharge is 450 PSIG
- D. Suction is 65 PSIG and discharge is 180 PSIG

3. S7 The valves have failed on a compressor. What is done?

- A. Replace head gasket and valve plate
- B. Replace valve plate gasket and head plate
- C. Replace valve plate gasket, head gasket and head plate
- D. Replace valve plate gasket, head gasket and valve plate

4. S7 The refrigerant leaves a well-functioning condenser in a commercial refrigeration system:

- A. As sub-cooled liquid
- B. With high enthalpy
- C. As superheated vapour
- D. As low temperature vapour

5. S7 What will a compound compressor system have between stages?

- A. A liquid injection device or an intercooler
- B. A vapour injection device
- C. A secondary condenser
- D. A secondary evaporator

6. S7 What is done to pressure test the entire system on a pump down system? Figure A3-T40-18

- A. Front seat the service valves
- B. Front seat the king valve
- C. Energize the liquid pump
- D. Energize the liquid line solenoid



Figure A3-T40-18

25. S7 The enthalpy control on a rooftop air conditioning unit's economizer is being calibrated. Which instruments are selected?

- A. Manometer, ammeter and psychrometer
- B. Manometer, Pitot tube and thermometer
- C. Multimeter, Pitot tube and thermometer
- D. Thermometer, psychrometer and multimeter





26. S7 What is the procedure for testing the oil failure control safety contacts? Figure A3-T43-01

- A. Remove jumper between terminals 2 & M
- B. Install jumper across pressure differential switch
- C. In 3 wire control install jumper between terminals 2 & M
- D. Install jumper across terminals L & M

23. S8 A pneumatic controller has a throttling range of 3-15 PSIG. What is the span?

- A. 3
- B. 9
- C. 12
- D. 18

24. S8 An R-507 system has a Suction Saturation Temperature (SST) of -10°F an evaporator superheat of 10°F and an additional suction line superheat of 15°F. Determine the total superheat at the compressor inlet.

- A. 10°F
- B. 15°F
- C. 25°F
- D. 35°F

25. S8 What is the tonnage of a chiller having a flow rate of 200 U.S. gallons per minute and an entering water temperature of 55°F and a leaving water temperature of 45°F?

- A. 83 tons
- B. 100 tons
- C. 120 tons
- D. 140 tons
- 26. S8 What is the tonnage of a chiller having a flow rate of 200 imperial gallons per minute and an entering water temperature of 55°F and a leaving water temperature of 45°F?
 - A. 83 tons
 - B. 100 tons
 - C. 120 tons
 - D. 140 tons
- 27. S8 How many cubic feet of propane will a 400,000 BTU per hour propane fired furnace require per hour?
 - A. 100
 - B. 120
 - C. 160
 - D. 300
- 28. S8 Referring to Figure A3-T66-06, two 45° elbows and an offset (Y) of 10 inches are used. What would be the length of pipe in "X"?
 - A. 12 inches
 - B. 14.14 inches
 - C. 16.97 inches
 - D. 17.52 inches



Figure A3-T66-06

29. S8 Referring to Figure A3-T66-06, if the length of each horizontal run of pipe is 40 inches and Y is 10 inches, what would be the length of Z?

- A. 90 inches
- B. 92 inches
- C. 94.14 inches
- D. 96.97 inches

30. S8 The walls of a building are 20 feet high and 200 long. The drywall has an R value of R0.5, the insulation is R10, the outside polystyrene board is R4 and the outside finish is R0.5. The indoor temperature is 72°F and the outdoor design temperature is -5°F. Calculate the

heat loss through the wall.

- A. 10,320 BTU per hour
- B. 12,320 BTU per hour
- C. 13,320 BTU per hour
- D. 20,533 BTU per hour

31. S8 The pneumatic 0 to 100°F temperature transmitter has an operating range of 3-15 PSIG. What is the mid-range point? Figure A3-T66-09

- A. 0 PSI and 100°F
- B. 9 PSI and 50°F
- C. 9 PSI and 100°F
- D. 15 PSI and 100°F



Figure A3-T66-09

32. S8 Refrigerant R-407C at a pressure of 96 PSIG, has a bubble point of 33°F and a dew point of 44°F and a vapour temperature of 54°F. How many degrees of superheat are there?

- A. 9
- B. 10
- C. 11
- D. 20

33. S8 The pressure at the inlet of a water pump is 30 PSIG and the pressure at the outlet is 120 PSIG. What is the feet-of-head across the pump? Figure A3-T66-11

- A. 90 feet
- B. 207.9 feet
- C. 143.3 feet
- D. 231 feet
- J. 251 leet





43. S8 On a R-134A system with a 20°F evaporator temperature differential, what is the Lowpressure control set at to maintain a box temperature of 36°F to 40°F?

- A. Cut-in is 33.1 PSIA and cut-out is 29.5 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
- 44. S8 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
- 45. S8 A Pitot tube connected to an inclined manometer gauge reads 0.2 in. water column. What is the air velocity?
 - A. 802 fpm
 - B. 1,791 fpm
 - C. 15,623 fpm
 - D. 20,050 fpm



Figure A3-T67-02

46. S8 A pump is generating 21.65 PSI pressure differential between its inlet and outlet. How many feet of head can this pump lift?

- A. 9.37 ft
- B. 21.65 ft
- C. 50.00 ft
- D. 93.70 ft
- 47. S8 A water chiller operates with a 4.4°C (40°F) evaporating temperature, return water temperature of 10°C (50°F) and a 7.2°C (45°F) supply water temperature. The water flow rate is measured at 682.5 L/min (150 imp. gal./min.). What is the cooling capacity?
 - A. 87,000 W / 300,000 BTU/h B. 109,875 W / 375,000 BTU/h C. 131,850 W / 450,000 BTU/h D. 153,825 W / 525,000 BTU/h



Figure A3-T67-04