



CLASS B – AIR CONDITIONING CONTRACTORS GENERAL TRADE KNOWLEDGE EXAMINATION CONTENT INFORMATION

Revised August 2017

The General Trade Knowledge portion of the examination will be administered in one. It will consist of 80 equally weighted questions.

The examination will have questions relating to the following content areas and necessary knowledge for each area includes:

- reading and interpreting plans and specifications
- reading and interpreting codes
- basic mathematics (addition, subtraction, multiplication, division, calculations of area and volume, fractions, decimals, percentages, calculating the sides of triangles, square roots, powers of numbers, and solving simple algebraic equations for unknown variables)

You should be prepared to respond to examination questions on any of the content areas listed. Questions asked and content areas tested on previous examinations should not be assumed to be the only possible questions to be asked or content areas to be tested on this examination.

The percentage of questions shown for each content area may vary by as much as plus or minus three (3) percent. Please refer to the Candidate Information Brochure and the Reference List for additional information.

Content Area A **12%** **Pre-Installation**

- 1. Reading and interpreting plans and specifications**
knowledge of symbols
knowledge of scales
- 2. Recommending changes to plans and specifications**
knowledge of equipment costing
knowledge of equipment efficiency
knowledge of design requirements

3. Recommending different types of equipment

knowledge of equipment costing
knowledge of effects on equipment efficiency
knowledge of heating and cooling loads
knowledge of seasonally adjusted and energy efficiency ratio
knowledge of air flow and duct design
knowledge of psychrometrics diagrams
knowledge of pump curves
knowledge of fan curves

4. Applying energy conservation principles

knowledge of effects on equipment efficiency
knowledge of Florida energy codes
knowledge of R and U factors
knowledge of seasonally adjusted energy efficiency ratio
knowledge of pump curves
knowledge of fan curves

5. Calculating thermal resistance

knowledge of R and U factors
knowledge of Florida energy codes

6. Discussing EER and SEER with owners and architects

knowledge of EER and SEER calculations
knowledge of Florida energy codes
knowledge of Florida Building Energy Rating System
knowledge of ARI listings
knowledge of cost analysis and cost effectiveness

7. Determining HVAC load (Heating, Ventilation, Air Conditioning)

knowledge of Florida energy codes
knowledge of heating and cooling load calculations
knowledge of R and U factors

8. Determining material and equipment live load requirements

knowledge of weights of materials
knowledge of structural capabilities
knowledge of rigging

9. Designing HVAC systems (Heating, Ventilation, Air Conditioning)

knowledge of equipment efficiency
knowledge of psychrometrics
knowledge of heating and cooling loads
knowledge of seasonally adjusted and energy efficiency ratio
knowledge of pressure and enthalpy relationship (diagrams)
knowledge of air flow and duct design
knowledge of pipe sizing
knowledge of wiring requirements, procedures and techniques
knowledge of types of controls and requirements
knowledge of refrigeration requirements

10. Designing duct systems

knowledge of air flow and duct design
knowledge of insulation requirements

11. Determining proper HVAC equipment (Heating, Ventilation, Air Conditioning)

knowledge of manufacturer's equipment
knowledge of proper sizing
knowledge of loads
knowledge of psychrometrics
knowledge of proper locations of equipment
knowledge of codes

12. Determining proper pipe sizes

knowledge of pipe sizing tables
knowledge of valves and fittings
knowledge of liquid flow
knowledge of resistance to flow and friction losses

13. Determining proper control requirements

knowledge of wiring requirements and procedures and techniques
knowledge of types of control and requirements
knowledge of air conditioning equipment
knowledge of refrigeration equipment

14. Determining proper fan motor requirements

knowledge of wiring requirements, procedures and techniques
knowledge of fans
knowledge of fan motors
knowledge of fan performance and CFM

15. Determining proper pipe insulation

knowledge of heating and cooling loads
knowledge of R and U factors
knowledge of insulating techniques and requirements

16. Determining proper compressor capacity

knowledge of heating and cooling loads
knowledge of refrigeration requirements

17. Designing grease handling duct systems

knowledge of air flow and duct design
knowledge of sizing
knowledge of fan and motor capabilities
knowledge of filter requirements
knowledge of fire and building codes

18. Unloading, lifting and lowering materials

knowledge of safety requirements
knowledge of loading and lifting equipment
knowledge of rigging techniques and requirements

19. Determining proper mechanical equipment

knowledge of fire codes
knowledge of safety requirements
knowledge of sprinkler and standpipe requirements
knowledge of design requirements

20. Determining proper pump requirements

knowledge of pump types, capacities, and requirements
knowledge of fluid flow

21. Determining proper boiler requirements

knowledge of boiler requirements
knowledge of pressure requirements
knowledge of steam properties
knowledge of fuel gas requirements
knowledge of fuel oil requirements

- 22. Layout and determining pipes, valves, fittings, and related components**
knowledge of pump types and requirements
knowledge of valve and fitting types and requirements
knowledge of tank sizing
knowledge of fluid flow
knowledge of pipe fitting
knowledge of metal pipe requirements
knowledge of plastic pipe requirements

- 23. Determining appropriate pipe sealants**
knowledge of welding
knowledge of pipe fitting
knowledge of metal pipe properties
knowledge of plastic pipe properties

- 24. Complying with piping plans and specifications**

Content Area B **9%**
Sheet Metal Ducts

- 1. Fabricating rectangular ducts under 2 ft**
knowledge of sheet metal ducts
knowledge of fiberglass ducts
knowledge of flex ducts
knowledge of duct fittings
knowledge of duct outlets and grilles
- 2. Fabricating rectangular ducts over 2 ft.**
knowledge of sheet metal ducts
knowledge of fiberglass ducts
knowledge of duct fittings
knowledge of duct outlets and grilles
- 3. Fabricating round ducts**
knowledge of sheet metal ducts
knowledge of duct fittings
knowledge of duct outlets and grilles
knowledge of flex ducts
knowledge of duct socks
- 4. Taping duct seams**
knowledge of sheet metal ducts
knowledge of fiberglass ducts
knowledge of flex ducts
knowledge of duct fittings
knowledge of duct outlets and grilles
knowledge of mastics and tapes

- 5. Fabricating standing seams for sheet metal ducts**
knowledge of duct fittings
knowledge of sheet metal ducts
- 6. Fabricating snap lock seams for sheet metal ducts**
knowledge of duct fittings
knowledge of sheet metal duct design requirements
- 7. Fabricating other locks and seams**
knowledge of sheet metal ducts
knowledge of fiberglass duct liners
- 8. Fabricating interior lined sheet metal ducts**
knowledge of duct fittings
knowledge of sheet metal duct design requirements
- 9. Fabricating fittings for rectangular ducts**
knowledge of duct fittings
knowledge of sheet metal ducts
- 10. Fabricating fittings for round ducts**
knowledge of duct fittings
knowledge of sheet metal layout
- 11. Fabricating kitchen hoods**
knowledge of codes
knowledge of sheet metal layout
- 12. Fabricating kitchen hood exhausts**
knowledge of codes
knowledge of sheet metal layout
- 13. Fabricating drain pans**
knowledge of codes
knowledge of sheet metal layout

Content Area C **22%**
Installation of Refrigeration and HVAC Systems

1. Installing split system air conditioners

knowledge of duct fittings
knowledge of sheet metal ducts
knowledge of air handlers
knowledge of refrigerant piping
knowledge of insulation requirements
knowledge of thermostats
knowledge of heat strips
knowledge of condensate piping
knowledge of condensate overflow protection

2. Installing package system air conditioners

knowledge of refrigeration cycles
knowledge of thermostats
knowledge of heat strips
knowledge of condensate piping
knowledge of condensate overflow protection

3. Installing split system heat pumps

knowledge of refrigeration cycles
knowledge of condensers
knowledge of air handlers
knowledge of refrigerant piping
knowledge of insulations
knowledge of thermostats
knowledge of heat strips
knowledge of condensate piping
knowledge of condensate overflow protection
knowledge of fire stats

4. Installing package heat pumps

knowledge of refrigeration cycles
knowledge of heat pump installation requirements
knowledge of thermostats
knowledge of heat strips
knowledge of condensate piping
knowledge of condensate overflow protection
knowledge of fire stats

5. Installing air-cooled systems

knowledge of air-cooled condensers
knowledge of air-cooled system installation requirements

6. Installing water cooled systems

knowledge of water-cooled condensers
knowledge of water-cooled system installation requirements

7. Installing secondary coolant systems

knowledge of secondary coolant condensers

8. Installing chilled water (or other temperature) systems

knowledge of chilled water loops
knowledge of water chillers and evaporators
knowledge of release vents
knowledge of air separators

9. Installing water towers

knowledge of evaporative cooling
knowledge of water tower principles, forced drag and induced drafts
knowledge of secondary coolant condensers

10. Installing systems under 25 tons

knowledge of installation techniques for system and associated components
knowledge of dead loads
knowledge of controls
knowledge of wiring procedures and techniques
knowledge of compressor capacities

11. Installing absorption cycle systems

knowledge of absorption cycles
knowledge of absorption cycle refrigerants
knowledge of refrigerant piping

12. Installing ultra low temperature systems

knowledge of multistage refrigeration
knowledge of cryogenics
knowledge of low temperature refrigerants
knowledge of refrigeration equipment
knowledge of refrigerant piping techniques

13. Installing low and medium temperature systems

knowledge of refrigeration equipment
knowledge of refrigerant piping techniques
knowledge of CFCs, HFCs, and blends
knowledge of refrigerant recovery and retrofit
knowledge of EPA regulations

14. Installing walk-in coolers

knowledge of refrigeration equipment
knowledge of evaporators
knowledge of expansion valves
knowledge of defrost equipment
knowledge of refrigerant piping
knowledge of controls

- 15. Installing reach-in coolers**
 - knowledge of refrigeration equipment
 - knowledge of evaporators
 - knowledge of expansion valves
 - knowledge of defrost equipment
 - knowledge of refrigerant piping
 - knowledge of controls
- 16. Installing ventilation systems (duct work)**
 - knowledge of air flow and duct designs
 - knowledge of fire codes
 - knowledge of scale dimensions
 - knowledge of sheet metal ducts
 - knowledge of fiberglass ducts
 - knowledge of flex ducts
 - knowledge of duct fittings
 - knowledge of duct outlets and grilles
 - knowledge of hanging requirements
- 17. Installing pneumatic control systems**
 - knowledge of control requirements
 - knowledge of pneumatic piping
 - knowledge of pneumatic controls
- 18. Installing ground water (geothermal) heat pumps**
 - knowledge of water cooled condensers
 - knowledge of refrigeration cycles
- 19. Installing smoke detectors**
 - knowledge of codes
 - knowledge of equipment
- 20. Installing exhaust (or make-up air) systems**
 - knowledge of fire codes
 - knowledge of air flow and duct designs
 - knowledge of sheet metal ducts
 - knowledge of fan and motor capacities
- 21. Installing grease handling duct systems**
 - knowledge of fire codes
 - knowledge of air flow and duct designs
 - knowledge of sheet metal ducts
 - knowledge of filter requirements
- 22. Installing ammonia refrigerant systems**
 - knowledge of absorption cycles
 - knowledge of ammonia as a refrigerant

- 23. Installing kitchen exhaust systems**
 - knowledge of air flow and duct designs
 - knowledge of fan and motor capacities
 - knowledge of sheet metal fabrications
 - knowledge of national and local fire and building codes
 - knowledge of welding
- 24. Testing and balancing systems**
 - knowledge of properties of air
 - knowledge of fans
 - knowledge of testing instruments
 - knowledge of duct systems
 - knowledge of register and grilles
 - knowledge of equations
- 25. Performing fire department required smoke tests**
 - knowledge of properties of air
 - knowledge of fans
 - knowledge of duct systems
 - knowledge of codes
- 26. Installing DDC control systems**
 - knowledge of control requirements
 - knowledge of DDC controls

Content Area D **14%**
Installation of Refrigeration and HVAC Equipment Components

- 1. Installing air-cooled condensers**
 - knowledge of wiring requirements, procedures and techniques
 - knowledge of air-cooled condenser characteristics
 - knowledge of metal pipes
 - knowledge of refrigerant piping
- 2. Installing water-cooled condensers**
 - knowledge of wiring requirements and procedures and techniques
 - knowledge of water tower characteristics
 - knowledge of water-cooled condensers characteristics
 - knowledge of secondary coolant condensers
 - knowledge of metal pipes
 - knowledge of plastic pipes
 - knowledge of pipe fittings
 - knowledge of refrigerant piping
 - knowledge of all refrigerants

3. Installing hermetic and semi-hermetic compressors

knowledge of wiring requirements, procedures and techniques
knowledge of compressor characteristics
knowledge of metal pipes
knowledge of refrigerant piping
knowledge of all refrigerants

4. Installing air handlers and evaporators

knowledge of wiring requirements, procedures and techniques
knowledge of metal pipes
knowledge of refrigerant piping
knowledge of all refrigerants
knowledge of control needs and requirements
knowledge of air handlers and characteristics

5. Installing fans and blowers

knowledge of wiring requirements, procedures and techniques
knowledge of air flow and duct designs
knowledge of fans
knowledge of fan motors
knowledge of air handlers
knowledge of condensers

6. Installing motors for fans and blowers

knowledge of wiring requirements, procedures and techniques
knowledge of air flow and duct designs
knowledge of fans
knowledge of fan motors
knowledge of air handlers

7. Installing sheet metal duct work

knowledge of sheet metal ducts
knowledge of duct fittings
knowledge of duct outlets and grilles

8. Installing fiberglass duct work

knowledge of fiberglass ducts
knowledge of duct fittings
knowledge of duct outlets and grilles
knowledge of duct hanging techniques and requirements

9. Installing other duct work (flexible)

knowledge of air flex duct installation and fastening techniques
knowledge of duct fittings
knowledge of duct outlets and grilles

10. Installing grilles, registers and volume dampers

knowledge of air flow and duct designs
knowledge of duct outlets and grilles

11. Installing fire dampers and metal chimneys

knowledge of fire codes
knowledge of fire dampers and metal chimney installations and fastenings

12. Installing refrigerant piping

knowledge of brazing
knowledge of refrigerant piping
knowledge of pipe fittings
knowledge of pipe hanging
knowledge of pipe sizing

13. Installing horizontally supported piping

knowledge of weights of materials
knowledge of structural capabilities
knowledge of hangers
knowledge of supports

14. Installing flues

knowledge of sheet metal duct installation techniques
knowledge of duct fittings
knowledge of gas codes

15. Installing air filters

knowledge of air filter installation techniques

16. Installing warm air appliances (heaters)

knowledge of heater installation techniques
knowledge of wiring procedures and techniques
knowledge of fire codes

17. Installing gas appliances

knowledge of fuel gases
knowledge of gas appliances
knowledge of installing controls
knowledge of wiring procedures and techniques
knowledge of gas codes

18. Installing fuel oil appliances

knowledge of fuel oils
knowledge of fuel appliance installation techniques
knowledge of types of controls and requirements
knowledge of wiring requirements, procedures and techniques

19. Installing heat exchangers

knowledge of heat transfer
knowledge of installing controls
knowledge of wiring requirements, procedures and techniques

20. Installing receivers

knowledge of receivers
knowledge of refrigerant piping
knowledge of local codes

21. Installing heat strips

knowledge of wiring requirements, procedures and techniques
knowledge of heat strips
knowledge of fire stats
knowledge of fire codes

22. Installing copper tubing and fittings

knowledge of copper tubing
knowledge of refrigerant piping
knowledge of brazing
knowledge of pressure testing

23. Installing other tubing or fittings

knowledge of metal pipes
knowledge of welding
knowledge of brazing
knowledge of pressure testing

24. Welding and brazing copper tubing

knowledge of welding
knowledge of copper tubing

25. Silver brazing copper to steel joints

knowledge of welding
knowledge of copper tubing
knowledge of metal pipes

26. Flaring copper tubing

knowledge of copper tubing
knowledge of flaring tools

27. Soft soldering copper tubing

knowledge of brazing
knowledge of copper tubing

28. Soldering swaged joints

knowledge of brazing
knowledge of copper tubing
knowledge of metal pipe
knowledge of swaging tools

29. Welding metal with filler rods

knowledge of metal pipes
knowledge of welding

30. Installing steel pipes

knowledge of piping and steel pipes
knowledge of pipe fittings
knowledge of hangers
knowledge of welding

31. Threading pipes

knowledge of pipe fittings
knowledge of metal pipes

32. Cutting mild steel with oxy-acetylene torches

knowledge of oxy-acetylene torches
knowledge of metal pipe characteristics

33. Installing refrigerant tubing under 2 inches

knowledge of brazing
knowledge of copper tubing
knowledge of flaring tools
knowledge of swaging tools
knowledge of copper fittings
knowledge of oxy-acetylene torches

34. Installing refrigerant tubing 2 inches or over

knowledge of brazing
knowledge of copper tubing
knowledge of flaring tools
knowledge of swaging tools
knowledge of copper fittings
knowledge of oxy-acetylene torches

35. Installing refrigerant metering devices

knowledge of expansion valves
knowledge of capillary tubes
knowledge of brazing
knowledge of copper tubing

36. Installing heat pump reversing valves

knowledge of reversing valves
knowledge of copper tubing
knowledge of low-voltage wiring

37. Installing thermostatic expansion valves

knowledge of expansion valves
knowledge of copper tubing

38. Installing capillary tube metering devices

knowledge of capillary tubes
knowledge of copper tubing

39. Installing liquid line dryers and filters

knowledge of dryer and filters
knowledge of copper tubing
knowledge of vacuum systems
knowledge of refrigerant recovery

40. Installing suction line dryers and filters

knowledge of dryers and filters
knowledge of copper tubing
knowledge of vacuum systems
knowledge of refrigerant recovery

41. Installing heat pump line dryers and filters

knowledge of dryers and filters
knowledge of copper tubing
knowledge of vacuum systems
knowledge of refrigerant recovery

42. Installing oil traps

knowledge of oil traps
knowledge of copper tubing

43. Installing bellows-type temperature controls

knowledge of control requirements
knowledge of temperature requirements
knowledge of copper tubing
knowledge of bellows-type temperature controls

44. Installing chilled water low temperature controls

knowledge of low temperature controls
knowledge of control requirements
knowledge of temperature requirements
knowledge of low-voltage wiring

45. Installing dual, high or low-pressure control switches

knowledge of high and low pressure control characteristics
knowledge of brazing
knowledge of copper tubing
knowledge of pressure requirements
knowledge of low-voltage wiring
knowledge of control installation techniques

46. Installing temperature controls

knowledge of temperature requirements
knowledge of pressure requirements
knowledge of control requirements
knowledge of low-voltage wiring

47. Installing oil-pressure safety control switches

knowledge of pressure requirements
knowledge of safety requirements
knowledge of pipe fittings
knowledge of control characteristics
knowledge of low-voltage wiring

48. Installing summer-winter switch-over controls

knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of control requirements

49. Installing thermostats

knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of control characteristics

50. Installing water regulating valves

knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of control requirements
knowledge of pressure requirements
knowledge of bellows type temperature controls
knowledge of water valves

51. Installing pressure regulators and strainers

knowledge of design pressure requirements
knowledge of control characteristics
knowledge of hot gas bypasses

52. Installing humidity and thermostatic controls

knowledge of control characteristics
knowledge of calibrating controls
knowledge of low-voltage wiring
knowledge of manufacturer's recommendations

53. Installing pneumatic controls

knowledge of pneumatic piping
knowledge of pneumatic controls
knowledge of air compressors
knowledge of control requirements

54. Installing solid-state controls

knowledge of manufacturer's recommendations
knowledge of codes

55. Soldering electrical connections

knowledge of brazing
knowledge of electrical wiring procedures and techniques

56. Installing transformers

knowledge of electrical wiring procedures and techniques
ability to read wiring diagrams

57. Installing capacitors

knowledge of electrical wiring procedures and techniques

58. Installing contactors

knowledge of electrical wiring procedures and techniques

59. Installing current relays

knowledge of electrical wiring procedures and techniques

60. Installing safety disconnects

knowledge of electrical wiring procedures and techniques

61. Installing defrost timers

knowledge of electrical wiring procedures and techniques
knowledge of control requirements
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance

62. Installing defrost heaters

knowledge of electrical wiring procedures
knowledge of control requirements
knowledge of defrost operation

63. Installing defrost thermostats

knowledge of electrical wiring procedures and techniques
knowledge of control requirements
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical-relationship between current voltage and resistance

64. Installing air-pressure switches

knowledge of pneumatic piping
knowledge of pneumatic controls
knowledge of air compressors
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical-relationship between current voltage and resistance

65. Installing electric humidistats

knowledge of electrical wiring procedures and techniques
knowledge of humidity control requirements
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance

66. Installing electronic air cleaners

knowledge of electrical wiring procedures and techniques
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance
knowledge of manufacturer's recommendations

67. Wiring three-phase equipment

knowledge of electrical wiring procedures and techniques
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance

68. Wiring single-phase equipment

knowledge of electrical wiring procedures and techniques
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance

69. Installing three-phase equipment

knowledge of electrical wiring procedures and techniques
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance

70. Installing single-phase equipment

knowledge of electrical wiring procedures and techniques

71. Installing capacitor start motors

knowledge of electrical wiring procedures and techniques
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance
knowledge of fan motors
knowledge of compressor requirements

72. Installing shaded-pole motors

knowledge of electrical wiring procedures and techniques
knowledge of fan motors
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance

73. Installing split-phase motors

knowledge of electrical wiring procedures and techniques
knowledge of fan motors
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance

74. Installing fan blades

knowledge of fans
knowledge of wiring diagrams
knowledge of placement of electrical wires
knowledge of electrical relationship between current voltage and resistance

75. Installing fan control switches

knowledge of electrical wiring procedures and techniques
knowledge of fan motors
knowledge of control requirements
knowledge of low-voltage wiring

76. Installing hermetic compressor overload protectors

knowledge of electrical wiring procedures and techniques
knowledge of safety requirements

77. Installing fan belts

knowledge of fans
knowledge of motor amperage requirements

78. Installing drive pulleys

knowledge of fans
knowledge of pulley ratios
knowledge of motor amperage requirements

79. Installing limit control switches

knowledge of control characteristics
knowledge of safety requirements

80. Installing solenoid coils

knowledge of electrical wiring procedures and techniques
knowledge of low-voltage wiring

81. Installing magnetic starters

knowledge of electrical wiring procedures and techniques

82. Installing starting relays

knowledge of electrical wiring procedures and techniques

83. Installing duty-motor protection devices

knowledge of electrical wiring procedures and techniques

84. Installing motor controllers
knowledge of motor controllers
knowledge of proper motor and overcurrent protection
knowledge of circuit breakers and fuses
knowledge of electrical wiring procedures
knowledge of controls

85. Installing plastic pipes and fittings
knowledge of plastic pipes and fittings
knowledge of different grades of pipe
knowledge of pressure testing
knowledge of safety codes
knowledge of joining materials
knowledge of cleaning and gluing materials

86. Installing of surge protectors
knowledge installation techniques
knowledge of SP sizing

87. Installing of phase monitors
knowledge of PM installation
knowledge of PM sizing

88. Installing of geothermal systems
knowledge of sizing of geothermal loops
knowledge of loop types

Content Area E **10%**
Maintenance Analysis of Refrigeration and HVAC Systems

- 1. Reading pressure and enthalpy diagrams for various refrigerants**
knowledge of pressure and enthalpy relationships
knowledge of reading pressures
knowledge of gauges
knowledge of refrigeration testing equipment
- 2. Reading and analyzing electrical circuits**
knowledge of electrical wiring procedures and techniques
knowledge of low-voltage wiring
knowledge of electrical testing equipment
- 3. Testing current relays**
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

4. Testing capacitors
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

5. Testing defrost thermostats
knowledge of controls
knowledge of manufacturer's recommendations

6. Testing high-voltage transformers
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

7. Testing high-voltage relays
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

8. Testing low-voltage relays
knowledge of low-voltage electrical wiring procedures and techniques
knowledge of electrical testing equipment
ability to utilize a amprobe
ability to utilize a ohmmeter

9. Testing magnetic starters
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

10. Testing potential relays
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

11. Testing appropriate motor terminals
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

12. Determining operating pressures of refrigeration or air conditioning systems
knowledge of design pressure requirements
knowledge of refrigerant pressure gauges
knowledge of pressure and temperature relationships

13. Determining air volumes
knowledge of air flow and duct designs
ability to utilize a velometer
ability to utilize a pitot tube

ability to utilize a manometer
ability to utilize a volume flow meter (flow hood)

14. Determining changes in enthalpy

knowledge of refrigeration testing equipment
knowledge of psychrometrics
ability to utilize a thermometer
ability to utilize a psychrometer

15. Determining wet bulb and dry bulb temperatures

knowledge of refrigeration testing equipment
knowledge of psychrometrics
ability to utilize a thermometer
ability to utilize a psychrometer

16. Determining current draw (amperage)

knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment
ability to utilize an amprobe
ability to utilize a volt-ohm meter

17. Determining voltages

knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment
ability to utilize an amprobe
ability to utilize a volt-ohm meter

18. Determining power consumption

knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

19. Determining working pressure in pipes

knowledge of pressure testing gauges
knowledge of access valves

20. Testing non-pressure type storage tanks

knowledge of tanks and pollution controls

21. Using chlorine and halogen leak detecting devices

knowledge of refrigeration testing equipment
knowledge of how and when to use devices

Content Area F **14%**
Maintenance Service of Refrigeration and HVAC Systems

1. Using nitrogen regulators

knowledge of pressure regulators

2. Using other gas regulators

knowledge of pressure regulators

3. Repairing semi-hermetic compressors

knowledge of electrical wiring procedures and techniques
knowledge of mechanical methods and procedures

4. Repairing hermetic compressors

knowledge of electrical wiring procedure and techniques
knowledge of mechanical methods and procedures

5. Repairing blowers

knowledge of electrical wiring procedures and techniques
knowledge of fans
knowledge of fan motors

6. Calibrating air sensitive thermostats

knowledge of electrical wiring procedures and techniques
knowledge of fans
knowledge of fan motors

7. Calibrating chilled-water low temperature controls

knowledge of low temperature controls
knowledge of control requirements
knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of refrigeration testing equipment

8. Calibrating dual or low pressure control switches

knowledge of high and low pressure controls
knowledge of brazing
knowledge of copper tubing
knowledge of refrigeration testing equipment

- 9. Calibrating pneumatic controls**
 - knowledge of pneumatic piping
 - knowledge of pneumatic controls
 - knowledge of air compressors
- 10. Calibrating proportional thermostats**
 - knowledge of low-voltage wiring
 - knowledge of temperature requirements
 - knowledge of control requirements
 - knowledge of refrigeration testing equipment
- 11. Calibrating summer-winter switch-over controls**
 - knowledge of low-voltage wiring
 - knowledge of temperature requirements
 - knowledge of control requirements
 - knowledge of refrigeration testing equipment
- 12. Adjusting thermostatic temperature controls**
 - knowledge of low-voltage wiring
 - knowledge of temperature requirements
 - knowledge of control requirements
 - knowledge of refrigeration testing equipment
- 13. Adjusting thermostatic motor controls**
 - knowledge of low-voltage wiring
 - knowledge of temperature requirements
 - knowledge of control requirements
 - knowledge of refrigeration testing equipment
 - knowledge of electrical wiring procedures and techniques
- 14. Adjusting superheat setting on expansion valves**
 - knowledge of expansion valves
 - knowledge of control requirements
 - knowledge of refrigeration testing equipment
 - knowledge of superheat
- 15. Adjusting oil-pressure safety controls**
 - knowledge of pressure
 - knowledge of gauges
 - knowledge of pipe fittings
 - knowledge of control requirements
 - knowledge of low-voltage wiring
 - knowledge of refrigeration testing equipment

- 16. Adjusting temperature controls**
 - knowledge of temperature requirements
 - knowledge of pressure requirements
 - knowledge of control requirements
 - knowledge of low-voltage wiring
 - knowledge of refrigeration testing equipment
- 17. Adjusting high pressure safety cutouts**
 - knowledge of high and low temperature controls
 - knowledge of electrical wiring procedures and techniques
 - knowledge of low-voltage wiring
 - knowledge of control operating requirements
 - knowledge of refrigeration testing equipment
 - knowledge of pressure gauges
- 18. Adjusting freezer controls**
 - knowledge of control operating requirements
 - knowledge of low-voltage wiring
 - knowledge of temperature measurements
- 19. Adjusting defrost time clocks**
 - knowledge of control requirements
 - knowledge of low-voltage wiring
 - knowledge of electrical wiring procedures and techniques
 - knowledge of temperature measurement
- 20. Adjusting bellows-type temperature controls**
 - knowledge of control requirements
 - knowledge of temperature requirements
 - knowledge of bellows-type temperature controls operating requirements
- 21. Operating oil safety control solid state pressure censoring devices**
 - knowledge of pressure requirements
 - knowledge of safety requirements
 - knowledge of control operating requirements
 - knowledge of low-voltage wiring
 - knowledge of refrigeration testing equipment
- 22. Aligning drive pulleys**
 - knowledge of mechanical alignments
- 23. Adjusting tension of v-belts**
 - knowledge of how and when to adjust

24. Calibrating electric actuating valves
knowledge of mechanical operation requirements
knowledge of refrigeration testing equipment

25. Calibrating electric humidistats
knowledge of humidity control requirements
knowledge of control requirements
knowledge of low-voltage wiring
knowledge of refrigeration testing equipment

26. Reversing the rotation of three-phase or single-phase motors
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

27. Starting seized hermetic compressor motors
knowledge of electrical wiring procedures and techniques
knowledge of electrical testing equipment

28. Adjusting crankcase pressure regulating valves
knowledge of pressure regulators
knowledge of pressure measurement
knowledge of evaporators
knowledge of compressors

29. Adjusting evaporator pressure regulating valves
knowledge of pressure regulators
knowledge of pressure measurement
knowledge of evaporators
knowledge of superheat

30. Adjusting unloaders
knowledge of pressure measurement (gauges)
knowledge of effect of pressure on compressor capacities

31. Cleaning cooling towers
knowledge of cleaning chemicals
knowledge of scale properties
knowledge of water deposit controls
knowledge of bleed-off

32. Cleaning foreign matter from systems
knowledge of cleaning chemicals
knowledge of solvents

33. Cleaning water-cooled condensers
knowledge of cleaning chemicals
knowledge of water-cooled condensers
knowledge of organic water problems

34. Cleaning condensate drain lines
knowledge of safety switches
knowledge of cleaning and adjusting techniques
knowledge of repairing condensate drains
knowledge of condensate pipe installation and traps

Content Area G **10%**
Safety and Equipment

- 1. Wearing hearing and head protection**
knowledge of safety requirements
- 2. Installing warning signs and barricades**
knowledge of safety requirements
knowledge of lock-out/tag-out
- 3. Wearing eye and face protection**
knowledge of safety requirements
- 4. Using respiratory protection**
knowledge of safety requirements
- 5. Digging with backhoes, trenchers or tractors**
knowledge of safety requirements
- 6. Using overhead hoists and cranes**
knowledge of safety requirements
knowledge of weights
knowledge of riggings
- 7. Using ventilation devices**
knowledge of safety requirements
knowledge of toxic materials
- 8. Using mobile equipment (e.g., forklifts, hi-lifts and cranes)**
knowledge of safety requirements
- 9. Using ladders, scaffolds and rolling platforms**
knowledge of safety requirements
knowledge of assembly

**10. Using various hand and power tools
(e.g., power shears, wrenches and snips)**

knowledge of safety requirements
knowledge of proper operation procedures

11. Using air compressors

knowledge of safe operating pressures
knowledge of safety requirements

**Content Area H
Energy Management 5%**

1. Conduct energy testing

knowledge of duct pressure testing
knowledge of blower door tests
knowledge of the effects of the building envelope on the operations of the HVAC

2. Promote energy efficiency equipment

knowledge of energy efficient equipment
knowledge of programmable and Wi-Fi enabled thermostats
knowledge of zoning system
knowledge of energy recovery ventilators (ERVs)
knowledge of cost analysis and cost effectiveness
knowledge of green buildings and renewable energy

3. Complete energy forms

knowledge of energy form software
knowledge of building material efficiencies (R and U factors)
knowledge of how to calculate thermal resistance

4. Perform load calculations

knowledge of building materials (R and U Factors)
knowledge of window efficiencies (heat gain)
knowledge of impact of outside air change requirements
knowledge of Florida energy codes
knowledge of heating and cooling load calculations
knowledge of how to calculate thermal resistances

**Content Area I
Indoor Air Quality 4%**

1. Manage indoor air quality

knowledge of UV bulbs
knowledge of filter types
knowledge of humidity control systems
knowledge of air cleaners
knowledge of air flows (test and balances)
knowledge of effects of poor air quality on humans