AIR A CONTRACTORS
GENERAL TRADE KNOWLEDGE
EXAMINATION CONTENT INFORMATION

Revised for August 2017

The Air A General Trade Knowledge Examination is composed of 130 questions. It will be administered in one session via computer in the calm atmosphere of one of our convenient testing centers at a time of your choosing.
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 — 14%
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 23%
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 systems between 25 - 100 tons**
    knowledge of installation techniques for system and associated components
    knowledge of dead loads
    knowledge of wiring procedures and techniques
    knowledge of compressor capacities

12. **Installing systems over 100 tons**
    knowledge of installation techniques for systems and associated components
    knowledge of dead loads
    knowledge of wiring procedures and techniques
    knowledge of compressor capacities

13. **Installing centrifugal compressor systems**
    knowledge of centrifugal compressors
    knowledge of chilled water systems
    knowledge of chilled water loops
    knowledge of water chillers and evaporators
    knowledge of pipe fittings
    knowledge of motor starters
    knowledge of gauges
    knowledge of valves and fittings

14. **Installing absorption cycle systems**
    knowledge of absorption cycles
    knowledge of absorption cycle refrigerants
    knowledge of refrigerant piping

15. 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

16. 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

17. 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

18. 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

19. 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

20. Installing pneumatic control systems
knowledge of control requirements
knowledge of pneumatic piping
knowledge of pneumatic controls

21. Installing ground water (geothermal) heat pumps
knowledge of water cooled condensers
knowledge of refrigeration cycles

22. Installing smoke detectors
knowledge of codes
knowledge of equipment

23. 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

24. 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

25. Installing ammonia refrigerant systems
knowledge of absorption cycles
knowledge of ammonia as a refrigerant

26. 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

27. 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

28. Performing fire department required smoke tests
knowledge of properties of air
knowledge of fans
knowledge of duct systems
knowledge of codes

29. 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 centrifugal compressors**
   knowledge of wiring requirements, procedures and techniques
   knowledge of centrifugal compressor characteristics
   knowledge of types of refrigerants
   knowledge of power requirements
   knowledge of design operating pressures
   knowledge of motor efficiency ratings
   knowledge of metal pipe fittings
   knowledge of refrigerant piping

5. **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

6. **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

7. **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

8. **Installing sheet metal duct work**
   knowledge of sheet metal ducts
   knowledge of duct fittings
   knowledge of duct outlets and grilles

9. **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

10. **Installing other duct work (flexible)**
    knowledge of air flex duct installation and fastening techniques
    knowledge of duct fittings
    knowledge of duct outlets and grilles

11. **Installing grilles, registers and volume dampers**
    knowledge of air flow and duct designs
    knowledge of duct outlets and grilles

12. **Installing fire dampers and metal chimneys**
    knowledge of fire codes
    knowledge of fire dampers and metal chimney installations and fastenings

13. **Installing refrigerant piping**
    knowledge of brazing
    knowledge of refrigerant piping
    knowledge of pipe fittings
    knowledge of pipe hanging
    knowledge of pipe sizing

14. Installing horizontally supported piping
knowledge of weights of materials
knowledge of structural capabilities
knowledge of hangers
knowledge of supports

15. Installing flues
knowledge of sheet metal duct installation techniques
knowledge of duct fittings
knowledge of gas codes

16. Installing air filters
knowledge of air filter installation techniques

17. Installing warm air appliances (heaters)
knowledge of heater installation techniques
knowledge of wiring procedures and techniques
knowledge of fire codes

18. 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

19. 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

20. Installing heat exchangers
knowledge of heat transfer
knowledge of installing controls
knowledge of wiring requirements, procedures and techniques

21. Installing receivers
knowledge of receivers
knowledge of refrigerant piping
knowledge of local codes

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

23. Installing copper tubing and fittings
knowledge of copper tubing
knowledge of refrigerant piping
knowledge of brazing
knowledge of pressure testing

24. Installing other tubing or fittings
knowledge of metal pipes
knowledge of welding
knowledge of brazing
knowledge of pressure testing

25. Welding and brazing copper tubing
knowledge of welding
knowledge of copper tubing

26. Silver brazing copper to steel joints
knowledge of welding
knowledge of copper tubing
knowledge of metal pipes

27. Flaring copper tubing
knowledge of copper tubing
knowledge of flaring tools

28. Soft soldering copper tubing
knowledge of brazing
knowledge of copper tubing

29. Soldering swaged joints
knowledge of brazing
knowledge of copper tubing
knowledge of metal pipe
knowledge of swaging tools

30. Welding metal with filler rods
knowledge of metal pipes
knowledge of welding

31. Installing steel pipes
knowledge of piping and steel pipes
knowledge of pipe fittings
knowledge of hangers
knowledge of welding

32. Threading pipes
knowledge of pipe fittings
knowledge of metal pipes

33. Cutting mild steel with oxy-acetylene torches
knowledge of oxy-acetylene torches
knowledge of metal pipe characteristics

34. 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

35. 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

36. Installing refrigerant metering devices
knowledge of expansion valves
knowledge of capillary tubes
knowledge of brazing
knowledge of copper tubing

37. Installing heat pump reversing valves
knowledge of reversing valves
knowledge of copper tubing
knowledge of low-voltage wiring

38. Installing thermostatic expansion valves
knowledge of expansion valves
knowledge of copper tubing

39. Installing capillary tube metering devices
knowledge of capillary tubes
knowledge of copper tubing

40. Installing liquid line dryers and filters
knowledge of dryer and filters
knowledge of copper tubing
knowledge of vacuum systems
knowledge of refrigerant recovery

41. Installing suction line dryers and filters
knowledge of dryers and filters
knowledge of copper tubing
knowledge of vacuum systems
knowledge of refrigerant recovery

42. Installing heat pump line dryers and filters
knowledge of dryers and filters
knowledge of copper tubing
knowledge of vacuum systems
knowledge of refrigerant recovery

43. Installing oil traps
knowledge of oil traps
knowledge of copper tubing

44. Installing bellows-type temperature controls
knowledge of control requirements
knowledge of temperature requirements
knowledge of copper tubing
knowledge of bellows-type temperature controls

45. Installing chilled water low temperature controls
knowledge of low temperature controls
knowledge of control requirements
knowledge of temperature requirements
knowledge of low-voltage wiring

46. 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

47. Installing temperature controls
knowledge of temperature requirements
knowledge of pressure requirements
knowledge of control requirements
knowledge of low-voltage wiring

48. 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

49. Installing summer-winter switch-over controls
knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of control requirements

50. Installing thermostats
knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of control characteristics

51. 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

52. Installing pressure regulators and strainers
knowledge of design pressure requirements
knowledge of control characteristics
knowledge of hot gas bypasses

53. Installing humidity and thermostatic controls
knowledge of control characteristics
knowledge of calibrating controls
knowledge of low-voltage wiring
knowledge of manufacturer's recommendations

54. Installing pneumatic controls
knowledge of pneumatic piping
knowledge of pneumatic controls
knowledge of air compressors
knowledge of control requirements

55. Installing solid-state controls
knowledge of manufacturer's recommendations
knowledge of codes

56. Soldering electrical connections
knowledge of brazing
knowledge of electrical wiring procedures and techniques

57. Installing transformers
knowledge of electrical wiring procedures and techniques
ability to read wiring diagrams

58. Installing capacitors
knowledge of electrical wiring procedures and techniques

59. Installing contactors
knowledge of electrical wiring procedures and techniques

60. Installing current relays
knowledge of electrical wiring procedures and techniques

61. Installing safety disconnects
knowledge of electrical wiring procedures and techniques

62. 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

63. Installing defrost heaters
knowledge of electrical wiring procedures
knowledge of control requirements
knowledge of defrost operation

64. 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

65. 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

66. 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

67. 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

68. 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

69. 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

70. 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

71. Installing single-phase equipment
knowledge of electrical wiring procedures and techniques

72. 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

73. 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

74. 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

75. 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

76. Installing fan control switches
knowledge of electrical wiring procedures and techniques
knowledge of fan motors
knowledge of control requirements
knowledge of low-voltage wiring

77. Installing hermetic compressor overload protectors
knowledge of electrical wiring procedures and techniques
knowledge of safety requirements

78. Installing fan belts
knowledge of fans
knowledge of motor amperage requirements

79. Installing drive pulleys
knowledge of fans
knowledge of pulley ratios
knowledge of motor amperage requirements

80. Installing limit control switches
knowledge of control characteristics
knowledge of safety requirements

81. Installing solenoid coils
knowledge of electrical wiring procedures and techniques
knowledge of low-voltage wiring

82. Installing magnetic starters
knowledge of electrical wiring procedures and techniques

83. Installing starting relays
knowledge of electrical wiring procedures and techniques

84. Installing duty-motor protection devices
knowledge of electrical wiring procedures and techniques

85. 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

86. 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

87. Installing of surge protectors
knowledge installation techniques
knowledge of SP Sizing

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

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

Content Area E 9%

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 testing equipment (velometer, amprobe, volt-ohm meter, vacuum gauges, etc.)**
    knowledge of electrical testing equipment
    knowledge of refrigeration testing equipment
    knowledge of how and when to use equipment

22. **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 centrifugal compressors**
   knowledge of electrical wiring procedure and techniques
   knowledge of mechanical methods and procedures

6. **Repairing blowers**
   knowledge of electrical wiring procedures and techniques
   knowledge of fans
   knowledge of fan motors

7. **Calibrating air sensitive thermostats**
   knowledge of electrical wiring procedures and techniques
   knowledge of fans
   knowledge of fan motors

8. 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

9. 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

10. Calibrating pneumatic controls
knowledge of pneumatic piping
knowledge of pneumatic controls
knowledge of air compressors

11. Calibrating proportional thermostats
knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of control requirements
knowledge of refrigeration testing equipment

12. Calibrating summer-winter switch-over controls
knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of control requirements
knowledge of refrigeration testing equipment

13. Adjusting thermostatic temperature controls
knowledge of low-voltage wiring
knowledge of temperature requirements
knowledge of control requirements
knowledge of refrigeration testing equipment

14. 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

15. Adjusting superheat setting on expansion valves
knowledge of expansion valves
knowledge of control requirements
knowledge of refrigeration testing equipment
knowledge of superheat

16. 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

17. 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

18. 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

19. Adjusting freezer controls
knowledge of control operating requirements
knowledge of low-voltage wiring
knowledge of temperature measurements

20. Adjusting defrost time clocks
knowledge of control requirements
knowledge of low-voltage wiring
knowledge of electrical wiring procedures and techniques
knowledge of temperature measurement

21. Adjusting bellows-type temperature controls
knowledge of control requirements
knowledge of temperature requirements
knowledge of bellows-type temperature controls operating requirements

22. Operating oil safety control solid state pressure sensing devices
knowledge of pressure requirements
knowledge of safety requirements
knowledge of control operating requirements
knowledge of low-voltage wiring
knowledge of refrigeration testing equipment

23. Aligning drive pulleys
knowledge of mechanical alignments

24. Adjusting tension of v-belts
knowledge of how and when to adjust

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

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

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

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

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

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

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

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

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

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

35. 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 9%
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 5%
Energy Management

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. Preform 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 3%

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