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
### Content Area B  
#### 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

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

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

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**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 condenser 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 an amprobe
   - ability to utilize an 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
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

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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

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
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

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