Here is the information you need to know for **NATE Heat Pump**:

1. R-22 vapor line diameters and lengths are typically specified for a vapor pressure drop that does not exceed 6 – 7 psi or 6°F

2. The primary purpose of using flux when soldering copper or brass parts is to prevent oxidation

3. The water that results from a defrost cycle of an air to air heat pump (runoff) must drain off and away from the outdoor coil to prevent excessive ice can build up on the bottom of the coil and reduce capacity

4. The component used to reduce sound transmission and prevent water leaks of a packaged heat pump installed on a roof is the curb gasket.

5. On some installations, a heat pump indoor coil can be installed on an existing, operable, fossil fuel furnace. When this type of installation is done you need to add a control so that the furnace and heat pump do not operate at the same time in normal heating

6. When under a deep vacuum, a hermetic refrigeration compressor's motor windings could be damaged if energized

7. In order for an evacuation to be considered complete, a heat pump refrigerant circuit should be evacuated to a vacuum pressure of 500 microns or below

8. A system is supplied from the factory with charge for a 15 foot line set. The data plate shows the required system charge to be 5 pounds 10 ounces. The line set uses a 3/8 inch liquid line and is 25 feet long. The manufacturer's instruction sheet specifies 0.6 ounces of refrigerant to be added for each added foot of refrigerant line length so the total refrigerant charge for the system would be 6 pounds

9. Drive slips are typically installed on the shorter sides of rectangular duct

10. To properly set a heat anticipator it is necessary to check the heating control circuit amperage draw

11. A heat pump operating in normal ice free conditions maintains a certain temperature difference between the outdoor coil temperature and the surrounding outdoor ambient. This temperature difference is referred to as coil TD

12. The smallest refrigerant leak that an electronic leak detector should be capable of sensing is 0.05 oz. per year

13. When checking the pressures in an operating system with a manifold gauge set, refrigerant oil in a hose will have no effect on the gauge reading

14. At sea level, a gauge pressure of 35 psig is equal to an absolute pressure of 49.7 psia

15. A technician measures the return air temperature of a 100,000 Btu output furnace to be 65°F and the supply side air temperature is 135°F. The CFM would be 1323

16. A residential supply diffuser that is noisy because of a loose vane is best serviced by replacing the diffuser

17. When performing preventive maintenance on a heat pump the technician should check the outdoor fan to be certain that the fan runs freely with no binding

18. What is the effect of 170 volts supplied to a 208/230 volt compressor would cause a current increase and the motor may trip on overload

19. On a service call for a cooling problem with a heat pump, your inspections find a liquid line that has condensation on it. The most likely cause would be the liquid line is restricted

20. A reason for cool air complaints when a heat pump is operating in the heating cycle is excessive supply air velocities

21. The following measurements are recorded on an operating heat pump system. The heat pump is operating with the compressor only with no auxiliary heat

• Heat pump only supply air temperature 92°F

• Heat pump only return air temperature 70°F

• Outdoor temperature 54°F

• Supply air temp. /auxiliary heat ON 115°F

• Return air temp. /auxiliary heat ON 70°F

• CFM 1228

The heating capacity of the unit in Btu/h would be 29,177 Btu/h

22. A dirty or clogged air filter in an operating heat pump system can cause by inadequate heating

23. To minimize noise problems in residential duct systems, what is the range (recommended to maximum) of design air velocity in the rectangular main supply trunk is 700 to 900 fpm

24. Proper ductwork connections and sealing is critical to good system performance.

Conditions are:

• Return side air leak of 15% in a ventilated attic

• 2½ ton system rated at 1,000 CFM.

• Attic Air 95°F

The loss in delivered capacity is equal to ratio of air leakage to total air.

25. A technician has the following conditions while checking a packaged heat pump in cooling.

• The unit has a piston type metering device on both the indoor and outdoor coils.

• Outdoor temperature 75°F

• Superheat 55°F

The diagnosis and corrective action is that the unit is low on charge and a charge needs to be added

26. The effect of adding a charge to sub cooling is it increases it

27. When a capillary tube is overcharged you would get a low superheat and high sub cooling

28. The effect of a low charge on the switchover operations of a reversing valve is the reversing valves are less likely to transfer if charge is low

29. A technician is working on a heat pump with a capacitor start-capacitor run compressor. On initial startup, the compressor hums momentarily and the shuts down on internal overload, the problem is too great a pressure difference on the compressor

30. A step down transformer has a rating of 40 VA. Its primary voltage is 120V with a secondary voltage of 24V. This transformer must not be connected to a load above a maximum current draw of 1.7 amps

31. A bright red or orange glow from the resistance element in a duct heater indicates that the flow of air is insufficient

32. The outdoor fan on a heat pump stops during defrost to minimize defrost time

33. A capacitor start-capacitor run (CSCR) motor has an open run capacitor so it may start, but it draws a higher than normal running current

34. Bent vanes on a direct drive blower wheel in an air handler can cause loss in airflow, excessive motor wear, and increased noise

35. A split system heat pump is using thermostatic expansion valves. The system performs properly in heating but in cooling the compressor pumps down which could mean the power element of the indoor expansion valve has lost its charge

36. Conditions that can cause a reduction from design capacity in a heat pump are an undersized vapor line

37. Flash gas in the liquid line of any heat pump must be avoided. Liquid line flash gas can be caused by excessive liquid line length or lift

38. A symptom that a technician would expect on a heat pump system in the cooling mode if the check valve is leaking internally is a flooding of the indoor coil

39. A voltage reading across a closed contact in a 24V control circuit indicates pitted or dirty contacts

40. The first two checks typically made on an electronic control are presence of proper input signals and proper output voltages

41. In a low voltage circuit, a corroded wire-to-terminal connection acts in the circuit like an additional resistor

42. The continuity of a fuse should be tested by checking resistance with power off

43. The first check made for most electrical troubleshooting is a voltage check of the supply line

44. To properly check an energized compressor circuit the technician should use a VOM set for volts

45. The following conditions exist in a circuit that supplies power to three parallel loads.

One load is resistive

One load is capacitive

One load is inductive

The total current in the circuit when operating will be the sum of the currents through each load

46. The technician is using an analog multimeter to check a run capacitor. With the meter set to ohms the needle swings toward zero and then slowly rises toward infinity, this tells the technician that the capacitor charges and discharges

47. If the technician believes that a hermetic compressor has a permanently open internal overload protector, the technician should test the compressor while it is cool

48. A control string is defined as two or more switch contacts connected in a circuit, or set of circuits, to control a load. In order to troubleshoot a load controlled by a control string, the technician must first check for proper voltage applied across the load

49. The technician suspects that an outdoor thermostat used to bring on auxiliary heat may be out of calibration. The thermostat is a close-on-fall type that is adjustable. One method for checking the thermostat calibration is to manually rotate the shaft until the thermostat closes and compare the dial setting to an accurate outdoor temperature reading plus 10°F

50. When changing out an evaporator coil the installer must be certain to plumb the cabinet so its sides are vertical

51. The recommended maximum external static pressure used for heating and cooling equipment with blowers for 5 ton of cooling or less is 0.1 in W.C

52. When a balancing check of a newly installed duct system the dampers should be open completely in all rooms

53. Operating sound is a consideration in the location of a condensing unit because excessive noise could be disruptive to the customer

54. A technician has determined a supply in a flexible duct system is leaking. All connections including inner and outer layers should be checked

55. Sensible heat ratio is sensible removed ÷ total heat removed

56. Service site conditions are:

• House feels “drafty” in cooling

• 3½ ton split system

• High supply face velocities

• Ductwork is properly sized

• Total CFM 1400

These readings indicate the system is operating normally but the supply registers are too restrictive

57. A wet bulb reading that is very close to the dry bulb reading from the same instrument indicates the relative humidity is very high

58. The following measurements would be needed to properly evaluate a complaint of “drafty” operation with a heating system are: system TD, drop, and static pressure

59. The kind of energy that the condenser removes from the refrigerant is sensible and latent heat

60. In a simple refrigerant system, the refrigerant boils in the evaporator

61. The common suction line on a heat pump is connected between the indoor coil and the compressor

62. There are two generally used methods for changing capacity on demand in a heat pump. One is to use a two speed compressor and the other method is using a two stage thermostat

63. The three things that happen when a heat pump is cycled into the defrost mode are, the reversing valve switches to the cooling mode, the outdoor fan is shut off and the auxiliary heat is energized

64. An extended plenum duct system is a single trunk extending in one or two directions with many branch ducts

65. The effect on supply airflow when static pressure on the return is reduced is airflow will be increased

66. The voltage most often used to power the outdoor unit in a residential system is 240V single phase

67. Residential control or low voltage wiring normally is shielded wired

68. If you increased suction pressure on a reciprocating compressor the capacity would decrease

69. The refrigerants typically used in residential and light commercial pumps have a storage life of an indefinite length of time

70. A restricted drier can cause a lower than normal suction pressure

71. The blower motor type generally used on air handling equipment with capacities of 4,000 cfm or greater is a belt driven with three phase

72. Electronic air cleaners can operate with internal voltages as high as 5000 volts

73. A “cross break” made on all flat sides of any rectangular section of metal duct will increase rigidity and reduce vibration

74. The terms grille and register are often used interchangeably. There is a difference between these two components. The primary difference between a grille and a register is that a register is equipped with an air volume control device and a grille is not

75. Thermostatic expansion valves meter refrigerant flow to a coil to maintain superheated refrigerant leaving the coil

76. Some electromechanical type thermostats require connections to both the hot side and common side of the low voltage transformer because the display lights must be powered using both sides of the line

77. Disc type temperature limit controls, used to protect auxiliary heat elements from overheating are always auto reset by temperature

78. A disc-type, close-on –rise pressure control is being used as a loss-of-charge limit control on the liquid line of a heat pump. The control must sense a specified pressure within 15 seconds of a compressor start for the compressor to continue operation. If the cut-in setting of the control drifts lower, the system is less likely to shut down as a result of a small leak

79. The sensor of an outdoor ambient thermostat for a heat pump system typically installed in the entering airstream to the outdoor coil

80. A high pressure limit control, used to shut down a compressor if condensing pressure becomes excessive, is typically installed to sense compressor discharge line pressure

81. Low pressure limit controls are often placed in the suction line of a heat pump for two purposes. They are to protect the compressor if suction pressure drops too low and to detect a loss of a charge

82. The function of a reversing valve is to provide heating and/or cooling

83. The relationship between inrush current and holding current of a relay coil is inrush current is always greater than holding current

84. The timing specification of sequencers is often marked on the device using a code similar to H1-24 C45-75. The specification for this particular sequencer marked with this code is contacts close 1 to 24 seconds after coil is energized; contacts open 45 to 75 seconds after coil is de-energized

85. A seven day programmable thermostat can program a different daily schedule which is used for the next seven days only

86. The capability of electronic programmable room thermostat to reset the set point early so that the space temperature reaches a set temperature at a specific time is called computed recovery

87. An important reason for using electronic controls is they can make decisions based on many inputs

88. One method used with electronic defrost controls to determine the need for defrost is to use two temperature sensors. One of the sensors measures coil temperature. The other measures outdoor air temperature. The two temperatures used by the control to determine if a defrost is needed because the lower temperature, the faster the outdoor coil builds up frost

89. When using a double (dual) element time-delay fuse with a 20 amp motor, the maximum fuse size should be 25 amps

90. According to fire protection codes, fire dampers should be used in any air duct that passes through all walls or partitions of a light commercial installation

91. When the capacity of a heat pump in heating, measured in Btu's, is the same ate the heat loss of a structure, the system is said to have reached its balance point

92. Electronic air cleaners do not remove odors

93. A packaged heat pump must be mounted on a slab if its location is at grade level. Whenever possible, the slab should be located away from the structure to minimize noise

94. A suction line accumulator should be used in a residential heat pump only when recommended by the manufacturer if long refrigerant lines increase system charge over recommended maximum charge

95. The measurement of a heat pumps efficiency is often stated using its "Coefficient of Performance" or COP. The COP of a heat pump is the heat pumps heat output in watts divided by its total electrical input in watts

96. A benefit in using electronic air cleaner is indoor air quality (IAQ) is improved

97. The purpose of calculating the heat loss at an outside design temperature is to select the appropriate equipment based on Btu output

98. The thermal balance point of a dual fuel heat pump is the outdoor conditions at which the capacity of auxiliary heat alone matches the heating load

99. The minimum circuit amp listed on a units' data plate is used to determine the max fuse or circuit breaker size.

100. Heat pumps are particularly sized based on the cooling load.

101. The effective method of reducing sound when AHU is located in a closet is to use vibration isolators.

102. When wiring a 20 amp FLA motor, the minimum amp fuse or circuit breaker should be 25.

103. The typical staging of a two stage HP system uses the deviation of the t-stat setting to determine when to engage each stage.

104. The purpose of a sequencer in a HP with an AUX 20 kW electric heater is to energize one or two elements and the blower then energize the other elements in timed intervals.

105. In a HP circuit, an open check valve is used to by-pass refrigerant flow around the metering device.

106. The forward curve centrifugal fan is the most commonly used type in residential systems.

107. A reversing valve; the single pipe is connected to the compressor discharge.

108. The airflow path of with an outdoor unit pull through coil is air moves from the outside to the inside.

109. Economizer systems close the outdoor air vent to a preset minimum when outdoor air enthalpy exceeds the set point.

110. Condensation on vapor lines is a concern when the lines are routed inside a wall.

111. Refrigerant sub-cooling is measured between refrigerant condensing temp and the liquid line temp.

112. In a single zone system; if a customer complains of feeling damp or sticky the cause could be unconditioned air being pulled into the duct work through holes in the duct.

113. When performing indoor air balancing tests the t-stat should be set to bring on the indoor fan on mid-high speed.

114. Most manufacturers recommend the smallest allowable t-stat wire at 18 AWG.

115. Checking voltage input to a compressor should take place at the load side of the contactor.

116. HP unit; 1st and 2nd stage appear to be calling, compressor runs but not electric heater. This is due to second stage being open.

117. After compressor burn out, test the oil for acidity levels.

118. Manufacturers recommend that the most acceptable method of attaching line sets to the AHU is be utilizing brazing alloy.

119. There are more circuits in a HP outdoor coil than in an A/C outdoor coil to minimize refrigerant pressure drop.

120. Inefficient voltage or current to a solenoid will result in vibration or chatter of the solenoid.

121. A compressor that is suspected to be grounded to its' housing should be checked for continuity from the terminal windings to ground.

122. The coil of a potential relay is connected to the common and start terminals of a compressor.

123. When the load on a HP in cooling mode decreases the suction pressure goes up and the discharge pressure goes down.

124. The measurements needed to find suction superheat are suction pressure & suction line temperature.

125. The purpose of an auto change over switch on a t-stat is to allow automatic change over between heating and cooling.

126. Undersized duct work will often cause high noise levels, high air quantity and high static pressures.

127. Determining voltage drop at the outdoor unit requires checking voltage feed with the outdoor unit not running and then with the outdoor unit running.

128. A manometer is used to measure static duct pressure.

129. A system that has been evacuated to 500 microns rises immediately and at a constant rate after the vacuum pump has been shut off due to a leak in the system.

130. To obtain an accurate refrigerant temperature on a horizontal suction line that is 1&1/8” or larger the TXV sensing bulb should be located at 4 or 8 o’clock on the pipe.

131. The primary consideration when bending soft copper to any radius is the cross sectional area must not be significantly reduced.