Lesson 1 - Basic Control Theory

Objectives:
- Describe the functions of an HVACR control system.
- Convert temperatures from Fahrenheit degrees to Celsius degrees, and vice versa.
- Convert temperatures from Fahrenheit degrees to Rankine degrees, and vice versa.
- Explain the Perfect Gas Law.
- Explain how gauge pressure differs from absolute pressure.
- Define the following terms: specific heat, sensible heat, latent heat, heat of fusion, and heat of vaporization.
- Name the four basic elements of control systems and describe their functions.
- Identify the six basic functions of fully automatic control equipment.
- Define the following terms used in HVACR controls: setpoint, control point, offset, deviation, and differential.
- Explain what terms "controller throttling range" and proportional band" mean.

Lesson 2 - Air Supply Equipment (Part 1)

Objectives:
- Describe the characteristics and operating principles of various types of air compressors.
- Size and specify the air supply equipment necessary for a pneumatic temperature control system.

Lesson 3 - Air Supply Equipment (Part 2)

Objectives:
- Describe common maintenance procedures for air supply systems.
- Identify the various components that make up an air supply system.
- Adjust and troubleshoot a typical air supply system.

Lesson 4 - Thermostats and Controllers (Part 1)

Objectives:
- Explain how controllers are classified.
- Describe the design, construction, and operation of various types of thermostats and controllers.
- Define the terms throttling range, proportional band and differential as they apply to controllers.

Lesson 5 - Thermostats and Controllers (Part 2)

Objectives:
- Describe the design, construction, and operation of high-capacity single-temperature thermostats.
- Explain the operation of the valve unit in a high-capacity thermostat.
- Describe the design, construction, and operation of high-capacity dual-temperature thermostats.
- Describe the design, construction, and operation of high-capacity heating/cooling thermostats.
Lesson 6 - Transmitter-Receiver Controller Equipment
Objectives:
- Explain the function of a transmitter in a pneumatic control system.
- Identify the various types of transmitters and describe their operation.
- Explain the function of a receiver controller in a pneumatic control system.
- Identify the various types of Receiver controllers and describe their operation.
- Define the terms sensitivity, span, proportional band, and authority as they apply to transmitter-receiver controller equipment.

Lesson 7 - Pneumatic Relays
Objectives:
- Describe the function and operation of various types of switching, reversing, volume-amplifying, and positive positioning pneumatic relays.
- Explain the difference between high-pressure selecting relays and low-pressure selecting relays.
- Explain how electric-pneumatic and pneumatic-electric relays are used in control systems.
- Give examples of the types of control applications in which manual switches are used.
- Describe the function and operation of integral reset relays.

Lesson 8 - Valve and Damper Actuators
Objectives:
- Explain the pneumatic principles of valve and damper actuators as they are used in control systems.
- Troubleshoot valve actuator applications and operational problems.
- Troubleshoot damper actuator applications and operational problems.
- Explain the difference between mixing valves and diverting values.
- Calculate the correct sizing of actuators.

Lesson 9 - Typical Component Applications
Objectives:
- Identify and explain simple control combinations.
- Describe the use of sequence control and limit control.
- Describe the use of manual switch control and changeover control.
- List typical uses of pneumatic-electric and electric-pneumatic relay combinations.
- Explain the purpose of recycling control.

Lesson 10 - Typical Control Applications
Objectives:
- Explain how the temperature of the discharge air is controlled in basic air-handling systems.
- Explain the differences between single-zone and multizone control systems.
- Describe the operation of mixed air and economizer controls.
- Explain how and why unit ventilator controls are used.
- Describe the operation of hot deck and cold deck control systems.
Lesson 11 - System Applications (Part 1)
Objective:
- Describe the control selection process necessary to meet specifications for the following types of pneumatic control systems:
  - Hot water radiation control
  - Electric unit heater control
  - Steam or hot water unit heater control
  - Electric reheat control
  - Steam or hot water reheat control
  - Hot water reset control (three-way valve or boiler reset)
  - Steam to hot water converter control
  - Hot water pump and chilled water pump control

Lesson 12 - System Applications (Part 2)
Objective:
- Describe the control selection process necessary to meet specifications for the following types of pneumatic control systems:
  - Supply fan volume control
  - Integral control (automatic reset)
  - Open-loop fan tracking control
  - Closed-loop fan tracking control
  - Day/night (occupied/unoccupied) variable volume control for interior zones
  - Day/night (occupied/unoccupied) variable volume control for perimeter zones.

Lesson 13 - Systems Applications (Part 3)
Objective:
- Describe the control selection process necessary to meet specifications for the following types of pneumatic control systems:
  - Pressure-independent VAV terminals
  - VAV terminals with and without reheat
  - VAV terminals with cfm limit control
  - Induction-type VAV terminals
  - Two-pipe heating/cooling systems
  - Four-pipe heating/cooling systems

Lesson 14 - Control System Maintenance
Objectives:
- Explain the maintenance procedures necessary to ensure the proper operation of a pneumatic control system.
- Describe the steps necessary to set up a scheduled maintenance program for a pneumatic control system.

Lesson 15 - Glossary of Terms

Lesson 16 - Appendix