

Lesson 1 - Types of Mechanical Equipment

Objectives:

- List the four major elements of a typical HVAC/R installation.
- Describe the functions served by air-handling units, and explain why they are located where they are.
- Explain how room controls operate.
- Discuss the concept, the operation, and the advantages of VAV systems.
- Explain the role of the terminal box.
- Describe ways to maintain positive static pressure in a duct system.
- Contrast the operational differences between pressure-dependent and pressure-independent systems.
- Identify the different forms of reheat.
- Explain the use of cooling, parallel fan-powered, and series fan-powered terminal boxes.

Lesson 2 - Control Components and Variables

Objectives:

- Describe the functions of an HVAC/R control system.
- Identify the comfort range for relative humidity.
- Explain why maintaining a slight positive pressure in a building is desirable.
- State the goal of air distribution.
- 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 press.
- Describe how barometers, U-tube manometers, and Magnehelic manometers are used.
- 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.
- Explain how electric, pneumatic, and electronic controllers differ from each other.
- Describe the operation of the various types of temperature and humidity sensors.
- Describe the operation of pneumatic and electronic modulating controllers.

Lesson 3 - Control Terminology

Objectives:

- Define the following terms used in HVAC/R controls: setpoint, control point, offset, deviation, differential, and droop.
- Explain what the terms "controller throttling range" and "proportional band" mean.
- Differentiate between direct-acting and reverse-acting controller actions.
- Describe the difference between direct rest and reverse rest.

Lesson 4 - Types of Control Systems

Objectives:

- List the advantages and the disadvantages of electric controls.
- List the advantages and the disadvantages of pneumatic controls.
- List the advantages and the disadvantages of electronic analog controls.
- List the advantages and the disadvantages of electronic digital controls.

- Define the following terms: two-position control, offset, timed two-position control, and floating control.
- Describe proportional pneumatic control.
- Describe proportional plus integral (P.I.) Control.
- Describe proportional integral plus derivative (P.I.D.) control.

Lesson 5 - Sequences of Operation

Objectives:

- Describe the operation sequence of various heating and cooling equipment configurations.
- Describe the operation sequence of a direct expansion (DX) cooling coil.
- Describe the operation sequence of chilled water and hot water coils.
- Describe the operation sequence of electric reheat coils.
- Describe a face and bypass heating control sequence.
- Explain the operation of a variable-frequency drive (VFD).
- Describe the operation sequence of duct-mounted humidification and dehumidification equipment.

Lesson 6 – Specifications

Objectives:

- Name the 16 CSI specification divisions.
- Identify Division 15 mechanical broad-scope specifications.
- Discuss automatic temperature control specifications in detail.

Lesson 7 - Electrical Safety

Objectives:

- Describe the different levels of electric shock, and explain their effects on the human body.
- Identify the kinds of accidents caused by electric shock.
- State the precautions against shock.
- Differentiate between hot, neutral and ground wires.
- Explain the proper grounding of electric power tools.
- Describe what a GFCI is and how it operates.
- Explain how to lock out a system. 8) List the three basic forms of fires.

Lesson 8 – Sensors

Objectives:

- Describe the various types of disturbance-sensing elements and their properties.
- Discuss the application of these sensors, including those that respond to changes in pressure, temperature, and relative humidity, in automatic HVAC/R control systems.
- Explain the two steps of converting a mechanical signal to an electrical signal.
- Describe the advantages and disadvantages of electrical pressure transducers, potentiometric pressure transducers, and capacitive pressure transducers.

Lesson 9 - Valves and Dampers

Objectives:

- Describe the construction and operation of two-way and three-way valves.
- Explain the difference between mixing valves and diverting valves.
- Identify the two basic kinds of control dampers and discuss their typical applications.

Lesson 10 - Glossary of Terms