

**Lesson 1 - Introduction to Hot Water Heating**

Objectives:

- Explain the principles of forced hot water heating.
- Describe various hot water heating system designs.
- List and define terms related to hot water heating.
- Explain design water temperature.

**Lesson 2 - Hot Water Boilers and Controls**

Objectives:

- List and describe three common types of hot water boilers.
- Explain how boilers are rated.
- Describe some of the criteria for selecting the location for a boiler.
- Identify devices used as safety controls and explain their operation.
- List several guidelines for cleaning and maintaining boilers.

**Lesson 3 - Heat Transfer Units**

Objectives:

- Explain what is meant by heat emission, and describe the heat emission rating methods for convectors, radiators, and baseboard units.
- Identify the best locations for the installation of convectors, radiators, and baseboard units.
- Describe basic selection and installation procedures for various types of heat transfer units.
- Explain how temperature control devices are used with heat transfer units.

**Lesson 4 - Centrifugal Pumps**

Objectives:

- Explain the basic construction and operation of centrifugal pumps.
- Evaluate the performance of a pump by analyzing its performance curve.
- Explain how to take gauge readings.
- Identify the different types of centrifugal pumps.
- List the three primary requirements of a circulating pump.
- Explain how system curves and pump curves can be used in selecting a pump.

**Lesson 5 - Air Control**

Objectives:

- Describe the two types of closed tanks used in hot water heating systems.
- Explain the purpose of air separation devices, and describe their operation and installation.
- Identify the three basic types of in-line air separators.
- Select the proper locations for installing tanks in hot water heating systems.
- Explain how tank size is determined.

**Lesson 6 - Hot Water Specialties**

Objectives:

- Explain the purpose of an air vent.
- List some of the advantages of a float vent.
- Explain the purpose of flow control valves, and describe their operation and installation.
- Explain where and why the following "specialties" are used in hot water heating systems: circulator valves, balancing elbows and fittings, vent tee fittings, pressure relief valves, pressure-reducing valves, dual-unit valves, and electric zone valves.
- Identify various types of balancing valves and explain how they differ from each other.

## **Lesson 7 - Piping Methods**

Objectives:

- Describe the concept of "first cost" in regard to how piping shall be arranged.
- Identify the two general categories of piping systems.
- Distinguish the general characteristics of the four types of piping systems.
- List the guiding considerations for selecting and laying out piping systems.
- Identify the steps for the initial cleaning of a system.
- Describe the procedures for operation start up and maintenance of a system.

## **Lesson 8 - Zoning**

Objectives:

- Explain how much heat a pipe will carry.
- Describe how much baseboard you can use in a single loop.
- Determine how many convectors a pipe will serve.
- Identify how many zone valves a circulator can handle.
- Size circulators for single or multiple zones.
- Zone hot water systems with nonelectric valves.
- Add a radiant panel zone by getting two water temperatures from one boiler.
- Run a hot water zone (up as high as the third floor) by using the water in a steam boiler.

## **Lesson 9 - Primary/Secondary Pumping**

Objectives:

- State the rule of primary/secondary pumping and control circuits.
- Explain "common piping."
- State the "Tee Law."
- Identify the three things that are characteristic of "mixing."
- Describe the "crossover bridge" and its various flow relationships.
- Determine crossover bridge temperature drop.
- Determine crossover bridge flow rate.
- Determine common piping flow rate and direction.
- Determine various types of injection pump applications.

## **Lesson 10 - Hydronic Radiant Heating Systems**

Objectives:

- Explain the concept and operation of hydronic radiant heating.
- Identify the basic materials used in radiant heating.
- Describe the relationship between temperature of the floor and tube spacing.
- List the six types of imbedded systems.
- List the four types of attached systems.
- Name and describe four tubing configurations.

## **Lesson 11 - Temperature Controls**

Objectives:

- Describe a fully integrated control systems of hydronic heating.
- Determine the advantage and disadvantage of controlling flow rate verses controlling water temperature.
- Describe the process of outdoor reset.
- Name the three ways to control the mixing process.
- List the basic rules of control system and heating system design.

- Describe the three important features of the proper operation of a hot water heating system.
- Name the five mixing methods.
- Utilize a design procedure that determines the use of direct or reverse injection piping in a heating system.

### **Lesson 12 - Troubleshooting Components (Part 1)**

Objectives:

- Name the various types of hydronic temperature controllers.
- Describe the procedure for installing an immersion-type controller.
- Recognize typical wiring hookups for hydronic temperature controllers.
- Describe the settings of a multiple Aquastat□ as a high-limit control, a low-limit control, and a circulator control.
- Explain the installation of the two types of Aquastat□ relays.
- Describe the operation of the triple-function controller.
- List three troubleshooting procedures for verifying the proper function of the controller.

### **Lesson 13 - Troubleshooting Components (Part 2)**

Objectives:

- Locate and mount various models of thermostatic radiator valves.
- Learn how to recalibrate a thermostatic radiator valve.
- Explain the performance of a relief valve under normal and emergency conditions.

### **Lesson 14 - Troubleshooting Components (Part 3)**

Objectives:

- Explain the installation of an outdoor reset control.
- Determine the reset ratio for an outdoor reset control.
- Describe the check-out procedure of an outdoor reset supply water temperature control.
- List the various types of automatic hydronic valves.
- Determine the types of operations for mixing valve applications.
- Describe the operation of a two-way zone valve.

### **Lesson 15 - Troubleshooting Hydronic Systems**

Objectives:

- Troubleshoot circulation problems in a hydronic heating system.
- Describe hydronic heating problems related to air in the system.
- Explain the function of a circulating pump and checking the pump performance.
- Identify the system noses related to pump performance.
- Describe the importance of compression tank location.
- Troubleshoot mechanical problems associated with pumps, i.e., lubrication, seals, and dry pump.
- Describe electrical problems that arise with circulating pumps.