Task Title: Hydronics Information for Plumbing

OALCF Cover Sheet – Practitioner Copy

Learner Name: _____

Date Started: _____

Date Completed: _____

Successful Completion: Yes ☐ No ☐

Goal Path: Employment ☐ Apprenticeship ■

Secondary School ☐ Post Secondary ☐ Independence ☐

Task Description: The learner will locate information about hydronics systems in an article.

Main Competency/Task Group/Level Indicator:

- Find and Use Information/Read continuous text/A1.2
- Use Digital Technology/D.2

Materials Required:

- Pen/pencil and paper
- Computer or digital device

Learner Information

Plumbers must understand how hydronic systems work. Many factors determine a successfully working system.

Read “Hydronics System”.

Hydronics System

Hydronics is the use of water as the heat-transfer medium in heating and cooling systems. Some of the oldest and most common examples are steam and hot-water radiators. Historically, in large-scale commercial buildings such as high-rise and campus facilities, a hydronic system may include both a chilled and a heated water loop, to provide for both heating and air conditioning. Chillers and cooling towers are used separately or together as means to provide water cooling, while boilers heat water. A recent innovation is the chiller boiler system, which provides an efficient form of Heating, Ventilation and Air Conditioning (HVAC) for homes and smaller commercial spaces.

Basic Types of Hydronic System

Hydronic systems are of two basic types:

- Steam or hot water
- Chilled water

Classification

Hydronic systems are classified in five ways:

- Flow generation (forced flow or gravity flow)
- Temperature (low, medium, and high)
- Pressurization (low, medium, and high)
- Piping arrangement
- Pumping arrangement

Piping Arrangements

Hydronic systems may be divided into several general piping arrangement categories:

- Single or one-pipe
- Two pipe steam (direct return or reverse return)
- Three pipe
- Four pipe
- Series loop

Improved Efficiency and Operating Costs

Insulation products have considerably improved the efficiency and operating costs of hydronic heating systems.

For example, radiator panel system pipes are covered with a fire-rated, flexible, lightweight elastomeric rubber material designed for thermal insulation. Slab heating efficiency is improved with the installation of a thermal barrier made of foam.

Boiler Water Treatment

Domestic (home) systems may use ordinary tap water, but sophisticated commercial systems often add various chemicals to the system water. These added chemicals may

- inhibit corrosion
- prevent freezing of the water in the system
- increase the boiling point of the water in the system
- inhibit the growth of mold and bacteria
- allow improved leak detection (for example, dyes that fluoresce under ultraviolet light)

Air Elimination

All hydronic systems must have a means to eliminate air from the system. A properly designed, air-free system should function properly for many years.

Air causes irritating system noises, as well as interrupting proper heat transfer to and from the circulating fluids. In addition, unless reduced below an acceptable level, the oxygen dissolved in water causes corrosion. This corrosion can cause rust and scale to build up on the piping. Over time these particles can become loose and travel around the pipes, reducing or even blocking the flow as well as damaging pump seals and other components.

Steam System

In steam systems, individual radiators are usually equipped with a thermostatic bleed valve. At room temperature, the valve opens the radiator to the air, but as hot steam flows into the radiator and pushes the

contained air out, the valve heats and eventually closes, preventing steam from escaping into the room.

Water-Loop System

Water-loop systems can also experience air problems. Air found within hydronic water-loop systems may be classified into three forms:

1. **Free Air**

Various devices such as manual and automatic air vents are used to address free air which floats up to the high points throughout the system. Automatic air vents contain a valve that is operated by a float. When air is present, the float drops, allowing the valve to open and bleed air out. When water reaches (fills) the valve, the float lifts, blocking the water from escaping. Small (domestic) versions of these valves in older systems are sometimes fitted with a Schrader-type air valve fitting, and any trapped, now-compressed air can be bled from the valve by manually depressing the valve stem until water rather than air begins to emerge.

2. **Entrained Air**

Entrained air is air bubbles that travel around in the piping at the same velocity as the water. Air "scoops" are one example of products which attempt to remove this type of air.

3. **Dissolved Air**

Dissolved air is also present in the system water and the amount is determined principally by the temperature and pressure (see Henry's Law) of the incoming water. On average, tap water contains between 8-10% dissolved air by volume.

Accommodating Thermal Expansion

Water expands as it heats and contracts as it cools. A water-loop hydronic system must have one or more expansion tanks in the system to accommodate this varying volume of the working fluid. These tanks often use a rubber diaphragm pressurized with compressed air. The expansion tank accommodates the expanded water by further air compression and helps maintain a roughly constant pressure in the system across the expected change in fluid volume. Simple cisterns open to atmospheric pressure are also used.

Automatic Fill Mechanisms

Hydronic systems are usually connected to a water supply such as the public water supply. An automatic valve regulates the amount of water in the system and also prevents backflow of system water, and any water treatment chemicals, into the water supply.

Safety Mechanisms

Excessive heat or pressure may cause the system to fail. At least one combination over-temperature and over-pressure relief valve is always fitted to the system to allow the steam or water to vent to the atmosphere in case of the failure of some mechanism such as the boiler temperature control to prevent the catastrophic bursting of the piping, radiators, or boiler. The relief valve usually has a manual operating handle to allow testing and the flushing of contaminants such as grit that may cause the valve to leak under otherwise-normal operating conditions.

Adapted from Wikipedia

Work Sheet

Task 1: What does HVAC stand for?

Answer:

Task 2: What are two ways that efficiency and operating costs can be improved in hydronic heating systems?

Answer:

Task 3: List three reasons why companies using sophisticated commercial boiler systems add chemicals to the system water.

Answer:

Task 4: List three reasons why it is not acceptable to have air trapped in the hydronic system.

Answer:

Task 5: Why is it important to accommodate thermal expansion?

Answer:

Task 6: Chillers are used in Hydronic Systems, usually in large buildings. Conduct a keyword search on the internet to find an explanation of "Chiller Hydronic Systems". Copy it below.

Answer:

Answers

Task 1: What does HVAC stand for?

Answer: Heating, Ventilation and Air Conditioning

Task 2: What are two ways that efficiency and operating costs can be improved in hydronic heating systems?

Answer: Radiator Panel system pipes are covered with a fire rated, flexible and lightweight elastomeric rubber material designed for thermal insulation. Slab Heating efficiency is improved with the installation of a thermal barrier made of foam.

Task 3: List three reasons why companies using sophisticated commercial boiler systems add chemicals to the system water.

Answer: Any three of

- Inhibit corrosion
- Prevent freezing of the water in the system
- Increase the boiling point of the water in the system
- Inhibit the growth of mold and bacteria
- Allow improved leak detection (for example, dyes that fluoresce under ultraviolet light)

Task 4: List three reasons why it is not acceptable to have air trapped in the hydronic system.

Answer: Irritating noises, heat loss (interrupting proper heat transfer to and from the circulating fluids), corrosion

Task 5: Why is it important to accommodate thermal expansion?

Answer: To accommodate changing volume of water - water expands and contracts with heating and cooling.

Task 6: Chillers are used in Hydronic Systems, usually in large buildings. Conduct a keyword search on the internet to find an explanation of "Chiller Hydronic Systems". Copy it below.

Answers will vary. Two sample answers are as follows:

- A chiller is a machine that removes heat from a liquid via a vapor-compression or absorption refrigeration cycle. This liquid can then be circulated through a heat exchanger to cool air or equipment as required. As a necessary by-product, refrigeration creates waste heat that must be exhausted to ambient or, for greater efficiency, recovered for heating purposes. Concerns in design and selection of chillers include performance, efficiency, maintenance, and product life cycle environmental impact.

- A chiller hydronic system, also known as a hydronic chiller system, uses chilled water to cool a building or facility. The system circulates chilled water through a series of pipes and coils to absorb heat from the air, effectively cooling the space.

Performance Descriptors

Levels	Performance Descriptors	Needs Work	Completes task with support from practitioner	Completes task independently
A1.2	scans text to locate information			
	locates multiple pieces of information in simple texts			
	makes low-level inferences			
	reads more complex texts to locate a single piece of information			
	obtains information from detailed reading			
D.2	selects and follows appropriate steps to complete tasks			
	begins to identify sources and evaluate information			
	locates and recognizes functions and commands			
	performs simple searches using keywords (e.g. internet, software help menu)			

This task: Was successfully completed ☐ Needs to be tried again ☐

Learner Comments:

Instructor (print): _____

Learner (print): _____