

OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

OALCF Task Cover Sheet

Task Title: Hydronics Information for Plumbing

Learner Name:	
Date Started:	Date Completed:
Successful Completion: Yes___ No___	
Goal Path: Employment___ Apprenticeship✓ Secondary School___ Post Secondary___ Independence___	
Task Description: Locate and understand information related to plumbing systems, such as Hydronics.	
Competency: A: Find and Use Information B: Communicate Ideas and Information D: Digital Technology	Task Group(s): A1: Read continuous text B1: Interact with others B2: Write continuous text D2: Digital Technology
Level Indicators: A1.2: Read texts to locate and connect ideas and information A1.3: Read longer texts to connect, evaluate and integrate ideas and information B1.1: Participate in brief interactions to exchange information with one other person B2.2: Write texts to explain and describe information and ideas D.2: Perform well-defined, multi-step digital tasks	
Performance Descriptors: see chart on last page	
Materials Required: <ul style="list-style-type: none"> • Pen and paper • Computer with internet connection and printer • Attached document - Hydronics Systems 	

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Learner Information and Tasks

Plumbers must understand how Hydronic Systems work. Many factors determine a successfully working system. Plumbers will have to source the information and parts from others in the trade or through searching resources, using both libraries and the internet. Read the document **Hydronics System**.

- Task 1:** In the Hydronic Systems many different types of valves are used, automatic, air-venting and zone. Use the internet using the keyword search "valves used in plumbing" to locate 3 additional valves used in plumbing. Write out the purpose of each of the 3 valves you locate.
- Task 2:** Chillers are used in Hydronic Systems, usually in large buildings. Conduct a keyword search on the internet to locate and print the meaning of Chiller.
- Task 3:** What does HVAC stand for?
- Task 4:** List 3 reasons why it is not acceptable to have air trapped in the hydronic system.
- Task 5:** There are chemicals added in Boiler Water Treatment when it is used in large commercial operations. Summarize the reasons these chemicals are used.
- Task 6:** Explain why it is important to accommodate thermal expansion.
- Task 7:** Why is it important to prevent backflow into the water system? Use different sources to locate this information such as an instructor, plumber, the internet or a library.

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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.

Types of hydronic system

Basic types

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

There have been considerable improvements in the efficiency and therefore the operating costs of a hydronic heating system with the introduction of insulating products.

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. There are now many product offerings on the market with different energy ratings and installation methods.

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Boiler water treatment

Domestic (home) systems may use ordinary tap water, but sophisticated commercial systems often add various chemicals to the system water. For example, 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 continue to function normally 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:

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.

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.

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.

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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 rather than allowing) 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

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Answer Sheet

Task 1: In the Hydronic Systems many different types of valves are used, automatic, air-venting and zone. Use the internet using the keyword search "valves used in plumbing" to locate 3 additional valves used in plumbing. Write out the purpose of each of the 3 valves you locate.

Ball Valve - Ball valves are made with a rotating sphere that has a hole in it. In the open position, the hole in the sphere is in line with the pipe. When closed, the hole in the sphere is perpendicular to the pipe. The lever handle operates the valve, but also serves as an indicator for whether the valve is open or closed. When the lever is parallel to the pipe, the valve is open

Check Valve - Check valves are used to keep water flowing in only one direction. They are generally not operational. A back-flow preventer is a type of check valve. A ball-check valve uses a ball to stop the flow of water in the wrong direction.

Pressure Balanced Valve - Pressure balanced valves are used to maintain a constant temperature of water in domestic showers or bathtubs.

There may be other valves.

Task 2: Chillers are used in Hydronic Systems, usually in large buildings. Conduct a keyword search on the internet to locate and print the meaning of Chiller.

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.

Task 3: What does HVAC stand for?

Heating, Ventilation and Air Conditioning

Task 4: List 3 reasons why it is not acceptable to have air trapped in the hydronic system.

Irritating noises, heat loss, and corrosion.

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Task 5: In Boiler Water Treatment used in large commercial operations chemicals are added. Summarize the intent of the use of these chemicals.

To ensure long term use of the system without issues such as corrosion, mold, prevent freezing and leak detection and increase the boiling point of the water.

Task 6: Explain why it is important to accommodate thermal expansion.

To accommodate changing volume of water, water expands and contracts with heating and cooling.

Task 7: Why is it important to prevent backflow into the water system? Use different sources to locate this information such as an instructor, plumber, the internet or a library.

Backflow of water can cause contaminated water to enter the system and cause serious sickness. Potable water should always be isolated from sewage/drainage water.

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Performance Descriptors		Needs Work	Completes task with support from practitioner	Completes task independently
A1.2	<ul style="list-style-type: none"> scans text to locate information 			
	<ul style="list-style-type: none"> locates multiple pieces of information in simple texts 			
	<ul style="list-style-type: none"> makes low-level inferences 			
	<ul style="list-style-type: none"> reads more complex texts to locate a single piece of information 			
	<ul style="list-style-type: none"> obtains information from detailed reading 			
A1.3	<ul style="list-style-type: none"> integrates several pieces of information from texts 			
	<ul style="list-style-type: none"> manages unfamiliar elements (e.g. vocabulary, context, topic) to complete tasks 			
	<ul style="list-style-type: none"> identifies the purpose and relevance of texts 			
	<ul style="list-style-type: none"> skims to get the gist of longer texts 			
	<ul style="list-style-type: none"> infers meaning which is not explicit in texts 			
	<ul style="list-style-type: none"> compares or contrasts information between two or more texts 			
	<ul style="list-style-type: none"> uses organizational features, such as headings, to locate information 			
	<ul style="list-style-type: none"> obtains information from detailed reading 			
A2.2	<ul style="list-style-type: none"> performs limited searches using one or two search criteria 			
	<ul style="list-style-type: none"> extracts information from tables and forms 			
	<ul style="list-style-type: none"> uses layout to locate information 			
	<ul style="list-style-type: none"> makes connections between parts of documents 			
	<ul style="list-style-type: none"> makes low-level inferences 			
B1.1	<ul style="list-style-type: none"> chooses appropriate language in exchanges with clearly defined purposes 			

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	<ul style="list-style-type: none"> participates in short, simple exchanges 			
	<ul style="list-style-type: none"> speaks or signs clearly in a focused and organized way 			
	<ul style="list-style-type: none"> repeats or questions to confirm understanding 			
B2.2	<ul style="list-style-type: none"> writes texts to explain and describe 			
	<ul style="list-style-type: none"> conveys intended meaning on familiar topics for a limited range of purposes and audiences 			
	<ul style="list-style-type: none"> uses limited range of vocabulary and punctuation appropriate to the task 			
D.2	<ul style="list-style-type: none"> selects and follows appropriate steps to complete tasks 			
	<ul style="list-style-type: none"> locates and recognizes functions and commands 			
	<ul style="list-style-type: none"> makes low-level inferences to interpret icons and text 			
	<ul style="list-style-type: none"> begins to identify sources and evaluate information 			
	<ul style="list-style-type: none"> 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 Signature