THE OPEN DIRECT SYSTEM INSTALLATION

HEATING SYSTEM INSTALLATION SUPPLEMENT 220

OVERVIEW

The Open/Direct System by Radiantec Company is the first truly new heating system in a generation. The system uses **one** very efficient water heater to make domestic hot water for the home and warm water for radiant heating. Radiant heating systems warm the building by locating heating tubes within a large surface area of the building (such as the floors or ceiling), and then circulating warm water through the tubes.

The Open/Direct system takes full advantage of the fact that only warm water is needed for both uses instead of the very hot water that is needed by other types of heating systems. There are significant advantages in simplicity, reliability, initial purchase cost, energy efficiency and pollution reduction. A solar energy assist is available because the system is based upon the domestic water heater.

One attractive feature is that the Open/Direct System is one of the simplest heating systems ever to be developed.

CODE COMPLIANCE

The Open/Direct System as supplied by Radiantec Company meets the requirements of the International Code Council and other major national code bodies. For full information contact Radiantec Company at 1-800-451-7593 or on the internet at http://www.Radiantec.com/codes-approval/index.php

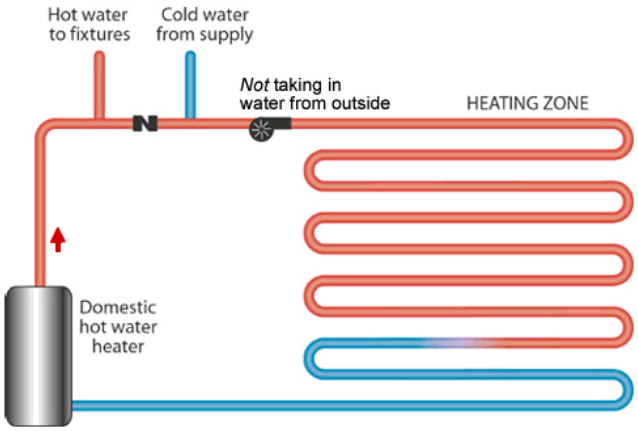
If you want to know more about the benefits and operation of the Open/Direct System you can go to our "Frequently asked Questions" publication which comes with the brochure package and is available on our website, www.Radiantec.com. You may also go to the website for detailed animated drawings, www.Radiantec.com/systems-sources/open-system.php. If you still have questions, just call Radiantec Company and ask to speak with a technician, **1-800-451-7593.**

OPERATION

The installer should understand how the Open/Direct System operates and how the water flows. The Open/Direct System is one single system that operates in two different and distinct ways. Yet, this ingenious system is entirely automatic. It needs no separate actions or adjustments by the homeowner at all.

Note: These are schematic conceptual drawings intended to show the flow of the system. They do not show all components**. Do not attempt to build a system from these drawings.**

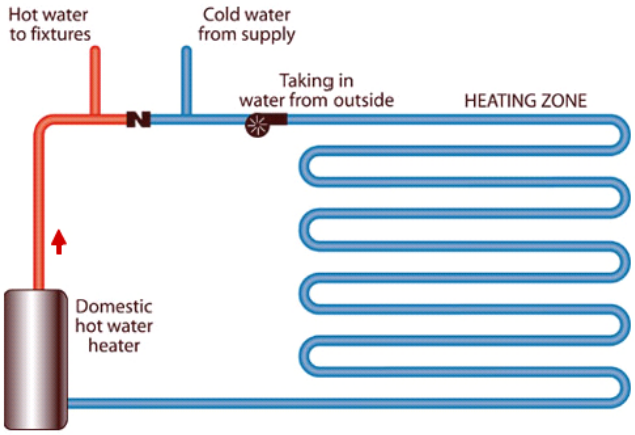
HEATING MODE



In the heating mode:
When heat is wanted, warm water is pumped from the water heater, through the tubing within the floor and back to the water heater. **Note: Cold water cannot enter the system when the pump comes on unless someone is taking hot water out of the system by taking a shower, doing dishes, etc.**

If space heating and domestic hot water consumption occurs at the same time, the domestic hot water always takes precedence.

DOMESTIC HOT WATER MODE



In the domestic hot water mode:
When domestic hot water is wanted, warm water comes out of the tank and goes to the fixtures. Cold water must replace the hot water that was used. The cold water goes through heating tubes within the floor on its way to the water heater (an important safety detail!).

This flow pattern provides limited free cooling and other benefits. Stagnation is prevented and priority is given to the domestic hot water use over the space heating use. A small amount of free cooling is realized in the summer.

INSTALLATION OF THE OPEN/DIRECT SYSTEM from RADIANTEC COMPANY

INSTALL THE TUBING BENEATH THE FLOOR using Radiantec Installation Manuals, and consultation with Radiantec technicians.

SELECT AN APPROPRIATE DOMESTIC WATER HEATER OR BOILER
Consider cost and availability of fuel in your area; now, and in the future. In general get the highest quality and highest efficiency you can afford. The unit should be at least 95% efficient. The water heater must have a BTU heating output that is large enough to meet the heating needs of the home on the coldest expected day plus a small extra reserve for simultaneous use of domestic hot water.

It is reasonable to add 10% to the heating load. Water storage capacity does not have to be unreasonably large. Remember that the Open/Direct System design gives the domestic hot water use priority by taking some heat out of the house in periods of high demand to be replaced later. A 34 gallon unit is adequate for most homes and extra storage will increase standby losses.

These installation instructions were written assuming that the installer will be using a "Polaris" gas fired water heater. This unit is an excellent choice because of its outstanding efficiency and high heating
capacity. If another water heater is used, certain adjustments and modifications may be needed. ***The Polaris Water Heater is all stainless steel, 95% efficient and vents though the wall or roof with plastic pipe.***

INSTALL THE WATER HEATER

The following recommendations are general in nature. The actual installation of the heater may not be a good "do it yourself" project for everyone. The installer should know exactly what he or she is doing. He should review the water heater instruction manual and follow all codes. If no building codes are mandated, the installer should follow plumbing and mechanical codes developed by the International Code Council (ICC). If in doubt, it may be wise to hire a licensed professional. The average home owner should **NEVER** work with gas. Correct installation will result in many years of trouble-free operation. Incorrect installation can result in poor performance, safety hazards and unnecessary expense.

The homeowner and installer should pay particular attention to these items:

1. Locate the water heater in the most desirable location first and then locate other components around it.
2. Locate the water heater where it can be eventually removed if necessary and where all components are accessible.
3. The venting of a direct vent water heater should be short and have a minimum number of turns.
4. The water heater should be located closely to those domestic hot water fixtures that will be used the most. When the domestic hot water is drawn, you should not have to draw a lot of cold water or wait an excessive length of time for water to travel from the heater to the fixture.
5. The water heater should be set upon a short stand to improve access and make installation easier. Many codes also require the water heater to be placed in a shallow plastic pan so that leaks are revealed and do not cause rotting of supporting lumber.
6. The Polaris water heater or any other condensing unit should be located near a drain. A byproduct of the efficient burning of gas is water, and the Polaris can produce up to a couple of gallons of condensate per day. If the heater is installed some distance from a drain, a condensate pump will be necessary (can be ordered from us) which is not very expensive. Use plastic tubing. The condensate has the acidity of lemonade and would corrode metal in a short period of time. Some codes may indicate that a condensate neutralizer be installed (you can order one from us if necessary). This condensate contains the pollutants that most heating units discharge into the air. These pollutants seriously damage the environment causing acid rain, global warming, emphysema, and other respiratory ailments. They are not harmful when discharged into an appropriate drain.

LOCATE AND INSTALL THE "INSTALLATION PACKAGES"

Installation packages from Radiantec have important advantages:

1. They are pre-assembled, pre-tested and pre-engineered.
2. They save an enormous amount of running around and site work time.
3. They are economical because of Radiantec buying power.
4. They help ensure code compliance.
5. They give a neat appearance to the work.
6. Radiantec technicians can easily trouble shoot any problems.
7. Professionals like them because they save time and money.
8. The packages are perfect for DIY's because the highly skilled part is done for them.

Your zone distribution manifold (ZDM) will look like this once installed.

THE ZONE DISTRIBUTION MANIFOLD (ZDM)

The Zone Distribution Manifold (ZDM) is the place where the heated fluid from the heating device branches off to the various heating zones.

A heating zone is any area whose performance is controlled by one thermostat. A heating zone may have any number of circuits or individual loops of tubing. Each heating zone will have a one way valve to prevent one zone from back flushing an adjacent zone.

Note: Radiantec Company prefers to use individual pumps for each zone instead of one large pump and individual zone control valves. If one large pump is used with individual zone controls, that pump must be large enough to provide adequate flow when all zones are called for. And yet, only one or two zones at a time will usually be calling for heat.

The result is a constant waste of electricity and in extreme cases, the possibility of what is called "erosion corrosion," where excess flow physically wears out components. Individual pumps provide safety if one pump fails. If you only have one pump, and that one pump fails, you have a much more urgent situation.

The Zone Distribution Manifold consists of several components. The first is the manifold itself which is shipped in its own wooden crate.

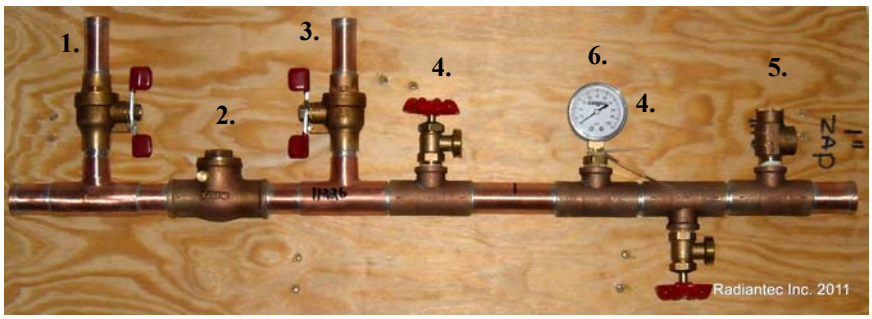
Another component is an "extras" package which includes all of the mounting hardware for the ZDM plus some other miscellaneous components. The extras package includes the digital temperature display, several 3/4" and 1" bell hangers, two end caps, extra pump gaskets, bolts and nuts for the pumps, (2) 1" elbows and a pressure testing plug. You can see a picture of these items on page 5.

All of these components will be in one box marked "extras package" and will be located in the box containing your pumps and controls (this is usually the box that has the packing slip; the shipping label will also describe the contents of the box).

THE ZONE ACCESSORY PACKAGE (ZAP)

The ZAP is a unique plumbing apparatus that takes the most difficult plumbing out of the equation for the installer. The Direct System, while it is simple, can be installed incorrectly by people that don't follow the instructions. This kit minimizes the likelihood that an installer will do the work incorrectly.

The ZAP comes in a narrow wooden box. The shipping label will describe the item so you can look for that description if you are unsure.



1. **Hot water to fixtures port.** The hot water that feeds all of the fixtures in your house should come off of this connection.

2. **Check valve.** This is to ensure that when hot water at the fixtures is consumed, the cold make-up water travels in the proper direction.

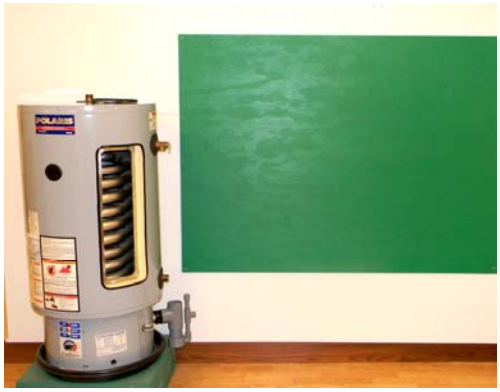
3. **Cold water from main.** The cold make-up water that feeds the water heater connects here. **DO NOT** connect the cold water from the main directly to the water heater! This is a very important safety feature that ensures the water in your system stays fresh all year long, even when you're not using the heating system.

4. **Drain valve.** Can be used to drain the system for maintenance.

5. **Pressure relief valve.** This is a spring-loaded valve that is designed to open whenever the pressure in the system goes above a certain point. The pressure relief valve is a very important safety device. It protects the system and the tubing from catastrophic rupture in the event that everything else fails. It must be open to the atmosphere at all times. It must never be plugged or capped. It should be located such that if it were to open, the vented fluid, which might be very hot, would go to a safe place. This valve must never be removed for any reason. Even though the water heater also has a pressure relief valve, its purpose is to protect the heater and is set much higher than the rating of the tubing in the system.

6. **Pressure gauge.** Displays the pressure within the system.

INSTALL THE MOUNTING PANEL AND MOUNTING BOARDS (not provided)



Before you install any of the mechanicals, we advise that you install a "mounting panel" on the wall that the mechanicals will mount to. This is simply a piece of ¾" plywood or OSB that you provide (you can use ½" if you will secure it to a framed wall) and can be cut to different sizes depending on how many zones you have.

For example, the mounting panel for a 2 zone system should be 4' tall and at least 4' wide (wider is ok as shown in the picture where the board was cut at 4' tall x 5' wide). For every zone above 2, add at least 6 more inches to the width. The edge of this mounting panel should be roughly even with or beyond the edge of the heater.

Next, at least 6" down from the top of the heater, you need to install a 2 x 4 at least 38" long (longer is ok). This piece is necessary because the pumps would rub against the mounting panel without it, creating the potential for vibration and noise. Again, this is for a 2 zone system and you should add at least 6" to this board for each zone that you add. Be sure to use a level.

You will also need another short piece of 2 x 4 at least 12" long (again, add 6" or so for every zone that you add) which you will install a little later.

INSTALL THE ZONE DISTRIBUTION MANIFOLD (ZDM)

1. Take apart the box with a Phillips head screwdriver and open the stainless steel clamps to release the copper manifold assembly.

2. Lay out everything to familiarize yourself with the parts and see if everything is there. Please note that these instructions show the installation of a 2-zone system. You should have:

3. Separate the supply manifold from the return manifold by cutting at the black marks between the ball valves. The supply manifold will be the one with the isolation pump flanges. The return manifold has a ball valve for each zone.

4. The supply manifold will get one bell hanger per zone because of the added weight of the pumps. Connect the bell hangers to the ZDM (leave them loose as you will need to remove them). You will receive the exact number necessary for your particular installation. If you feel that you need more, simply phone us to order them; there will be an additional charge, however.

Next, put the manifold up to the mounting board and mark the location of the bell hangers. Be sure to use a level! The manifold should be located so that it is at the end of the mounting board and the top of the bell hangers should be flush with the top of the board.

Once the bell hangers are marked, take them off of the ZDM and screw them into the mounting board. Then, put the manifold in place and slightly tighten the hangers around the manifold. You will initially leave these a little loose so that the ZDM can swing towards you during a future installation procedure.

5. Separate the pump flanges by backing off the nuts that connects them, install two of the oblong pump gaskets (one on the top and one on the bottom) that came in your extras package (discard the round o-rings that may have come with the pumps), and secure the pumps to the manifold using the bolts that came with your package (two held the flanges together, there are more in the extras package). If your pumps came with check valves, you can remove them at this time because the ZDM already has one built into every zone.

Be certain that the pumps are turned roughly at a 45 degree angle with the electrical box facing out (see photo). This will allow you easy access once it becomes time to wire them to the relay box. Also, the pumps should be installed in the order of smallest to largest in relation to the heater. This minimizes the likelihood of a large pump "starving" a smaller pump if they both come on at the same time. There are arrows on the back of the pump to indicate direction of flow. Be sure they are pointed up.

6. Now that the pumps are in place, it is time to install the top mounting board that was mentioned earlier. This board should be at least 12" long for a 2 zone system. Loosely attach the ¾" bell hangers to the ¾" stub of copper that is coming out of the top of the pump. Next, swing the ZDM up into place to mark the spot for the mounting board.

Swing the ZDM back down out of the way and mount the board to the mounting panel with screws and be sure to use a level. Once again, swing the ZDM back up and mark the location of the bell hangers. The bell hangers can now be taken off of the copper stubs and secured to the mounting board with the screw. Once this is done, swing the ZDM up one last time and secure it to the bell hangers. You can also tighten the 1" bell hangers on the trunk of the ZDM.

7. The return manifold can now be installed and it can be located virtually anywhere. It can be located directly below the supply manifold, offset (as shown in the photos), or even across the room if necessary; you will just have a longer run of copper or PEX to get back to the water heater. This header will get only two bell hangers regardless of how many zones are present.

8. Prepare the end caps for soldering (clean and flux) and slide them over the end of both the supply and return manifolds.

INSTALL THE ZONE ACCESSORY PACKAGE (ZAP)

There may be other ways to install the ZAP but our experience shows that this is the best arrangement to minimize the likelihood of thermo-siphoning (the natural flow of hot water from a lower place to a higher place). Please consult with Radiantec technicians if you want to alter this plumbing arrangement.

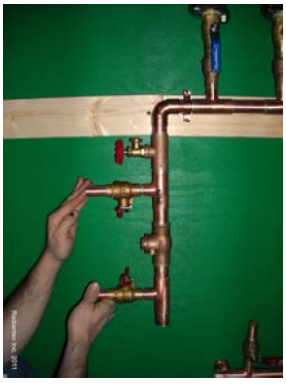
1. Take the ZAP out of its shipping crate and use a pipe cutter to separate the supply portion from the return portion by cutting at the black mark (they are soldered together for shipping and testing purposes). The pressure caps can either be cut off or removed by heating them at this time.

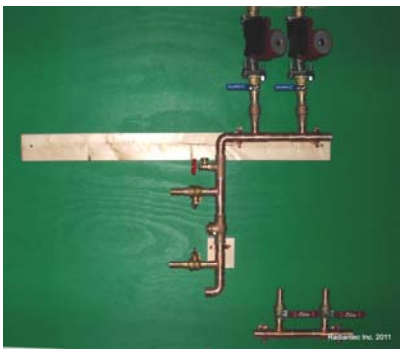
Supply Side Zap

Return Side Zap

2. Prepare the copper elbows for soldering (clean and flux) and insert them over the ends of the supply ZAP.

3. Slide the supply portion of the ZAP onto the supply side of the ZDM. If it's a tight fit, the ZAP will be suspended there on its own. If not, you will need an extra set of hands. Next, cut a 2" x 4" into a 4" x 4" block and mark it where a bell hanger can be attached to the ZAP. This will hold the ZAP in place so that it can be soldered. Screw the block to the mounting board, attach the bell hanger to the block, and connect the bell hanger to the ZAP. Be sure to use a level!





4. Prepare the 1” copper coupling for soldering and slide it over the return portion of the ZDM. Next slide the return portion of the ZAP into the ZDM.

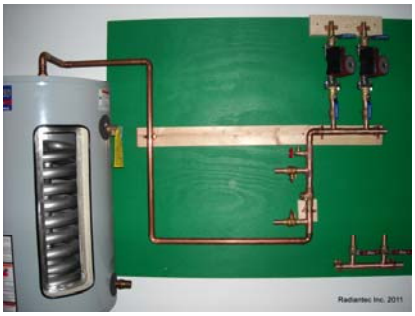
HOOK EVERYTHING TOGETHER AND PRESSURE TEST

When you connect from the water heater to the PMP and then to the ZDM, and back again, select the copper tubing size based upon the rate at which water will flow through the tube. The same size pipe should be used for the return line from the ZDM back to your water heater.

Use 3/4” tubing for up to 8 gallons per minute.
Use 1” tubing for up to 16 gallons per minute
Use 1 1/4” tubing for up to 25 gallons per minute.

If you are in doubt, give us a call and we’ll be happy to assist you.

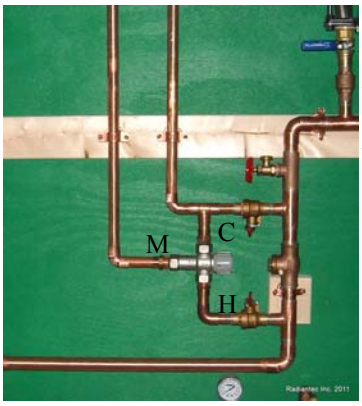
Screw a 1” female threaded adapter to the port on the top of the Polaris water heater labeled “hot water out.” Be sure to use thread compound or teflon tape on the threads. Now run copper to the supply header of the ZAP and connect to the 1” copper elbow. You can use one of the bell hangers to help hold the vertical pipe to the mounting board.



Please note in the pictures how the ZAP and ZDM are mounted below the top of the heater. This creates a heat trap which reduces the chance of thermal siphoning as referenced earlier.

The return header can connect into either one of the two bottom ports on the tank using the same detail as above; one is labeled “cold water inlet” and the other is labeled “heating system return.” Since all of the ports access the same body of water, either port will work equally well. The port that is not used should be capped with a 1” bronze cap. You will also need to cap the port labeled “heating system outlet.” If you are using a heater other than the Polaris, this return should go into the port labeled, “cold water in.”

If the water heater will ever be set higher than 120° F., a mixing valve will be necessary. A mixing valve takes the hot water from the tank and mixes in some cold water to give you a desired temperature ≤ 120° F. **which is an important safety consideration**. If a Polaris water heater will be used, a mixing valve is provided



If you look at the valve, you will notice one port labeled H (hot), another labeled C (cold), and the last M (mix). All you have to do is plumb the appropriate pipes into the valve. The H will connect to the copper pipe coming out of the water heater. The C will connect to the cold water line that is feeding the system. The M will now feed all of your domestic hot water fixtures. A completed installation can be seen to the left.

Do you need an expansion tank?

Before you fill the system, be sure that there is a way to accommodate expansion and contraction of the hot water in the system. When water is heated, it will increase in volume. This will raise pressure in the system if there is no place for it to go. A small amount of water must either go backwards to the source, or go into an expansion tank. If there is no way for a little bit of water to flow backward, it will be necessary to install a potable rated expansion tank. The pressure relief valve is a safety valve that is not meant to be operated daily to relieve system pressure. A backflow preventer, a check valve or a pressure reducing valve installed on your cold water main will prevent water from flowing backward and will also require that a potable rated expansion tank be installed. This expansion tank should be located somewhere between the device and the ZDM.

PRESSURE TEST

It is a good idea to pressure test your work with air before you put it in service. You may also want to pressure test your work as you go. You will simply cap off the unfinished plumbing and then remove the cap once the test is done. If a leak is detected, you have a better idea of its location. Air will leak in places where water will not. If the system passes the air test, you know that the system will not leak water.

Radiantec provides you with an air stem that is threaded into a hose attachment for convenient pressure testing. The hose attachment with air stem can easily be attached to either of the drain valves. We recommend using the drain valve on the supply header so that the one way valves do not prevent air from going to all areas of the system. After filling the system with air, close the shutoff valve as the pressure testing plug may not be air tight.

Since the pressure relief valve is preset at the factory for 75 psi, you will need to adjust the valve if you plan to pressure test above this level (some codes dictate a pressure test at 100 psi). To do this, unscrew the cap on the top of the valve. Next, take a common screw driver and turn the inside of the valve clockwise to raise the pressure or counter clockwise to lower it. If an expansion tank is in place, it should be removed at this time as the pressure test could rupture the internal bladder.

Now you can add air with anything that will blow up a tire. Watch the pressure gauge. You should pressurize up to at least 75 psi or to whatever is mandated by your local codes.

Never plug a pressure relief valve because of the slight chance that you may forget to unplug it. Check the pressure after a couple of hours; there should be virtually no drop in pressure. If all is well, leave the tubing pressurized over night.

The next day you may find that the pressure has dropped a few psi. This is normally explained by cooler temperatures and the air in the system contracting a little bit. If the pressure drop is greater than this, you may want to test the system again at a higher pressure.

Find any leaks with a diluted dish liquid solution. Patience and diligence at this time will pay itself back with many years of trouble free operation.

Once your test is complete, let the air out by backing off on the screw of the pressure relief valve. Set the pressure relief valve to 75 psi. Refer to the pressure gauge. In particular, refer to the temperature and pressure ratings of the plastic heat exchanger tubing. Let the rest of the air out with a drain valve. The air will come out once you remove the test plug.

Now you are ready to fill the system.

FILL THE SYSTEM

The Open/Direct System can be filled and flushed by opening any domestic hot water faucet in the building. You may also turn on the circulating pumps for additional flow. The most common cause of poor performance in hydronic systems is failure to get the air out. Circulating pumps will not pump air. Enough air in one zone or circuit will cause the water to go in another direction and leave that portion of the heating system "starved" for heating fluid.

When building the system, make sure that you design enough shut off valves so that you can make the water flow only one way. If there are two or more ways for the heating fluid to go, it will take the easiest way, and the air bubble may not be forced to move.

Close off all of the zones except one by turning the ball valves on the ZDM. Next, in the zone that is open, close off all of the runs of tubing except one. Now, turn on any domestic hot water faucet. You may also turn on the circulating pump for additional flow. Water will begin to flow into the open zone and circuit. The first circuit of the first zone will take the longest to purge because the entire distribution system as well as the heater will be filled at this time.

After a while, water will begin to flow out of the hot water fixture in sputtering bursts. Allow the flow to become smooth and continuous for at least 3 minutes. Air can sometimes be trapped in a bend in the tubing and it sometimes takes several minutes to remove it. Once you feel all of the air and debris are removed from the circuit, open circuit number two and close circuit number one. Repeat the same procedure as above for all other circuits as well as all other zones. **You may have to repeat this process a few times to get all of the air out, but once the air is out, it does tend to stay out.**

When you believe that all of the air and debris are purged from the system, close the hot water faucet and let the incoming water pressurize the system. System pressure should rise immediately. If not, significant air remains in the system and the air is acting like an expansion tank. Continue to isolate and purge as needed.

Now you are ready to fire up the heater and attach the controls to the pumps. We will discuss controls in another section.

MAINTAIN POTABILITY

The installer must understand and keep in mind at all times that the water that flows through the heating loops is **potable** and must be kept that way. In particular, no material that is not potable rated shall be introduced into the system and no portion of the system may be allowed to become stagnant during any time of the year.

TROUBLESHOOTING

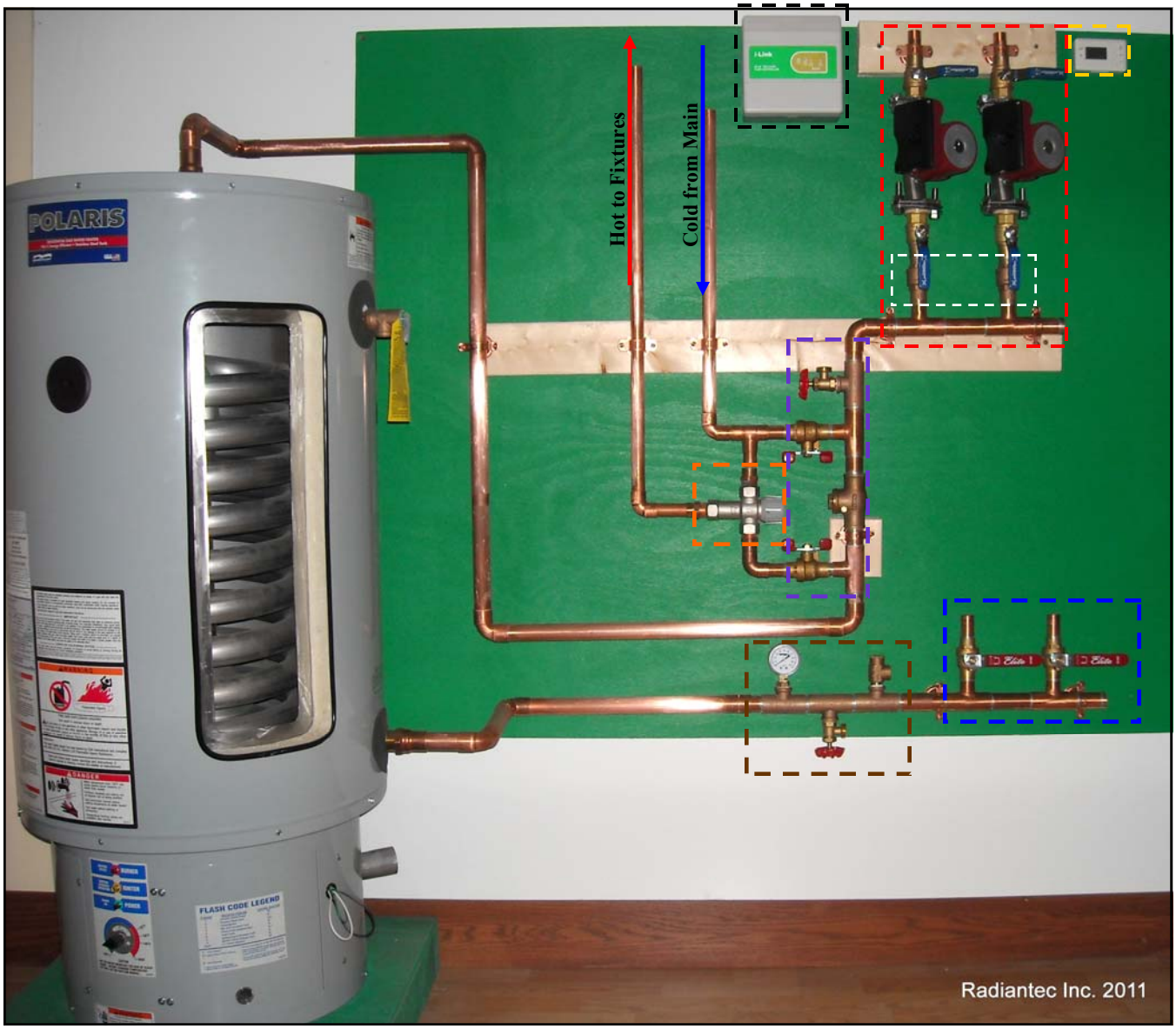
1. When the thermostat calls for heat, the pump should come on and circulate the heating fluid throughout the system. The pump may be very quiet and hard to hear.
2. The heating unit should come on and make hot water. If not, the heating zone may not be putting out any heat. If the heating unit is running constantly, it is either too small for the purpose or not putting out its rated output.
3. The heating fluid coming out of the zone should be about 10-15 degrees cooler than what it when in at. This is ideal, but many systems run satisfactorily with different temperature drops. If the water seems to be coming out cold, suspect that it is not flowing at all. If the water is coming out of the system with a 10-15 degree temperature drop, the system is running well, unless it is air bound.
4. When you have no flow, suspect air in the system. That is the number one cause. Note that when domestic hot water is consumed, the cold water that replaces the hot water will pass through the tubes in the floor on its way to the bottom of the water heater. There are several important reasons for this flow pattern and elimination of air is one of them. If this detail is not done, the heating system will not work properly.
5. Verify that flow through a section of tubing is possible with a garden hose. If flow is blocked, consider a check valve in backwards, or debris in the tube or a kink in the tube. All of these are very rare. If you have respected the minimum bending diameter of the tubing, there is no kink. You can back flush by removing the pump.
6. A pump that is spinning but unable to circulate the fluid because of air or a blockage will generate a great deal of heat by friction. This could give the illusion that hot water is flowing when it is not. You need to feel the temperature of the pipe farther away from the pump.
7. The return pipe may feel warm from conduction from other pipes that are operating even if the water in that zone isn't flowing properly. Again, feel the temperature of the pipe farther away from the other pipes.
8. If you can make water flow well with a garden hose but you cannot make it flow with the pump, the problem is either the pump or air entrapment. Is the pump in backwards?

95% of the time, the problem is trapped air.

TOOL LIST

1. Installation packages (Zone Distribution Manifold) and Accessory packages
2. Phillips and flathead screwdrivers, drill attachment (optional)
3. Drill with 1/8" bit
4. Soldering kit
5. Pipe cutter
6. Screws to attach plywood to the wall
7. Screws to attach wall brackets and hang 15 pounds
8. Two adjustable wrenches.
9. Pressure testing equipment

Important notice *- These design and installation suggestions are of a general nature and they are based upon our 30 plus years of experience. It is important to understand that every project is a little different. It is the role of the designer to incorporate all available information into the project. Radiantec makes no representation that these general suggestions are applicable to any particular project. Radiantec takes no responsibility for the design of any heating project. Radiantec makes no representation about the completeness of the information provided. It is important to comply with all building codes.*



- Mixing Valve
- Digital Temperature Display
- Relay Box
- Check Valves
- Supply Side ZAP
- Return Side ZAP
- Supply Side ZDM
- Return Side ZDM

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