Filling and Bleeding a Boiler System with Radiant Tubing Manifolds.

********** IMPORTANT **********

It is highly recommended that these instructions be read in their entirety before beginning this procedure.

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- First thing to consider is the normal direction of water flow through the system. Check and note the direction of flow of the system by looking at all the pumps and zone valves in the system. The pumps and zone valves will have an arrow cast into the side of their body indicating the direction of flow through the pump/zone valve.
    - It is very important to push/direct the water in the correct direction.
    - Some boilers have pumps built into their internal system so be sure to check them for direction of flow also.
    - The boiler may not have an internal pump but still may have a recommended direction of flow through the boiler.
    - Many boilers have flow switches in them, pushing the water backwards through these boiler types may damage the flow switch.

****** Refer to the boiler installation manual for direction of flow *******

    - Motorized zone valves have a gate type valve and they allow water to flow much better if the water is flowing in the right direction.

- One method to help you better 'see' the direction of flow is to use a marker and make arrows on the pipes to indicate flow direction.

- Before proceeding ensure that the system is totally piped and every zone is completely hooked up.

- If the system is not totally piped and/or every zone is not completed and hooked up then you will need to isolate the zone or zones not yet completed.

    - If there are valves on both the supply and return side of the control panel manifolds, the isolation can be accomplished by simply turning these valves to their off position.

- Sometimes the control panel manifolds will only have valves on the return side. In this case the zone valve can be used to for isolation purposes.

- For filling and bleeding a system with incomplete zones that use spring type zone valves, the zone valve cannot be used for isolation purposes, as they will not stop the flow of water adequately.

- If you find you have the spring type zone valve, other provisions will have to be made, depending upon how the Supply and Return (S & R) lines to the remote zone manifolds are piped. There are a few methods you can use to rectify your situation:

    - If the S & R lines are piped in Copper then a simple Copper Cap sweated onto the end of the Copper piping will work.

    - If piped in Kitec tubing, similarly, a test cap can be installed on the end of the tubing. Another solution is to use a coupling to join the ends of the tubing together and create a loop.

    - Another solution is to have a small loop of tubing connect the supply side outlet of the control panel manifold to the corresponding return side of the control panel manifold.

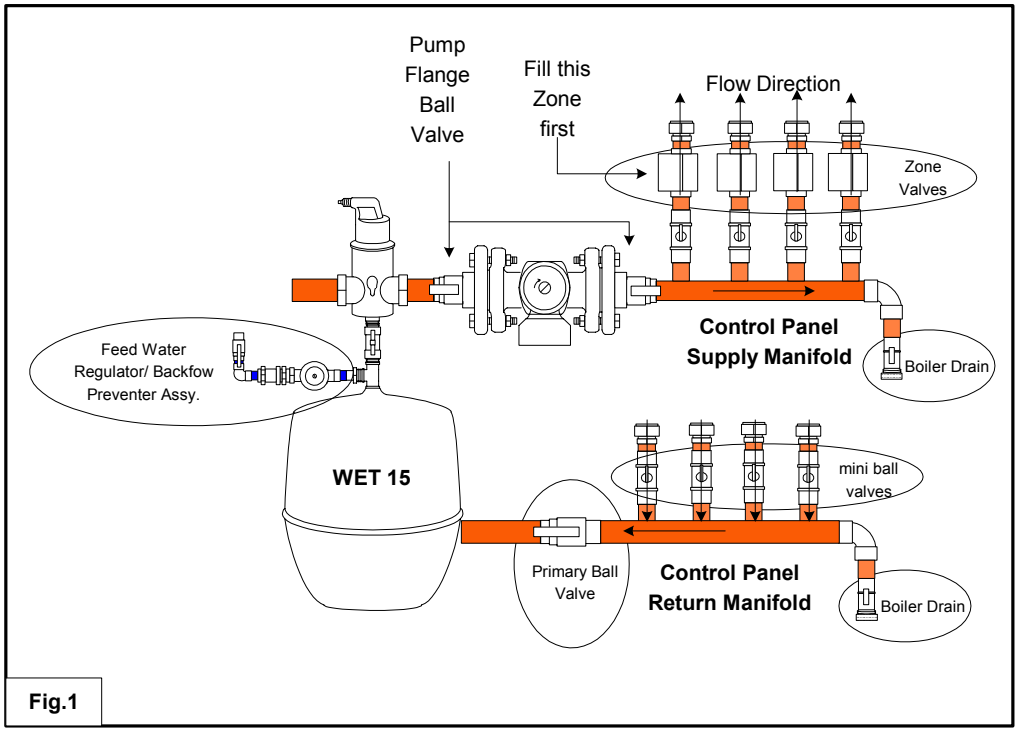
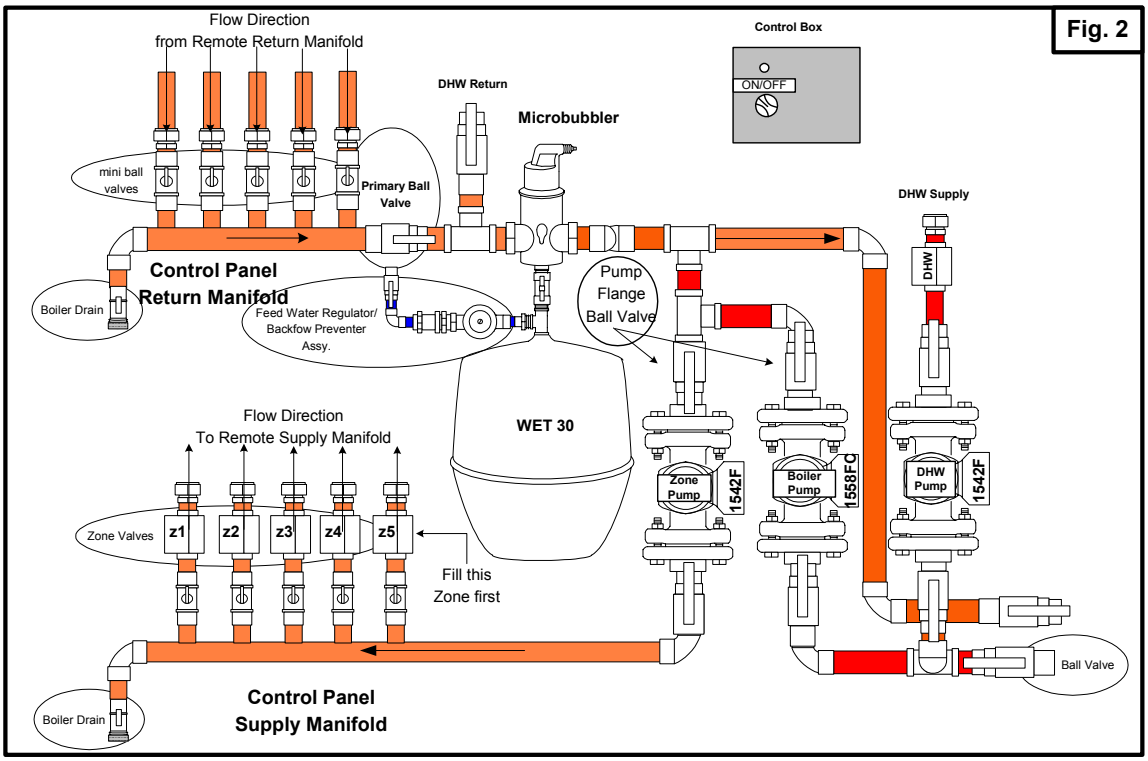


Fig.1



NOTE: While your control panel may not look identical to the control panels shown in Fig. 1&2, you will have all the components referred to in these directions. In any event, read and follow these instructions fully for a successful fill/bleed operation.

- Now that we have created a closed loop system you need to consider where the supply water is going to come from. Usually there are two choices:

    - The water supply can come through the feed water regulator/ backflow preventer assy. When filling from here you will need to close any ball valves located on the control panel in order to push/direct the water through the control panel S&R manifold zone(s) that you will be bleeding and not into the boiler side of the system.

    - Another option is to use a garden hose as a temporary water supply until a permanent water supply is established. The garden hose is connected to the boiler drain on the end of the control panel supply manifold. A washing machine hose with double-ended female fittings is required to make the hose connections.

- Now that we have a water supply we need to have a drain to bleed air and water to.
    - Attach a garden hose to the boiler drain on the end of the control panel return manifold.

    - It is highly recommended that you fill the heating zones first.

    - Fill the zone nearest the boiler and furthest from the boiler drain that your garden hose is connected to first (fig.1&2). This will keep air from back feeding into the system when the next zone is bled.

    - You will need to trace and direct the flow of supply water to get it to the zone valve. This can be accomplished by shutting the ball valves located on the pump flanges.
      Make sure the water always goes through your system in the same direction that the water will normally flow when operating.
      Close any Valves that would let the water go someplace other than through the control panel supply manifold zone valve.

- Now that we have a complete path for the water supply through the zone valves we will need to isolate a drain location.

    - Close the primary ball valve on the control panel return manifold indicated in fig.1. Close all the mini ball valves (fig.1&2) located on the control panel return manifold, except for the one that you are attempting to bleed and fill.

    - Double check the path of your supply water ensuring that it flows from the feed water regulator or boiler drain hose connections, through the piping to the control panel supply manifold zone valve, out to the remote zone manifolds, back to the control panel return side manifold, and out the garden hose to the drain.

    - The boiler drains that the garden hose's are connected or the feed water regulator should be opened at this time.

    - If the path of the water has to go thorough the boiler it must flow in the normal direction. ***Refer to the boiler installation manual for direction of flow.*** Boilers have pressure relief valves in them usually set to between 30 & 45 psi. Given that the head pressure generated by the tubing connected to the remote zone manifolds could be high, and the house supply water pressure could also be high, you will have to monitor the pressure gauge on the boiler and adjust the supply water pressure accordingly so as to avoid expelling water through the pressure relief valve located in the boiler. If the boiler does not have a drop tube attached to the pressure relief valve to direct the overflow of water, now would be a good time to install one. ***Refer to the feed water regulator literature for directions on how to adjust the delivery pressure***.

- Make sure all the zone valves are in the closed position.

- Manually open the zone valve for the zone you are attempting to fill and bleed. Open the zone valve by slowly and carefully pushing the silver lever on the end of the zone valve to the right until it catches in the detent molded into the plastic body. If you are too aggressive in opening the zone valve manually you run the risk of stripping the nylon gears inside the zone valve motor housing and the valve may not close properly when the filing/bleeding procedure for that zone has been completed.

- Now you will need to check the remote zone manifolds that the radiant floor tubing is connected to.

    - Be sure that all the valves on the remote zone manifold are in the fully open position to allow for proper filing/bleeding of the system.

    - If there is a balance loop in the zone you are filling/bleeding (a loop that is more than 25% shorter than the other loops in that zone) you will begin by filling that zone first. After the water has run through the tubing for a bit you will isolate this loop by closing the mini ball valve on the supply remote zone manifold for that particular loop of tube. Continue this process until all the loops serviced by the remote zone manifolds have been filled and bled of all the air.

    - If you have trouble bleeding the air out of the out of a circuit of tube, you may want to close all the valves on the remote zone manifold except one, then you can fill/bleed and isolate each loop individually. This is a more time consuming process and will increase the head pressure dramatically so if the water flows through the boiler keep an eye on the pressure gauge and adjust the supply water pressure accordingly so as not to blow/pop the relief valve.

- Now you are ready to fill/bleed the first zone

    - Gradually open the feed water valve (refer to the instructions for your particular feed water valve) or the boiler drain valve on the end of the control panel supply manifold to allow water to flow into the system. Open any and all valves with a gradual smooth motion. Remember to keep an eye on the boiler pressure gauge if the path of water flows through the boiler.

    - Now is the time to start looking for any possible leaks in the system. If you observe a leak shut off the supply water immediately. Try to isolate the leak if possible with the valves and look at the water path to see if you can drain this part of the system enough to repair the leak. Leaks that require soldering can be very hard to repair unless all the water has been drained from the repair area.

- When you are confident that there are no more leaks and the path the water is taking is correct, you can just watch and listen to it run for a while.

- Sometimes a leak won't show up until the loops in the zone are full of water and pressurized, or sometimes not even until the system is up and running hot water throughout so keep an eye out for leaks for the first day or two while the system is stabilizing.

- The object is to get 'all' the air out of the loop/zone.

    - 'All' is a relative term. You may only get 95% of the air out of the system because tiny micro bubbles will have a tendency to stick to the inside of the tubing. These will be removed automatically over time via the air removal mechanism (micro bubbler) built into your system. <u>This is why it is important to have feed/make up water supply completed prior to running the system.</u> As the air is removed through the micro bubbler the feed water regulator assy. allows makeup water to enter the system, which will automatically maintain the set level of water pressure in the system.

    - The best way to tell if you have all the air out of the system is to look, listen, and feel the garden drain hose. You should be able to notice if the water running out of the hose is still purging air from the system. Another method is to drain the hose into a bucket so you can observe the flow exiting the tube and tell if there are any air bubbles left in the stream of water exiting the hose. You may want to place the bucket outdoors in case of overflow.

- Once you have the air out of the loops/zone the system will be full of water and can now be pressurized.

    - First close the boiler drain valve at the end of the control panel return manifold where the garden hose drain is attached.

    - Then close the mini ball valve on the control panel return manifold that corresponds to the zone just filled and bled.

    - Close the mini ball valve on the control panel supply manifold that corresponds to the zone just filled and bled.

    - Finally close the zone valve by carefully raising and releasing the lever from the detent.

    - This zone is now pressurized to the level previously set at the feed water regulator, as well as isolated from the remaining zones.

- Using the same procedure you can move onto the next zone in line and fill/ bleed and pressurize this and each zone successively.

- When you feel confident that all the air has been purged from the system, close the boiler drain valve that the drain garden hose is connected to. Close all the mini ball valves and zone valves on the control panel S&R manifolds for the last zone filled.

- Remember to check the system for leaks occasionally!

- Now that the manifold/ zone side of the control panel has been filled/bled, the remaining side(s) of the system can be filled/bled. Try to use the same drain point for this part that you did when filling/bleeding the manifold/zone side of the system. If you have domestic hot water on the panel you may have to use another drain point. Keep in mind that the process is still the same. You want to open only those valves that will allow water to flow through this part of the system, while keeping all other valves closed so as to isolate and keep pressurized that part of the system that has been previously filled/bled.

- Before filling the boiler side of the system, double check to make sure that the water is flowing in the right direction through the boiler. When filling/bleeding is complete, be sure to close the drain valve first, then all remaining valves. Finally, remove the garden hose(s) from the boiler drain(s), once again ensuring that all valves are closed before doing so, and replace the boiler drain drip caps.

Congratulations. Your heating system is now filled, bled, and pressurized.

- You can continue to ready the boiler for operation or if you are going to add a corrosion inhibitor you can add it at this time.

    - To add the corrosion inhibitor you will need a small utility electric pump, one double ended washing machine hose, a five gallon bucket, 2 other hoses (one can be a full length garden hose, the other will need to be a short section of garden hose with only one end fitting so you can stick it in the bottle of corrosion inhibitor and pump it into the system.

******* You can also use this method to initially fill/bleed your system. *******

- The input side of the pump gets the short section of garden hose attached to it. This will pull fluid from the bottom of the five-gallon bucket. The output side of the pump will need to be connected to one end of the double-ended washing machine hose. The other end of the hose will get connected to the control panel supply manifold boiler drain. The longer section of garden hose will get connected to the control panel return manifold boiler drain and be run back into the five gallon bucket. Now you need to isolate the control panel manifolds from the rest of the system by closing the primary ball valve (fig.1&2) and the ball valves on the pump flanges (fig.1&2).

Remember that the system is full, bled of air, and up to pressure. During this process try not to introduce any air into the system or you will have to bleed it off again.

- The next step will require doing two things at once.
    - Priming the pump and bleeding off the pressure in the heating zones. To do this you will first need to manually open and lock in the open position all the zone valves on the control panel supply manifold.
    - Then open the mini ball valves on the control panel return manifold.
    - Finally open the boiler drain on the end of the control panel supply manifold. This will allow the pressurized water in the zones to run backwards through the pump, which will in turn prime the pump and begin to fill the bucket.
    - Depending upon how large your system is and how much pressure it was under you may have to add more water to the bucket to fill it the rest of the way. Don't allow too much of the system water to drain back into the bucket. The object here is just to relieve the system pressure allowing it to prime the pump, so as the pressure bleeds down you will have to close the boiler drain so as not to drain your system down too much which could introduce air into it.
    - Once the pressure is relieved and the pump is primed you can use the pump to circulate the water and bleed the heating zones if they aren't already bled. As this process is happening you will pump in the corrosion inhibitor.
    - The object of the pump bucket setup is to pull water form the bottom of the bucket where there is no air, push it through the system and allow the air filled water to drain back into the top of the bucket. The hoses can be held in place with a couple of spring-loaded clamps. You can begin now by turning on/ plugging in the pump.
        - Ease the control panel supply manifold boiler drain open.
        - Ease the control panel return manifold boiler drain open to allow the water to drain back into the top of the bucket.

- The setup is now recirculating the water and bleeding the air off to the top of the bucket. After the pump has run for a bit and is circulating the fluid you can open the bottle of corrosion inhibitor and add it to the system. To accomplish this without adding any air to the system you will need to slowly place the opened bottle of corrosion inhibitor vertically upright in the bucket of water. This will allow any air in the bottle to escape and be replaced by water from the bucket. With the pump still running, take the short section of hose connected to the suction side of the pump pulling off the bottom of the bucket, and place it into the bottle. As the pump draws the inhibitor out of the bottle the water from the bucket will fill the bottle.

********** **IMPORTANT** **********

The bottle of inhibitor and suction hose must be kept submerged while in the bucket so as not to introduce any air into the system.

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- To shut the system down you will need to close the boiler drain on the control panel return manifold. This will begin to pressurize the system (keep an eye on the pressure relief valve to ensure that you don't over pressurize the system. If you pop the pressure relief valve you will have water spilling from the valve. Contain the spilled water and proceed to shut the system down as described herein). After a bit you can close the boiler drain on the control panel supply manifold. Once the boiler drain is closed you can turn off/ unplug the pump. The system has now been filled/ bled/ and pressurized again.

- Be sure to release the zone valve levers from their detents so they fully close and open all other valves that were closed, except for the boiler drains of course. Once the boiler is up and running the corrosion inhibitor will be distributed throughout the entire system as it runs.

- You may hear some pinging noises in the pipes as the water runs through the system. This is because there may still be a bit of air in the system. Remember there is an automatic air removal mechanism built into your system so as the system continues to run the air will be bled out and the pressure will be maintained via the feed-water regulator.

- You are now ready to turn on the power to your boiler and system. Remember to check for leaks as the system comes up to temperature.

Sit back and enjoy the relaxing comfort of your new radiant heating system.