



D E S I G N E D T O L E A D

Multiple Boiler Systems Using Aruba 5 and Bali 2 Series Boilers

⚠ WARNING

Improper boiler installation, adjustment, alteration, service, or maintenance can cause property damage, injury, or loss of life. This manual provides supplementary information for the installation of multiple boilers.

- **Boiler installation, operation, and service must be one be in accordance with the manuals shipped with the boiler and all applicable codes.**
- **This manual describes the application of controls by other manufacturers. Those controls must be installed in accordance with the control manufacturer's instructions and all applicable codes.**

The use of multiple residential boilers in small commercial applications is a practice that has been around for decades. It offers several advantages over a single commercial boiler:

- Ease of installation – It may be easier to get two residential boilers into a boiler room than one larger commercial boiler. The need to assemble cast iron sections is also eliminated.
- Built in redundancy - Some heat will be available if one boiler must be shut down for repairs or service. If each boiler is isolated with valves and unions, one boiler can even be completely replaced without shutting down the entire system.
- Ease of service – Residential boilers tend to use parts that are simpler, less expensive, and more readily available than their commercial counterparts.
- Load matching – Sufficient boiler capacity has to be present to heat the building on a “design day”, however for most of the heating season the heating load will be far smaller. Multiple boilers can be turned on individually to provide an output closer to what is actually needed. This reduces burner cycling and improves system efficiency. When done using Aruba or Bali series boilers, this turndown capability is achieved using simple, rugged, cast iron boilers.

There are drawbacks to multiple residential boiler applications that should also be considered:

- The piping and venting systems for multiple boilers are sometimes more complex than they would be for a single large boiler.
- The overall footprint for two residential boilers will likely be larger than for one commercial boiler (when piped as shown on the following pages, however, this may be mitigated by the fact that the two boilers don't necessarily need to be located next to each other).

- Some jurisdictions charge boiler operating license fees based on the number of boilers at an installation. Because the residential boilers are individually certified, and because they can be isolated from each other using shut-off valves, codes will generally classify these installations as a “multiple boiler system” (i.e., a system with two individual boilers), as opposed to a “modular boiler system” (i.e., a system with one “modular boiler”). Licensing fees may therefore be higher.

There are myriad ways to design multiple boiler systems. This manual provides three basic piping and wiring diagrams for multiple boiler systems using two boilers. The following comments are generally applicable to all of them:

- 1) All three diagrams employ primary-secondary piping, where each boiler is on its own secondary (“boiler”) loop. This offers the following advantages:
 - a. No system water flows through the boiler that is not firing. This reduces system heat losses.
 - b. The “residential” pumps supplied with the boiler may be used on the boiler loop and the boiler loop piping can generally be 1-1/4”.
 - c. The system will work if the boiler loops are of different lengths. This means that the boilers can be located wherever there is room for them, as opposed to being located in a fixed relationship to each other.
- 2) Internal boiler wiring is not modified.
 - a. Each boiler, and its associated boiler pump, is cycled on and off using the thermostat connections on that boiler.
 - b. The AWR and BWF boilers have built in auto-reset temperature limits and low water cut-offs. Many jurisdictions will also require manual reset limits and low water cutoffs. When required, these will be needed for each boiler. They are wired in place of the external limit jumper as shown in Figures 1b, 2b, and 3b.
- 3) All of the control systems shown in this manual employ the Taco PC702 staging control. This control varies the target system water temperature based on outdoor air temperature (the colder the outdoor air temperature, the higher the target water temperature). If the system water temperature is significantly below this target temperature, the PC702 will close the thermostat connections of the first boiler. After waiting for the “interstage delay” period to pass, it will then close the contacts on the second boiler if the target system temperature has still not been achieved. Refer to the Taco PC702 instruction sheet for additional details.
- 4) The piping and wiring diagrams shown will work for two AWR (“Aruba 5”) series boilers, two BWF (“Bali 2”) series boilers, or one of each type.
- 5) The boilers do not necessarily need to be the same size. If they are different sizes, however, the rotation DIP switch in the Taco PC702 should be turned OFF. The boiler connected to the “Stage 1” contacts in the PC702 will then always be the “lead boiler” (i.e., the boiler which the PC702 will first try to use to meet the demand. In most cases, this should be the smaller boiler. If both boilers are the same size, the rotation switch should be turned ON. The lead boiler will switch after every 48 hours of run time. This balances “wear” on each boiler.
- 6) Design and size multiple AWR venting systems in accordance with the boiler installation manual and the *National Fuel Gas Code* (NFPA-54/Z223.1). For the purposes of doing this, each boiler is treated as a separate Category 1 appliance.
- 7) Each BWF boiler must be vented separately using the stainless-steel vent system specified in the boiler installation manual.

WARNING

Do not common vent BWF boilers or connect an AWR boiler to a common vent system operating under positive pressure. Doing so could result in personal injury or death from asphyxiation or carbon monoxide poisoning.

Comments on Specific Applications

Figure 1 (Heat Only) – A call for heat from the system thermostat starts the system pump. The PC702 will start each boiler as needed (see description above and Taco installation sheet) by closing the space heating thermostat connections for that boiler. The boiler's circulator will start and the boiler will fire after completing the thermal purge described in the Operation section of the boiler manual.

Figure 2 (Heating and Indirect Water Heater Connected to One Boiler) – Connecting an indirect water heater to one of the boilers as shown in Figure 2a allows the use of the existing DHW zone control built into the boiler, thus saving a relay. In many cases one boiler will be sufficient to power the DHW load, so there is no reason to ever start the second boiler for a DHW demand. This simplicity does come at the expense of some loss of some boiler redundancy, however.

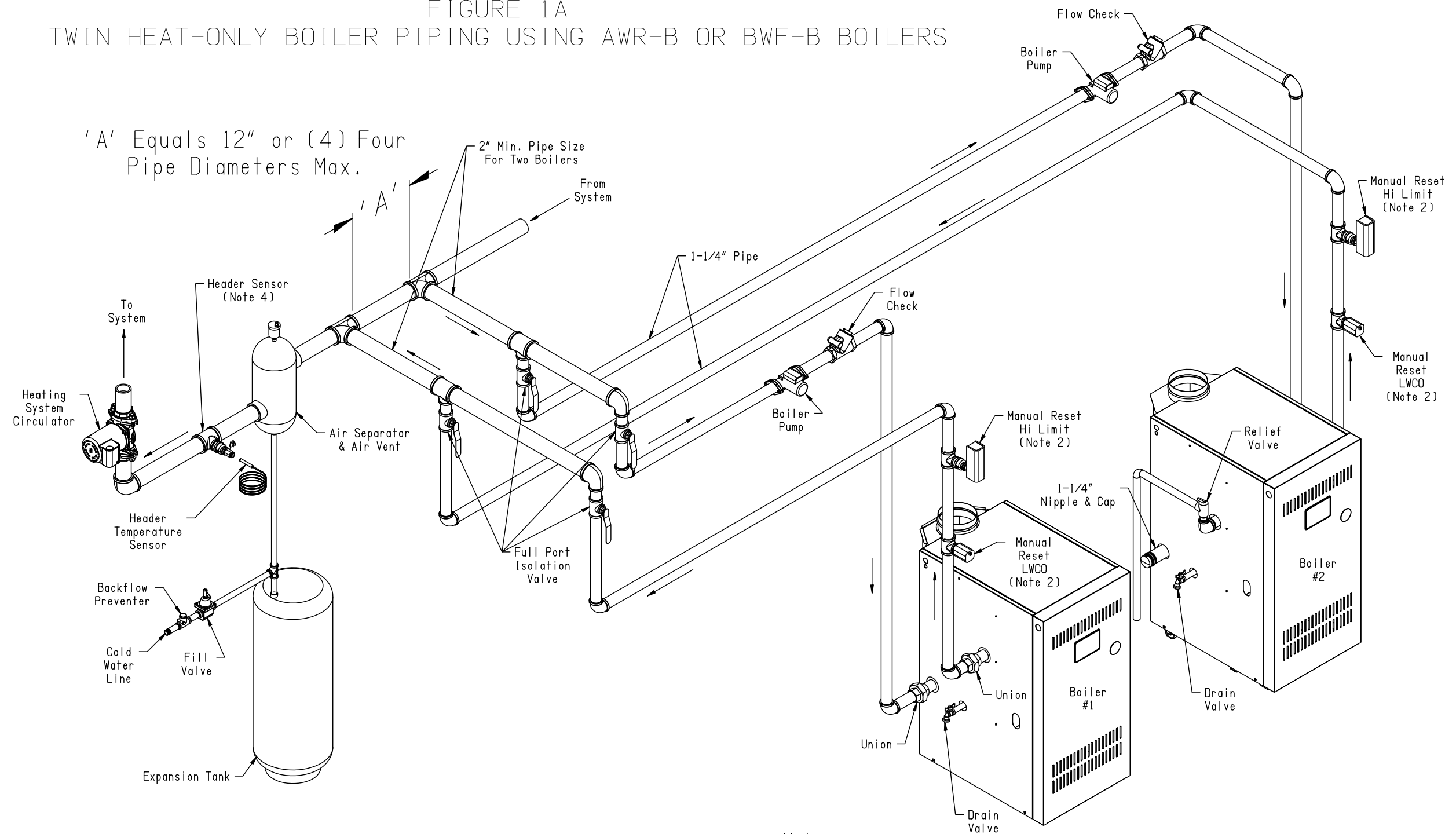
This system responds to a call for space heat in the exact same manner as for the Figure 1 system. A call from the DHW thermostat starts Boiler #1, and the DHW pump, without waiting for the thermal purge. Boiler #1 will then continue firing until the call for DHW ends, or until the boiler's high limit setting is reached. If Boiler #1 simultaneously sees calls for heat from both the PC702 and the DHW thermostat, the boiler will behave as follows:

- If the boiler's priority setting is ON (factory default), the boiler pump will be held off until the call for DHW is satisfied.
- If the boiler's priority setting is OFF, both the boiler and DHW pumps will run simultaneously.

Figure 3 (Heating and Indirect Water Heater Connected to System) – The indirect water heater is connected to the system and calls for DHW are managed by the system zone relay (SR503 in Figure 3b). This allows the output of both boilers to be used for DHW production and also will provide some DHW if either one of the two boilers is down.

When there is a call for DHW, 120V is applied to the "DHW Demand Wires" on the PC702. This defeats the outdoor reset function in the PC702 so that the target header temperature is at least 180F during the call for DHW, regardless of the outdoor temperature.

FIGURE 1A
TWIN HEAT-ONLY BOILER PIPING USING AWR-B OR BWF-B BOILERS



Notes:

- 1) This drawing is intended to show multiple boiler piping only. Other critical systems, such as venting, are not shown. See boiler installation manual and local codes for complete installation requirements.
- 2) AWR-B and BWF-B series boilers have a built in auto reset LWCO and high limit. Consult local codes to see if manual reset LWCO and limit are required.
- 3) Supply and return connections may be made on either side of either boiler (see installation manual for details). Supply and return may NOT be connected to opposite sides of the same boiler.
- 4) If header sensor is used, locate it far enough downstream of closely spaced tees to provide good mixing.

FIGURE 1B

TWIN HEAT-ONLY BOILER WIRING USING AWR-B OR BWF-B BOILERS, TACO PC702-1 & TACO SR501-EXP-4 SWITCHING RELAY

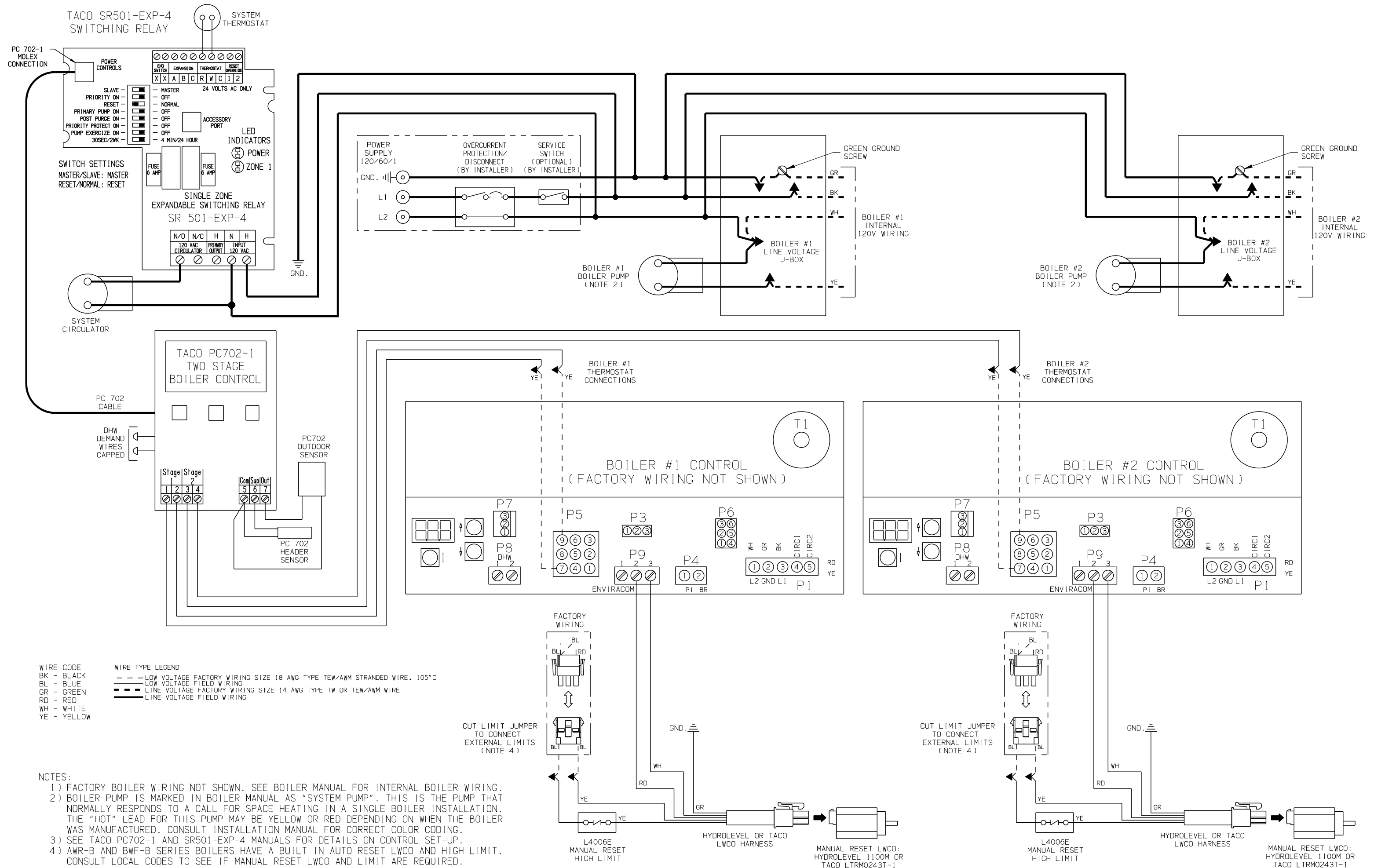
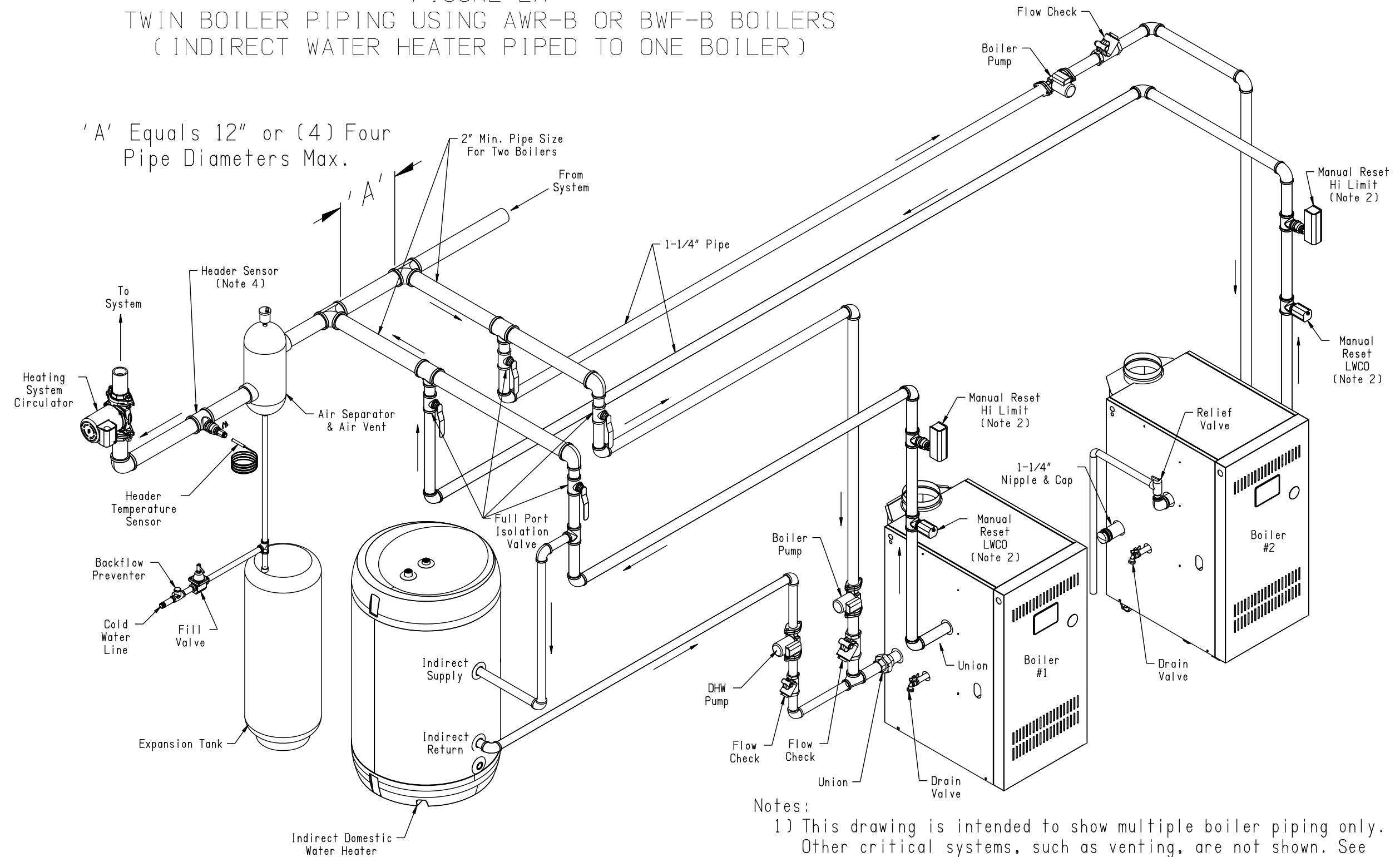


FIGURE 2A
TWIN BOILER PIPING USING AWR-B OR BWF-B BOILERS
(INDIRECT WATER HEATER PIPED TO ONE BOILER)



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- 2) AWR-B and BWF-B series boilers have a built in auto reset LWCO and high limit. Consult local codes to see if manual reset LWCO and limit are required.
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- 4) If header sensor is used, locate it far enough downstream of closely spaced tees to provide good mixing.

FIGURE 2B
TWIN BOILER WIRING USING AWR-B OR BWF-B BOILERS, TACO PC702-1 & TACO SR501-EXP-4 SWITCHING RELAY
(INDIRECT WATER HEATER PIPED TO ONE BOILER)

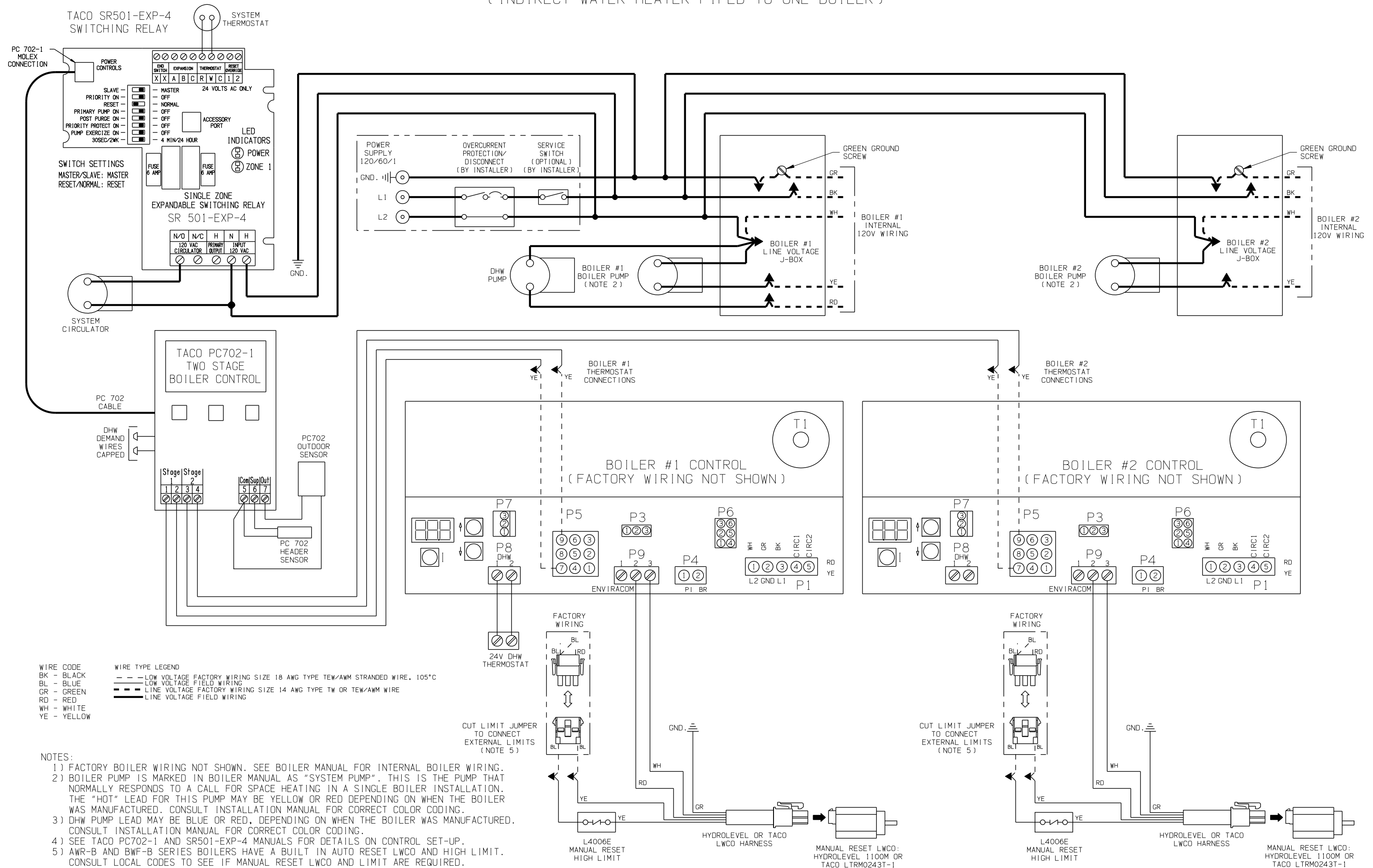
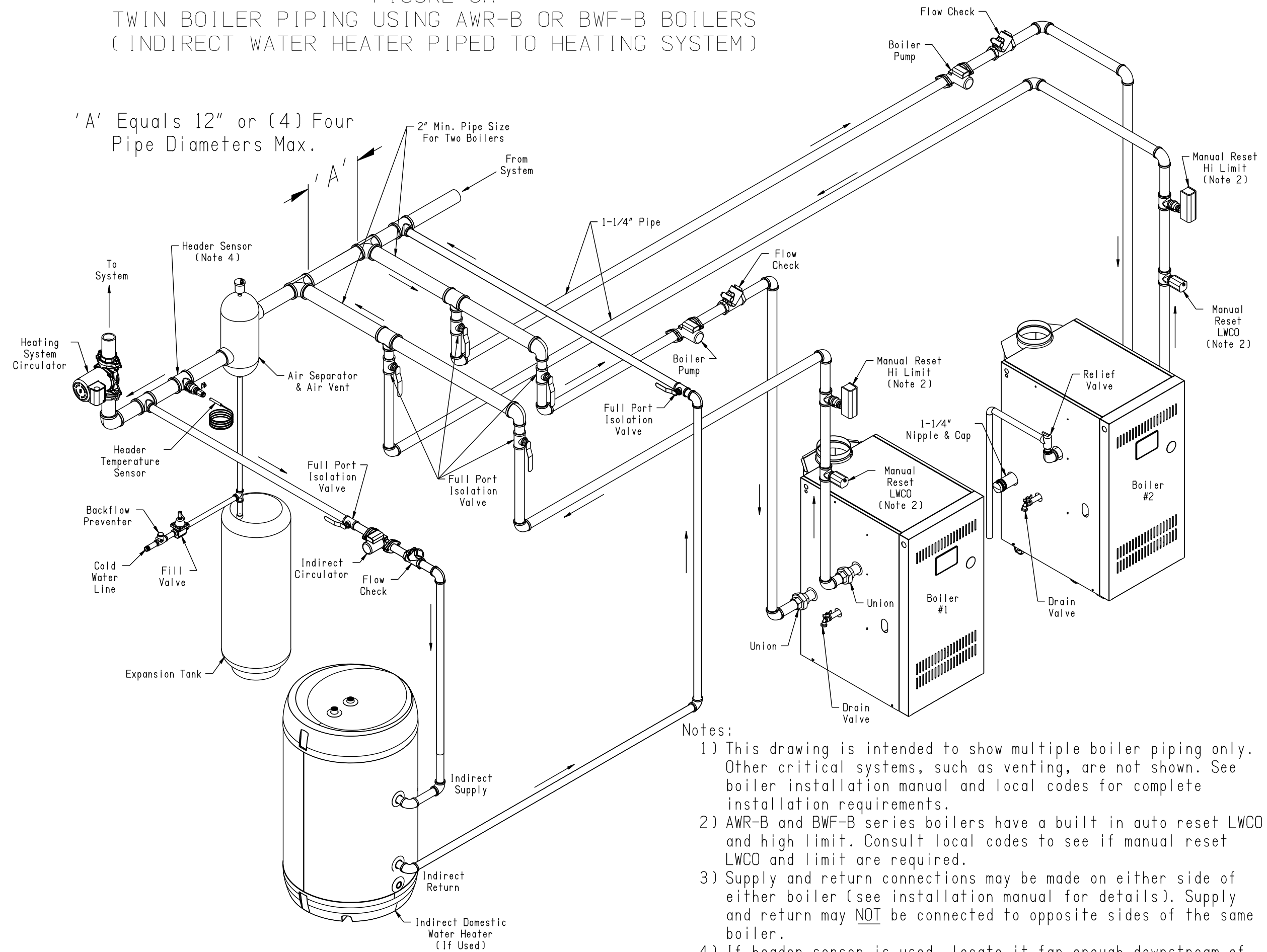


FIGURE 3A
TWIN BOILER PIPING USING AWR-B OR BWF-B BOILERS
(INDIRECT WATER HEATER PIPED TO HEATING SYSTEM)



Notes:

- 1) This drawing is intended to show multiple boiler piping only. Other critical systems, such as venting, are not shown. See boiler installation manual and local codes for complete installation requirements.
- 2) AWR-B and BWF-B series boilers have a built in auto reset LWCO and high limit. Consult local codes to see if manual reset LWCO and limit are required.
- 3) Supply and return connections may be made on either side of either boiler (see installation manual for details). Supply and return may NOT be connected to opposite sides of the same boiler.
- 4) If header sensor is used, locate it far enough downstream of closely spaced tees to provide good mixing.

FIGURE 3B
TWIN BOILER WIRING USING AWR-B OR BWF-B BOILERS, TACO PC702-1 & TACO SR503-EXP-4 SWITCHING RELAY
(INDIRECT WATER HEATER PIPED TO HEATING SYSTEM)

