

OVERVIEW

By integrating an outdoor reset control directly into a circulator (00-VR, RMB) or valve (iSeries-R) used to supply water to a particular zone, the heat supplied to each individual zone matches the heat lost by each of the zones. As loads change in each individual zone, due to factors such as solar gain, the heat input is adjusted based on the reset ratio to optimize the comfort levels in each zone.

System control, comfort and energy savings has evolved from the days of pumping 180° water around baseboard systems controlled solely by an air sensing room thermostat and the boiler high limit control. We got smarter and started to use boiler reset controls to modulate the boiler water temperature based on a reset ratio, maximizing whole house comfort and providing energy savings. We then went a step further and started to use reduced water temperatures supplied directly to floor surfaces, further optimizing comfort and control. So why not go all the way? Zone-by zone outdoor reset maximizes the efficiency and comfort to each zone independently of the load demands of any other zone within a house.

As shown in the installation section, the iSeries Mixing Valves and 00-VR circulators with integral reset can be pulled directly off of the primary loop. This makes it convenient to add a radiant zone to an existing system or design a system that has very diverse temperature requirements. All the wiring is done directly to the pump or valve, eliminating the need for any external controls. The Radiant Mixing Block can provide zone-by-zone outdoor reset control and also control the boiler for load reset, optimizing the main boiler loop as well as the zone loops (see installation section). By using common zoning components with built-in outdoor reset controls the ultimate in comfort and control can be easily achieved.

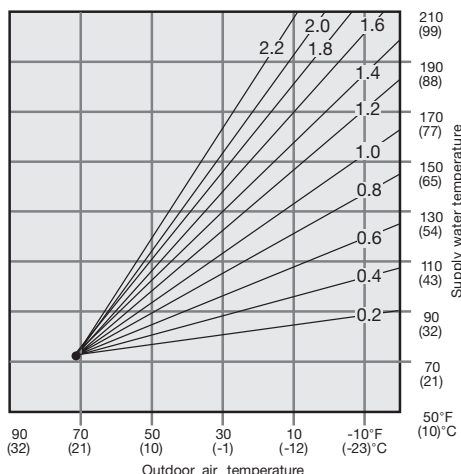
CONTROL STRATEGY

Outdoor Reset

In order to maximize each individual zone of a hot water heating system, the heat supplied to each zone must equal the heat lost by each zone.

- The heat supplied to the zone is directly proportional to the temperature of the water and the surface area of the heating element. The higher the temperature of the water flowing through the heating terminal, the higher the heat output.
- The heat lost from a zone is dependent on the outdoor temperature. As the outdoor temperature drops, the zone's heat loss increases.

These two facts lead to the concept of outdoor reset, based on a reset ratio, which increases the supply water temperature as the outdoor temperature drops. Using this approach, the heat lost from the zone is matched by the heat provided by the terminal units, therefore providing more comfort and energy savings.



Benefits:

- Full independent reset of each heating zone
- Precise temperature control
- Less fluctuation of indoor temperature
- Optimized comfort
- Selectable Min./Max. supply temperature
- Warm weather shutdown
- Adjustable heating curve
- Manual operation button
- Low energy cost
- Boiler protection
- All wiring done directly to valve or pump
- Solid state microprocessor design

Products:

- 00-VR - Variable Speed Outdoor Reset "00" Circulator (available in all models of 003-0014)
- iSeries-R - Outdoor Reset Mixing Valve
- RMB-1 - Radiant Mixing Block

Reset Ratio

The Reset Ratio sets the relationship between outdoor temperature and supply water temperature. It determines the amount the supply water temperature is raised for every 1 degree outdoor temperature drop. For example, if a Reset Ratio of 1.2 is selected, the supply water temperature is increased by 1.2 degrees of every 1 degree of outdoor temperature drop.

VALVE SIZING AND SELECTION

2-Way iSeries-R Mixing Valve Selection

In order to properly size the 2-Way iSeries-R Mixing Valve, follow the design procedure below:

1. Determine the design radiant heating load.
2. Determine the design boiler supply temperature.
3. Determine the radiant system return temperature which is based on the design temperature drop across the radiant system.
4. Determine the design injection flow rate using the following equation:

$$\text{Design Injection Flow Rate (US GPM)} = \frac{\text{Design Radiant Heating Load (BTU/hr)}}{500 \times (\text{Boiler Supply} - \text{Radiant System Return})}$$

5. From the 2-Way Cv chart below, select the valve size with the closest Cv value to the injection flow rate calculated in step 4. Do not size the 2-Way iSeries-R Mixing Valve based solely on pipe size.

3-Way iSeries-R Mixing Valve Selection

Select the 3-Way iSeries-R Mixing Valve based on the 3-way Pressure Drop chart below:

iSeries: 2-Way Cv	
Size	Cv
1/2"	4.9
3/4"	10.3
1"	8.9

Flow	iSeries: 3-Way Valve Pressure Drop					
	1/2" (Cv = 1.5)		3/4" (Cv = 3.3)		1" (Cv = 3.0)	
	PSI	Ft Head	PSI	Ft Head	PSI	Ft Head
GPM						
1/2	0.11	0.26	0.02	0.05	0.03	0.06
1	0.44	1.03	0.09	0.21	0.11	0.26
1 1/2	1.00	2.31	0.21	0.48	0.25	0.58
2	1.78	4.11	0.37	0.85	0.44	1.03
4	—	—	1.47	3.39	1.78	4.11
6	—	—	3.31	7.64	4.00	9.24
8	—	—	5.88	13.58	—	—

4-Way iSeries-R Mixing Valve Selection

To be updated upon 4-way product release.

PUMP SIZING AND SELECTION

In order to properly size the pump, follow the design procedure below:

1. Determine the design operating temperatures of the system loop and boiler. (Ts and Tb from figure 1)
2. Determine the flow rate and design temperature drop (ΔT - Delta T) in the system loop. If one of these variables is unknown use Equation 1 or 2 to calculate the other variable.
3. Compute Tb - Ts. Look up the flow ratios in Figure 2.
4. The design injection flow rate for direct injection is calculated from Equation 3. If the injection flow rate is greater than 40 US GPM, a 3-way or 4-way valve may be required.
5. Decide whether or not to include a balancing valve in the injection piping. A balancing valve allows adjustment when the injection pump is larger than needed. A balancing valve also provides the possibility of manual operation of the system by turning the injection pump fully on and adjusting the balancing valve to obtain the desired supply water temperature.
6. The injection piping size and model of Taco 00 pump to install can now be looked up in Figure 3. Do not oversize the injection system. If the injection system is not able to provide enough heat, the boiler's aquastat may be increased.

$$\text{Eq. 1: System Flow Rate (US GPM)} = \frac{\text{Design Heating Load (BTU/hr)}}{500 \times \Delta T_s (^\circ\text{F})}$$

$$\text{Eq. 2: } \Delta T_s (^\circ\text{F}) = \frac{\text{Design Heating Load (BTU/hr)}}{500 \times \text{System Flow Rate (US GPM)}}$$

$$\text{Eq. 3: Design Injection Flow Rate (US GPM)} = \text{System Flow Rate (US GPM)} \times \text{Flow Ratio}$$

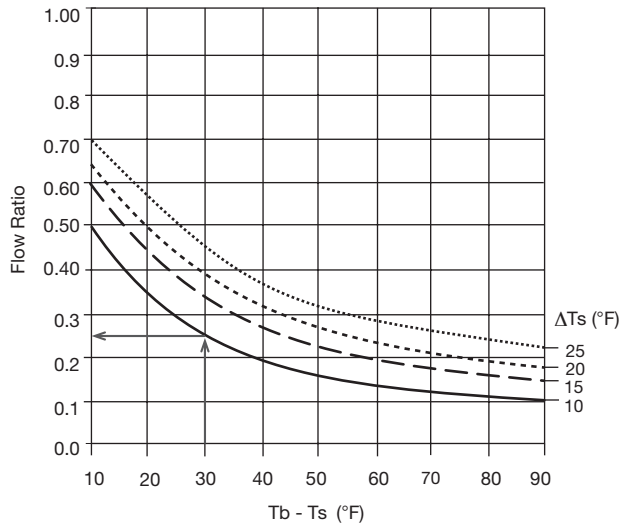


Figure 2

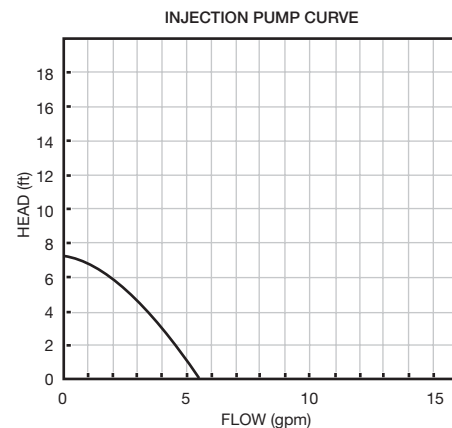
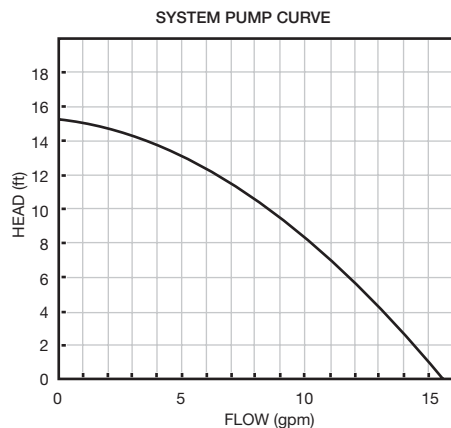
Design Injection Flow Rate (US GPM)	Balancing Valve Position (% open)	Balancing Valve Cv	Nominal Pipe Diameter (inches)	TACO Pump
1.5	30	2.4	0.5	003
2	40	4.5	0.5	003
3	40	4.5	0.5	006
4	100	15	0.5	006
7	40	6.9	0.75	007
8	50	10.4	0.75	007
9	30	5.76	1	007
12	40	10.8	1	007
14	40	10.8	1	0010
16	100	36	1	0010
20	50	19.8	1.25	0010
25	50	28.8	1.5	0010
30	30	18.2	2	0012
40	40	34.2	2	0012

This table assumes there are 5 feet of pipe, 4 elbows, and 4 branch tees of the listed diameter. Balancing valve is assumed to be a ball valve. The approximate Cv value is provided in order to allow for proper balancing device. Valve characteristics may vary for the same size and type of ball valve from manufacturer to manufacturer.

Figure 3

In order to ensure proper selection of the Radiant Mixing Block, follow the design procedure below:

1. Using the pump curve located below, ensure that the System Pump of the Radiant Mixing Block will provide adequate flow for the system in which it is to be installed.
2. Using the table or equation below, determine the required flow rate for the Injection Pump.
3. Using the pump curve located below, ensure that the Injection Pump of the Radiant Mixing Block will provide adequate flow for the system in which it is to be installed.



Required Injection Pump Flow Rate

Tb = Boiler Supply Temperature
Ts = Radiant Supply Temperature

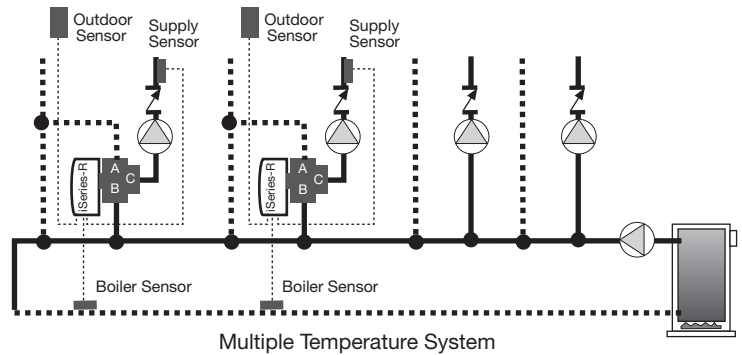
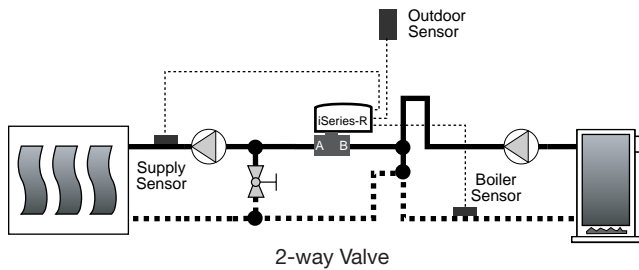
$$\text{Eq. 4: Injection Flow Rate (GPM)} = \frac{\text{BTU's}}{(\text{Tb} - \text{Ts}) \times 500}$$

Required Injection Flow Rate (GPM)

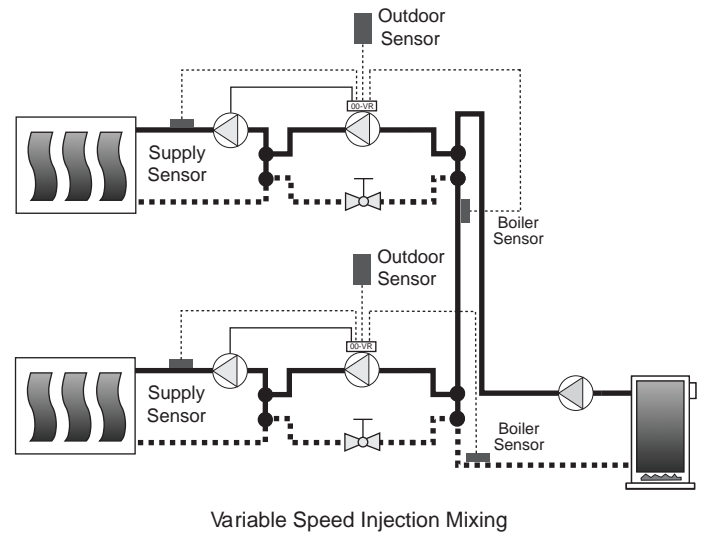
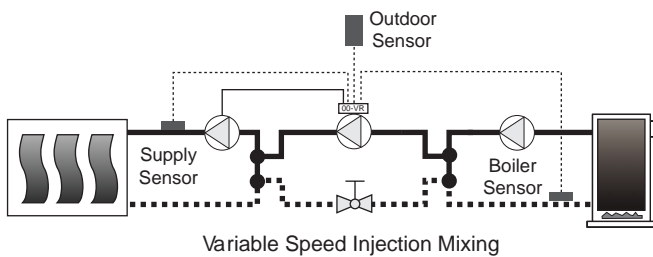
Tb - Ts	BTU's x 1000					
	20	40	60	80	100	120
100	0.4	0.8	1.2	1.6	2.0	2.4
80	0.5	1.0	1.5	2.0	2.5	3.0
60	0.7	1.3	2.0	2.7	3.3	4.0
40	1.0	2.0	3.0	4.0	5.0	
20	2.0	4.0				

INSTALLATION

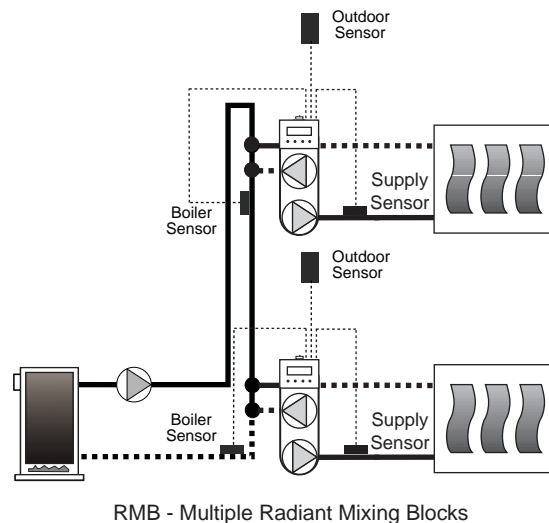
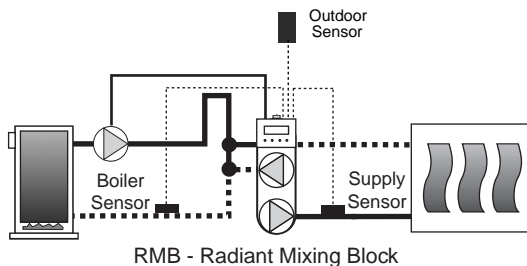
iSeries-R (Outdoor Reset) Mixing Valve



Variable Speed Outdoor Reset “00” Circulator (00-VS)



Radiant Mixing Block (RMB)



For installations where boiler protection is **NOT** required, the boiler sensor does not need to be installed.
For additional installation diagrams, refer to the appropriate product's Products & Application documentation.

Radiant Made Easy™

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