Taco Radiant Made Easy Application Guide	Operating Mode
Outdoor Mixing Reset: 2-Way/3-Way/4-Way Mixing Valves	**OM03**

EFFECTIVE: August 15, 2005 SUPERSEDES: March 1, 2004

OVERVIEW

2–way/3–way/4-way Mixing Valves

To achieve outdoor mixing reset, the position of a 2, 3 or 4-way valve is modulated based on the relationship between outdoor temperature and supply water temperature (reset ratio). By modulating the valve, a percentage of the hot water from the boiler loop is mixed with the cooler return water from the system loop. Using this approach, the heat lost from the building (or individual zone) is matched by the heat provided by the terminal units. Typcially used in radiant primary/secondary piping designs, the valve is installed in the "bridge" piping (see Figures 1 & 2) between the boiler loop and system loop. This configuration allows for virtually any water temperature to be supplied to the heating system. With outdoor mixing reset, the water temperature supplied to the heating zones can be reduced all the way down to room air temperature (full reset) even when a non-condensing boiler is being used. This allows for optimal control of the heating zone, no matter the load requirements.

Outdoor mixing reset can be easily achieved by using a 2-way, 3-way or 4-way iSeries-R (Outdoor Reset) Mixing Valve. All power and sensor wiring is done directly to the iSeries-R valve, eliminating the need for an external control. When deciding between a 2-way, 3-way or 4-way valve, maximum flow rates and piping design must be considered. See the charts on page 2 and 3 before selecting style of valve/piping. Since most boilers cannot operate at low temperatures, the iSeries-R can be modulated back in order to prevent the boiler from operating at cold temperatures by installing the boiler return sensor.

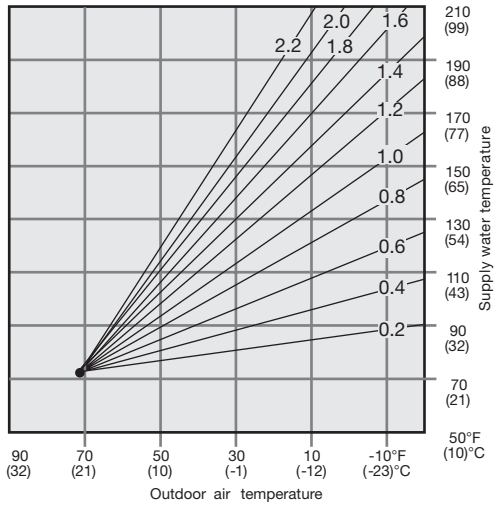
CONTROL STRATEGY

Outdoor Reset

In order to properly control a hot water heating system, the heat supplied to the building must equal the heat lost by the building.

- The heat supplied to the building 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 building is dependent on the outdoor temperature. As the outdoor temperature drops, the building 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 building is matched by the heat provided by the terminal units, therefore providing more comfort and energy savings.



Benefits:

- **Full reset of heating zones**
- **Precise temperature control**
- **Less fluctuation of indoor temperature**
- **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 actuator**
- **Complete solid state microprocessor designed electronics inside compact actuator**

Products:

iSeries-R – Outdoor Reset Mixing Valve

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.

DESIGN

When using an iSeries-R Mixing Valve, the following piping requirements must be considered for proper operation.

1. In order to hydraulically isolate the boiler loop from the injection or system loop primary/secondary piping must be used. There must be no more than 4 pipe diameters between the tees in the boiler loop (Note 1).
2. There must be at least 6 pipe diameters of straight pipe on either side of the tees (Note 2) in order to prevent the momentum of water in the boiler loop from pushing flow through the injection loop.
3. There should be a minimum of 1 foot drop on the return pipe of the injection loop, in order to create a thermal trap (Note 3) and prevent unwanted heat transfer.
4. When using a 2-way iSeries-R Mixing Valve, a balancing valve must be located between the tees in the system loop, in order to provide a pressure drop to induce flow through the mixing loop.

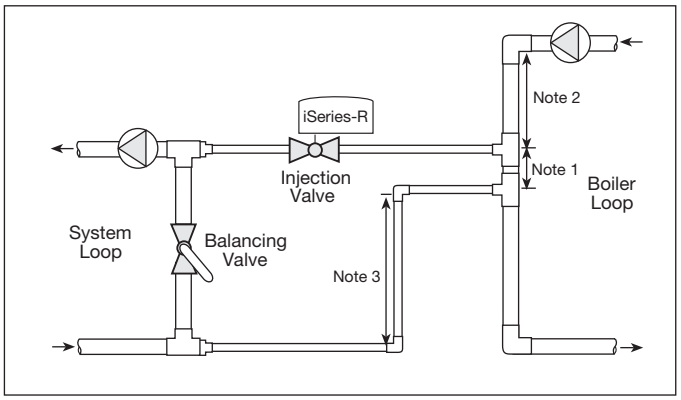


Figure 1

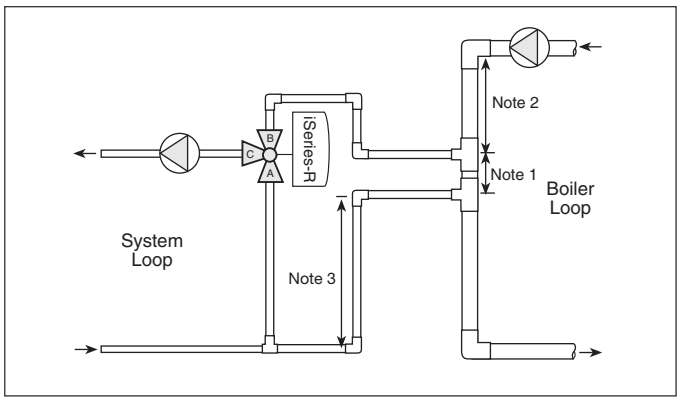


Figure 2

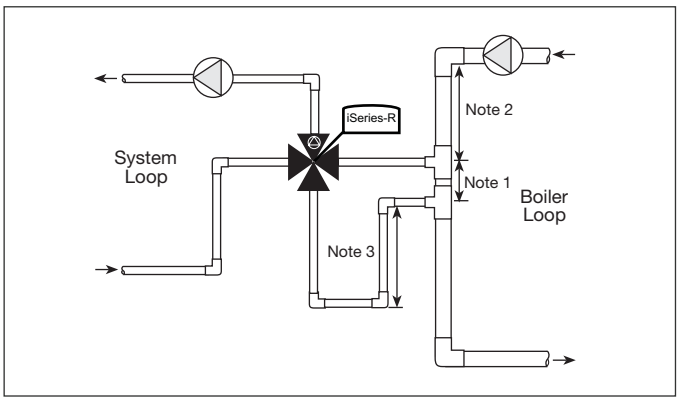


Figure 3

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:

$$\text{Eq. 1:} \quad \text{Design Injection Flow Rate (US GPM)} = \frac{\text{Design Radiant Heating Load (BTU/hr)}}{500 \times (\text{Boiler Supply - Radiant System Return})}$$

5) From the 2-way Cv chart on the right, 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.

iSeries: 2-way Cv	
Size	Cv
½"	4.9
¾"	10.3
1"	8.9

3-way iSeries-R Mixing Valve Selection

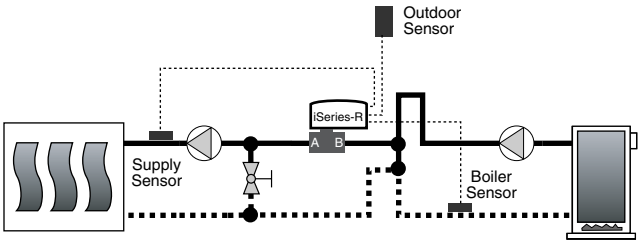
Select the 3-way iSeries-R Mixing Valve based on the 3-way Pressure Drop chart below:

	iSeries: 3-way Valve Pressure Drop					
Flow	½" (Cv = 1.5)		¾" (Cv = 3.3)		1" (Cv = 3.0)	
GPM	PSI	Ft. Head	PSI	Ft. Head	PSI	Ft. Head
½	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
1½	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	—	—

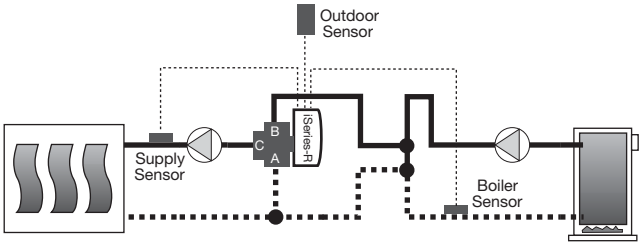
4-way iSeries-R Mixing Valve Selection

Select the 4-way iSeries-R Mixing Valve based on the 4-way Pressure Drop chart below:

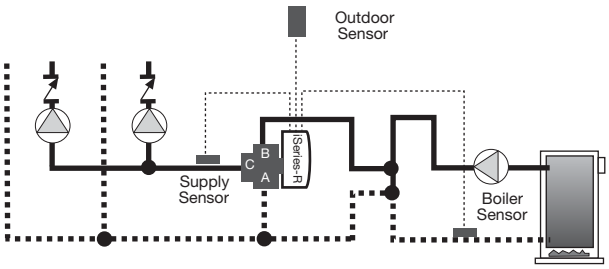
	iSeries: 4-way Valve Pressure Drop					
Flow	¾" (Cv = 7.0)		1" (Cv = 9.3)		1 ¼" (Cv = 17.5)	
GPM	PSI	Ft. Head	PSI	Ft. Head	PSI	Ft. Head
½	0.01	0.01	0.00	0.01	0.00	0.00
1	0.02	0.05	0.01	0.03	0.00	0.01
2	0.08	0.19	0.05	0.11	0.01	0.03
4	0.33	0.75	0.18	0.43	0.05	0.12
6	0.73	1.69	0.42	0.96	0.12	0.27
8	1.31	3.01	0.74	1.71	0.21	0.48
10	2.04	4.71	1.16	2.67	0.33	0.75
12	2.94	6.79	1.66	3.84	0.47	1.08
14	4.00	9.24	2.28	5.27	0.64	1.48
16	—	—	2.96	6.84	0.84	1.93
18	—	—	3.76	8.70	1.06	2.44
20	—	—	—	—	2.30	5.31



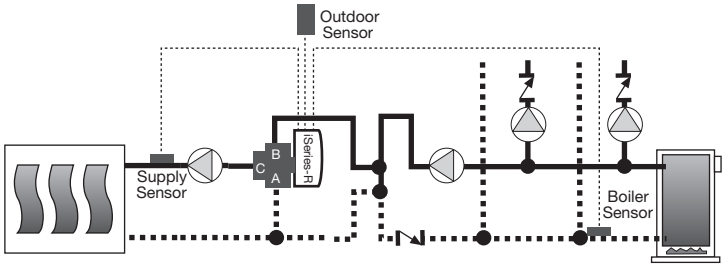
2-way Valve



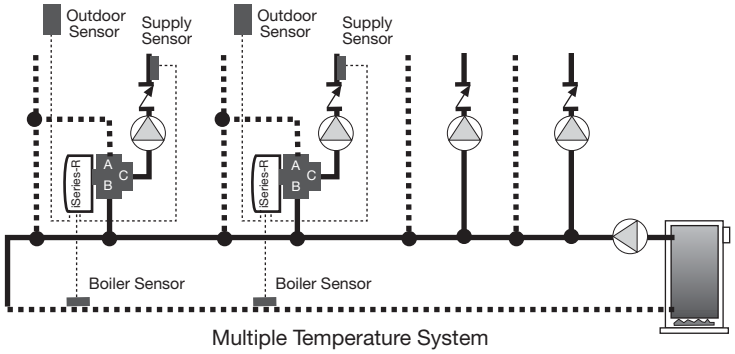
3-way Valve



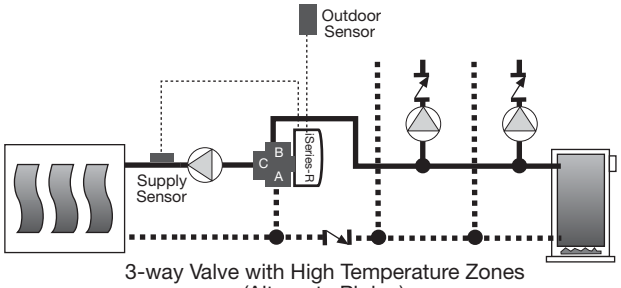
3-way Valve with Low Temperature Zones



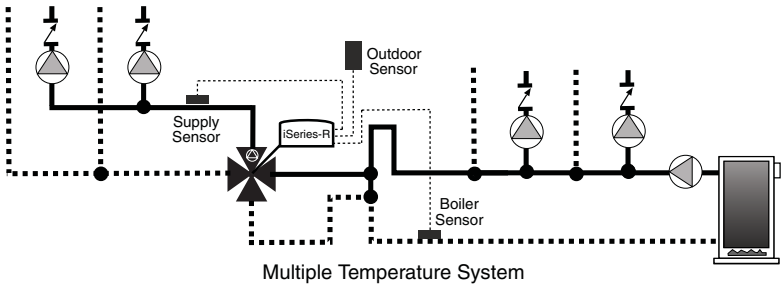
3-way Valve with High Temperature Zones



Multiple Temperature System



3-way Valve with High Temperature Zones
(Alternate Piping)



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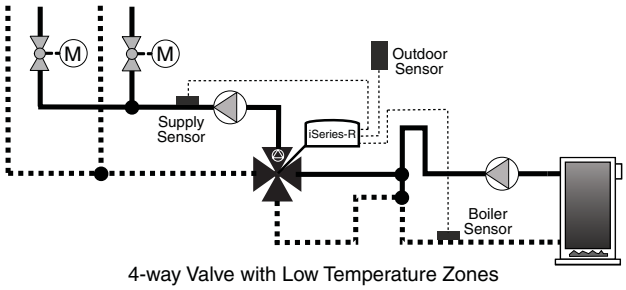

4-way Valve with Low Temperature Zones

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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