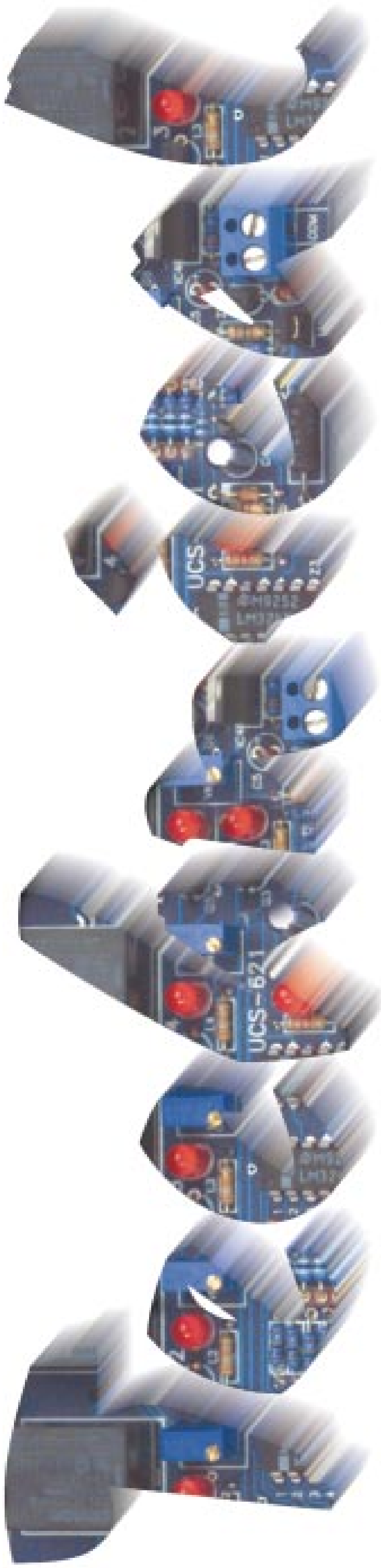
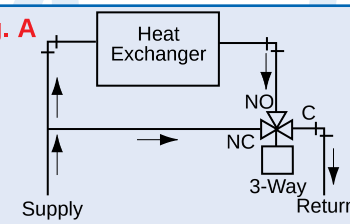


Did You

That valves are the

Something is hissing, hammering, frozen, roasted, or short cycling. Another service call is dispatched to that building. If it's not noise, it's complaints about being hot or cold, but the controls check out! What on earth is the problem? Many times it's the simplest device in the system: the control **valve**.

Fig. A

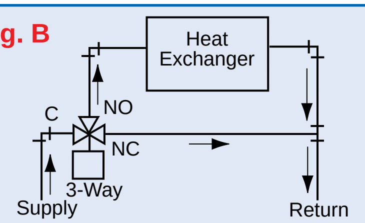


Three-Way Mixing Valve on "By-pass" Application Variable Volume Control

While simple, the water control valve is one of the main components used in HVAC control. Therefore, valve sizing is one of the most important tasks when designing a control system. Properly performing this task involves using tables or calculations to determine the best size valve for the specific application. We are going to begin exploring this process in the next few *20/20 Insights*, starting with **water valve sizing**.

Capacity is one of the major considerations when sizing a valve. The valve must be large enough so that when open, full flow is delivered to the coil. The valve must also be small enough so that at low load conditions, the valve has enough modulated stroke to afford good control.

Fig. B



Three-Way Diverting Valve on "By-pass" Application Variable Volume Control

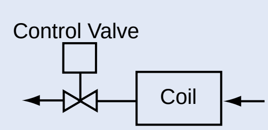
Valves are sized by flow capacity, which is measured by the flow coefficient (C_V). The goal is to select a valve with a C_V which will offer good control and capacity. Once the correct C_V is found, the appropriate valve may be chosen from the Kele catalog.

A table is often used to get the correct C_V (see the Technical Reference section in our catalog). This table is derived from the following formula.

$$\mathbf{Cv = GPM / \sqrt{\Delta P}}.$$

GPM is gallons per minute through the coil and **ΔP** is differential pressure across the valve at full flow. Using either the table or the formula is acceptable.

Fig. C



Two-Way Valve Application Variable Volume Control

Know?

heart of your system?

1. The maximum **GPM** is a quantity that is given and can be found in the mechanical drawings for the loads to be controlled. If they are not given then there are coil capacity formulas to determine GPM which your Kele Sales Associate can send to you on request.
2. The valve pressure drop (Δ**P**) is often given in the specifications. If the pressure drop is not given, then the rules of thumb in Table 1 should help.
3. Calculate the C_V using the formula above and select the valve C_V closest to the calculated C_V. **Caution:** Sometimes there are wide gaps between C_V values. If your calculated C_V is not close to the smaller size valve, round up to the next larger size valve.

Tabe 1

Water Pressure Drop Selection Chart

RoT = Rule of Thumb ΔP = Pressure Difference

Control Type	2 Position On/OFF **Low ΔP**	Modulating Varying Volume **HI ΔP Fig. A** or **Fig. B**	Modulating Varying Temp. **Low ΔP Fig. D**
2 Way Valve **Fig. C**	10% of inlet Pressure RoT-Line size	50% of inlet Pressure or Δ**P**=coil pressure drop (see note 1) RoT-4 PSI min.	Not Applicable (see note 2)
3 Way Valve	10% of inlet RoT-Line size	50% of inlet pressure or Δ**P**=coil pressure drop (see note 1) RoT-4 PSI min.	20% of inlet pressure 25% of Δ**P** across load

Note 1: If the coil Δ**T** is known, use the coil Δ**P** X Δ**T** multiplier=valve Δ**P**

Coil Δ**T** rise or fall	Multiplier	Example: Coil Δ**P**=4 psi
Δ**T**=20 DegF	3	Valve Δ**P**=4x3=12 psi
Δ**T**=40 DegF	2	Valve Δ**P**=4x2=8 psi
Δ**T**=60 DegF	1	Valve Δ**P**=4x1=4 psi

Note 2: A two way valve application is always variable volume as in **Fig.C**.

It's always good to double-check your valve choice with the following Rule of Thumb: The valve you pick will never be larger than the line size and will often be one pipe size smaller. If your valve falls outside this rule, double check your calculations.

The following additional criteria should be considered when selecting the correct valve for a specific application:

by Eric Karl

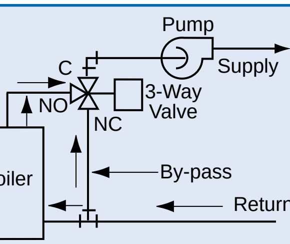
A) What close off pressure is required?
The safest close off is the pump head pressure in PSIG. Most often the pump head is specified in feet of water. The conversion from feet of water to psig is: **PSIG = Feet of Water x 0.433**. Make sure your actuator can close off against this pressure.

B) What flow characteristics are needed: Equal Percentage, Linear, or Quick Opening?
a)Control valves used for modulating flow through coils should use equal percentage.
b)Control valves used in modulating mixing applications use linear or equal percentage.
c)Control valves used in two position applications can havequick opening, linear, or equal percentage characteristics.

In general an equal percentage type valve works well with any HVAC control application.

C) What body mounting style is required?
Most smaller valves (less than 3") use styles such as threaded, union, sweat or flared type fittings. However, threaded is the most common. The larger valves use a flanged fitting.

Fig. D



Three-way mixing valve on mixing application
Variable Temperature Control

Continued on page 7

D) **The maximum temperature and pressure are also considerations for steam and high temperature hot water systems.**

E) **The next consideration is the actuator for your valve.**

Pneumatic actuators offer less cost if air is available in large jobs, always have spring return and may be configured with a positive positioner in the field if needed. It is important to select the appropriate spring range for your application and sequence. If you plan to operate from a transducer, (such as a **UCP-522**) a high spring range such as 8-13# is best so you have better return force. The drawback is that you must have a pneumatic air system. The pneumatic actuator also invites less precise control due to back pressure from the water causing a spring range shift, thus changing the control pressure required to close the valve. A positive positioner may be used to solve this problem.

Electric actuators have a different selection criteria including type of power, signal type and whether or not spring return is required.

Power: 24 VAC/DC or 120 VAC

Signal: 2 position, tri state, or modulating control signals such as (0-5V, 1-5V, 0-10V, 2-10V, 0-20 mA, 4-20 mA, or pneumatic signals with a **PVI-1** transducer)

The main advantage is very precise control without the need for a positioner. The unit can also be ordered with multiple control signals and power selections. The drawback is generally higher unit cost, but may actually be less expensive if control air is not available, which is typical on medium and small jobs.

Look for the next *20/20 Insights* which will focus on another valve sizing topic. In the meantime, call Kele & Associates for solutions to all your control valve needs. ◆