Modeling Circuit Balancing Valves in PIPE-FLO

Customers who wish to model circuit balancing valves in PIPE-FLO should first obtain the performance curve or $C_v$ data for the valve from the valve manufacturer. The performance characteristic curve of flow rate (gpm) vs. head loss (feet of water) for a 4” Bell & Gossett Circuit Setter Plus balancing valve is shown in Figure 1.

**Circuit Setter Calibrated Balance Valve**

**PERFORMANCE CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Part No. 117112</th>
<th>Model No. CB-4F</th>
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<tr>
<td>Part No. 117118</td>
<td>Model No. CB-4G</td>
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**FOR SYSTEM BALANCING**

**AND SYSTEM PRESSURE DROP**

![Performance Chart](image)

Figure 1: 4” Bell & Gossett Circuit Setter Plus balancing valve performance curves.

For each valve position, values of head loss and flow rate are selected, the head loss converted to differential pressure (dP) using Equation 1, then $C_v$ values calculated for each valve position using the flow coefficient equation, Equation 2.

$$dP = \frac{\rho H_L}{144}$$

Equation 1: Conversion of head loss to differential pressure

$$C_v = \frac{Q}{\sqrt{dP/SG}}$$

Equation 2: Flow coefficient equation

The calculated $C_v$ values are then entered into the control valve dialog box as shown in Figure 2 (the value at 5% open is estimated, along with typical values of Fl and Xt).
PIPE-FLO can then be used to help determine the required setting of each circuit balancing valve by setting the set point of the control valve to the required flow rate. PIPE-FLO calculates the head loss and valve position at the desired flow rate as shown in Figure 3. These values can then be verified on the manufacturer's performance curve.
Figure 3: PIPE-FLO used to calculate the head loss and valve position of a circuit setter at a desired flow rate.

The control valve should then be set to the manual position determined by PIPE-FLO or by the manufacturer's calculation method, as shown in Figure 4. The manual valve setting is used to simulate the operation of the circuit balancing valve in the actual system.

Figure 4: Circuit setters set to manual valve positions.

If a change is made to any of the valves, or somewhere else in the system, the effect on each circuit can be calculated. For example, if Circuit Setter 3 is adjusted to a setting of 60% to increase the flow rate to 230 gpm, as shown in Figure 5, the flow rate through Circuit Setter 1 is reduced to 243.8 gpm and the flow rate through Circuit Setter 2 is reduced to 223.7 gpm.

Figure 5: Calculated results showing the effect of a change in Circuit Setter 3.