What is the Pressure Activated Bypass Valve (PABV)? Also called a differential pressure bypass valve, it is a control valve that opens and closes automatically to maintain a near constant differential pressure across the inlet and outlet ports.

Why Bother?

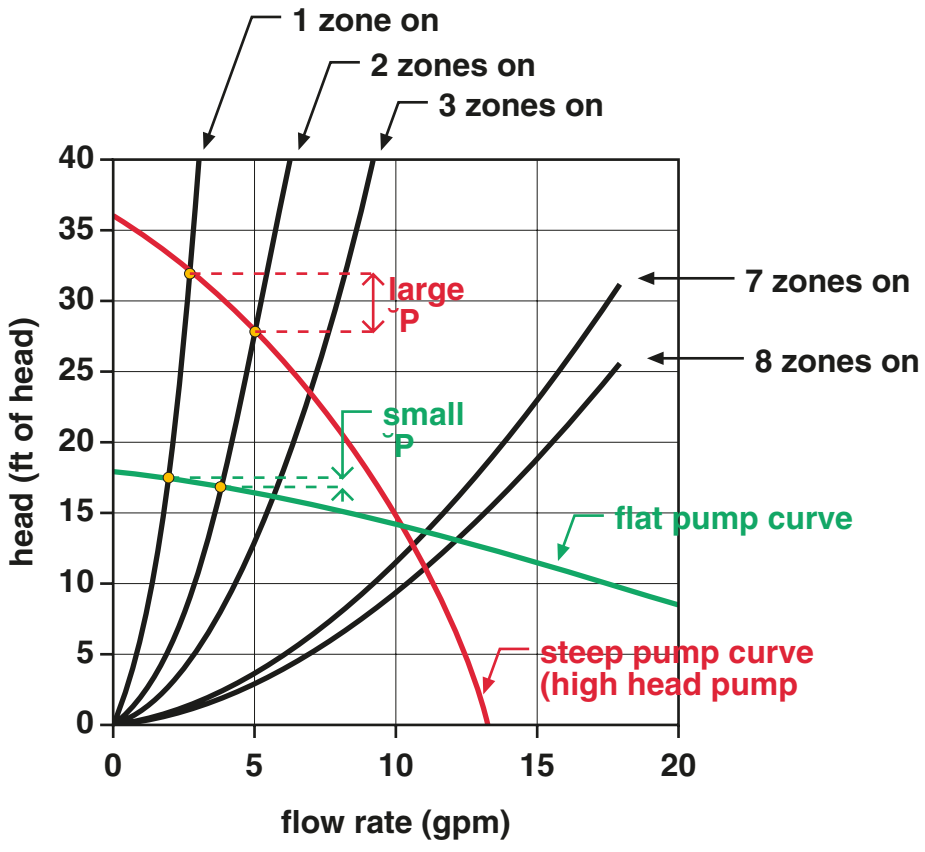
Hydronic systems are typically designed to operate at a certain differential pressure across the supply and return mains. This differential pressure can increase or decrease as pump flow goes down or up respectively. As the differential pressure rises (and exceeds the close-off pressure), there can be noise, premature valve wear, damage due to hammering, and valve malfunction.

A common reason for the pressure variation is due to the characteristics of the pump. As zone valves begin to close the total flow through the circulating pump decreases. With a typical circulator, the head pressure decreases with increasing flow. So typical pump sizing looks at the total system demand at a given differential pressure, and that sets the pump size at a specific design condition. Other than at the design condition (which is most of the time), the pump will be delivering more pressure than required.

Sizing a PABV

The requirement of the PABV valve is to bypass enough flow so that the differential pressure does not increase to objectionable levels. So, in a home where one zone is operating, the pump (typically single speed) will operate at a differential pressure higher than when all zones are open. (In this case, a differential valve that can handle all the flow, except for one zone, is required.) For instance, the 3/4" HeatLink #60020 can bypass up to 13 gpm. Using the rule of thumb (10,000BTUH/gpm for water and a ΔT of 20°F), this can accommodate at least 130,000 BTUH. The system can actually be larger because some rise in differential pressure can usually be accommodated.

A more scientific approach is to look at the pump curve and see how the system pressure varies with flow. By looking at the maximum and minimum flows, one can establish the variation in differential pressures. A differential pressure valve can then be sized to maintain the flow through the pump so that differential pressure does not rise too high. The differential pressure valve can provide a pressure relief to reduce the water hammer noise that can arise from fast closing zone valves.

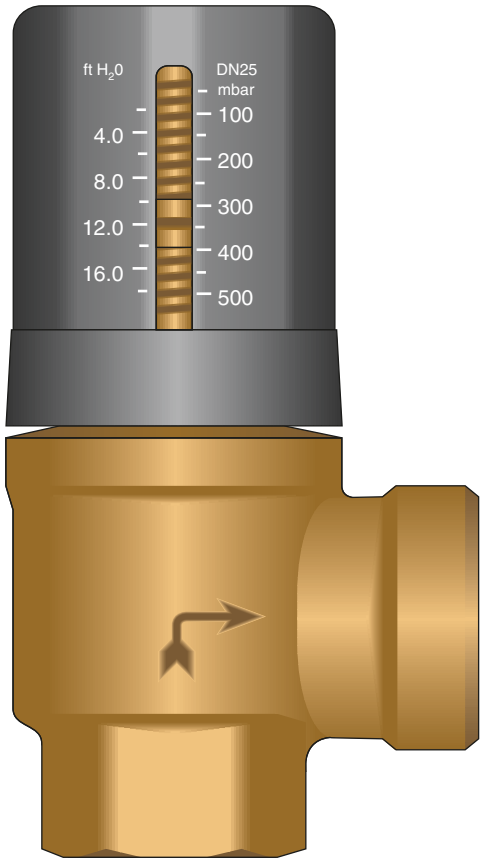


Valve Sizing Guidelines

- For most residential and small commercial systems the 3/4" or 1" size PABVs are adequate.
- Larger systems use the 1-1/4" size valves.

Setting PABV for Small Systems

1. Set the PABV to its maximum pressure differential setting (for example: a 12' head on a 3/4" valve; or a 60' head on a 1" or 1-1/4" valve) after loosening its top screw.
2. Run the circulator while all zone valves are closed. Hold the discharge side of the PABV with one hand and begin reducing the differential pressure setting gradually until the pipe on the discharge side of the PABV heats up, indicating that there is flow through the valve.
3. Open all zone valves and ensure that the discharge side of the valve cools over time to the return water temperature. Reset its top screw to fix the pressure setting.



Field Installation Hint

Do not overheat the valve body during installation. When making a sweat installation with a PABV, first solder a length of pipe into the male adapter, and then thread the male adapter into the valve. This will ensure that its inlet and outlet threads are not subject to any heat. Using several wraps of Teflon tape and/or pipe dope is recommended when making threaded connections.

Alternatives to a PABV

The ultimate alternative is to use a variable speed pump. This is common in large commercial systems. For residential systems this is usually not cost effective. Large systems also employ staged pumping where several pumps are parallel and are sequentially activated as the system demand increases. Again the cost of such a system is a consideration. A pump with a flat curve would also minimize the need for a differential pressure control valve, as discussed previously.

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