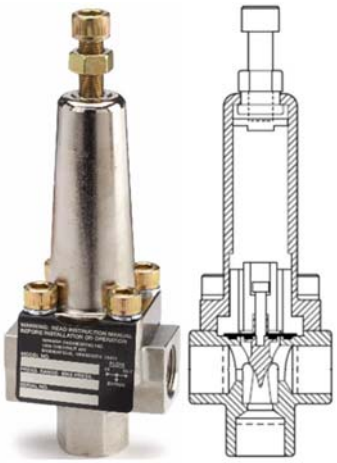
Pressure Regulating and Back Pressure Valves Comparison with Application Examples

By: Chris Pasquali, CEO Factory Direct Pipeline Products, Inc.

Pressure regulating and back pressure valves look similar and are sometimes used in the same pumping system. This article describes both styles of valves and provides examples to assist you with your application.



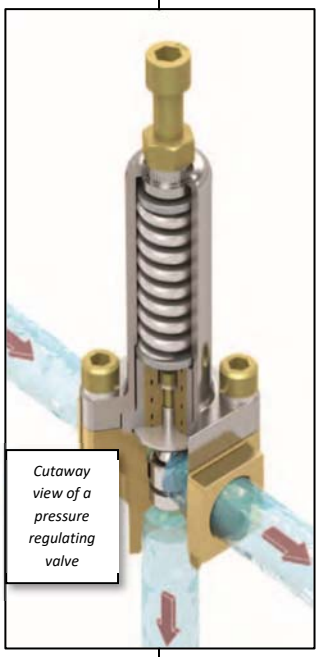
Pressure Regulating Valves

They are a common accessory for positive displacement pump systems due to potential high discharge pressures which can damage downstream equipment and processes. Examples of such equipment include hoses, valves, filter housings and just about any other fitting or instrument installed downstream of a positive displacement pump.

Pressure regulating valves are used to limit the downstream pressure within an acceptable range for a given process. *They open proportionally in response to pressure*, enabling bypass of flow to ensure the maximum allowable downstream pressure is not exceeded.

Constant Pressure or Maximum Pressure?

Positive displacement pumps discharge a fixed volume of liquid for each rotation of its pump shaft. In applications where pressure is not especially important, a pressure regulating valve simply protects against over-pressurization. Transfer and metering applications are examples that are flow centric where the pressure may not need to remain constant and the pressure regulating valve is used to simply prevent over-pressurization. Then there are applications requiring a specific discharge pressure which use pressure regulating valves to maintain that pressure even when the flow rates may vary.



Cutaway view of a pressure regulating valve

Applications requiring a constant pressure across a range of flow rates include CNC machining (several different sized tools), high pressure washing (multiple wands or cleaning stations) and evaporative cooling spray nozzle systems requiring constant droplet sizes (phasing in additional atomizing spray nozzles).

Safety and Relief Valves

The nomenclature of “regulating”, “relief” and “safety” valves are often used interchangeably so it is important to understand how you want the valve to function for a specific application.

Safety and relief valves are often designed to completely relieve system pressure at a certain threshold and some designs will not automatically reset. These are used in conjunction with pressure regulating valves to guard downstream equipment from an instance of a failed pressure regulating valve.

A properly sized pressure regulating valve should be able to bypass the pumps full flow rate but will not reduce the line pressure lower than the set amount.

It is important to note that the flow path through a pressure regulating valve is unrestricted and when the line pressure is high enough to compress the spring seating the plunger against its seat, some flow is diverted to the bypass port. The bypass port is often routed back to the feed tank. It is recommended that the bypass line extends past the low liquid level of the feed tank and as far away from the tank outlet as possible; this will minimize entrained air and turbulence that could otherwise contribute to pump cavitation.

If the bypass port is routed back to the inlet piping, try to ensure it is located at least 10 pipe diameters from the pump inlet to minimize turbulence entering the pump.

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Back Pressure Valves

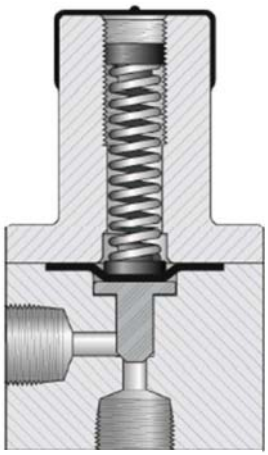
This type of valve provides a restriction greater than the downstream components or process would provide, creating a pressure drop at the discharge port of the back pressure valve.

Whereas a pressure regulating valve controls the pressure downstream of the valve, a back-pressure valve controls the pressure upstream of the valve

Unlike a pressure regulating valve, the flow path through a back pressure valve begins fully restricted (closed) until sufficient pressure develops to compress the spring and lift the plunger from its seat. In this regards it is similar to a check valve except the spring tension is adjustable and it does not control flow direction.

Back pressure valves benefit processes requiring minimum pressures, in the case of Hydra-cell positive displacement pumps, a back pressure valve can improve pumping efficiency by ensuring the discharge pressure is ≥ 30 PSI.

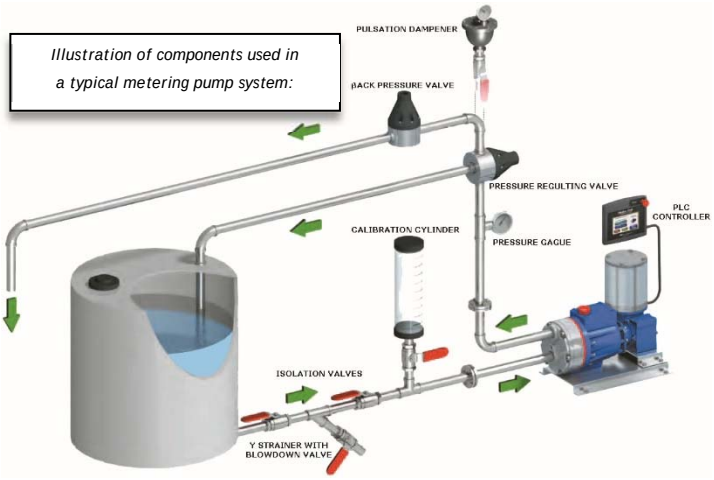
Pumps which use check valves to create a one-way flow path are usually spring loaded to react quickly to high frequency strokes. As an example, a typical Hydra-Cell pump operated at 1800 RPM results in 30 check valve seatings per second. The check valve spring helps positively seat the valve and the seating speed is further enhanced when assisted by back pressure in excess of 30 PSI. Thus, when Hydra-Cell pumps are operated against pressures <30 PSI and without a back pressure valve, the flow rate accuracy may vary by more than the ±1% *stipulated by API 675 Metering Pump Standards.*



Cutaway view of a back pressure

Even if your application does not require high pressure to transfer your liquid, you might require using both a pressure regulating valve and back pressure valve.

Positive displacement pumps and back pressure valves are commonly used together for precise metering applications which do not require much pressure. An example would be adding food coloring to a mixing vessel where it is important to transfer a precise volume of fluid but the pump only has to overcome a little more than atmospheric pressure.



The back pressure valve would ensure there is sufficient pressure applied to the pumps check valves to maximize efficiency and the pressure regulating valve would protect components from accidental over-pressurization (Positive displacement pumps can generate nearly instantaneous spikes in pressure due to sudden restrictions to flow).

You can learn more about each of the components illustrated above via our website at https://fdpp.com and you will find articles on the designs and applications for Y strainers, ball valves, metering pumps, customized PLC based pump control systems and pressure gauges.

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