The Benefits of Using Fixed Ratio Reducing Valves for Surge and Water Hammer Elimination in High Rise Buildings

Fixed ratio reducing valves are essential components in hydraulic systems, providing numerous advantages in terms of pressure control, system performance, and reliability. With the specific features of the ACV Ratio Reducing Valve, available in flanged sizes ranging from 50mm to 500mm and screwed BSP sizes from 15mm to 40mm, the benefits are further enhanced. Notably, these valves offer simplified hydraulics, fast and easy installation, complete security, and high performance. Additionally, they play a vital role in eliminating surge events and water hammer, safeguarding the integrity and longevity of pipeline systems. Let's explore these benefits in detail.

The Evolution of FRRV Technology

Fixed ratio reducing valves have a long-standing history of successful implementation in the mining industry and high-rise buildings in various overseas countries. However, the concept of self-actuated pressure reducing valves without pilots is relatively new to the water industry and the general building industry. Despite initial reservations regarding the non-adjustability of these valves, an increasing number of users now prefer FRRVs over the standard pilot-operated pressure reducing valves (POPRV), considering the numerous advantages offered by the former.

Hydraulics Simplified

The ACV Ratio Reducing Valve's inline axial flow design provides several inherent advantages. First, it offers high cavitation resistance, enabling the valve to withstand extreme pressure differentials without damage. This feature ensures the valve's reliability and longevity even in demanding hydraulic systems. Additionally, the valve's fast response time allows it to instantaneously adjust to changes in demand, maintaining system stability and efficiency. Furthermore, the valve exhibits high range-ability, enabling precise control even at very low flow rates. This capability simplifies sizing and application engineering, making it easier to select and install the appropriate valve without complex calculations.

How FRRV Operates

The operation of a fixed ratio reducing valve is based on the principle of utilizing different surface areas between the valve's inlet and outlet. Careful calculations account for the dynamic effects of velocity and pressure drops across the seat area. These calculations enable the piston to be influenced by pressure forces on various areas, causing it to move either more open or more closed. When there is no demand for water, the valve ensures a drip tight seal by closing tightly.

Benefits of FRRV in High-Rise Buildings

1. **Surge and Water Hammer Mitigation:** FRRVs play a pivotal role in minimizing the risk of surge and water hammer within the water supply system. By accurately regulating and maintaining a steady flow and pressure, these valves instantly react to sudden changes in velocity, which can lead to damaging hydraulic surges. The fixed ratio design ensures a controlled reduction of pressure, reducing the likelihood of water hammer occurrences.

2**. Reliability:** FRRVs offer exceptional reliability due to their robust design and self-actuating nature. By eliminating the need for external pilots, these valves simplify the system and reduce the chances of failure points. The absence of adjustable components such as pilot valves and needle valves also

eliminates the risk of tampering or incorrect adjustments, ensuring a consistent and reliable performance over time.

3. **Compact Size and Material Options:** FRRV technology has advanced to the point where manufacturers like AFC Valve now offer small-sized valves in various stainless steel options (304 and 316) with female screwed BSP connections. This versatility allows for seamless integration into different piping systems. The availability of FRRVs in sizes ranging from 15mm to 40mm in the screwed version and up to 500mm in the standard flanged version with standard ratios of 1:2, 1:3, 1:4, 1:5, or any fraction thereof, in different pressure ratings (PN16, PN25, and PN40) further enhances their suitability for high-rise buildings.

4. **Ease of Installation and Maintenance:** The simplicity of FRRV design makes them easy to install and maintain. With fewer components and an inherently self-regulating mechanism, these valves require minimal adjustments and upkeep, reducing maintenance costs and downtime. Furthermore, their non-adjustable nature eliminates the need for frequent calibration or readjustment, enhancing operational efficiency.

Complete Security

Fixed ratio reducing valves offer complete security and reliability in pressure regulation. With fixed ratio settings, there is no need for adjustments or calibration, as the valve settings remain constant over time. This feature ensures consistent performance and eliminates the risk of accidental or unauthorized changes to the pressure settings. Moreover, the valve's simple sealing action, relying on only one moving part, guarantees high reliability and shutoff when required. There are no internal ports that can become blocked, nor springs that can corrode or become damaged. This design contributes to the valve's robustness and longevity, eliminating the likelihood of failures and minimizing maintenance requirements.

Maintained Pressure and Ease of Maintenance

The ACV Ratio Reducing Valve excels in maintaining downstream pressure, even under no-flow conditions. When there is no flow, the valve remains closed, and it only opens when the downstream pressure drops. This feature ensures that the downstream pressure is maintained and prevents unwanted pressure surges, protecting the system from potential damage. Additionally, the valve's ease of maintenance is a significant advantage. It can be serviced by a single person and typically requires maintenance only once every 3 to 5 years. Service kits, including readily available standard seals and O-rings, simplify the maintenance process, further reducing downtime and costs.

Tamper-Proof and Leakage Elimination

The absence of external regulators or pilot tubes and needle valves etc. in fixed ratio reducing valves ensures tamper-proof operation, preserving the integrity and security of the system. This feature prevents unauthorized adjustments and safeguards the valve's performance. Furthermore, the ACV Ratio Reducing Valve eliminates leakages from control tubing, which is a common problem in buildings. This enhancement ensures efficient and leak-free operation, minimizing water waste and preventing potential damage to surrounding structures.

High Performance and Surge/Water Hammer Elimination

The ACV Ratio Reducing Valve's design, featuring only one moving part and two O-ring seals along with one main seal, ensures years of trouble-free operation with minimal maintenance

requirements. Compared to hydraulic diaphragm pressure-reducing valves commonly used in high-rise buildings, fixed

ratio reducing valves provide superior performance and reliability. Moreover, these valves offer significant benefits in eliminating surge events and water hammer within pipeline systems.

Surge and water hammer can cause substantial damage to pipelines, valves, and other system components. The ACV Ratio Reducing Valve effectively mitigates these issues due to its fast response time, controlled pressure reduction, and streamlined flow characteristics. By providing a gradual reduction in pressure, the valve dampens the effects of sudden pressure fluctuations, significantly reducing the risk of surge. Additionally, the valve's design minimizes turbulence and disturbances within the pipeline, diminishing the likelihood of water hammer occurrences.

Implementing a fixed ratio reducing valve like the ACV Ratio Reducing Valve in hydraulic systems offers comprehensive protection against surge events and water hammer. By ensuring controlled pressure reduction, reliable performance, and streamlined flow, these valves preserve the integrity and longevity of pipeline systems. The elimination of surge and water hammer enhances system reliability, minimizes maintenance and repair costs, and prevents potential downtime and damage.

In conclusion, fixed ratio reducing valves, such as the ACV Ratio Reducing Valve, offer a multitude of benefits, including simplified hydraulics, easy installation, complete security, and high performance. Moreover, these valves play a vital role in eliminating surge events and water hammer, safeguarding pipeline systems and enhancing their reliability. By choosing fixed ratio reducing valves, engineers and operators can optimize the efficiency, durability, and safety of hydraulic systems while minimizing maintenance requirements and reducing operational costs.

Materials of manufacture Flanged & BSP Screwed

Flanged

- **WCB (PN10/16 to PN150)**
- **304 Stainless Steel (PN10/16 to PN40)**
- **316 Stainless Steel (PN10/16 to PN40)**

BSP Screwed (15mm to 40mm)

- **304 Stainless Steel (PN10/16 to PN40)**
- **316 Stainless Steel (PN10/16 to PN40)**