

SchuF Fetterolf Control Valves

REGELVENTILE



100 Years
SchuF  **FETTEROLF**
2011 Innovation

Company Profile

“Every SchuF valve is an innovation in itself”

Wolfgang Frank
Chairman, SchuF Fetterolf Group

For over 100 years SchuF valves have stood for innovation and quality at the highest level.

Together with our customers, we invent, design and manufacture valves customised to exact tolerances, processes or special operating conditions. SchuF Fetterolf valves can be found in standard and in many severe service applications in the Chemical, Polymer, Pharma, Oil, Gas, Offshore and Refining industries.

... Innovation

The invention of the Lift Plug valve in 1911 and piston & disc bottom outlet valves in the nineteen twenties by the founder of SchuF – Josef Frank – were the first of a long line of valve inventions and innovative designs. Continuing research and development in materials (used in valve bodies and trim), design as well as complex processes enable SchuF today to offer valve solutions for applications with high pressure, high temperature and difficult media; or a combination of all three.

The integration of Fetterolf Corporation in 2004 further broadened the Group’s product portfolio, innovation and geographical reach. Today the SchuF Fetterolf product line includes control, isolation, sampling, switching and safety related valves.

... Quality

The exceptional quality and longevity of SchuF Fetterolf valves is a result of the precise attention to process detail, creative design, and the use of the appropriate high quality materials. In addition to its own high internal company standards, SchuF is ISO 9001, GOST and PED certified and can manufacture according to ASME, DIN, NACE, API, Fire Safe, GMP, JIS or any other internationally recognised standard.

... Worldwide presence

SchuF Fetterolf is represented in over 65 countries worldwide and has design and production facilities in Germany, Ireland, India, Brazil, the United States and the United Kingdom.



Control Valves

Control valves work to keep a process variable such as flow or pressure within a predefined operating range. They are often the last piece of equipment in a process loop that can compensate a load disturbance and are therefore considered critical valves.

Custom Applications

SchuF's experienced design engineers provide you with unique valve designs to meet both usual and unusual process demands. Special application designs, in service worldwide and showing continuous satisfactory performance, include:

- Discharge and feed flow control valve in **PET, PVC, PP & PE** reactors
- Level, pressure & steam injection control valves in **PTA** processes
- Level control of flashing fluid in **coal liquefaction** or **heavy oil upgrading**
- Feed and level control for **gasification** according to the Siemens, Lurgi, GE and Shell process licences
- Flow control of powder in **fine chemical & pharmaceutical** processes
- High precision multi-port flow control of highly viscous, non linear, non-Newtonian **polymer** fluids
- Discharge flow control valve for **urea** reactors where urea grade stainless steel is mandatory
- Fully jacketed short body wafer control valves, for **Nylon** and **PC** production
- Mineral processing applications such as high pressure acid leaching (**HPAL**)
- Sour water and Amine letdown in several **refinery** processes
- Resurge and flare control for **gas**

Angle Control Valves – Model 74

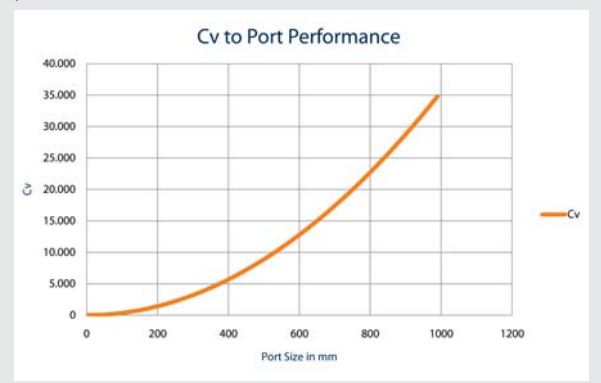
The SchuF Model 74 Angle Control or Choke Valve is designed for critical or severe applications involving level control and pressure let-down in High Pressure Acid Leach (HPAL), Hydrocracking, Coal Liquefaction, PTA and other demanding processes.

Available in sizes from 1 inch to 36 inches and up to ASME 2500# as standard, SchuF can address almost any size or pressure class. Materials of construction include cast or forged Carbon or Stainless Steel, Hastelloy, Inconel and Titanium bodies with ceramic or tungsten carbide trim components for handling flashing slurries of 20% solid content and above.

The SchuF Angle Control Valve is often custom made to process requirements in order to optimise field performance. Valve bodies are simulated to extend service life, by preventing impingement of particles on internal surfaces. Stagnant areas are minimized to prevent build up of slurry or scale.



SchuF Control valves optimise Cv to port performance.



Key Angle Control Valve Features:

■ Accelerating Flow Path:

Acceleration of abrasive process media is maintained continuously through a sweeping, non-expanding angle body to prevent flashing until the fluid, gas or slurry enters the protected outlet area. There is no stagnant space where process slurry can form eddies or undesired turbulence.

■ Cv Sizing for 3 Phase Flow:

SchuF's proprietary Cv sizing model is particularly well adapted to three phase flow media.

■ Large Stem Diameter:

Stem diameters are individually sized to eliminate deflection and the possibility of damage to critical trim components.

■ Replaceable Valve Seat:

The ability to change the customised valve seat reduces downtime and saves money.

■ Unique Flow Characteristics:

Linear and equal percent control characteristics are available as standard. Customers can opt for SchuF's patented X³ bell curve for better control at known operating levels.

■ Anti-Rotation Device:

The yoke includes a device to stop the valve stem from turning when the valve plug is subjected to high velocity lateral fluid flow.

■ Cast Yoke:

Rugged yoke bracket in cast stainless or carbon steel is used to prevent structural deformation when the valve is mounted in non-vertical positions.

■ Cavitation & Flashing Solutions:

Please see the flashing and cavitation highlight on page 17 and 18 respectively.

In-Line Control Valves – Model 50R

The Y-globe control valve can be installed in process lines from 1 inch to 24 inches and is ideal to control flow or to reduce pressure. It has a sturdy design, superior flow and control characteristics (compared to globe or ball control valves) and zero leakage sealing performance.



Addressing Fugitive Emissions

SchuF has extensive experience in stuffing box design to minimize emissions to the work area. Typical packing options include PTFE and Graphite with a lantern ring for early leakage detection. A proprietary wiper ring design prevents migration of slurry into the stuffing box area. These elements can be applied to most of the SchuF control valve range.

Globe Control Valve – Model 72

Globe control valves combine the protection of a bellows seal with the controllability and leak tightness of a SchuF control valve. They are used in arduous and lethal services with critical media such as chlorine, phosgene, hydrofluoric acid, NH₃, CO₂, urea etc. They are Eurochlor compliant.

Globe control valves are available in sizes from 1" up to 24", ASME 150# to 900#, in long or short bellows design, in carbon steel, stainless steel, Hastelloy, Monel and Titanium, with pneumatic or electrical controls. All electrical equipment can be explosion proof.

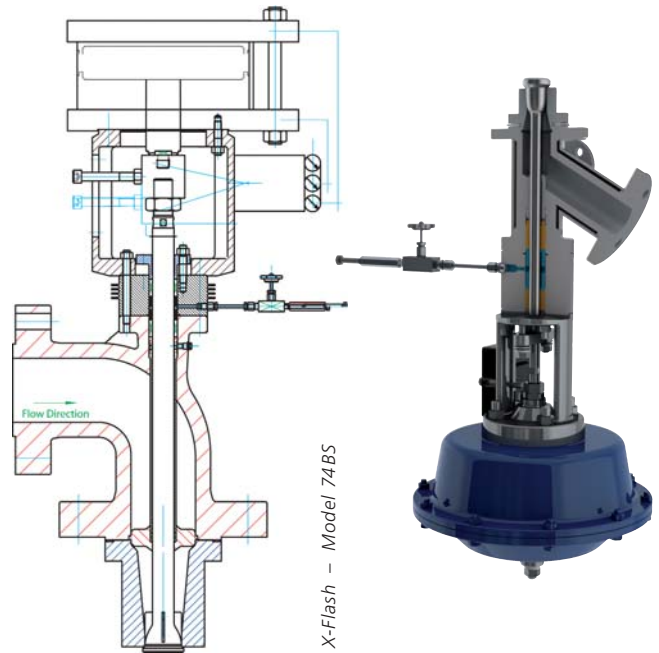
Angle Control Valves

The SchuF control valve product range consists of angle as well as in-line control valves. SchuF has developed over 20,000 control valve variations in its hundred year history. Each has its own specific characteristics tailored to the process control elements that are most important for it – pressure, level, flow or temperature.

X-Flash – Model 74BS

Ideal for **avoiding** flashing in the valve

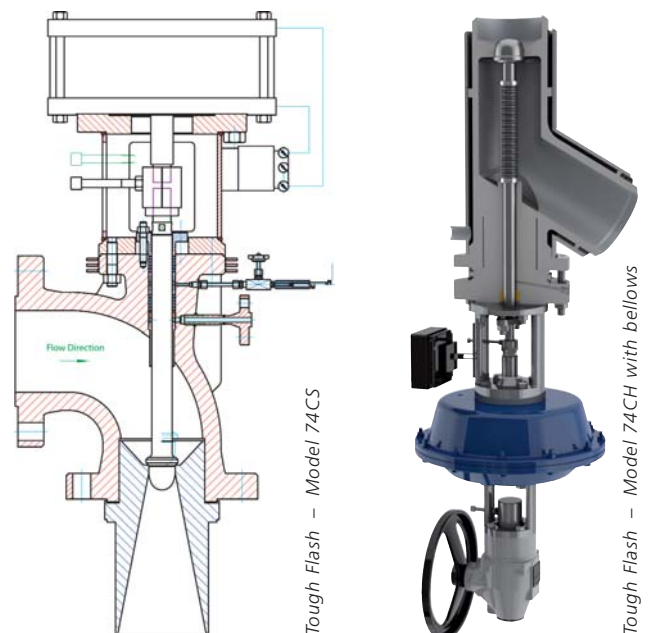
- Flow to open – External Flashing
- Single stage letdown design
- High Cv values (1 to 3000)
- Low wear and tear
- Disc opening direction eliminates plugging by sediments
- Best suited for vessel installation



Tough Flash – Model 74CS

Ideal to **accommodate** flashing in the valve

- Flow to close
- Hard material trim
- Flashing occurs in the protected seat / choke tube area
- Up to 180 bar let down is possible in a single stage
- Customised and replaceable choke tube
- Suitable for pipeline or vessel installation



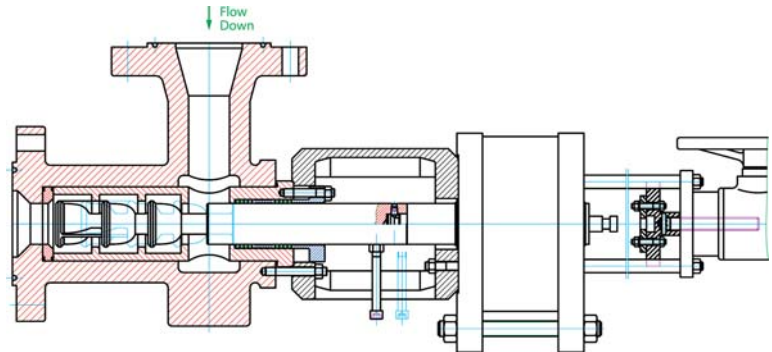
Common SchuF Angle and In-line Control Valve Features:

- Accelerating body geometry design
- Optimised 3 phase flow calculation
- Linear, equal % and SchuF bell X^3 control curve
- Integral plug and stem
- Seat leakage to Class VI, API 598 or EN 60534-4
- Standard robust yoke construction
- Inlet angle 45°, 60° or 90°
- DN 25 (1") to DN 900 (36")

Multi-S – Model 74MS

Ideal to let down high pressure over several stages and **avoid cavitation**

- 2, 3 or up to 6 staged pressure reduction disc design
- Up to ASME 2500# as standard
- True Equal % characteristics
- High Cv values (1 to 3000)
- Large outlet chamber to reduce velocities
- Disc opening direction eliminates plugging by catalyst fines or other sediments
- Cast or single block forged body available
- Easy to replace severe service trim

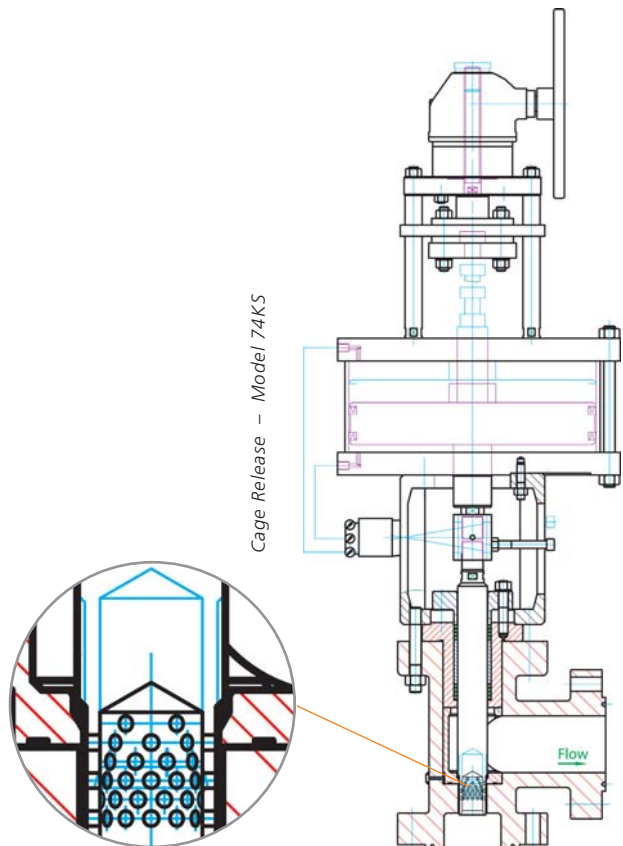


Multi-S – Model 74MS

Cage Release – Model 74KS

Ideal for **energy dispersion and noise control**

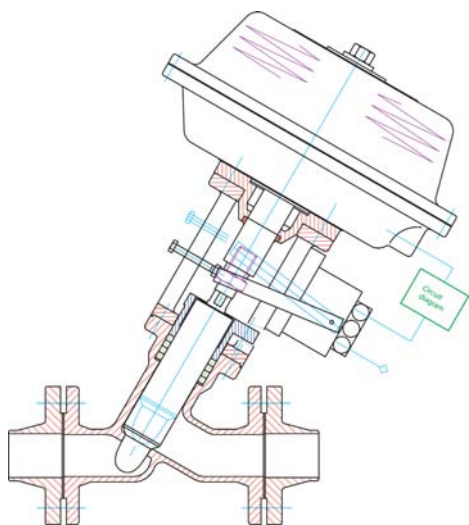
- Multi hole cage or labyrinth design – to achieve accurate flow characteristics and noise attenuation
- Class VI (API 598) shut-off is achieved, eliminating unacceptable leakage
- Linear or Equal % control characteristics
- Available with fast opening actuators, and smart positioners
- Easy to replace trim parts
- Stainless steel or special hard metal materials can be used



Cage Release – Model 74KS

In-Line Control Valves

Y-Globe Control Valve – Model 50



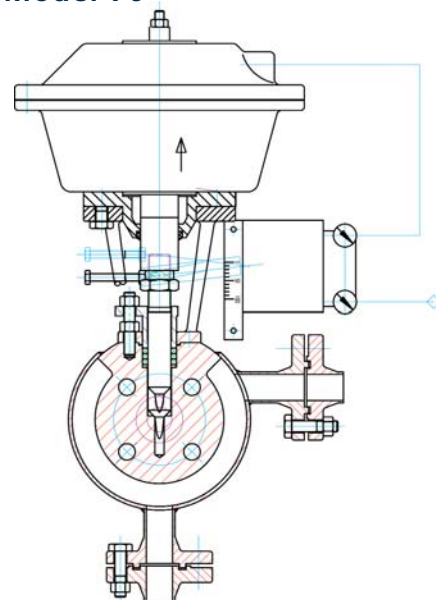
Ideal for in-line control with bubble tight positive shut-off

- High throughput (e.g. 4" (DN 100) – Cv min 140 to max 300)
- Flow optimised – low pressure drop
- Equal %, linear or custom control characteristics
- Class VI process shut-off and zero leakage to atmosphere performance
- Dead and slow space free options

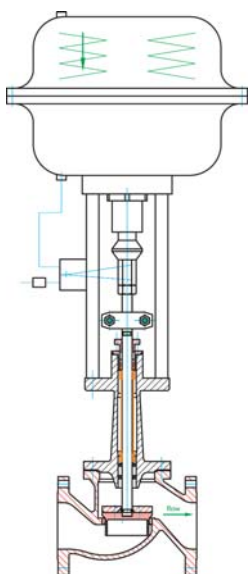
Wafer Control Valve – Model 76

Ideal for limited space control applications

- Space saving design
- Cost optimised
- Linear or equal %
- 1/2 inch to 3 inch
- To ASME 2500#



Globe Control Valve – Model 72



Ideal for lethal service control applications

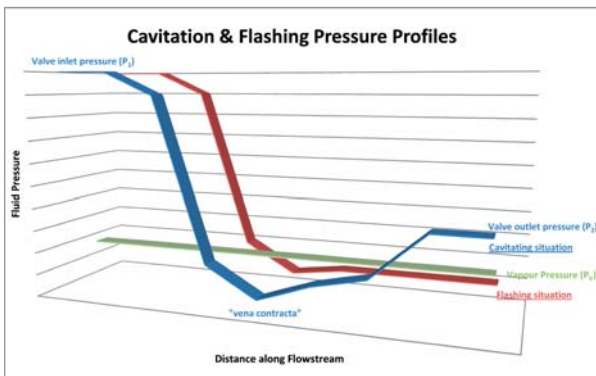
- Designed for at least 20,000 operations
- Emergency stuffing boxes as standard
- Linear, equal % or on/off control
- Bellows fitted in bonnet to protect against erosion
- Control disc or cage (for noise reduction)
- Loose self aligning disc for absolute shut-off, (ASME Class VI)
- Metallic sealing surfaces with different hardness (e.g. stellite)

Control Valves

Control Valve Flashing Solutions

Control valves used in applications involving liquids in high pressure or high pressure drop conditions are highly susceptible to damage from flashing or cavitation.

Flashing occurs in the liquid flow when the internal pressure of the liquid falls below the vapour pressure and remains below it. During this phase vapour bubbles form and flow with the liquid downstream at increased velocities causing erosion to valves and piping.



Whilst the variables (P_2 and P_v – see above diagram) that define flashing are not directly controlled by the valve, the best approach for flashing medium is to choose control valves that minimise its effects. SchuF provides a number of anti flashing control features:

■ Particle Impact Prevention

The SchuF Model 74BS is an accelerating flow angle body design with flow to open characteristics. Installed in a tank or vessel the outward opening disc moves any potential flashing to the exit seating area of the valve. Flashing then takes place outside of the valve and the kinetic energy is dissipated into a special tank or vessel.

■ Velocity Reduction

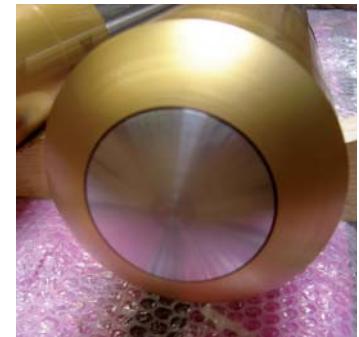
Valves with expanded flow areas downstream of the vena contracta are beneficial as the erosive velocity is reduced. SchuF's angle control valve range either as a flow to open –

X-Flash, or flow to close – ToughFlash (for pipeline installation, where the plug rises into the body) design can be provided with an expanding choke tube or customised outlet. This allows pressure to increase and minimises velocity.

■ Hardened Materials & Surfaces

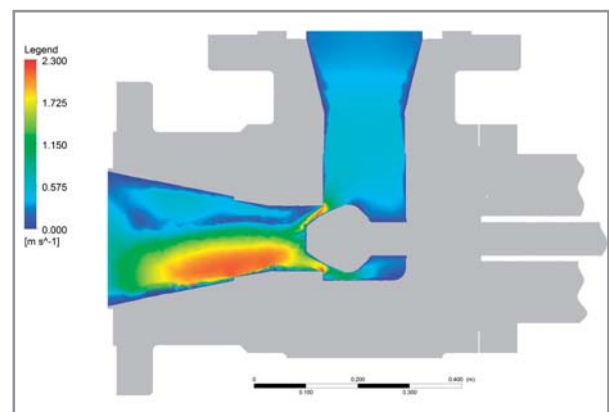
Correct selection of both the body and trim material can go a long way to reducing the effects of flashing and cavitation.

The synergetic effects of erosion and corrosion in flashing water applications (water corrosion of the steel and flashing erosion of the resultant soft oxide layer for example) can be minimised by selecting a low alloy steel.



Piston head with tungsten carbide coating

For more complex flashing media, a wide choice of hard trim materials from ceramic to tungsten carbide, stellite or surface coatings are available to protect the valve.

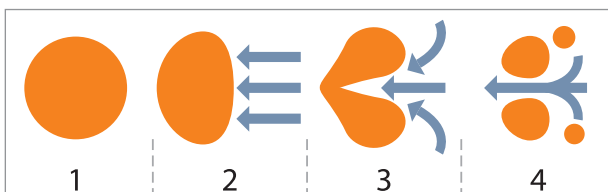


Simulation is at the heart of control valve design for difficult applications. Many negative process consequences such as flashing, crystal formation, or sediment deposits are either avoided or accommodated in SchuF control valve design through extensive use of FEA and CFD (ANSYS) simulation.

Control Valves

Cavitation

Cavitation occurs in a similar way to flashing with the formation of gas bubbles as the liquid pressure falls below vapour pressure. If the liquid pressure then recovers and rises above the vapour pressure the bubbles start to collapse or implode creating a shock wave which releases energy in the form of multiple micro jets.

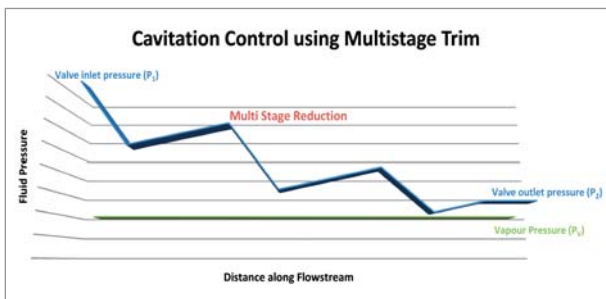


Micro jets have a velocity of 400 km per hour and temperatures of up to 5,500 °C and literally blast away pieces of the valves components or lead to severe pitting and accelerated corrosion. Cavitation is typically accompanied by accentuated hydrodynamic noise and vibrations in the valve and piping.

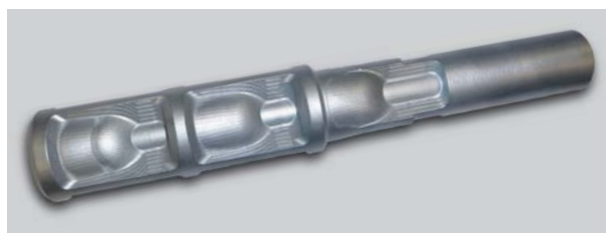
Anti-Cavitation Solutions

■ Pressure Drop Management

The best means to eliminate cavitation is to control the pressure drop and ensure that it never falls below vapour pressure.



This is achieved by using a multiple stage trim that reduces the pressure drop in stages. The principle is illustrated in the above diagram, where pressure is let down in three successive stages. SchuF has a broad range of multistage trims that allow pressure to be let down in up to six stages in a step plug, or more in a stacked cage design.



Three stage control plug example

■ Valve Sizing and Design

Proper valve sizing and body or trim design are also important factors in fighting cavitation. SchuF has specialised in the more complex dual and triple phase medium, typically slurries, and has developed its own advanced Cv sizing model for them. The model takes into account pressure drops at minimum, normal, and maximum flows as well as full details of inlet pressure and fluid conditions. The results are referenced against empirical data collected over the past 40 years in exact or similar applications and result in design recommendations for valve, seat and outlet size, body and trim material, as well as trim design for flashing or cavitating applications.

■ Control Valve Diversity

As a result of its focus on real life field control issues SchuF has designed a broad range of both in-line and angle valves. These valves are suitable for critical services as well as severe services that exhibit flashing and cavitation. All SchuF control valves exhibit the following key benefits:

Key Benefits

- Proven critical reliability
- Special design options
- Longer valve life
- Lower maintenance

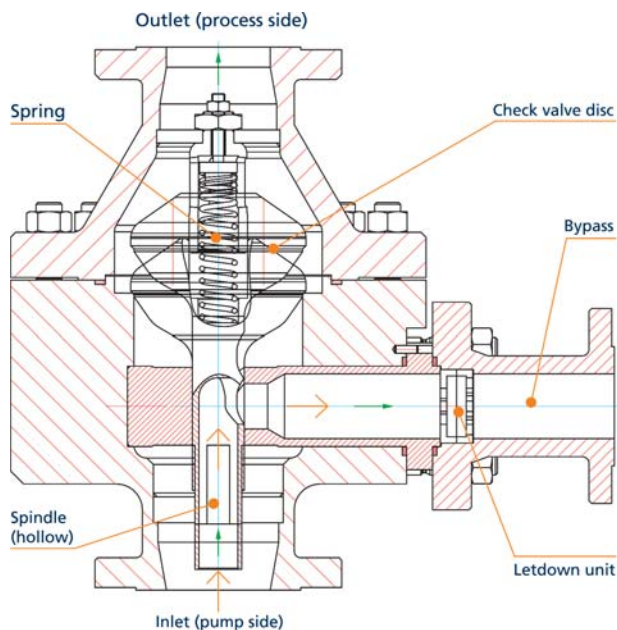
A full brochure is available at: www.schuf.com/pdf

Automatic Recirculation Valve (ARV) – Model 78

Automatic recirculation valves have the primary purpose of protecting centrifugal pumps by assuring minimum flow through the pump at all times.

Purpose

They replace conventional multi valve pump protection solutions which have proven to be costly or inefficient. The automatic recirculation valve approach unites the check valve, the automatic bypass control valve and pressure letdown functionality in a single valve body.



SureFlo™ design

Mode of Operation

The automatic recirculation valve is installed in the pump discharge line in the position of the main check valve that it replaces. The valve opens as soon as the pump builds sufficient flow to move the internal valve disc in the main line into an open position. Decreasing flow through the valve causes the spring loaded disc to return to its seat closing the process outlet. At the same time the bypass outlet is uncovered allowing a minimum flow of liquid to be routed back to the pump.

A full brochure is available at: www.schuf.com/pdf

Key Features:

- Standard sizes up to 16" (DN 400) and ASME 4500#
- Automatic bypass operation
- Non return function
- Modular design
- Custom pressure letdown in bypass
- No power or air pressure required
- Offshore design available



ARV Product Range

SchuF Fetterolf has a broad range of ARV designs to meet most applications. The **SureFlo™** design is suitable for line sizes up to 10" and ASME 2500# pressure class. The **HighFlo™** goes to 24" and ASME 4500#, whilst the **ControlFlo™** is more suitable for high pressure applications where multistage letdown or enhanced bypass sealing is required.

ARV Pump Applications

- General centrifugal pumps
- Boiler feed water pumps
- Cooling plant feed pumps
- Crude oil pumps
- Fluid gas pumps (LNG, LPG etc.)
- Process liquid pumps
- Booster pumps
- Seawater injection pumps
- Fire fighting pumps

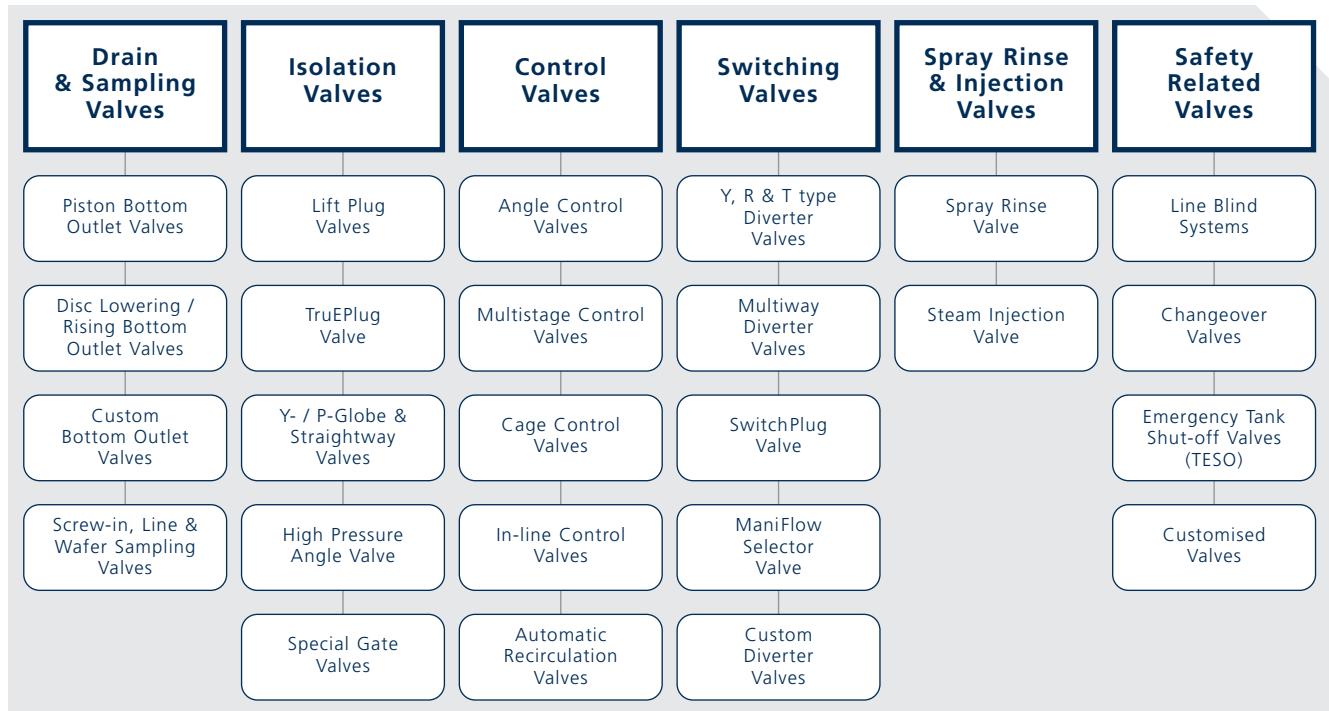
Product Portfolio Overview

SchuF Fetterolf has delivered over one million valves during its 100 year history to a wide variety of industries in over 50 countries worldwide.

Headquartered near Frankfurt in Germany, the company has additional design and manufacturing centres in Brazil, India, Ireland, UK and the USA.

The SchuF group has sales and agent offices covering almost every country in the world.

We manufacture valve products that control, isolate, divert, and sample liquids, gases, powders, and slurries. Our product range of engineered, customised valves includes:

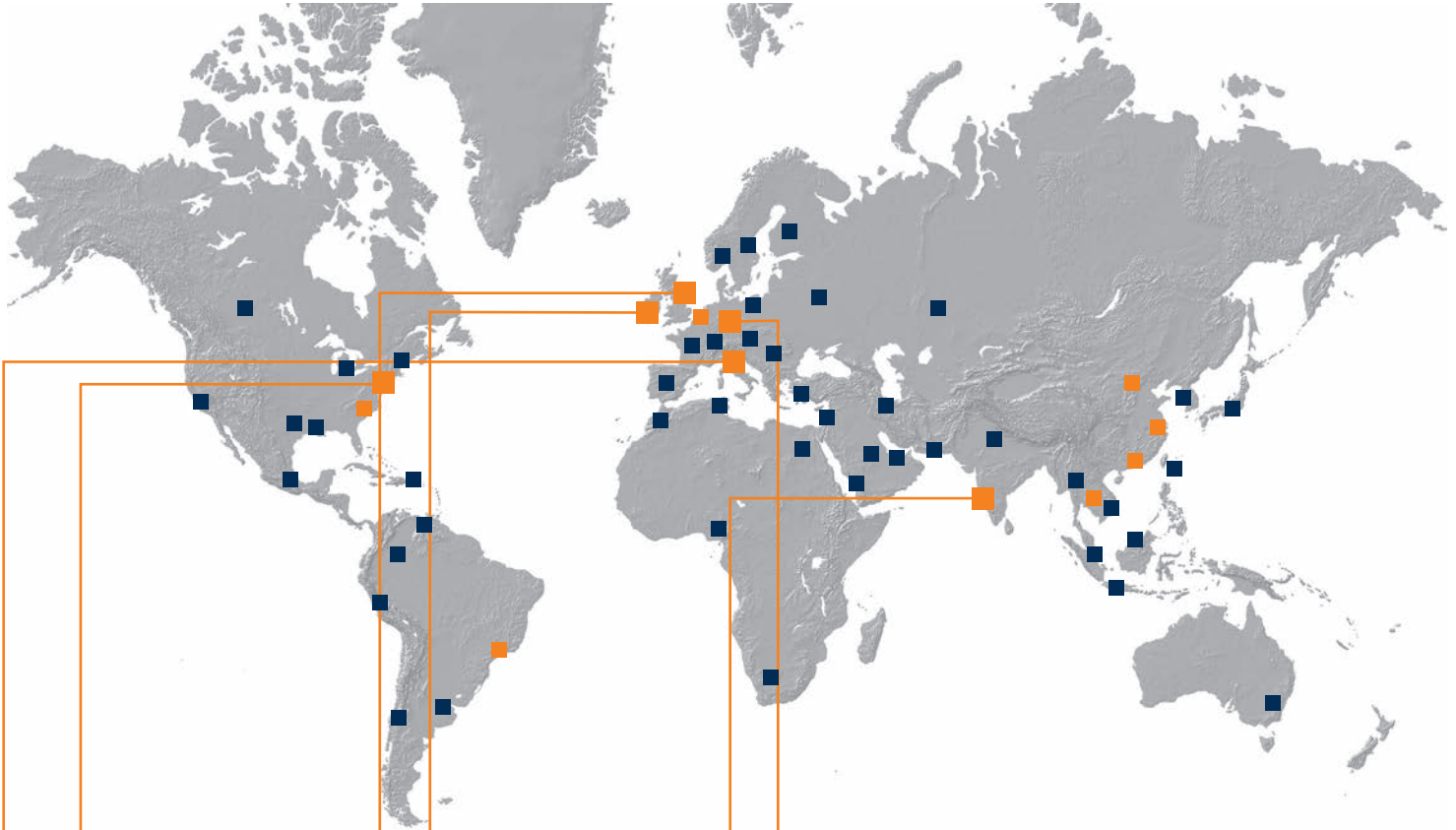


Key Client List:

- | | | |
|------------------|---------------------|------------------|
| ■ AkzoNobel | ■ Glaxo Smith Kline | ■ Reliance |
| ■ AstraZeneca | ■ INEOS | ■ Roche |
| ■ BASF | ■ Invista | ■ SABIC |
| ■ Bayer | ■ Jiangsu Hengli | ■ Saipem |
| ■ BP | ■ Lanxess | ■ Salavat |
| ■ Chevron | ■ LG Chemical | ■ Samsung |
| ■ Clariant | ■ Linde | ■ Sandoz |
| ■ DOW Chemical | ■ Lukoil | ■ Sanofi Aventis |
| ■ Du Pont | ■ Lurgi | ■ Shell |
| ■ Eastman | ■ Merck | ■ Shin Etsu |
| ■ Evonik | ■ Novartis | ■ Sinopec |
| ■ Exxon Chemical | ■ Oerlikon | ■ Sulzer |
| ■ FCFC | ■ Oxy Vinyls | ■ Temex |
| ■ Far Eastern | ■ Pemex | ■ Tuntex |
| ■ Foster Wheeler | ■ Petrobras | ■ Uhde |
| ■ GE | ■ Pfizer | ■ Vinnolit |



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