Lift Plug Valves

SchuF

Lift Plug Valves

Patented Innovation

SchuF is a highly specialised group of companies, whose expertise is the design and manufacture of process control valves for critical service applications. SchuF is the inventor of the Lift Plug Valve. The patent dates back to 1914. Since its invention SchuF has continued to develop this type of valve, with many innovations. These include the addition of electric, hydraulic and pneumatic operators, and new applications such as switching and dumping variants. SchuF also pioneered the inverted plug design, which can be serviced in-line; designed flushing systems; and several high-pressure and high-vacuum versions. SchuF's special high-temperature valve range can be used in operating conditions up to 1000° C.

Feature-Rich

SchuF valves offer unique flexibility:

- *the valve can be automatically actuated either using a SchuF **Lift-Turn-(re)Seat (LTS)** operator or using two separate actuators for maximum reliability on larger sizes*
- *the plugs can be straightway or inverted for better flushing or ease of maintenance*
- *the plug can be solid or lightweight*
- *full- or reduced-bore, which can be round (pigable), or a space-saving oval profile*
- *the valves can be supplied with standard or oversized flushing connections*
- *the body of the switching valve can have its three outlets at 120° to each other, or be in a 'T' configuration*
- *the Automated Control Panel can automate the process system, including the switching valve and all the on/off isolation valves associated with a two- or three-drum delayed coking installation*
- *trunnion spindle guiding can be used for high-pressure applications or to prevent vibration damage*

Rugged Simplicity

The valve essentially consists of only two parts, the body and the plug. There are no sealing rings, bellows or gaskets. There is little to break, fail, or clog.

Material Choice

SchuF's strengths include flexibility of design and construction. We have produced Lift Plug valves in all stainless steels, high Nickel alloys, Titanium and Zirconium, with many different coatings including full stelliting and gold plating. SchuF uses special surface coatings and trunnion spindle guiding to improve resistance against vibration and erosion. SchuF also offers solid Tungsten Carbide and ceramic trims.

Reliable Operation

Most lift plug valves come equipped with manual or electric actuators. SchuF can also fit the valves with pneumatic or hydraulic systems. The SchuF Lift-Turn-(re)Seat (LTS) operator converts simple rotation movement to lift, turn and reseat the plug. A master slave actuator arrangement simplifies control.

Industry Experience

SchuF valves can be found in a wide cross-section of industry and process applications. The ability of our engineers to adapt the SchuF valve to almost any critical or severe condition is well established in the Hydrocarbon, Cement, Alumina, Power and Chemical Industries.

General Specifications

Rating:

- ASME Class 150# to 900# (specials to 4500#)
- High temperature version to 1200° C

Sizes:

- **SwitchPlug** - Typical sizes range from 8" to 24".
- **IsoPlug** - Typical sizes range from 8" to 36".

Materials and Options:

- **Body**

St. Steel, Duplex, Hastelloy, Lucoly, Inconel.

Titanium, WCB, WC6, WC12, WC12A

- **Bore**

Full bore, oval or round (pigable)

- **Trim Coating**

Chrome, Ceramics, Bonding

- **Lining/ Sleeves**

Gold, Titanium, and other materials on request

- **Sealing**

Standard metal to metal; wide sealing lip

- **Flanges**

Fully flanged RF and RTJ, DIN and ANSI Through bolt-holes

- **Jacketing**

Full or partial jacketing available.

- Purge and Flushing connections

Five connections as standard: more on request

Port size - 1 to 2 inch

- **Flow Direction:**

Bi-directional; flow to open or close

- **Actuation:**

Electric, pneumatic or hydraulic are available

- **Coking Defense System:**

- 1. Steam flushing during plug operation
- 2. Integral flush drain/dump valve enabling steam purging above or below the plug
- 3. IsoPlug valves with detachable bottom lids to allow hydro-blasting of any lodged coke or debris.

Lift Plug Cv Values Table
(full Bore)

Size	DN	Cv
4 inch	100	3100
8 inch	200	10000
10 inch	250	16000
12 inch	300	22000
14 inch	350	31000
16 inch	400	42000
18 inch	450	57000
20 inch	500	71000
24 inch	600	105000
30 inch	750	175000
36 inch	900	290000

Lift Plug and Ball Valve Comparison Table

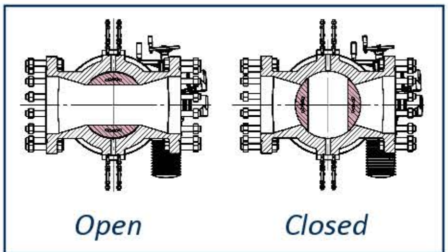
LIFT-PLUG	BALL VALVE
Simple rugged design, only two main parts	*Complex design, many major parts*
Plug seizing is not possible	*Can get stuck*
Seals do not wear during operation	*Seal wear with every operation*
Seat seals are load free during rotation, but thrust loaded by lowering the plug after the rotation, ensuring a perfect seal	*Seals are exposed to the process while loaded, sealing cannot be improved by the actuator*
Flushing only required during valve operation	*High flushing requirements, high cost of ownership*
Valve suffers no ill effects if flushing fails while in service	*If flushing fails, maintenance and spare parts expensive*
Uses two actuators for larger/more rugged service	*Single much bigger actuator*
Low torque required to turn the valve	*High torque, large motors*
Switching valves available with inlet from below, and either 3 or 4 outlets	*Switching valves available with inlet from below and three outlets only*
Top or bottom entry design permits inspection and easy maintenance without removal from the line	*Not always possible with a ball valve and therefore difficult to maintain*
Maintenance rarely required, no parts required	*Expensive spare parts and repairs are required*

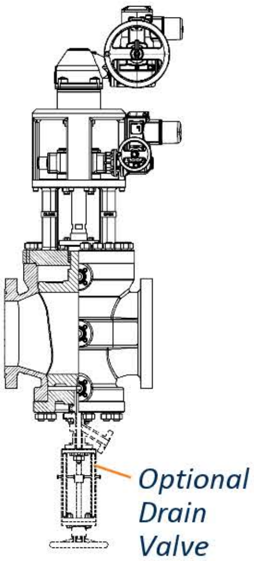
IsoPlug Valves

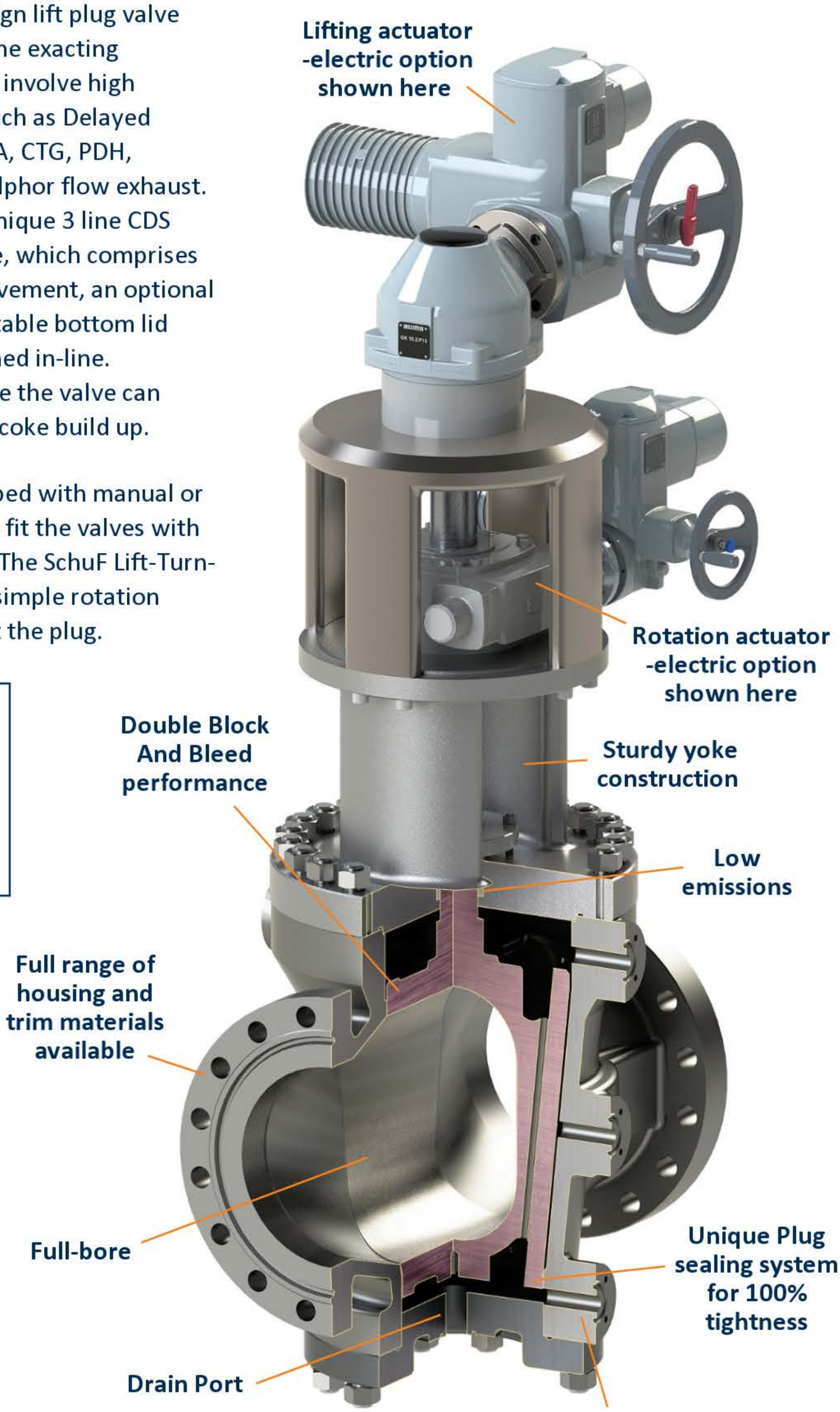
Features

The IsoPlug valve is a special-design lift plug valve that has been modified to meet the exacting requirements of processes which involve high temperatures and dirty media, such as Delayed Coking, Visbreaking, TDI, PET, PTA, CTG, PDH, styrene, acetic acid, and liquid sulphor flow exhaust.
The IsoPlug valve features the unique 3 line CDS (Coking Defence System) package, which comprises of steam flushing during plug movement, an optional integral drain valve, and a retractable bottom lid that enables the valve to be cleaned in-line.
The CDS package ensures that the the valve can always be kept clean, and avoids coke build up.

Most lift plug valves come equipped with manual or electric actuators. SchuF can also fit the valves with pneumatic or hydraulic systems. The SchuF Lift-Turn-(re)Seat (LTS) operator converts simple rotation movement to lift, turn and reseat the plug.





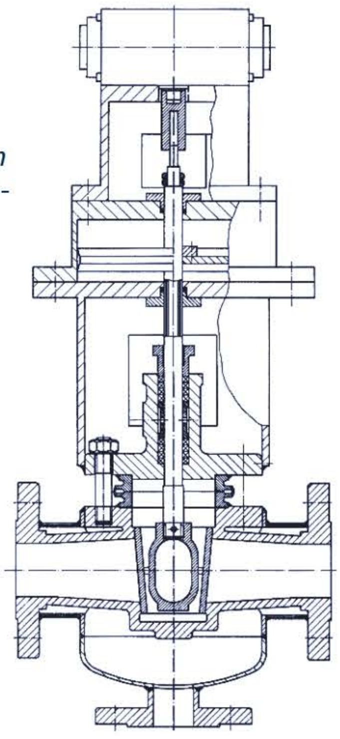


IsoPlug Valves

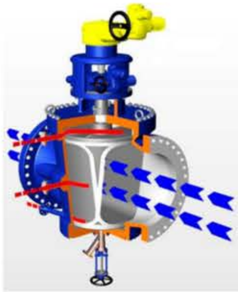
Key Design Principles

- **Integral 'double block and bleed'** design that ensures a perfect seal
- **Protected Valve Seat (PVS)** – valve life is increased as seat or body faces do not come in contact with the media flow
- **Optional flushing and/or Purging** (if required by the process) is only required during operation from open to close or vice versa. This leads to significant cost savings in comparison with other valve designs (i.e.ball valve).
- **Roval bore plug** advantages:
  - full port with narrow plug; this means that flanges can thus feature through-bolting and still maintain standard length
  - reduces considerable the steam flow into the main line when the plug is partially turned, since this effect depends on the width rather than the height of the bore
- **Three line Sediment Defence System** (3 SDS- see right) - optional
- **Automated Control Panel** (ACP) can be used to control single or multiple valves, actuators and sensors
- **Top- or bottom-entry** for ease of maintenance

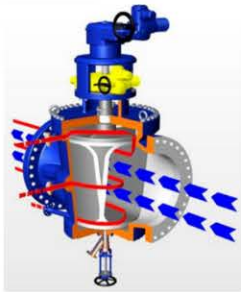
Right: Cross-section drawing of an Auto-Lift Plug Valve, type 12DH, with pneumatic lifting actuator and electric turning actuator



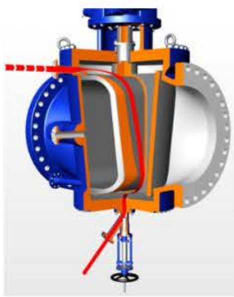
Sediment Defense System



This cut-away of the IsoPlug (left) shows the media in blue with the plug in open position. The top actuator has been engaged and the plug starts to rise. Note how steam flushing takes place during plug lifting (red lines). This is the first line of attack of the Sediment Defense System.

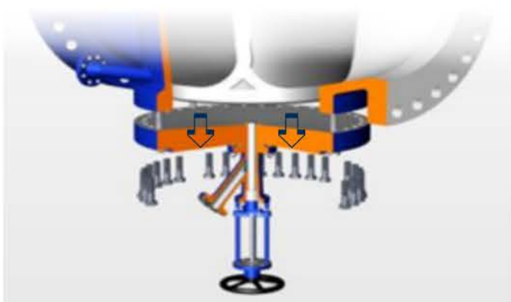


The 2nd actuator has now been engaged and the plug is turning. Flushing will now take place in, around, above and below the plug.



*The integral flush drain valve is now open and the second line of the Sediment Defence System can begin.
A steam purge has been activated, and this will clean any remaining sediment debris above or below the valve plug. Any remaining debris will be deposited to a dump point.*

*This image (below) shows how the bottom of an IsoPlug valve can easily be lowered/retracted to carry out any necessary maintenance. This is the 3rd element of the **SchuF Sediment Defense System***

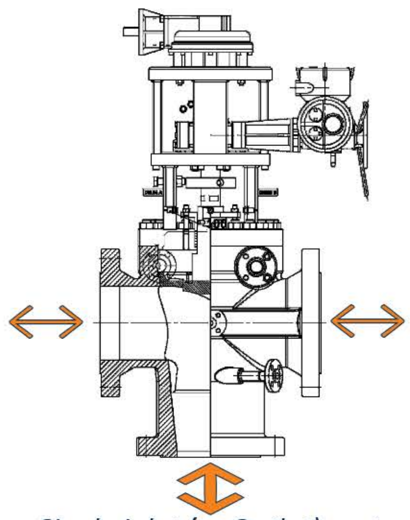


SwitchPlug Valves

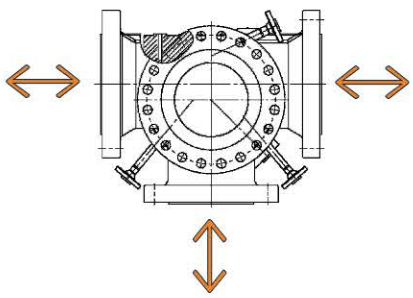
Features

The SchuF SwitchPlug valve is a switching valve with typically three outlets and one inlet. It is used to switch media flow from one outlet to another in a defined sequence whilst isolating all other outlets.
It is commonly used in the refining industry for delayed coking due to its leak-tight metal-to-metal sealing characteristics and suitability to high temperatures.
The SwitchPlug consists of only a few moving parts - body, plug and actuator - and is therefore highly reliable. There is no gap between the plug and the valve body, where the fluid or process particles can settle, damage piping or score the valve. Flushing is therefore only required while the plug is in motion.

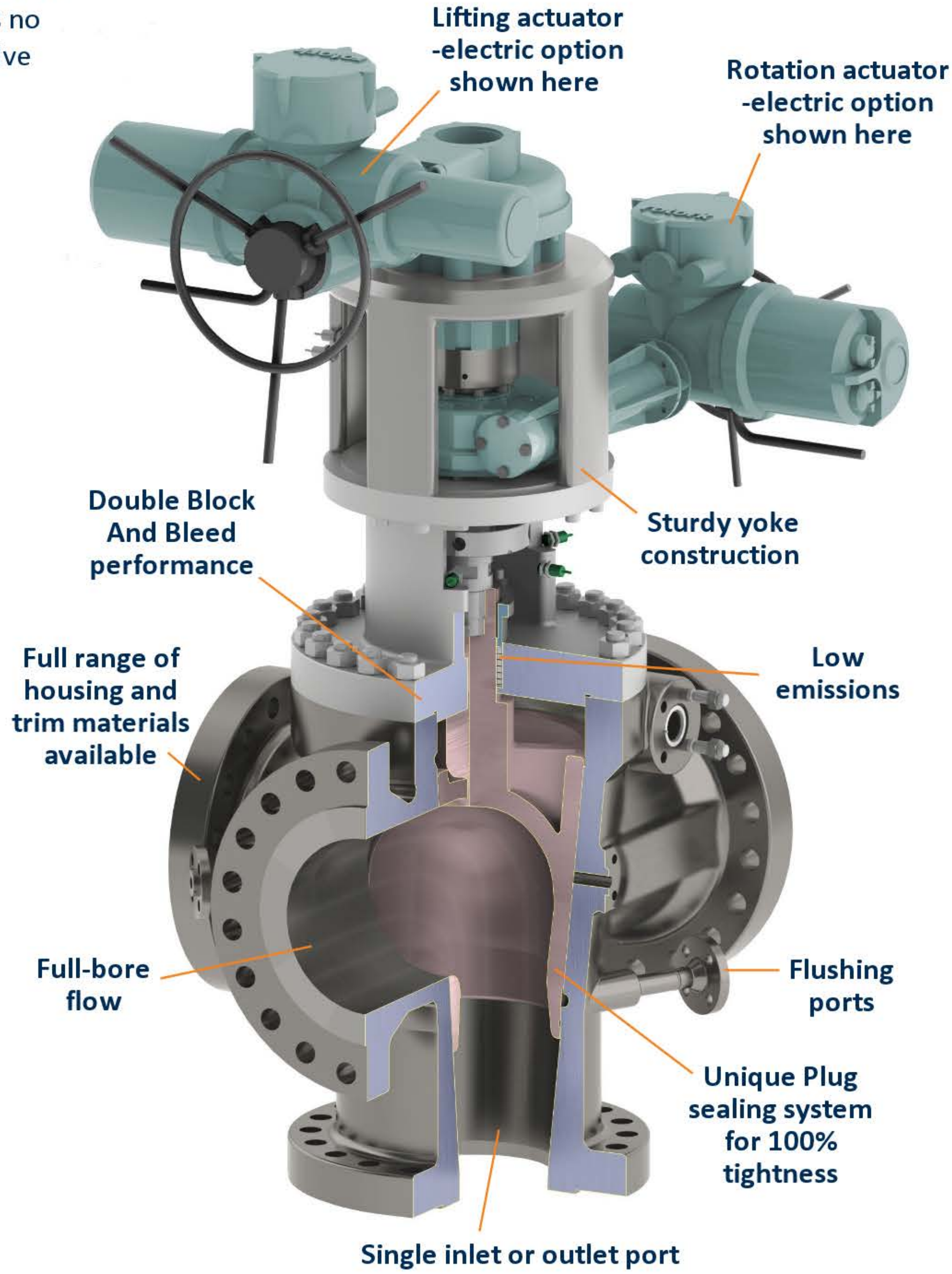
- Size: 6" (DN150) to 24" (DN600) (Others on request)
- Pressure Class: ASME 150# to 1500# (higher on request)
- 2, 3, 4 or more outlets
- Full-bore round plug design
- High throughput during switching
- Dual motor actuation
- 3 line Sediment Defence System (SDS)
- Integral flushing options



Single Inlet (or Outlet) port



This 'T'-configuration provides three flow paths



SwitchPlug Valves

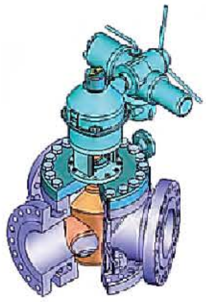
Key Design Principles

• **Benefits** - The SwitchPlug is designed to outperform conventional valves (e.g. ball valves) in services where sediments or, for example, coke particles can collect and cause equipment failure. In fact, the **Coking Defence System** developed by SchuF features a combination of gap-free design, integrated drain valves and distributed and tangential flushing to ensure optimal coke-free valve operation.

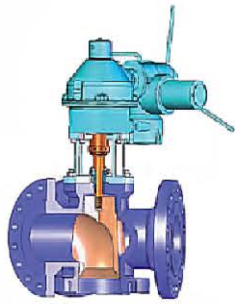
• **'Y' or 'T' design** - SchuF can provide the Switch Plug in either a 'Y' (120°) or 'T' (90°) configuration. This allows for greater piping flexibility, particularly in existing plants or for revamps. The SwitchPlug can also be mounted in horizontal or vertical positions.

• **Dual Actuation** - the SwitchPlug operates with two actuators - one to lift or lower the plug and a second one to rotate it to the required position. The lower torque requirement leads to longer actuator life, reduces maintenance and eliminates plug sticking.

• **Flow Regulation Mechanism** - the SwitchPlug actuators are provided with an integral control system. This ensures both accurate positioning of the plug to the outlets or bypass line - time and time again. For example, in the Coking process, it enables proportionate distribution of the coke media between two lines or drums- e.g. 70% / 30%.. Greater than 90% of the flow throughput can be realised even in these intermediate positions.

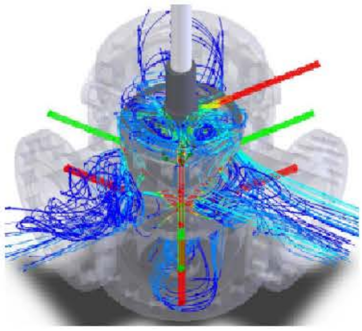


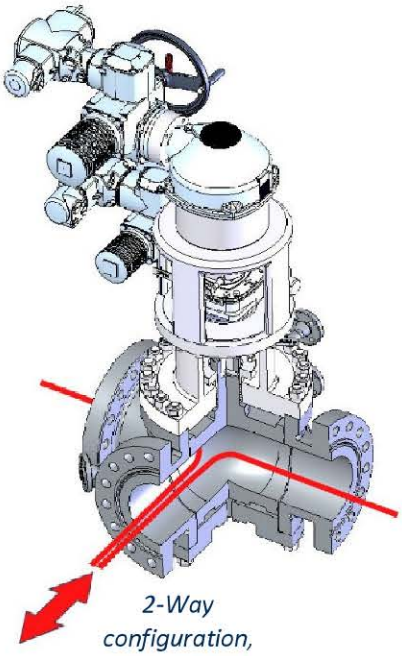
Type 12SD Valve: Plug inserted from above



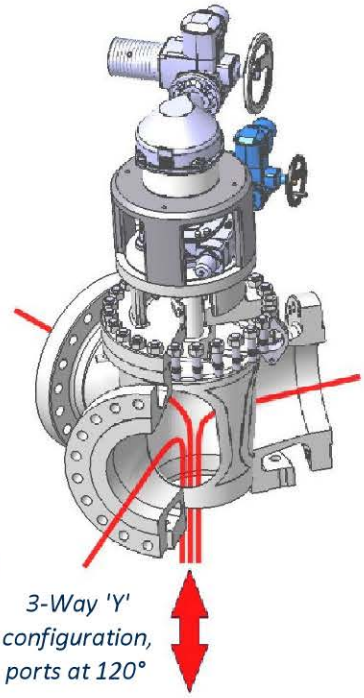
Type 14SD Valve: Plug inserted from below

Right: Flow Simulation analysis of the flushing system of a 3-way SwitchPlug Valve

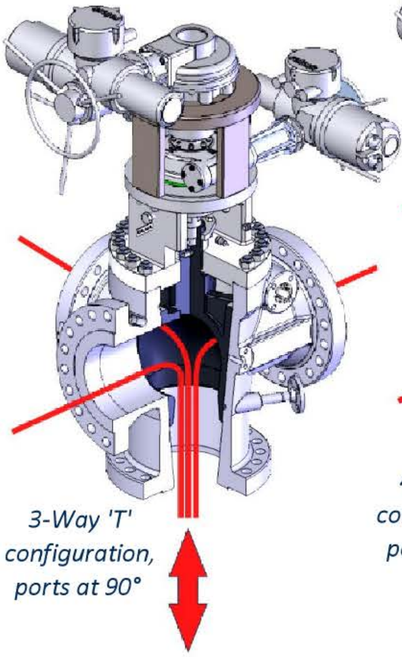




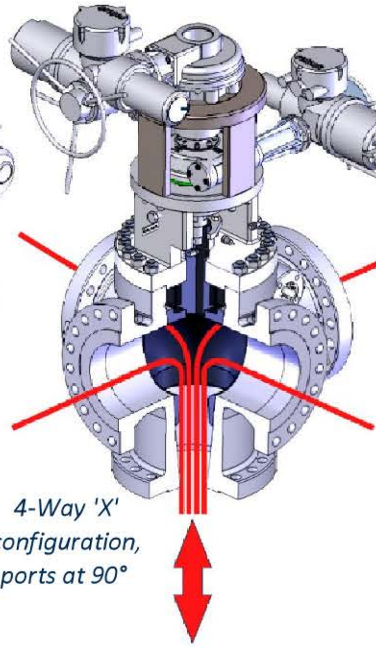
2-Way configuration, ports at 180°



3-Way 'Y' configuration, ports at 120°



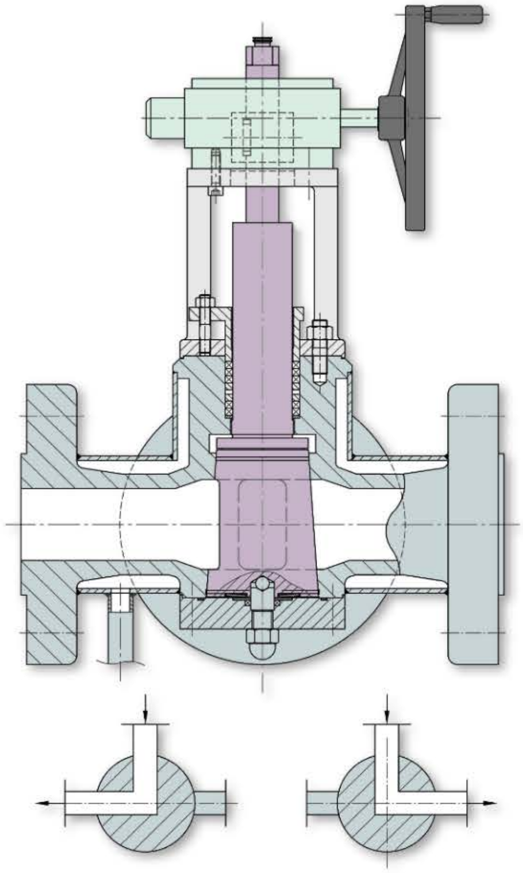
3-Way 'T' configuration, ports at 90°



4-Way 'X' configuration, ports at 90°

Lubricated Plug Valves

For high pressure and special applications

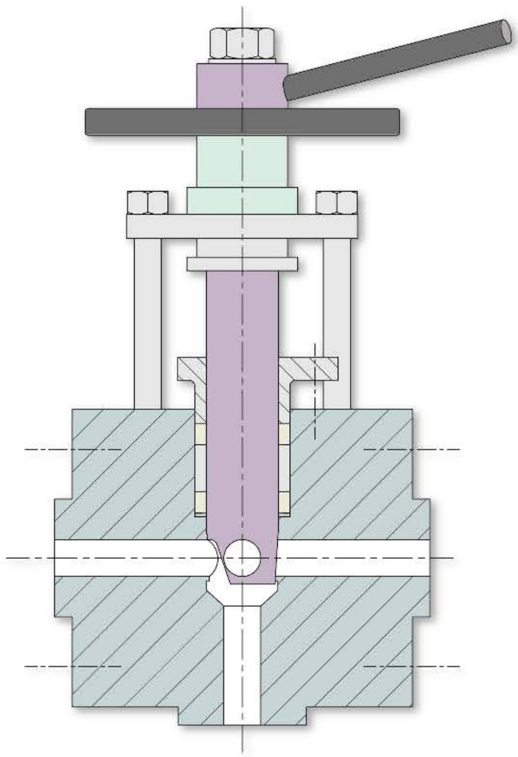


SchuF has delivered lubricated plug valves in sizes from ½" up to 10", and in pressure ratings from ASME 150# to 1500#. These valves require careful choice of lubricant and friction-reducing coatings of the plug and body to ensure that they do not seize up. In terms of cost, you will find that these SchuF Lubricated Plug Valves prove to be extremely competitive in terms of their extra capabilities at high pressures and temperatures. When used in conjunction with the correct grease, these valves can handle temperatures up to 400°C.

Additionally, when a suitable low-friction coating is used, we can even eliminate the use of lubricant completely, greatly improving the maintainability and cost-effectiveness of these specialised plug valves.

Dump Valves

A combination of qualities



SchuF Dump Valves combine the advantages of a lift-plug valve and a diverter valve. These Dump valves can be used for diverting or dividing flow, filter-changing and start-up dumping. These valves are dead-space free, and have no cavity above the plug - which makes them ideal for processing non-flushable, hardening polymers such as Nylon 66.

The 3-way 'T'-shape is standard, but 4- or 5-way layouts are also available. Various flow patterns can be set by different plug holes ('L', 'T', etc.) and rotations stops appropriately. These Valves are available in block form for electric heating, or fully-jacketed. They can be supplied with weld-end or flanged connections in a variety of materials.

TruEPlug Valves

Clean Media Isolation

The Tru**EP**lug is a special rotary plug valve that achieves true Double Block and Bleed (DB&B) service in one enclosed valve body.

Benefits

- Quick and easy operation
- Cost effective 088.8
- Zero leakage
- Easy maintenance

Operation

*Tru**EP**lug Valve, closed position*

The Tru**EP**lug has a simple yet efficient design with few pieces. The key parts include the body, bonnet, plug, seals and actuator. The plug has a special moving insert or shield that is fixed to the central plug and has an inlaid soft sealing ring. As the plug lifts and rotates from the open to the closed position, clearance is maintained between the plug shield and the valve body, allowing free movement and avoiding scoring.

As the plug enters its closing position it is lowered forcing the plug shield against the body and thereby initiating a soft seal. In the closed position the plug shields are effectively expanded [the reason why the valve is some- times referred to as an **Expanding Plug valve**).

The soft seal is further compressed until a metal to metal seal is achieved. This double mechanical sealing mechanism gives the TruEPlug one of the most reliable leak-tight seals available.

Applications

The Tru**EP**lug is suitable for Isolation of mostly clean media at moderate temperatures [to 256°C) where seal tight closure is essential.

Typical applications include:

- Tank storage isolation
- Meter stations
- Loading/Unloading terminals
- Fire suppression system isolation
- Branch line isolation

*Tru**EP**lug Valve, open position*

*The Tru**EP**lug seal Shield features a soft sealing ring*

Key Features

- 1" to 42" and up to ASME 900#
- Replaces traditional two-valve and spool-piece DB&B arrangement
- Reduced bore or full bore piggable
- Positive shut-off double seal
- Abrasion-free plug movement
- Bleed function proves zero leakage
- Metal to metal seal in the open position
- Manual, electric or pneumatic actuation
- Fire Safe option

Lift plug Valves

Catofin Dehydrogenation Case Study

A leading provider of plastics runs an Air Products Catofin Deydrogenation plant.

- A de-oiler stripper takes C4+ heavies from C3 gas (propane); the bottom stream heavies are sent to 2 re-boilers to further remove C3.
- Initially our client equipped the lines to and from the stripper with double block and bleed gate valves and spectacle plates.

- However the gate valve could not provide sufficient tightness and leakage followed. The leakage was so severe that the bleed could not relieve the pressure. Coke lumps also formed in the lines from the stripping column.
- The customer then considered using a knife gate valve (due to cost), but finally decided to use a SchuF Lift Plug Valve as a double block and bleed.
- The Lift Plug stopped the leakage and proved to work well in dirty service as it allowed the seat to be cleaned by grinding during closure.
- After two years of successful operation, an additional Lift Plug valve was bought from SchuF for the 2nd re-boiler.

Delayed Coking Case Study

Coking systems require simplicity and crevice-free design

- If the valve is open, or in a particular switching position, the plug and the body form a smooth continuous contour, without gaps or crevices. This eliminates the need for flushing during routine operation.
- To operate the lift plug valve, the plug is raised slightly from the body. It can then be turned easily, without the type of torque associated with a ball valve. Once the plug has been turned to its required position, the plug is lowered again.
- During operation the valve is flushed with steam to prevent solid entrapment between the plug and body. However once the plug is seated, flushing stops automatically.

- The SchuF 3 line Coking Defense System (CDS) is unique. After discussion with the Coking industry, SchuF has designed a valve that offers 3 lines of defense against coke build up in and around the valve. All three elements of the Coking Defense system can be achieved without taking the plug out of the valve, or the valve out of the line. This significantly reduces maintenance and down time.
- The lift plug valve may have a slightly higher initial acquisition cost than that of the ball valve. However, the costs of flushing, maintenance and repairs are significantly higher for ball valves. The difference in cost of ownership of a ball valve could amount to twice that of a lift plug valve, even excluding the additional cost for downtime.

Lift Plug Valves

Styrene Production Case Study

SchuF Lift-Plug valves recommended ahead of ceramic ball valves and wedge-plug valves

- An external licensor of styrene process technology oversaw a trial where a SchuF IsoPlug valve was tested in comparison to existing wedge-plug valves.
- The valve was required to handle steam and catalyst effluent at temperatures approaching 900°C.
- Following the succesful trial the licensor now recommend SchuF Lift Plug valves over competitors' ceramic ball valves and wedge-plug valves for their process.
- The advantages of the Lift-Plug valve over the wedge-plug design are as follows:
  - Easier to actuate, even when closed for long periods, with no sticking.
  - Operator can easily see the position of the valve
  - Better sealing performance
  - Zero leakage to atmosphere
  - Safer and more reliable
- Lift-plug valves have subsequently been supplied to other licencees of the Styrene process technology

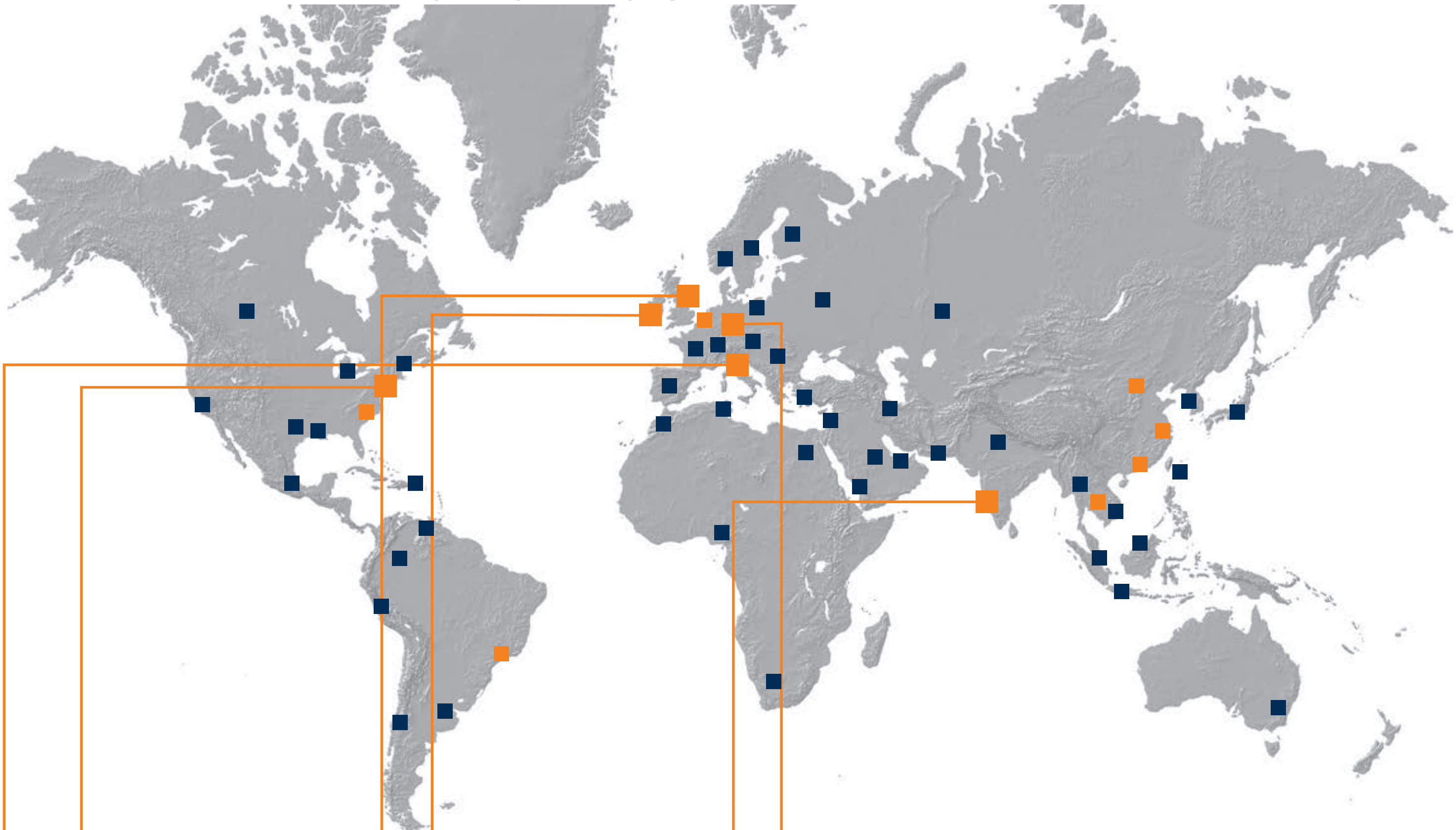
Acetic Acid Service Case Study

Corrosion resistance a primary concern

- Acetic acid is a widely produced industrial commodity, with a worldwide demand of over 6 million tonnes per year.
- Our customer is a leading supplier of acetic acid and thus corrosion resitance was a primary concern when discussing valve specifications and requirements.
- Design temperatures of over 200°C at pressures of almost 40 bar made the corrosion issue even more of a concern.

- SchuF designed and supplied IsoPlug valves with Hastelloy® body and trim.
- These IsoPlug valves now have many years of successful service behind them.

SchuF Worldwide



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