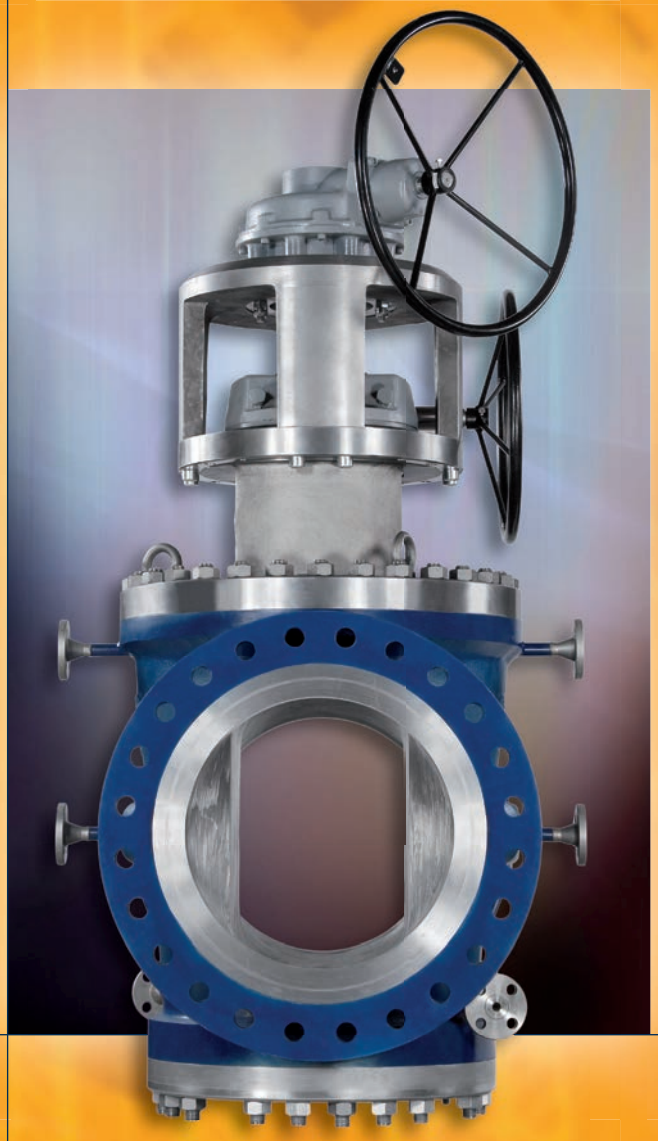
Lift Plug Valves

Metal-To-Metal Sealing
Multi-Way Valves



SchuFlo

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SchuF is fully registered, accredited and certified worldwide

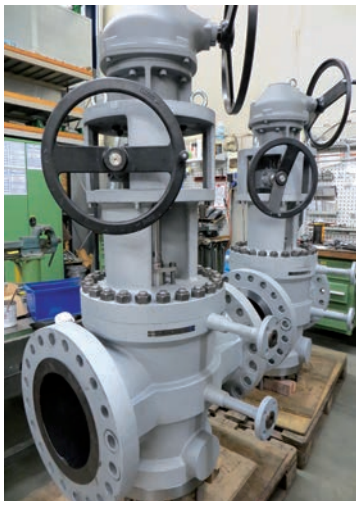
Lift Plug Valves

Patented Innovation

SchuF is a highly specialised group of companies, whose expertise is the design and manufacture of process 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 or hydraulic actuators, and new applications such as switching 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 1200°C.

Material Choice

SchuF's strengths include flexibility of design and construction. We have produced Lift Plug valves in all stainless steels, C12, high Nickel alloys, Titanium and Zirconium, with many different coatings, including stelliting and gold plating. SchuF uses special surface coatings and trunnion spindle guiding to help improve resistance against vibration and erosion.

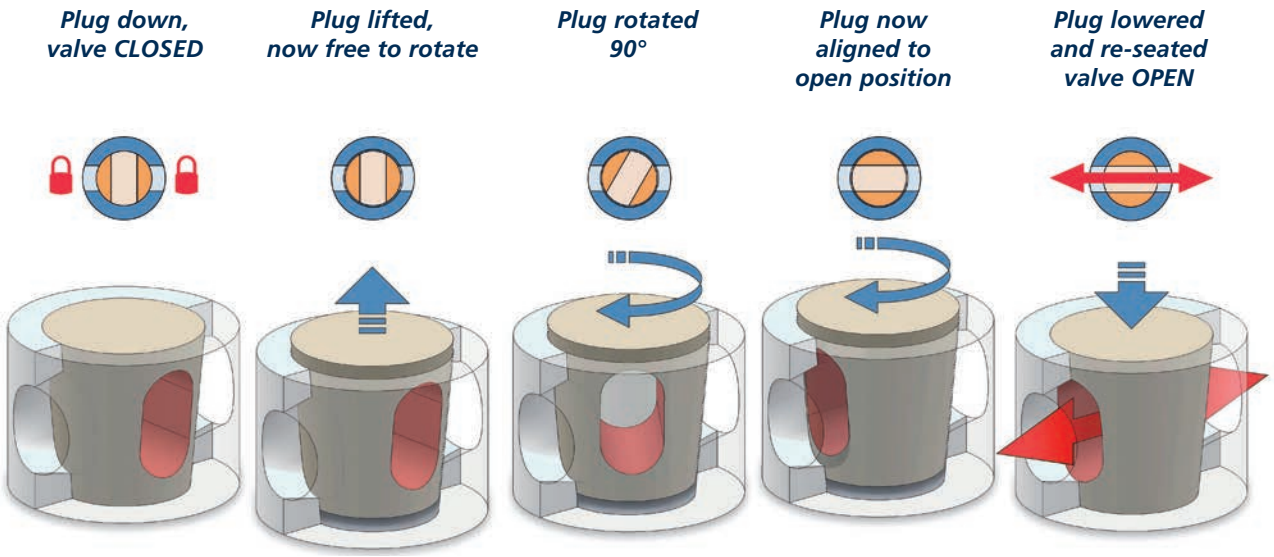


Reliable Operation

SchuF Lift Plug Valves come equipped with manual or electric actuators. The SchuF Lift-Turn-(re)Seat (LTS) actuator converts simple rotation movement to lift, turn and reseat the plug. A master/slave electric actuator arrangement simplifies control and helps protect against incorrect operation.

The Lift Plug Principal: Simple operation, distinct advantages

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. This design provides 100% seal tightness, smaller actuator requirements, non-wearing internal movement, and full-bore unimpeded flow. Note that the bore can be fully round (piggable) or roval (for full flow) as required, roval option shown below.

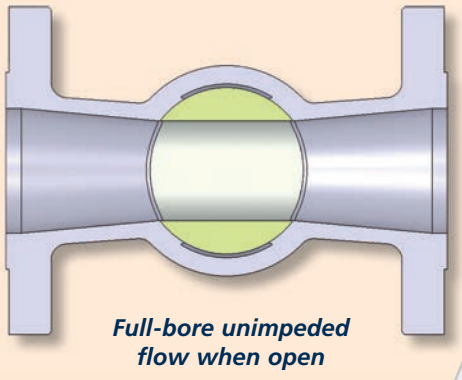


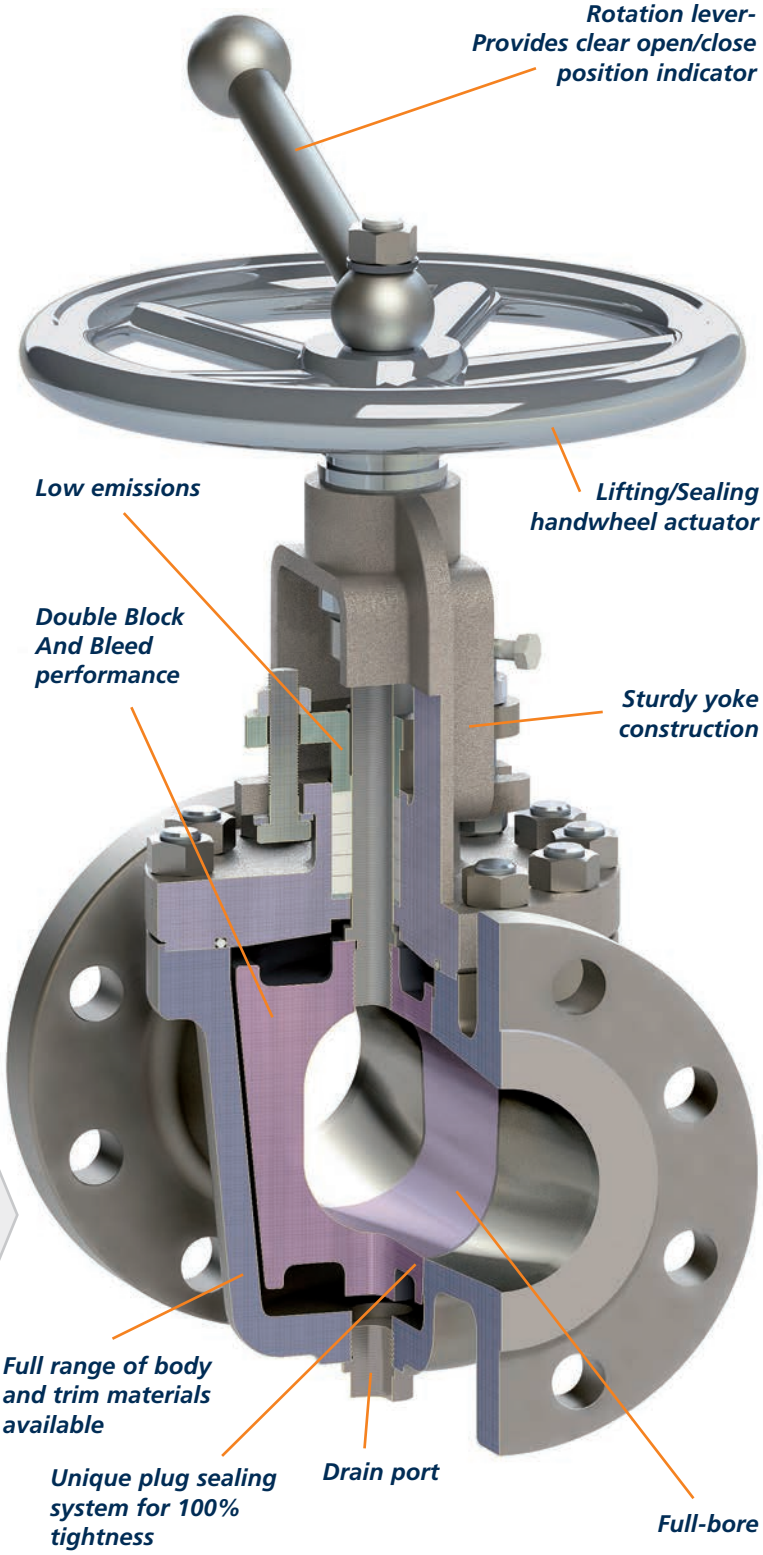
Standard Lift Plug Valves

Features

When SchuF invented the Lift Plug Valve it was the first ever **'Double Block And Bleed'** valve, a new standard for safety and reliability.

The simple and rugged design make it suitable for severe applications at high temperatures or with highly abrasive or erosive materials such as TDI, PET, PTA, CTG, PDH, styrene, or acetic acid. In those situations, the Lift Plug Valve has proven to be an ideal isolation valve with many advantages over traditional ball valves. This is due to the fact that the seal to the process does not wear as the plug is lifted before turning.





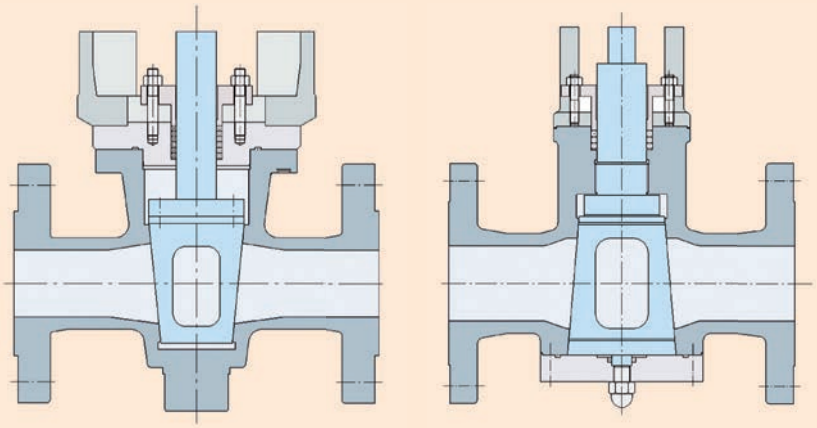
Standard Lift Plug Valves

Common Lift Plug Design Principles

- **Dead-space free** during flow
- **Integral 'Double Block And Bleed'** design that ensures a perfect seal
- **Protected Valve Seat (PVS)** – valve life will be increased as plug-to-body sealing faces are protected during media flow
- **Top- or bottom-entry** for ease of maintenance
- **Non-friction** operation
- **Manual actuation as standard**
- **Roval** or **round (piggable) port**
- **Full-** or **reduced-bore**

Additional Options

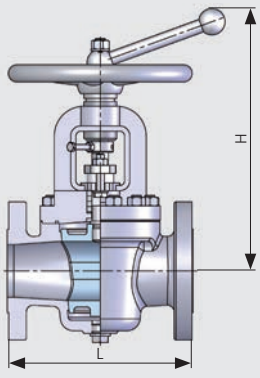
- **Optional flushing and/or purging** (if required by the process) is still only required during operation from open to close or vice versa. This leads to significant cost savings in comparison with other valve designs (i.e. ball valve), which can require constant flushing
- **High-temperature** and **high-pressure** designs
- **Electric, pneumatic,** and **hydraulic actuation**
- **Automated Control Panel** (ACP) can be used to control single or multiple valves, actuators and sensors



Below: The valve plug can be inserted from above, or from below, whichever arrangement gives the best access for maintenance

Lift Plug valve with heating jacket

Size	L Face-to-face (mm)			H Height (approx, mm)			Weight (approx) (kg) Manual		
Rating	ASME			ASME			ASME		
Size	150–300#	600#	900#	150–300#	600#	900#	150–300#	600#	900#
DN 25/ 1"	165	216	254	350	350	400	30	30	40
DN 50/ 2"	216	292	368	400	400	450	40	40	70
DN 80/ 3"	282	356	381	400	400	450	80	90	120
DN 100/ 4"	305	432	457	500	500	550	90	90	150
DN 125/ 5"	381	508	559	500	500	550	130	130	200
DN 150/ 6"	403	559	610	600	600	700	150	150	250
DN 200/ 8"	502	660	–	700	700	–	250	300	–
DN 250/10"	568	787	–	800	800	–	400	500	–
DN 300/12"	711	838	–	1000	1000	–	600	800	–

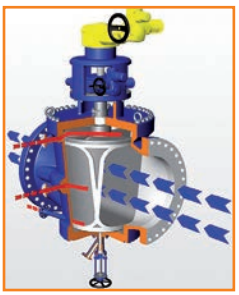


IsoPlug Valves

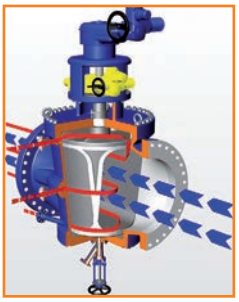
Features

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 and Visbreaking. The IsoPlug valve features the unique 3-line **CDS (Coking Defence System)** package, which comprises of steam flushing, draining, and a retractable bottom lid that enables the valve to be cleaned in-line. The **CDS** package ensures that the valve can always be kept clean, and avoids coke build-up.

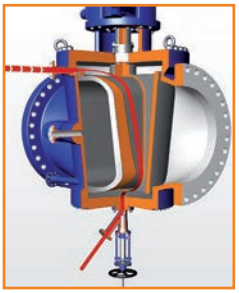
Coking Defence System



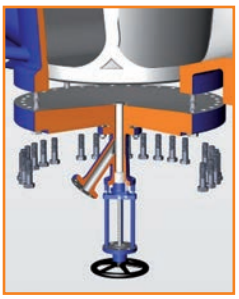
This IsoPlug image (left) shows the media (blue) with the plug in open position. The top actuator has been engaged and the plug starts to rise. Note how flushing takes place during plug lifting (red lines). This is the **first** line of defence of the **Coking Defence System**.



In this image, the second actuator has now been engaged and we can see that the plug is turning. Flushing (shown again as red lines) will now take place in, around, above and below the plug.

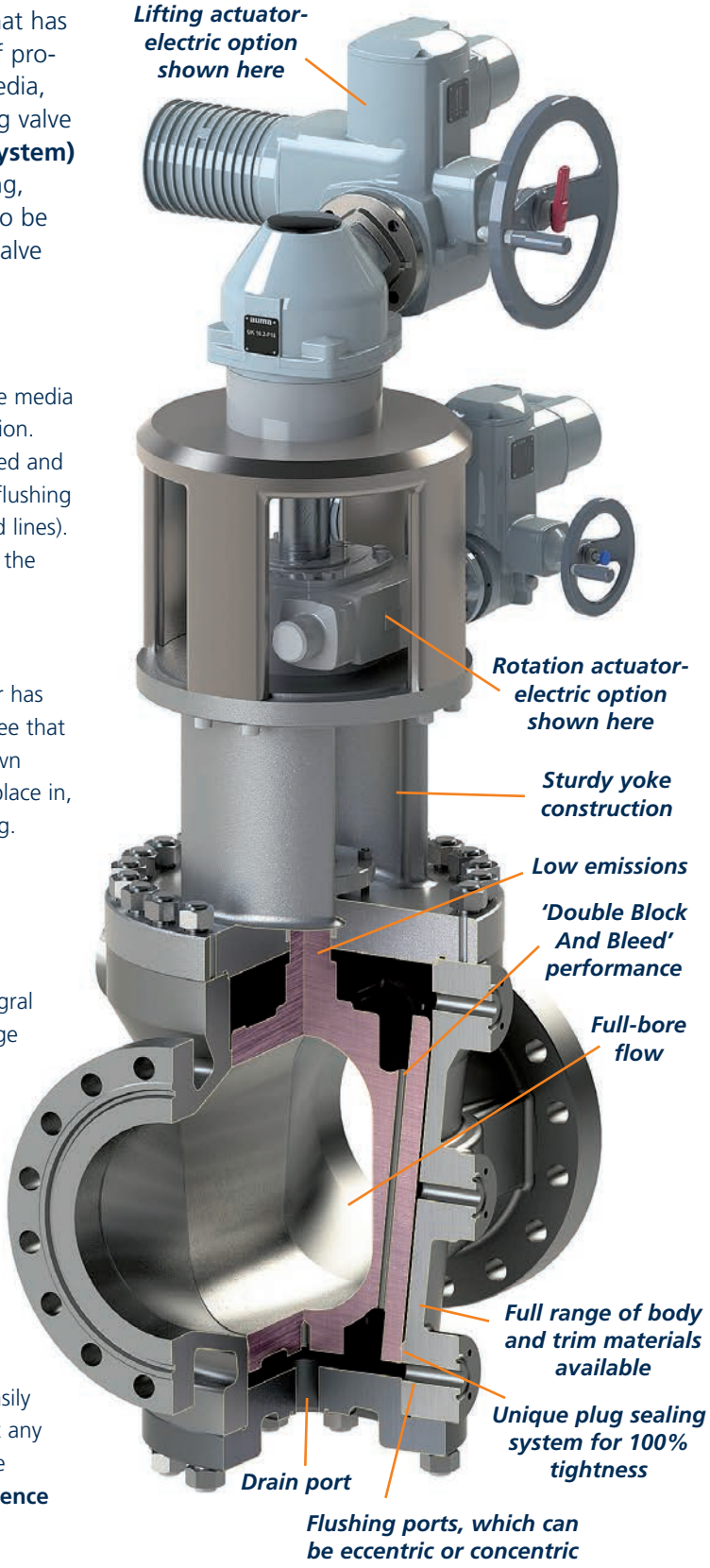


When the plug is seated, the integral flush drain valve can open. A purge has been activated, and this will clean any remaining sediment or debris above or below the valve plug- the **second** part of the **Coking Defence System**.



While the valve is in-line and the process off-line, and the flushing medium has been removed, the bottom of an IsoPlug valve can easily be lowered/ retracted to carry out any necessary maintenance. This is the **third** element of the **Coking Defence System**.

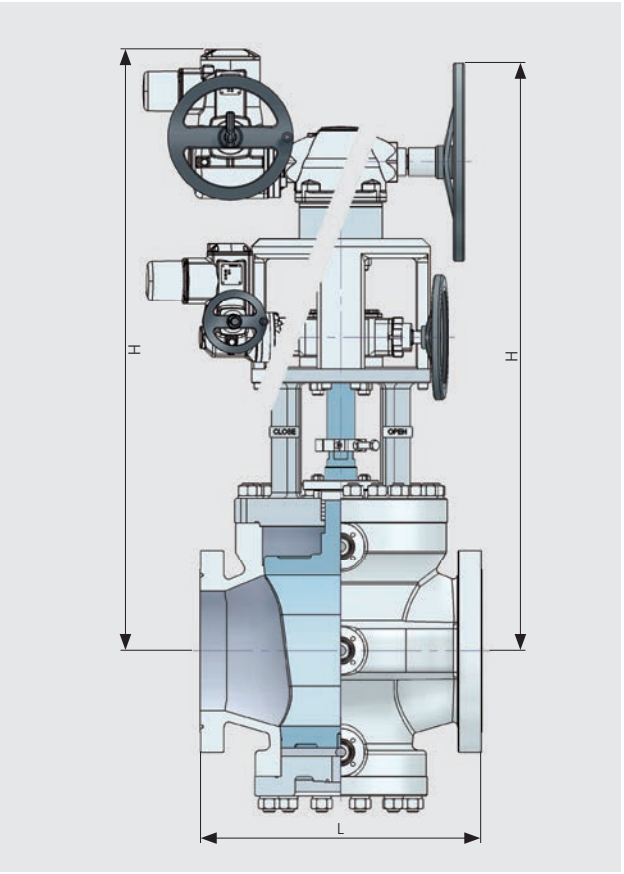
Note: Drain valve can also be mounted horizontally (shown vertically here)



IsoPlug Valves

Key Design Principles

- See page 4 for **Common Lift Plug Design Principles**
- **Integral Strength** – in addition to technical innovations such as the optional CDS package (see opposite), the demanding requirements of the processes for which IsoPlug valves are designed result in a number of approaches to ensure maximum durability and reliability. These include single-piece casting of the yoke and upper body-flange/lid, which eliminates weld fatigue potential. Similarly, the plug and plug stem are cast as a single component, with the actuator spindle connection to the plug stem being visible in the yoke.
- **Complex functionality in a minimal package** – each IsoPlug valve is designed to best fit its specific plant position, and items such as the drain valve can be located in the ideal orientation for access.
  The IsoPlug flushing ports can also be supplied in eccentric or concentric configurations.



Variable	L Face-to-face (mm)			H Height (approx, mm)			Weight (approx) (kg) Manual/Electrical		
Rating / Size	ASME			ASME			ASME		
	150–300#	600#	900#	150–300#	600#	900#	150–300#	600#	900#
DN 25/ 1"	165	216	254	500	500	600	30/70	30/70	70/110
DN 50/ 2"	216	292	368	750	750	800	60/100	60/100	110/150
DN 80/ 3"	282	356	381	1000	1000	1050	90/130	90/130	190/230
DN 100/ 4"	305	432	457	1000	1000	1100	150/200	150/200	300/350
DN 125/ 5"	381	508	559	1000	1000	1100	200/270	200/270	380/450
DN 150/ 6"	403	559	610	1100	1100	1200	250/320	350/420	500/580
DN 200/ 8"	502	660	737	1200	1200	1300	500/570	600/670	900/980
DN 250/10"	568	757	838	1200	1200	1300	600/670	700/770	1100/1200
DN 300/12"	711	838	965	1500	1500	1600	1000/1080	1300/1380	1800/1900
DN 350/14"	762	889	1029	1500	1500	1600	1400/1480	1700/1800	2100/2200
DN 400/16"	838	991	1130	1700	1700	1800	1800/1900	2200/2300	2900/3000
DN 450/18"	914	1092	1219	1700	1700	1800	2000/2100	2400/2500	2400/2500
DN 500/20"	991	1194	1321	1800	1800	1900	2400/2500	2900/3000	4100/4200
DN 600/24"	1143	1397	1549	2000	2000	2100	3800/4000	4500/4700	6300/6500
DN 700/28"	1346	1549	–	2000	2000	–	4600/4800	5300/5500	–
DN 750/30"	1397	1651	–	2100	2100	–	5300/5500	6300/6500	–
DN 800/32"	1524	1778	–	2100	2100	–	5800/6000	6600/6800	–
DN 900/36"	1727	2083	–	2200	2200	–	8800/9000	9800/10000	–

SwitchPlug Multi-Way Valves

Features

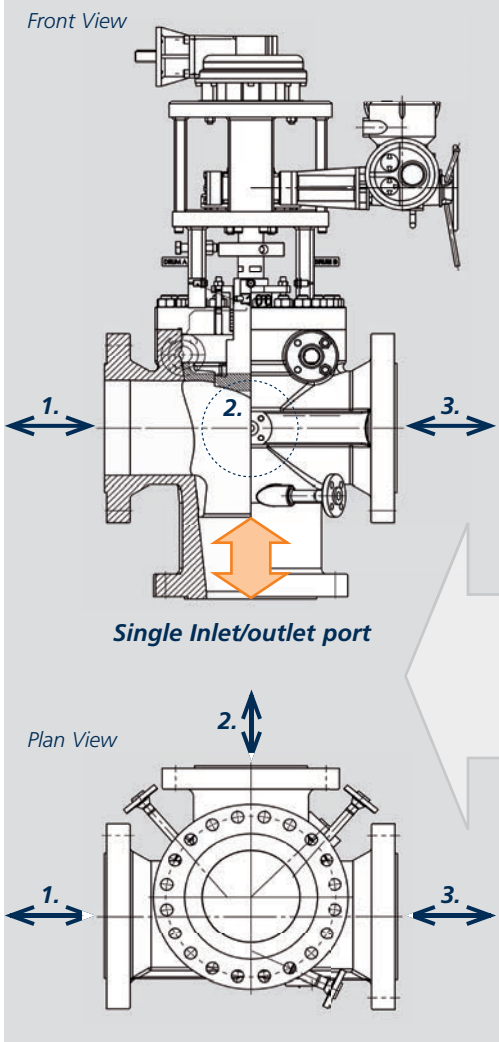
The SchuF SwitchPlug valve is a switching valve with typically one inlet and three outlets. It is used to switch media flow from one outlet to another in a defined sequence, while isolating all other outlets.

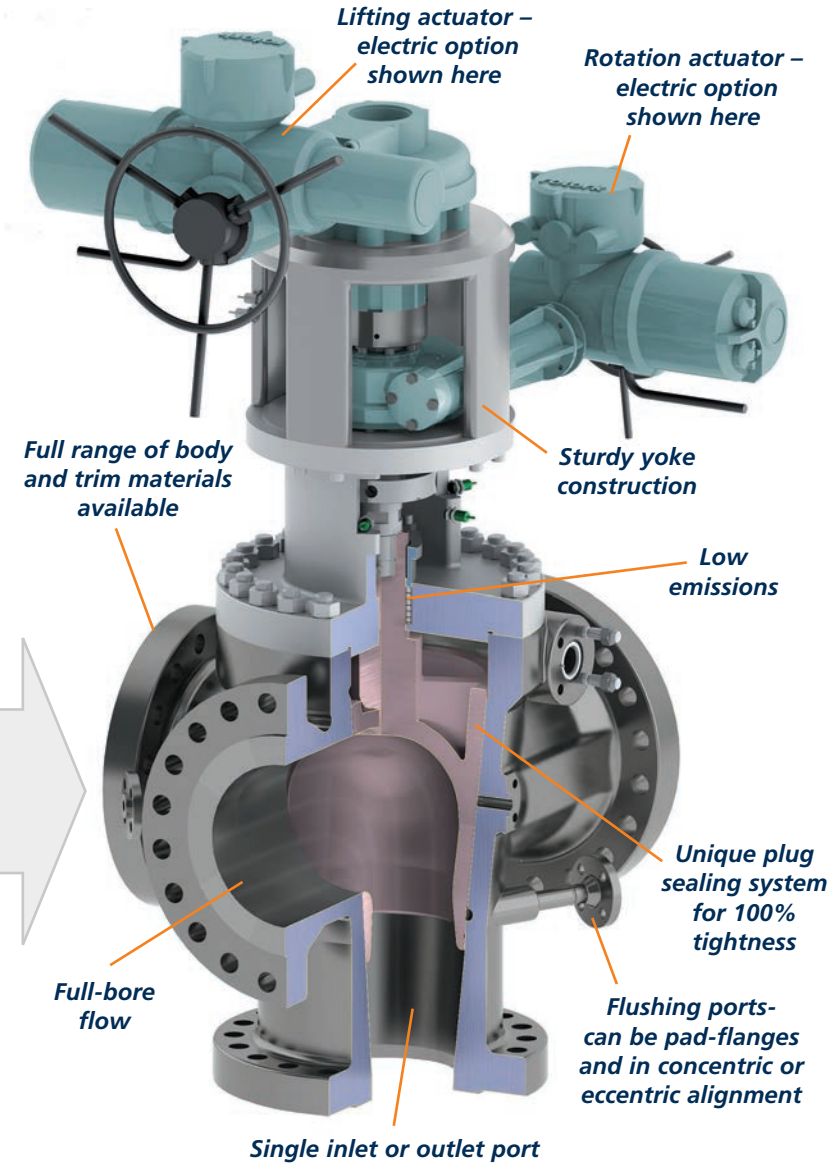
It is commonly used in the refining industry for delayed coking due to its leak-tight metal-to-metal sealing characteristics and suitability for high temperature operation. The SwitchPlug consists of only a few moving parts – body, plug and actuator – and is therefore highly reliable.

There is no gap between the plug and the valve body, where the fluid or process particles could settle, damage piping, or score the valve. Flushing is therefore only required while the plug is lifted.

- Size: 6" (DN150) to 24" (DN600)
- Pressure Class: ASME 150# to 2500#
- 2, 3, 4 or more outlets
- 'L', 'T' or 'Y' configurations
- Full-bore round plug design
- High throughput during switching, no dead-ending
- Dual motor actuation
- 3-line Coking Defence System (CDS) option
- Integral flushing options

T-configuration Switch Plug Valve with three flow paths

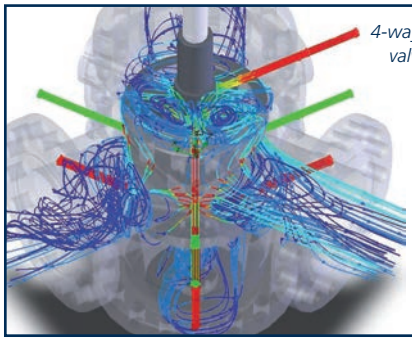




SwitchPlug Multi-Way Valves

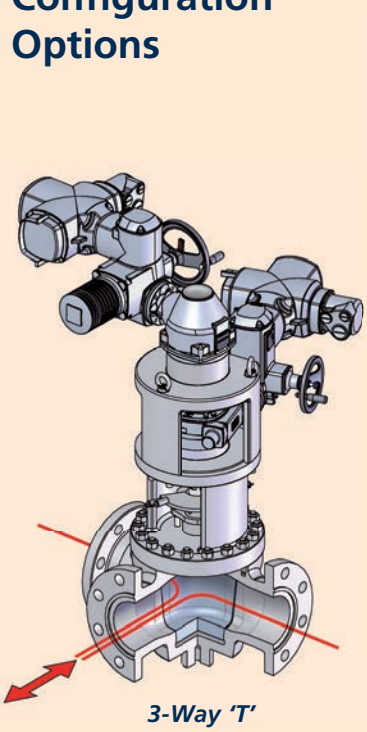
Key Design Principles

- **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 (see image below) to ensure optimal coke-free valve operation.
- **'Y' or 'T' Design** – SchuF can provide the SwitchPlug 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 and 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 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 70% of the flow throughput can be achieved even in these intermediate positions.

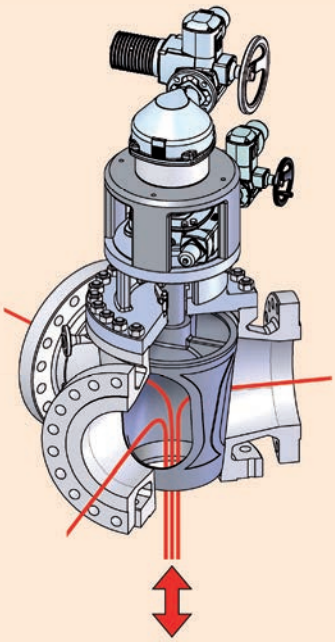


4-way SwitchPlug valve – flushing system flow simulation analysis

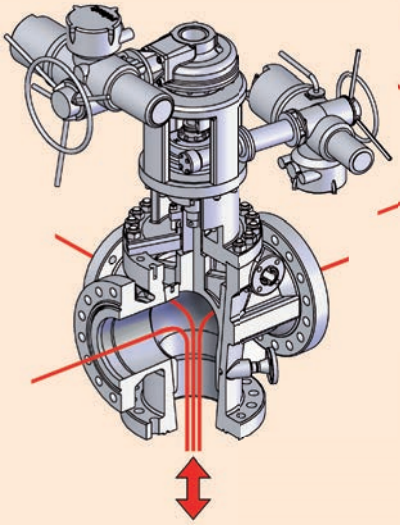
Configuration Options



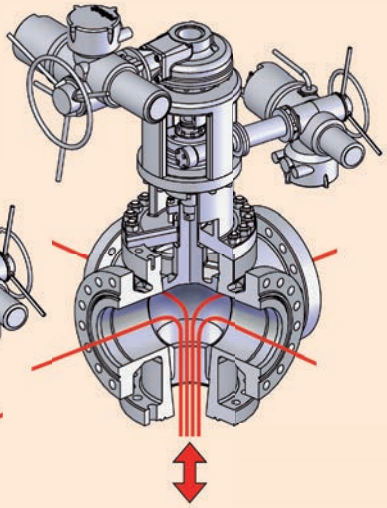
3-Way 'T' configuration, ports at 180°



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



4-Way 'T' configuration, ports at 90°

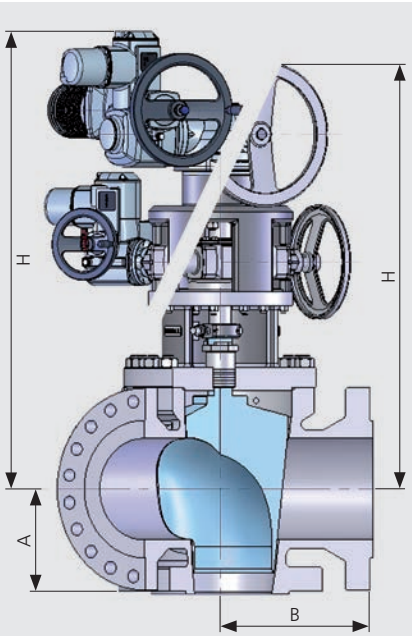


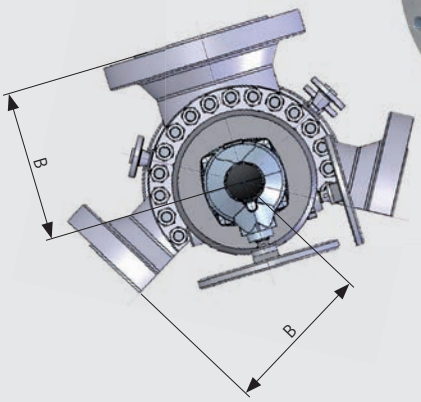
5-Way 'X' configuration, ports at 90°

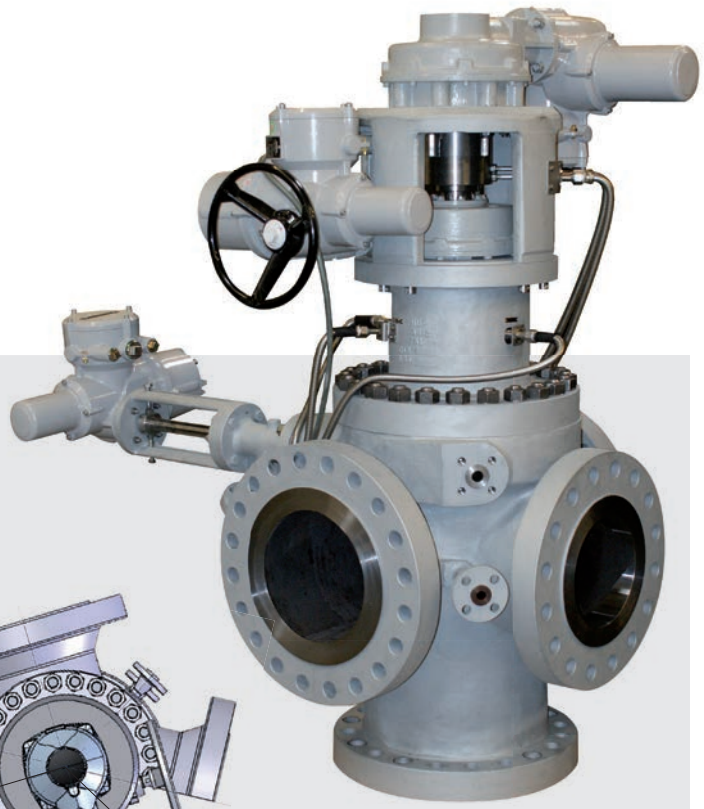
SwitchPlug Multi-Way Valves

Flexibility of Design

The SchuF SwitchPlug principal of design offers great flexibility in matching new valves to very specific customer requirements. The plug can be upward- or downward-oriented, whichever allows easier maintenance access. Electric actuation can incorporate the SchuF Lift-Turn-Seal operation. All flush and purge connections can be oversized.







Above: 4-way SwitchPlug Valve, 'T'-configuration, with all-electric actuation and flushing valve (to left)

Variable	A Dimension Inlet (mm)			B Dimension Outlet (mm)			H Height (approx, mm)			Weight (approx) (kg) Manual/Electrical		
Rating	ASME			ASME			ASME			ASME		
Size	150–300#	600#	900#	150–300#	600#	900#	150–300#	600#	900#	150–300#	600#	900#
DN 25/ 1"	100	110	130	100	110	130	500	500	600	40/80	40/80	80/120
DN 50/ 2"	130	140	170	130	140	170	750	750	800	70/110	70/110	120/160
DN 80/ 3"	170	180	200	170	180	200	1000	1000	1050	110/150	110/150	210/250
DN 100/ 4"	200	220	230	200	220	230	1000	1000	1100	170/220	170/220	320/370
DN 125/ 5"	220	240	280	220	240	280	1000	1000	1100	230/300	230/300	420/490
DN 150/ 6"	250	280	300	250	280	300	1100	1100	1200	280/350	380/450	550/630
DN 200/ 8"	329	350	370	329	350	370	1200	1200	1300	540/610	640/710	1000/1080
DN 250/10"	378	400	420	378	400	420	1200	1200	1300	650/720	750/820	1200/1300
DN 300/12"	428	450	480	428	450	480	1500	1500	1600	1100/1180	1400/1480	2000/2100
DN 350/14"	428	450	500	458	480	500	1500	1500	1600	1500/1580	1850/1950	2300/2400
DN 400/16"	454	480	550	484	510	550	1700	1700	1800	1950/2050	2400/2500	3200/3300
DN 450/18"	454	480	620	521	550	620	1700	1700	1800	2200/2300	2650/2750	3800/3900
DN 500/20"	600	640	750	600	640	750	1800	1800	1900	2800/2900	3500/3600	4900/5000
DN 600/24"	750	800	900	750	800	900	2000	2000	2100	4400/4600	5300/5500	7300/7500

General Specifications

	Standard Lift Plug Valves	IsoPlug Valves	SwitchPlug Valves
Rating			
	ASME Class 150# to 2500# High temperature version to 1200 °C		
Size			
Standard	1/2" to 36"	6" to 36"	6" to 24"
Materials			
Body	Stainless Steel, Duplex, Hastelloy, Incoloy, Inconel Titanium, WCB, WC6, C12, C12A, C5, other on request		
Bore	Full-bore roval or round		
Options			
Flanges	Fully flanged RF and RTJ, DIN, ASME or through bolt holes		
Jacketing	Full or partial jacketing		
Purge and Flushing connections	Five connections as standard: less or more on request Port size: 3/4" or 1", larger on request		
Flow Direction	Bi-directional		
Actuation	Manual, electric, pneumatic or hydraulic		

Lift Plug Cv Values

(full Bore)

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

Lift Plug Standards

DESIGN	QUALITY	FLANGES	TESTING	SOUR SERVICE
ASME B16.34	PED 2014/68/EU	ASME B16.5	EN 10204	NACE MR-01-75
ASME B&P.V. CODE	EN ISO 9001	ASME B16.34	API 598	NACE MR0103
ASME 31.8/31.4	TR CU 032/2013	ASME B16.47	ASME B16.34	EN ISO 15156
EN 12516		EN 1092-1	API 6D	
API 6D				

Case Studies

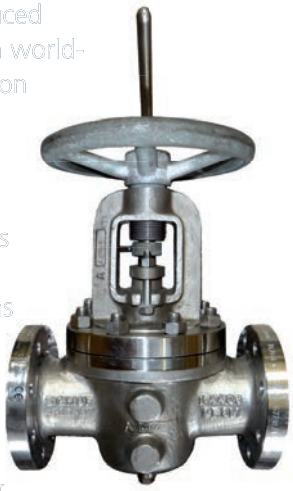
Catofin Dehydrogenation

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. These could not provide the seal-tightness required, and coke lumps also formed in the lines from the stripping column. A switch to knife-gate valves was considered before the client chose a SchuF Lift Plug valve as a 'Double Block And Bleed' valve.
- The Lift Plug valve 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.

Acetic Acid Service

Corrosion resistance a primary concern



- Acetic acid is a widely produced industrial commodity, with a world-wide demand of over 6 million tonnes per year.
- Our customer is a leading supplier of acetic acid and thus corrosion resistance 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 Lift Plug valves with Hastelloy® body and trim.
- These Lift Plug valves now have many years of successful service behind them.

Delayed Coking

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, free of gaps and crevices.
- During operation the valve is flushed with steam to prevent solid entrapment between the plug and body. When the plug is seated, flushing automatically stops.
- The SchuF 3 line Coking Defence System (CDS- see P.6) can function without taking the plug out of the valve, or the valve out of the line.
- The IsoPlug 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.

Styrene Production

SchuF Lift-Plug valves recommended ahead of ceramic ball valves and wedgeplug valves

- An external licensor of styrene process technology oversaw a trial where an Incoloy SchuF Lift Plug valve was tested against existing wedge plug valves.
- The valve was required to handle steam and catalyst effluent at temperatures up to 900°C.
- The advantages of the Lift Plug valve over the wedge plug design became obvious:
  - Easier to actuate, even when closed for long periods, with no sticking.
  - Operator can see the position of the valve
  - Better sealing performance
  - Zero leakage to atmosphere
  - Safer and more reliable
- Lift Plug valves have subsequently been recommended by the licensor and have since been supplied to other licensees of the Styrene process technology.

Lift Plug Valves and Ball Valves Comparison Table

Lift Plug	Ball Valve
Simple rugged design, only two main parts	Complex design utilising many major parts
Plug seizing is almost impossible	Ball component can get stuck
Seals do not wear during operation	Seal wear occurs with every operation
Seat seals are load-free during rotation, but thrust is loaded by lowering the plug after the rotation, ensuring a perfect seal	Seals are exposed to the process while loaded, so quality of the seal 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 valves and/ or more rugged service	A single much bigger actuator used in all cases
Low breakaway torque required to turn the valve	High breakaway torque and thus large motors required
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 an easy maintenance without removal from the line	Inspection not always possible with a ball valve and therefore maintenance can be difficult
Maintenance rarely required, no parts required	Expensive spare parts (e.g. coated balls, or bellows) when repairs are necessary

Customer Enquiry Sheet

Part 1 – Your Company Information

Name: Title:

Company: Telephone:

E-mail: Fax:

Part 2 – Your Order Information

General:

Quantity: Application:

Tag No.: Project Name:

Process/Process Licence: Project No.:

Part 3 – Valve and Process Information

Valve Information:

Valve Type: Lift Plug ☐ IsoPlug ☐ SwitchPlug ☐ Valve Inlet Size (DN/Inch):

Valve Pressure Rating: Valve Outlet(s) Size (DN/Inch):

Valve Delta P: No. of Valve Inlets/Outlets:

Inlet Flanged/Weld-End: Outlet Flanged/Weld-End:

Outlet Flange Configuration: (i.e. 120°, 180°): Operating Pressure:

Operating Temp.: Design Pressure:

Design Temp.: Trim Material:

Body Material: Fugitive Emissions/Clean Air:

Medium: Firesafe Rating:

Certificates Etc.: Hazard Class:

Actuator Type: Air Supply Pressure:

Air-Fail Position: Manual Override:

Part 4 – Further Notes/Topics/Info

Product Portfolio Overview

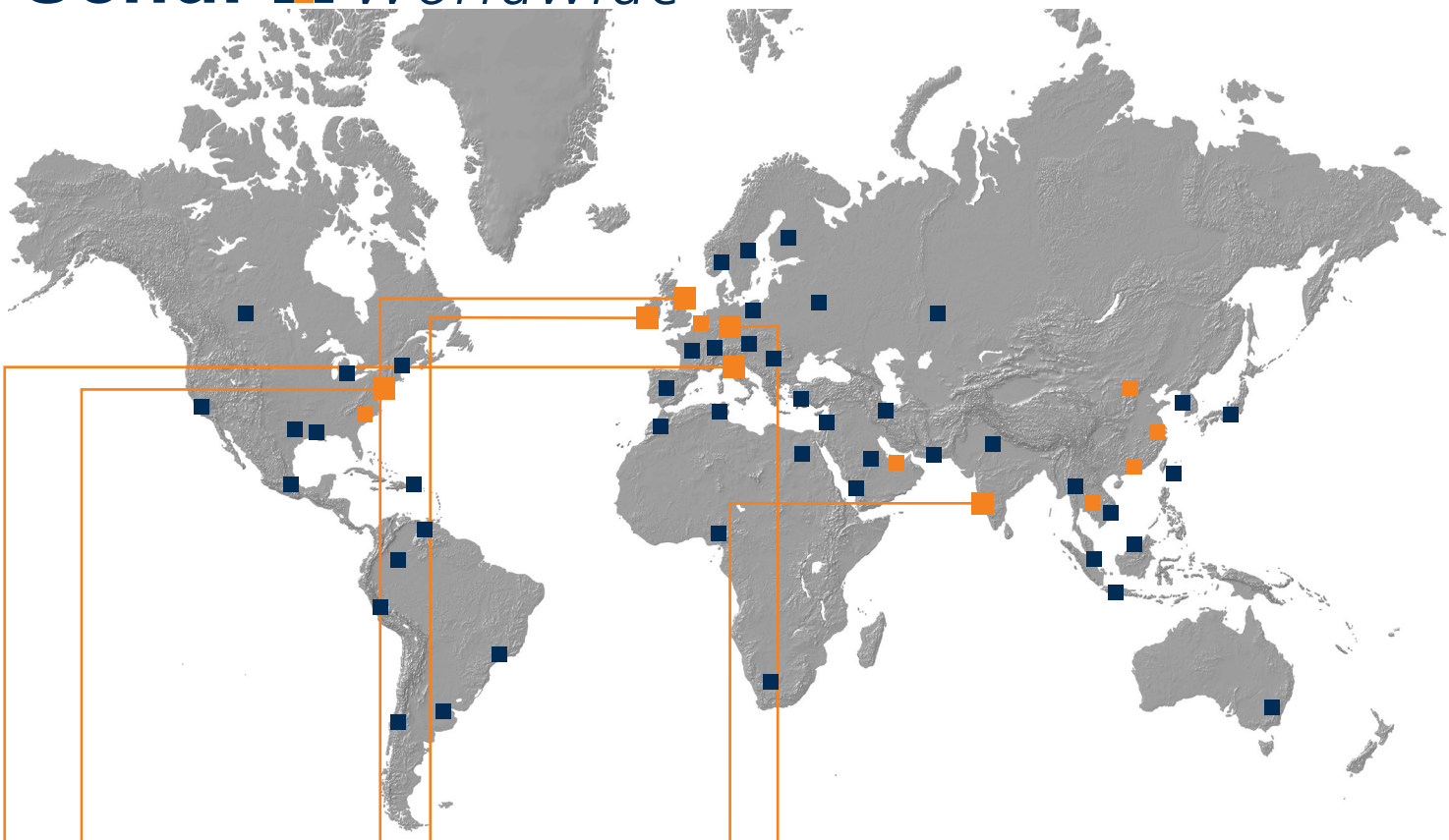
In over one hundred years, the SchuF Group has delivered more than one million valves to a wide variety of industries in over 50 countries worldwide. Headquartered near Frankfurt in Germany, the company has additional design and manufacturing centres in Italy, India, Ireland, UK and the USA. The SchuF 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:

Drain & Sampling Valves	Control Valves	Isolation Valves	Switching Valves	Safety Related Valves	Other Products
Piston Bottom Outlet Valves	Angle Control Valves	Lift Plug Valves	Y, R & T type Diverter Valves	Line Blind Systems	Spray Rinse Valves
Disc Bottom Outlet Valves	In-Line Control Valves	TruEPlug Valves	Multiway Diverter Valves	Goggle Valves	Distributor Valves
Bottom Outlet Ball Valves	Multistage Control Valves	Y- / P- Globe & Straightway Valves	SwitchPlug Valves	Changeover Valves	Steam Injection Valves
Screw-in, Line & Wafer Sampling Valves	Cage Control Valves	High Pressure Angle Valves	Maniflow Selector Valves™ (MSV)	In-Tank Emergency Shut-Off Valves (TESO)	
Complete Sampling Systems	Automatic Recirculation Valve (ARV)	Special Ball Valves	Custom Diverter Valves	IsoTank External Tank Emergency Shut-Off Valves	
	Choke Valves	Special Gate Valves		Non-Slam Check Valves	
	Blowdown Valves				

Lift Plug Valves Client List:

- BASF
- BAYER
- Bechtel
- Borealis
- BP
- Celanese
- Chemtex
- Eastman
- Fluor Daniel
- FORMOSA
- Husky
- Indorama Ventures
- INEOS
- Jiangsu Hengli
- Jindal
- JSC Tatneft
- Lanxess
- Lurgi Zimmer
- Motiva
- CHS
- Nan Ya
- OMV Petrom
- PetroCanada
- SABIC
- Shinkong Synth. Fibers
- Styrolution
- Suncor
- Taita Chemical Co
- Technip
- 3M

SchuF Worldwide



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