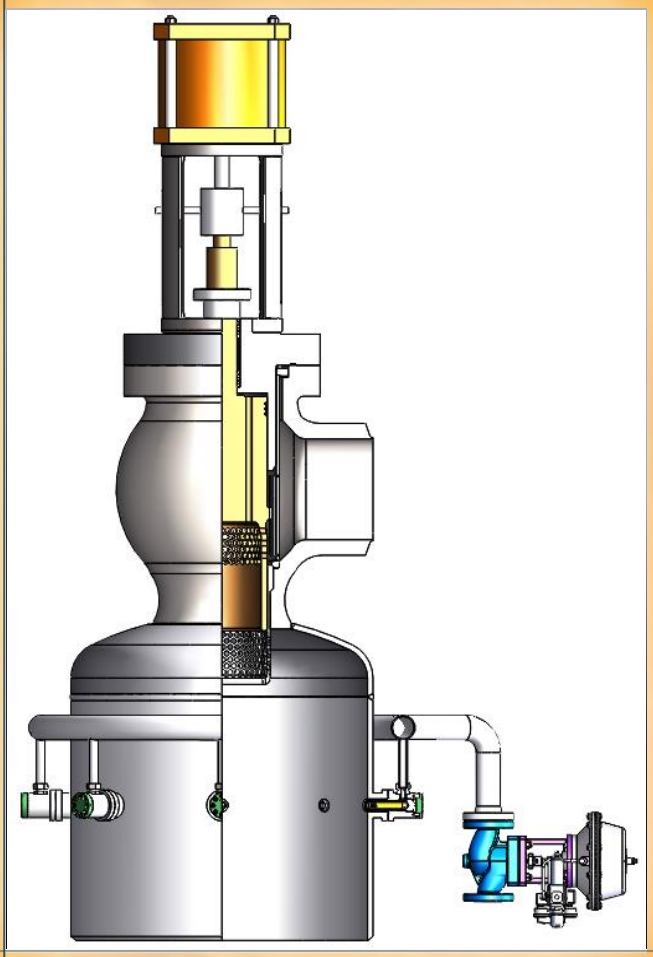
Power Station Severe Service Control Valves



SchuFlo

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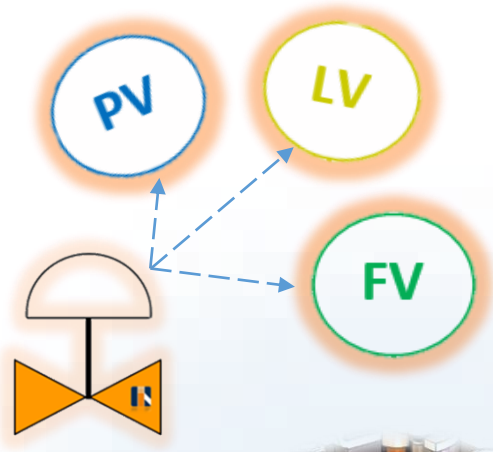
SchuF is fully registered, accredited and certified worldwide

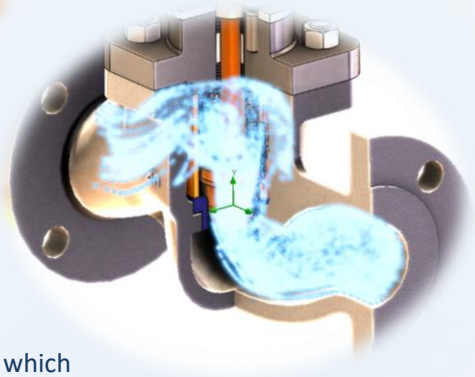
SchuF Control Valves



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.

Why choose SchuF?

The SchuF Group is an industry-renowned valve supplier with over 100 years´experience designing and manufacturing application-specific valve solutions.



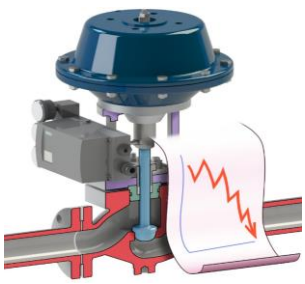
SchuF has developed over 200,000 control valve variations in its hundred-year history. Each has its own specific characteristics tailored to the process control elements that Are most important for it – pressure, level, flow or temperature.

SchuF has the capability to ship unique and highly-praised valve solutions worldwide from production facilities located in Germany, India, Ireland, Italy, the United Kingdom and the United States.

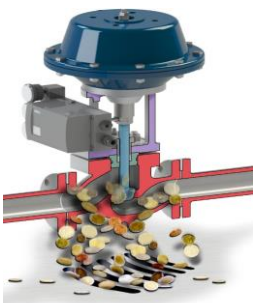
SchuF has an extensive product selection with a vast and diverse range of applications which is taylor made to solve a power station‘s most severe problems. SchuF´s skilled team of engineers and product specialists design each valve from the ground up to meet specific application requirements and provide optimal service life and performance.

Symptoms of Severe Service Control Valve Problems

In a traditional power station unit there are hundreds of installed valves. Usually less than 50 of these are in the “Severe Service” category. These are the valves that are experiencing or causing one of the below symptoms:



Lost production

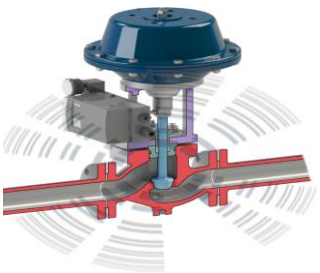


High maintenance

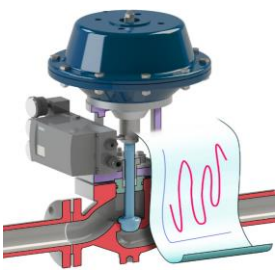
Pipe erosion

System shutdown

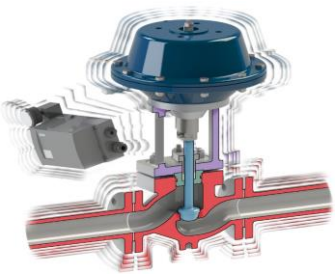
Body & Trim wear



Noise



Poor control

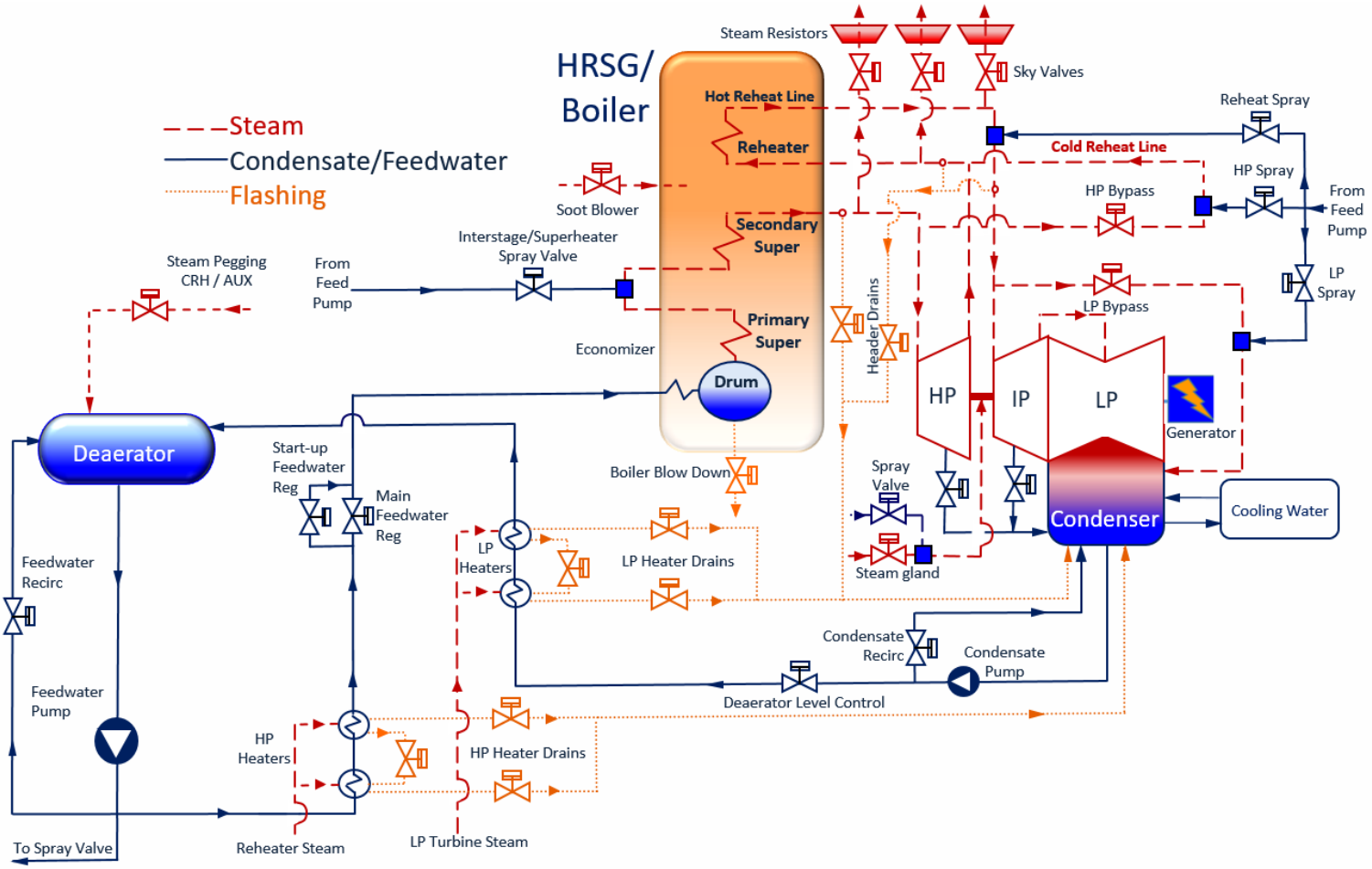


Vibration

The above symptoms are traditionally caused by cavitation, flashing, incorrect valve-actuator specification, high fluid velocity, wrong material or piping/system installation design. It is important that all these factors are considered, especially as a power station can generate pressures above 5500 psi (387 kg/cm^2) therefore these valves have to be robust designs and able to safely control the required pressure drops as well as provide the fine control the client’s application requires to maximize the power stations efficiency.

Typical Fossil Fuelled Power Station

The following applications seen on the below PID fall into the severe service category:

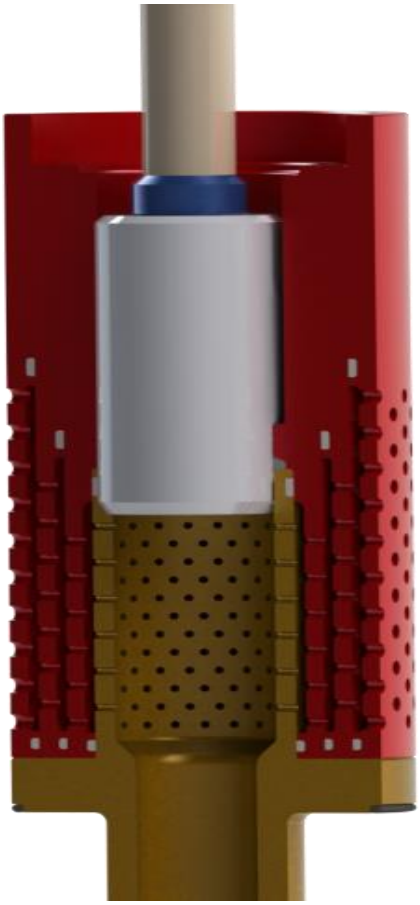


SEVERE SERVICE APPLICATIONS

- Condensate pump and booster pump recirculation
- Deaerator level control
- Deaerator Steam Pegging flow control
- Booster and Main feedpump recirculation
- Superheat and reheat attemperator spray plus the water injection equipment (e.g. nozzles, probe & manifold, etc…)
- Start-up and main feedwater regulator
- HP/IP/LP Turbine bypass valve and its spray + water injection equipment
- Atmospheric steam dump and steam venting
- Auxiliary steam pressure control
- Once-through boiler start-up (base loaded and cycling units)
- System start-up valves in various power station designs: B&W, CE, FW and licensees
- Turbine gland seal pressure control and desuperheating
- HP and LP heater drain valves
- Boiler Blowdown valves
- Steam header drains
- Sootblower pressure control (in coal fuel stations)

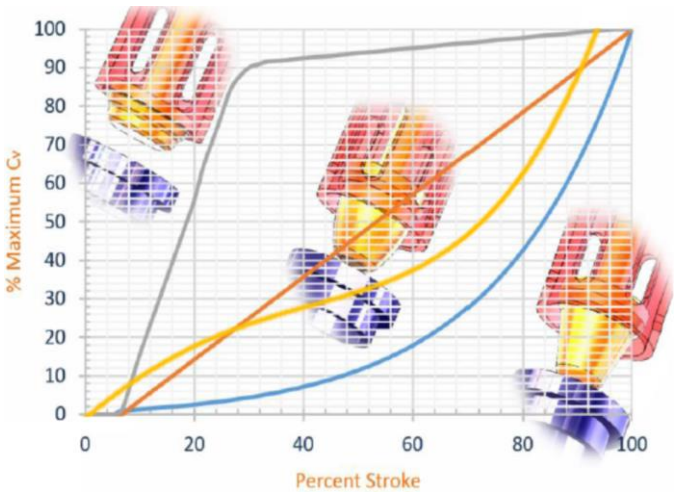
Trim Design: Multi-stage Cage Designs

- Installed in any type of body (angle, straight thru globe, Y-globe & Z-globe) including 4500ANSI (PN640).
- Series of “multiple hole” “drilled cages” = torturous path
- Used for liquids, gases and mixed phase fluids
- Different designs reduce the fluid pressures by contracting, expanding & change of direction.
- All trim materials are available
- Relatively Low cost
- Characterization
  - Equal %,
  - Mod =%
  - Linear
  - Quick opening
  - SchuF’s patented bell x^3 curve
- Effective up to 3 cages
- Anti-cavitation & low noise configuration



Liquid : Over-the-plug flow

Gas : Under-the-plug flow

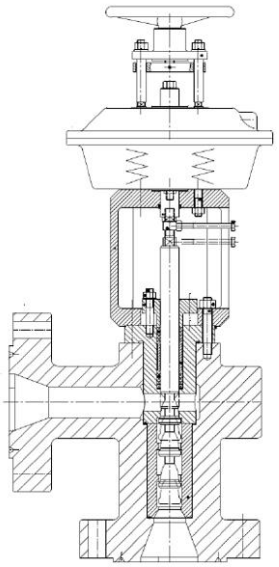


Valve Size		Available trim Cv for Cage Trims
in	mm	
1	25	10
1,5	40	20
2	50	45
3	80	90
4	100	150
6	150	300
8	200	400
10	250	600
12	300	900
14	350	1200
16	400	1500
18	450	2000
20	500	3000

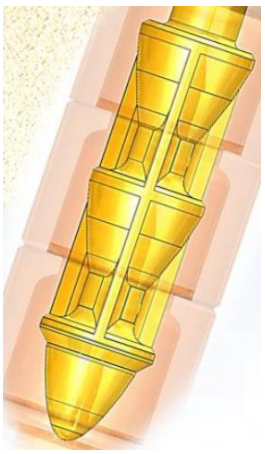
Trim Design: Axial Flow

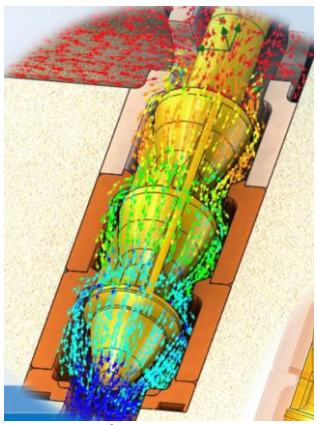
- Angle or Globe body
- ≤4500 ANSI (PN640)
- High Cv values (1 to 3000)
- Large outlet chamber to reduce velocities
- True Equal % characteristics
- Cast or single block forged body available
- Quick Change trim
- Cavitation elimination
- Pressure reduction method:
  - Expansion
  - Contraction
  - Directional change
  - Flow area increase
- Guiding along entire length of plug
- Stages throttle together
- Large flow passages. Size of particle which is allowed to pass will depend on the distance the seating surface is away from the seat. This will depend on the size of the valve. The larger the valve the larger the trim, which means the longer the distance between seating surfaces. This dictates the size of the particle which is allowed to pass.
- Effective for contaminated flows
- Up to 8 stages of pressure reduction
- Protected seats, as the seating angle tends to be on the high pressure side therefore less chance of cavitation to occur.
- Shut-off up to Class VI with soft-seat and Class V with metal-to-metal. Also MSS-SP-61 (Manufacturers Standardization Society Standard Practice).

74MB trim, Under-the-plug flow



74MC trim, Over-the-plug flow





Velocity/Pressure Analysis ensuring optimized design

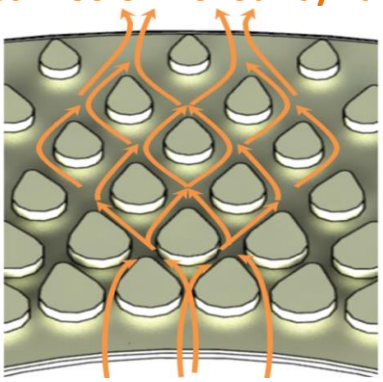
Valve Size		Available trim Cv for Multi Stage Trims
in	mm	
1	25	
1,5	40	
2	50	35
3	80	70
4	100	200
6	150	300
8	200	400
10	250	600
12	300	900
14	350	1200
16	400	1500
18	450	2000
20	500	3000

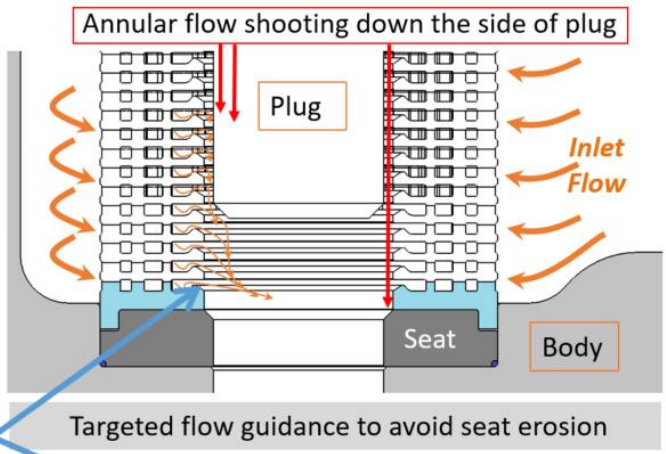
Trim Design : Patented SchuF disk stack technology can be installed in any body design

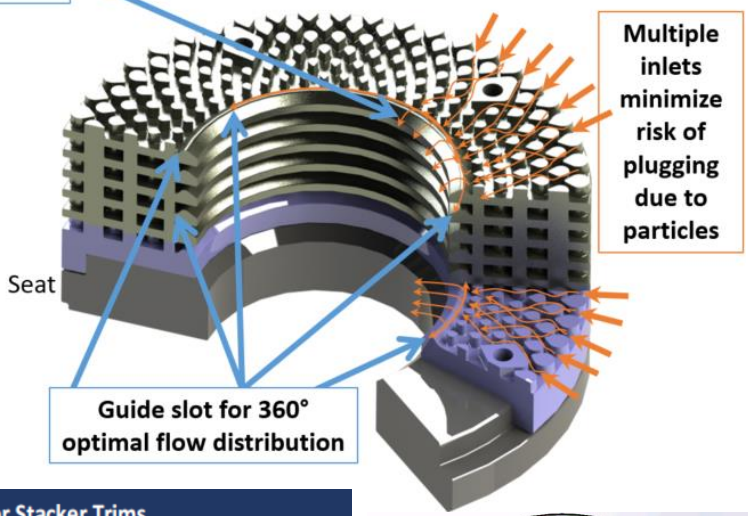
Torturous path features :

- No recirculation zones
  - Reducing particle erosion & clogging
- Pressure Reduction Strategy
  - Largest passage friction
  - Contraction
  - Expansion
  - Fluid impact on itself
  - Change of direction
  - 90° turns without metal sharp corners
  - Expanding flow passage to reduce velocity
- Minimized fluid “angle of attack” material impact, reduces particle/sand impact erosion
- Fluid Pressure & Velocity calculations (CFD) to ensure static pressure never drops below the fluid vapor pressure
  - Eliminating cavitation, vibration
  - Reducing noise/erosion
  - Eliminating hydrate condensate formation
- Circumferential passage exit flow intercepts the downward annular flow.
  - Protects the seating area from high velocity impingement erosion
  - 360° Guide slot allows flow to spread around the plug o.d. circumference.
    - Circumferential flow centers plug to reduce risk of plug lateral vibration/instability
    - Intercepts all of the down coming annular flow & redirects it to center of seat ring flow area.

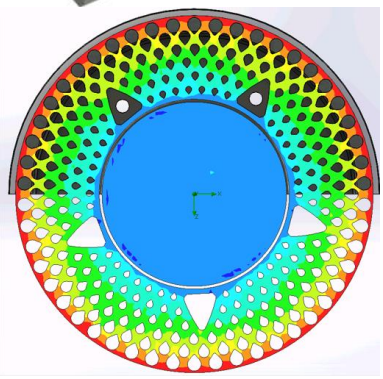
Impact Erosion vs. Sand/Particles







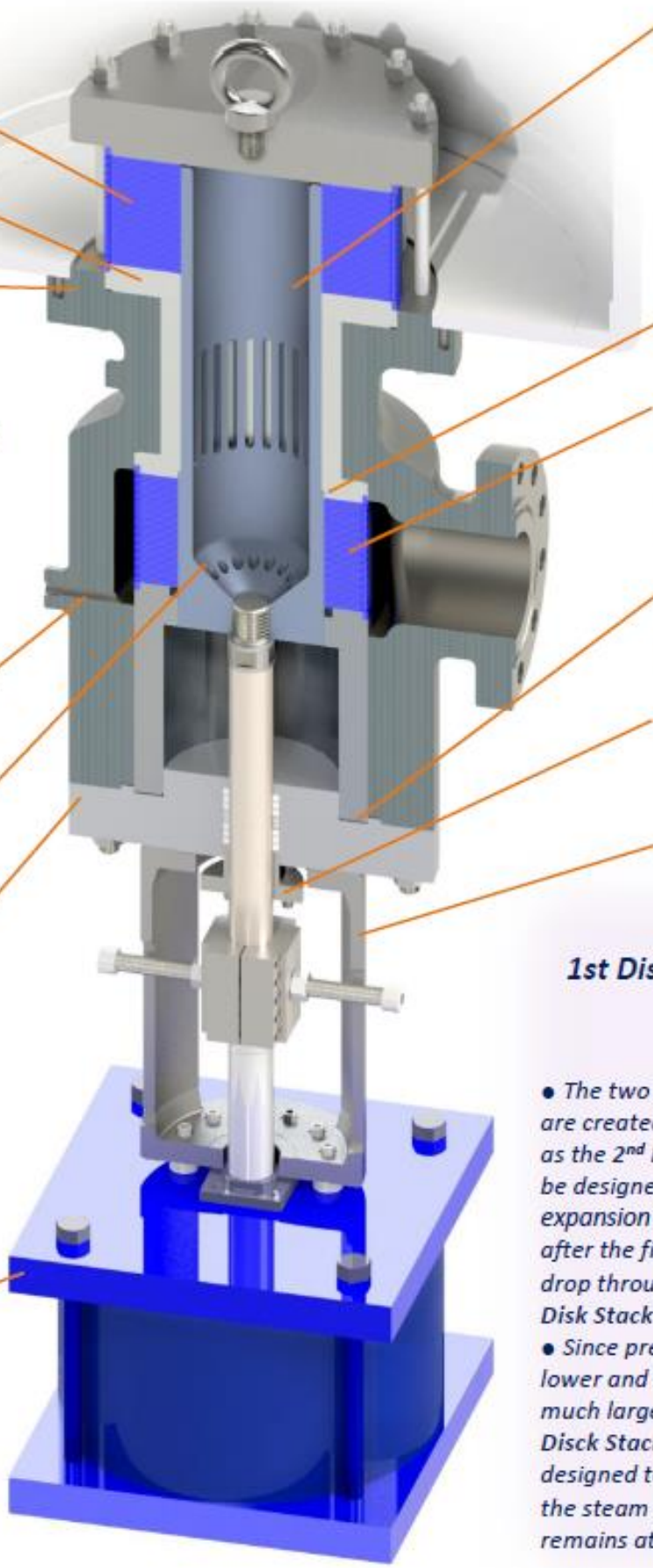
Valve Size		Available trim Cv for Stacker Trims
in	mm	
1	25	
1,5	40	
2	50	10
3	80	20
4	100	50
6	150	100
8	200	150
10	250	200
12	300	250
14	350	350
16	400	500
18	450	700
20	500	1000



Type 27SV

Sky valve (Steam Vent)

Noise & vibration reduction using a double disk-stack solution



Resistor
(2nd disk stack)

Extended hard-faced seat

Bolts/flange connected to shroud/cowling

Plug with portals
The centre of the plug is hollow. As the portals open, flow is throttled through the 1st Disk Stack and into the inner gallery, where optimised design keeps velocity below 0.3 Mach.

Drain plug
[Or pre-warming path]

Balance plug design

Bonnet
This compresses the trim via the balance cylinder. The Bonnet is bolted to body for quick and easy removal

Actuator
- with at least a 24" diameter.

Long plug (extended cage)
The end of the plug covers the entrance to the 2nd Disk Stack. When the plug opens, it opens both disk stacks at same time, with only the appropriate number of passages being opened.

Seating area
Metal-to-metal sealing edge

1st Disk Stack
This prevents unbalanced turbulence and pressure waves/fluctuations from entering the inner gallery

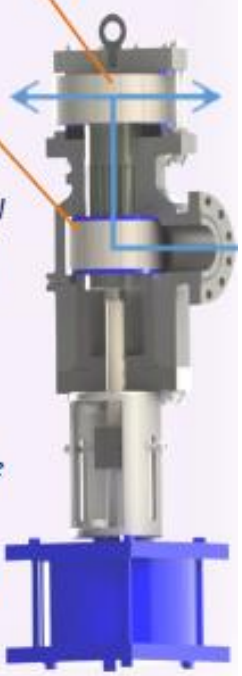
2nd Drain Connection in the Bonnet here (not shown)

Stuffing Box Seal to Atmosphere (choice of packing available)

Actuator Yoke

2nd Disk Stack

1st Disk Stack

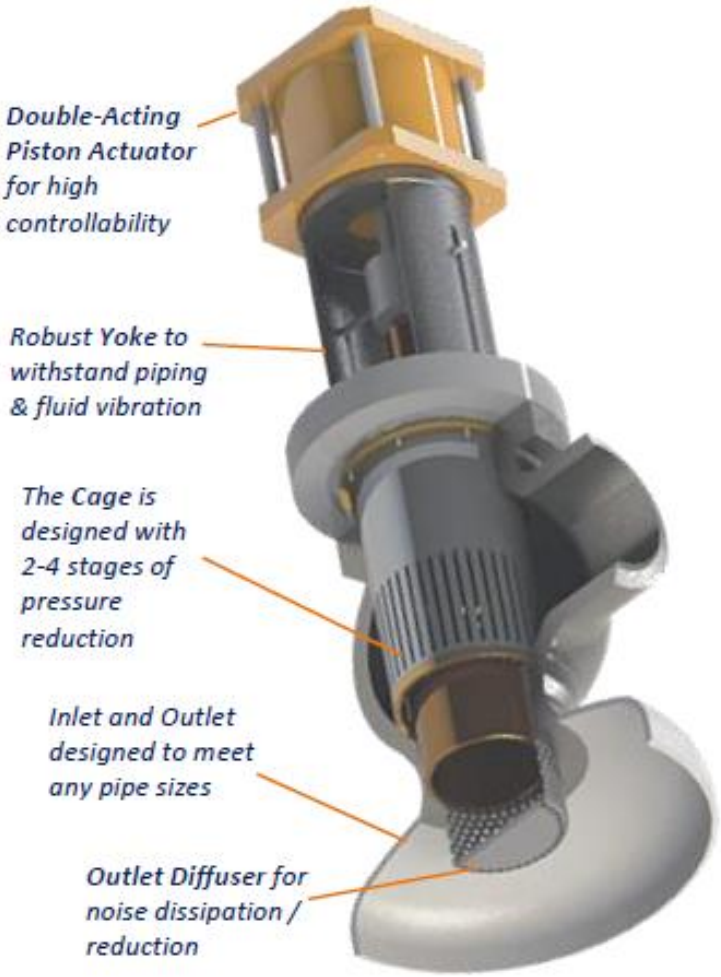


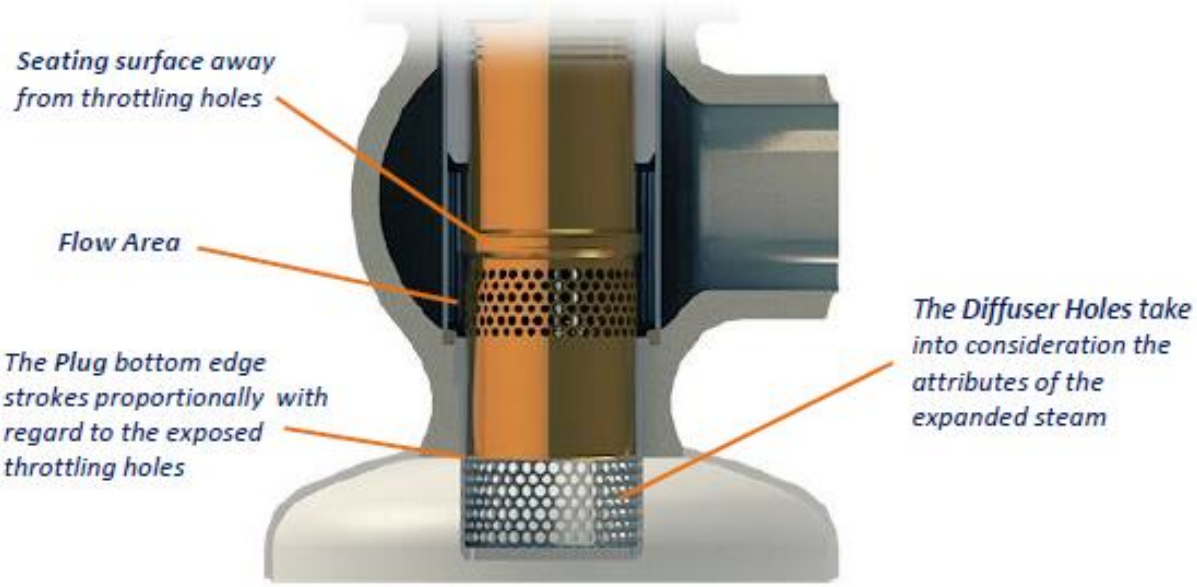
- *The two Disk Stacks are created differently, as the 2nd Disk Stack will be designed to allow for expansion of the steam after the first pressure drop through the 1st Disk Stack.*
- *Since pressure is now lower and steam volume much larger, the 2nd Disck Stack is carefully designed to ensure that the steam velocity remains at safe levels,.*

Type 27DR

Steam Application Solution

- **One-piece Plug/Cage** for improved resistance against vibration compared to a 2-piece plug-stem
- **One-piece Body**, no welded flanges
- **Replaceable Seat** and **Pressure-Reduction Cages** compressed securely between flanges.
- **Class V shut-off**
- Designs for **All Steam Pressure-Reduction Applications**
- Angle body, flow-to-close (a.k.a. *over-the-plug* flow)
- Pipe connection is **butt-welded** or **flanged**
- **Actuation**: Pneumatic, hydraulic or electro-mechanical
- Options: **Transition Pieces** for large pipe diameters and material compatibility
- Options: **Pre-Warming** and **Drain** connections available upon request
- **Multi-Stage Cage** or **Disc-Stack** available
- - Can also be supplied with a flange at the **outlet** where the trim is exchanged through the outlet instead of through the **bonnet**.
- **Body internal/external contours fully machined** to ensure **smooth transition** for **reduced thermal stress, resistance to thermal shock and fatigue**



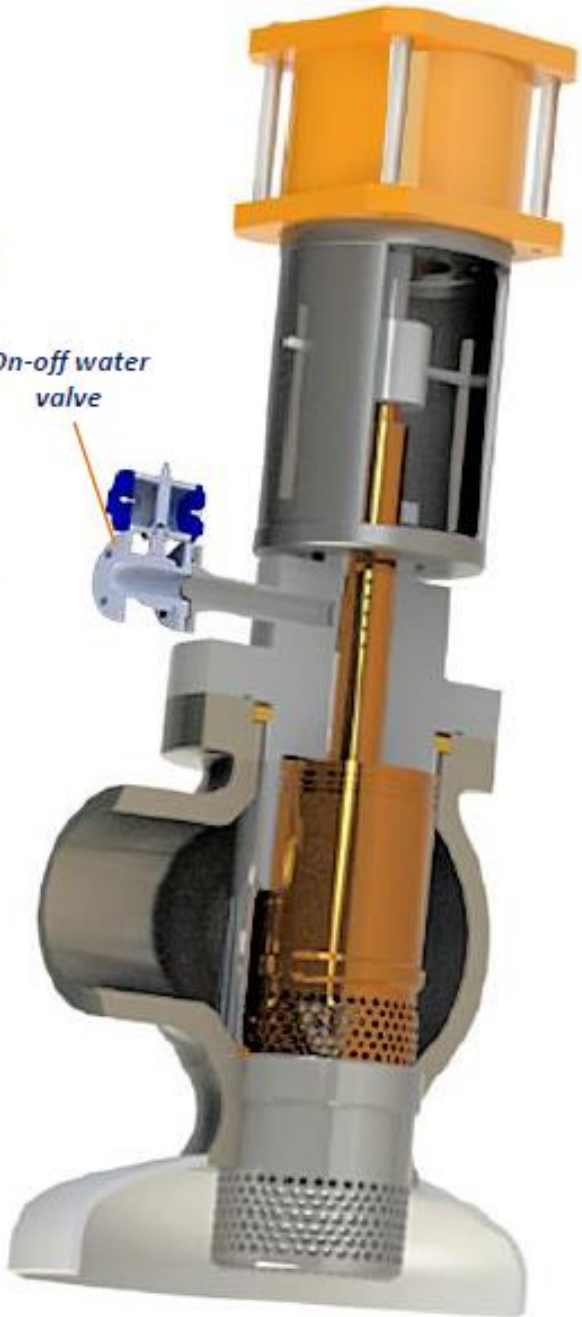


- Up to **Four-Stage Cage** or **Disk Stack** (>24 stages) with a **Proportional Diffuser** controlling steam expansion can be supplied
- +3 **Outlet Cages** are possible for sound control
- The **Seat is not welded to the body**, so the **Seat** can be removed easily for inspection
- **Plug-Cage Holes/Passages** are **away from seating surface** for **better sealing** compared to plug designs with no holes. Any erosion due to condensed steam could damage the holes, but here the **Seating/Sealing angle face is protected**.

Type 27DU

Steam Desuperheating Application

- **One-piece Plug-Cage** for **improved resistance against vibration** compared to a 2 piece plug-stem
- **One-piece Body,** no welded flanges
- **Replaceable Seat** and **Pressure Reduction Cages** compressed securely between flanges.
- **Class V shut-off**
- Design for all **Steam Pressure-Reduction Applications**
- Angle body, flow-to-close (a.k.a. over-the-plug flow)
- Pipe connection is **butt-welded** or **flanged**
- **Actuation**: Pneumatic, hydraulic or electro-mechanical
- Options: **Transition Pieces** for large pipe diameters and material compatibility
- Options: **Pre-Warming** and **Drain** connections available upon request
- **Multi-Stage Cage** or **Disc-Stack** available
- - Can also be supplied with a flange at the **outlet** where the trim is exchanged through the outlet instead of through the **Bonnet**.
- **Controlled Water Injection** through the **stem** to control **steam temperature**



Replaceable seat outlet flange available similar to 27DR model

Type 27DS

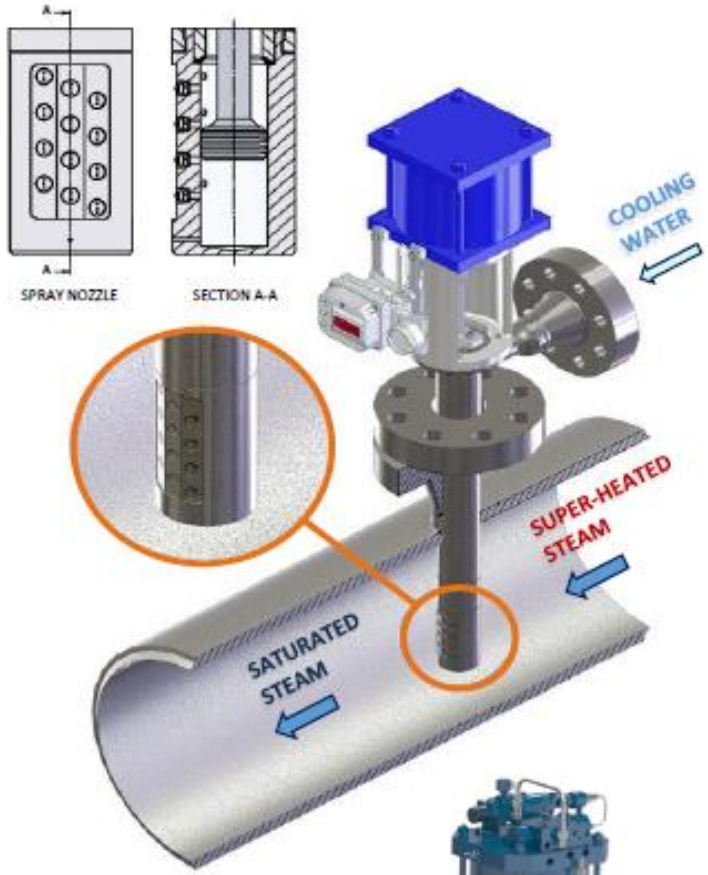
Steam Desuperheating/Attemperation Application

This is the SchuF basic design, and can be a **standalone installation** in a steam pipe. This would be used in **interstage attemperation** where no steam pressure reduction is needed.
It can also be used after our **27DR Model** where steam pressure reduction is required.

The typical nozzle diameter of each hole is 0.5 to 1 mm, and smaller sizes are possible.

Features:

- **Counterflow Nozzles** designed to **ensure atomisation** with a **delta P** as **low as one bar.**
- **Valve Cv from 0.05 to 15** with 3,4,6,8,9 or 12 nozzles in the spray head.
- **Nozzles are staggered, for linear flow characterisation.**
- **Piston Sealing Rings** are **titanium-nitrided** for **better sealing** and **smoother running.**
- **Graphite Packing** and **nitrided Spindle** ensure **perfect, leak-free sealing** to the outside while maintaining the **low packing friction** important for **good control.**
- **Special materials available** for non water/steam applications.
- Available with **Pneumatic Diaphragm** or **Piston Actuator, Air Motor, Hydraulic** or **Electric Actuators. Intelligent** or **standard positioners** as per customer preference.

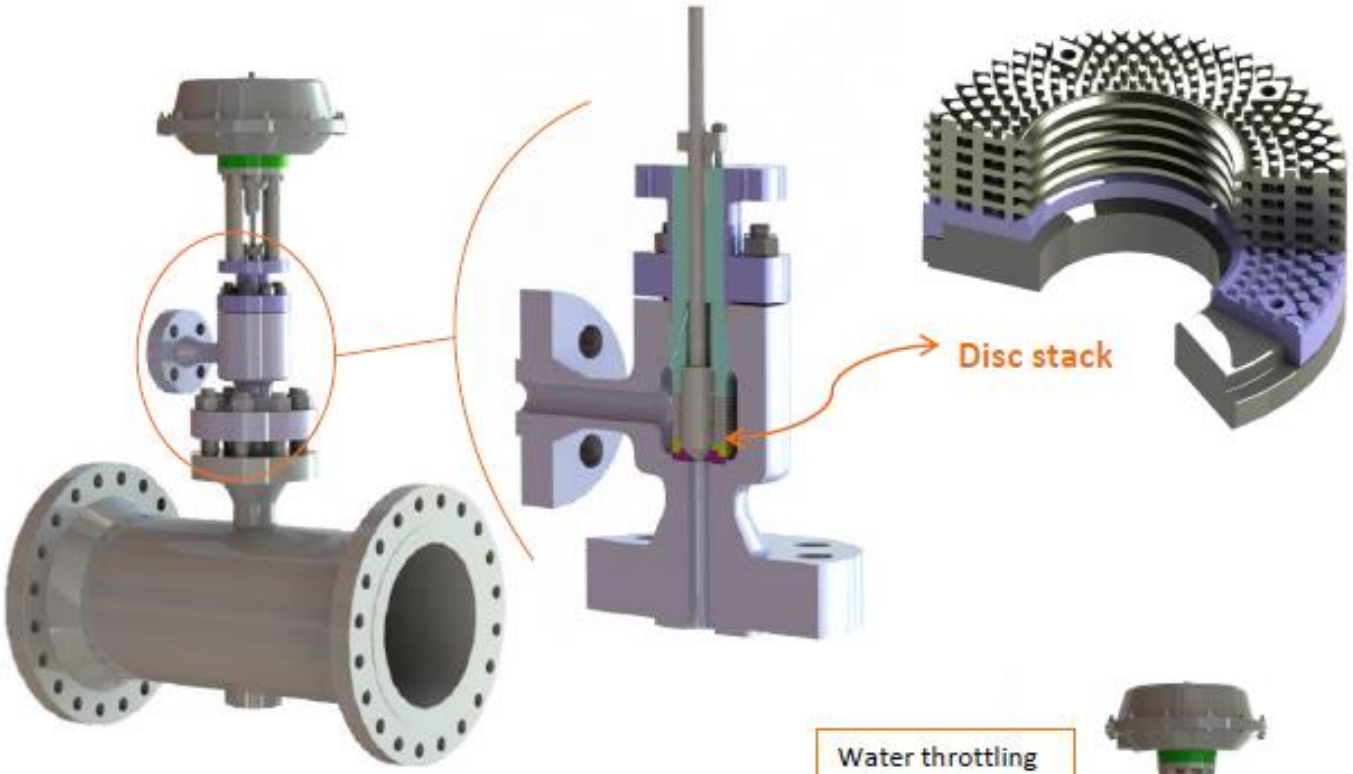


A Type 27DS Valve is shown here being used for water injection in a steam pipe. It is installed (on the right) after a **Type 27DR** Steam Pressure Reduction Valve (on the left)

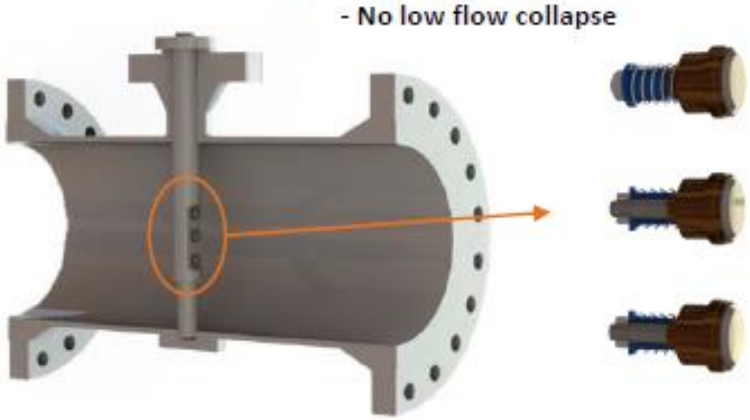
Type 27DC

Steam Desuperheating / Attemperation Application
Disc-Stack design with spring-loaded spray nozzles

This design is used when the client needs better **attemperation**. In these applications, **spring-loaded nozzles** provide the solution.
The nozzles are spring-loaded to allow them to open according to a pressure controlled by the water control valve. This design will optimize the water injection velocity. The spring ensures that the nozzle opens to the absolute minimum opening, therefore providing the highest injection exit velocity- and this in turn increases the chances of the droplets breaking up at a faster rate, resulting in the formation of smaller droplet diameters more quickly.
The water throttling point is also moved away from **inside** the steam path (inside the probe) to **outside** of the steam path- therefore creating a reduced risk of **thermal shock** on the **Cage** (or **Disk-Stack**), **Plug and Seat Ring** (i.e. Seating surfaces).

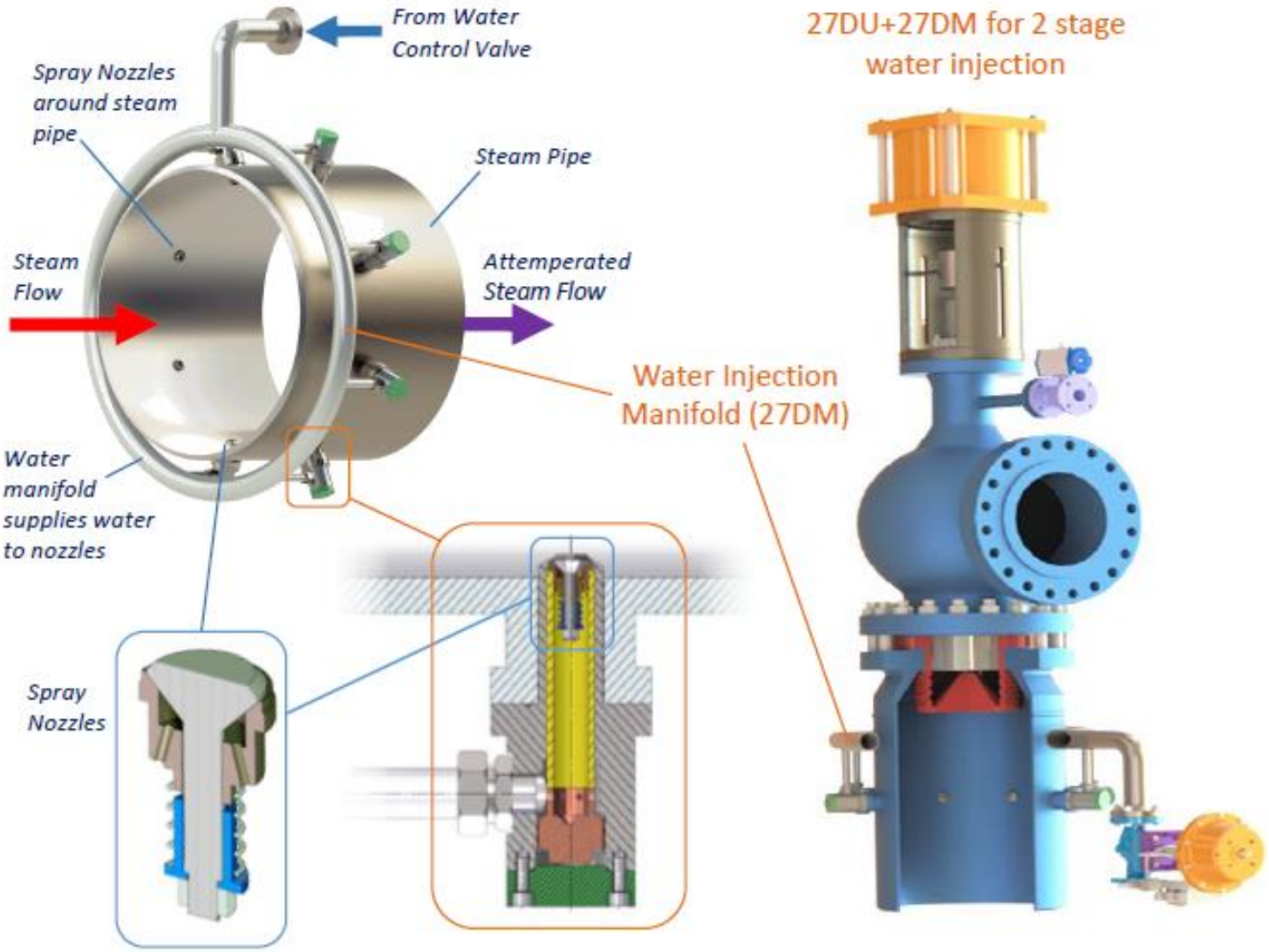


Spring activated nozzles
- No low flow collapse



27DM
Water Injection Manifold with Spring-Loaded Nozzles
Steam Desuperheating / Attemperation Application

In order to improve on the **desuperheating** performance even further, we can install our **Manifold-style design**. This design has a **Manifold** around the steam pipe. Part of the water injection angle will be against the steam flow, therefore increasing the net impact vector between the water and steam flow, which means **more of the droplets will be reduced in size more quickly**. The steam itself will break up the water droplets at a much faster rate compared to a traditional probe-style design.



Existing designs often include the welding of the water manifold assembly to the steam pipe shown above. If there is damage to the nozzle-holder, the complete assembly, including the steam pipe section, has to be cut out. Next, the water manifold is repaired and then re-welded back into the steam pipe section. This steam pipe section is subsequently welded back into the main steam pipe.

In contrast, the SchuF design has a **'Replaceable Nozzle Holder' Body**. In this design, the holder body can be removed and replaced/repaired, providing huge savings in maintenance costs over the welded version. SchuF can also supply a welded water manifold design if requested.

Type 70 Liquid-Throttling Service

Disk stack technology solutions

Angle-Type 70SC with Manual Hand-wheel

Z-Type Body 70GA with Electro-Mechanical Actuator & Manual Hand-wheel

Globe Model 70CG with various actuator design installed

Double Acting Piston Actuator with Manual hand-wheel

Diaphragm actuator for shorter strokes

Double Acting Piston Actuator for longer strokes

Valve Details

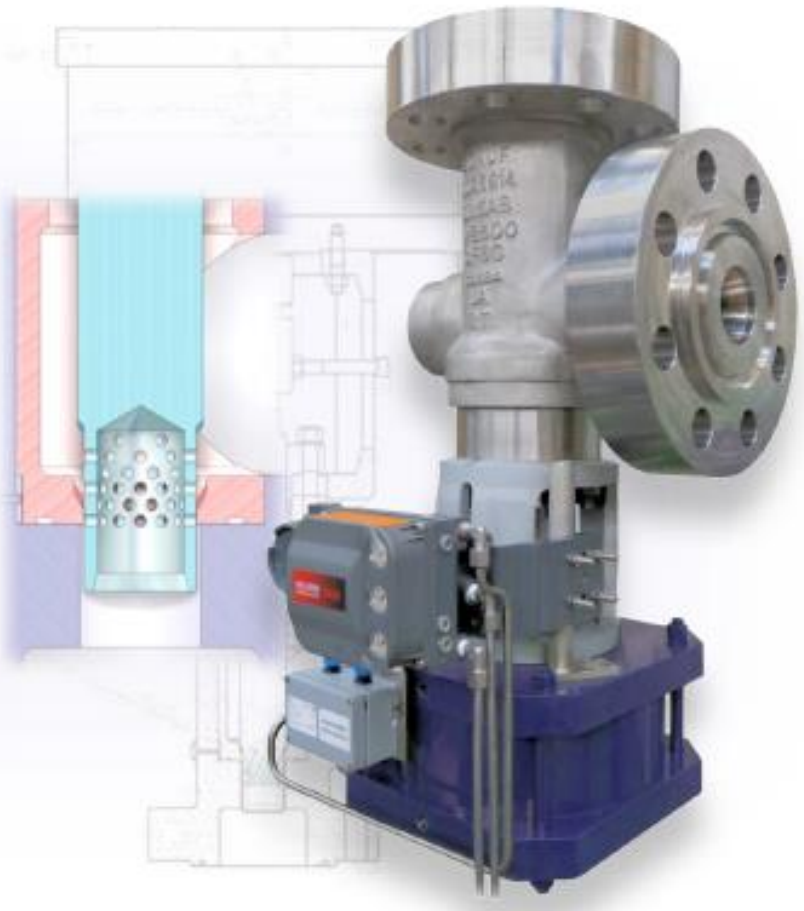
- Size 1.2"(Din 15) up to 24(Din 600) inches
- 4500 ASME (PN640) & API 15k
- Trim options: 3-Stage Cage, Axial flow & Disk-stack >30 stages available
- Flanges: Threaded, BWE, RF, & RTJ
- Actuators and positioners as per client request
- Shut-off up to Class VI with soft-seat and Class V with metal-to-metal
- Actuator & positioners as per client request

Type 74KS

Angle 'Cage Release' Valve

Valve Details

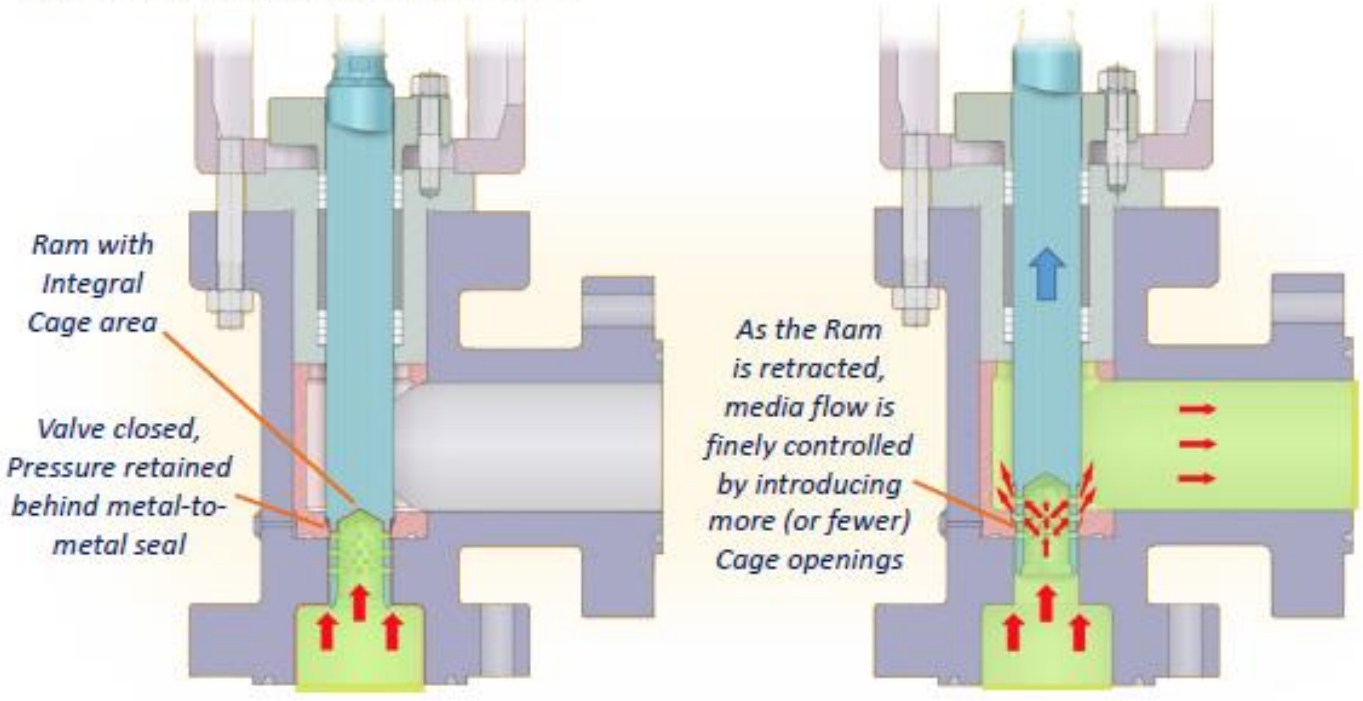
- 1"(DN 25) to 36"(DN 900)
- 2500 ANSI (PN420)
- Inlet Angle 45°, 60°, or 90°
- Flanges Threaded, BWE, RF, & RTJ
- Available Flow Characteristics:
  - Equal %,
  - Linear
  - SchuF-patented x^3 bell curve
- Actuator & positioners as per client request



Trim Designs

- One piece Plug-Cage (1 stage)
- Multi-stage Cage (3-4 stages)
- Class VI (API598) shut-off
- Shut-off up to Class VI with soft-seat and Class V with metal-to-metal

Type 74KS; Control via Cage Release



Materials of Construction 70SC & 70GA, 74KS/MB/MC

Globe, Angle & Z Control Body & Bonnet Materials for liquid applications					
Pressure Rating	Standard ASME 150 to ASME 4500 Other pressure applications are possible				
Temperature Rating	Standard -29°C to 593° C Other temperature applications are possible.				
Shut-Off Class	ANSI/FCI 70-2 Class V / Class VI Available API 598 / EN 1022-1				
Trim Material	STANDARD	STAINLESS	TITANIUM	ALLOYS	SPECIALS
Recommended Service	-	*Corrosive*	*Highly Corrosive*	*Highly Corrosive*	*Abrasive*
Body	**Carbon Steel** **•DIN 1.0619** **•A216 (WCB)**	**Duplex** •DIN 1.4462 / A 479 (S31803) **Stainless Steel** **•DIN 1.4401 / A 182 (316)** **•DIN 1.4404 / A 182 (316L)** **•DIN 1.4552 / A 351 (CF8C)**	Titanium Grade 2	•Hastelloy® •Incolloy® **•Inconel®** •Monel®	Cladded with Alloy Steel
Trim	**Carbon Steel** **•DIN 1.0619** **•A216 (WCB)** **Stainless Steel** **•DIN 1.4401 / A 182 (316)** **•DIN 1.4404 / A 182 (316L)** **•DIN 1.4541 / A 182 (321)** **•DIN 1.4550 / A 182 (347)**	**Duplex** •DIN 1.4462 / A 479 (S31803) **Stainless Steel** **•DIN 1.4401 / A 182(316)** **•DIN 1.4404 / A 182 (316L)** **•DIN 1.4541 / A 182 (321)** **•DIN 1.4550 / A 182 (347)** **•Nitronic**	**Titanium** Grade 2 or 5	Hastelloy® Incolloy® Monel® **Inconel®**	**Cladded with Alloy Steel** **Ceramic** Tungsten Carbide Proprietary coatings

Bold text above: Materials used in water applications

Inlet / Outlet dimensions

Inlet	6 to 24 inches
Outlet	10 to 36 inches
Sootblower & Steam Pegging Valves	2 to 4 inches

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Materials of Construction Type 27DR, 27DU, 27SV, 27DS* & 27DC*

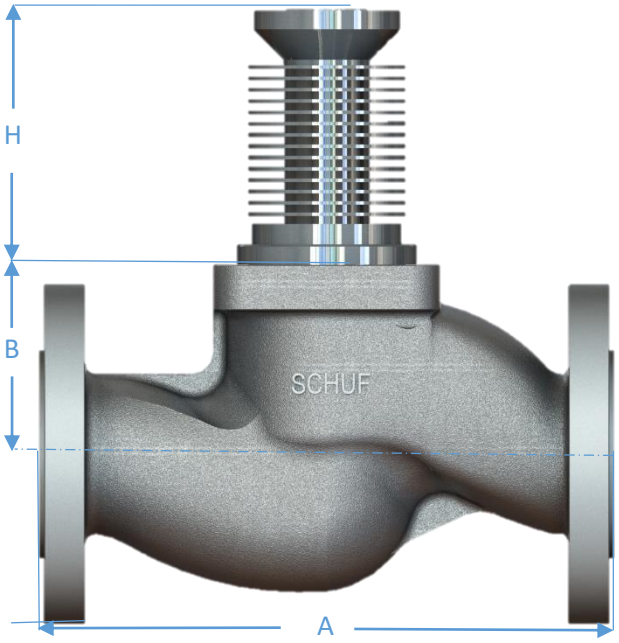
Body	Plug / Stem Cage	Outlet Cage	Seat
A182 F22/A217WC9 (<540°C/1005°F)	X19CrMoV121, A182-F22 with Stellite & 10CrMo910 (<540°C/1005°F)	10CrMo910/A182-F22 (<600°C/1132°F)	10CrMo910, A182-F22 with Stellite (<540°C/1005°F)
A182 F91/A217 C12A (540-600°C/1005°-1132°F)	Inconel 718, X20CrMoV121 (540-600°C/1005°-1132°F)		X20CrMoV121(540-600°C/1005°-1132°F)
		*27DS & 27DC Nozzle housing (probe) into steam pipe A182 F22/F91	

Water injection manifold (27DM)

Nozzle Plug	Spring	Nozzle body	Steam pipe / liner	Water pipes
X19CrMoVNb11.1	Heat resistant spring steel, NIMONIC 90 (Boiler applications)	X19CrMoVNb11.1, AISI 616	10CrMo910, A335-P11/A182-F11, A335-P22/A182-F22, 13CrMo44, A335-P12, St35.8 (A105) or A335-P91/A-182 F91	13CrMo44, A335-P12 or St35.8 (A105)

Globe Control Valve Standard Dimensions

[1] Additional sizes, connections, and configurations are available upon request; dimensions are subject to change.
[2] Threaded, BWE, RF, RTJ, API, BX, and PE connections are available for all sizes and configurations.
[3] ASME RF flanged dimensions are shown. Threaded, BWE, RTJ and ISO flanged dimensions are available upon request.

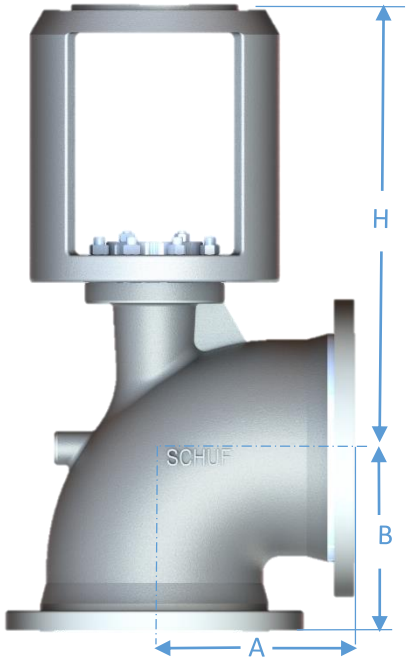


ASME/ANSI RF Flanged Globe Control Valve Dimensions[12]

Body Size (Din)	A/B (mm) [3]						B (mm)	H (mm)	
	Integral Flange								
	Class 150 PN10/16	Class 300 PN25/40	Class 600 PN100	Class 900 PN100	Class 1500 PN	Class 2500 PN100		Std. Bonnet	Ext. Bonnet
½“ (15)	108	140	165	216	-	264	38	97	212
¾“ (20)	117	152	190	229	229	273	38	97	212
1“ (25)	127	165	216	254	254	308	44	97	212
1½“ (40)	165	190	241	305	305	384	59	132	246
2“ (50)	203	216	292	368	368	451	59	138	252
3“ (80)	241	282	356	381	470	578	86	172	312
4“ (100)	292	305	432	457	546	673	133	214	354
6“ (150)	406	403	559	610	705	914	146	311	451
8“ (200)	495	419	660	737	832	1022	190	365	505
10“ (250)	622	457	787	838	991	1270	227	359	524
12“ (300)	698	502	838	965	1130	1422	318	413	578
14“ (350)	787	762	889	1029	1257	-	330	622	908
16“ (400)	914	838	991	1130	1384	-	400	721	1013
18“ (450)	978	914	1092	1219	1537	-	407	714	1020
20“ (500)	978	991	1194	1321	1664	-	489	902	1082
24“ (600)	1295	1143	1397	1549	1943	-	508	864	1180

Angle Control Valve Standard Dimensions

[1] Additional sizes, connections, and configurations are available upon request; dimensions are subject to change.
[2] Threaded, BWE, RF, RTJ, API, BX, and PE connections are available for all sizes and configurations.
[3] ASME RF flanged dimensions are shown. Threaded, BWE, RTJ and ISO flanged dimensions are available upon request.



ASME/ANSI RF Flanged Angle Control Valve Dimensions[12]							
Body Size (Din)	A/B (mm) [3]						H (mm)
	Integral Flange						
	Class 150 PN10/16	Class 300 PN25/40	Class 600 PN100	Class 900 PN100	Class 1500 PN	Class 2500 PN100	
½“ (15)	51	76	83	-	108	132	229
¾“ (20)	57	89	95	114	114	137	234
1“ (25)	70	102	108	127	127	154	251
1½“ (40)	83	114	121	152	152	192	324
2“ (50)	102	133	146	184	184	226	364
3“ (80)	121	159	178	190	235	289	461
4“ (100)	146	178	216	178	273	337	551
6“ (150)	203	222	279	305	353	457	768
8“ (200)	248	279	330	368	416	511	876
10“ (250)	311	311	394	419	495	635	994
12“ (300)	349	356	419	483	565	711	1124
14“ (350)	394	457	490	514	629	-	-
16“ (400)	457	536	555	660	-	-	-
18“ (450)	536	605	627	737	-	-	-
20“ (500)	605	627	763	826	-	-	-
24“ (600)	694	770	801	991	-	-	-

Control Globe Standards

Design Standards

ASME B16.10

ASME B16.34

ASME Boiler Pressure Vessel Code Sec. VIII

Pressure Equipment Directive (PED)

Flange Standards

ASME B16.5

ASME B16.47

EN 1092-1

ISO 10423-API 6A

API 17D

ASME B16.5

Quality Standards

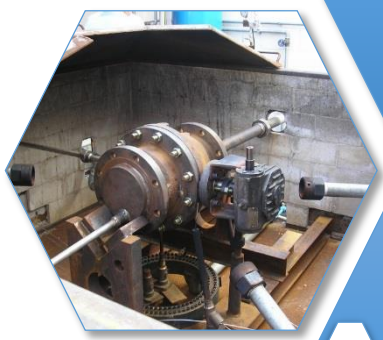
Pressure Equipment Directive (PED)

API Q1

API PSL 1,2,3 & 3G

ISO 10423-API 6A

EN ISO 9001



Testing Standards

API 6A PR2

API 17D

EN 10204

ASME B16.34

ISO 15848-1

ASME FCI 70-2

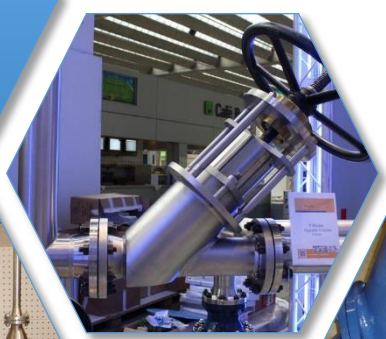
Additional Testing Standards

ANSI/ ISA S75.02

ANSI/ ISA S75.07

ANSI B16.104

Class IV & V



Sour Service Standards

Nace MR-01-75

Nace MR0103

ISO 15156

Add. Standards

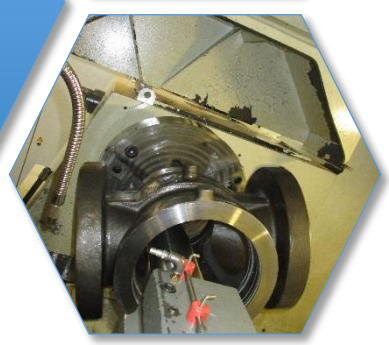
ISO 4406

EN ISO 9001

ATEX 96/9/EC

TR-CU

NORSOK



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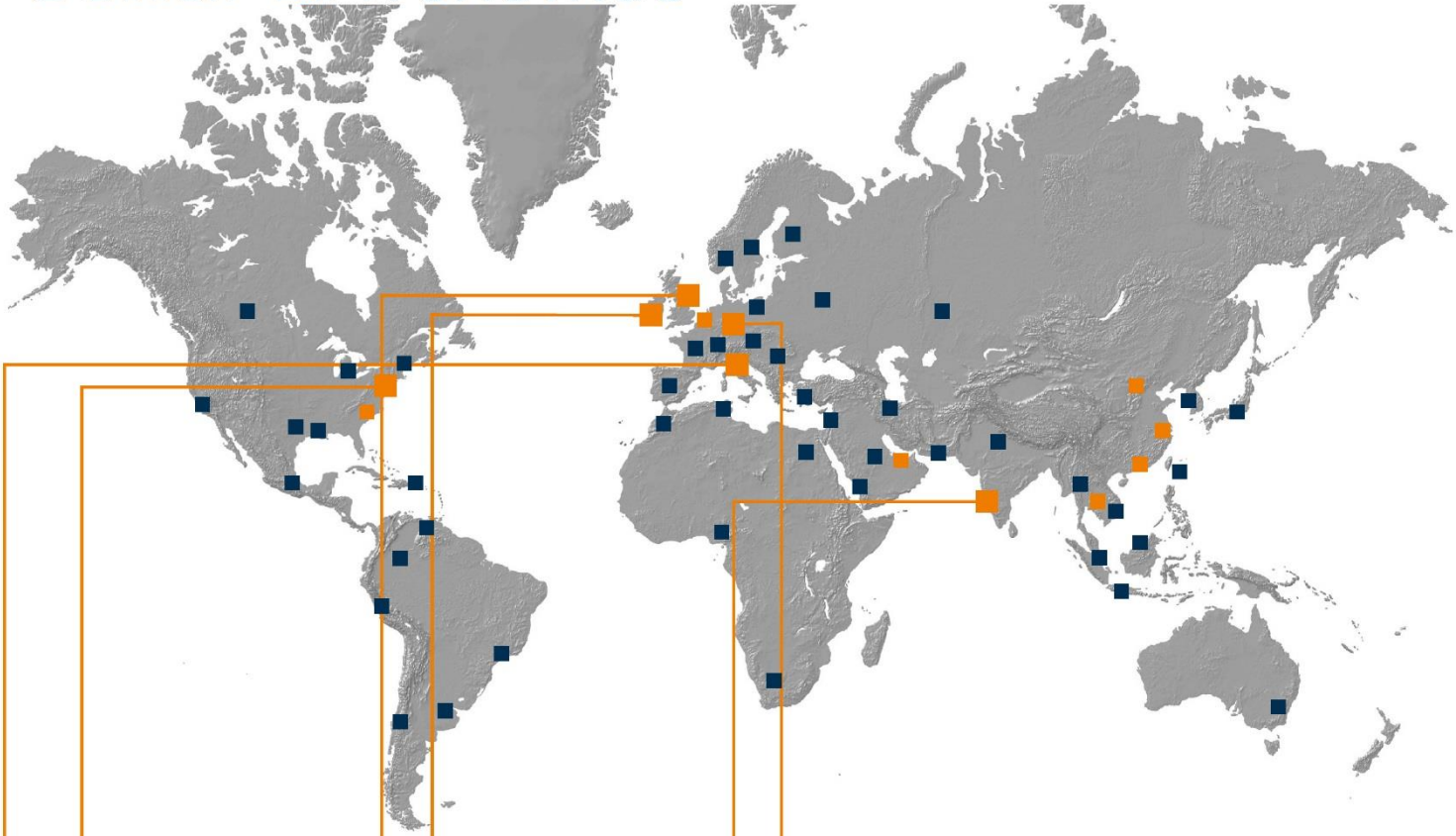

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