

Automatic Recirculation Valve

MIL 90000

Type Series Booklet



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Type Series Booklet MIL 90000

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Check Valves and Strainers

Automatic Recirculation valve

MIL 90000



Main applications

- Power stations
- Refinery
- Petrochemical industry

Fluids handled

- Water
- Boiler feed water
- Oil

Operating data

Table 1: Operating properties

Characteristic	Value
PN	40 - 400
Class	150 - 2500 ¹⁾
Nominal size [inch]	NPS 1,5 - 12
Min. permissible temperature [°C]	≥ -29 ²⁾
Max. permissible temperature [°C]	≤ +260

Valve body materials

Table 2: Overview of available materials

Material	Material number	ASTM ³⁾	Temperature limit
P 250 GH	1.0460	A105	-10°C to +260°C

Design details

Design

- Automatic Recirculation Valve to ASME B16.34
- Body made of forged steel
- Check valve function in main flow direction
- Integrated control valve in the bypass
- Hard-faced seat of lift check valve in the main flow direction
- Bypass with multistage throttling distance
- Leakage class IV in accordance with ANSI FCI 70.2: check valve in main flow direction (all designs)
- Leakage class IV in accordance with ANSI FCI 70.2: control valve in bypass (design 903/902)
- Flanged ends

¹ Maximum differential pressure across bypass valve is limited to 230 bar.

² Lower temperature available on request.

³ ASTM materials similar to the materials indicated. Supply condition shall be as per ASTM only,

Designation

Table 3: Designation example

Position								
1	2	3	4	5	6	7	8	9
9	0	-	-	-	-	-	-	-

Table 4: Designation key

Position	Code	Description
1-2	Type	
	90	Automatic recirculation valve
3	Design	
	1	Single-stage
	2	Two-stage
	3	Multistage
4	Size	
	2	1 1/2 inches
	3	2 inches
	4	2 1/2 inches
	5	3 inches
	6	4 inches
	7	5 inches
	8	6 inches
	9	8 inches
	A	10 inches
	B	12 inches
5	Pressure class	
	1	Class 150
	2	Class 300
	3	Class 600
	4	Class 900
	5	Class 1500
	6	Class 2500
	K	PN 40
	D	PN 64
	E	PN 100
	F	PN 160
	G	PN 250
	H	PN 320
	J	PN 400
6	Connection	
	F	Flanged ends
	W	Butt weld end
7	Installation position	
	V	Vertical
	H	Horizontal
8	Bypass option	
	S	Standard
	O	Oversized
	R	Reduced
9	Valve body material	
	C	Carbon steel
	S	Stainless steel
	A	Alloyed steel
	D	Duplex stainless steel

Product benefits

- The valve features both on/off and modulating control functions. It can be used in a variety of different load conditions without loss of energy.
- The robust design of the spring-loaded lift check valve prevents any loss of stability during operation. The hard-faced seat of the check valve ensures a long service life.
- Rugged bypass design. The bypass branch features the tried-and-tested technology of the MIL 78000 series. This technology is based on the principle of multistage pressure reduction by high-resistance axial flow.

Product information

Product information as per Pressure Equipment Directive 2014/68/EU (PED)

The valves satisfy the safety requirements of Annex I of the European Pressure Equipment Directive 2014/68/EU (PED) for fluids in Groups 1 and 2.

Product information as per Regulation No. 1907/2006 (REACH)

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see <https://www.ksb.com/en-global/company/corporate-responsibility/reach>.

Related documents

Table 5: Information/documents

Document	Reference number
Operating manual	0500.80

Purchase order specifications

Please specify the following information in all enquiries or purchase orders:

1. Type
2. Class
3. Nominal size
4. Design temperature
5. Operating temperature
6. Material
7. Fluid handled
8. Flow rate at duty point
9. Maximum minimum flow rate
10. Shut-off head (Q=0)
11. Head at duty point
12. Head at Q_{min}
13. Pump inlet pressure
14. Backpressure in the bypass
15. Kv value
16. Reference number
17. Specific gravity

Always indicate the original serial number and the year of construction when ordering spare parts.

Pressure/temperature ratings

Table 6: Permissible operating pressures [bar] (to ASME B16.34 Standard Class)

Class	Material	[°C]				
		-29 to +38	50	100	150	200
300	A105	51,1	50,1	46,6	45,1	43,8
600		102,1	100,2	93,2	90,2	87,6
900		153,2	150,4	139,8	135,2	131,4
1500		255,3	250,6	233	225,4	219

Design and function

Design

The valve has one inlet port and two outlet ports. The main outlet port connects to the main process and the bypass port connects back to the deaerator.

Function

The main flow lifts the check disc (6). The check disc (6) changes its position depending on the flow rate of the pump and transfers this motion to the lever (9) of the bypass system. The motion of the lever (9) is transferred to the multistage bypass plug (19). In the bypass, the pressure and flow rate are reduced to the minimum flow conditions along a multistage throttling distance (low cavitation and low noise). As a result of modulating control, the sum of main flow rate and bypass flow rate is almost constant. The valve is flow-controlled and does not require an external control system or auxiliary energy.

High flow rate: The check disc (6) is fully open and the bypass system is fully closed.

Reduced flow rate: If the flow rate is reduced, the check disc (6) closes and the bypass system opens.

Low flow rate: If the flow rate drops below the pump's minimum flow value, the check disc (6) fully closes and the bypass system fully opens. The entire minimum flow rate is routed through the bypass system.

Bypass function

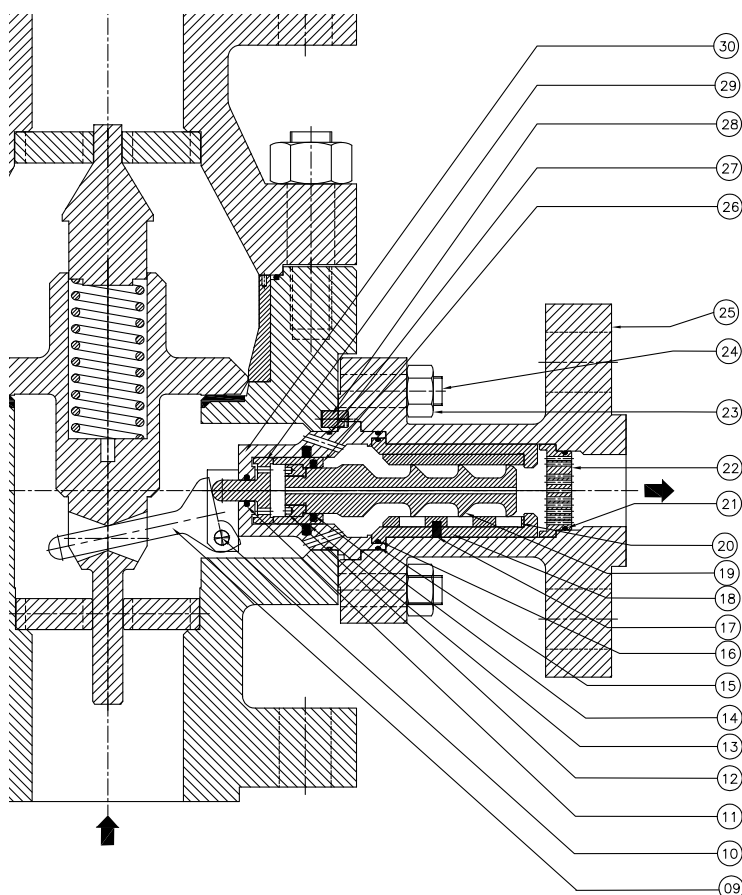


Fig. 1: Sectional drawing of bypass

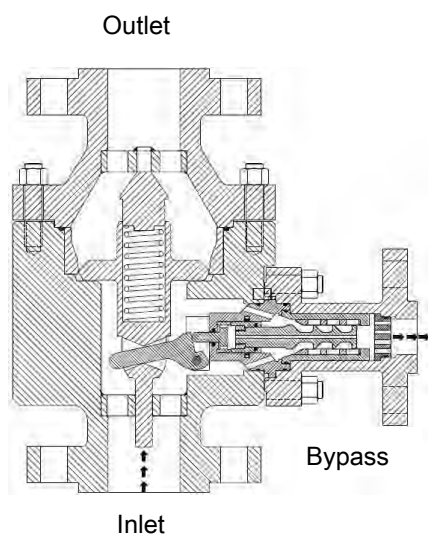
Table 7: List of components of bypass

Item No.	Description	Item No.	Description
9	Lever	20	Liner
10	Pivot pin	21	O-ring
11	Sealing element	22	Perforated disc
12	Threaded ring	23	Nut
13	Sealing element	24	Stud
14	Sealing element	25	Bypass body
15	O-ring	26	Bush
16	O-ring	27	O-ring
17	Spring-type straight pin	28	Pin
18	Seat	29	Balance bolt
19	Bypass plug	30	Control head

The bypass system features the tried-and-tested control valve technology of the MIL 78000 series. This technology is based on the principle of multi-stage pressure reduction by high-resistance axial flow.

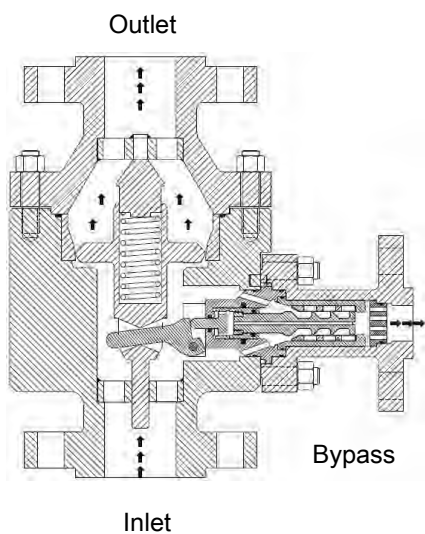
The pressure is reduced along the length of the bypass plug (19) through a series of throttling stages. The total pressure drop is divided equally between the individual trim elements or throttling stages.

Function



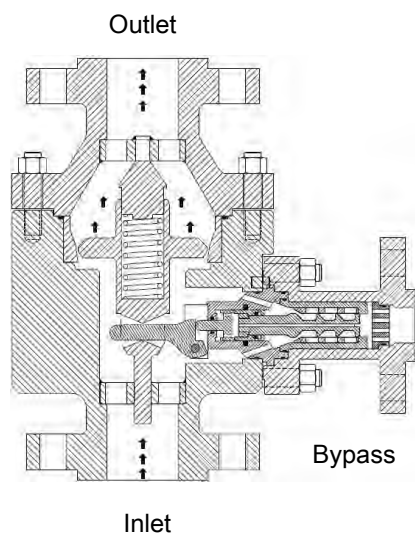
- No process flow required
- No main flow
- Flow through bypass only

Fig. 2: Valve with check disc closed and bypass open



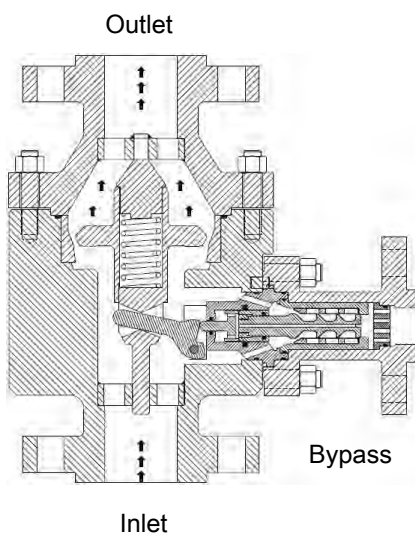
- Process flow starts
- Partial flow through main valve outlet
- Partial flow through bypass

Fig. 3: Valve with check disc open and bypass open



- Check disc in half open
- Main flow is increasing
- No flow through bypass
- Switching point

Fig. 4: Valve with check disc open and bypass closed



- Increasing process flow required
- Main flow reaches maximum
- No flow through bypass

Fig. 5: Valve with check disc open at maximum travel and bypass closed

Valve characteristics

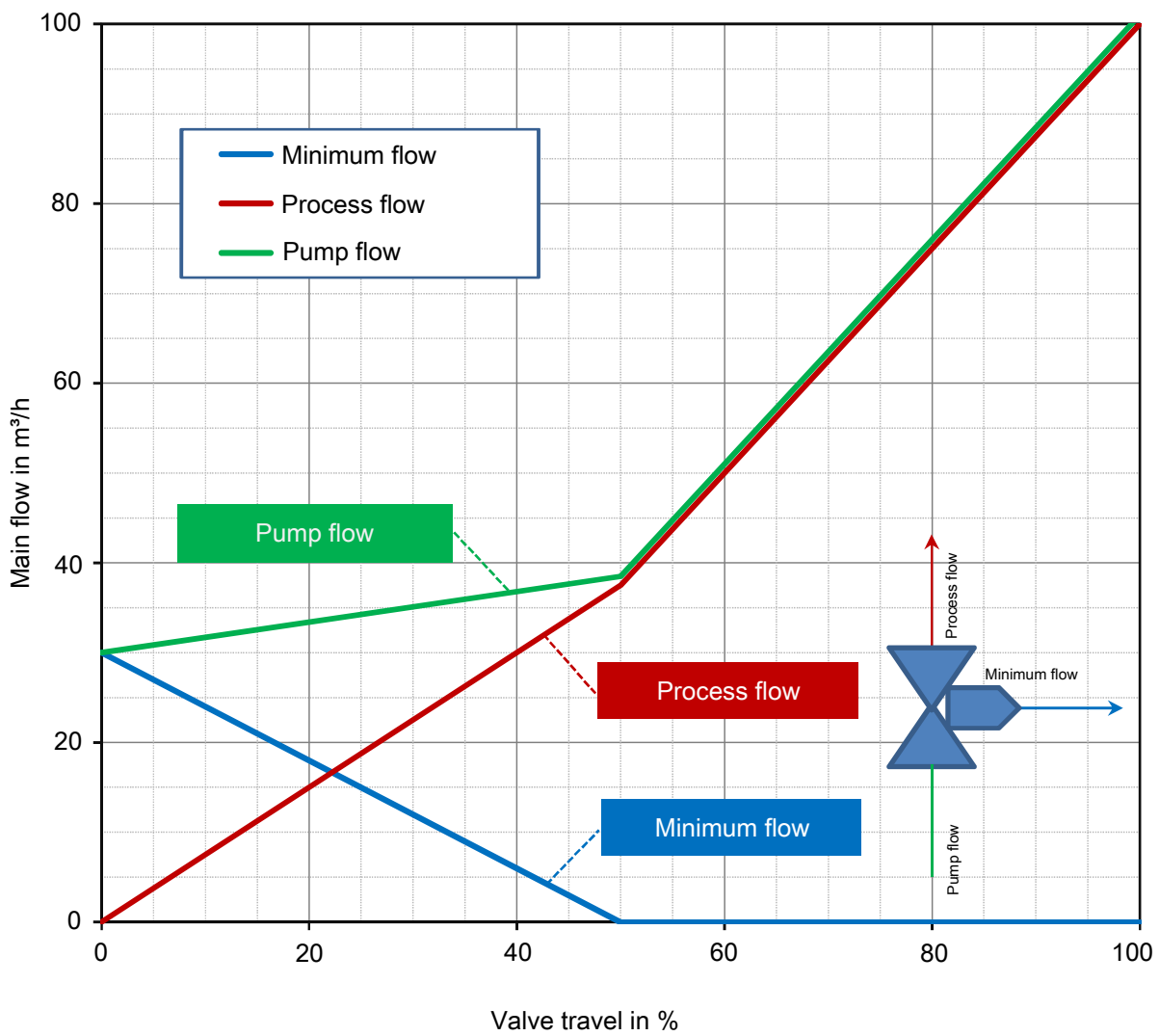


Fig. 6: Example characteristic for MIL 90300 / MIL 90200 automatic recirculation valve

Materials

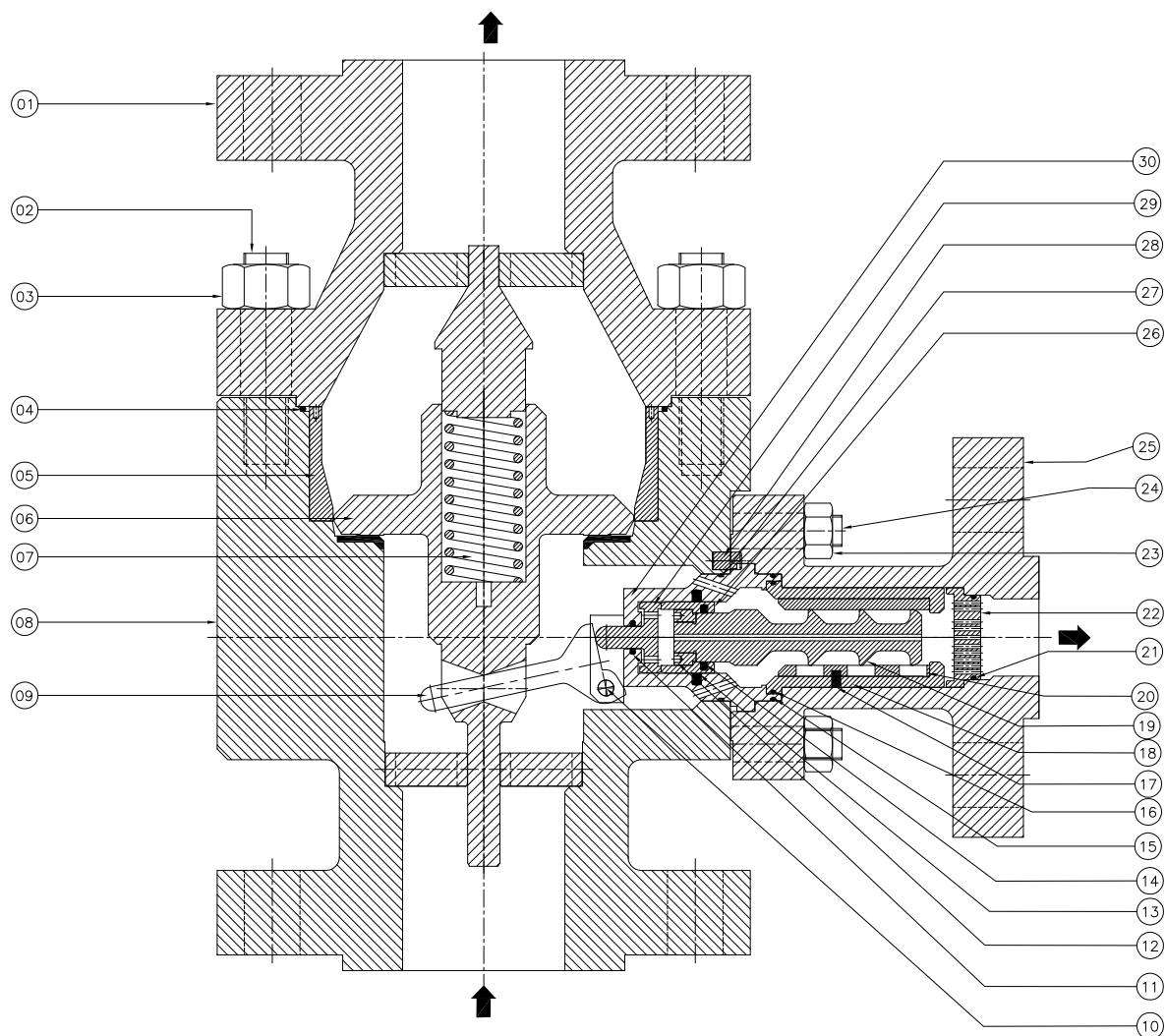


Fig. 7: Sectional drawing

Table 8: Parts list

MOC as per above table is reference only. Other materials on request / application.

Part No.	Description	Material
1	Upper body section	ASTM A 105
2	Stud	ASTM A193 Gr. B7
3	Nut	ASTM A194 Gr. 2H
4 ⁴⁾⁵⁾	O-ring	EPDM
5	Liner	SS 304
6	Check disc	SS 316L
7	Spring	SS 304
8	Lower body section	ASTM A 105
9 ⁶⁾	Lever	17-4 PH (H1150)
10 ⁶⁾	Pivot pin	AISI 420
11 ⁶⁾⁵⁾	Sealing element	PTFE + carbon/graphite
12 ⁶⁾	Threaded ring	AISI 420
13 ⁶⁾⁵⁾	Sealing element	PTFE + carbon/graphite

⁴ Recommended spare parts

⁵ Other material based on application/temperature.

⁶ Recommended spare parts (included in bypass trim spare parts kit)

Part No.	Description	Material
14 ⁶⁾⁵⁾	Sealing element	PTFE + carbon/graphite
15 ⁴⁾⁵⁾	O-ring	EPDM
16 ⁴⁾⁵⁾	O-ring	EPDM
17 ⁶⁾	Spring-type straight pin	AISI 420
18 ⁶⁾	Seat	AISI 420
19 ⁶⁾	Bypass plug	AISI 420
20 ⁶⁾	Liner	AISI 420
21 ⁴⁾⁵⁾	O-ring	EPDM
22	Perforated disc	AISI 420
23	Nut	ASTM A194 Gr. 2H
24	Stud	ASTM A193 Gr. B7
25	Bypass body	ASTM A 105
26 ⁶⁾	Bush	AISI 420
27 ⁴⁾⁵⁾	O-ring	EPDM
28	Pin	SS 316
29 ⁶⁾	Balance bolt	AISI 420
30 ⁶⁾	Control head	AISI 420

Dimensions and weights

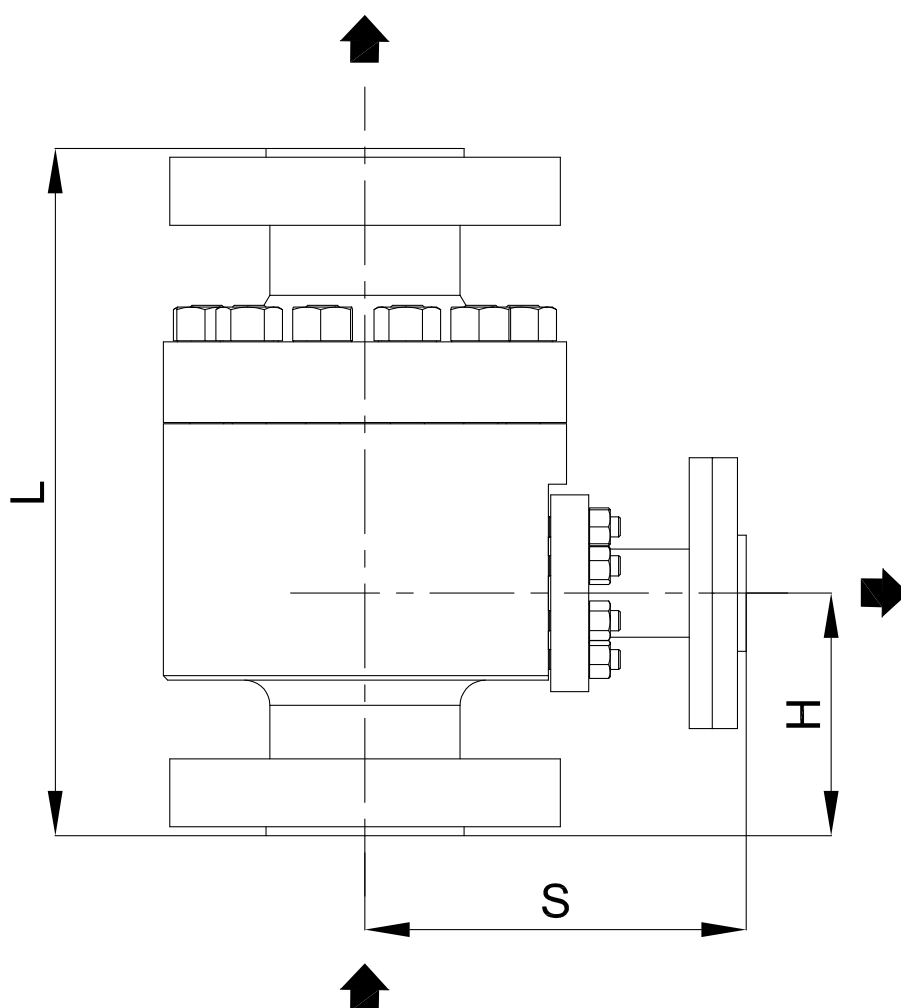


Fig. 8: Sectional drawing of MIL 90000

Table 9: Dimensions and weights

Type	Main body		Bypass body		Class	L [mm]	S [mm]	H [mm]	[kg]
	NPS	DN	NPS	DN					
	[inch]	[mm]	[inch]	[mm]					
90322	1,5	40	1	25	300	260	190	90	31
90323	1,5	40	1	25	600	260	190	90	34
90324	1,5	40	1	25	900	300	200	110	36
90325	1,5	40	1	25	1500	310	215	120	49
90332	2	50	1	25	300	300	185	115	45
90333	2	50	1	25	600	300	193	110	48
90334	2	50	1	25	900	340	203	130	70
90335	2	50	1	25	1500	350	233	130	80
90342	2,5	65	1,5	40	300	340	199	125	65
90343	2,5	65	1,5	40	600	340	220	125	70
90344	2,5	65	1,5	40	900	380	230	140	96
90345	2,5	65	1,5	40	1500	400	250	145	112
90352	3	80	1,5	40	300	380	233	140	85
90353	3	80	1,5	40	600	380	240	140	96
90354	3	80	1,5	40	900	410	250	150	115
90355	3	80	1,5	40	1500	450	275	165	149
90362	4	100	2	50	300	430	266	155	125
90363	4	100	2	50	600	430	266	155	176

Type	Main body		Bypass body		Class	L [mm]	S [mm]	H [mm]	[kg]
	NPS	DN	NPS	DN					
	[inch]	[mm]	[inch]	[mm]					
90364	4	100	2	50	900	450	280	160	188
90365	4	100	2	50	1500	520	300	190	249
90372	5	125	2	50	300	500	290	175	183
90373	5	125	2	50	600	500	300	175	235
90374	5	125	2	50	900	525	310	185	273
90385	5	125	2	50	1500	650	341	235	338
90382	6	150	2,5	65	300	550	350	190	257
90383	6	150	2,5	65	600	585	355	190	273
90384	6	150	2,5	65	900	785	355	200	455
90385	6	150	2,5	65	1500	700	405	250	547
90392	8	200	3	80	300	650	405	215	470
90393	8	200	3	80	600	680	430	225	555
90394	8	200	3	80	900	700	430	225	558
90395	8	200	3	80	1500	880	485	310	938

Mating dimensions as per standard

Flanges: ASME B16.5
Flanges: DIN EN 1092-1

Installation information

Install the valve directly at the pump discharge nozzle. If it cannot be installed directly at the pump nozzle, it must be installed as close to the pump discharge nozzle as possible. The distance between the pump discharge nozzle and valve connection flange must not exceed a straight pipe run of 3 m. If the valve cannot be installed directly at the discharge nozzle, the valve requires a straight upstream stabilisation distance of at least 2x DN (no pipe bends).

To stabilise turbulent flows, a straight stabilisation distance of at least 3x DN is recommended downstream of the bypass port and of 1 m downstream of the valve outlet port. No pipe bends are permitted downstream of the bypass port.

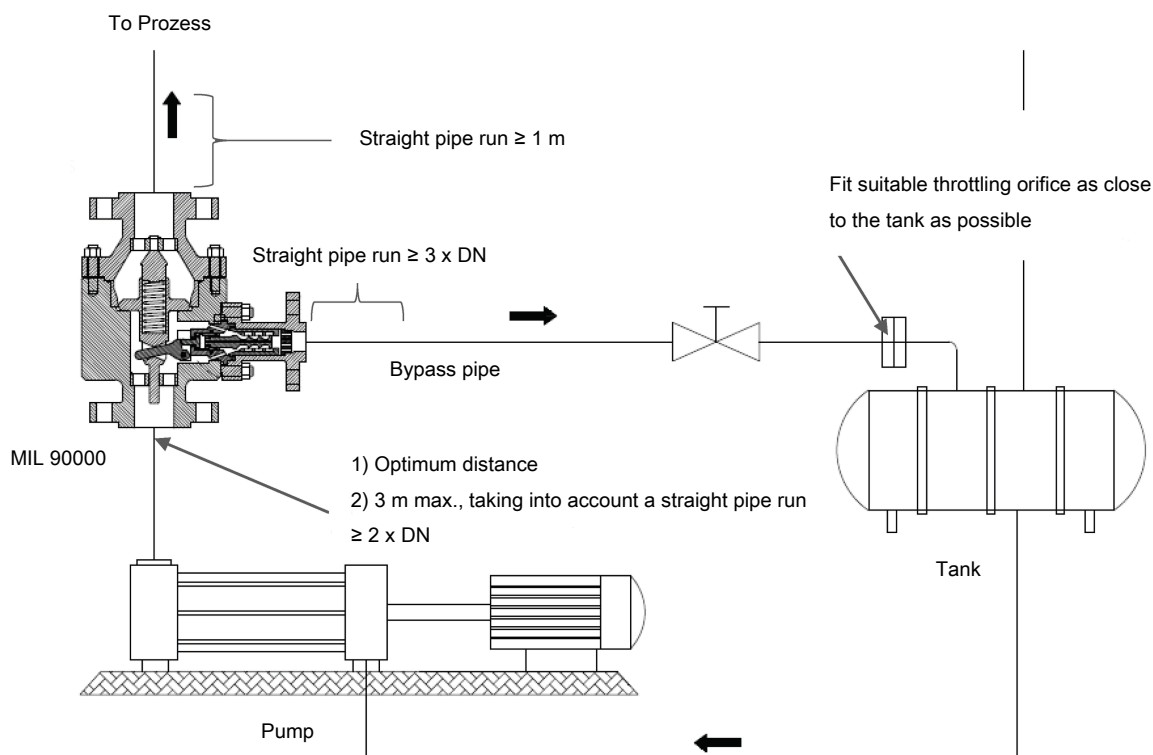


Fig. 9: Schematic diagram of the installation conditions

Selection information

Table 10: Sizing and selection

Size code	Valve size [inch]	Main flow rate [m³/h]	Bypass size [inch]	Max. bypass flow rate [m³/h]
1	1	6–20	1	18
2	1½	9–47	1	18
3	2	14–80	1	18
4	2½	20–115	1½	40
5	3	33–178	1½	40
6	4	52–305	2	65
7	5	77–435	2	65
8	6	108–574	2½	120
9	8	138–840	3	180



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