LVA

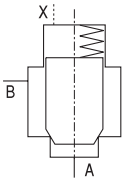
SLIP IN 2/2 WAY CARTRIDGE VALVES

|KE 4021| 08/14 |

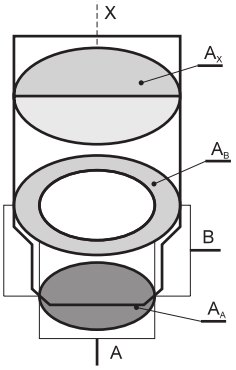
D_n 16 to 100 | p_{max} 35 MPa |
Q_n 200 to 10000 dm³/min

Slip in 2/2 way cartridge valves according to DIN 24342 (ISO 7368) standard. The flow between ports A and B is controlled by a pilot pressure in port X.

Dn 16 to 100| high power density | compact design | designed according to DIN 24342 (ISO 7368) standard



FUNCTIONAL DESCRIPTION



The slip in 2/2 way cartridge valve consists of the sleeve with the valve seat and the valve cone with the closing spring (for types of cones and sleeves see the chapter Types of cones and sleeves). The cartridge chamber in the manifold is closed by a cover plate which allocates the cartridge and connects it to the circuit of the manifold over the pilot connection X. Thus the pilot valves of the control circuit can directly control the switching function of the cartridge-valve either between two terminal position (open or closed) or in any number of intermediate positions. The control is influenced by the pressure in connection X only. The position of the valve cone depends on the ratio of the control pressure (acting on the control area A_X) to the pressure acting from the working connections A and B (i.e. the contact area $A_A$and the annular area A_B)(*). If the valve cone is open (by the unloading of the X connection), the flow in the working connections A and B is possible in both directions. By applying the pressure at X the working connections A and B are hermetically sealed if the valve cone is sealed in its seat. If there is a pressure difference between the connection B and the pilot connection X (this can happen because of the clearance between the cone and the sleeve); the small leakage can be avoided by hooking up the pilot connection to the working connection B. If the required function does not allow such a switching operation, then can be used a cartridge valve with an additional sealing area hermetically dividing the connections A, B and X from each other.

ORDERING CODE

□ **L V A** □ □ **2 -** □□□ **/** □ □□ □□□ □□ **- 1**

SEALING TYPE
no code standard NBR
V Viton

VALVE TYPE
LVA cartridge valve

VALVE FUNCTION
E cartridge without cover
D cartridge pilot operated

MOUNTING
E manifold mounting
P subplate mounting
R threaded mounting
F flange mounting

2 Innovation stage

NOMINAL SIZE
16 Dn = 16 mm
25 Dn = 25 mm
32 Dn = 32 mm
40 Dn = 40 mm
50 Dn = 50 mm
63 Dn = 63 mm
80 Dn = 80 mm
100 Dn = 100 mm

* see Surface area ratios

1 Design number

ORIFICES/PLUGS
00 plug (**)
XY orifice Ø X.Y [mm] (**)
99 without orifice, without plug (**)
(** see page 4)

CODE FOR COVER PLATE
see Covers and sandwich plate
no code for LVAE

OPENING PRESSURE

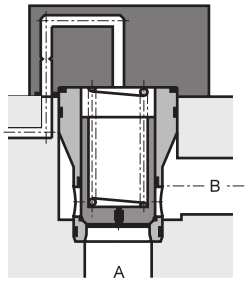
	Cone B, C	Cone A, D
01	0.01 MPa	0.007 MPa
03	0.03 MPa	0.02 MPa
05	0.05 MPa	0.03 MPa
10	0.10 MPa	0.06 MPa
20	0.20 MPa	0.12 MPa
40	0.40 MPa	0.24 MPa
60	0.60 MPa	0.37 MPa

CONE TYPE
A Cone with ratio $A_A = A_X$ (*)
D $A_A < A_X$ with damping (*)
B $A_A < A_X$ (*)
C $A_A < A_X$ with damping
R $A_A < A_X$ (*)

APPLICATION

2/2 way valves, also called cartridge valves, have two working connections A and B where the main flow is hydraulically operated by a controlling current applied to the port X. Depending on the control input these valves can be used as:

- directional control valves (start, stop and directional control)
- pressure control valves (pressure relief, pressure control, pressure sequence and unloading valves)
- check valves (direct controlled and pilot operated function)
- flow control valves.



LVA cartridge valves are made in conformity with DIN 24342 (ISO 7368) standard. The production program also contains cartridge housing for a great number of application for subplate, pipe and flange mounting.

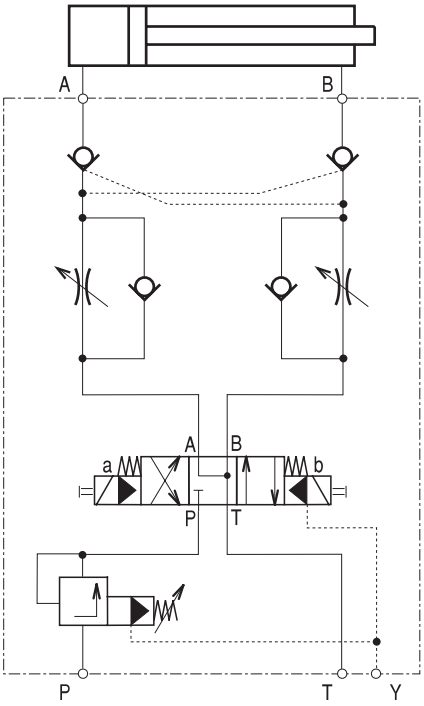
COMPARISON OF CONVENTIONAL AND CARTRIDGE CONTROL

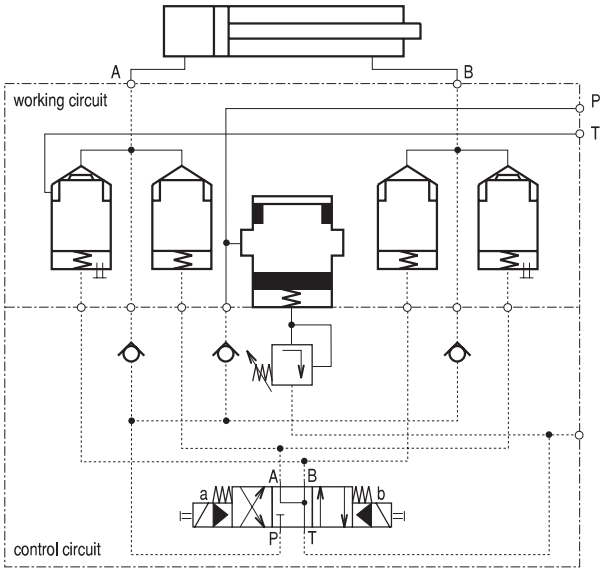
Conventional control with single valves

In conventional hydraulic systems the required function of the working circuit is achieved by parallel and serial connections of single valves depending on the hydraulic circuit. These valves usually have just one special function, e.g. flow, pressure, directional or check function. Due to this specialization of the functions in conventional control, the number of the valves needed to build complex hydraulic circuit with intended function increase the required space and hydraulic losses.

Cartridge valves control

As cartridge valves can be used for pressure, way, check and flow control, the single valves of the working circuit in cartridge controls can be grouped in such a way that overriding function is taken over by the cartridge valves.
The required valve functions can be relocated from the working to the control circuit thus eliminating disadvantages of conventional control. Using cartridges reduces the number of space-demanding working valves. The space required by the manifold block as well as the performance loss (especially at large nominal bores) is thus reduced.





SPECIAL CHARACTERISTIC FEATURES

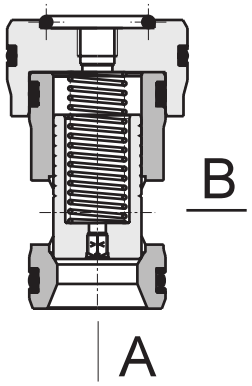
- increased power density
- compact design
- several functions at one mounting position
- reduced manifold dimensions
- reliability
- long service life
- low noise level
- short switching time
- high switching frequency
- soft switching process without pressure peaks due to pressure-depended control with adjustable dampening
- leakproof check function
- easy replacement of valve elements during maintenance

TYPES OF CONES AND SLEEVES

Pressure control valves

In pressure control valves the cartridge valve is usually integrated in the control function as a main stage and therefore the control surface area A_X and the cone surface area A_A should be equal for an optimized function. This is guaranteed by a cartridge valve with cone A and the matching sleeve A.
Note: the flow direction is only from A to B in the cartridge valve.

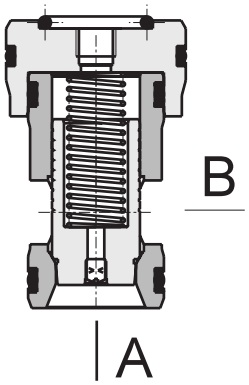
Sleeve A, cone A



Compensators

In order to improve the control reaction within some range a cartridge cone with a dampening nose can be used. Accordingly, the cartridge is then composed of a sleeve A and a cone D with a cone ratio 1:1.
Note: flow direction is only from A to B.

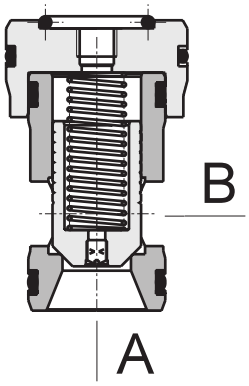
Sleeve A, cone D with dampening nose



Directional, check and flow control valves

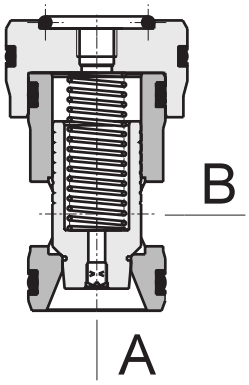
A cartridge valve that permits flows in either direction (A><B) is necessary for multiple application of the directional, check and flow control valves.
For such an application the cones whose control surface area A_X is larger than cone surface area A_A ($A_X > A_A$) are suitable. The corresponding cartridge is composed of sleeve B and cone B.

Sleeve B, cone B



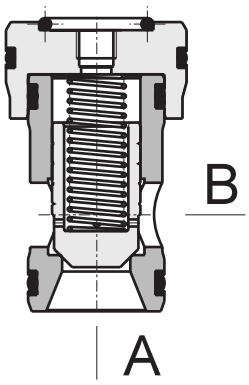
Soft switching operation is enabled by the difference between control surface area A_X and cone surface area A_A. In addition to this, the closing time is improved with an external pilot oil supply.
In order to avoid pressure peaks in tank circuits or to improve adjustment of flow control valves, the cone B can be replaced by a cone with dampening nose (cone C).

Sleeve B, cone C with dampening nose



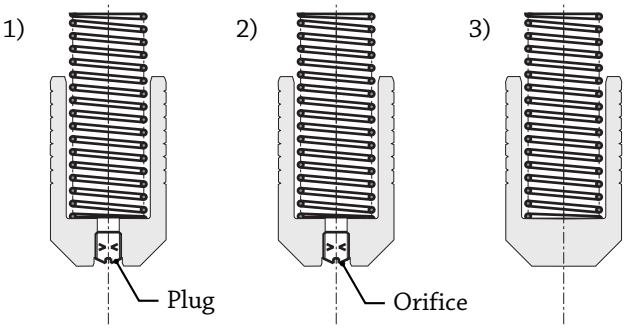
Check valves

If a cartridge valve is used as a check valve, the control area A_X has to be larger than the cone area A_A.
The cartridge valve consisting of sleeve B and cone R allows free flow from A to B and hermetically closes direction B to A.



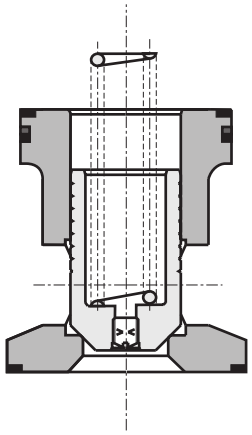
ORIFICES AND PLUGS

Cones of the cartridge valves are manufactured in 3 individual versions.
1) Front face of the cone with threaded hole and plug installed (Ordering code: "00")
2) Front face of the cone with threaded hole and orifice installed (Ordering code: "XY"). XY stands for orifice size (e.g. 08 for orifice 0.8 mm)
3) Front face of the cone without hole (Ordering code: "99")

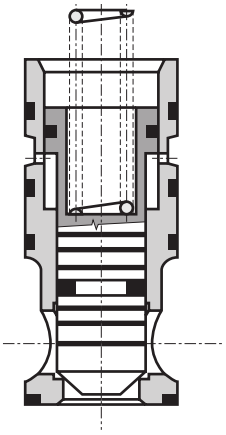


CARTRIDGE TYPE FAMILY

2/2 way valves

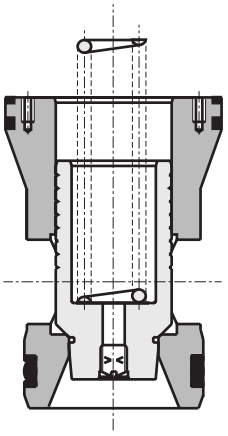


Active cartridge valve

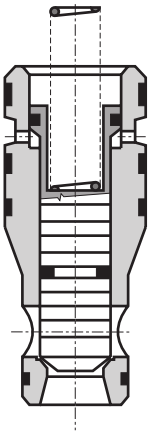


Note: Installation dimensions according to PQS standard

2/2 way valves



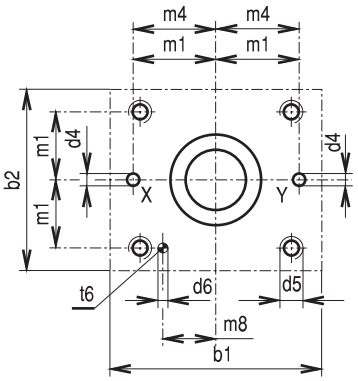
Active cartridge valve



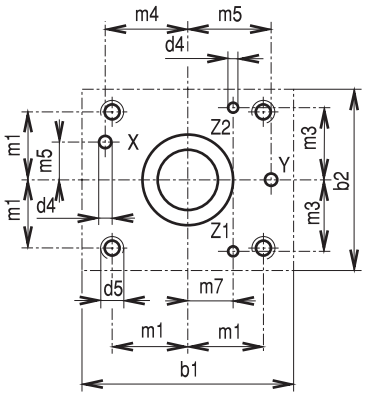
Note: Installation dimensions according to DIN 24342 (ISO 7368)

INSTALLATION DIMENSIONS

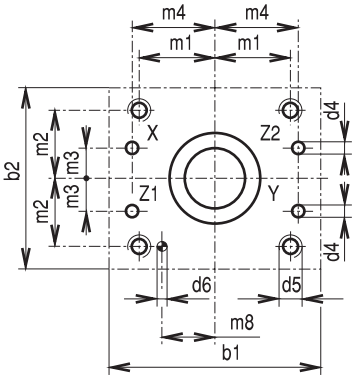
E10



E15–30

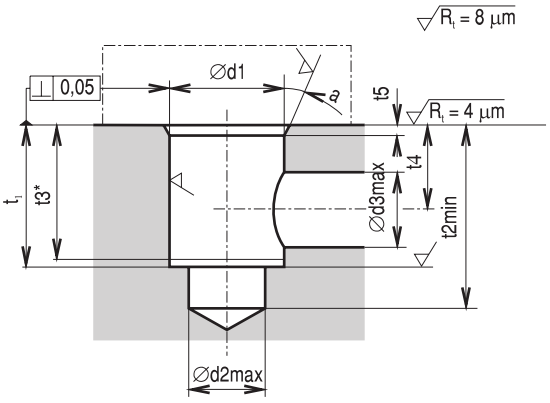


E40–63

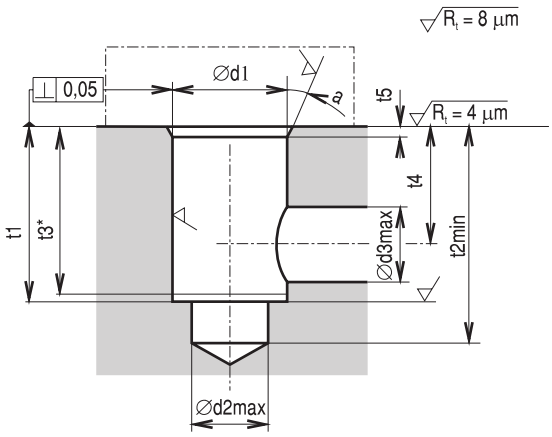


	m1	m2	m3	m4	m5	m6	m7	m8	d4max.	d5	d6	t6	b1	b2
E10	14	/	/	16	/	/	/	7	5	M16×13	4	7	50	45
E15	22.2	/	23.8	24	25.4	10.8	11.1	/	5	M8×13	/	/	70	60
E30	22.2	/	23.8	24	25.4	10.8	11.1	/	5	M8×13	/	/	70	60
E40	28	28	12	40	/	/	/	16	6	M12×20	6	7	100	80
E50	35	45	20	50	/	/	/	20	10	M16×26	7	8	130	120
E63	50	50	15	65	/	/	/	30	10	M20×40	7	8	160	140

Standard



Deepended mounting



	d1	d2max	d3max	t1	t2min.	t3	t4	t5	α
E10	18 H7	10	9	$29^{+0.05}$	38	27.5	17	1.3	15°
E15	28 H7	18	18	$34^{+0.05}$	44	32.5	20	2	15°
E30	38.1 H8	25	30	$50.75^{+0.05}$	61	49	29	2	20°
E40	50 H8	35	40	$60^{+0.05}$	82	57.5	35	2.5	20°
E50	62 H8	45	45	$68^{+0.05}$	96	65.5	40	2.5	20°
E63	90 H7	63	63	$110^{+0.1}$	135	107.5	70	2.5	20°

	d1	d2max	d3max	t1	t2min.	t3	t4	t5	α
E15	28 H7	18	18	$46^{+0.05}$	56	44.5	32	2	15°
E30	38.1 H8	25	30	$66.75^{+0.05}$	77	65	45	2	15°
E40	50 H8	35	40	$84^{+0.05}$	106	81.5	58	2.5	20°
E50	62 H8	45	45	$92^{+0.1}$	120	89.5	64	2.5	20°

Dimensions

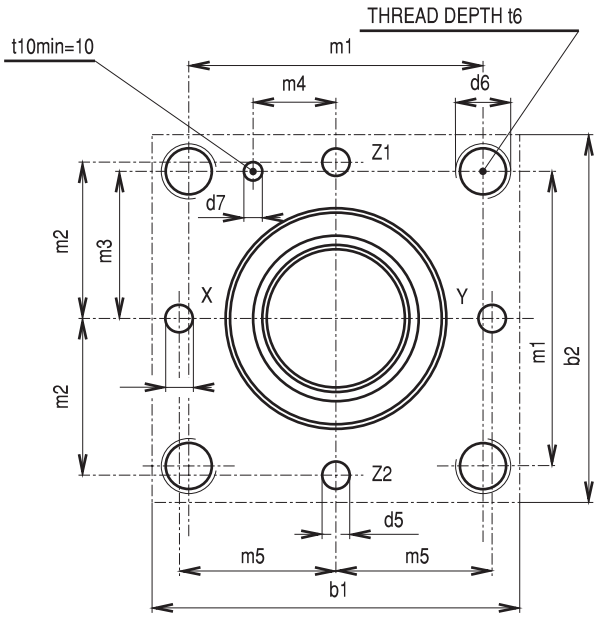
form A

	Dn16	Dn25	Dn32	Dn40	Dn50	Dn63
b1	65	85	102	125	140	180
b2	65	85	102	125	140	180
d1 H7	32	45	60	75	90	120
d2 H7	25	34	45	55	68	90
d3	16	25	32	40	50	63
d4	16	25	32	40	50	63
d4max	25	32	40	50	63	80
d5max	4	6	8	10	10	12
d6	M8	M12	M16	M20	M20	M30
d7H13	4	6	6	6	8	8
m1±0.2	46	58	70	85	100	125
m2±0.2	25	33	41	50	58	75
m3±0.2	23	29	35	42.5	50	62.5
m4±0.2	10.5	16	17	23	30	38
m5±0.2	25	33	41	50	58	75
t1+0.1	43	58	70	87	100	130
t2+0.1	56	72	85	105	122	155
t3	11	12	13	15	17	20
t4	34	44	52	64	72	95
$t4-d4_{max}$	29.5	40.5	48	59	65.5	86.5
t5	20	30	30	30	35	40
t6	20	25	35	45	45	65
t7	2	2.5	2.5	3	4	4
t8	2	2.5	2.5	3	3	4
t9	0.5	1.0	1.5	2.5	2.5	3
U	0.03	0.03	0.03	0.05	0.05	0.05
W	0.05	0.05	0.1	0.1	0.1	0.2

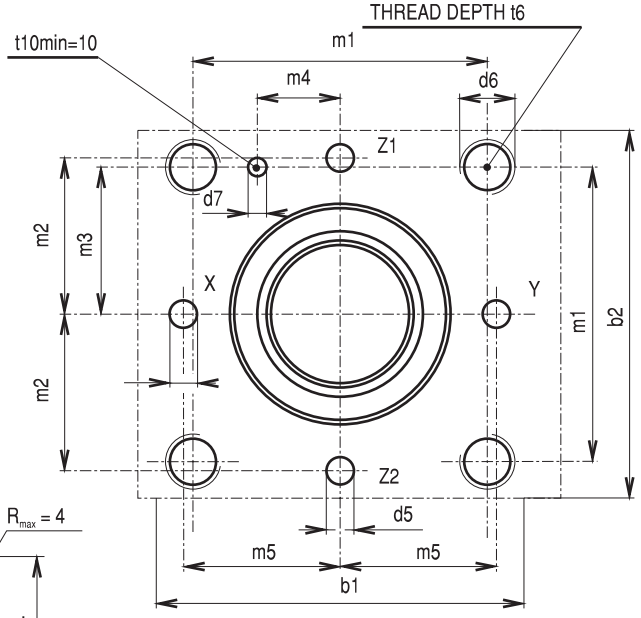
form B

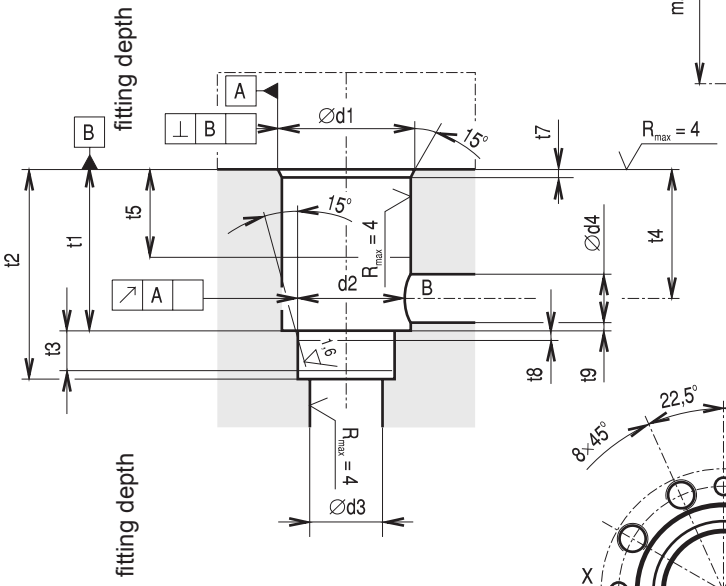
b3	80	100	116	146	160	200
m6+0.2	32	40	48	60	68	85

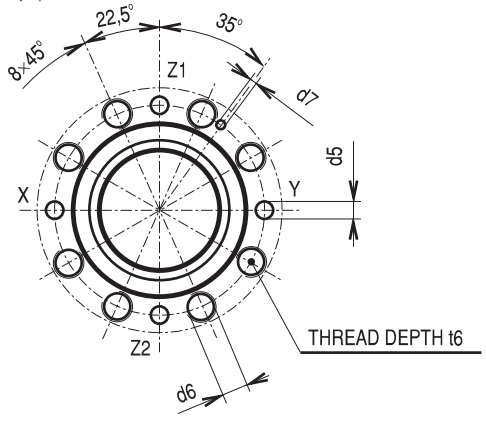
form A



form B







Dimensions

	Dn80	Dn100
bmax	250	300
d1 H7	145	180
d2 H7	110	135
d3	80	100
d4	80	100
d5max	16	20
d6	M24	M30
d7	10	10
t1	175	210
t2+0.2	205	245
t3	25	29
t4	130	155
t5	40	50
t6	45	55
t7	5	5
t8	5	5
U	0.05	0.05
W	0.2	0.2
m±0.3	200	245

CODE FOR COVERS AND SANDWICH PLATES

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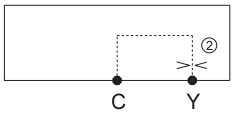
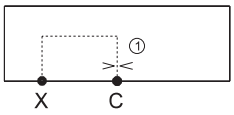
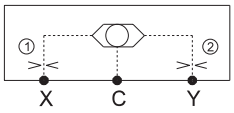
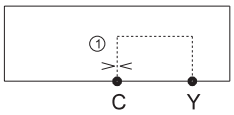
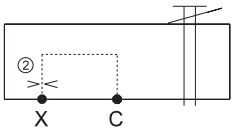
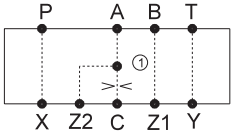
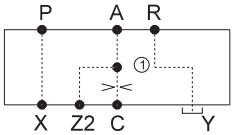
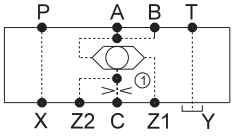
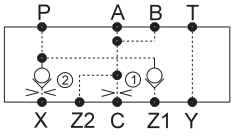
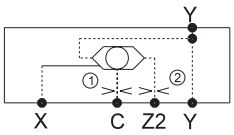
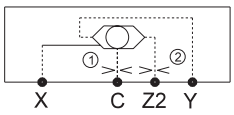
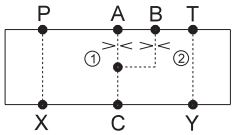
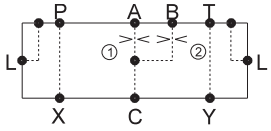
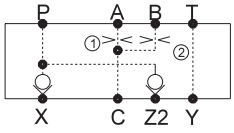
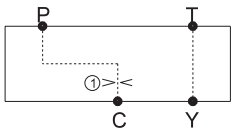
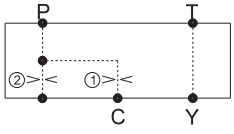
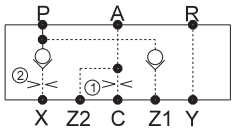
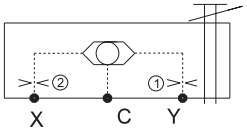
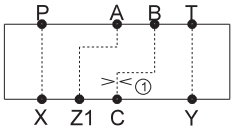
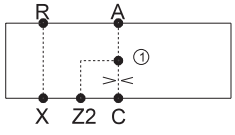
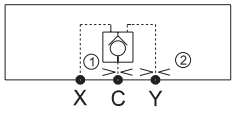
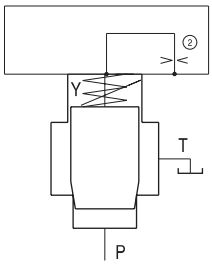
	Cover	DBD
	Cover	1D
	Cover	2D
	Cover	3D
	Cover	1H
	Sandwich plate	1W
	Sandwich plate	1WS
	Sandwich plate	2W
	Sandwich plate	4W
	Cover	RE
	Sandwich plate	RV/SY

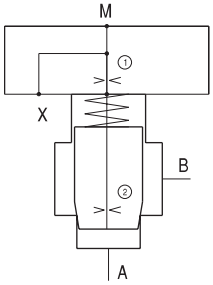
Symbol	Type	Code
	Cover	RV
	Sandwich plate	RM
	Sandwich plate	RM/X9
	Sandwich plate	RMC
	Sandwich plate	RMS
	Sandwich plate	RMS-Z
	Sandwich plate	4WS
	Cover	2DH2
	Sandwich plate	4D
	Cover	1WS/X1
	Cover	DRD

CIRCUIT EXAMPLES OF STANDARD COVER PLATES AND SUBPLATES



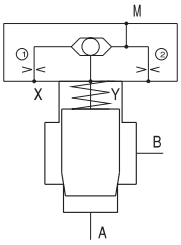
Code DBD

Pressure relief function for low pressure range adjustment, cone A necessary.



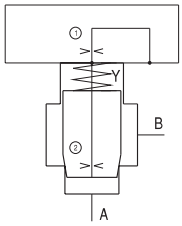
Code 1D

Hydraulic control acts through the pilot connection X. An additional external connection is possible via the gauge port M with R3/8". The gauge port is not available for NB (Dn) 15 and 30.



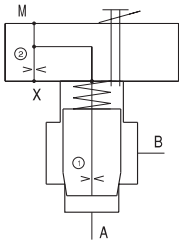
Code 2D

For higher pressure at two independent pilot connections X or Y interlocked to each other. The cartridge is controlled over the shuttle valve on the cartridge. The gauge port M with 3/8" is not available at NB (Dn) 15 and 30.



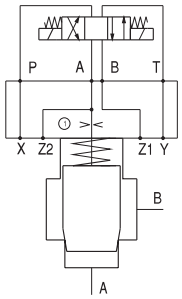
Code 3D

Similar to 1D but the hydraulic control acts through the pilot connection Y.



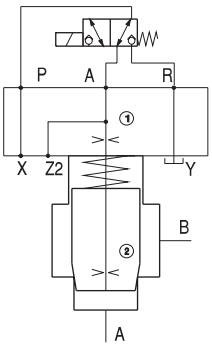
Code 1H

The mechanical stroke limitation for the opening of the cone enables the application as a throttle valve. Cone C with dampening nose is preferred. The gauge port M with 3/8" is not available at NB (Dn) 15 and 30.



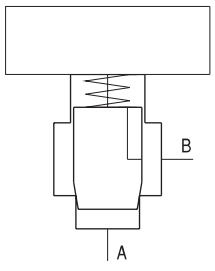
Code 1W

Electrohydraulic control of the cartridge depending on the switch function of the attached directional control valve. (Directional control valve is not a part of the cover assembly.) Control of further elements over pilot connections Z1 and Z2 is possible.



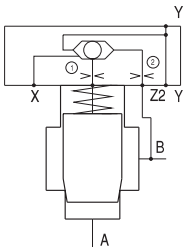
Code 1WS

Electrohydraulic control of the cartridge depending on the switch function of the attached directional control valve. (Directional control valve is not a part of the cover assembly.) Control of further elements over pilot connections Z2 is possible.



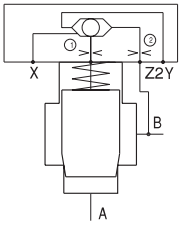
Code RE

Valve cover for check valves with cone R.



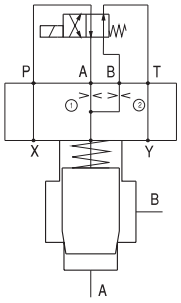
Code RV/SY

Sandwich plate design. Hydraulic control over operated shuttle valve. If connection X is unloaded, the cartridge acts as check valve A→B, that offers short closing times. If control pressure is introduced at connection X and Y, the cartridge acts as switching valve.



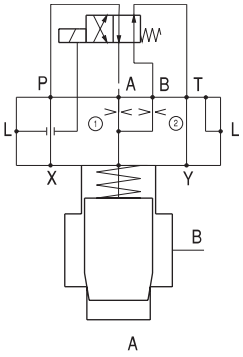
Code RV

Similar as RV/SY, but in cover design. Hydraulic control over operated shuttle valve. If connection X is unloaded, the cartridge acts as check valve A→B, that offers short closing times. If control pressure is introduced at connection X and Y, the cartridge acts as switching valve.



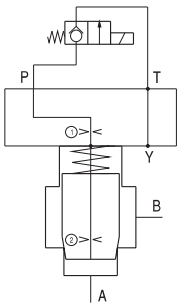
Code RM

If X is supplied by a pilot pressure, the cartridge acts as a switching valve. If X is connected to B, the cartridge acts as a pilot operated check valve. Reversed function can be achieved by changing the plug between 1 and 2.



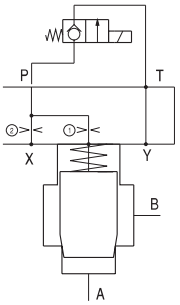
Code RM/X9

If X is supplied by a pilot pressure, the cartridge acts as a switching valve. If X is connected to B, the cartridge acts as a pilot operated check valve. Reversed function can be achieved by changing the plug between 1 and 2. Equipped by additional drain connection.



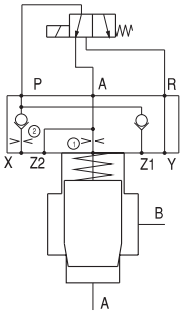
Code RMS

Electrohydraulic control of the cartridge depending on the switching function of the used seat valve. This seat valve is not a part of the cover assembly.



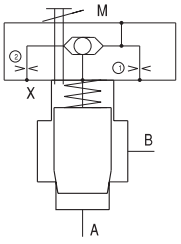
Code RMS-Z

Electrohydraulic control of the cartridge depending on the switching function of the used seat valve. Seat valve is not a part of the cover assembly. The external pilot pressure is supplied to the channel X.



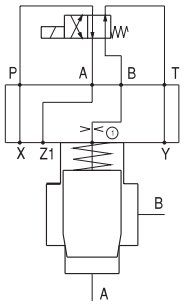
Code 4WS

Over the two check valves the cartridge is continuously pressurized by higher pressure from X or Y. Cartridge control depends on the switching function of the directional control valve. Directional control valve is not a part of the delivery.



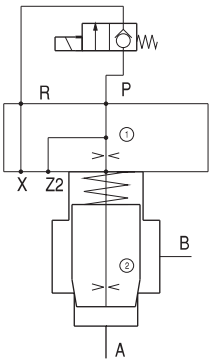
Code 2DH2

The higher pressure of the two independent pilot connections X or Y (interlocked to each other) acts on the cartridge via the shuttle valve. Mechanical stroke limitation of the cone allows the cartridge to be used as a throttle valve. Cone C is recommended.



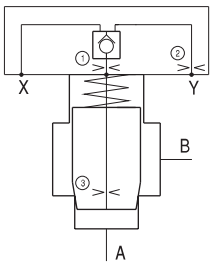
Code 4D

Electrohydraulic control of the cartridge depending on the switching function of the directional control valve. Directional control valve is not a part of the cover assembly. Control of further elements is possible over the connection Z.



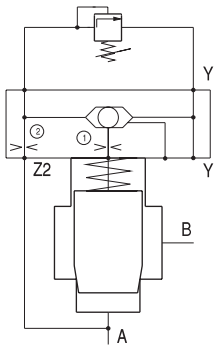
Code 1WS/X1

Electrohydraulic control of the cartridge depends on the 2/2-way seat valve, which is not a part of the delivery. If 2 is plugged and Z2 is connected to B, the cartridge acts as a pilot operated check valve A←B. If Z2 is plugged and an orifice is placed at 2, the cartridge acts as a pilot operated check valve A→B.



Code DRD

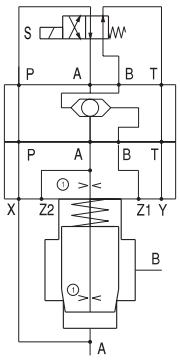
Hydraulically controlled check valve B→A by pressure in X. Free flow from A to B. The higher pressure of the two independent pilot connections Z2 or X (interlocked to each other) acts on the cartridge via the shuttle valve.



Code RVDB

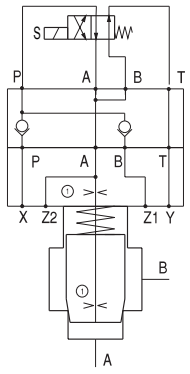
The higher pressure of the two independent pilot connections Z2 or X (that are interlocked to each other) acts on the shuttle valve on the cartridge.

FUNCTIONAL ADDITIONS OF STANDARD COVER PLATE 1W WITH SANDWICH PLATE



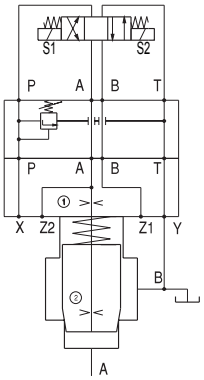
Sandwich plate with Shuttle valve

Electrohydraulic control over the shuttle valve
S unpowered: A→B locked
S powered: cartridge acts as a check valve with short switching times
Reverse function can be achieved by changing the plug B→A in the sandwich plate.



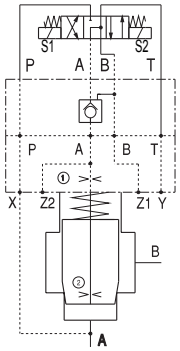
Sandwich plate with double check valve

Over the two check valves the cartridge is continuously pressurized from X or Z.
S powered: cartridge is unloaded.
Reverse function can be achieved by changing the plug B→A in the sandwich plate.



Pressure control valve - sandwich plate

Additional pressure function can be achieved by using pressure control valve.
Circuit example:
- center position: A→B blocked
- S1 powered: A→B unloaded
- S2 powered: pressure control function

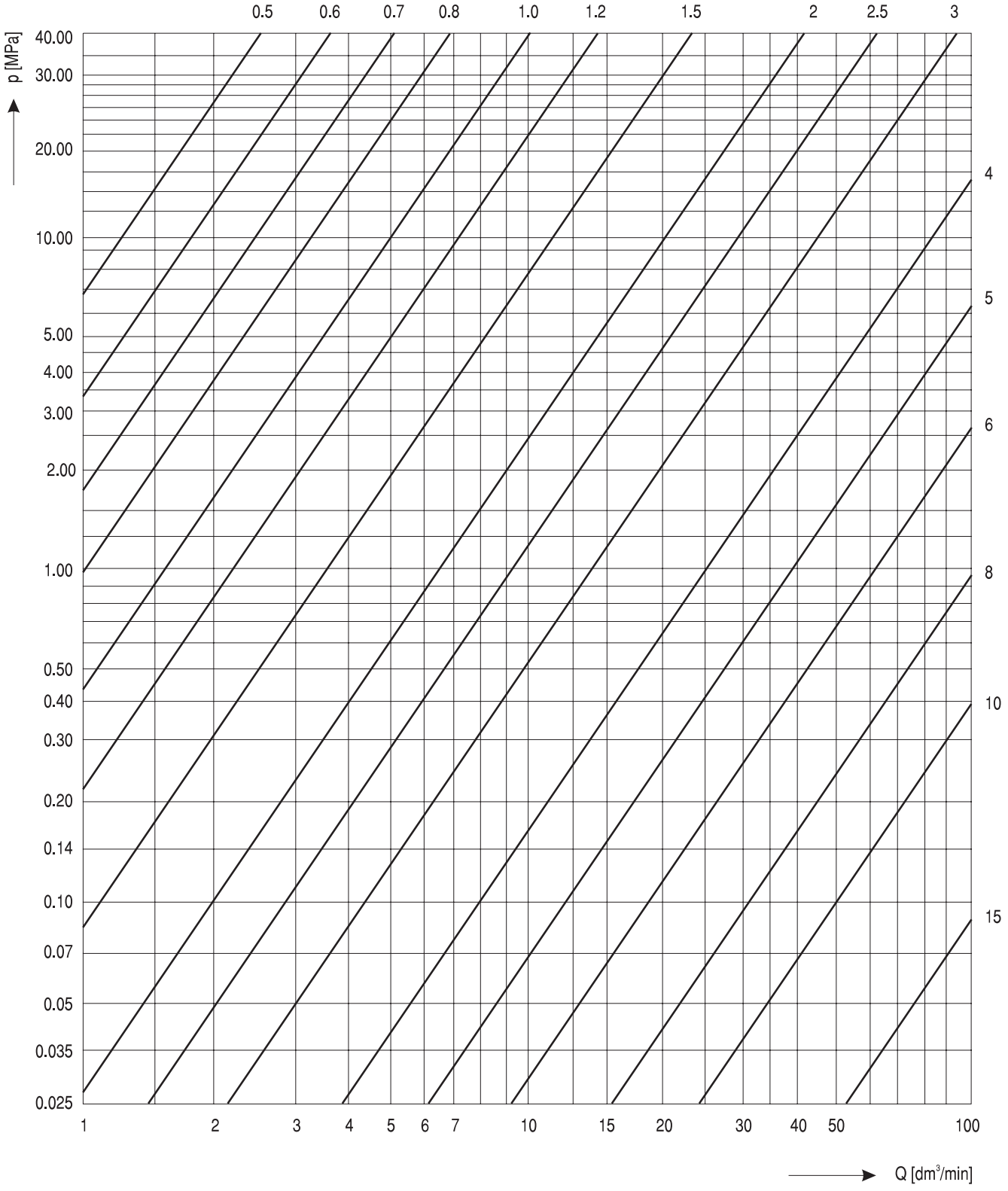


Pilot operated check valve - sandwich plate

The additional pilot operated check valve enables the leakproof blocking of B and avoids leakages in the directional control valve.
Circuit example:
- center position: B→A blocked flow A→B
- S1 powered: flow A→B
- S2 powered: B→A, A→B blocked

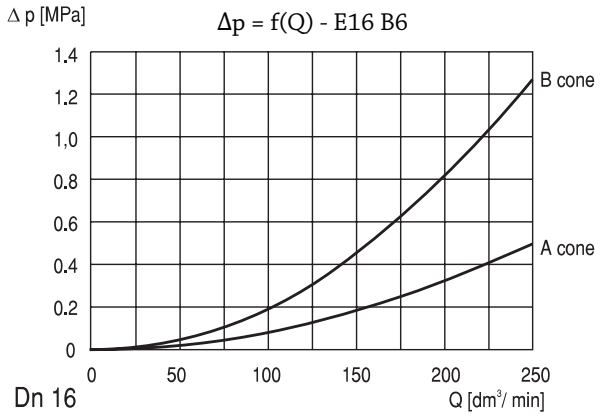
ORIFICES NOMOGRAM

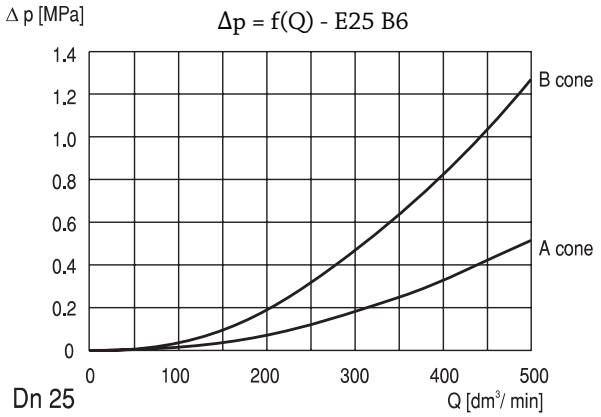
function and switching speed of the cartridge valve depends on changes in pilot port where the orifices can be used. The proper size of the orifice can be chosen according to the following nomographic chart.

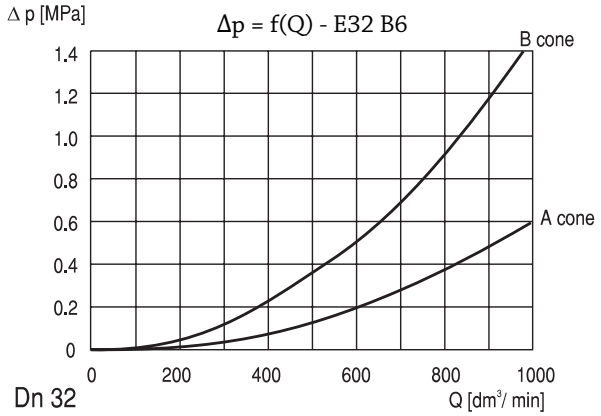


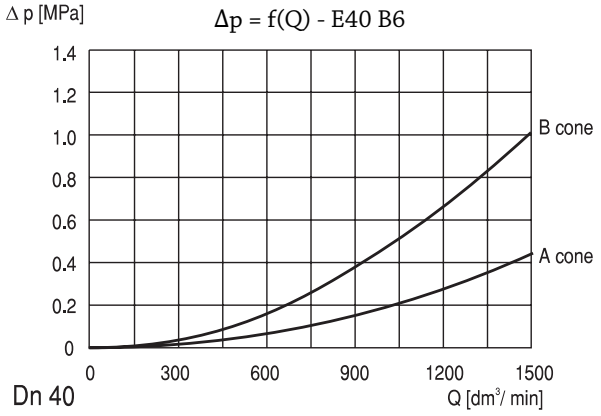
Hydraulic oil viscosity: 35mm^2/s
Hydraulic oil temperature: 50°C / 122°F

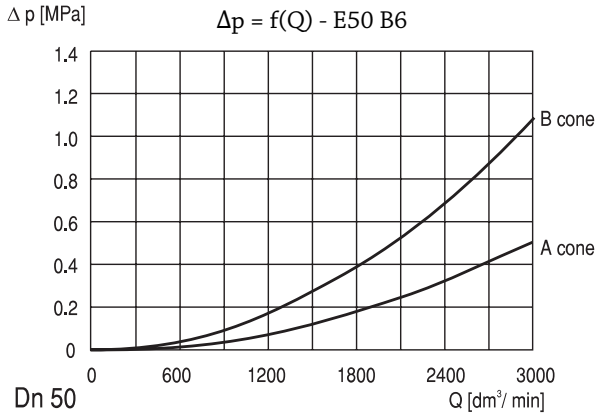
PRESSURE DROP Δp = f(Q)

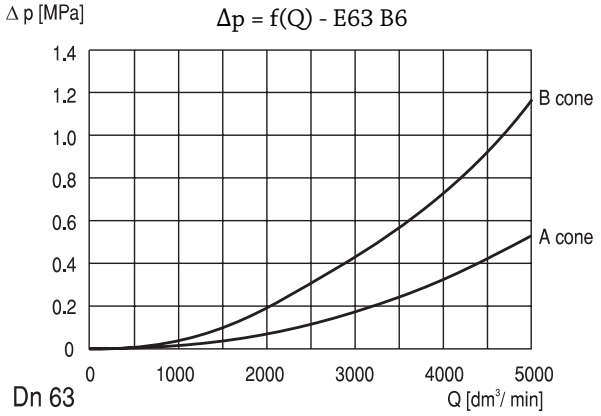


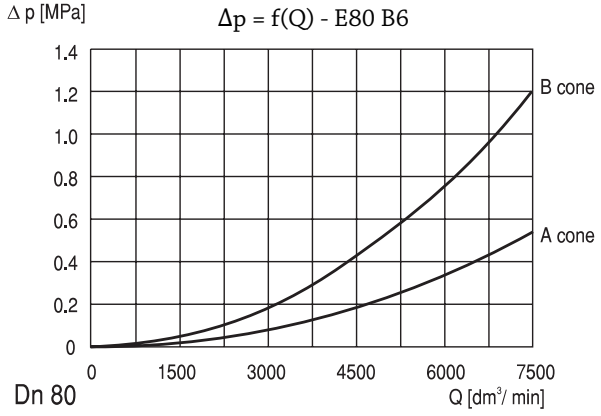


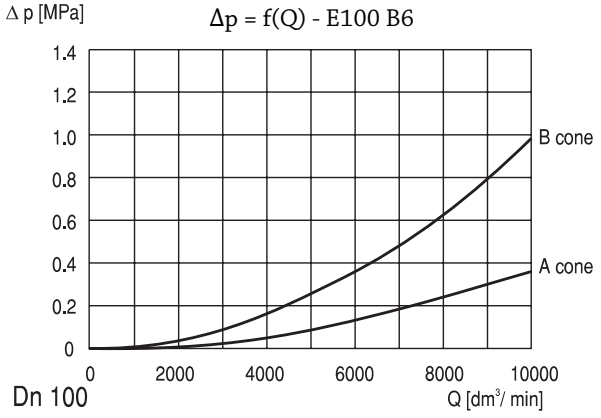








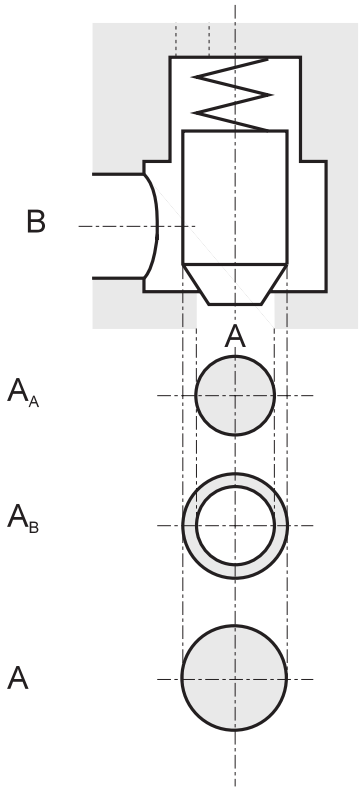




TECHNICAL DATA

Technical data	Symbol	Unit	Value							
Nominal size	D_n	mm	16	25	32	40	50	63	80	100
Nominal flow	Q_n	dm^3/min	200	450	850	1500	3000	4500	7000	10000
Weight	m	kg	0.2	0.4	0.9	1.8	3.2	6.9	12	24
Ambient temperature range	t_A	°C	-25 ... +60							
Installation dimensions	according to DIN 24 342, ISO 7368									
Working pressure	p	Mpa	0 - 35							
Working fluid temperature range	t_{PO}	°C	-25 ... +80							
Working fluid viscosity range	ν	mm^2/s	2.8 ... 380							
Working fluid operating viscosity	ν	mm^2/s	35							
Mounting position	optional									

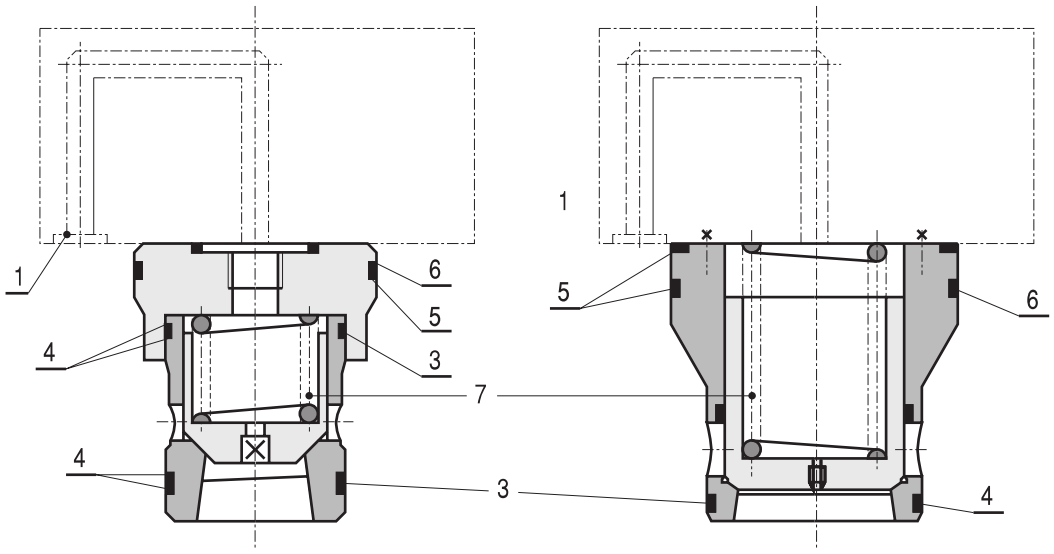
SURFACE AREA RATIOS



Reference surface A_A

D_n/NG	16	25	32	40	50	63	80	100
Sleeve B, Cones B, C and R								
A_A	1	1	1	1	1	1	1	1
A_B	0.6	0.7	0.6	0.6	0.5	0.5	0.5	0.7
A_X	1.6	1.7	1.6	1.6	1.5	1.5	1.5	1.7
Sleeve A, Cones A and D								
A_A	1	1	1	1	1	1	1	1
A_B	-	-	-	-	-	-	-	-
A_X	1	1	1	1	1	1	1	1

SPARE PARTS



Pos.	Sealing set	Dn 16	Dn 25	Dn 32	Dn 40	Dn 50	Dn 63	Dn 80	Dn 100
1	"O" ring 90° shore								
2	"O" ring 90° shore	17.17 x 1.78	23.47 x 2.62	29.82 x 2.62					
3	"O" ring 90° shore	21.95 x 1.75	28.24 x 2.62	37.69 x 3.53	47.22 x 3.53	59.92 x 3.53	78.74 x 5.33	97.79 x 5.33	129.02 x 6.99
4	Back-up ring	22.1 x 25 x 0.7P	29.5 x 34 x 0.7P	38.8 x 45 x 0.7	48.8 x 55 x 0.7	61.9 x 68 x 0.7	80.6 x 90 x 0.85	100.6 x 110 x 0.85	122.8 x 135 x 1.25
5	"O" ring 90° shore	28.3 x 1.78	39.34 x 2.62	53.57 x 3.53	66.27 x 3.53	78.74 x 5.33	107.32 x 5.33	129.54 x 6.99	164.47 x 6.99
6	Back-up ring	29.1 x 32 x 0.7P	40.5 x 45 x 0.7P	53.8 x 60 x 0.7	68.8 x 75 x 0.7	80.6 x 90 x 0.85	110.6 x 120 x 0.85	132.8 x 145 x 1.25	167.9 x 180 x 1.25
Pos.	**Springs**	**Dn 16**	**Dn 25**	**Dn 32**	**Dn 40**	**Dn 50**	**Dn 63**	**Dn 80**	**Dn 100**
7	Spring O 0.01MPa	Drw. 450911	Drw. 449777	Drw. 449789					
7	Spring P 0.03MPa	Drw. 450912	Drw. 449779	Drw. 449790	Drw. 450907	Drw. 449784	Drw. 450796	Drw. 450983	Drw. 450987
7	Spring R 0.05MPa	Drw. 450913	Drw. 449780	Drw. 449791	-	Drw. 449785	Drw. 450797	Drw. 450984	Drw. 450988
7	Spring S 0.1MPa	Drw. 450914	Drw. 449781	Drw. 449792	Drw. 450908	Drw. 449786	Drw. 450980	Drw. 450985	Drw. 450989
7	Spring T 0.2MPa	Drw. 450915	Drw. 449782	Drw. 449793	Drw. 450909	Drw. 449787	Drw. 450981	Drw. 450986	Drw. 450990
7	Spring U 0.4MPa	Drw. 450916	Drw. 449783	Drw. 449794	Drw. 450910	Drw. 449788	Drw. 450982	-	-
7	Spring V 0.8MPa	Drw. 450917	Drw. 449778	Drw. 449795					

Ordering example:

"O" ring pos. 3 for Dn 32: 37.69 x 3.53
Spring 0.2MPa pos. 7 for Dn 32 (Drw. 449793)

NOTES

NOTES

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