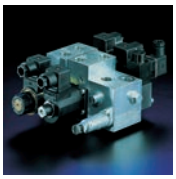
2.1 Directional spool valves



Directional spool valves type SWR and SWS

Proportional directional spool valves type PSL and PSV

On/off directional spool valves

Type	Nomenclature/version	Actuation	p_{max}	Q_{max}
SG, SP	**Directional spool valve, individual valve** ■ Individual valve for pipe connection ■ Individual manifold mounting valve	- Solenoid - Manual - Mechanical - Pressure-actuated	200 ... 400 bar	12 ... 100 lpm
SW, SWP, NSWP	**Directional spool valve, individual valve** ■ For pipe connection ■ Individual manifold mounting valve **Directional spool valve, valve bank** ■ With sub-plates ■ Combination with hydraulic power packs	- Solenoid	315 bar	12 ... 25 lpm
SWR, SWS	**Directional spool valve, valve bank** ■ Connected in series ■ Combination with hydraulic power packs	- Solenoid	315 bar	12 ... 25 lpm
HSRL, HSF	**Directional spool valve, individual valve** ■ Individual manifold mounting valve **Directional spool valve, valve bank** ■ Connected in series	- Electro-hydraulic - Hydraulic	up to 400 bar	80 ... 160 lpm

Throttling directional spool valve

Type	Nomenclature/version	Actuation	p_{max}	Q_{max}
DL	**Throttling directional spool valve, valve bank** ■ Connected in series	- Manual - Pressure	250 ... 315 bar	12 ... 90 lpm

Proportional directional spool valve

Type	Nomenclature/version	Actuation	p_{max}	Q_{max}
PSL, PSV	**Prop. directional spool valve (Load-Sensing), valve bank** ■ Connected in series	- Manual - Electro-hydraulic - Pressure	400 ... 420 bar	$Q_{consumer\ max}$ 3 ... 240 lpm $Q_{Pu\ max}$ approx. 300 lpm
PSLF, PSVF, SLF	**Prop. directional spool valve (Load-Sensing), individual valve** ■ Individual manifold mounting valve **Valve bank** ■ With sub-plates	- Manual - Electro-hydraulic - Pressure	400 ... 420 bar	$Q_{consumer\ max}$ 3 ... 470 lpm $Q_{Pu\ max}$ approx. 1000 lpm

Valve combinations

Type	Nomenclature/version	Actuation	p_{max}	Q_{max}
NSMD	**Combination of directional spool valve and pressure-reducing valve** **As individual valve** ■ Individual manifold mounting valve **As valve bank** ■ Valve banks are available with BA	- Solenoid	120 bar	25 lpm

Directional spool valves

2.1 Directional spool valves type SG and SP

Directional spool valves type SG and SP can be supplied in 5 different sizes and are available in two versions, either for pipe connection (SG) with and without pressure-limiting valve, or as a manifold mounting valve (SP). They are used to control the direction of movement of consumers such as hydrostatic motors and hydraulic cylinders.

The sturdy design means that these valves are suitable for a wide range of applications, such as ship building or mobile hydraulics. The different actuations can also be used for this purpose.

Features and benefits:

- Sturdy design
- Suited for maritime applications
- Various actuations

Intended applications:

- Mining machinery
- Cranes and lifting equipment
- Ship building
- Road vehicle construction

Nomenclature:	**Directional spool valve**
Design:	**Individual valve for pipe connection or manifold mounting**
Actuation:	**Solenoid** **Manual** ■ **With automatic spring return** ■ **With detent** **Mechanical** ■ **Roller head** ■ **Pin head** **Pressure (only or combined with manual actuation)** ■ **Hydraulic** ■ **Pneumatic**
p_{max}:	**200 ... 400 bar**
Q_{max}:	**12 ... 100 lpm**

Design and order coding example

SP 1 SG 3	D E	3E	- A - MD 3/24	- 120

Pressure setting pressure limiting valve [bar]

Actuation mode

Pressure limiting valve

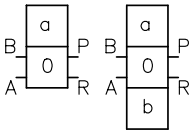
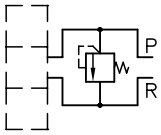
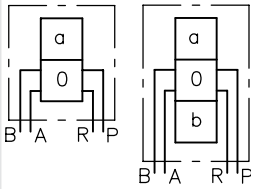
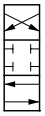
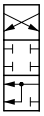
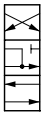
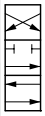
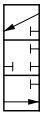
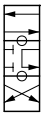
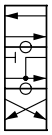
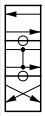
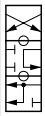
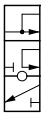
Function

- Parallel- or series connection
- Directional spool valves either with positive (blocked between switching positions) or negative (slightly floating position) overlap
- SP 1 with/without check valve insert

Basic type and size

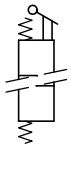
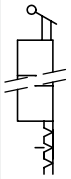
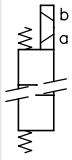
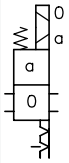
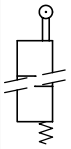
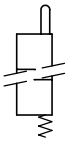
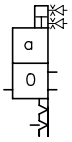
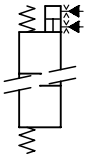
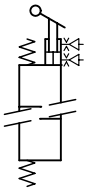
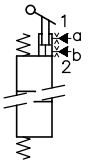
Directional spool valve SG 0 to 5, SP 1, SP 3, SP 5
Directional spool valves type SP for manifold mounting, sizes 1, 3, 5

Function

Basic symbol		Symbol									
SG	**SP**	**G**	**C**	**D**	**E**	**N**	**W**	**R**	**V**	**Z**	**U**
Individual valve for pipe connection  With pressure limiting valve  	Individual valve for manifold mounting  										
		L	**F**	**H**	**Y**	**S**	**X**				
											

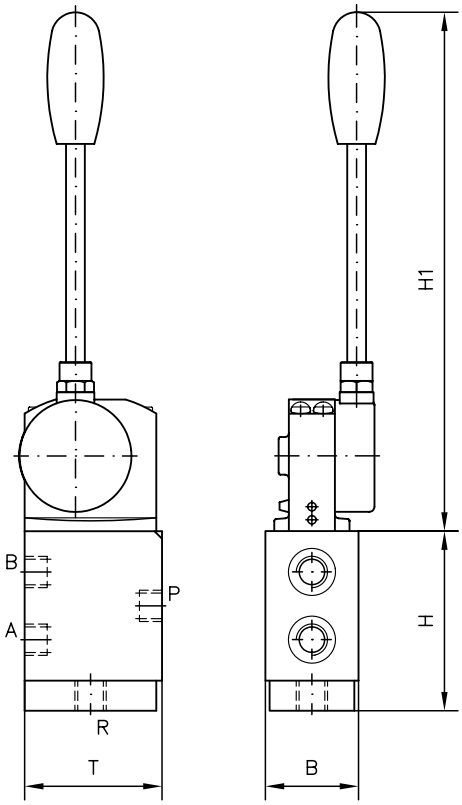
- Symbols Z, U, X: Only size 2, 3, and 5

Actuations:

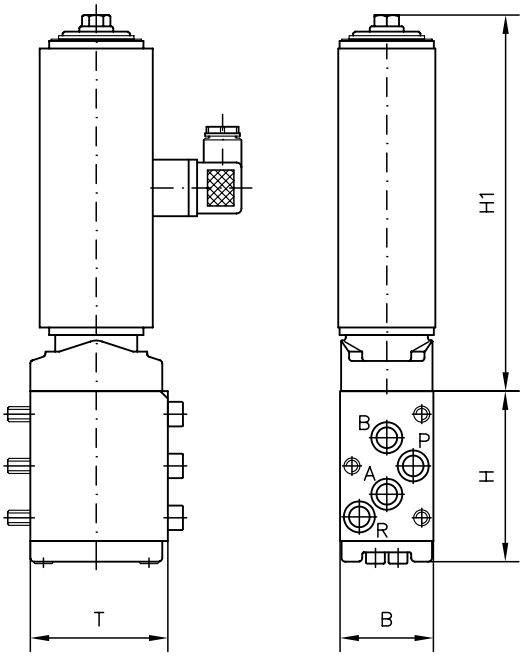
Manual		Solenoid		Mechanical		Pressure			Double acting	
A, AK	C, CK	ME, MD	MU	RE, RD	BE, BD	NE, ND	NU	NM	KD	KM
Spring return	Detent			Roller head	Pin head	Pneumatic		Hydraulic	Pneumatic / manual	Hydraulic / manual
										
		Solenoid voltage: 12V DC, 24V DC, 230V AC other voltage on request		Actuation force: 90 ... 280 N depending on size		Control pressure: Pneumatic 5 ... 10 bar Hydraulic 12 ... 20 bar				

General parameters and dimensions

SG with manual actuation



SP with solenoid actuation



	Q_{max} [lpm]	Operating pressure p_{max} [bar] for actuation			Ports (BSPP)	Dimensions [mm]				m_{max} [kg]
		Solenoid	Mechanical	Manual/ pressure		H	H1	B	T	
SG 0	12	200	400	400	G 1/4, G 3/8	59.5	151	39.5	51	0.8 ... 1.0
SG 1	20	200	400	400	G 3/8	59.5	151	39.5	51	0.8 ... 1.0
SG 2	30	315	400	400	G 3/8	max. 100.5	342	49.5	73	2.5 ... 5.7
SG 3	50	315	400	400	G 1/2	max. 100.5	342	49.5	73	2.5 ... 5.7
SG 5	100	200	315	400	G 1	110	342	50	80	2.9 ... 6.1
SP 1	20	200	400	400	-	59.5	151	40	51	0.8 ... 1,0
SP 3	50	315	400	400	-	94.5	342	49.5	73	2.5 ... 5.7

Associated technical data sheets:

- Directional spool valves type SG, SP: D 5650/1
- Actuations:
  - Manual: D 6511/1
  - Solenoid: D 7055
  - Mechanical: D 5870
  - Pressure: D 6250

Similar products:

- Directional spool valve connected in parallel and in series type SKP, SKH: D 7230

Plugs:

- With LEDs etc.: D 7163
- With economy circuit: D 7813, D 7833

Directional spool valves

2.1 Directional spool valves type SW, SWP and NSWP

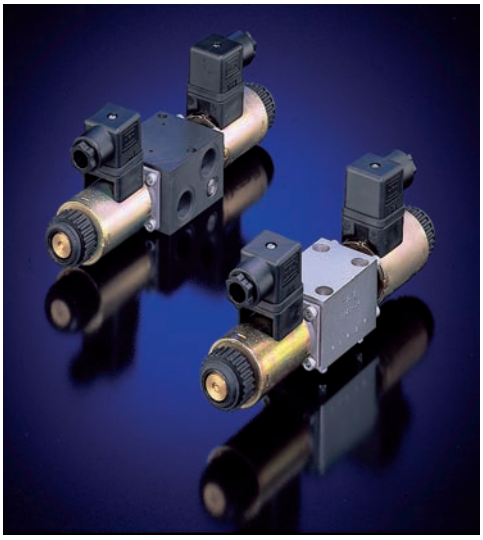
These directional spool valves are designed as individual valves either for pipe connection (type SW) or for manifold mounting (type SWP, NSWP) or as valve bank (type SWP, NSWP). Actuation is via directly acting pressure resistant single stroke solenoids (wet armature); type NSWP may feature twin solenoids enabling two speed rates or prop. solenoids which may be combined also with a stroke limitation. Versions with ATEX-approval are available as well. The individual manifold mounting valves can be combined with sub-plates enabling pipe connection plus an optional pressure limiting valve. The valve sections type NSWP can be combined with various options either on the pump side e.g. check valves, throttles, or orifices plus orifices or restrictor check valves on the consumer side.

Features and benefits:

- Compact valve banks
- Simple actuation of proportional functions
- Various versions
- Combinations with NG6 available

Intended applications:

- Machine tools - chipping (milling, drilling, turning, grinding)
- Construction and construction materials machinery
- Offshore and marine technology
- Road vehicle construction



Nomen-clature:	**Directional spool valve**
Design:	**Individual valve for pipe connection Individual manifold mounting valve Valve bank with sub-plates Combination with hydraulic power packs**
Actuation:	**Solenoid**
p_{max}:	**315 bar**
Q_{max}:	**12 ... 25 lpm**

Design and order coding example

NSWP2	G	/M	/R	/ ABR1,0	/50	/G24	- 3/8

Indiv. connection block — For direct installation in the pipe work, ports G 3/8 (BSPP) (type NSWP and SWP2), with/without check valve (manually or tool adjustable) between P and R (type SWP1)

Voltage of the actuation solenoids — 12V DC, 24V DC, 110V AC, 230V AC

- Solenoids with various plug versions

Pressure switch or pressure gauge at A or B

Additional elements at A and/or B — Restrictor check valve or orifice

Additional elements at P — Check valve or orifice

Solenoid version

- ON/OFF-solenoid (p_{max} = 315 bar)
- Solenoid with detent
- Prop. solenoid with/without stroke limitation (limiting Q_{max})
- Double solenoid (two speed rates)
- Solenoid version conforming ATEX (p_{max} = 210 bar)

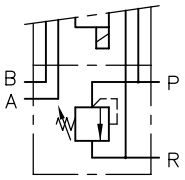
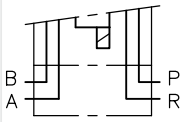
Function

- Indiv. valve with check valve or orifice in gallery P and/or check valve in gallery R (type SWP)
- Indiv. valve with 6/2-way function

Basic type, size — Directional spool valve SW, SWP size 1 and 2
NSWP size 2, connection hole pattern NG 6 (CETOP)

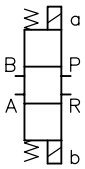
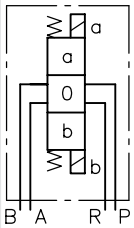
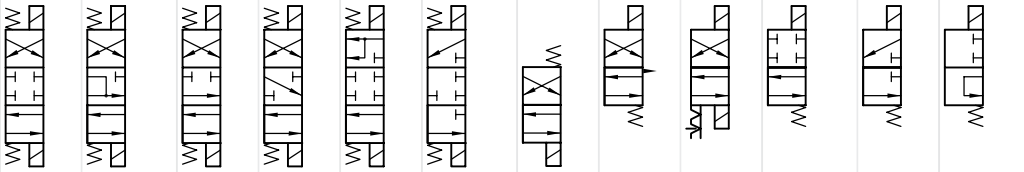
Function

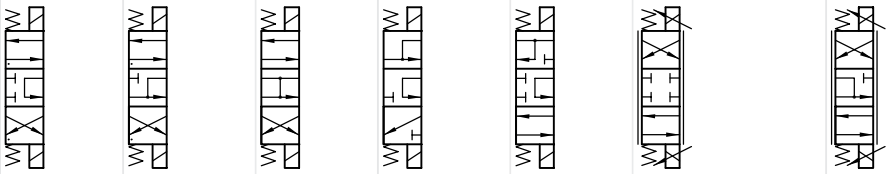
Sub-plate for pipe connection

- 1/4 S(R)	- 3/8
	
Sub-plate with pressure limiting valve[1)]	Sub-plate[2)]

1) Only for type SWP 1
2) Only for type NSWP and SWP 2

Valve sections

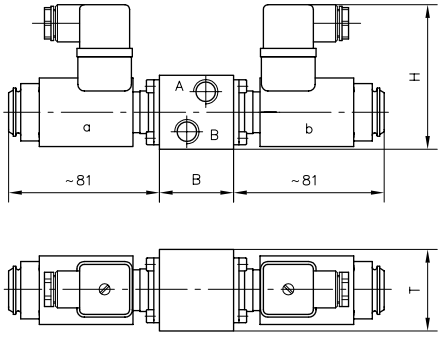
Basic symbols		Symbol										
Individual valve		May be connected either in parallel or in series within a valve bank										
SW	SWP / NSWP	G	D	E	O	C [3)]	N	B	W	K	Q	R [3)]	U [3)]
												

Only connected in series within a valve bank (only type SW1)					Spool valves suited for prop. actuation	
L	F	H	S	Y	G	D
						

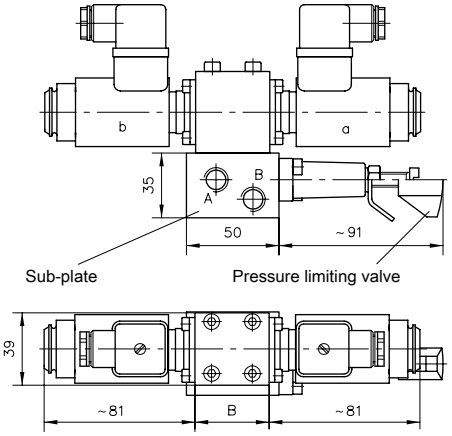
3) Only for type SWR 1

General parameters and dimensions

SW



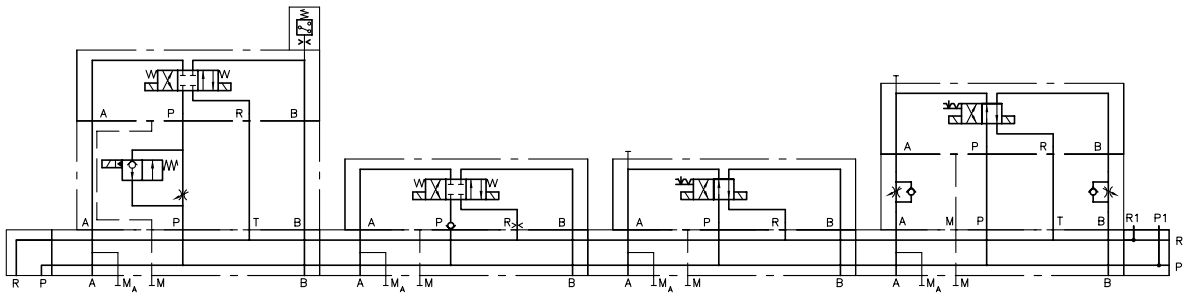
SWP/NSWP2



	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	Dimensions [mm]			m [kg]	
				H	B	T	Individual directional spool valve	Sub-plate
SW/SWP 1	12	315	G 1/4	77 ... 90	40	40 ... 44	1.1 ... 1.5	0.6 ... 0.7
SW/SWP 2	25	315	G 3/8, G 1/4	78 ...- 82.5	60 ... 70	40 ... 45	1.1 ... 2.4	approx. 0.8
NSWP2			NG 6					

Circuit example:

BA2-A5 -NSWP2G/M/03/NZP16V/PQ20/0
-NSWP2G/M/R/B1,0
-NSWP2K/M/20/0
-NSWP2K/M/20/NZP16Q33/0
-2-L24



Combinable products:

- Valve bank type BA: Page 34
- Intermediate plate type NZP: D 7788 Z
- 6/2-way directional valve: **Sk 7951-J-6/2**

Similar products:

- Valve banks type SWR and SWS: Page 88
- Clamping modules type NSMD: Page 116D 7787

Associated technical data sheets:

- Directional spool valves type SW: D 7451
- Directional spool valves type SWP: D 7451 P
- Directional spool valves type SWR: D 7451 R
- Directional spool valves type NSWP: D 7451 N

Plugs:

- With LEDs etc.: D 7163
- With economy circuit: D 7813, D 7833

See also section “Devices for special applications”:

- Industrial trucks
- Devices for explosion hazardous areas, conforming ATEX
- Proportional valves

Directional spool valves

2.1 Directional spool valves type SWR and SWS

These directional spool valves are designed as valve bank. Actuation is via directly acting pressure resistant single stroke solenoids (wet armature); type SWS may be controlled also via twin solenoids enabling two speed rates or via prop. solenoids optionally with a stroke limitation. Versions with ATEX-approval are available as well. The valve sections consist of an end plate and a connection block (for pipe connection) or an adapter plate (for direct mounting to the hydraulic power packs), held together by a tension rod.

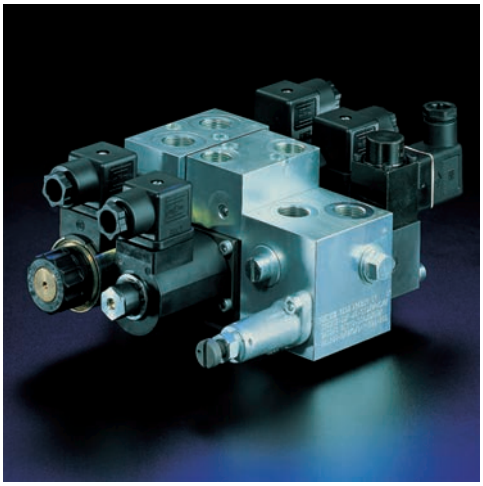
With type SWS, the valve sections can be fitted with additional functions, such as double check valves, load-holding valves or precharge valves etc., in ancillary blocks on the consumer side. It is also possible to integrate a check valve, throttle, orifice or pressure compensator on the pump side. The directional spool valves are primarily used in mobile hydraulics.

Features and benefits:

- Combination with lifting modules available (for fork lifts)
- Proportional movements can be controlled independently from the load
- Wide range of ancillary blocks
- Compact

Intended applications:

- Material handling (industrial trucks etc.)
- Wind turbines
- Construction and construction materials machinery
- Handling and assembly technology (industrial robots etc.)



Nomen-clature:	**Directional spool valve**
Design:	**Valve bank Combination with hydraulic power packs**
Actuation:	**Solenoid**
p_{max}:	**315 bar**
Q_{max}:	**12 ... 25 lpm**

Design and order coding example

SWR1 | **A-6/230** | **- GG** | **- 1** | **- G24**

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC
- Solenoids with various plug versions

End plate
- Additional ports P and/or R (P can be blocked)
- Idle circulation valve (ON/OFF, proportional)
- End spool valve

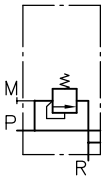
Valve sections
- Directional spool valve
- Additional options for the valve sections:
  - Options upstream (orifice, flow controller)
  - Consumer-side additional functions in ancillary block, e.g. double check valves, shock valves (load-holding valves etc.)

Connection block/adapter plate
- Pressure limiting valve (for pipe connection)
- For direct mounting at compact hydraulic power packs (type HK, HC, MP)
- For direct mounting at hydraulic power packs type R
- Idle circulation valve
- 3-way flow controller
- Adapter plates with optional connection of a pressure switch type DG3.. for gallery P

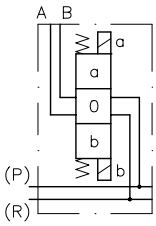
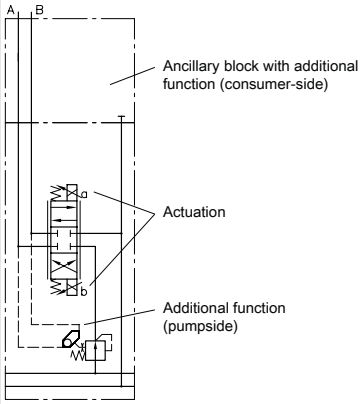
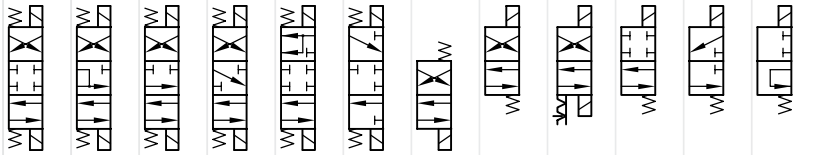
Basic type, size Type SWR 1 and SWS 2
Type SWC 1 for direct mounting at compact hydraulic power packs type KA, HC, MP, HK

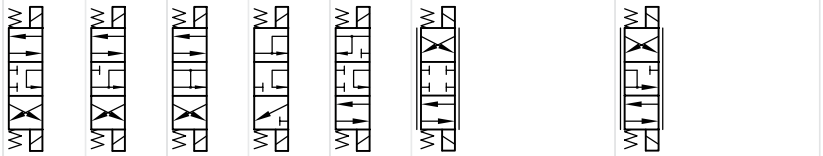
Function

Connection blocks:

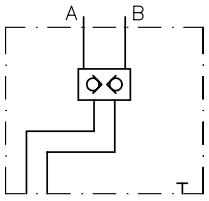
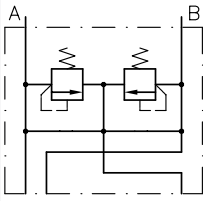
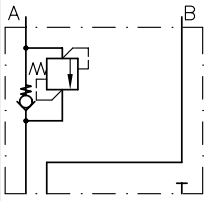
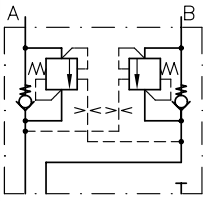
A 6	F/D
	
With tool adjustable pressure limiting valve (for pipe connection)	For direct mounting onto hydraulic power packs (type KA, HC, MP, HK)

Valve sections:

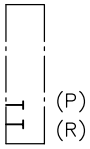
Basic symbol		Symbol											
SWR 1	SWS 2	G	D	E	O	C	N	B	W	K	Q	R	U
													

Only connected in series within a valve bank					Spool valves suited for prop. actuation	
L	F	H	S	Y	G	D
						

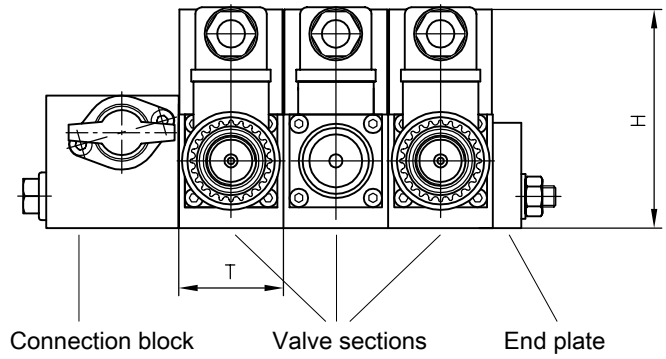
Ancillary block type SWS 2 with additional functions (consumer side):

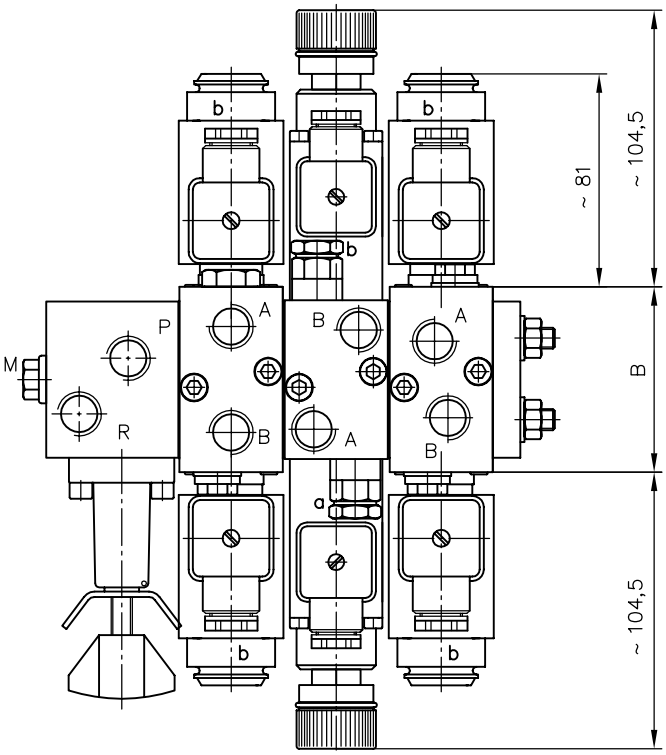
Releasable check valve	Shock valve	Sequence valve	Over center valve
			

End plates:

SWR 1/SWS 2


SWR 1, SWS 2

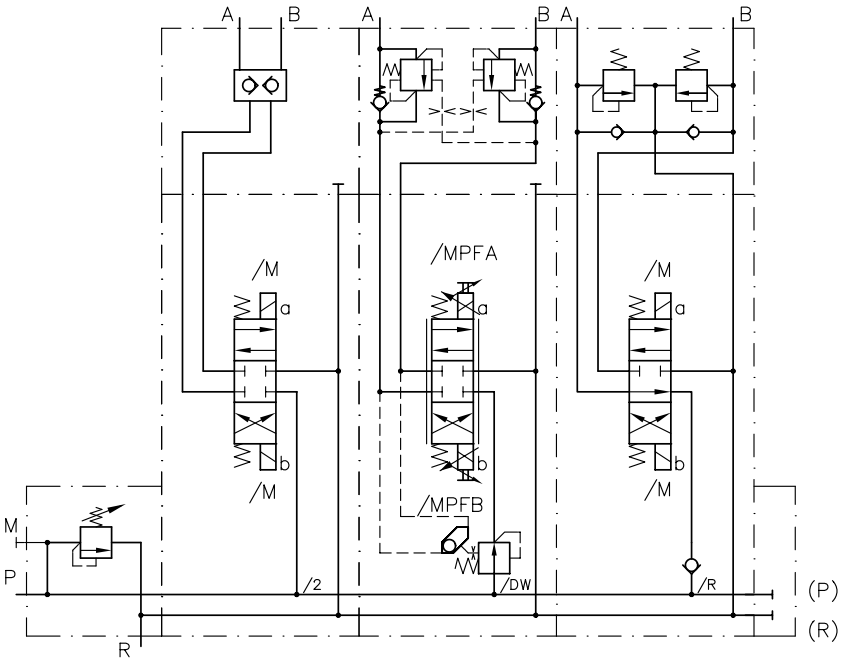




	Q_{max} [lpm]	p_{max} [bar]	Ports	Dimensions [mm]			m_{max} [kg]	
				H	B	T	Individual section	Connection block
SWR 1	12	315	G 1/4	77 - 90	40	40	1.1 - 1.5	0.6 - 0.7
SWS 2	25	315	G 3/8, G 1/4	78 - 82.5	60	40	1.1 - 2.4	approx. 0.8

Circuit example:

SWS 2 A 7/200	- G/M/2/2 RH	- G 10/MPF/DW/2 AL B 7/180 BLC 4/140	- E/M/R/2 AN100 BN 100-1-G 24
Valve bank type SWS, size 2, connection block with pressure limiting valve (manually adjustable, factory set to 200 bar)	1. Valve section flow pattern G with solenoid actuation, no additional function in gallery P, with ancillary block featuring releasable check valves for ports A and B	2. Valve section flow pattern G with prop. solenoid actuation (MP) and stroke limitation for A and B (FAB), max. flow for ports A and B is 10 lpm, flow control in gallery P of the basic valve body (DW), ancillary block with over center valves (factory set to A = 180 bar and B = 140 bar)	3. Valve section flow pattern E with solenoid actuation, check valve in gallery P, ancillary block featuring shock and suction valves for ports A and B (both factory set to 100 bar), standard end plate. All solenoids 24V DC



Associated technical data sheets:

- Directional spool valve banks type SWR: D 7451 R
- Directional spool valve banks type SWS: D 7951

Suited products for combination:

- Pressure switches type DG3..., DG5.E: Page 266

Suitable plugs:

- With LEDs etc.: D 7163
- With economy circuit: D 7813, D 7833

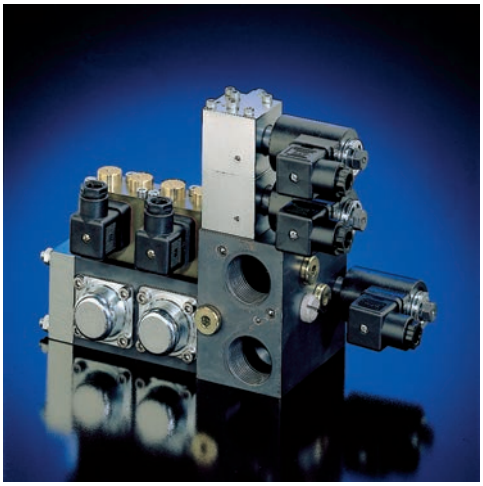
See also chapter "Equipment for special applications":

- Forklift trucks and lifting equipment
- Mobile hydraulics
- Devices for explosive environments (ATEX-compliant)
- Proportional valves

Directional spool valves

2.1 Directional spool valves type HSRL and HSF

The directional spool valves are available as individual valve for pipe connection (type HSL), manifold mounting (type HSF) or as valve banks (type HSR). These valves are utilized to control the direction of movement of hydraulic consumers. All of them are indirectly electro-hydraulically actuated. The control fluid demand is either taken internally from the main circuit or fed externally from a separate control oil circuit. Harsh switching operations and the risk of decompression surges, particularly in the event of high pressure and large consumer volumes, can be avoided (except with HSRL 3) by using adjustable thread type throttles (adjustable response time).
Standard connection blocks or connection blocks with an idle circulation valve, a pressure-limiting valve and integrated pressure-reducing valve are available for series connection. With the HSRL 3 version it is also possible to arbitrarily select different pressure levels.



Nomen-clature:	Directional spool valve
Design:	Individual manifold mounting valve Valve bank in series connection
Actuation:	Electro-hydraulic Hydraulic
p_{max}:	400 bar
Q_{max}:	80 ... 160 lpm

Features and benefits:

- Soft shifting of high flow
- Suitable for high pressures due to steel housing
- Hydraulic pilot actuation via compact twin solenoids
- Versions conforming ATEX

Intended applications:

- Mining equipment (incl. oil exploration)
- Cranes, lifting-lowering devices
- Construction and construction materials machinery
- Material handling (forklift trucks etc.)

Design and order coding example

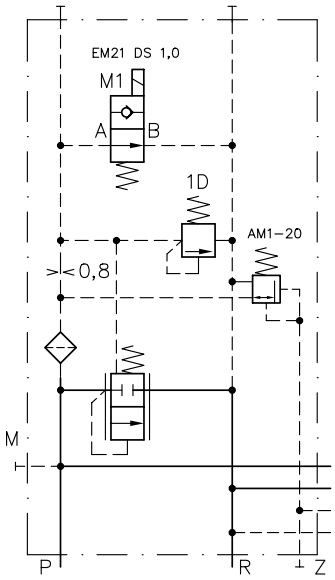
HSRL3 | /C321 | - DD | - 1 | - G24 | - 300

- **Pressure setting pressure limiting valve [bar]**
- **Solenoid voltage** 12V DC, 24V DC, 98V DC, 205V DC, 110V AC, 230V AC, at HSRL: Solenoid conforming ATEX
- **End plate** Internal or external control oil return
- **Valve sections** With/without adjustable switching speed
- **Connection block**
  - With/without pressure limiting valve (tool or manually adjustable)
  - Internal or external control oil supply (max. 160 bar)
  - Type HSRL: Ancillary blocks to the connection block with various pressure stages
- **Basic type and size** Type HSF: Manifold mounting
Type HSRL: Size 3 directional spool valve bank

Function

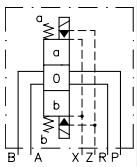
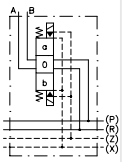
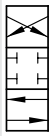
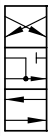
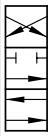
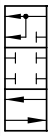
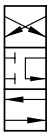
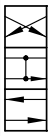
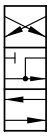
Connection blocks (HSRL):

C 321



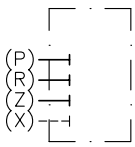
With internal control oil supply picked up
from P gallery, idle circulation valve and pressure-limiting valve,
optional ancillary blocks for
three additional pressure stages

Valve sections:

Basic symbol		Symbol								
HSF	HSRL	G	D	E	C	W	B	L	H	F
										
Manifold mounting valve	Valve section	All symbols are also available with adjustable response time (not for type HSRL 3)								

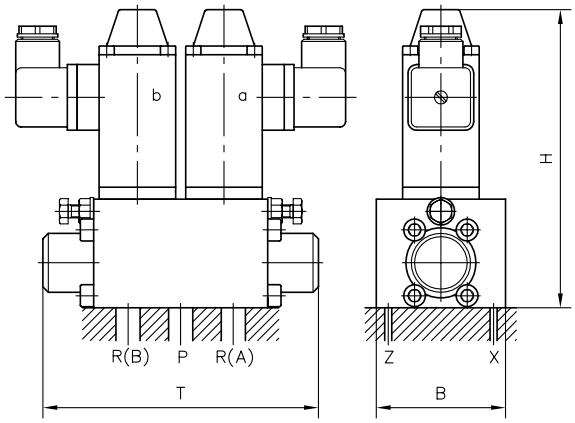
End plates:

HSRL

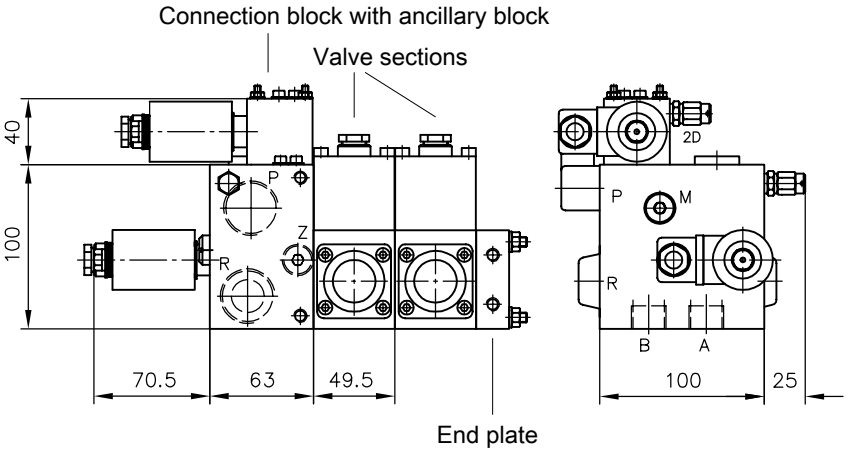


General parameters and dimensions

HSF



HSRL 3

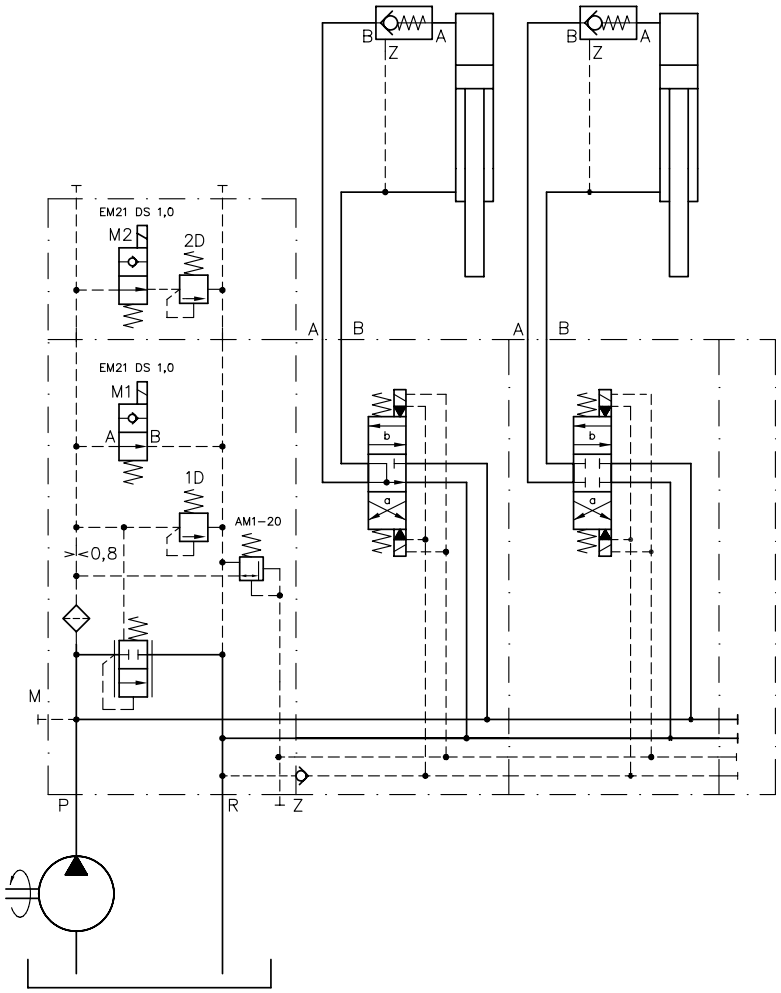


	Q_{max} [l/min]	p_{max} [bar]	$p_{contr.}$ [bar]	Ports (BSPP)		Dimensions [mm]			m [kg]	
				A, B, P, R	M, X, Z	H	B	T	Individual spool valve or valve section	Connection block
HSF 3						137	59	126		
HSRL 3						see illustration			2.0	1.7 ... 4.0
HSF 4						157	70	184		

Circuit example:

HSRL 3/C322/1D200 2D100 - DG - 1 - G 24

Size 3 valve bank type HSRL, connection block with integrated pressure-reducing valve, idle circulation valve, pilot-controlled pressure-limiting valve, main pressure-limiting valve factory set to 200 bar, second pressure stage set to 100 bar, two valve sections with the symbols D and G and a standard end plate, solenoid voltage 24V DC



Associated technical data sheets::

- Directional spool valve type HSR: D 7493
- Directional spool valve type HSRL: **Sk 7493 RL**
- Directional spool valve type HSF: D 7493 E
- Directional spool valve type HSL: D 7493 L

Plugs:

- With LEDs etc.: D 7163
- With economy circuit: D 7813, D 7833

Directional spool valves

2.1 Manually actuated directional spool valves type DL

The directional spool valve bank type DL is used for smooth manual measuring for general hydraulic systems with single and double-acting consumers as well as stationary and mobile lifting devices.
This measuring process is caused by the bypass pump venting line gradually closing and the consumer line simultaneously opening. The movement begins when the throttling effect in the bypass channel causes the pressure to reach the consumer level.
The DLS directional spool valves are designed for industrial trucks (forklift trucks). The primary function (hydraulic cylinder) is therefore integrated into the connection block. A version with a priority flow divider in the connection block is also available. Different additional functions for the valve sections (e.g. shock valves) extend the range of possible applications.

Features and benefits:

- Compact design with up to 10 sections
- Various actuations for manual actuation
- Simple pressure reduction in downstream sections using intermediate plates
- Combinations possible for controlling lifting devices

Intended applications:

- Material handling technology (forklift trucks etc.)
- Machines for agricultural and forestry purposes
- Construction and construction materials machinery
- Road vehicle construction

Nomen-clature:	**Throttling directional spool valve**
Design:	**Valve bank, featuring integrated by-pass idle pump circulation**
Actuation:	**Manual:** ■ **Spring return, detent** **Pressure:** ■ **Pneumatic**
p_{max}:	**250 ... 315 bar**
Q_{max}:	**12 ... 90 lpm**

Design and order coding example

DL3	1	- 3	- GGD	- B/E1	- 2	- 210

Pressure specification [bar]

End plate

Actuation, mounting

Valve sections

- Directional spool valve
- Valve section options:
  - Secondary pressure limiting valve for consumer port A or B or A and B
  - Intermediate plate with pressure-limiting valve for all downstream valve sections
  - Lock-out circuit for all downstream consumers
  - Additional functions on the pump side (orifice, 2-way flow control valve)
  - Additional functions on the consumer side in the ancillary block (e.g. double check valves, shock valves, load-holding valves etc.) (size 3)
  - Reducing intermediate plate (size 3 into 2) with 3-way flow control valve

Port size G 1/4, G 3/8, G 1/2 (BSPP)

Connection block

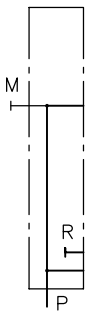
- With/without pressure limiting valve
- With priority flow divider (e.g. for hydraulic steering circuit)
- With shock valve
- With drop-rate braking valve

Basic type, size Type DL, type DLS for industrial trucks (e.g. fork lifts), type DLSR for variable displacement pumps, size 1 to 4

Function

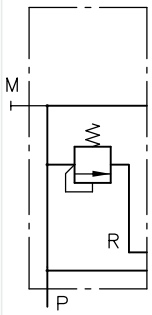
Connection blocks:

DL .5



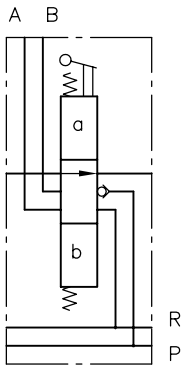
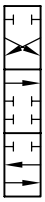
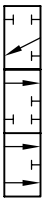
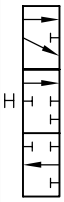
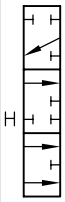
Without pressure-limiting valve

DL .1



With pressure-limiting valve

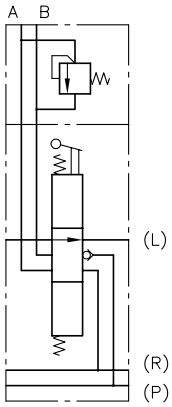
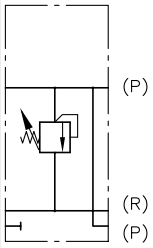
Valve sections:

Basic symbol	Symbol						
	G and B	D	E	N	R	A	P
							
						Reduced internal leakage due to reduced spool valve play	

Versions of valve sections:

- Additional function on the pump side (orifice, 2-way flow control valve)
- Valve sections for size 3 with consumer-side additional functions in ancillary block (e.g. double check valves, shock valves, load-holding valves etc.)
- Reducing intermediate plate (size 3 into 2) with 3-way flow control valve
- Valve section with lock-out circuit for all downstream consumers
- Size 4 also available without check valve in P
- Manual operation with spring return for switching position “a” and detent for switching position “b”
- Manual operation with detent in both switching positions
- Manual operation with combinations of contact switch, switch cam and switch carrier
- Manual operation with different mounting directions
- Manual operation with closed lever housing for sizes 3 and 4
- Pneumatic operation for sizes 3 and 4
- Displacement transducer or contact switch at the valve spool

Additional options for the valve sections:

Example: DL 21-1-GDD G71 GG-B/E1-2-180	Example: DL 21-2-GG X5 D-B/E1-2-210
	
Secondary pressure-limiting valve at consumer port A or B, or A and B	Intermediate plate with pressure-limiting valve for all downstream valve sections

End plates:

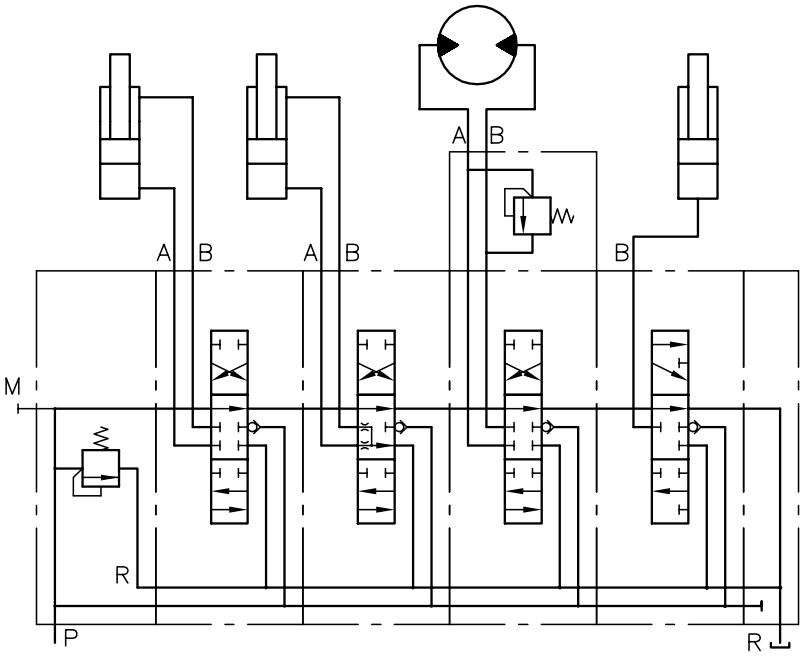
2	3
	
Standard end plate with port R	End plate for subsequent connection of a DL

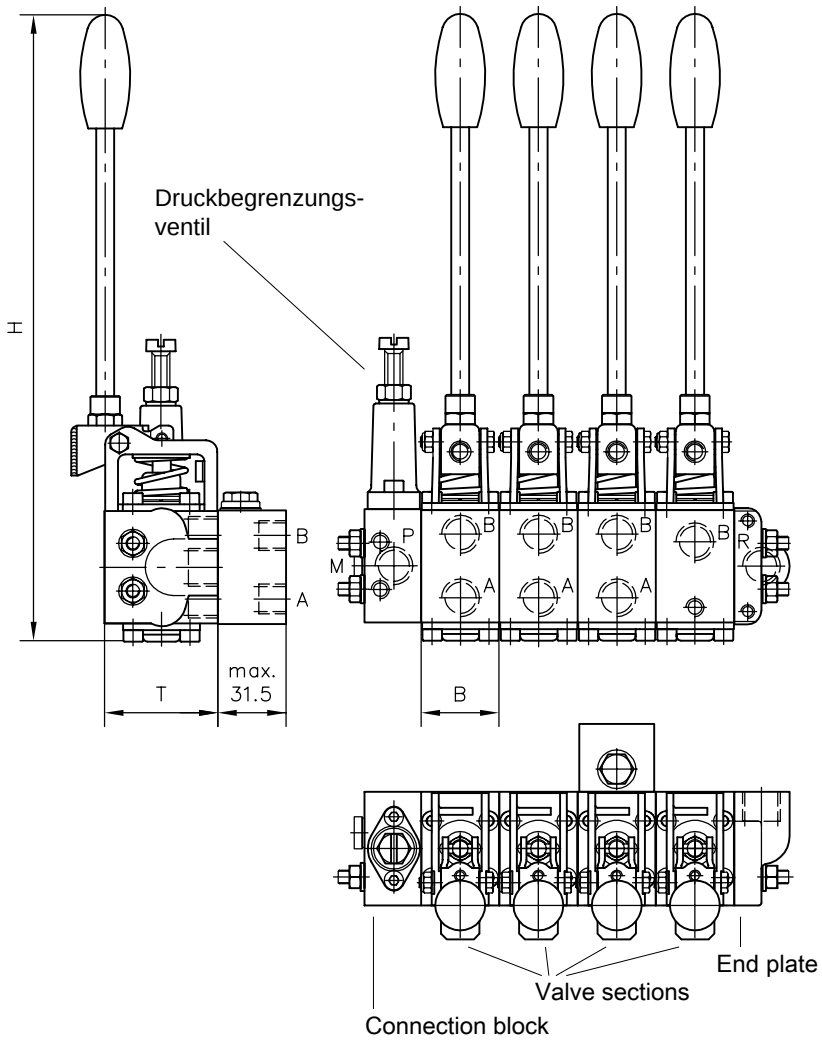
Example circuit:

DL 21-2-G D G71 N-B/E1-2-180

Size 2 DL directional spool valve with pressure-limiting valve (set to 180 bar), size 2 ports with G 3/8 tapped ports, symbols G, D, G, N; symbol G with pressure-limiting valve in port A (coding 71), valve sections with manual operation B (series with hand lever) and mounting type E1 (ports A, B are directed towards the front, valve spool is pushed into the housing for switching position “a”), valve bank with end plate 2 (coding 2)

Symbol





	Q_{max} [lpm]	p_{max} [bar]	Tapped ports			Dimensions [mm]			m [kg]
			Characteristic value	A, B	H, P, R	H	B	T	
DL 1	12 ... 16	315	1	G 1/4	G 1/4	approx. 192	31,5	45	0,5
DL 2	20 ... 30	315	1	G 1/4	G 3/8	approx. 278	34,5	50	0,85
			2	G 3/8	G 3/8				
DL 3	30 ... 60	250	2	G 3/8	G 1/2	approx. 351	39,5	60	1,4
			3	G 1/2	G 1/2				
DL 4	90	250	3	G 1/2	G 3/4	approx. 368	39,5	70	1,8

Associated technical data sheets:

- Directional spool valves type DL: D 7260

See also section "Devices for special applications":

- Industrial trucks
- Hydraulic for mobile applications

Directional spool valves

2.1 Proportional directional spool valves type PSL and PSV

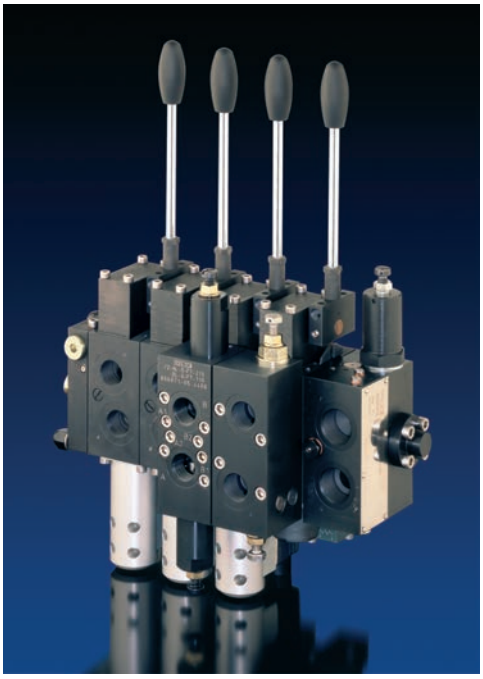
The directional spool valve bank in series design is available in three sizes in type PSL for constant delivery pump systems and type PSV for variable displacement pump systems (pressure/flow controller). It is intended for load-independent, continuous control of the movement speed of hydraulic consumers. Several consumers can be operated simultaneously and independently from each other. The application area of this valve type is mostly in mobile hydraulics (e.g. crane control). Being able to select different maximum volumetric flows for consumer ports A and B as well as the option to use various additional functions (e.g. secondary pressure limitation, function deactivation, in the basic valve, in intermediate plates and ancillary blocks) guarantees optimal adaptation to the respective control tasks.

Features and benefits:

- One product for various control functions and volume quantities
- Energy-saving Closed-Center systems
- Compact and lightweight design
- Modular system with wide range of design variants

Intended applications:

- Construction/construction material machinery
- Mining machinery (incl. oil production)
- Cranes and lifting equipment
- Machines for forestry and agricultural purposes



Nomencla-ture:	Prop. directional spool valves as per load-sensing principle
Version:	Valve bank in series connection
Actuation:	Manual ■ Return spring ■ Detent Electro-hydraulic Pressure-actuated ■ Hydraulic ■ Pneumatic
p_{max}:	400 ... 420 bar
$Q_{max.\ consumer}$:	3 ... 240 lpm
$Q_{pu\ max}$:	approx. 300 lpm

Design and order coding example

PSL41F	/380	- 3	- A2J40/40/EA/3	- E4	- G24

Solenoid voltage 12V DC, 24V DC
- Actuated via prop. amplifier or PLVC
- Solenoids with various plug versions
- Explosion proof solenoids

End plates

Valve sections with actuation

Size

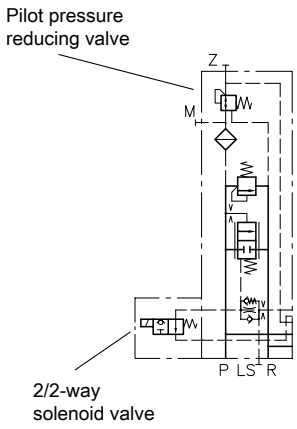
Connection block
- Ports BSPP or UNF (SAE-12)
- Pressure limiting valve (piloted main pressure limiting valve)
- Suited for both constant and variable displacement pump systems (type PSM)

Basic type Type PSL (hydraulic oil supply by constant pump), sizes 2, 3 and 5
Type PSV (hydraulic oil supply by control pump), sizes 2, 3 and 5
Type HMPL (hydraulic oil supply by constant pump) for industrial trucks, sizes 2 and 3
Type HMPV (hydraulic oil supply by control pump) for industrial trucks, sizes 2 and 3

Function

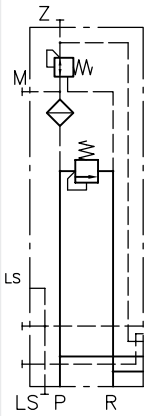
Connection blocks:

PSL



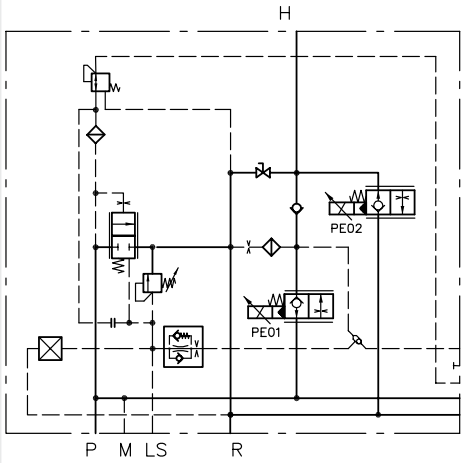
Connection block for constant delivery pump systems with incorporated 3-way controller and pressure-limiting valve

PSV



Connection block for control pump systems with or without pressure-limiting valve

HMPL (HMPV)

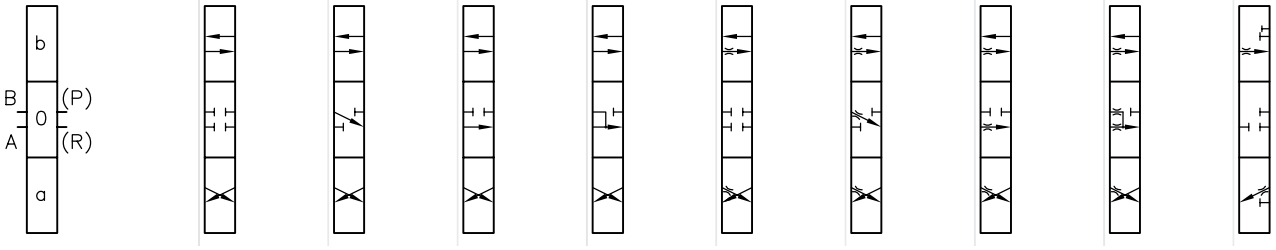


Connection block for constant delivery pump with incorporated proportional seated valve for lifting and lowering

Additional versions of connection blocks:
- 2/2-way solenoid valve for randomly switching the pump direction
- Additional damping option of the 3-way/pump controller
- Additional isolation valve to minimise the pump direction resistance
- Version with additional shut-off valve for the pump line, can be switched randomly
- Proportionally adjustable pressure limitation

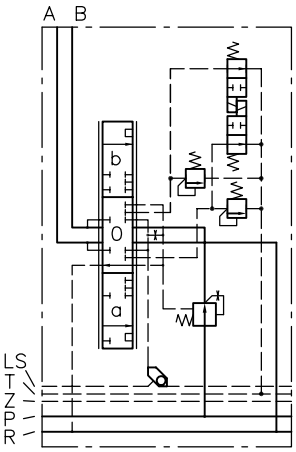
Valve sections:

Basic symbols	Switching symbol								
	L	M	F	H	J	B	R	O	G



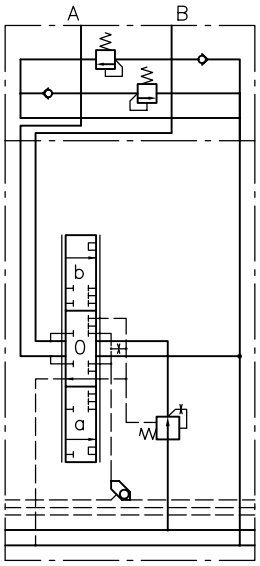
Versions of valve sections:

- Load pressure signal outputs at A, B; A and B together
- 3/3 directional spool valve with 2-way input and output controller
- Version with and without 2-way input controller
- Function deactivation feature
- Secondary pressure-limiting valves (can be selected for A and/or B)
- Prop. Pressure limitation of individual functions
- Version with ancillary blocks
- Intermediate plates for various additional functions
- Combination of various sizes possible in one valve bank
- Version with ATEX magnet for use in explosive environments
- Version with explosion-proof, intrinsically safe magnets for mining applications



Additional functions in the ancillary block:

- Shock and servo-suction valves
- Load-holding valves
- Differential circuits
- Check valves with release, no leakage
- Floating and block functions can be switched
- Proportional seated valves as per D 7490/1 for lifting and lowering using plunger cylinders



Characteristic values for max. volumetric flows:

	$Q_{A, B}$							
Size 2	3	6	10	16	25	40		
Size 3	3	6	10	16	25	40	63	80
Size 5	16	25	40	63	80	120	160	

- Characteristic value corresponds to the max. volumetric flow [lpm] of input controller versions at the consumer ports A and/or B
- Volumetric flows for A and/or B can be selected separately
- Increasing the control pressure enables 60 lpm (size 2), 120 lpm (size 3) and 240 lpm (size 5) per consumer port side.
- Versions with 2-way input controller and check valve function

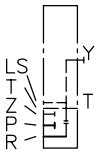
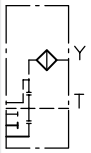
Actuations:

Basic type	Brief description	Switching symbol (example)
A	Manual actuation	 Combination of electro-hydraulic and manual actuation
C	Detent (continuous)	
K	Manual actuation via mechanical joystick	
E EA	Electro-hydraulic actuation in combination with manual actuation CAN: Actuation variant with direct CAN actuation	
H, P HA, PA	Hydraulic and pneumatic actuation in combination with manual actuation	
HEA	Combination of H, E and A actuation	

Intermediate plates:

- Electrically or hydraulically actuated shut-off valve for all downstream consumers
- With pressure-limiting valve for limiting the operating pressure of all downstream valves
- For random switchable reduction of the volumetric flow of all downstream consumers
- Priority module, size 3

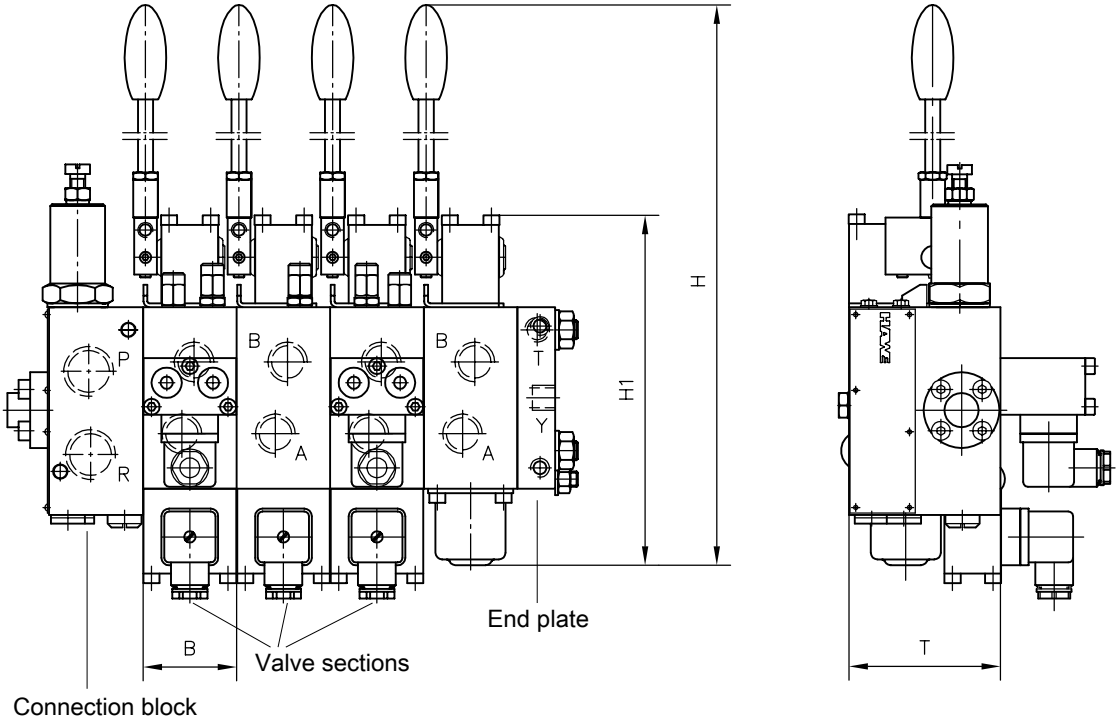
End plates:

E1	E2
	
Standard end plate	With additional Y-port for LS-input signal

Additional versions of end plates:

- End plate with internal leakage oil routing (no T gallery)
- End plates with additional P and R gallery
- Adapter plate to combine size 5 and 3 (coding ZPL 53), size 5 and 2 (coding ZPL 52) and size 3 and 2 (coding ZPL 32)
- End plate with integrated connection block function for dual-pump/dual-circuit systems

PSL

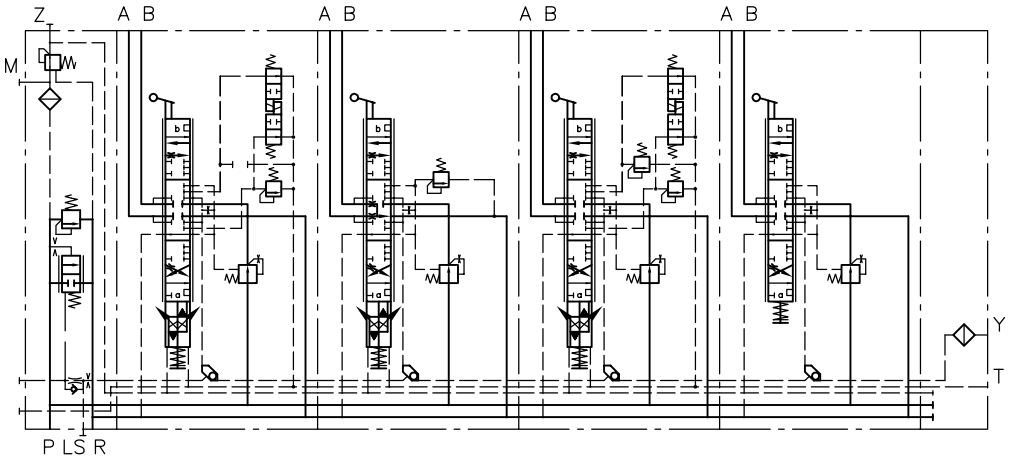


	Flow [lpm]		Oper. pressure [bar]	Ports (BSPP)		Dimensions [mm]				m [kg]
	Q_{max}	$Q_{pu\ max}$	p_{max}	P, R	A, B	H	H1	B	T	Per valve section[1]
PSL/PSV 2	3 ... 54	80	420	G 1/2, 3/4-16 UNF-2B	G 3/8, 3/4-16 UNF-2B	approx. 272	approx. 150	40	60	1.8 ... 2.9
PSL/PSV 3	3 ... 120	200	420	G 1/2, G 3/4, G 1, 1 1/16-12 UNF-2B	G 1/2, G 3/4, 7/8-14 UNF-2B	approx. 364	approx. 195	50	80	3.3 ... 4.1
PSL/PSV 5	16 ... 240	300	400	G 1, G 1 1/4, 1 5/8-12 UN-2B	G 1, 5/16-12 UNF-2B	approx. 400	approx. 224	62.5	100	3.7 ... 4.5

1) Dep. on actuation and additional functions

Example circuit:

PSL 41/350 - 3	-32 J 25/16 A300 F1/EA -42 O 80/63 C250/EA -42 J 63/63 A100 B120 F3/EA -31 L 40/16/A	- E2 - G24
Type PSL valve bank for constant pump systems Connection block: – Coding for thread size (here 4 = G 3/4) – Coding for pilot pressure-reducing valve (here 1) – Coding for set pressure at pressure-limiting valve (here 350 bar) Size: 3	1. Valve section: (exemplary for all subsequent valve sections): – Directional spool valve block with coding for consumer connection size (here 3 = G 1/2) – Coding for the type of directional spool valve block (here 2) – Switching symbol (here J) – Coding for max. consumer volumetric flow to ports A and B (here 25 and 16 lpm) – Coding of additional functions (here A 300; secondary pressure-limiting valve at port A set to 300 bar, function deactivated for port A (here F1)) – Coding for actuation type (here EA)	End plate: – Coding for end plate (here E2) – Coding for 24V DC solenoid voltage (here G24)



Suited products for combination:

- Type LHT, LHDV load-holding valves: Page 212
- Type KFB hydraulic joystick: D 6600, D 6600-01

Additional electronic components

- Type EJ joystick: D 7844
- Type EV1M2, EV1D1 and EV22K2 prop. amplifier (module): D 7831/1
- Programmable logic valve control type PLVC: Page 278
- See "Electronics" section Page 274

Associated technical data sheets:

- Type PSL/PSV prop. directional spool valves, size 2: D 7700-2
- Type PSL/PSV, size 3: D 7700-3
- Type PSL/PSV, size 5: D 7700-5
- Type PSL/PSV prop. directional spool valves with direct CAN actuation: D 7700 CAN
- Type HMPL/HMPV connection blocks Sizes 2 and 3: D 7700 H

See also section "Devices for special applications":

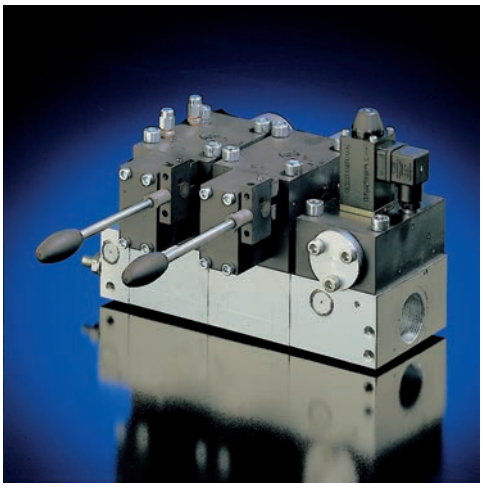
- Mobile hydraulics
- Devices for explosive environments (ATEX-compliant)
- Proportional valves

Directional spool valves

2.1 Prop. directional spool valves type PSLF and PSVF - Manifold mounting design

The directional spool valve bank type PSLF/PSVF consists of valve sections attached via manifolds. Type PSLF is designed for constant delivery pump systems (pressure/flow controller) whereas the type PSVF is for variable displacement pump systems. Both are available in two sizes. They serve to control the direction of motion and provide infinite control of the speed of motion of hydraulic consumers regardless of their load. Several consumers may be operated simultaneously and independently of each other. The main field of application is mobile hydraulics (e.g. boom controls of concrete pumps etc.). Main advantage against type PSL/PSV is simplified servicing as individual valve sections can be replaced easily. The main field of application is mobile hydraulics (e.g. crane controls etc.).

Being able to select different maximum volumetric flows for consumer ports A and B, as well as the option to use various additional functions (e.g. function deactivation) guarantees optimal adaptation to the respective control tasks.



Features and benefits:

- Max. flow 1000 lpm at 420 bar
- Rear side ports for easy access to valves, even in small installation spaces
- Flange construction can be combined across all sizes with fast valve replacement
- Simultaneous operation of several functions at full speed

Intended applications:

- Construction machinery and machines for building materials
- Crane and lifting equipment
- Offshore and marine technology
- Mining machinery

Nomen-clature:	**Prop. directional spool valve acc. to the Load-Sensing principle**
Design:	**Individual manifold mounting valve Valve bank via individual manifold mounting valves**
Actuation:	**Manual** ■ **Return spring** ■ **Detent** **Electro-hydraulic** **Pressure** ■ **Hydraulic** ■ **Pneumatic**
p_{max}:	**400 ... 420 bar**
$Q_{max.\ consumer}$:	**3 ... 470 lpm**
$Q_{pu\ max}$:	**approx. 1000 lpm**

Design and order coding example

PSLF	A1/380/4	- 3	- A2J40/40/EA/3	- E2	- G24

Solenoid voltage 12V DC, 24V DC
- Operated using a proportional amplifier or PLVC
- Magnets with different plug versions
- Explosion-proof magnets

End plates

Valve sections with actuation

Size

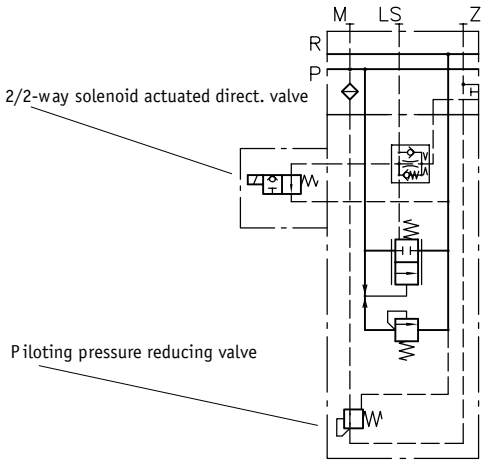
Connection block
- Port G or UNF (SAE-12)
- Pressure-limiting valve (pilot-controlled main pressure-limiting valve) in connection block

Basic type Type PSLF (supply via constant pump),
Type PSVF (supply via variable displacement pump),
size 3, 5 and 7

Function

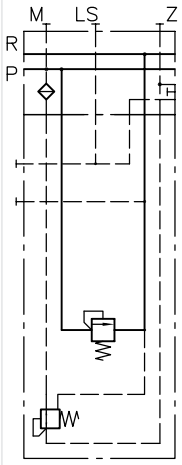
Connection blocks:

PSLF



Connection block for constant delivery pump systems with incorporated 3-way flow controller and pressure limiting valve

PSVF



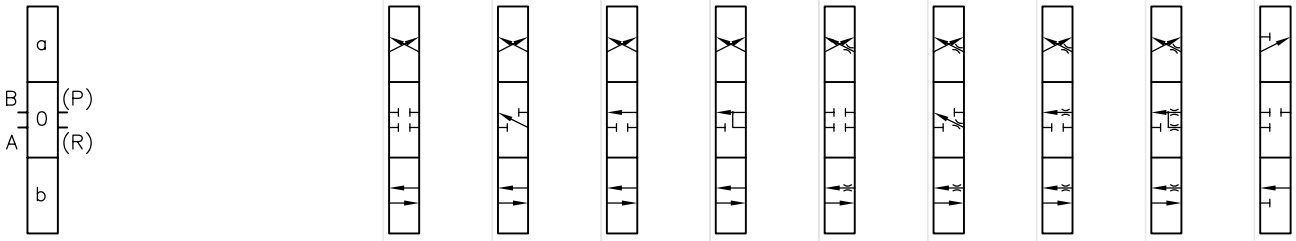
Connection block for variable displacement pump systems with or without pressure limiting valve

Additional versions of connection blocks:

- 2/2-way solenoid actuated directional valve for arbitrary idle pump circulation
- Additional damping of the 3-way flow controller or pump controller

Valve sections:

Basic symbol	Symbol								
	L	M	F	H	J	B	R	O	G



Versions of valve sections:

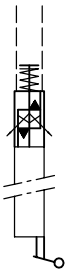
- Load pressure signal outputs at A, B; A and B together
- Version with and without 2-way input controller
- Function deactivation
- Secondary pressure-limiting valves (can be individually selected for A and/or B)
- Prop. pressure limitation of individual functions
- Sub-plates with different additional functions
- Combination of various sizes possible in one valve bank
- Version with ATEX magnet for use in explosive areas
- Version with explosion-proof, intrinsically safe magnets for mining applications

Coding for max. consumer flow:

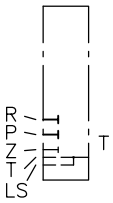
	$Q_{A, B}$							
Size 3	3	6	10	16	25	40	63	80
Size 5	16	25	40	63	80	120	160	
Size 7	120	160	250	320	400			

- Characteristic value corresponds to the max. volumetric flow (lpm) at the consumer ports A or B for the version with input controller
- Volumetric flows for A and/or B can be selected individually
- Increasing the control pressure enables 60 lpm (size 2), 120 lpm (size 3) and 240 lpm (size 5) per consumer port side.
- Version with 2-way input controller and check valve function

Actuations:

Basic type	Brief description	Symbol (example)
A	Manual actuation	 For combination of electro-hydraulic and manual actuation
C	Detent (stepless)	
E **EA**	Electro-hydraulic actuation in combination with manual actuation	
H, P **HA, PA**	Hydraulic and pneumatic actuation in combination with manual actuation	
HEA	Combination of actuation H, E, and A	

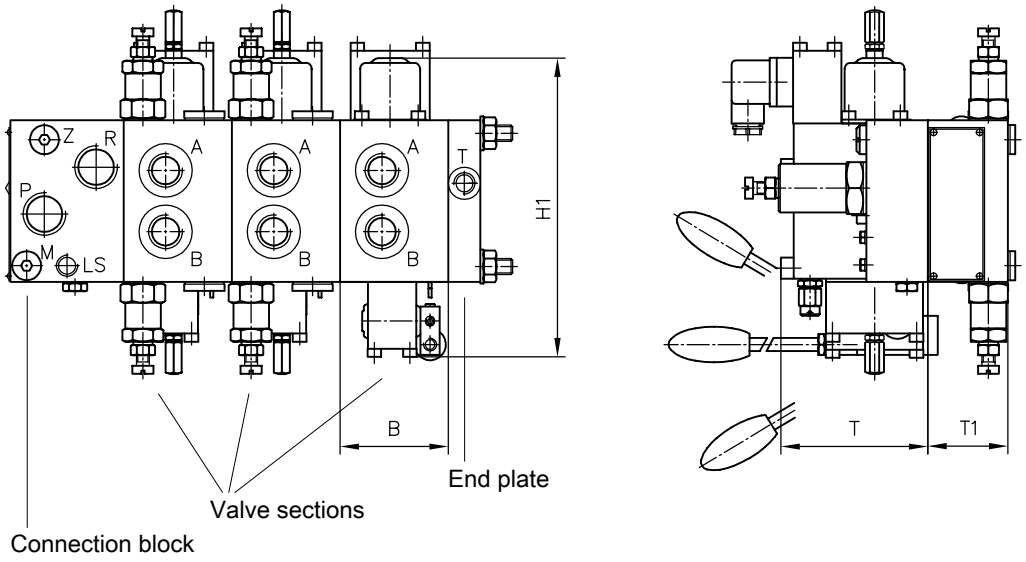
End plates:

E1	E2
	
End plate (std.)	With additional Y-port for LS-input signal

Additional versions of end plates:

- End plate with internal drain line (without T-port)
- End plates with an additional port R
- Adapter plate enabling combination of size 5 with size 3 (coding ZPL 53)

PSVF

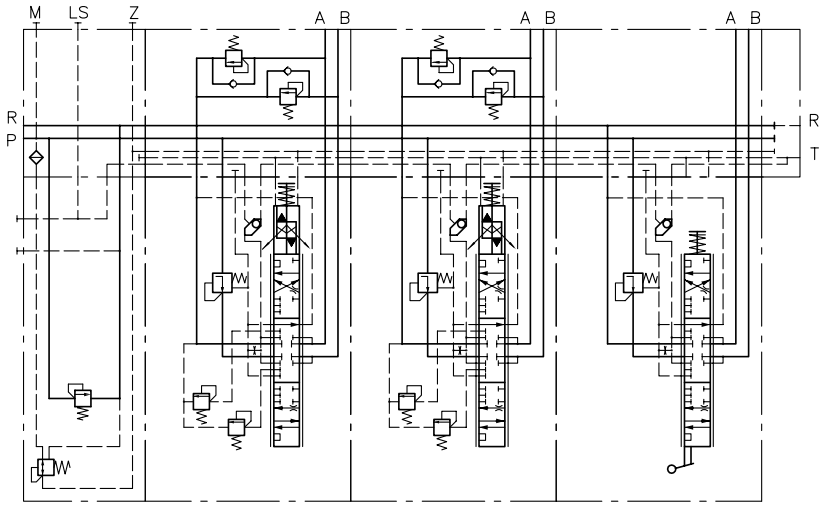


	Flow [lpm]		Oper. pressure [bar]	Ports (BSPP)		Dimensions [mm]				m [kg]	
	Q_{max}	$Q_{PU\ max}$	p_{max}	P, R	A, B	H1	B	T	T1	1)	2)
PSLF/PSVF 3	3 - 120	200	420	G 3/4, 1 1/16-12 UN-2B	G 1/2, G 3/4, 7/8-14 UNF-2B	approx. 195	50	80	50	3.3 ... 4.1	6.6 ... 7.6
PSLF/PSVF 5	16 - 210	350	400	G 1, G 1 1/4, SAE 1 1/2	G 1, SAE 1 1/2	approx. 224	62.5	100	100	3.7 ... 4.5	10.9 ... 16.3
PSLF/PSVF 7	120 - 500	1000	400	G 1 1/2, SAE 1 1/2	G 1 1/4, SAE 1	approx. 305	106	101	95	13	23

1) Per valve section depending on actuation and additional functions
2) Per valve section complete with manifold

Example circuit:

PSVF A1/380/4-3	- A2 J 40/40 A200 B200 /E /3 AN210 BN210 - A2 J 80/40 A280 B130 /E /3 AN290 BN140 - A2 J 25/16 /EA /3	- E1 - G24
Valve bank type PSVF for variable displacement pump system Connection block: – Coding for flange construction (here A.) – Coding for pilot pressure-reducing valve (here 1) – Coding for set pressure at pressure-limiting valve (here 380 bar) – Coding for thread size of sub-plate (here /4 = G 3/4) Size: 3	1. Valve section: (exemplary for all subsequent valve sections): – Directional spool valve block with coding for flange construction (here A.) – Coding for basic function of the directional spool valve block (here 2) – Symbol (here J) – Coding for max. consumer volumetric flow at port A and B (here 40 and 40 lpm) – Coding of additional functions (here A 200 B 200; secondary pressure-limiting valve at port A and B set to 200 bar) – Coding for the actuation type (here E = electrical-hydraulic) – Coding for sub-plate (here 3AN210 BN210, G 1/2 with shock and servo-suction valve)	End plate: – Coding for end plate (here E1) – Coding for solenoid voltage 24V DC (here G24)



Suited products for combination:

- Load-holding valves type LHT, LHDV: Page 212
- Hydraulic joystick type KFB: **D 6600-01**

Electronic accessory components

- Joystick type EJ: D 7844
- Prop. amplifier (module) type EV1M2, EV1D1 and EV22K2: D 7831, D 7817/1, D 7831 D
- Programmable logic valve control type PLVC: Page 278
- see “Electronics” section Page 274

Associated technical data sheets:

- Prop. directional spool valve type PSLF/PSVF size 3, 5: D 7700-F
- Prop. directional spool valve type PSLF/PSVF size 7: D 7700-7F

See also chapter "Equipment for special applications"

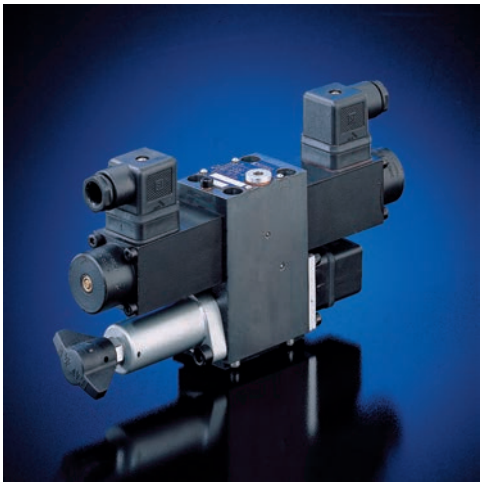
- Mobile hydraulics
- Devices for explosive areas (ATEX-compliant)
- Proportional valves

Directional spool valve

2.1 Clamping modules type NSMD2

The clamping modules type NSMD2 are used to actuate power-operated clamping devices such as hydraulically actuated hollow or solid clamping cylinders for automatic lathes. They are available as manifold mounting valves with a standard connection diagram according to DIN 24340-A6. The clamp/release functions of the clamping cylinder, pressure control and, if required, the electrical pressure monitoring are combined in one device. The clamping pressure at the consumer side A or A and B and the pressure switch can be adjusted simultaneously with a manual, mechanical or electro-proportional adjustment device. A special safety circuit monitors the switching position of the valve. 4/3- or 4/2-way directional functions with spring-centred actuation, the latter also with detent actuation, allows for adjustment to the respective application.

The throttling options in the spool end position as well as the rapid and creeping movements are available as an additional function for one or both consumer ports.



Features and benefits:

- Directional valve, pressure-reducing valve and pressure switch in one device
- Adjustment of pressure-reducing valve and pressure switch with an adjustment device
  (manual or electro-proportional)
- The controlled pressure is picked up directly at the consumer port
- Valve with connection diagram according to DIN 24340-A4

Intended applications:

- Machine tools (cutting)
- Machine tools (non-cutting) - forming and cutting
- Handling and mounting technology (industrial robots, etc.)

Nomenclature:	**Valve combination consisting of:** ■ **Directional spool valve (4/3-, 4/2-way function)** ■ **Pressure reducing valve with tracked pressure switch**
Design:	**Individual valve for sub-plate mounting (Valve banks with sub-plates type BA are available)**
Actuation:	**Solenoid**
p_{max}:	**120 bar**
Q_{max}:	**25 lpm**

Design and order coding example

NSMD 2 | D1 | 60 | R | - G24

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC
Solenoids with various plug versions

Means of adjustment for the claming pressure
- Slotted head screw + hexagon nut
- Wing screw + wing nut
- Lockable turning handle
- Electro-proportional adjustment with/without additional function monitoring

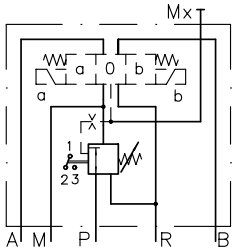
Additional functions
- Throttle
- Rapid and creeping movement (one or both directions)

Function
- With pressure switch
- With orifice (flow limitation in accumulator mode)

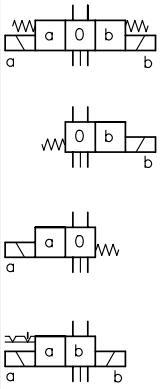
Basic type, size Type NSMD size 2 with connection hole pattern conf. NG 6

Function

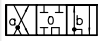
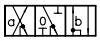
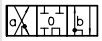
Basic symbols



D, E, G, D1, E1, G1



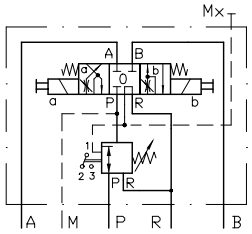
Symbols

D	E	G
		
D1	**E1**	**G1**
		
B, W, K	**B1, W1, K1**	
		

Further functions:

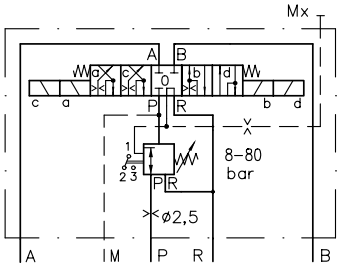
G1/MD

Pressure reducing function and throttle in switching positions a and b



G/MM6

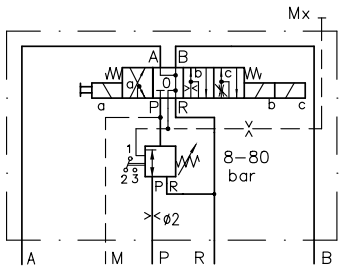
Rapid traverse and creeping in both directions



G/MMDA7

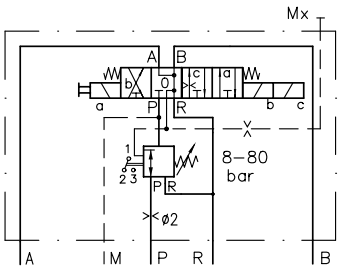
Rapid traverse and creeping in one direction featuring also a limitation for rapid traverse (switching position a, c)
rapid traverse in opposing direction (switching position b)

Switching position a, speed limitation is possible by means of a throttle with pressure reduction and pressure monitoring



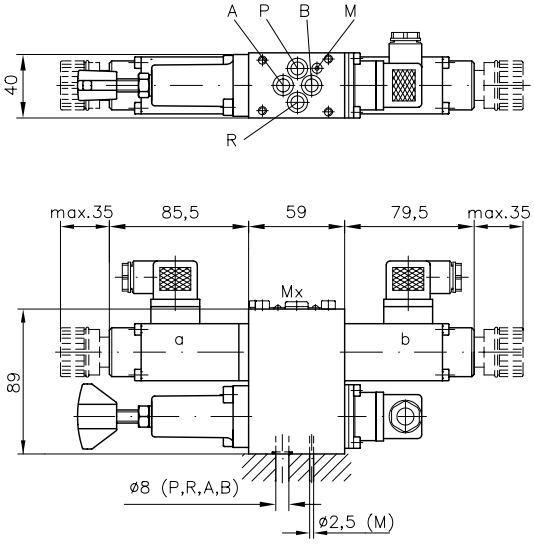
G/MMA7

Switching position with fixed rapid traverse speed without pressure reduction and pressure monitoring.

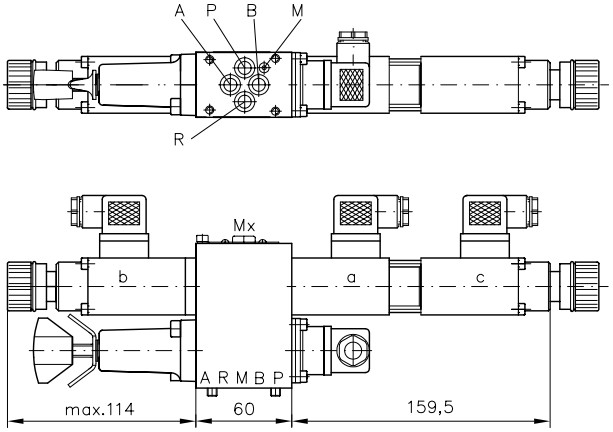


General parameters and dimensions

NSMD2 K...



NSMD2 G...



	Q_{max} [lpm]	p_{max} [bar]	Clamping pressure range [bar]	Trigger flow [lpm]	Connection hole pattern[1]	Dimensions [mm]			m [kg]	
						H	B	T	Individual valve[2]	Additional function
NSMD2	25	120	5 ... 50 8 ... 80	2 ... 4 3 ... 5 4 ... 6	Hole pattern conf. DIN 24340-A6	see illustration			2.2 ... 3.8	+ 0.6 ... 1.1

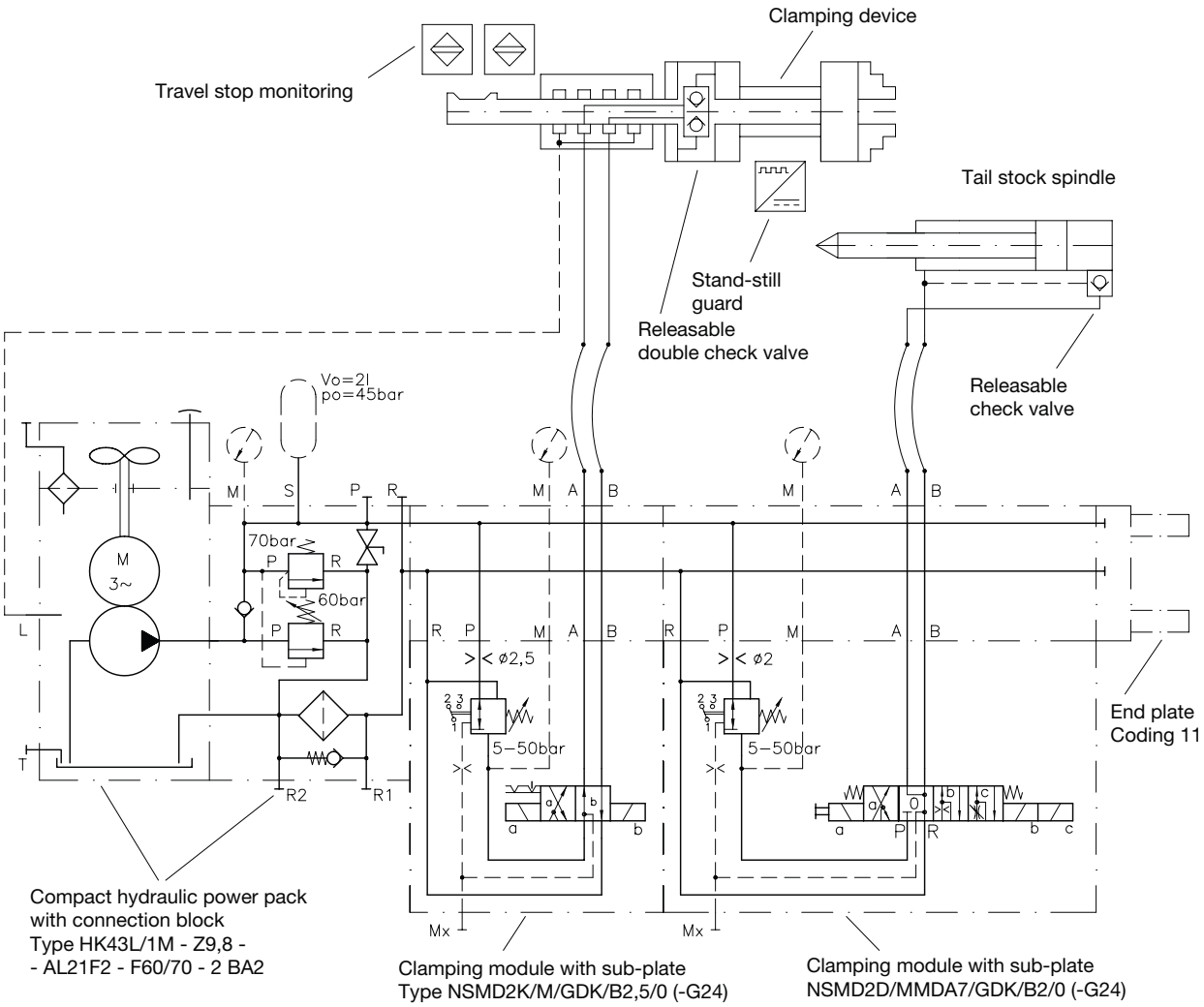
1) Port Mx; G 1/8 (BSPP)
2) Depending on flow pattern symbol andactuation mode

Circuit example:

NSMD2K/M/GDK/B2,5-G24	NSMD2G1/MD/E4VK/B1-G12
Clamping module type NSMD size 2 with industrial standard (DIN 24340- A6) connection hole pattern, flow pattern symbol K, detented version, clamping pressure range G, 5-50 bar and min. operational flow 2-4 lpm. The actuation for the adjustment of the clamping pressure and tracked pressure switch takes place by means of wing screw and wing nut. An orifice ∅ 2.5 mm is installed in the P gallery, solenoid voltage 24V DC	Clamping module type NSMD size 2 with industrial standard connection hole pattern conf. DIN 24340-A6, flow pattern symbol G1 with pressure monitoring at port A, adjustable throttle setting for switching position a and b. Valve for clamping pressure range E, 8-80 bar and min. operational flow 4-6 lpm. The actuation for the adjustment of the clamping pressure and tracked pressure switch takes place with self-locking turn knob. An orifice ∅ 1 mm is installed in the P gallery, solenoid voltage 12V DC

Circuit example:

HK 43L/1M-Z 9,8-AL 21F2-F60/70-2-BA 2
- **NSMD2K/M/GDK/B2,5/0**
- **NSMD2D/MMDA7/GDK/B2/0-G24**



Associated technical data sheets:
- Clamping modules type NSMD: D 7787

Products:
- Directional valves type NSWP2: Page 84
- Directional seated valves type NBVP16: Page 156

Plates:
- Valve banks type BA2: Page 34
- Intermediate plate NG6 type NZP: D 7788 Z

Plugs:
- With LEDs or to support the EMV etc.: D 7163
- With economy circuit: D 7813, D 7833

2.2 Directional seated valves

Directional seated valve bank type VB

Directional seated valves type BVG, BVE, BVP and NBVP

(Solenoid-actuated) seated valves

Type	Nomenclature/Design	Actuation	p_{max}	Q_{max}
VB	**Directional seated valve, zero leakage, valve bank** ■ For pipe connection ■ For combination with hydraulic power packs	- Solenoid - Pressure - Manual	500... 700 bar	6... 120 lpm
WN, WH	**Directional seated valve, zero leakage, individual valve** ■ Individual valve for manifold mounting ■ Combination with connection block for pipe connection	- Solenoid	350... 450 bar	5... 60 lpm
BWH, BWN	**Directional seated valve, zero leakage, valve bank** ■ For pipe connection ■ For combination with hydraulic power packs	- Solenoid	350... 450 bar	5... 60 lpm
VZP	**Directional seated valve, zero leakage, individual valve** ■ Individual valve for manifold mounting	- Solenoid	250... 450 bar	5... 15 lpm
BVZP	**Directional seated valve, zero leakage, valve bank** ■ For pipe connection ■ Combination with hydraulic power packs	- Solenoid	450 bar	15 lpm
EM, EMP, EMC	**Directional seated valve, zero leakage, individual valve** ■ Screw-in valve ■ Combination with connection block for pipe connection ■ Combination with connection block for swivel fitting	- Solenoid	450 bar	1... 160 lpm
BVG, BVE, NBVP	**Directional seated valve, zero leakage, individual valve** ■ Screw-in valve ■ For pipe connection ■ Individual valve for manifold mounting	- Solenoid - Hydraulic - Pneumatic - Manual	400 bar	20... 300 lpm
VP	**Directional seated valve, zero leakage, individual valve** ■ Individual valve for manifold mounting	- Solenoid - Hydraulic - Pneumatic	400 bar	15 lpm

Valve combinations

Type	Nomenclature/Design	Actuation	p_{max}	Q_{max}
HSV	■ Individual valve for pipe connection	- Solenoid	315... 400 bar	20... 120 lpm
CR	■ Individual valve for pipe connection	- Solenoid - Manual	HP 400 bar NP 30... 60 bar	HP 8... 20 lpm NP 80... 160 lpm A⟶ R 160... 300 lpm
HMB, HMC, HMT	■ Valve bank	- Solenoid	315 bar	120 lpm

Manually actuated seated valves

Type	Nomenclature/Design	Actuation	p_{max}	Q_{max}
VH, VHR, VHP	**Directional seated valve, zero leakage** ■ Individual valve for pipe connection ■ Individual valve for manifold mounting ■ Valve bank	- Manual	500... 700 bar	12... 25 lpm
DA, EA	**Directional seated valve, zero leakage** ■ Individual valve for pipe connection	- Manual	500 bar	60... 150 lpm

Seated valves

2.2 Directional seated valves with various actuations

These directional seated valves with various actuation modes comprise manifold mounting valves that use spring-loaded balls as valve elements and therefore do not show any leakage. The actuation element used moves the valve to the appropriate switching position using an angled lever and tappet.

The basic versions are designed as 2/2- and 3/2-way directional valves. 3/3- and 4/3-way functions are possible if two valves are housed in one valve block, whereas 4/2-way functions require an additional intermediate plate. The variants of size G..-22 can be used as a reinforced version for fluctuating, pulsating continuous loading and high switching frequency in the upper pressure range.

Connection blocks can be flange-mounted to incorporate the valves into the pipe systems. Optional additional functions in the connection blocks (e.g. pressure-limiting or bypass check valve) extend the range of applications of this valve type. It is possible to combine several valves connected in parallel in one valve bank (type VB).

Features and benefits:

- Zero-leakage ball valve construction with high switching reliability
- Solenoid, pressure, mechanical or manual actuation
- Low shifting forces and gentle, smooth switching
- Operating pressures up to 700 bar

Intended applications:

- Machine tools (cutting and non-cutting)
- Clamping equipment, punching tools, jigs
- Rubber and plastics machinery
- Oil hydraulics and pneumatics

Nomen-clature:	**Directional seated valve, zero leakage**
Design:	**Individual valve, manifold mounting combination with sub-plates for pipe connection**
Actuation:	**Solenoid Pressure (hydraulic, pneumatic) Mechanical (roller, pin) Manual (hand lever, adjusting knob)**
p_{max}:	**350 ... 700 bar**
Q_{max}:	**6 ... 120 lpm**

Design and order coding example

G	R2	- 3	R	- 1/2	- G24

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC

Indiv. connection blocks for pipe connection

Additional versions:

- Connection blocks with by-pass check valve or pressure limiting valve between P and R
- Connection block with bridge rectifier circuit. Check valves in "GRAETZ"-circuitry ensure flow direction through the valve

Additional elements

- With check valve insert for port P
- With check valve insert for port P
- With return pressure stop for port R
- Lift monitoring (size 3 and 4)

Size Size 0 to 4

- Size 1 also available with industrial connection hole pattern NG 6 (CETOP), type NG

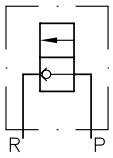
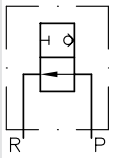
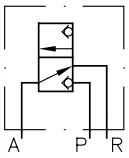
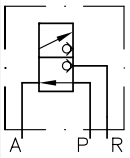
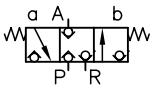
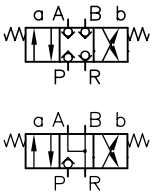
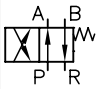
Function

- 2/2-way directional valve (R2, S2)
- 3/2-way directional valve (3, Z3)
- 3/3-way directional valve (21, 39)
- 4/3-way directional valve (22, 48, 49)
- 4/2-way directional valve (4, Z4)

Actuation

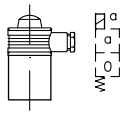
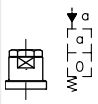
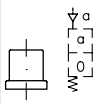
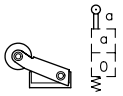
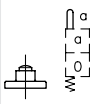
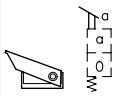
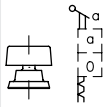
- Solenoid (G, WG)
- Hydraulic (H)
- Pneumatic (P)
- Mechanical (K, T, F, D)

Function

2/2-way directional valve		3/2-way directional valve		3/3-way directional valve	4/3-way directional valve	4/2-way directional valve	
R2	S2	3	Z3	21, 39	22, 48, 49	4	Z4
							

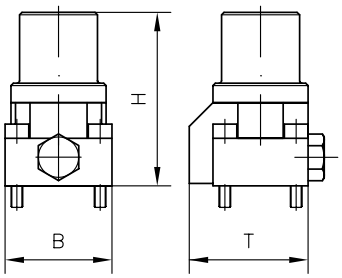
- Simplified symbols for 3/3-, 4/3- and 4/2-way functions
- Type 21, 22 not in size 4
- Type 39, 48, 49 only in size 22
- Type 4, Z4 only in size 1

Actuation:

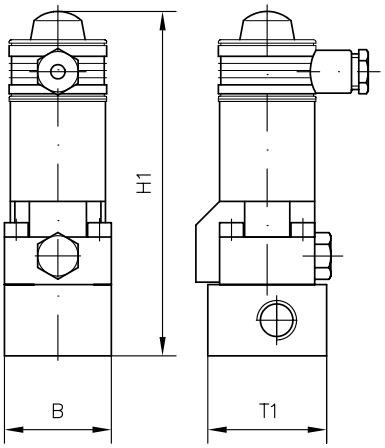
Solenoid		Pressure		Mechanical		Manual	
		Hydraulic	Pneumatic	Roller	Pin	Hand lever	Turn knob
G	WG	H	P	K	T	F	D
							
Solenoid voltages: 12V DC, 24V DC (type G) 230V AC (type WG)		Control pressure $p_{contr.\ max}$ [bar]:		Shifting force [N]:		Shifting force [N]:	Shifting torque [Ncm]:
		400... 700	15	25... 80	51... 20	25... 80	45... 98
		Control pressure $p_{contr.\ min}$ [bar]:		Shifting travel [mm]:		Shifting travel [mm]:	
		9... 16	2.5... 4	10.5... 30	4 and 5	20.5... 45	

- Valve with solenoid actuation also available in ATEX-compliant version (24V DC)

Individual valve



Valve with connection block



	Dimensions						
Size	**H_{max}**	**$H1_{max}$**	**B**		**T_{max}**	**T1**	**m_{max} [kg]**
			2/2- and 3/2-way	**3/3- and 4/3-way**			
0	90.5	110.5	36	75	41.5	40.0	0.8/1.0
12	115	145	45	92	50	50	1.4/1.9
2, 22	126.5; 134.5	156.5; 161.5	56; 56	116; 116	62.5; 67.5	56; 56	2.9/3.9; 3.0/4.0
3	162	202	70	144	91.5	70	5.7/7.1
4	226	226	80	162	127	125	16.3/20.1

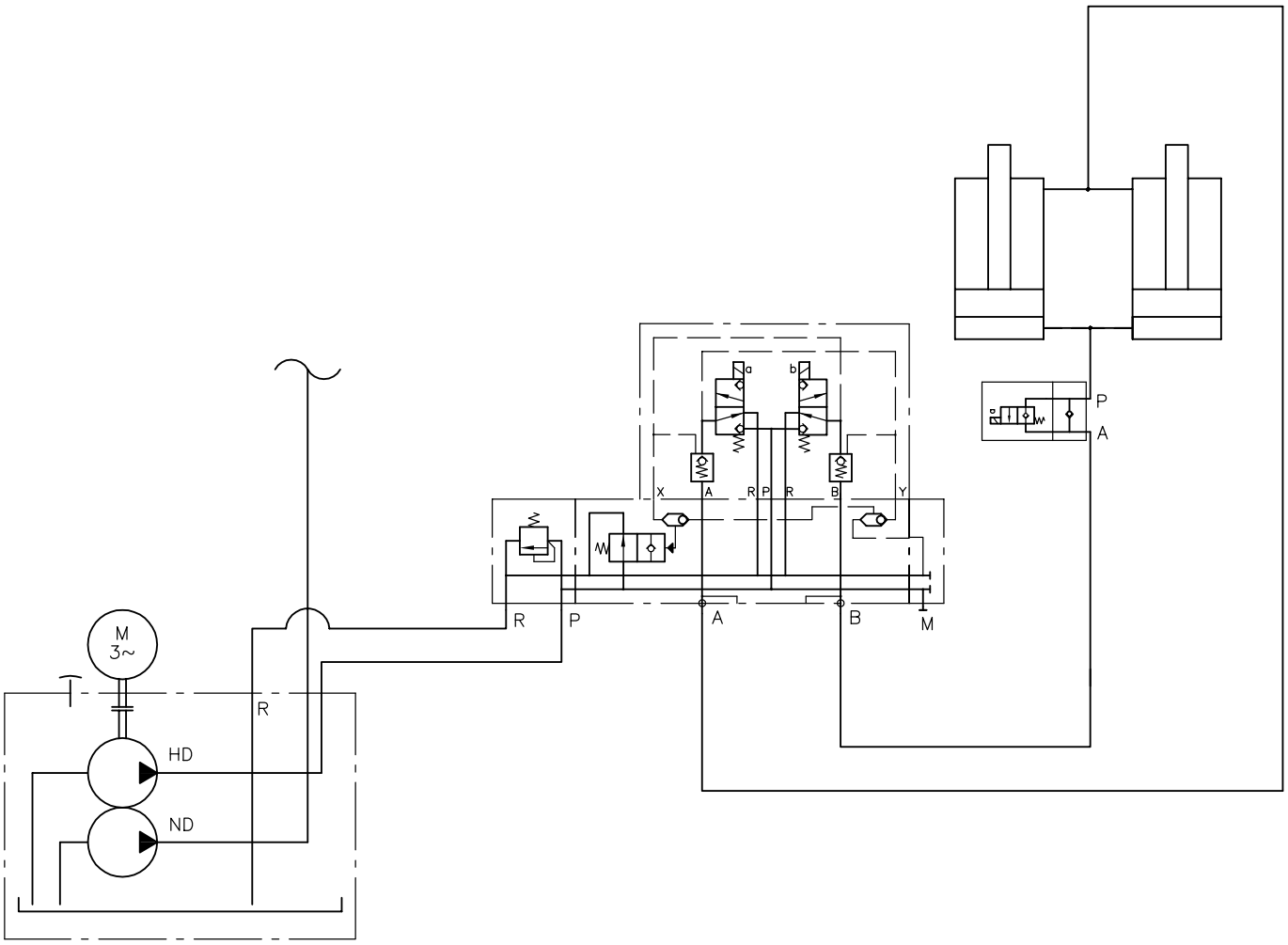
	Q_{max} [lpm]	p_{max} [bar]								Ports (BSPP)
Size		**Solenoid**		**Pressure**		**Mechanical**		**Manual**		
		G	**WG**	**H**	**P**	**K**	**T**	**F**	**D**	**P, R, A, B**
0	6	300... 500		500	-	-		-	500	G 1/4
12	12	350... 500 (700)		500... 700		400... 700		400... 700		G 1/4 and G 3/8
2, 22	25	350... 500 (700)		500		400... 500		400... 500		G 3/8 and G 1/2
3	65	350... 400		400		350	-	350	-	G 1/2 and G 3/4
4	120	350		-		-				G 3/4 and G 1

Example circuit:

RZ 4.0/2-12.3-B 75-V 5.5
- 3 x 690/400 V 50 Hz

VB 22 AM 1/500
-G 49/U 22
-8 E-2-G 24

GR 2-12-3/8 C-G 24



Associated technical data sheets:

- Directional seated valves: D 7300
- Directional seated valves with standard connection diagram (CETOP3, NG 6): D 7300 N
- Directional seated valves with lift monitoring: **D 7300 H**

Valve banks:

- Valve banks type VB: Page 130

Plugs:

- With LEDs etc.: D 7163
- With economy circuit: D 7813, D 7833

See also section "Devices for special applications":

- Devices for explosion hazardous areas, conforming ATEX
- Devices for up to 700 bar

Seated valves

2.2 Directional seated valve bank type VB

The valve bank type VB consists of a connection block (with ports P and R), the directional seated valves (acc. to D 7300) installed on sub-plates and connected in parallel plus the end plate. The whole valve bank is held together with one or two tension rods.

Through selection of the sub-plate, different symbols can be achieved with the individual valves, including in conjunction with additional functions (e.g. pressure switches in the consumer channel). These valve banks may be either directly flange-mounted to a pipe system via a connection block or installed directly onto hydraulic power packs (type HK, HC, MP, MPN and KA) using an adapter plate.

Various end plates (e.g. with pressure switch in the P gallery or accumulator drain valve) extend the range of possible applications.

Particularly in conjunction with hydraulic power packs, the compact design enables hydraulic control systems for high pressure and with low spatial requirements to be achieved.

Nomen-clature:	**Directional seated valve, zero leakage**
Design:	**Valve bank for pipe connection**
Actuation:	**Solenoid Pressure: Hydraulic, Pneumatic Manual: Hand lever, Turn knob**
p_{max}:	**500 ... 700 bar**
Q_{max}:	**6 ... 120 lpm**

Features and benefits:

- Compact hydraulic controls for high pressure
- Combination with compact hydraulic power packs result in cost efficient turn-key solutions
- Elimination of time-consuming installation due to integrated hydraulic power packs
- Simple repairs thanks to modular structure of the systems

Intended applications:

- Machine tools (chipping and non-chipping)
- Clamping, punching and jigs
- Rubber and plastics machinery
- Oil hydraulics and pneumatics

Design and order coding example

VB12	F	M	DCNR5	1	WG230

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC

Port size G 1/4 (1), G 3/8 (2), G 1/2 (3) (BSPP)

Valve sections Symbols: 2/2-way directional valve, 3/2-way directional valve, 3/3-way directional valve, 4/3-way directional valve, 4/2-way directional valve

Valve section options

- Pressure switch for P or the consumer side
- Pressure reducing valve reducing the pressure in the downstream gallery P
- Orifices in gallery P and/or return pressure stop in gallery R

Sub-plates

- With 2-way flow controller by-passing to the tank
- Pressure reducing valve reducing the pressure in the downstream gallery P
- With pressure limiting valve and throttle
- With idle circulation valve and/or shuttle valve

Intermediate plates

- With pressure reduction for gallery P or throttle for port A (parallel connection)

Actuation

Connection block/adapter plate

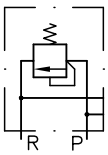
- For pipe connection
- For direct mounting at compact hydraulic power packs
- For direct mounting at hydraulic power packs

Basic type, size Type VB, size 01, 12, 21, 31, 41

Function

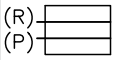
Connection blocks:

A .-1/..



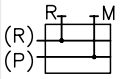
For pipe connection, with tool adjustable pressure limiting valve (/..- pressure specification in bar)

C, D, E



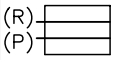
For mounting onto hydraulic power packs type R, Z and RZ, depending on tank and size

F



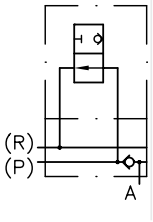
For mounting onto compact hydraulic power packs (type KA, HC, MP, MPN, HK)

G

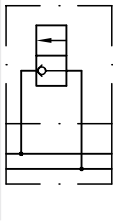


Valve sections:

A



D



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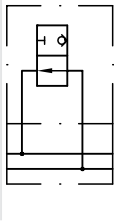
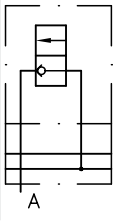
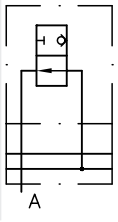


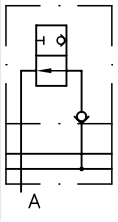
B



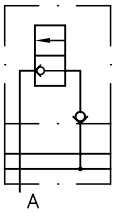
C



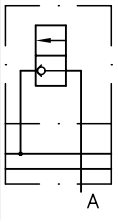
E



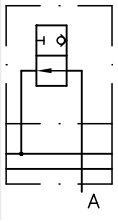
Q



P

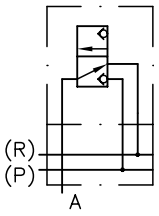


O

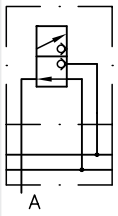


- A for VB 01VB 11 only with tapped ports G 1/4 (BSPP)

H



L



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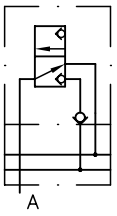
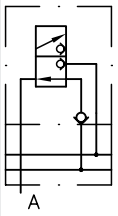
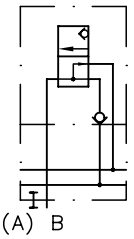


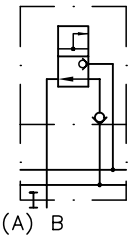
R



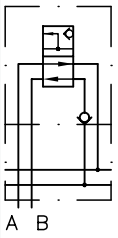
Y



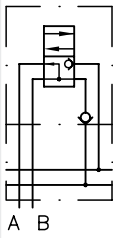
I



S

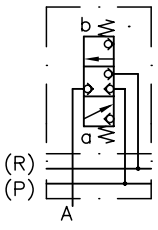


T

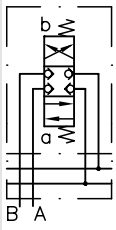


Simplified flow pattern

J, G39

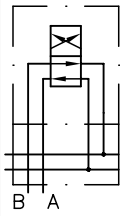


G , G49

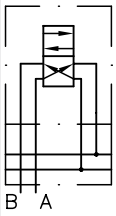


Simplified flow pattern

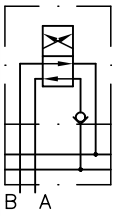
HX



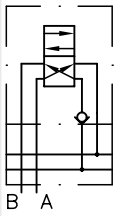
LX



NX



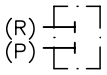
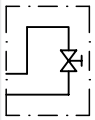
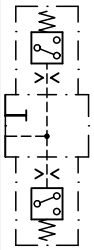
RX



Simplified flow pattern

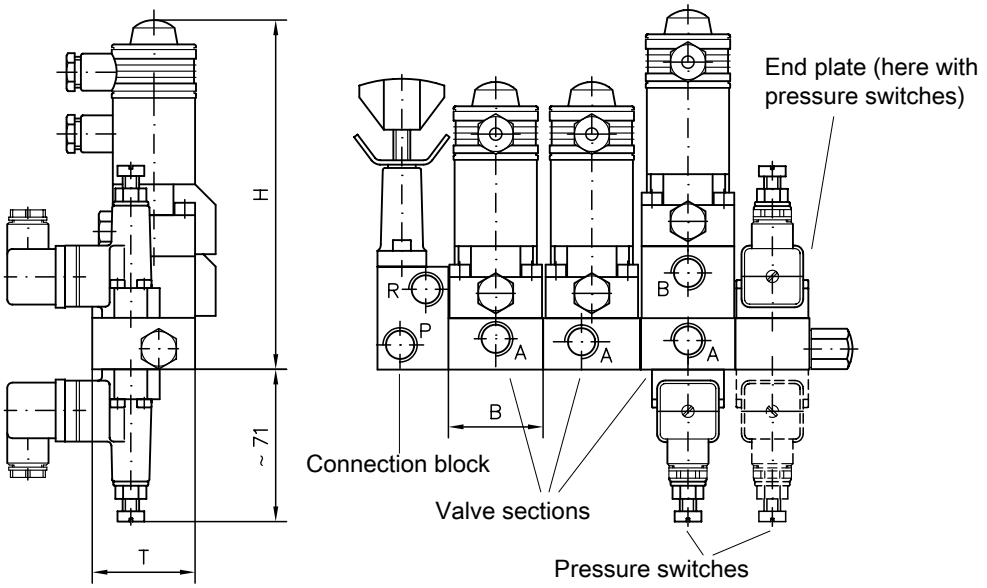
- J, G39, G49 only available for VB 21, 22
- G not available for VB 41
- HX, LX, NX, RX only available for VB 11

End plates:

	/2	/3 ... /65
		
Standard end plate	End plate with accumulator drain valve	End plates with one or two pressure switches type DG 3..

- /2, /3 ... /65 only with type VB01 and VB11

VB 01



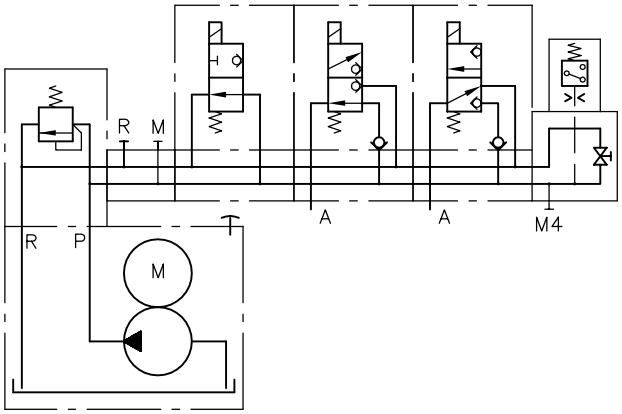
	Q_{max} [lpm]	p_{max} [bar]					Ports (BSPP)	Dimensions [mm]			m [kg]
		Solenoid	Pressure		Manual						per valve section
		M	H	P	F	D	P, R, A, B	H	B	T	
VB 01	6	300 ...- 500	-	500	-	500	G 1/4	110 ... 135	38	40	0.6 ... 1.25
VB 12	12	350 ... 500 (700)	500 ... 700		400 ... 700		G 1/4 and G 3/8	139 ... 174	46	50	1.1 ... 2.3
VB 21	25	350 ... 500 (700)	500		400 ... 500		G 3/8 and G 1/2	180 ... 220	58	63	2.0 ... 4.6
VB 22								172 ... 221	58	70	2.2 - 4.8
VB 31	65	350 ... 400	400		-	350	G 1/2 and G 3/4	202 ... 252	72	80	4.5 ... 9.1
VB 41	120	350	-		-		G 3/4 and G 1	265 ... 312	82	100	8.9 ... 14

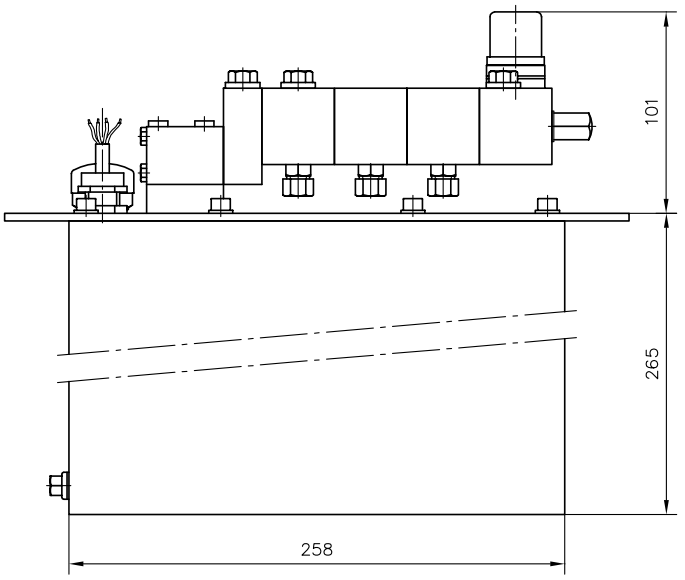
Circuit example:

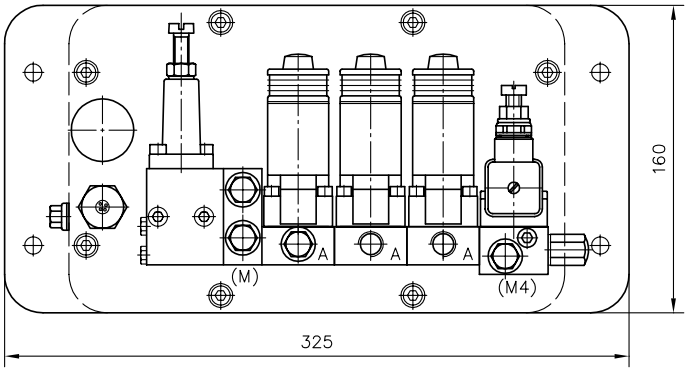
MP24A - H1,39/B5 - A1/300	- VB01FM - FRN/32 - 1 - WG230
Compact hydraulic power pack type MP size 2, connection block with pressure limiting valve (tool adjustable)	Valve bank type VB size 0 with 3 valves (actuation mode M (solenoid), solenoid voltage 230V 50/60 Hz) and end plate. Here 32 with pressure switch and drain valve

Parameters of the circuit example:

- Q_{pu} = approx. 1.39 lpm (at 1450 rpm)
- $p_{max\ pu}$ = 400 bar
- p_{system} = 300 bar (set pressure of the pressure-limiting valve)
- Tank V_{usable} = approx. 6 l, V_{total} = approx. 7.7 l







Suites compact hydraulic power packs:

- Type MP, MPN, MPNW, MPW: Page 22
- Type HC, HCW, HCG: Page 14
- Type HK, HKF, HKL: Page 26
- Type NPC: Page 12
- Type KA, KAW: Page 18
- Connection blocks type A: Page 32

Suites hydraulic power packs:

- Type R: Page 46
- Type RZ: Page 62
- Type Z: D 6820

Corresponding pamphlets (data sheets):

- Valve banks type VB: D 7302

Suited valves:

- Directional seated valves with various actuations: Page 124

Accessories:

- Pressure switches type DG 3.., DG 5 E: Page 266
- Pressure-reducing valves type CDK: Page 196

Plugs:

- With LEDs etc.: D 7163
- With economy circuit: D 7813, D 7833

See also section “Devices for special applications”:

– Devices for up to 700 bar

Seated valves

2.2 Directional seated valves type WN and WH

These directional seated valves type WN and WH use spring loaded balls as valve elements and therefore do not show any leakage. They are manifold mounting and are available in four sizes. These valves are very compact as the functional valve parts are partly integrated in the solenoid body. The basic versions are designed as 2/2- and 3/2-way directional valves. Whereas 3/3- , 4/3-way functions require two valves to be installed on one valve sub-plate.

Connection blocks can be flange-mounted to incorporate the valves into the pipe systems. Optional additional functions in the connection blocks (e.g. pressure-limiting or bypass check valve) extend the range of applications of this valve type. By combining two valves in one connection block, 3/3- and 4/3-way functions can be achieved.

The type WN (size 1 only) has a simpler design than the WH types (no moving seals and no separate solenoid discharge). Therefore the permissible operating pressure for these more cost-effective variants is lower than for the type WH.

It is possible to combine several valves connected in parallel in one valve bank (type BWN and BWH).

Nomen-clature:	**Directional seated valve, zero leakage**
Design:	**Individual valve, manifold mounting combination with connection blocks for pipe connection**
Actuation:	**Solenoid**
p_{max}:	**350 ... 450 bar**
Q_{max}:	**5 ... 60 lpm**

Features and benefits:

- Excellent price/performance ratio
- Compact design
- Directional seated valves with zero leakage
- Solenoid version with 8-watt technology

Intended applications:

- Machines for forestry and agricultural purposes
- Clamping, punching and jigs
- Clamping equipment, punching tools, jigs
- Process engineering systems

Design and order coding example

WN1 | H | 1 | - 1/4 | - G24

Solenoid voltage — 12V DC, 24V DC, 110V AC, 230V AC
- Versions with M12-plug and 8-Watt solenoid

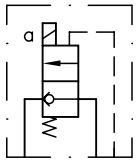
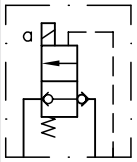
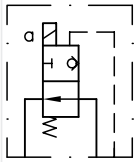
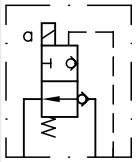
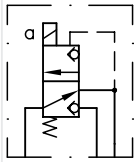
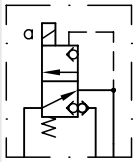
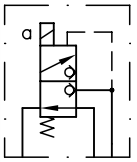
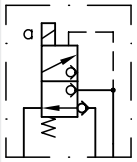
Indiv. connection block — Port size G 1/4, G 3/8, G 1/2 (BSPP)
- By-pass check valve or pressure limiting valve between P and R

Additional elements
- Return pressure stop for port R
- Check valve insert for port P
- Pressure limiting valve

Function
- 2/2-way directional valve (F, D, Q, E)
- 3/2-way directional valve (H, R, M, N)
- 3/3-way directional valve (J, U)
- 4/2-way directional valve (W)

Basic type, size — Type WN, size 1
Type WH, size 1 to 4

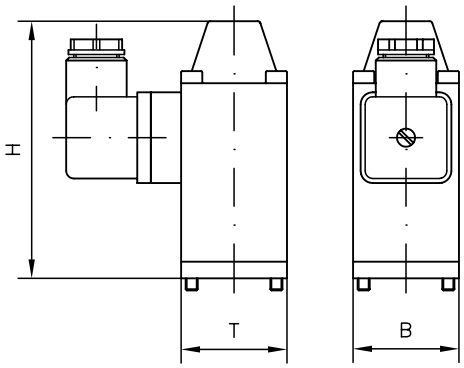
Function

D	Q	F	E	H	N	M	R
							

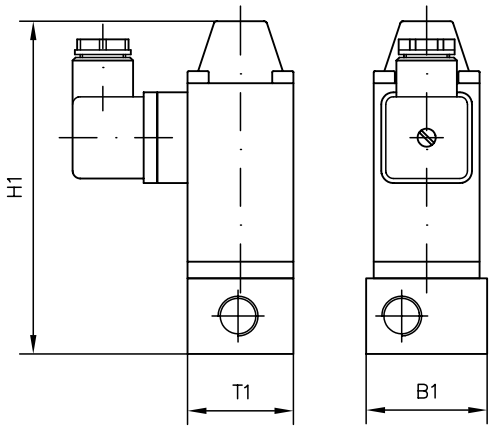
- Symbols show type WH
- Type WN 1 without de-pressuring duct for the solenoid (add. leakage duct is not necessary)

General parameters and dimensions

Individual valve



Valve with sub-plate for pipe connection



	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	Dimensions (individual valve) [mm]			m_{max} [kg]	Dimensions (with sub-plate) [mm]			m [kg]
				H	B	T		H1	B1	T1	
WN 1	5	320 ... 350	G 1/4	86.5	35	35	0.6	111.5	40	35	0.9
WH 1	8	450	G 1/4	86.5	35	35	0.6	111.5	40	35	0.9
WH 2	15	350	G 1/4	97.0	35	35	0.65 ... 0.7	125	40	40	1.0
WH 3	30	350	G 3/8	95.5	45	45	1.2 ... 1.3	128	50	50	1.8
WH 4	60	350	G 1/2	118.0	60	60	2.7 ... 3.0	158 ... 173	70	70	3.6 ... 4.0

Associated technical data sheets:

- Directional seated valves type WN1, WH: D 7470 A/1

Valve banks:

- Type BWN1, BWH: Page 138

Plugs:

- With LEDs etc.: D 7163
- With economy circuit: D 7813, D 7833

2.2 Directional seated valve bank type BWH and BWN

The valve bank types BWN and BWH consist of a connection block (with ports P and R), the directional seated valves types BWN and BWH installed on sub-plates and connected in parallel plus the end plate. The whole valve bank is held together with one tension rod.

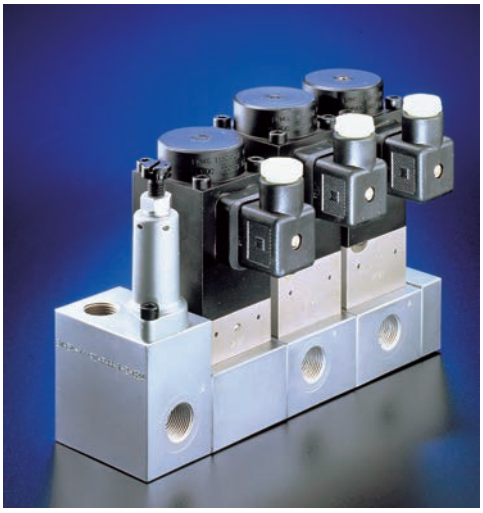
Through selection of the sub-plate, different symbols can be achieved with the individual valves, including in conjunction with additional functions (e.g. pressure switches or pressure-limiting valves in the consumer channel). These valve banks may be either directly flange-mounted to a pipe system via a connection block (with or without pressure-limiting valve) or installed directly onto hydraulic power packs (type HK, HC, MP, MPN, KA and NPC) using an adapter plate. Various end plates (e.g. with pressure switch in the P gallery or accumulator drain valve) extend the range of possible applications.

Features and benefits:

- Modular concept
- Adapter plates for flange-mounting on hydraulic power packs or combination with other valve types
- With the valve bank version, option to incorporate additional functions in the sub-plate, such as pressure-limiting valves, pressure switches etc.
- Energy-efficient solutions in connection with hydraulic accumulators

Intended applications:

- Machine tools (chipping and non-chipping)
- Rubber and plastic machinery
- Mining machinery (incl. oil production)
- Rubber and plastics machinery



Nomen-clature:	Directional seated valve, zero leakage
Design:	Valve bank ■ For pipe connection ■ Combination with hydraulic power packs
Actuation:	Solenoid
p_{max}:	350 ... 450 bar
Q_{max}:	5 ... 60 lpm

Design and order coding example

BWH2 | A-1/300 | - FH5N5 | - 1 | - 1 | - G24

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC
- Versions with M12-plug and 8-Watt solenoid

Port size G 1/4, G 3/8 (BSPP)

End plate
- With one or two pressure switches
- With accumulator drain valve
- With additional pressure limiting valve in gallery P

Valve sections
- Directional valves type WH or WN
- Valve section options:
  - Return pressure stop
  - Pressure switch for the consumer ports or for gallery P
  - Pressure limiting valves at the consumer port
  - Pressure reducing valve reducing the pressure in the downstream P gallery
- Additional sections:
  - Pressure reducing valve
  - Indiv. sub-plate with pressure switch
  - Separation plate for gallery P

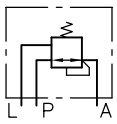
Connection block/adapter plates
- For pipe connection, with/without pressure limiting valve, manually or tool adjustable, with/without prop. pressure limiting valve
- For direct mounting at compact hydraulic power packs
- For direct mounting at hydraulic power packs
- Adapter plates for combination with directional valves type BVZP or SWR/SWP

Basic type, size Type BWN, size 1 and type BWH, size 1 to 3

Function

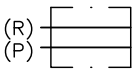
Connection blocks/adapter plates:

A-1/...



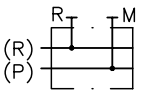
For pipe connection, with tool adjustable pressure-limiting valve (/...- pressure specification in bar)

C



For mounting onto hydraulic power packs

F

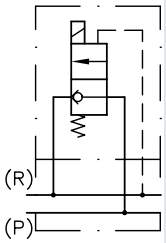


For mounting onto compact hydraulic power packs with connection block (type HK, HC, MP, MPN, KA and FP)

Valve sections:

2/2-way directional seated valves

D



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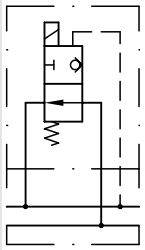

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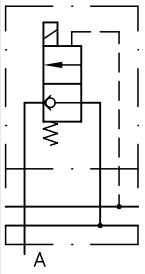

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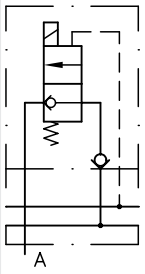

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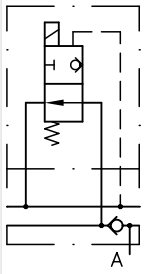

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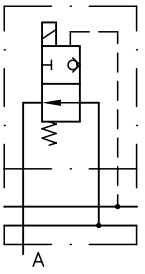

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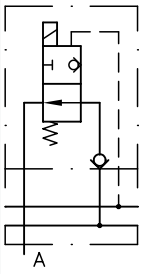

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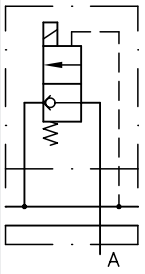

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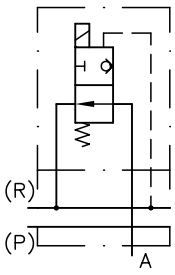

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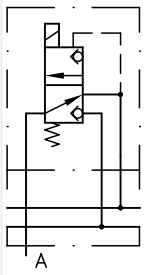

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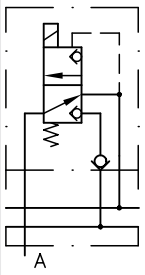

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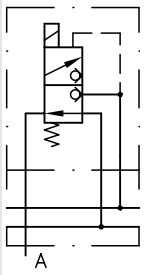

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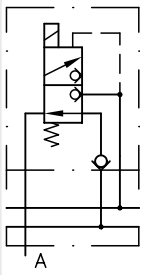

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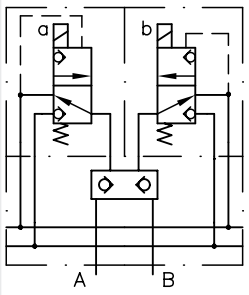

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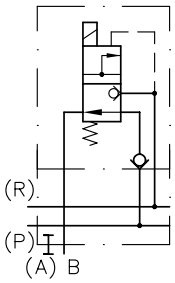

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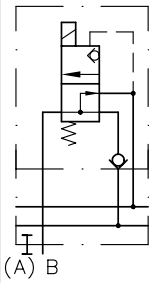

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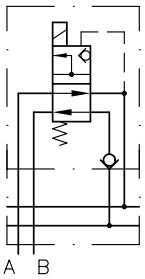
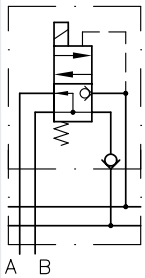
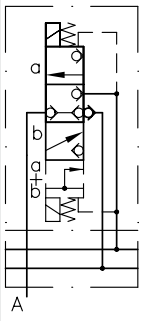


T



J



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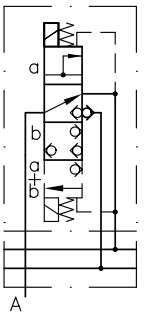

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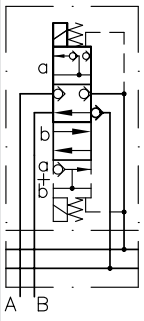
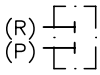
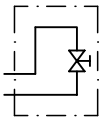
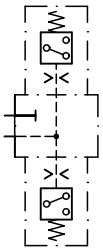


Additional options for the valve sections:

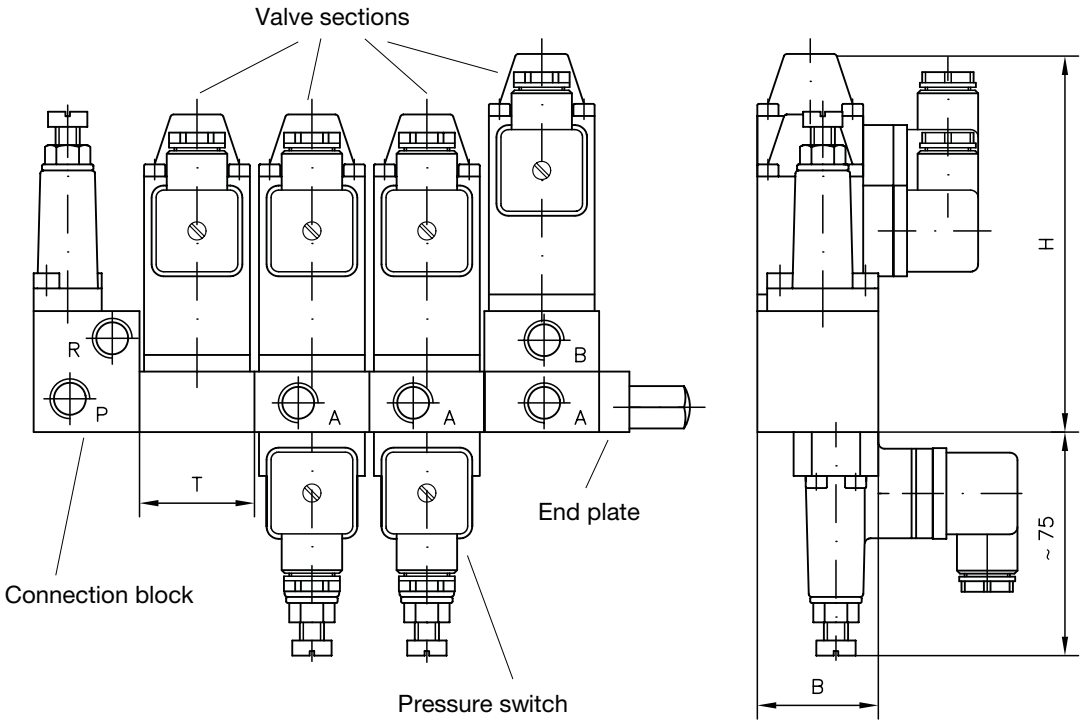
- Pressure switches in the consumer or pump channel. The pressure switches (type DG 3..) are directly flange-mounted to the sub-plate.
- Pressure-limiting valves in the consumer channel (for 3/2- or 3/3-way directional valves, for size 1). The pressure-limiting valve is directly incorporated in the sub-plate.
- Pressure-reducing valves for pressure reduction in the subsequent pump channel.

End plates:

1	2	3../3..
		
Standard end plate	End plate with accumulator drain valve	End plate with one or two pressure switches connected to the P gallery

BWH

For pipe connection:



	Q_{max} [lpm]	p_{max} [bar]	Ports P, R, A, B (BSPP)	Dimensions [mm]			m [kg]
				H	T	B	
BWN 1	5	350	G 1/4	116.5 ... 131.5	38	40	0.8 ... 0.9
BWH 1	8	450	G 1/4	116.5 ... 131.5	38	40	0.8 ... 0.9
BWH 2	15	350	G 1/4	122 ... 157.5	38	50	0.9 ... 1.1
BWH 3	30	350	G 3/8	155.5 ... 168	50	60	1.9 ... 2.4
BWH 4	60	350	G 1/2	158 ... 213	70	92	4.1 ... 6.1

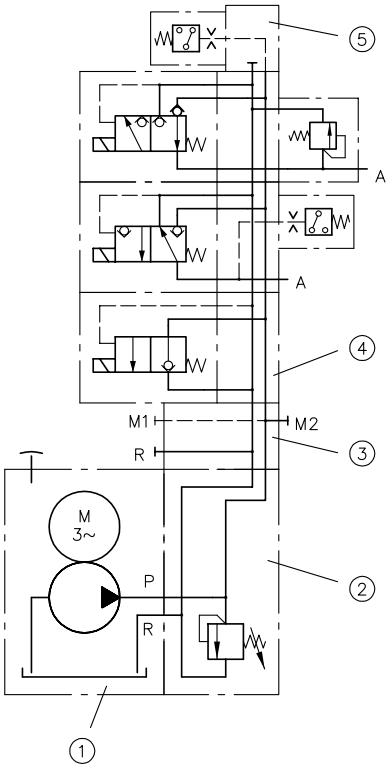
- Mass [kg] per valve section: + 0,3 kg with added pressure switch

Circuit example:

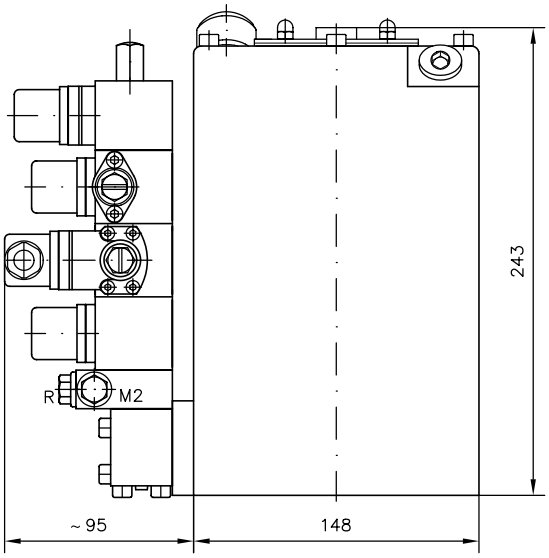
HC 24/0,64 - A2/400	- BWH1F1 - D H5 R/150 - 36 - 1 - G24
Hydraulic power pack type HC, size 2, connection block with pressure limiting valve (manually adjustable)	Valve bank type BWH, size 1 with three valve sections and end plate with pressure switch

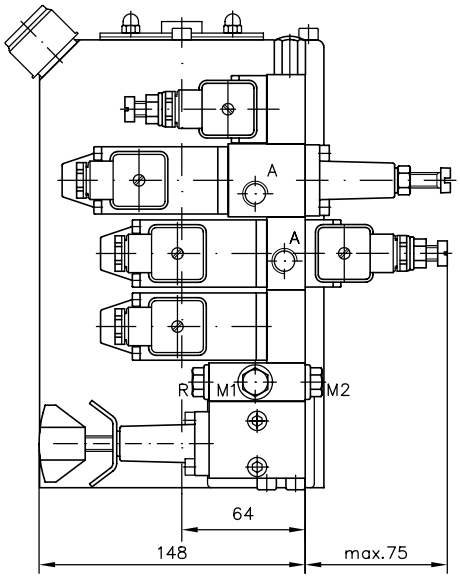
Main parameter of the circuit examplet:

- Q_{pu} = 0.64 lpm (at 1450 rpm)
- $p_{max\ pu}$ = 700 bar
- p_{system} = 400 bar (setting of the pressure limiting valve)
- V_{usable} = approx. 1.5 l



1 Compact hydraulic power pack
2 Connection block
3 Adapter plate
4 Valve section
5 End plate





Associated publications:

- Directional seated valve banks type BWN1, BWH: D 7470 B/1
- Directional seated valves type WN1, WH: D 7470 A/1

Connection block:

- Type A: Page 32

Compact hydraulic power packs:

- Type HC, HCW, HCG: Page 14
- Type HK, HKF, HKL: Page 26
- Type NPC: Page 12
- Type KA, KAW: Page 18

Hydraulic power packs:

- Type R: Page 46

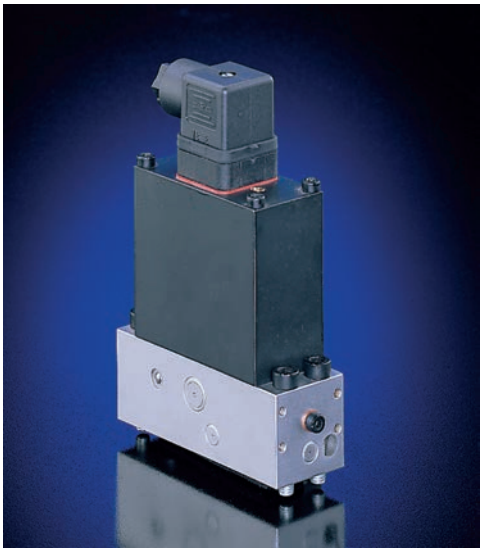
Hydraulic accessories:

- Pressure switches type DG 3.., DG 5E: Page 266
- Pressure-reducing valves type CDK: Page 196

Seated valves

2.2 Directional seated valves type VZP

These type VZP use spring-loaded balls or cones as valve elements and therefore do not show any leakage.
The twin layout of the 3/2- and 2/2-way directional seated valves means that all functional elements for valve function and actuation share one housing, making them very compact.
Depending on pairing, these valves can fulfil either one 4/4-, 4/3-, 3/3-way function or two independent 3/2- and 2/2-way functions. When compared with individual valves for manifold mounting of conventional layout, the twin design is more advantageous due to lower spatial requirements and the possibility to directly mount pressure switches for monitoring the consumer pressure. This compact design offers particular advantages in type BVZP valve banks consisting of several valves of this type connected in parallel.



Nomenclature:	Directional seated valve, zero leakage
Design:	Individual valve, manifold mounting
Actuation:	Solenoid
p_{max}:	250 ... 450 bar
Q_{max}:	5 ... 15 lpm

Features and benefits:

- Good price-performance ratio
- Max. operating pressures up to 450 bar
- Adapter plates for flange-mounting on compact hydraulic power packs
- Option to incorporate additional functions in the sub-plate, such as pressure switches, throttle and check valve combinations etc.

Intended applications:

- Machine tools (cutting and non-cutting)
- Mining machinery (incl. oil production)
- Clamping equipment, punching tools, jigs
- Rubber and plastics machinery

Design and order coding example

VZP1	H	12B1,0	- G12

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC
- Versions with M12-plug and 8-Watt solenoid

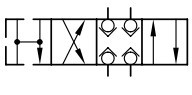
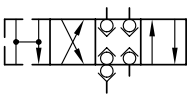
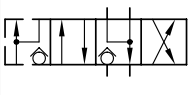
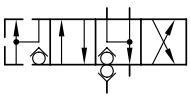
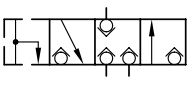
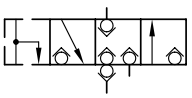
Additional elements
- Indiv. valves with check valve insert in gallery P
- Indiv. valves with return pressure stop in gallery R
- Pressure switch for the consumer ports

Function
- 4/2-way functions via directional spool valve
- 4/3-way directional seated valve (G, D, E, O)
- 3/3-way directional seated valve (J, P)
- 2/2- and 3/2-way directional seated valve (F, D - H, M, N, R)

Basic type, size Twin valve type VZP, size 1
- Connection blocks for pipe connection

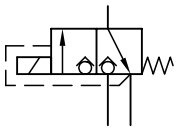
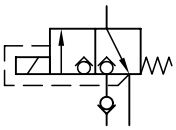
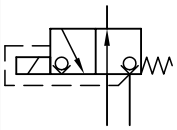
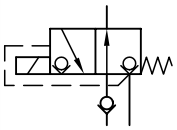
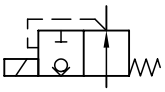
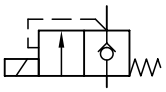
Function

Cone seated valves with 4/3- (4/4-) or 3/3- (3/4-) way functions up to 400 bar

E	G	D	O	P	J
					

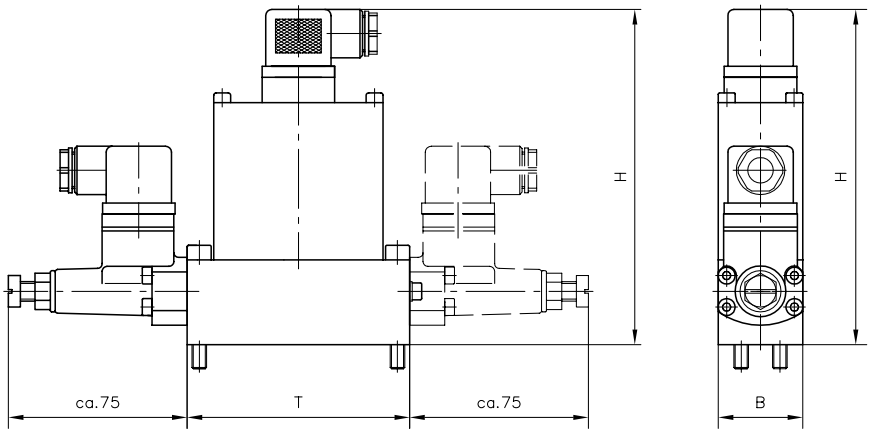
- The 4. shifting position illustrates mode, when both solenoids are energized

Ball seated valves with 3/2- (2/2-) way functions up to 450 bar (always two valve functions in one valve body)

H	N	M	R	F	C
					

General parameters and dimensions

VZP 1 (example with mounted pressure switches)



	Q_{max} [lpm]	p_{max} [bar]	Dimensions [mm]			m [kg]
			H	B	T	
VZP 1	5... 15	250... 450	137... 142	35... 39	92	1.9... 2.2

- Weight m [kg] +0.3 kg per mounted pressure switch

Associated technical data sheets:

- Directional seated valves type VZP: D 7785 A

Valve banks:

- Type BVZP: Page 146

Accessories:

- Pressure switches type DG 3.., DG 5E: Page 266

Plugs:

- With LEDs or to support the EMV etc.: D 7163

2.2 Directional seated valve bank type BVZP

The valve bank type BVZP consist of a connection block (with ports P and R), the directional seated valves type VZP installed on sub-plates and connected in parallel plus the end plate. The whole valve bank is held together with two tension rods. Depending on the type, the sub-plate feature optional functions e.g. restrictor check valves and/or pressure reduction valves covering only the corresponding valve section. Connection blocks with or without pressure-limiting valve can be mounted for pipe connection. Combination with hydraulic power packs (type HK, HC, MP, MPN and KA) and other directional valve types is achieved using appropriate adapter plates. Various end plates (e.g. with and without pressure switch in the P gallery) extend the range of possible applications. Particularly in conjunction with hydraulic power packs, the compact design enables complete hydraulic control systems with low spatial requirements to be achieved.

Features and benefits:

- Excellent price/performance ratio
- Max. operating pressure 450 bar
- Adapter plates for flange-mounting on compact hydraulic power packs
- Option to incorporate additional functions in the sub-plate, such as pressure switches, throttle and check valve combinations etc.

Intended applications:

- Machine tools (chipping and non-chipping)
- Mining (incl. oil production)
- Clamping equipment, punching tools, jigs
- Rubber and plastics machinery

Nomen-clature:	**Directional seated valve, zero leakage**
Desing:	**Valve bank** ■ **For pipe connection** ■ **Combination with hydraulic power packs**
Actuation:	**Solenoid**
p_{max}:	**450 bar**
Q_{max}:	**15 lpm**

Design and order coding example

BVZP1 | **A-1/400** | **- G33/22** | **- 1** | **- 1** | **- G24**

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC
- Versions with M12-plug and 8-Watt solenoid

Port size G 1/4 (BSPP)

End plate
- With/without pressure switch or prepared for retro-fitting of a pressure switches
- Adapter plates for adding other valve banks (type BWN(H)1/BWH 2)

Valve sections
- 4/2-way functions via directional spool valve
- 4/3-way directional seated valve (G, D, E, O)
- 3/3-way directional seated valve (J, P)
- 2/2- and 3/2-way directional seated valve (F, D - H, M, N, R)
- Pressure reducing valve for gallery P

Additional elements
- Pressure switch in consumer port
- Pressure-reducing valve in the consumer port

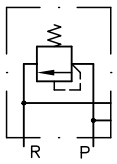
Connection block/adapter plates
- For pipe connection
  - Pressure limiting valve (manually of tool adjustable)
  - Drain valve (for discharging the accumulator)
  - Pressure switch
- For direct mounting at compact hydraulic power packs with connection block with/ without prop. 3-way flow controller and optional pre-load valve in gallery R

Basic type, size Type BVZP, size 1

Function

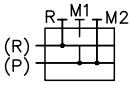
Connection blocks:

A 1



For pipe connection, with tool adjustable pressure limiting valve (/...- pressure specification in bar)

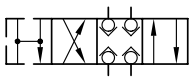
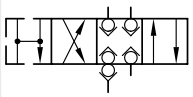
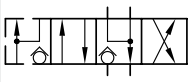
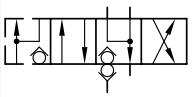
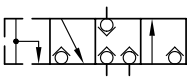
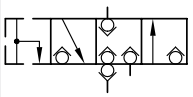
F



For direct mounting onto hydraulic power packs with connection block (type KA, HC, MP, MPN and HK), prepared for retrofitting of one or two pressure switches connected to gallery P

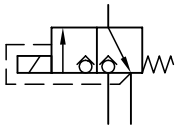
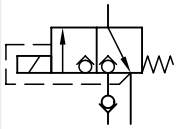
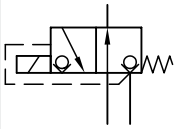
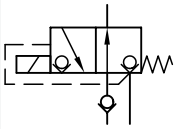
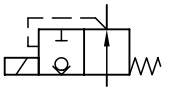
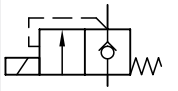
Valve sections:

Cone seated valves with 4/3- or 3/3-way function up to 400 bar

E	G	D	O	P	J
					

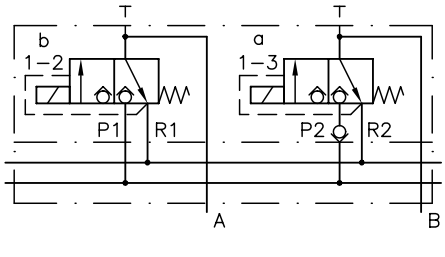
- The 4. shifting position illustrates mode when both solenoids are energized

Ball seated valves with 3/2- or 2/2-way function up to 450 bar

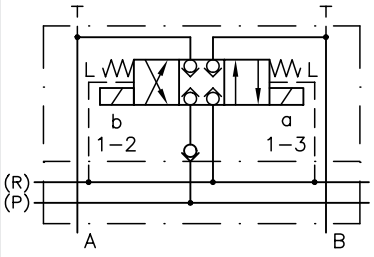
H	N	M	R	F	C
					

Valve sections

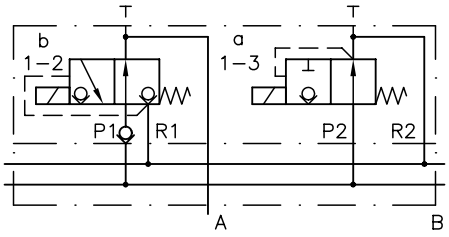
Example: -G22/0



Example: -H2N2/0



Example: -R2F2/0



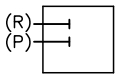
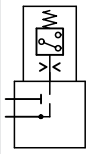
Options for the valve section:

- Sub-plate with throttle and restrictor check valves in the consumer port
- Valve section with 4/2-way function, directional spool valve
- Pressure reducing valve reducing the pressure for one valve section only (connected in parallel)
- Pressure reducing valve reducing the pressure for all subsequent valves (connected in series)
- Pressure reducing valve with orifice/throttle and by-pass check valve in the consumer port

Additional versions:

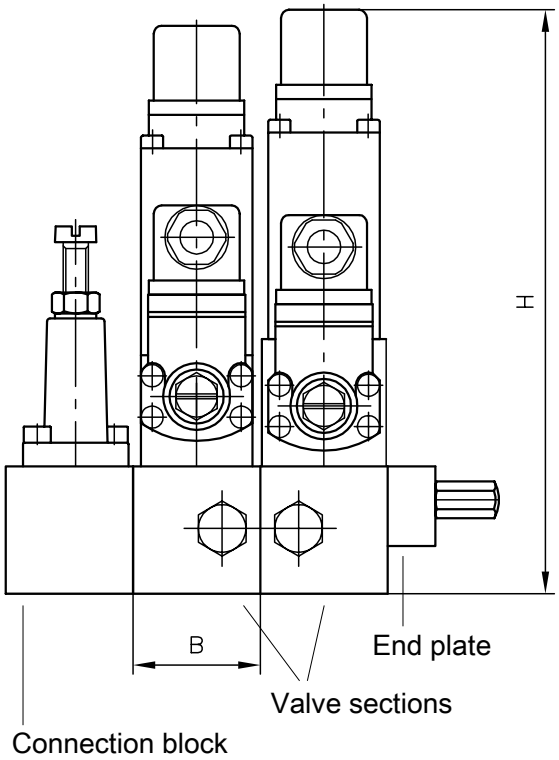
- Individual valve with orifice in the gallery P and/or return pressure stop in the return gallery
- Individual valve type WH with sub-plate, may be integrated in a valve bank
- Sub-plate for 4/3-way valves with ancillary blocks at the consumer side featuring a pressure reducing valve with tracked pressure switch and throttles

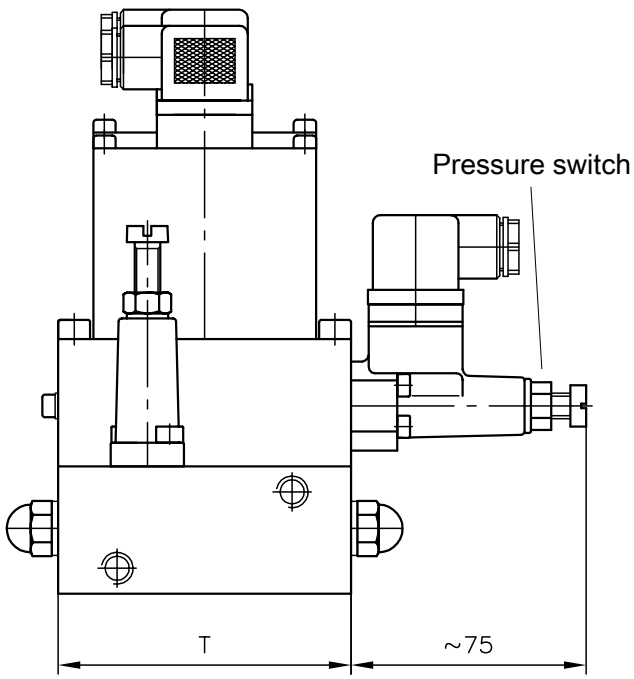
End plates:

1	32	33 to 37
		
Standard end plate	End plate prepared for retrofitting of a pressure switch type DG 3..	End plate with pressure switch type DG 3..

BVZP 1

Example: BVZP1 A-1/200 - G 52/22 - R5 M2/0 - 1 - 1 - G24





	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	Dimensions [mm]			m [kg]
			A, B, P, R, M	H	B	T	Valve section
BVZP 1	15	450	G 1/4	max. 182	40	92	2.9 - 3.2

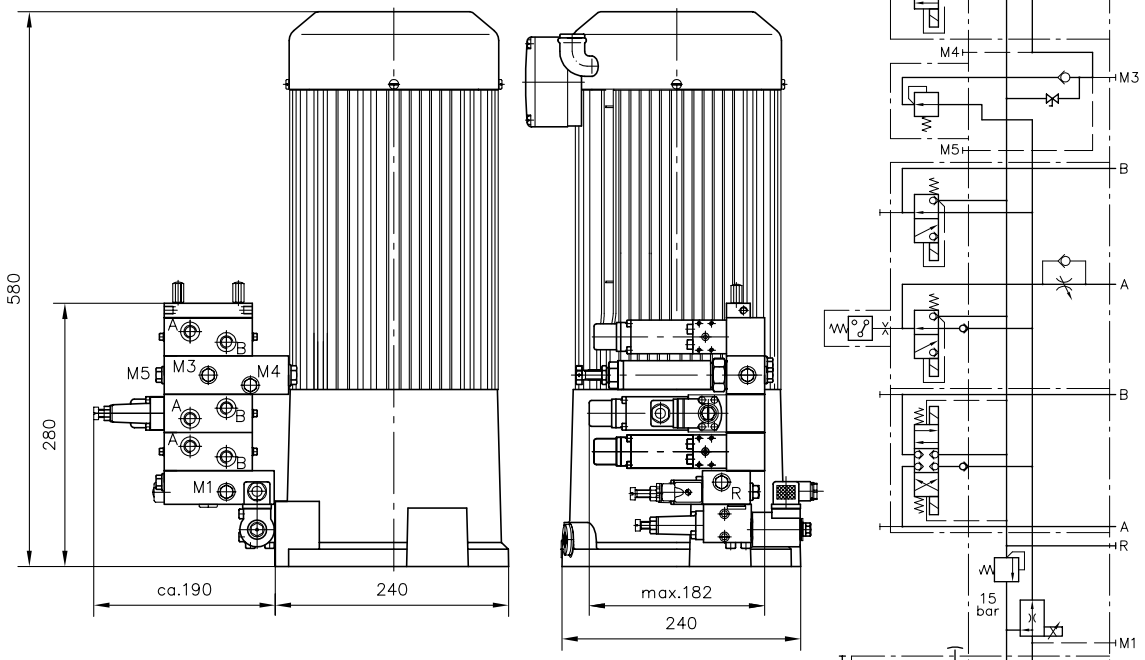
- m [kg]: + 0.3 per mounted pressure switch

Circuit example:

HK 448/1 - H7,0 - AS1/150	BVZP1 FEH10F V15/G12 - G22/0 - R5 M2/20 - CZ5/80/5R - H12 H12/0 - 1 - 1 - G24
Hydraulic power pack type HK, size 4; connection block with integrated idle circulation valve and pressure limiting valve	Valve bank type BVZP with 5 individually controlled valve functions housed in 3 valve sections, two functions are supplied with reduced pressure (pressure reducing valve section). The flow can be arbitrarily adjusted via a prop. flow control valve

Main parameter of the circuit example:

- Q_{pu} = 7.0 lpm (at 1450 rpm)
- $p_{max\ pu}$ = 215 bar
- p_{system} = 150 bar (setting of the pressure limiting valve)
- V_{consum} = approx. 3.7 l



Associated technical data sheets:

- Valve banks type BVZP: D 7785 B

Products:

- Directional seated valves type VZP1: Page 144
- Valve banks type BWN1, BWH: Page 138
- Pressure-reducing valves type CDK and DK: Page 196
- Slot-type throttles type Q, QR, QV: Page 232

Accessories:

- Pressure switches type DG 3.., DG 5E: Page 266

Plugs:

- With LEDs or to support the EMV or with economy circuit etc.: D 7163

Directional seated valves

2.2 2/2-way directional seated valve cartridges type EM, EMP and EMC

These 2/2-way ball seated directional valves are either directly or pilot actuated by a solenoid. With the directly actuated version the valve passage is opened or closed by a cone whereas with the piloted a piloting duct of a stepped piston is opened or closed generating a pressure difference at the opposing facial areas of the piston forcing it in the open or closed position. Type EMP is a proportional valve, acting like a throttle but with zero leakage in blocked position. The dampened version will increase the switching time for on/off controls (hydraulic ramp). The wet armature solenoids for the valve actuation are pressure resistant, where all moving internal parts are flushed by oil. There is a wide range of connection blocks either for pipe connection or for banjo bolt mounting, which may feature optional elements such as drain valve, by-pass throttle, pressure switch, 2-way flow control valve etc.

Features and benefits:

- Zero leakage in blocked state
- Directly switching up to approx. 3 lpm and piloted up to 160 lpm
- Minimized back pressure even at high flows
- Long service life due to hardened valve seats

Intended applications:

- Cranes and lifting equipment
- Road construction industry
- Materials handling, industrial trucks etc.
- Handling and assembly robots, etc.

Nomen-clature:	Directional seated valve, zero leakage
Design:	Screw-in valve Combination Combination with connection block for pipe connection Combination with connection block for swivel fitting Combination with connection block for manifold mounting
Actuation:	Solenoid
p_{max}:	450 bar
Q_{max}:	1 ... 160 lpm

Design and order coding example

EM 21 | V | - 3/8 | - G24

Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC

Versions with

- Versions with M12-plug and 8-Watt solenoid
- Quarter-turn plug, plugs of Co. KOSTAL or AMP

Connection blocks

Versions with

- Drain valve
- Drain valve and drop-rate braking valve
- Drain valve and by-pass check valve
- Bypass- throttle
- Pressure switch
- 2-way flow controller

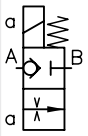
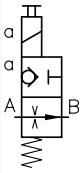
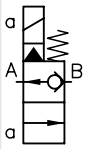
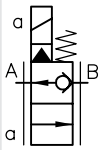
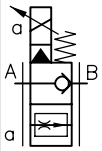
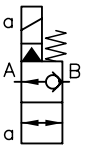
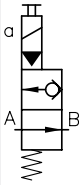
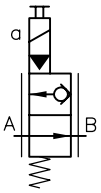
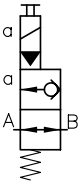
Function

- V - 2/2-way valve (NC-type)
- S - 2/2-way valve (NO-type)

Basic type, size

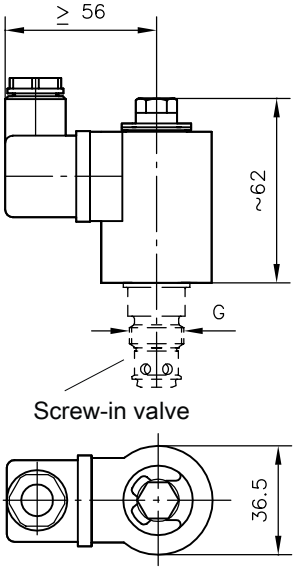
- Type EM: ON/OFF-valve, size 1 to 4
- Type EMP: Prop. valve, size 1 to 4
- Type EMC: proportional valve, load compensated, size 3

Function

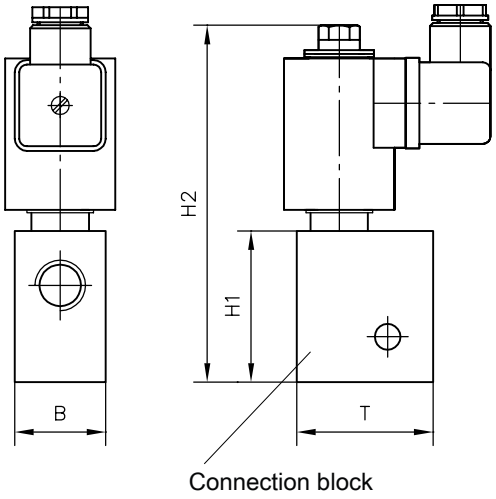
	Flow in arrowed direction			Arbitrary flow direction	Flow in arrowed direction		Arbitrary flow direction
	Energized open				**Energized closed**		
Directly actuated	EM .1 D 				EM .1 DS 		
Pilot actuated	EM .1 V 	EMP .1 V 	EMC .31 V 	EM .2 V 	EM .1 S 	EMP .1 S 	EM .2 S 

General parameters and dimensions

Screw-in valve



Valve compl. with connection block for pipe connection

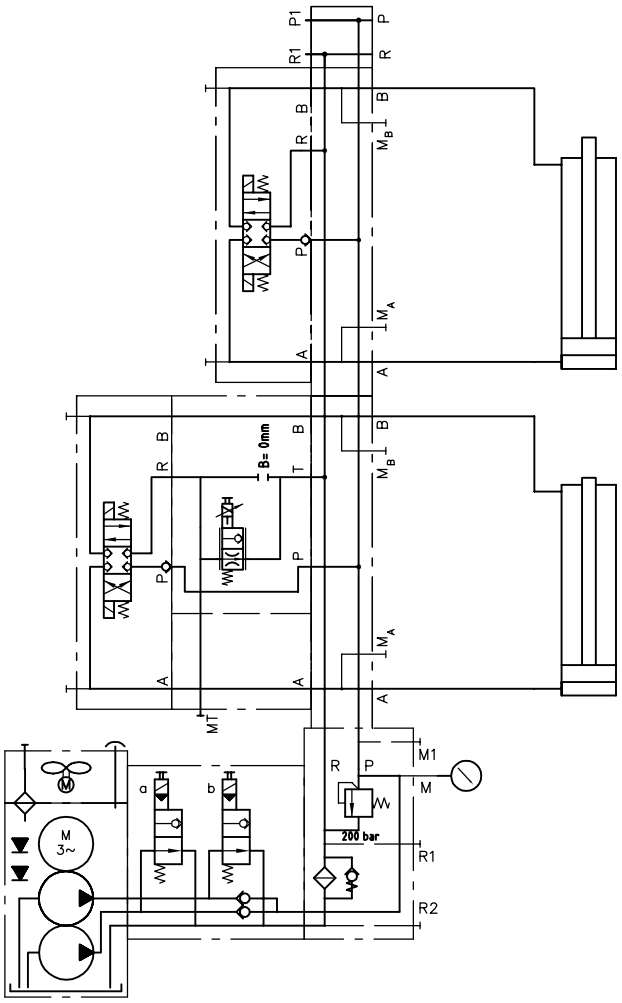


			Screw-in valve		Valve with connection block					
	Q_{max} [lpm]	p_{max} [bar]	G	m [kg]	Ports (BSPP)	Dimensions [mm]				m [kg]
						H1	H2	B	T	
EM 11 (D, DS)	5	450	M 14 x 1.5	0.3	G 1/4	40	approx. 120	20	35	0.6
EM 21 (D, DS)	3	400	M 18 x 1.5	0.35	G 1/4	50	approx. 120	30	45	0.7
EM 1.. (V, S)	20	450	M 14 x 1.5	0.3	G 1/4	40	approx. 120	20	35	0.6
					G 3/8			25	45	
EM/EMP 2.. (V, S)	40	400	M 18 x 1.5	0.35	G 3/8	50	approx. 120	30	45	0.7
					G 1/2				50	
EM/EMP 3.. (V, S)	80	400	M 18 x 1.5	0.4	G 1/2	60	approx. 133	40	55	1.0
					G 3/4				60	
EM/EMP 4.. (V, S)	160	400	M 33 x 2	0.6	G 3/4	70	approx. 150	40	65	1.2
					G 1			50	70	

- Pressure above 300 bar only with manifolds made of steel. Pay attention to the possibly reduced rigidity of the thread with other materials (e.g. iron, light alloy).

Example circuit:

KA 442 LFK/HH 13.1/13.1
-SS-A 1 F 3/200
-BA 2
-NBVP 16 G/R-GM/NZP 16 TSPG/TB 0/3
-NBVP 16 G/R-GM/3
-2-G 24
-X 84 G-9/250
-3 x 400/230V 50 Hz-4.0 kW/24V DC



Suitable products:

- Intermediate plates NG 6 type NZP: D 7788 Z
- Connection blocks type HMPL and HMPV: Page 104
- Lifting/lowering valves type HSV: Page 162
- Lifting modules type HST, HMT etc.: Page 166

Associated technical data sheets:

- Directional seated valves type EM, EMP: D 7490/1, D 7490/1E

Accessories:

- Pressure switches type DG 3.., DG 5E: Page 266
- Drop rate braking valve type SB, SQ, SJ: Page 222
- Suitable prop. amplifier type EV1M2 (module), EV1G1 (module) and EV1D (module): Page 276

Plugs:

- With LED etc.: D 7163
- With economy circuit: D 7813, D 7833

See also section "Devices for special applications"

– Screw-in valves and installation kits

Seated valves

2.2 Directional seated valves type BVG, BVE, BVP and NBVP

The group of directional seated valves type BVG, BVE and BVP includes 2/2- and 3/2-way directional valves in two sizes. Size 1 valves feature a version with standard connection diagram NG 6 (type NBVP) and a version with 4/3-way function. They are designed as zero-leakage, cone seated valves. All ports are equally pressure-resistant due to an internal static pressure balance. The valves can be connected via pipes (type BVG), screwed onto self-manufactured base plates (type BVP) and industrial standard connection plates (type NBVP)or screwed into self-manufactured valve blocks as a screw-in valve (type BVE). The various actuation modes (type BVE with solenoid actuation only) enable use of these valves in a wide range of applications. Additional elements for ports P, R, A and B (e.g. orifices, check valves and restrictor check valves) can be incorporated in the valve block to tailor the range of possible applications to the special requirements of the customer.

Features and benefits:

- Zero-leakage, cone seated construction
- Pressure switch can be directly mounted
- Complete system solution with compact hydraulic power packs made from the modular system
- ATEX-compliant version

Intended applications:

- Machine tools
- Woodworking and processing machinery
- Testing machinery
- Jig construction

Nomen-clature:	**Directional seated valve, zero leakage**
Design:	**Individual valve for pipe connection Individual valve, Manifold mounting**
Actuation:	**Solenoid Hydraulic Pneumatic Manual**
p_{max}:	**400 bar**
Q_{max}:	**20... 300 lpm**

Design and order coding example

BVG1 - R /B2 - 1/4 - WGM 230

Actuations: Solenoid, hydraulic, pneumatic, manual

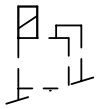
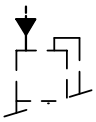
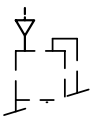
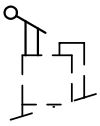
Connection size or connection block

Additional elements
- Orifice in one port
- NBVP: orifice and/or check valve in the P gallery, orifice, restrictor check valve and/or pressure switches in port A, B, return pressure stop in T

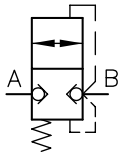
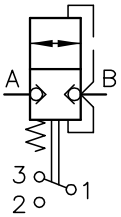
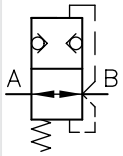
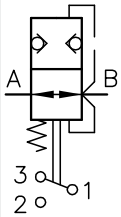
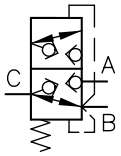
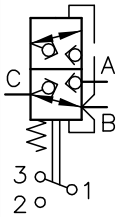
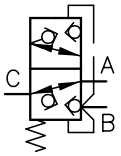
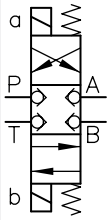
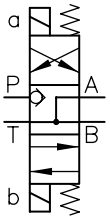
Function
- 2/2-way directional valve (R, S), also available in version with lift monitoring (RK, SK)
- 3/2-way directional valve (Z, Y), also available in version with lift monitoring (ZK)
- 4/3-way directional valve (G, D)

Basic type, size
Type BVG and BVP, size 1 and 3
Type BVE, size 1, 3 and 5
Type NBVP (with standard connection diagram NG 6), size 1

Actuations:

Solenoid	Hydraulic	Pneumatic	Manual
			
Solenoid voltages: 12V DC, 24V DC, 110V AC, 230V AC ■ BVP 1, NBVP16 also available in ATEX-compliant version ■ Version with M12 plug and 8-watt solenoid	Control pressure: $p_{contr.\ min}$ = 24 bar $p_{contr\ max}$ = 320 bar	Control pressure: $p_{contr.\ min}$ = 2... 3.5 bar $p_{contr.\ max}$ = 15 bar	Actuation torque: approx. 1.5... 3 Nm

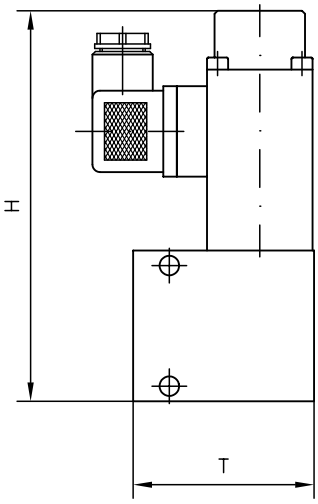
Function

R	RK	S	SK	Z	ZK	Y	G	D
								

- Additional flow pattern symbols available
- **G, D:** only type NBVP16

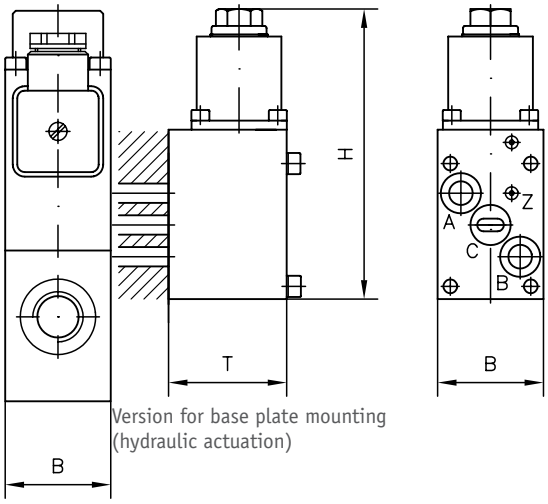
General parameters and dimensions

BVG



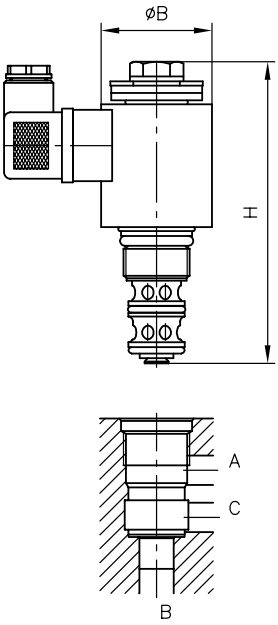
Version for pipe connection
(solenoid actuation)

BVP, NBVP



Version for base plate mounting
(hydraulic actuation)

BVE



	Q_{max}[lpm]	p_{max}[bar]	Ports (BSPP)	Dimensions [mm]			m_{max} [kg]
			A, B, C	H_{max}	B_{max}	T_{max}	
BVG 1	20	400/250[1)]	G 1/4, G 3/8	115 (130)	60	40	1.6
BVP 1					35	39	1.0
NBVP 16	20	400/250[1)]	NG 6	230	45	45	2.1
BVG 3	50	320	G 1/2	145	80	50	3.3
BVP 3				155	50	76	2.4
BVE 1	20	500	-	121	37	-	0.4
BVE 3	70	400		122.5	45	-	0.7
BVE 5	300	400	-	206.5	72	-	1.5

[1)] with solenoid actuation GM.. and WGM
- BVE: screw-in valve, also available with connection block for pipe connection

Associated technical data sheets:
Directional seated valves
- Type BVG, BVP: D 7400
- Type BVG1, BVP1: D 7765
- Type BVE: D 7921
- Type NBVP: D 7765 N

Products:
- Type BA: Page 34
- Type NZP: Page 34
- Type BVH: Page 40

Plugs:
- With LED etc.: D 7163
- With economy circuit: D 7813, D 7833

Seated valves

2.2 Directional seated valves type VP

Type VP 1 valves are designed as zero-leakage, cone-seated valves and can be used as 2/2-, 3/2- and 4/2-way directional valves. The internal pressure balance enables free selection of the flow direction and maximum pressure resistance of all ports. Due to the air-switching actuation, there is no risk of interaction between actuation elements and the medium used. No sticking or resinification as a result of increased temperatures is possible.

The preferred area of application is hydraulic lubrication systems that use high-viscosity grease or oils. Other fluids in the relevant viscosity range can also be considered provided they have the appropriate seal compatibility.

Features and benefits:

- Freely selectable flow direction
- No interaction between actuation elements and medium
- No sticking or resinification as a result of increased temperatures is possible.

Intended applications:

- Lubricating systems
- Mining machinery
- Construction and construction materials machinery
- Handling and assembly technology

Nomenclature:	**Directional seated valve, zero leakage**
Design:	**Manifold mounting**
Actuation:	**Solenoid Hydraulic Pneumatic**
p_{max}:	**400 bar**
Q_{max}:	**15 lpm**

Design and order coding example

VP1 - R - 3/4 - G24

Actuation
- Solenoid
- Mechanical: roller, feeler
- Manual: lever, turn-knob

Optional connection block For direct pipe connection

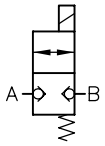
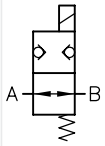
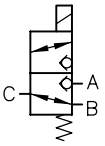
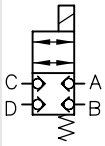
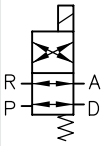
Function
2/2-way directional seated valve (R, S)
3/2-way directional seated valve (Z)
4/2-way directional seated valve (W, G)

Basic type, size Type VP, size 1
- Versions conforming ATEX

Actuation:

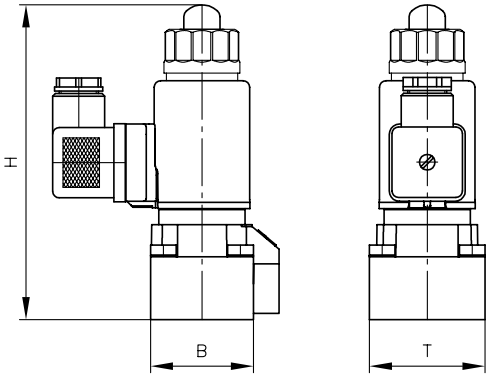
Solenoid	Hydraulic	Pneumatic
		
Solenoid voltage: 12V DC; 24V DC; 110V AC, 230V AC	Control pressure: $p_{control\ min}$ = 24 bar $p_{control\ max}$ = 320 bar	Control pressure: $p_{control\ min}$ = 2 ... 3.5 bar $p_{control\ max}$ = 15 bar

Function

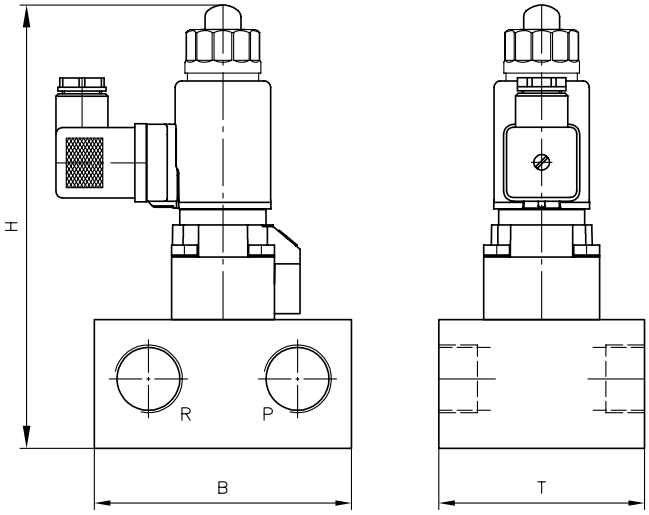
R	S	Z	G	W
				

General parameters and dimensions

Individual valve
Example: VP1R-G24



Valve with sub-plate
Example: VP1W-3/4-WG 230



	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	Dimensions [mm]			m_{max} [kg]
			A, B, C	H_{max}	B_{max}	T_{max}	
VP 1	15	400	G 1/4, G 3/8, G 3/4	127	40	50	1.0
VP 1 with sub-plate				147 ... 177	50 ... 100	45 ... 80	1.5 ... 2.2

- H_{max}: Figures apply to solenoid actuation

Associated technical data sheets:

- Directional seated valves type VP: D 7915

Similar products:

- Directional seated valves type BVG1, BVP1, BVE, NBVP16: Page 156

Plugs:

- With LEDs or to support the EMV etc.: D 7163
- With economy circuit: D 7813, D 7833

Seated valves

2.2 Lifting/lowering valves type HSV

The lifting/lowering valves type HSV are preferentially used for controlling lifting equipment with single-acting cylinders. The valve block combines the functions of a 2/2-way directional seated valve with solenoid actuation for lowering the raised load. It is optionally available with an adjustable throttle to limit the lowering speed or a 2-way flow control valve to guarantee the lowering speed is as load-independent as possible. A pressure-limiting valve is incorporated to limit the permissible load. An additionally installed check valve prevents uncontrolled lowering of the load. Flange-mounting on self-manufactured connection plates is possible.

Features and benefits:

- Optimal control of lifting and lowering function
- High pressures up to 400 bar
- Zero leakage to prevent unwanted lowering of loads and platforms
- Integrated overpressure protection

Intended applications:

- Cranes and lifting equipment
- Materials handling
- Road vehicle construction
- Mining machinery

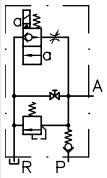
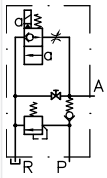
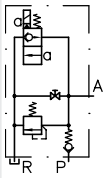
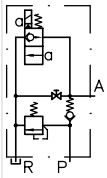
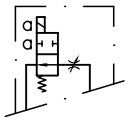
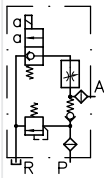
Nomen-clature:	**Valve combination consisting of:** ■ 2/2-way directional seated valve, solenoid actuated ■ Pressure-limiting valve ■ Check valve optional ■ Throttle or 2-way flow control valve
Design:	**Individual valve for pipe connection**
Actuation:	**Solenoid**
p_{max}:	**315 ... 400 bar**
Q_{max}:	**20 ... 120 lpm**

Design and order coding example

HSV41 - R1 - R-150 - G24

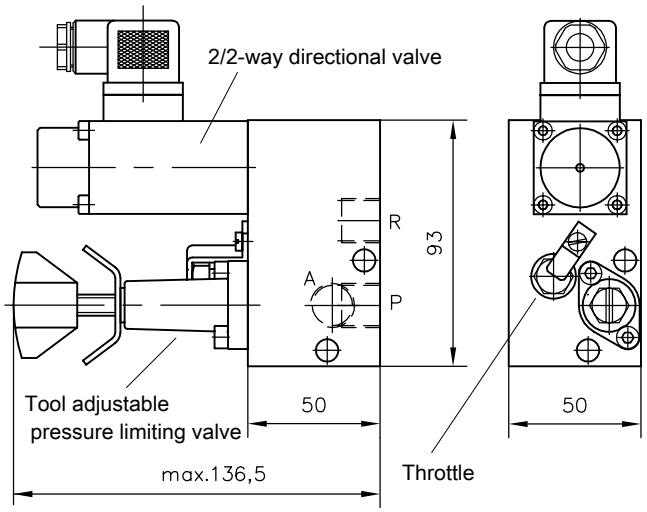
- **Solenoid voltage** — 12V DC, 24V DC, 110V AC, 230V AC; HSV 21 and HSV 22 version conforming ATEX
- **Pressure limiting valve** — Manually or tool adjustable, pressure setting in bar
- **Function**
- **Basic type, size** — Type HSV, size 2, 4, 6 and 7

Function

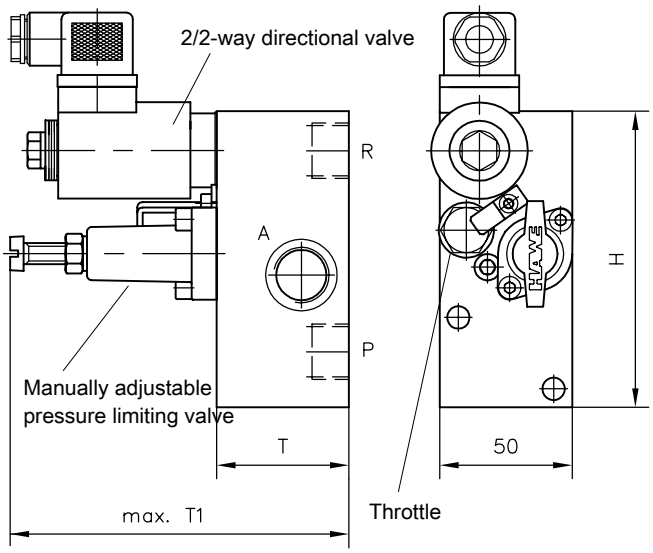
	With throttle		Without throttle		With/without throttle	With 2-way flow control valve
	R 1	R 2	R 3	R 4	S 1 ... S 4	R 6
HSV 21 HSV 22 HSV 41 HSV 61 HSV 71						

General parameters and dimensions

HSV 21 and HSV 22



HSV 41 and HSV 71



	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)		Dimensions [mm]			m [kg]
			P	A, R	H	T	T1	
HSV 21	20	315	G 3/8	G 3/8	see illustration			2.2
HSV 22	30	315	G 3/8	G 1/2	see illustration			2.2
HSV 41	40	400	G 1/2	G 1/2	112	50	140	2.2
HSV 61	60	350	G 1/2	G 1/2	100	63	166.5	2.5
HSV 71	120	315	G 3/4	G 3/4	100	80	160	3.1

Associated technical data sheets:

- Lifting/lowering valves type HSV, HZV: D 7032

Plugs:

- With LEDs or to support the EMV etc.: D 7163
- With economy circuit: D 7813, D 7833

2.2 Switch units (press control valves) type CR

The switch units type CR, available in three sizes, are intended for the control of bottom and top ram presses, which are driven by dual stage pumps. They consist of a 2/2-way ball seated directional valve, a ball type check valve and pressure valves. Low pressure and high pressure circuit are joined during rapid transverse, as soon as the set pressure is achieved or exceeded the low pressure circuit is switched in idle circulation mode, whereas the high pressure circuit continues feeding the press cylinder. An automatic pre-release ensures decompression without pressure surges. These switch units are designed for direct mounting onto our hydraulic power packs type MP and RZ.

Features and benefits:

- Optimized for the controls of bottom ram presses
- Smooth, gentle switching
- No pressure drop during press operation due to zero leakage
- Fully automatic switching of the low-pressure pump to circulation

Intended applications:

- Machine tools (presses)
- Woodworking and processing machinery
- Printing and paper technology
- Foodstuff and packaging machinery

Nomen-clature:	**Valve combination consisting of:** ■ 2/2-directional seated valve ■ Ball-type check valve ■ Pressure valve
Design:	**Individual valve for pipe connection**
Actuation:	**Solenoid** **Manual**
p_{max}:	**HP 400 bar** **LP 30 ... 60 bar**
Q_{max}:	**HP 8 ... 20 lpm** **LP 80 ... 160 lpm** **A → R 160 ... 300 lpm**

Design and order coding example

CR4 **M-WG230** **- 400/60**

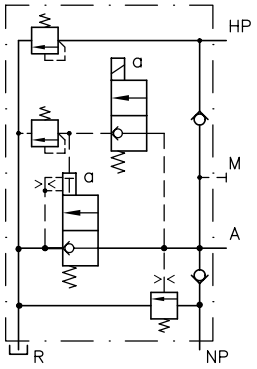
Pressure settings [bar] High-/low pressure

Actuation mode
- Solenoid
  Voltage of the actuation solenoids 24V DC, 230V AC 50/60 Hz
- Manually

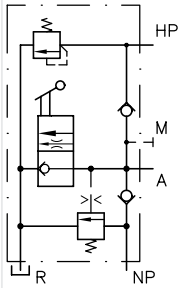
Basic type, size Type CR, size 4 and 5

Function

CR 4M and CR 5M

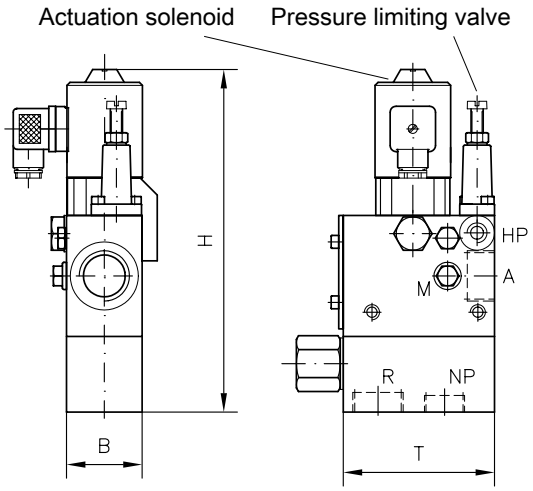


CR 4H

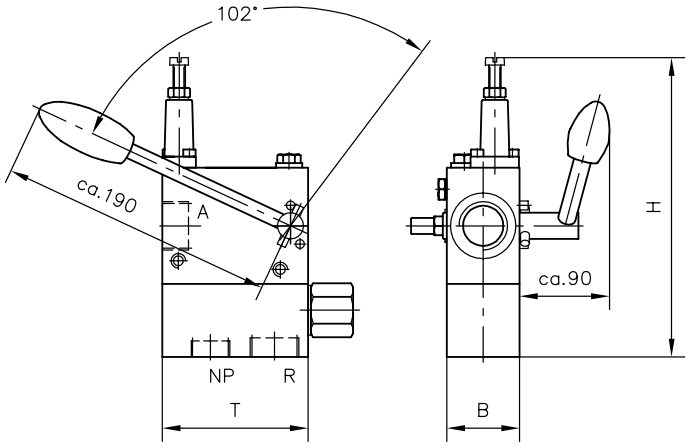


General parameters and dimensions

CR 4M



CR 4H



	Q_{max} [lpm]			p_{max} [bar]		Ports (BSPP)				Dimensions [mm]			m [kg]
	HP	NP	A→R	HP	NP	A and R	HP	NP	M	H	B	T	
CR 4M	8	80	200	400	30 ... 60	G 1	G 1/4	G 3/4	G 1/4	max. 247.5	50	100	5.2
CR 4H	8	80	200	400	30 ... 60	G 1	G 1/4	G 3/4	G 1/4	max. 202	50	100	4.7
CR 5M	20	160	300	400	30 ... 60	G 1 1/4	G 3/8	G 1	G 1/4	max 277.5	63	135	10.0

Associated technical data sheets:

- Switch units type CR: D 7150

Similar products:

- Two-stage valves type NE: Page 206

Hydraulic power packs:

- Hydraulic power packs type RZ: Page 62
- Compact hydraulic power packs type MP, MPN, MPNW, MPW: Page 22

Plugs:

- With LEDs or
  to support the EMV etc.: D 7163

See also section "Devices for special applications"

- Press controls
- Devices for up to 700 bar

2.2 Lifting modules and lifting/lowering valves type HMB, HMC, HMT, and HSV, HZV etc.

They are a combination of different valves (flow control valves, throttles, directional valves) for main lift and, in some cases, other additional functions. The lifting modules and lifting/lowering valves are for controlling lifting devices, especially high-rack stackers, order pickers, reach trucks and mobile lifting units. The design of the internal control system is extremely flexible. This enables solutions that are not only precisely tailored to the relevant drive concept (fixed or variable displacement pump) and the customer-specific application, but also affordable.

Control systems for secondary or additional functions can be achieved using directional seated valves or directional spool valves (type SWR or SWS). These valves are directly flange-mounted to the main valve in the form of mounting blocks, therefore making the whole valve combination extremely space-saving.

Features and benefits:

- Flexible design for fixed or variable displacement pump systems
- Low spatial requirements due to steel design
- Flexible combination with directional valves

Intended applications:

- Materials handling (industrial trucks etc.)
- Cranes and lifting equipment
- Road vehicle construction

Nomenclature:	**Valve combination according to type consisting of:** ■ 3-way flow control valves ■ 2-way flow control valves ■ 2-way seated valves ■ Directional spool functions
Design:	**Valve bank**
Actuation:	**Solenoid**
p_{max}:	**315 bar**
Q_{max}:	**120 lpm**

Design and order coding example

HMT34 - 1/200 - FH5N5 - 30EP12/G24

End plate
- With two P ports and one R port
- With prop. idle circulation valve
- With solenoid valve for the parking brake

Valve sections, ancillary- and intermediate blocks
Diverse intermediate blocks for
rotating/extending fork for high rack stackers;
Function rotating/stifting/lifting/lowering
Directional valve sections type SWR 1 with additional functions
Directional valve sections type SWS 2

Connection block
Pressure setting [bar] of the pressure limiting valve

Additional versions
- Connection blocks type SWR
  - With flow divider
  - With/without pressure limiting valve
  - With shut-off valve for P and H (lift)

Basic type
Lift modules and lifting/lowering valves

Drive concept an field of application:

	Drive concept			Application					
	1	2	3	Scissor lift	Miniature stacker, Walkie stacker	Counter balance truck	Reach truck	Order picker (warehouse)	
								no man aloft	man aloft
HSV	x			x	x				
HZV	x			x	x				x
HSN			x					x	x
HST	x	x			x	(x)		x	x
HMB	(x)	x			(x)			x	x
HMC	x				(x)				x
HMT		x				x	x	x	x
HMS	x	x	x					x	x
HMF	x	x	x					x	x
HMR		x	x					x	x
SWR..SE	x	x					x	x	x
HSW	x				x				

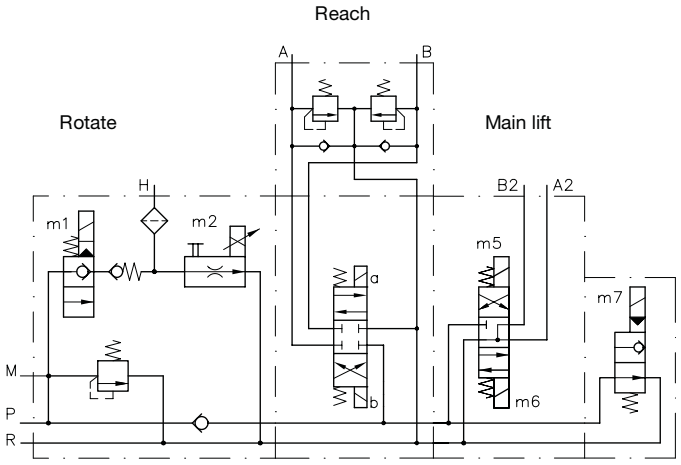
Drive concept:

- 1: Constant delivery pump, lifting/lowering via flow controller (throttle)
- 2: Lifting via speed controlled pump, lowering via flow controller (throttle)
- 3: Lifting/lowering via speed controlled pump

Circuit examples:

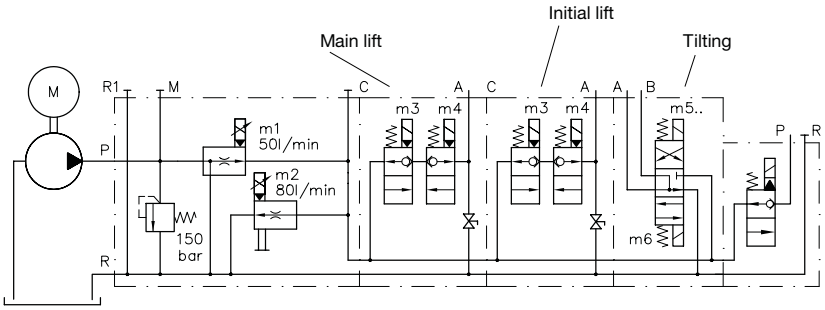
HMT 34-1/200-70F
-G/M/0/2 AN40 BN130
-D/M/0/02
-30E-P12/G 24

Lifting module type HMT, size 3, port size 4 with pressure limiting valve (set for 200 bar), outflow controller with 70 lpm metering throttle (blocked in idle position); section G with shock and suction valves is part of the ancillary block (settings 40 and 130 bar); end plate with idle circulation valve (open in idle position), proportional-solenoid voltage for the flow control valve 12V DC, solenoid voltage for directional spool valve and directional seated valves 24V DC



HMC 33-1/150-50/80F-T3 T3/D-20E-G 24

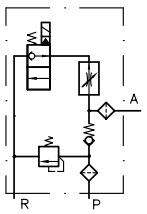
Lifting module type HMC, size 3, port size 3 (G 3/4 (BSPP)) with pressure limiting valve (set for 150 bar), 3-way flow control valve with metering throttle up to 50 lpm, 2-way flow controller up to 80 lpm (blocked in idle position), two intermediate blocks type T3 with seated valves and one directly added directional spool valve section type SWR 2 flow pattern D, end plate with additional port P and R as well as a shut off valve for port P, solenoid voltage 24V DC



Function

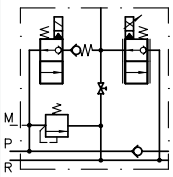
Single devices:

HSV

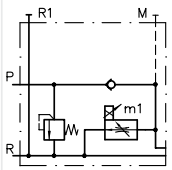


Lifting modules and connection blocks:

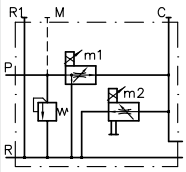
HST



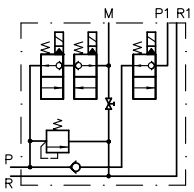
HMB



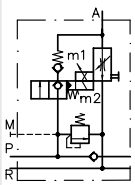
HMC



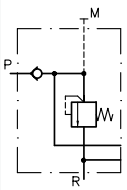
HSN



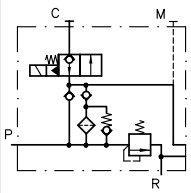
HMT



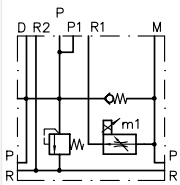
HMS



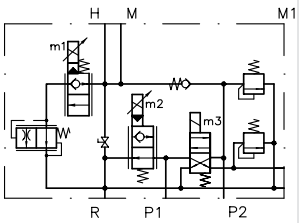
HMF



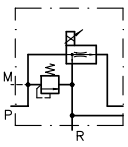
HMR



HSW



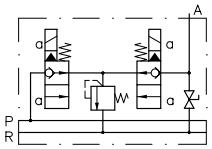
SWR



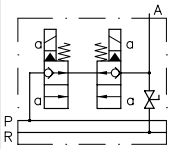
Intermediate blocks (main and initial lift):

Size 2

T 23

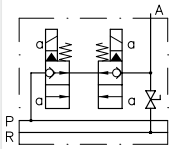


T 2

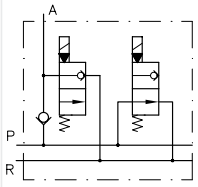


Size 3

T 3, T 34, T 44



T 25

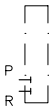


- Size 2: Hole pattern SWR 1, Size 3: Hole pattern SWR 2 / SWS 2

End plates:

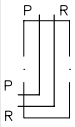
Size 1 and 2

1



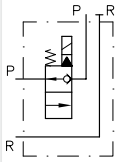
Size 1 and 2

2



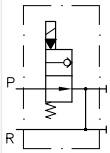
Size 2

20E



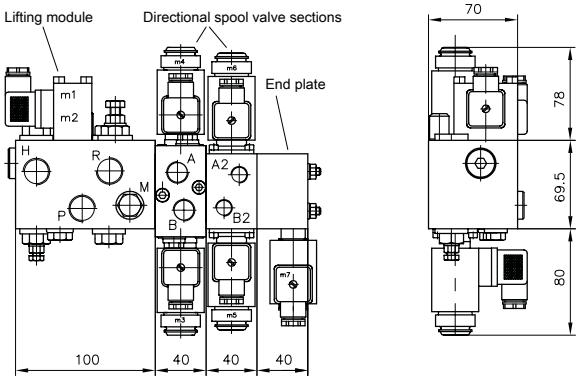
Size 2

30E

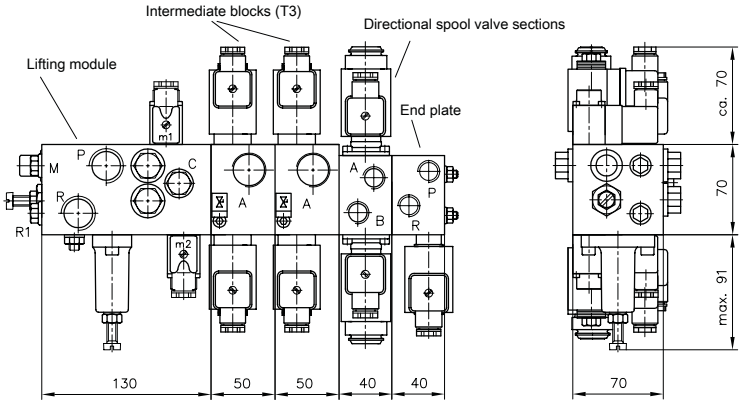


General parameters and dimensions

HMT 34 ...



HMC 33 ...



	Q_{max} [lpm]	p_{max} (bar)	Note	Ports (BSPP)
HSV 21	20	315 ... 400	Individual device	P, R, A = G 3/8
HSV 22	30			P = G 3/8; A, R = G 1/2
HSV 41	40			P, R, A = G 1/2
HSV 61	60			P, R, A = G 1/2
HSV 71	160			P, R, A = G 3/4
HSN	50 -100			H, R = G 3/4; P1 = G 3/8; P = (flange connection)
HST 2	20 - 40	315	Connection blocks of lifting module Add-on components: - SWR/SWS-Valve sections - Intermediate blocks - End plates	P, R, H = G 1/2; M = G 3/8
HST 3	30 - 60			P, R, H = G 3/4; M = G 3/8
HMB 2	30			P, R = G 1/2; M = G 1/4
HMB 33	90			P, R = G 3/4; M, R1 = G 1/4
HMC 2	30			P, R, A = G 1/2; M = G 1/8
HMC 3 (33)	90			P, R = G 3/4; M, R1 = G 1/4; C = G 3/8
HMT 3	70 - 90			H, P, R = G 1/2; M = G 3/8
HMT 34	70 - 90			H = G 3/4; P, R = G 1/2; M = G 3/8
HMS 4	100			R = G 3/4; C, R1 = G 3/8; M = G 1/4
HMF 4	100			R = G 3/4; C, R1 = G 3/8; M = G 1/4
HMR 4	100			P, R1, R 2 = G 3/4; P1, D = G 3/8; M = G 1/4
HSW 2	25			H, R = G 1/2; P1, P 2 = G 3/8; M = G 1/8
SWR 1 SE	12			P, R, R1 = G 1/4; M = G 1/8
SWR 2 SE	25			P, R = G 3/8; M = G 1/4

- HMB 2, HMC 2, SWR 1 SE: Hole pattern SWR 1, T2; adaptor plates from X12 to SWR 2
- SWR 1 SE, SWR 2 SE: also for external additional functions

Associated technical data sheets:

- Type HMC: D 7650
- Type HMT: **Sk 7758 HMT**
- Type HMB: **Sk 7650 B2, SK 7650 B33**
- Type HST: **Sk 7650 HST ff**
- Type HSW: **Sk 7650 HSW**

Information on additional lifting modules on inquiry

Similar products:

- Type SWR, SWS 2: Page 88
- Connection blocks type HMPL and HMPV:Page 104

Plugs:

- With LED's and others: D 7163
- With economy circuit: D 7813, D 7833

See also section "Devices for special applications"

– Devices for industrial trucks and hoists

Seated valves

2.2 Directional seated valves type VH, VHR and VHP

The directional seated valves types VH, VHR and VHP operate leakage free and are available in two different sizes. They are operated via a hand lever on an eccentric shaft transferring the switching moment to an actuation pin acting on the valve elements (balls). The actuation either features a detent or is self returning to its idle position. Valve banks type VHR are also available, featuring individual valves (type VH) connected in parallel and held together with tension rods. Valves type VHP size 1 is also available as individual manifold mounting version.

Features and benefits:

- Max. pressure 700 bar (manual actuation)
- Actuation using hand lever with automatic centring in zero position or with notch
- Different arrangements in valve bank possible
- Leakage-free seated valve technology

Intended applications

- Machines for construction and construction material
- Offshore and marine technology
- Process engineering systems
- Oil hydraulics and pneumatics

Nomen-clature:	**Directional seated valve, zero leakage**
Design:	**Individual valve for pipe connection Individual valve, manifold mounting, bankable**
Actuation:	**Manual**
p_{max}:	**500 ... 700 bar**
Q_{max}:	**12 ... 25 lpm**

Design and order coding example

VH 1 VHR 1	**H1 G1/N1/E1**

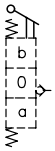
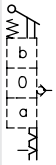
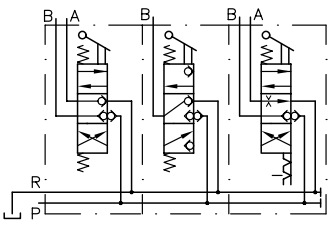
Function/valve sections with actuation Hand lever with automatic return (1) or detent (2)

Additional versions:

- Actuation with idle position monitoring via contact switch, available either as indiv. valve or valve bank

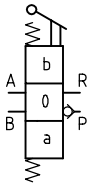
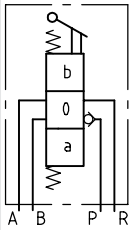
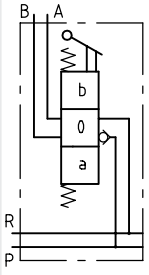
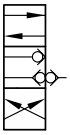
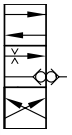
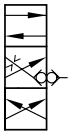
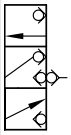
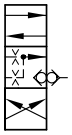
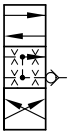
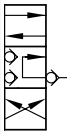
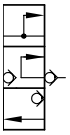
Basic type, size Type VH (Individual valve for pipe connection)
Type VHP (Individual valve, manifold mounting)
Type VHR (Valve bank)
Size 1 and 2

Actuations:

Return spring	Detent	
		Symbol type VHR.. 

- Return spring: The automatic return is limited to operating pressure of 50 bar. The hand lever has to be returned manually at operating pressure between 50 ... 700 bar.

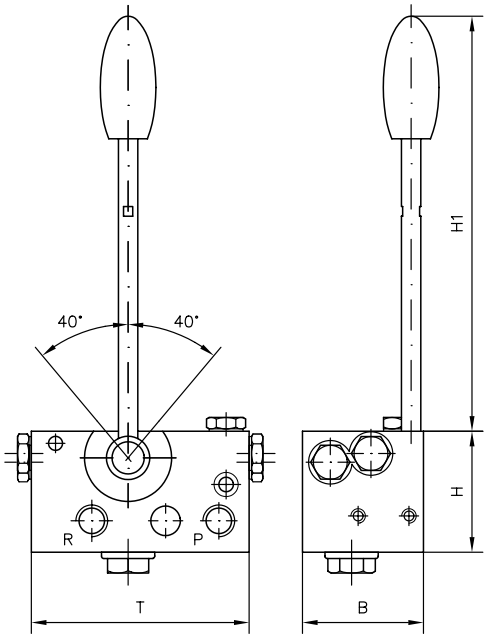
Function

Basic symbols			Symbol							
VH	VHP	VHR	G	E	M	N	D	H	L	S
										

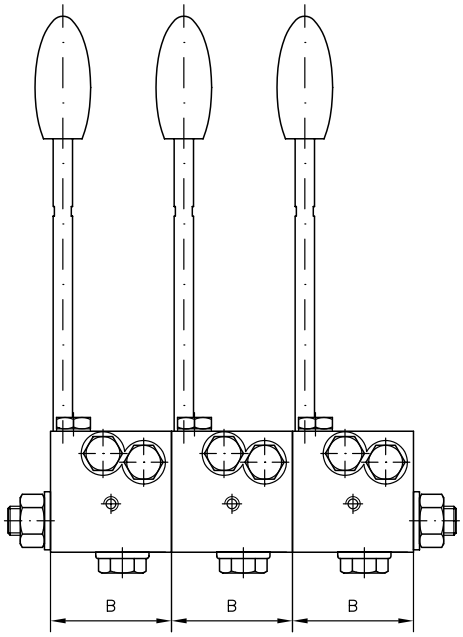
- Max. 7 or 5 valves for type VHR,(size 1 or 2) may be combined
- Type L and S individual valve only, not for type VHR

General parameters and dimensions

Individual valve **VH..**



Valve bank **VHR..**



	Q_{max} [lpm]	p_{max} [bar]	Ports	Dimensions [mm]				m [kg]
				H	H1	B	T	Valve section
VH 1, VHP 1, VHR 1	12	700	G 1/4	50	approx. 172	50	90	1.6
VH 2, VHR 2	25	500	G 3/8	60	approx. 162	60	120	3

Associated technical data sheets:

- Directional seated valves type VH, VHR, VHP: D 7647

Similar products:

- Directional seated valves type BVG 1, BVP 1, NBVP 16: Page 156
- Shut-off valves type DA, EA: Page 172

See also section "Devices for special applications"

– Devices for up to 700 bar

Seated valves

2.2 Shut-off valves type DA and EA

The shut-off valves types DA and EA are of ball seated design and are available in two sizes. They are used in hydraulic systems for blocking the flow in one or both directions. They are available with hand lever or with eccenter shaft for customer furnished hand lever. Both versions can be ordered either with or without detent.

Features and benefits:

- Zero leakage blocking of a hydraulic line
- Pressures up to 500 bar manually switchable
- Flows up to 150 lpm
- Single or double-blocking

Intended applications:

- Rolling mill equipment
- Shipbuilding
- Construction and construction materials machinery
- Mining machinery

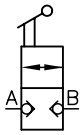
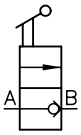
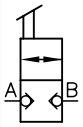
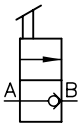
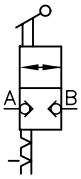
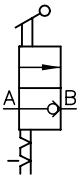
Nomen-clature:	Directional seated valve, zero leakage
Design:	Individual valve for pipe connection
Actuation:	Manual
p_{max}:	500 bar
Q_{max}:	60 ... 150 lpm

Design and order coding example

EA 3

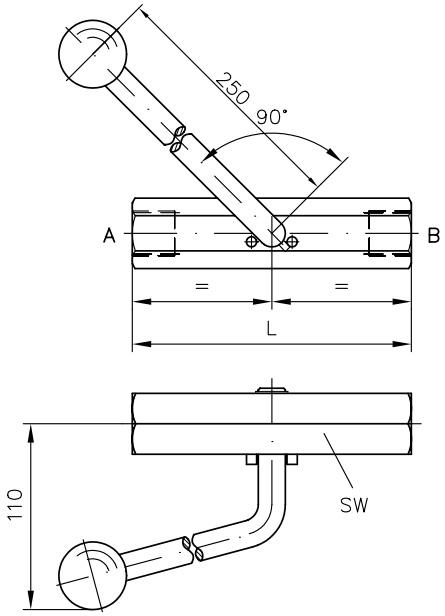
Basic type, size Type DA (doppeltwirkend) size 2, 3, Typ EA (einfachwirkend), size 2, 3

Function

DA 2	EA 2	DA 2B	EA 2B	DA 3	EA 3
					
With hand lever		Without hand lever		Hand lever with detent	

General parameters and dimensions

DA 3



	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	Dimensions [mm]		m [kg]
			A, B	L	SW = a/f	
DA 2, EA 2	60	500	G 3/4	165	SW 36	1.3 - 1.5
DA 2B, EA 2B	60	500	G 3/4	165	SW 36	1.3 - 1.5
DA 3, EA 3	150	500	G 1	200	SW 50	3.0 - 3.2

Associated technical data sheets:

- Shut-off valves type DA, EA: D 1741

Similar products:

- Directional seated valves type VH, VHR, VHP: Page 170

2.3 Pressure valves

Directly controlled pressure-limiting and sequence valves type MV, SV

Proportional pressure-limiting valves type PMV and PDV

Pressure-limiting and sequence valves (also proportional)

Type	Design	Adjustability	p_{max}	Q_{max}
MV, SV	■ Individual valve for pipe connection or manifold mounting ■ Screw-in valve, assembly kit	- Tool adjustable - Manually adjustable	700 bar	5... 160 lpm
CMV(Z), CSV(Z)	■ Screw-in valve ■ Directly controlled	- Tool adjustable - Manually adjustable	500 bar	60 lpm
DV, AS	■ Individual valve for pipe connection or manifold mounting	- Tool adjustable - Manually adjustable	420 bar	120 lpm
VR	■ Insert valve ■ Version with housing	- Tool adjustable	315 bar Δp_{max}: 15 bar	120 lpm
PMV, PDV	■ Individual valve for pipe connection or manifold mounting	- Electro-proportional	700 bar	120 lpm

Pressure-reducing valves (also proportional)

Type	Design	Adjustability	p_{max}	Q_{max}
ADC, AM	■ Screw-in valve ■ for pipe connection	- Tool adjustable	$p_{max\ P}$: 300... 400 bar $p_{max\ A}$: 15... 100 bar	2... 10 lpm
ADM, VDM	■ Individual valve for pipe connection or manifold mounting ■ Directly controlled or piloted	- Tool adjustable - Manually adjustable	$p_{max\ P}$: 300 - 400 bar $p_{max\ A}$: 250 - 400 bar	120 lpm
CDK, CLK, DK, DLZ, DZ	■ Screw-in valve (2-way principle) ■ Combination with connection block	- Tool adjustable - Manually adjustable	500 bar	22 lpm
PM	■ Assembly kit ■ Individual valve for manifold mounting	- Electro-proportional	$p_{max\ P}$: 40 bar $p_{max\ A}$: 19 bar	approx. 2 lpm
PDM	■ Individual valve for pipe connection or manifold mounting	- Electro-proportional	$p_{max\ P}$: 400 bar $p_{max\ A}$: 5 - 350 bar	120 lpm

Externally pressure-controlled relief valves (switch-off, follow-up valves)

Type	Nomenclature/Design	Adjustability	p_{max}	Q_{max}
CNE 2	■ 2-way idle circulation valve ■ Screw-in valve	- Tool adjustable	500 bar $p_{max\ adjust}$: 450 bar	30 lpm
NE	■ Two-stage valve (high-pressure/low-pressure stage) ■ Individual valve for pipe connection	- Tool adjustable	500... 700/ 30...80 bar	25/ 180 lpm
LV, ALZ	■ Shut-off valve (idle circulation valve, directly controlled or piloted) ■ Individual valve for pipe connection or manifold mounting	- Tool adjustable - Manually adjustable	350 bar	120 lpm
DSV, CDSV	■ Individual valve for pipe connection or manifold mounting ■ Screw-in valve	- Tool adjustable - Manually adjustable	600 bar	60 lpm

Load-holding valves

Type	Nomenclature/Design	p_{max}	Q_{max}
LHK, LHDV, LHT	**Load-holding valve, over centre valve** ■ Individual valve for pipe connection or manifold mounting ■ Screw-in valve, version for banjo bolt mounting	360... 450 bar	250 lpm

Pressure valves

2.3 Directly controlled pressure limiting and sequence valves type MV, SV

Pressure valves influence the pressure in hydraulic systems.
Pressure-limiting valves (safety or overpressure valve) safeguard the system against excessive pressure or limit the operation pressure. Sequence valves generate a constant pressure difference between the inlet and outlet flow.
A damping device is fitted as standard in the directly controlled valves to ensure quiet operation, but an undamped variant is also available for special operating conditions.
Pressure-limiting valves with unit approval and CE mark (type MV.X) are also available.

Features and benefits:
- Operating pressures up to 700 bar
- Various adjustment options
- Numerous configurations

Intended applications:
- General hydraulic systems
- Test benches
- Hydraulic tools

Nomen-clature:	**Pressure limiting valve, sequence valves (directly controlled)**
Design:	**Individual valve for pipe connection Screw-in valve Individual manifold mounting valve Assembly kit**
Adjustment:	**Tool adjustable Manually adjustable**
p_{max}:	**700 bar**
Q_{max}:	**5 ... 160 l/min**

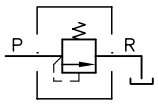
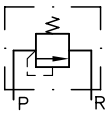
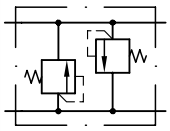
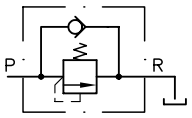
Design and order coding example

MVS 52 | B | R | X | - 650

- **Pressure setting]**
- **Optionally without dampening (X)**
- **Adjustability (while pressurized)**
  - Tool adjustable
  - Manually adjustable
  - Adjustable with turn knob (self-locking/lockable)
- **Pressure range and flow** Pressure ranges A, B, C, E and F
- **Basic type, size** Type MV.., DMV.. and SV..

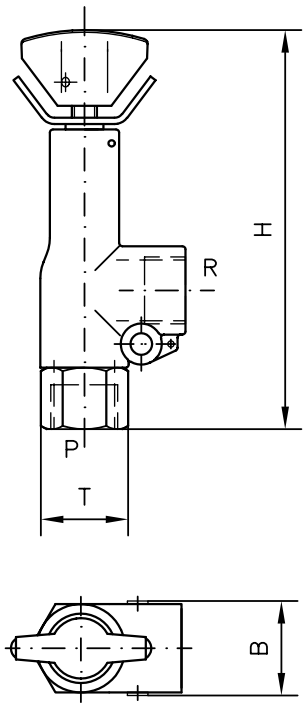
Additional versions
- Multiple pressure limiting valves (2, 3, 4, 5 valves in parallel)
- Pressure-limiting valves with unit approval (TÜV valves) (type MVX, MVSX, MVEX, MVPX, SVX, size 4, 5 and 6)
- Various actuations: ball head for controls via cam, lever etc. (type MVG and MVP only)

Function

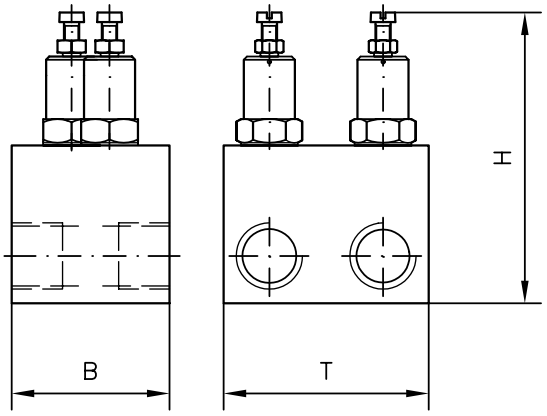
	MV[1]	MVS MVG	MVE	SV	MVP	DMV	MVCS MVGC	SVC	MVB
									
Function	Pressure limiting valve	Pressure limiting valve and differential pressure regulators				Pressure limiting valve	Pressure-limiting valve with free return flow R→P via a bypass check valve		Pressure limiting valve and differential pressure regulators
Brief description	Corner valve for pipe connection	Corner valve for pipe connection	Screw-in valve	Straight-way valve for straight pipe installation	Manifold mounting valve	Twin valve as shock valve for hydraulic motors	Corner valve for pipe connection	Straight-way valve for straight pipe installation	Assembly kit
Size	4, 5, 6	13, 14, 4, 5, 6, 8	13, 14, 4, 5, 6, 8	4, 5, 6, 8	13, 14, 4, 5, 6, 8	4, 5, 6, 8	13, 14, 4, 5, 6	4, 5, 6	4, 5, 6, 8
$p_{perm\ R}$ [bar]	20	500	500	500	500	350	500	500	200

1) Only size 4, 5, 6, and 8
Type MVG and MVGC only size 13 and 14

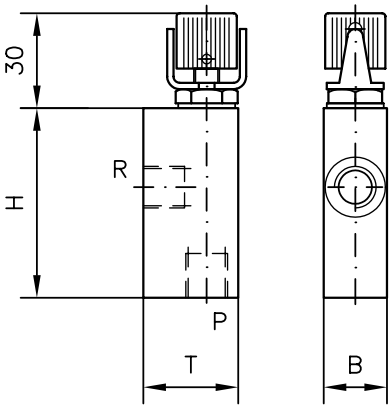
MV, MVS



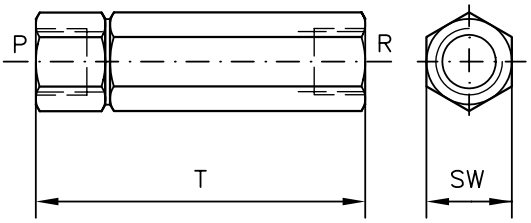
DMV



MVG



SV, SVC



See following table for dimensions

	Size	Dimensions [mm]			m [kg]	Size	Pressure range/ Flow	Ports (BSPP)[1]
		H_{max}	B/SW	T_{max}				
MV, MVS, MVCS, MVE	4	126	24	48	0.3	4	F: 80/20 E: 160/20 C: 315/20 B: 500/20 A: 700/12	G 1/4, G 3/8
	5	142	29	60	0.4			
	6	164	36	70	0.7			
	8	208	40	60	2.0			
DMV	4	107	40	52	0.7	5	F: 80/40 E: 160/40 C: 315/40 B: 500/40 A: 700/20	G 3/8, G 1/2
	5	123	50	65	1.3			
	6	142.5	60	75	1.8			
	8	192	80	96	4.5			
MVP	4	102	28	35	0.3	6	F: 80/75 E: 160/75 C: 315/75 B: 500/75 A: 700/40	G 1/2 G 3/4
	5	113	32	40	0.5			
	6	133	35	50	0.8			
	8	172	50	60	1.6			
	13, 14	82	29	50	0.3	8	E: 160/160 C: 315/160 Bi: 500/160	G 3/4, G 1
MVE	13, 14	75	SW 27	-	0.1			
MVG, MVGC	13, 14	94	20	42	0.3	13	H: 700/5	G 1/4
SV, SVC	4	-	SW 22	87	0.2	14	N: 50/8 M: 200/8 H: 400/8	G 1/4
	5	-	SW 27	108	0.4			
	6	-	SW 32	132	0.9			
SV	8	-	SW 41	157	0.9			

1) For pipe connection versions only

Associated technical data sheets:

- Pressure limiting valves type MV etc.: D 7000/1
- Miniature pressure limiting valves type MVGetc.: D 3726
- Pressure limiting valves (assembly kits) type MV: D 7000 E/1
- Multiple pressure limiting valves type MV: D 7000 M
- Pressure limiting valves with type approval (TÜV) type MVX etc.: D 7000 TÜV

Similar products:

- Screw-in pressure valves type CMV, CSV: Page 182
- Piloted pressure valves type DV: Page 184
- Piloted pressure valves type A: Page 184

See also section "Devices for special applications":

– Devices for up to 700 bar

2.3 Pressure limiting valves type CMV and CSV

Pressure valves influence the pressure in hydraulic systems. Pressure-limiting valves (safety or overpressure valve) safeguard the system against excessive pressure or limit the operation pressure. Sequence valves generate a constant pressure difference between the inlet and outlet flow, where the flow in the opposite direction (return flow) is free via a bypass check valve.
One advantage of the valves described here is the easily produced mounting hole (see dimensions). Type CMV is also available as a CE-marked pressure-limiting valve with unit approval, e.g. as a safety valve for accumulators in accordance with Pressure Equipment Directive 97/23 EC. Types CMVZ and CSVZ are not influenced by the pressure conditions downstream and are therefore suitable for use in loss-free sequence control systems.

Features and benefits:
- Operating pressures up to 500 bar
- Various adjustment options
- Easily produced mounting hole

Intended applications:
- General hydraulic systems
- Test benches
- Hydraulic tools

Nomen-clature:	Pressure limiting valve, sequence valves (directly controlled)
Design:	Screw-in valve
Adjustment:	Tool adjustable Manually adjustable
p_{max}:	500 bar
Q_{max}:	60 lpm

Design and order coding example

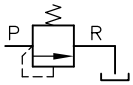
CMV 3 | F | R | - 200 | - 1/4

- **Indiv. connection block for pipe connection**
- **Pressure setting [bar]**
- **Adjustability (while pressurized)** Tool or manually adjustable
- **Pressure range** Pressure ranges B, C, E and F
- **Basic type, size** Type CMV (pressure limiting valve), size 1 to 3
Type CSV (pressure difference valve), size 2 to 3

Additional versions:
- Sequence valves CMVZ or CSVZ
- Version with unit approval type CMVX
- Undamped version (CMV)

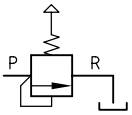
Function

CMV

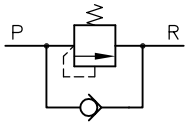


Pressure limiting valve (port R pressure resistant)

CMVZ

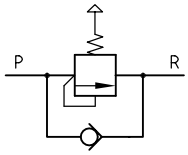


CSV



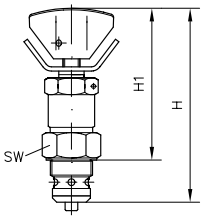
Sequence valves with by-pass check valve

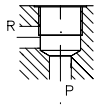
CSVZ



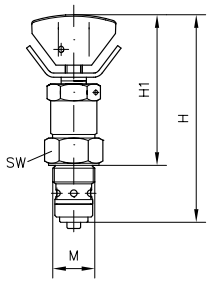
General parameters and dimensions

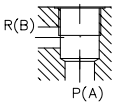
CMV/CMVZ





CSV/CSVZ





	Size	Q_{max} [lpm]	Pressure range p_{max} [bar]	M	SW = a/f	Dimensions [mm]		m [g]
						H_{max}	$H1_{max}$	
CMV, CMVZ	1	20	F: 80 E: 160 C: 315 B: 500	M 16 x 1.5	SW 22	78	57	90
	2	40		M 20 x 1.5	SW 24	94	72	160
	3	60		M 24 x 1.5	SW 30	114	83	275
CSV, CSVZ	2	40		M 20 x 1.5	SW 24	104	73	150
	3	60		M 24 x 1.5	SW 30	122	82	300

Associated technical data sheets:

- Pressure-limiting valves type CMV, CSV: D 7710 MV
- Pressure-limiting valves with unit approval type CMVX: D 7710 TÜV

Similar products:

- Pressure-limiting valves type MV, SV etc.: Page 178
- Miniature pressure-limiting valves type MVG etc.: Page 178
- Piloted pressure valves type DV: Page 184
- Piloted pressure valves type AS: Page 184

See also section "Devices for special applications"

- Screw-in valves and installation kits
- Devices for up to 700 bar

Pressure valves

2.3 Piloted pressure limiting valves type DV, AS etc.

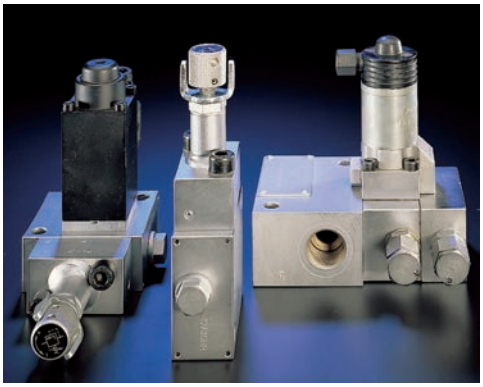
Pressure valves influence the pressure in hydraulic systems. Pressure-limiting valves (safety or overpressure valve) safeguard the system against excessive pressure or limit the operation pressure. Sequence valves generate a constant pressure difference between the inlet and outlet flow. Follow-up valves (release valves) block the flow until a set pressure value is reached (free flow once this value is exceeded). Compared with pressure valves of the type DV, the types AS and AE have an additional check valve in the consumer port.

Features and benefits:

- Various adjustment options
- Various additional functions

Intended applications:

- General hydraulic systems
- Test benches



Nomen-clature:	**Pressure limiting valve Sequence valve Follow-up valve (piloted)**
Design:	**Individual valve for pipe connection Individual valve manifold mounting**
Adjustment:	**Tool adjustable Manually adjustable**
p_{max}:	**420 bar**
Q_{max}:	**120 lpm**

Design and order coding example

DV3	G	H	R	- WN 1F- 24	- 200

Pressure setting [bar]

2/2-way directional seated valve Optionally with mounted 2/2-way directional seated valve for arbitrary idle circulation

Adjustability in operation Tool adjustable or manually adjustable (R)

- Various actuations for the pilot valve: ball head for controls via cam, lever etc. (type DV, DVE)

Pressure range

- N: 2 to 100 bar
- H: 5 to 420 bar

Line connection Pipe connection or manifold mounting

Basic type, size Type DV (internal control oil drain),
Type DVE (external control oil drain),
Type DF (valve for remote control), size 3 to 5
Type AS (additional check valve), size 3 to 5
Type AE (release valve), size 3 to 5

Additional versions:

- Additional switching combinations with the types AS and AE

Function

DV

Pressure limiting, sequence valve

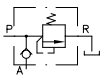
DVE

Follow-up valve

DF

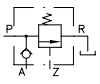
Pressure limiting, sequence valve, follow-up valve or 2/2-way directional valve (remote controlled, depending on the kind of valve connected to port X)

AS



Pressure limiting valve

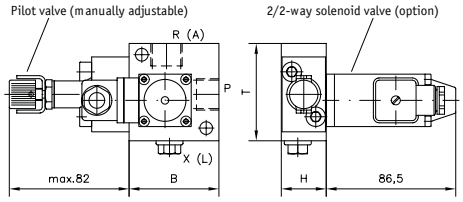
AE



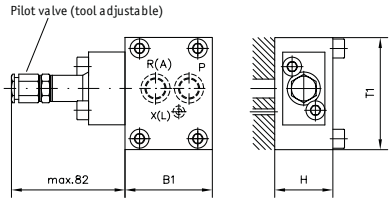
Release valve (remote controlled), combined function as pressure limiting valve possible (type ASE)

General parameters and dimensions

DV..G



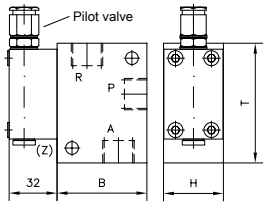
DV...P



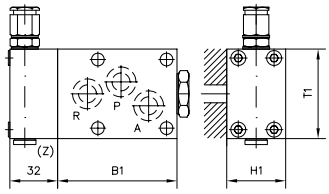
Type, size	Q_{max} [lpm]	Pressure range: p_{max} [bar]	Ports (BSPP)	Dimensions [mm]					m [kg]1)
DV, DVE, DF				H	B	B1	T	T1	
3	50	N: 100 H: 420	G 1/2	30	60	-	66	-	1,1 / -
4	80		G 3/4	40	65	60	71	78	1,5 / 2,0
5	120		G 1	50	80	88	73	81	2,0 / 2,5

1) Versions for pipe connection/manifold mounting (with installed solenoid valve + 0.6 kg)

A..G



A...P



Type, size	Q_{max} [lpm]	Pressure range: p_{max} [bar]	Ports (BSPP)	Dimensions [mm]						m [kg]1)
AS, ASE, AE				H	H1	B	B1	T	T1	
3	50	M: 200 H: 350/300 (type AE)	G 1/2	40	-	60	-	80	-	1.8
4	80		G 3/4	40	40	70	80	94	60	2.2
5	120		G 1	6.3	40	100	94	85	80	4.1

1) Versions for pipe connection/manifold mounting (with installed solenoid valve + 0.6 kg)

Associated technical data sheets:

- Piloted pressure valves type DV: D 4350
- Piloted pressure valves type AS, AE: D 6170

Similar products:

- Pressure limiting valves type MV, SV etc.: Page 178
- Miniature pressure limiting valves type MVG etc.: Page 178
- Pressure limiting valves type CMV(Z): Page 182

Pressure valves

2.3 Sequence valves with check valve type VR

Pressure valves influence the pressure within a hydraulic system. The type illustrated below is a sequence valves which generates a constant pressure difference between inlet and outlet of the flow. The flow in opposite direction (reflow) is unhindered via a by-pass check valve. This valve shows minor leakage like other spool valves in flow direction V → F.

These pre-load valves are used, for example, as drop protection in fork lift trucks, safeguarding the lifting cylinder during lowering to prevent continued travel if the fork accidentally gets caught (accident protection), or preventing undesired oscillations by increasing the back pressure when used as pre-load valve in return pipes.

Features and benefits:

- Compact screw-in valve

Intended applications:

- Industrial trucks
- Lifting devices

Nomen-clature:	**Sequence valve**
Design:	**Screw-in valve Combination with housing for pipe connection**
Adjustment:	**Fixed (non-adjustable)**
p_{max}: Δp_{max}:	**315 bar 15 bar**
Q_{max}:	**120 lpm**

Design and order coding example

VR 3 | 3 | C

Design with housing
- Cartridge valve
- Versions with housing for pipe connection
- Design with metric fine thread

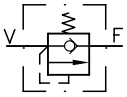
Pre-load pressure Open-up pressure Δp_{max} 3 to 15 bar

Basic type, size Type VR, size 1 to 4

Function

VR

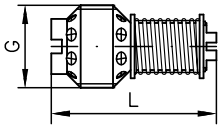
Screw-in valve



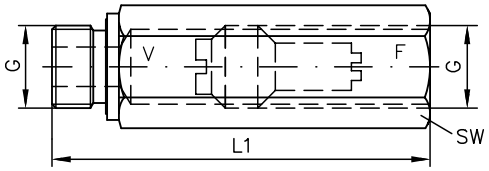
Version with housing for pipe connection

General parameters and dimensions

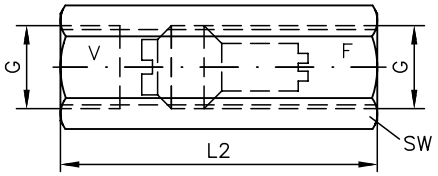
VR 3 3 C
Insert valve



VR 4 9 E
Version with housing



VR 1 15 G
Version with housing



	Q_{max} [lpm]	Δp_{max} [bar] 1)	Dimensions [mm]					m [g] 2)
			G (BSPP)	L	L1	L2	SW = a/f	
VR 1	15	3, 5, 7, 9, 12, 15	G 1/4 (A)	31	78	66	SW 19	15/120
VR 2	40	3, 5, 7, 9, 12, 15	G 3/8 (A)	36	82	70	SW 22	25/160
VR 3	65	3, 5, 7, 9, 12	G 1/2 (A)	42	96	80	SW 27	40/270
VR 4	120	3, 5, 7, 9, 12	G 3/4 (A)	54	106	100	SW 32	80/400

1) The selected pre-load pressure e.g. opening pressure cannot beltered
2) Individual valve/design with housing

Associated technical data sheets:
- Sequence valves type VR: D 7340

Similar products:
- Pressure limiting valves type MV, SV etc.: Page 178
- Miniature pressure limiting valves MVG etc.: Page 178
- Piloted pressure valves type DV: Page 184
- Pressure limiting valves type CMV: Page 182

See also section "Devices for special applications":
- Industrial trucks
- Screw-in valves and installation kits

2.3 Proportional pressure limiting valves type PMV and PDV

These pressure limiting valves are electrically remote controlled and rule the hydraulic pressure within the system. These pressure limiting valves are electrically remote controlled and safe guard the system against an excessive pressure whose value can be altered.

The valve series described here are directly controlled (type PMV) or piloted (type PDV). A minimum pressure of 3 bar or more is required for proper functioning of the integrated prop. pressure-reducing valve.

Features and benefits:

- Max. operating pressure 700 bar

Intended applications:

- General hydraulics
- Test benches

Nomen-clature:	**Prop. pressure-limiting valve (directly controlled or piloted)**
Design:	**Individual valve for pipe connection Individual valve Manifold mounting**
Adjustment:	**Electro-proportional**
p_{max}:	**700 bar**
Q_{max}:	**120 lpm**

Design and order coding example

PDV4G PMVP4	H - 44	- G24 - G24

Nominal voltage of proportional solenoid — 12V DC, 24V DC
Controls via prop. amplifier or PLVC

Pressure range [bar]

Basic type, connection size — Type PMV (pipe connection), type PMVP (manifold mounting)

- Optionally with separate control oil supply, i.e. pressure reduction right above 0 bar, no leakage in the main pump circuit (type PMVS, PMVPS)

Type PDV

- Additionally with 2/2-way solenoid valves for arbitrary idle circulation

Function

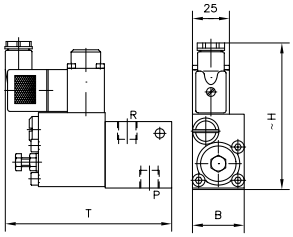
PMV, PDV

Pipe connection

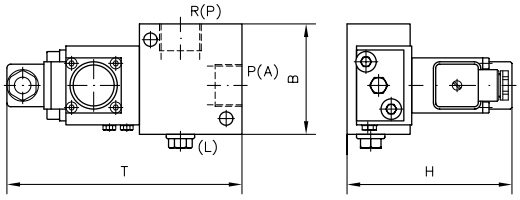
Manifold mounting valve

General parameters and dimensions

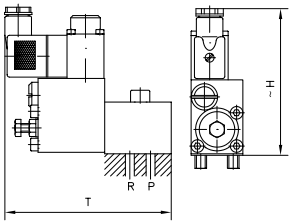
PMV



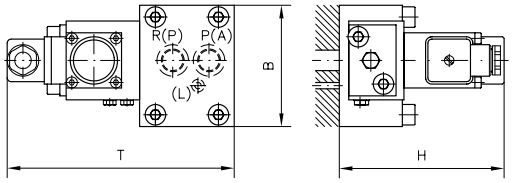
PDV..G



PMVP



PDV..P



	Size	Q_{max}[lpm]	Pressure range p_{max} [bar]	Ports (BSPP) [1]	Dimensions [mm]			m [kg]
					H	B	T	
PMV/PMVP	4	16	41: 180 42: 290 43: 440 44: 700	G 1/4, G 3/8	97/95	35	135	1,2 / 1,1
	5	16... 60	41: 110 42: 180 43: 270 44: 450	G 1/4, G 3/8, G 1/2	98/95	35/40	140	1.2
	6	60... 75	41: 80 42: 130 43: 190 44: 320	G 3/8, G 1/2, G 3/4	102/95	40/50	150/140	1,5/1,3
	8	120	41: 45 42: 70 43: 110 44: 180	G 3/4, G 1	107/97	45/60	160/150	1,9/1,7
PDV.G/PDV.P	3	40	N: 130 M: 200 H: 350	G 1/2	96	66	150	1.8
	4	80		G 3/4	99.5	71/78	155/150	2,2/2,7
	5	120		G 1	104.5	73/81	170/178	2.7/3.2

1) For pipe connection versions only

Associated technical data sheets:

- Prop. pressure limiting valves type PMV(S), PMVP(S): D 7485/1
- Prop. pressure valves type PDV: D 7486
- Type NPMVP: D 7485 N
- Type NZP: D 7788 Z

Electronic accessories:

- Prop. amplifier (module) type EV1M2: Page 276
- Prop. amplifier (module) type EV1D1: Page 276
- Prop. amplifier (card version) type EV 22K2: Page 276
- Programmable logic valve control type PLVC: Page 278

See also section "Devices for special applications"

- Proportional valves
- Devices for up to 700 bar

2.3 Miniature pressure reducing valves type ADC, AM etc.

The task of pressure-reducing valves is to maintain a largely constant outlet pressure despite a higher and changing inlet pressure. These valves are used when a secondary circuit has to be fed with a lower but constant pressure level by a main (primary) oil circuit with a higher and varying pressure level. The valves mentioned here are suitable for the supply of control circuits with low oil consumption. There is a design-related permanent leakage flow, which has to be led back to the tank in a de-pressurized line via port R. A reversal of the flow direction is possible up to approx. 30% of Q_{max}. A bypass check valve has to be provided for higher reversed flow. These pressure-reducing valves feature an override compensation, i.e. acting like a pressure-limiting valve, if the pressure on the secondary side exceeds the set pressure e.g. due to external forces.

Features and benefits:

- Compact design
- Numerous configurations

Intended applications:

- For control oil supply in pilot circuits

Nomen-clature:	Pressure reducing valve
Design:	Screw-in valve Valve for pipe connection
Adjustment:	Fixed (non-adjustable)
$p_{max\ P}$: **$p_{max\ A}$:**	300 ... 400 bar 15 ... 100 bar
Q_{max}:	2 ... 10 lpm

Design and order coding example

ADC 1 - 25 - 1/4

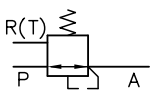
Design
- Cartridge valve
- Design with housing for direct pipe connection
- Version with housing for manifold mounting (type AM 11)

Pressure downstream Pressure at port A [bar]

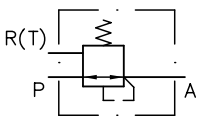
Basic type Type ADC, AM
Type ADM, ADME
- Type ADM 1 adjustable version available

Function

ADC, AM, ADM, ADME



Screw-in valve



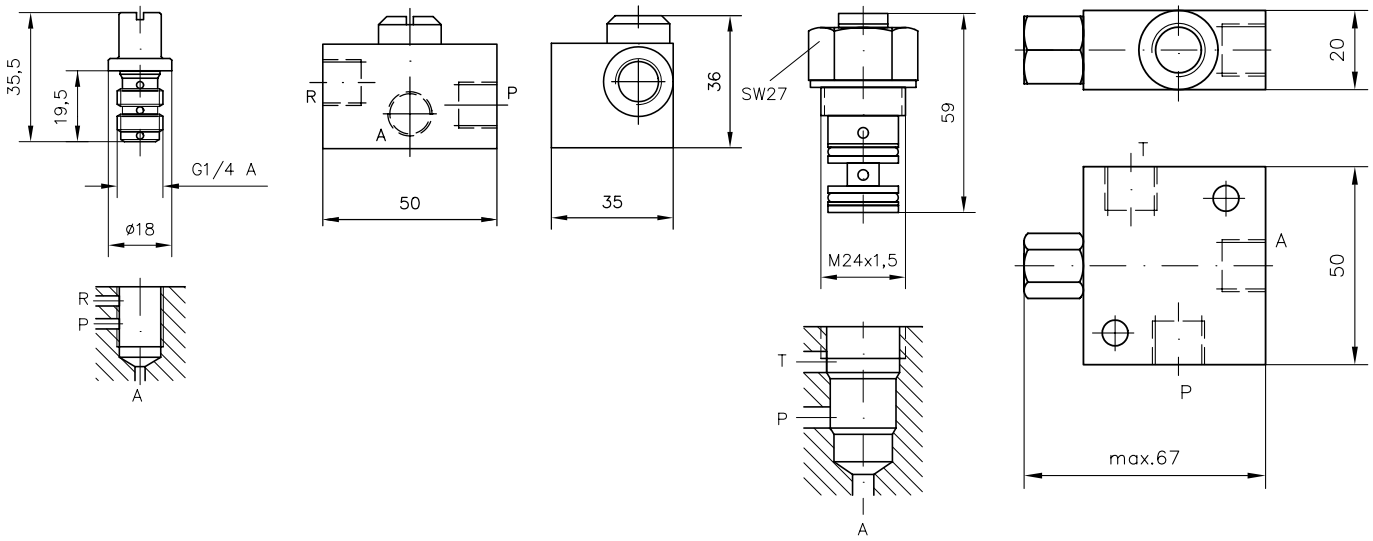
Pipe installation

ADC 1-.25
Pressure reducing valve type ADC 1, screw-in valve, pressure at A approx. 25 bar

AM 1 - 20 -1/4
Pressure-reducing valve type AM 1, version for pipe connection (ports G 1/4 (BSPP)), pressure at A approx. 20 bar

ADME 1-...

ADM 1-70
Pressure-reducing valve type ADM 1, version for pipe connection, pressure at A approx. 70 bar



	Q_{max} [lpm]	p_{max} [bar]	Outlet pressure [bar] at A	Ports (BSPP)[1]	m_{max} [kg]	
					Screw-in valve	Pipe installation
ADC 1	2	300	15, 25	G 1/4	0.03	0.32
AM 1	2	400	20, 30, 40, 100	G 1/4	0.03	0.3
ADM 1	8 ...10	300	15, 20, 30, 70	G 1/4	-	0.34
ADME	8	300	15, 20, 30	-	0.05	-

1) In version for pipe connection only

Associated technical data sheets:
- Miniature pressure-reducing valves type ADC etc.: D 7458

Similar products:
- Pressure-reducing valves type ADM, VDM: Page 192
- Pressure-reducing valves type CDK: Page 196
- Prop. pressure-reducing valves type PDM: Page 202
- Miniature prop. pressure-reducing valves type PM, PMZ: Page 200

See also section "Devices for special applications"
– Screw-in valves and installation kits

Pressure valves

2.3 Pressure reducing valves type ADM and VDM

The task of pressure reducing valves in a hydraulic circuit is to maintain a rather constant outlet pressure despite a higher and changing inlet pressure. These valves are usually used when a secondary circuit has to be fed with a lower but constant pressure level by a main (primary) circuit with a higher and varying pressure level. These valves are either directly controlled (type ADM) or hydraulically piloted (type VDM). There is a design related permanent leakage flow apparent at L, which has to be led back to the tank via a de-pressurized line. A reversal of the direction of flow is possible up to approx. 50% of Q_{max}. A by-pass check valve has to be provided for higher reversed flow. The pressure reducing valves type ADM feature a override compensation i.e. acting like a pressure limiting valve, if the pressure on the secondary side exceeds the set pressure e.g. due to external forces.

Features and benefits:

- With safety valve function
- Various adjustment options
- Various additional functions

Intended applications:

- General hydraulics
- Jigs
- Test benches

Nomen-clature:	**Pressure-reducing valve (directly controlled or piloted)**
Design:	**Individual valve for pipe connection Individual valve Manifold mounting**
Adjustment:	**Tool adjustable Manually adjustable**
$p_{max\ P}$: $p_{max\ A}$:	**300 ... 400 bar 250 ... 400 bar**
Q_{max}:	**120 lpm**

Design and order coding example

ADM 22 D R - 250

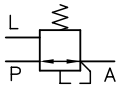
- **Pressure setting [bar]**
- **Adjustability in operation**
  - Tool adjustable (-)
  - Manually adjustable (R)
  - Adjustable with turn knob (self-locking -V/lockable -H)
- **Pressure range** Pressure ranges for outlet pressure at A
- **Basic type, size** Type ADM (non-piloted), size 1 to 3

VDM 5 H R - 250

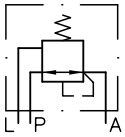
- **Pressure setting [bar]**
- **Adjustability in operation**
  - Tool adjustable (-)
  - Manually adjustable (R)
- **Pressure range** Pressure ranges for outlet pressure at A
- **Basic type, size** Type VDM (hydraulically piloted), size 3 to 5
  - Hydraulically piloted pressure-reducing valve type VDX (pressure-limiting valve at port L)

Function

ADM..

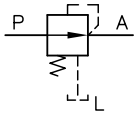


Valve for pipe connection

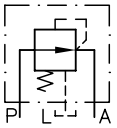


Manifold mounting valve

VDM..



Valve for pipe connection

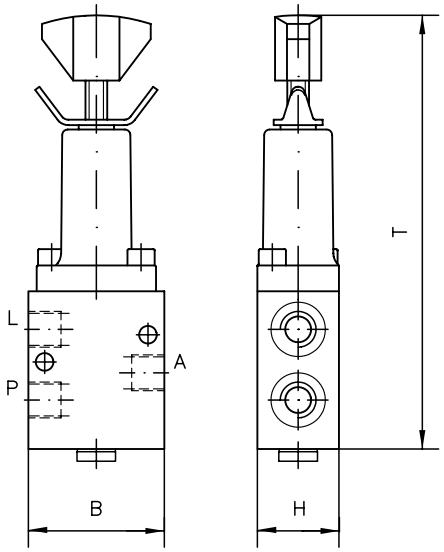


Manifold mounting valve

General parameters and dimensions

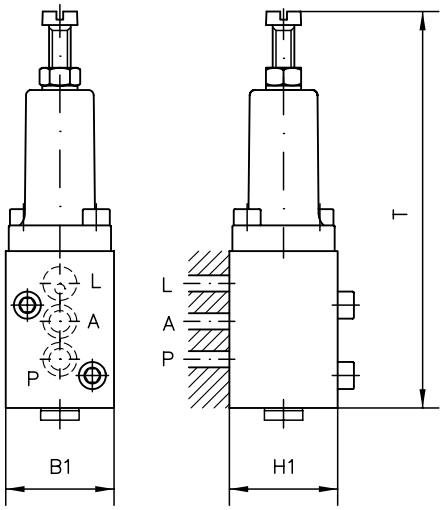
ADM 22 DR

Directly controlled pressure reducing valve type ADM size 2, for pipe connection
(tapped ports G 3/8 (BSPP), coding 2),
pressure range 30 to 120 bar (coding D),
pressure manually adjustable (coding R)
Directly controlled pressure-reducing valve type ADM, size 2 for pipe connection
(ports G 3/8 (BSPP), coding 2),
Pressure range 30 to 120 bar (coding D),
Manually adjustable pressure (coding R)



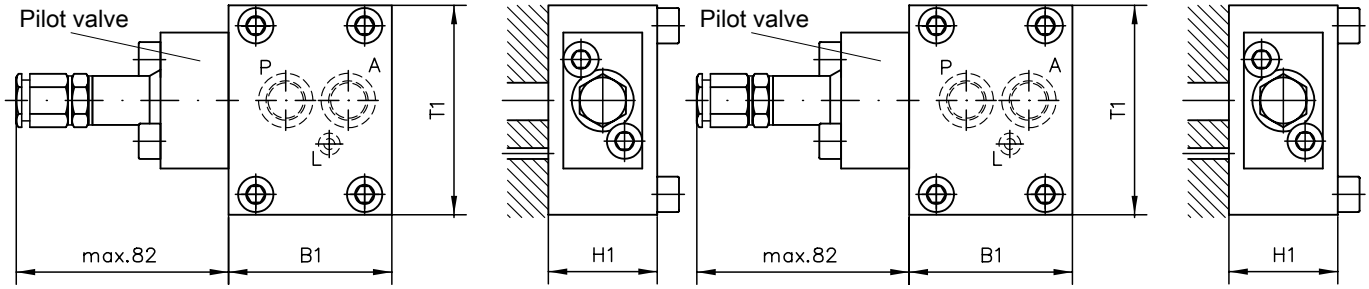
ADM...P

Manifold mounting valve



VDM...G
Valve for pipe connection

VDM 5 PH - 250
Piloted pressure reducing valve type VDM size 5,
manifold mounting (coding P),
pressure range 10 to 400 bar (coding H),
pressure tool adjustable to 250 bar
Piloted pressure-reducing valve type VDM, size 5
for manifold mounting (coding P),
pressure range 10 to 400 bar (coding H),
tool adjustable pressure to 250 bar



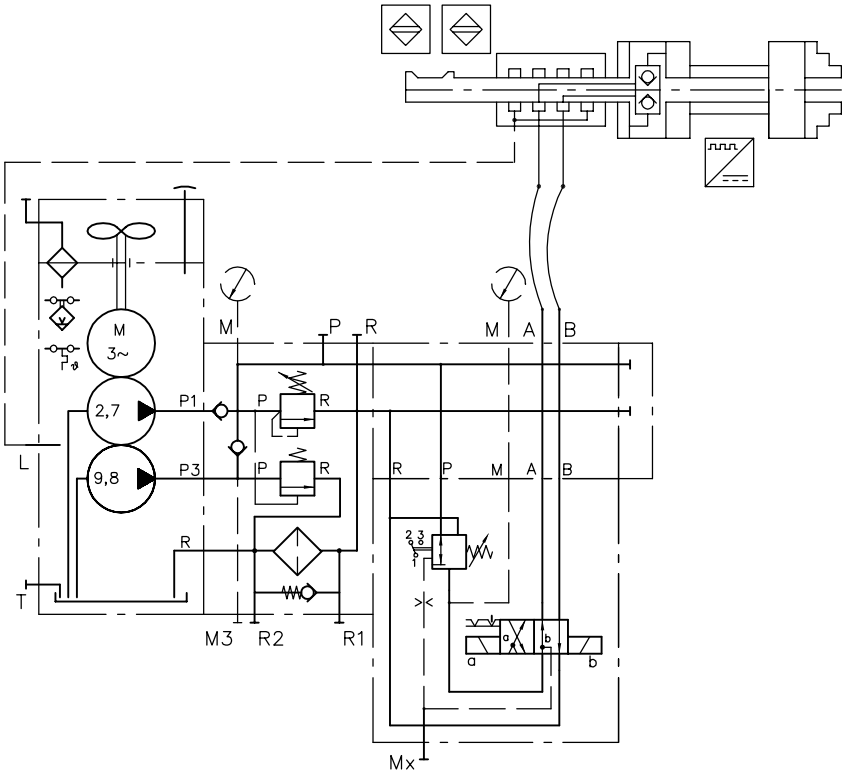
	Q_{max} [lpm]	p_{max} [bar]	$p_{max\ A}$ [bar]	Ports (BSPP)[2]	Leakage flow Q_{leak} [lpm]	Dimensions [mm]						m_{max} [kg][3]
						H	H1	B	B1	T	T1	
ADM 1...	12	300	F: 30 D: 120 C: 160 A: 250	G 1/4	approx. <0.05	30	35	45	35	141	-	0.6/0.6
ADM 2..	25			G 1/4, G 3/8	approx. <0.05	30	40	50	40	162	-	0.7/0.85
ADM 3..	60		F: 25 D: 100 C: 160 A: 250	G 3/8, G 1/2	approx. <0.07	30	40	50	40	174	-	1.0/1.1
VDM 3..	40	400	N: 100 H: 400[1]	G 1/2	approx. <0.4	30	-	60	-	66	-	1.1/--
VDM 4..	70			G 3/4		40	40	65	60	71	78	1.5/2.0
VDM 5..	120			G 1		50	50	80	88	73	81	2.0/2.5

1) Max. pressure difference is 300 bar between inlet and outlet
2) Design for pipe connection
3) Version for pipe connection / manifold mounting

Example circuit:

HK 43 LDT/1 M - ZZ 2.7/9.8

-AN 21 F 2-D45-F50
-BA 2
-NSMD 2 K/GRK/0
-1-G 24



Associated technical data sheets:

- Pressure-reducing valves type ADM: D 7120
- Pressure-reducing valves type VDM, VDX: D 5579

Similar products:

- Miniature pressure-reducing valves type ADC etc.: Page 190
- Miniature prop. pressure-reducing valves type PM, PMZ: Page 200
- Pressure-reducing valves type CDK: Page 196
- Prop. pressure-reducing valves type PDM: Page 202

2.3 Pressure-reducing valves type CDK, CLK, DK, DLZ and DZ

The task of pressure reducing valves is to maintain a largely constant outlet pressure despite a higher and changing inlet pressure. These valves are used when a secondary circuit has to be fed with a lower but constant pressure level by a main (primary) oil circuit with a higher and varying pressure level. The valve described here is directly controlled. Compared with conventional, piston-type pressure reducing valves suffering from leaking oil, where an additional drain port is required, this type is designed according to the two-way principle, i.e. it has zero leakage when in a closed state. Type CLK has an integrated safety valve function. A reversal of the flow direction is possible up to approx. 2 x Q_{max}. A particular feature of type DK is the tracked pressure switch, i.e. the pressure and switch are set at the same time with one adjustment device.

Features and benefits:

- Zero leakage in closed state
- Version with integrated overpressure function

Intended applications:

- General hydraulic systems
- Jigs
- Test benches

Nomen-clature:	**Pressure reducing valve (2-way valve)**
Design:	**Screw-in valve combination with a connection block for** ■ **Pipe connection** ■ **Manifold mounting**
Adjustment:	**Tool adjustable** **Manually (adjustable)**
p_{max}:	**500 bar**
Q_{max}:	**22 lpm**

Design and order coding example

CDK 3 -2 R - 250

Pressure setting [bar]

Adjustment
- Tool adjustable (-)
- Manually adjustable (R)
- Adjustable with turn knob (self-locking -V/lockable -H)

Basic type and pressure range Type CDK, type CLK (with additional override compensation)
- Screw-in valve
- Version with connection block for pipe connection with/without pressure-limiting valve
- Version with connection block for manifold mounting with/without pressure-limiting valve
- In intermediate plate design NG6 (type NZP)

DK 2 R /160 /4R

Additional elements Orifice/throttle

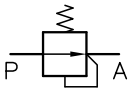
Pressure setting [bar]

Adjustment
- Tool adjustable (-)
- Manually adjustable (R)
- Adjustable with turn knob (self-locking -V/lockable -H)

Basic type and pressure range Type DK (with tracked pressure switch)
Type DZ with type CDK
Type DLZ with type CLK
- With bypass check valve
- Manifold mounting
- Version with connection block for pipe connection

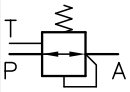
Function

CDK

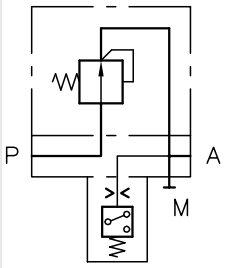


Screw-in valve

CLK

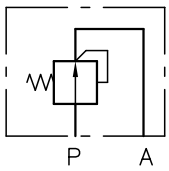


CDK 3. -..-1/4-DG3.



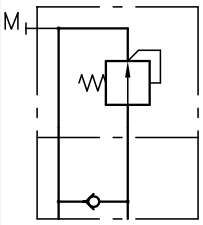
Version for pipe connection, a pressure switch type DG 3. May be installed as option, additional port for pressure gauge

CDK 3. -..-P



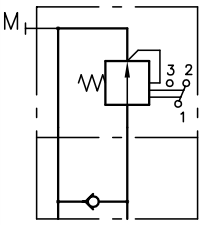
Manifold mounting valve

DZ, DLZ



Manifold mounting valve, optional with orifice/throttle and bypass check valve

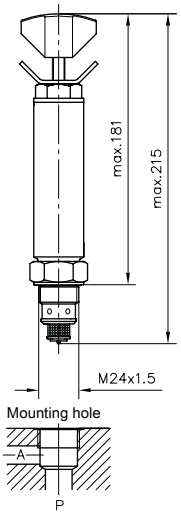
DK



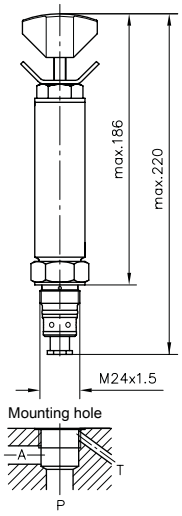
Manifold mounting valve with tracked pressure switch

General parameters and dimensions

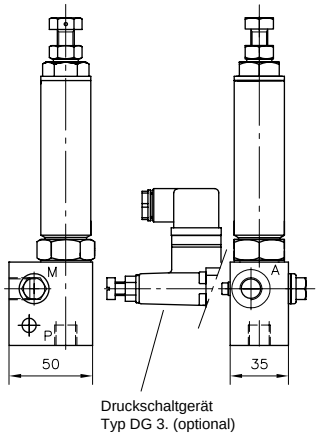
CDK 3..



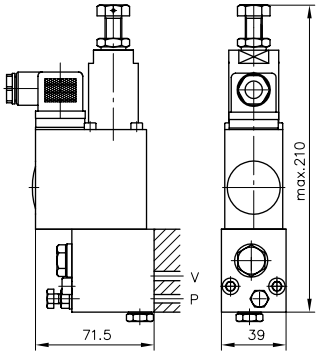
CLK 3..



CDK 3. -..-1/4-DG3.



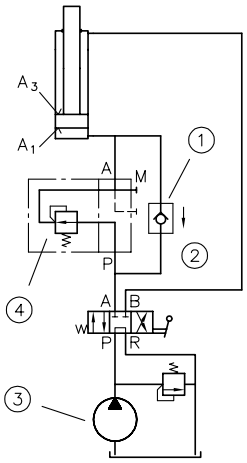
DK 2.



	Q_{max} [lpm]	Pressure range p_{max} [bar]		Ports (BSPP)	m [kg]
CDK 3.-..., CLK 3.-...	6... 22	**..-08:** 450[1)]	**..-2:** 200..	-	0.7
CDK 3. -..-1/4-DG3.		**..-081:** 500[1)] **..-1:** 300..	**..-21:** 250.. **..-5:** 130..	G1/4	1.25
CDK 3. -..-P		**..-11:** 380...	**..-51:** 165	-	1.4
DZ..., DLZ..., DK...				-	

1) Only available as type CDK and DK

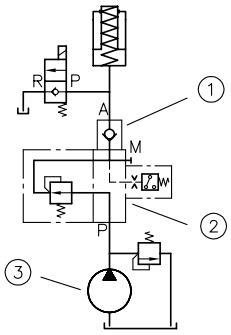
Example of a version
with large flows $Q_{A \rightarrow P}$
Example: Q_P = 15 l/min [formula]



Application example for large flows

1. e.g. Type RK 2G acc. to D 7445
2. Q_{reflow} = 45 lpm
3. Q_P = 15 lpm
4. Type CDK 3-2-1/4

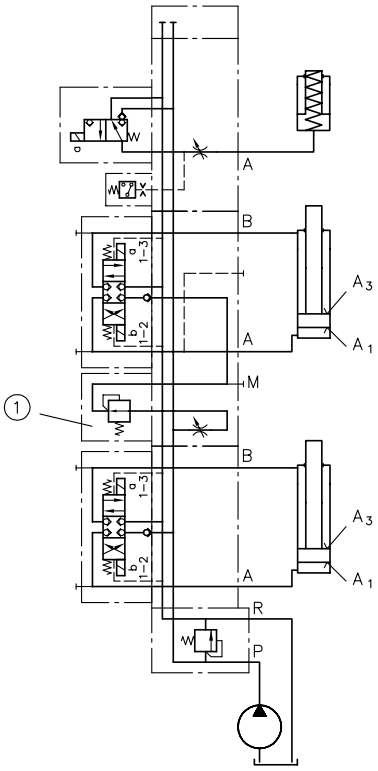
Example of a version
with undesired return flow



Application example for undesired return flow

1. e.g. type RK 1E in acc. with D 7445 (shown here screwed into port A of the CDK 3 valve)
2. Type CDK 3- 2-1/4-DG 34

Use in the valve bank,
shown here with seated valves type BVZP 1
in acc. with D 7785 B
BVZP 1 A - 1/300 - G22/0
- G22/CZ2/100/4/2
- WN1H/10/4
- 1 - 1 - G 24



Application example in the valve bank

1. Type CDK 3-2-100 shown here incorporated as
-/CZ 2/100...

Associated technical data sheets:
- Pressure-reducing valves type CDK: D 7745
- Pressure-reducing valves type CLK: D 7745 L
- Pressure reducing valve with tracked pressure switch type DK, DZ: D 7941

Similar products:
- Pressure-reducing valves type ADM, VDM, VDX: Page 192
- Miniature pressure-reducing valves type ADC etc.: Page 190
- Prop. pressure-reducing valves type PDM: Page 202

Intermediate plates:
- Intermediate plate NG 6 type NZP: D 7788 Z

Accessories:
- Pressure switches type DG 3., DG 5 E: Page 266

See also section "Devices for special applications"
- Screw-in valves and installation kits

Pressure valves

2.3 Miniature proportional pressure reducing valves type PM

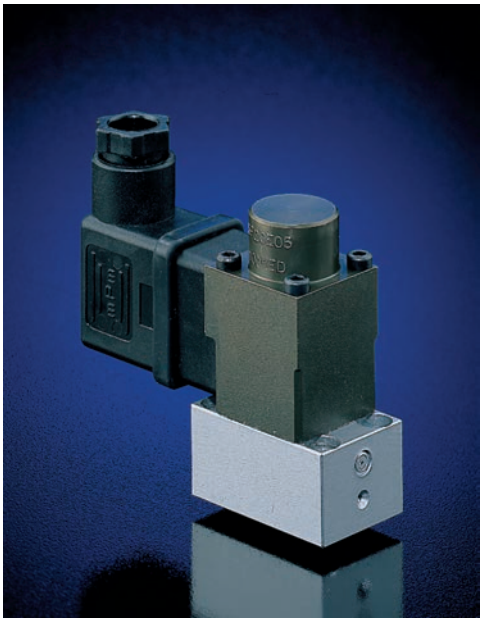
These proportional pressure reducing valves are used for circuits, where other devices i.e. directional spool valves should be controlled with a low flow and varying pressure. The pressure on the secondary side (port A) can be adjusted, independently from the pressure on the primary side, according to an electrical signal. The reduced pressure at port A will change proportional to alternation of the electrical input signal. There is a design related permanent leakage flow apparent at R, which has to be led back to the tank via a depressurized line. These pressure reducing valves feature a override compensation i.e. acting like a pressure limiting valve, if the pressure on the secondary side exceeds the set pressure e.g. due to external forces.

Features and benefits:

- Compact design
- Numerous configurations

Intended applications:

- For control oil supply in piloting circuits



Nomen-clature:	**Prop. pressure reducing valve**
Design:	**Assembly kit Individual valve Manifold mounting**
Adjustment:	**Electro-proportional**
$p_{max\ P}$: $p_{max\ A}$:	**40 bar 19 bar**
Q_{max}:	**approx.. 2 lpm**

Design and order coding example

PM 1 - 11 B 0,6 - G24

Nominal voltage of proportional solenoid — Controls via prop. amplifier or PLVC
Type PMZ also available in ATEX-compliant version

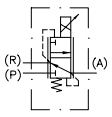
Additional elements
- Orifice for oscillation damping in A and B
- Return pressure stop in R

Prop. adjustable nominal pressure difference [bar]

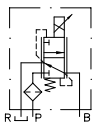
Basic type — Type PM
Type PMZ
- Assembly kit (type PM 1, PMZ 01, PMZ 11)
- For manifold mounting (type PM 11, PM 12)
- Version in valve bank (type PMZ) with up to 10 prop. pressure-reducing valve sections

Function

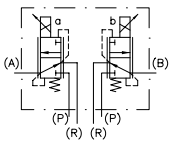
PM 1



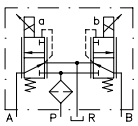
PM 11



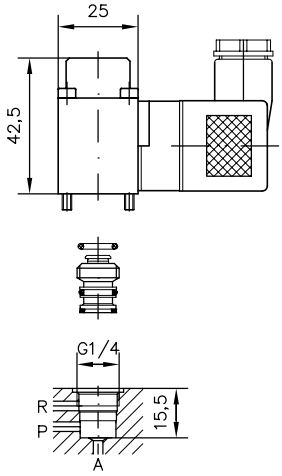
PMZ 1



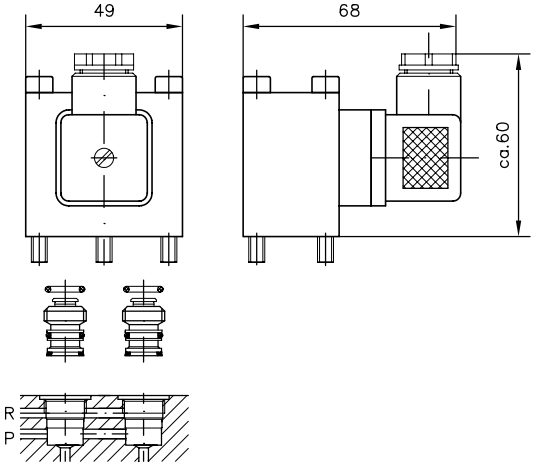
PM 12



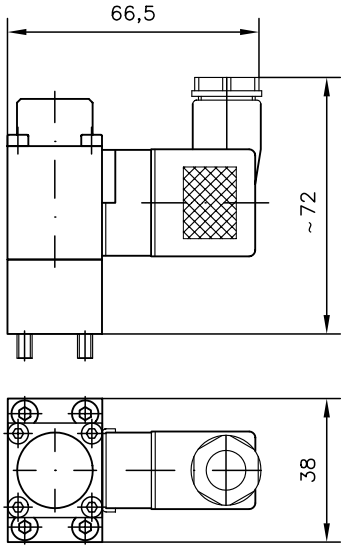
PM 1



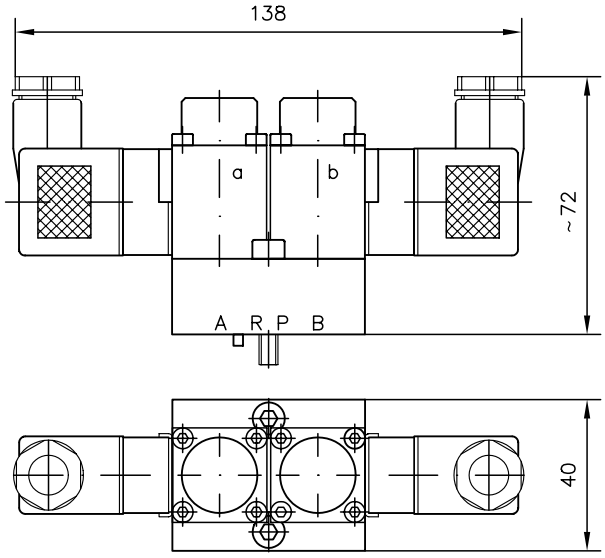
PMZ 1



PM 11



PM 12



	Design		Pressure range (prop. adjustable nom. pressure difference $\Delta p = p_A - p_R$) [bar]
PM 1	Assembly kit	Individual valve	0... 9
PMZ 1, PMZ 01		Twin valve	0... 4.5 and 0... 11.5
PM 11	Valve for manifold mounting	Individual valve	0... 5.5 and 0... 14
PM 12		Twin valve	0... 7.5 and 0... 19

Associated technical data sheets:

- Miniature prop. pressure reducing valves type PM, PMZ: D 7625

Similar products:

- Prop. pressure reducing valves type PDM: Page 202

Prop. amplifier:

- Type EV1M (module): Page 276
- Type EV1G (module): Page 276
- Type EV1D (module): Page 276
- Type EV22K (card version): Page 276

Additional electrical components:

- Programmable logical valve control type PLVC: Page 278

See also section “Devices for special applications”:

– Proportional valves

2.3 Proportional pressure reducing valves type PDM

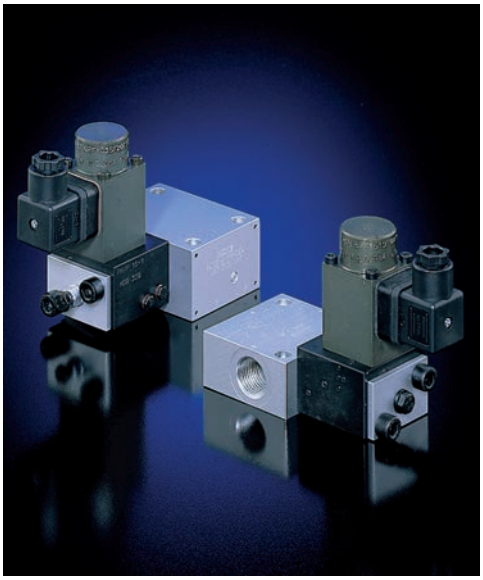
The task of proportional pressure reducing valves in a hydraulic circuit is to maintain a rather constant outlet pressure (port A) despite a higher and changing inlet pressure (port P). They are used when an hydraulic circuit with a higher pressure level (primary side) is to supply another circuit with a lower pressure level (secondary side), without affecting the higher pressure in the primary circuit. There is a design related permanent leakage flow apparent at L, which has to be led back to the tank via a de-pressurized line. A reversal of the direction of flow is possible up to approx. 50% of Q_{max}. A by-pass check valve has to be provided for higher reversed flow. The pressure reducing valves size 11 and 21/22 feature an override compensation i.e. acting like a pressure limiting valve, if the pressure on the secondary side exceeds the set pressure e.g. due to external forces.

Features and benefits:

- With safety valve function

Intended applications:

- General hydraulics
- Jigs
- Test benches



Nomen-clature:	**Prop. pressure-reducing valve (directly controlled or piloted)**
Design:	**Individual valve for pipe connection Individual valve Manifold mounting**
Adjustment:	**Electro-proportional**
$p_{max\ P}$: $p_{max\ A}$:	**400 bar 5 ... 350 bar**
Q_{max}:	**120 lpm**

Design and order coding example

PDMP 2 PDM 4 G	- 43	- G24

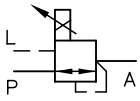
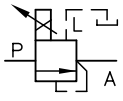
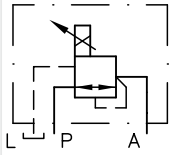
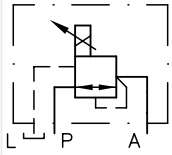
Nom. voltage prop. solenoid 12V DC, 24V DC, controls via prop. amplifier or PLVC

Pressure range Pressure ranges for pressure downstream at A

Basic type, size, design Type PDM (pipe connection), size 11, 21, 22
Type PDMP (manifold mounting), size 11, 22
Type PDM, size 3 to 5
Pipe connection (G), manifold mounting (P)

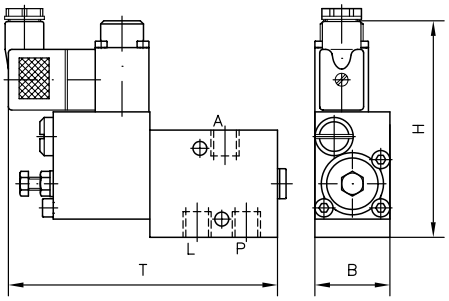
Function

PDM

		Piloted	Piloted
Valve for pipe connection:		Manifold mounting valve:	
			

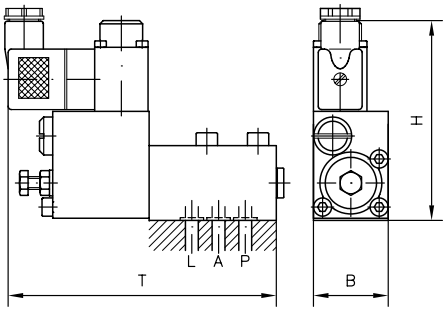
PDM 11, PDM 21, PDM 22

Valve for pipe connection

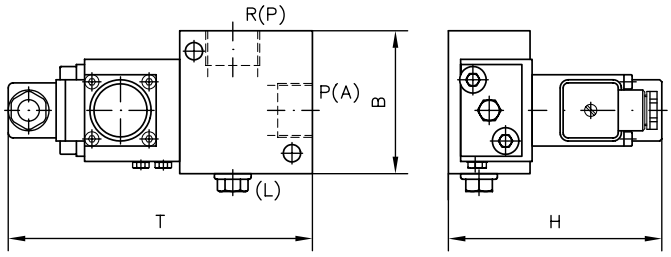


PDMP 11 and PDMP 22

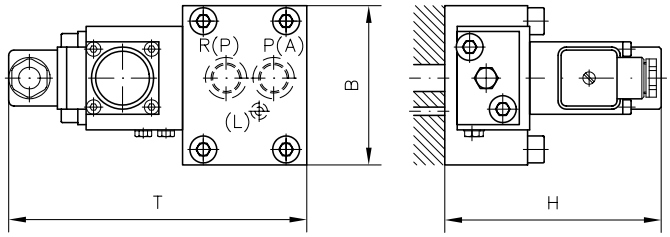
Manifold mounting valve



PDM 3 to 5



PDM 4P and PDM 5P



		Q_{max} [lpm]	Pressure range $p_{max\ A}$ [bar]	Ports (BSPP)[1]	Leakage flow Q_{leak} [lpm]	Dimensions [mm]			m [kg]
						H	B	T	
PDM 11	Directly controlled	12	41: 80 42: 130 43: 200 44: 320	G 1/4	< 0.5	113	35	135	1.5
PDMP 11				-		108	35	135	1.4
PDM 21/22		20	41: 45 42: 70 43: 110 44: 180	G 1/4, G 3/8	< 0.5	113	35	142	1.6
PDMP 22				-		108	40	142	1.3
PDM 3 G	Piloted	40	N: 130 M: 200 H: 350	G 1/2	< 0.8	96	66	150	1.8
PDM 4 G		70		G 3/4		99.5	71	155	2.2
PDM 5 G		120		G 1		104.5	73	170	2.7
PDM 4 P		70		-	-	99.5	78	150	2.7
PDM 5 P		120		-	-	104.5	81	178	3.2

1) Version for pipe connection

Associated technical data sheets:

- Prop. pressure reducing valves type PDM: D 7486, D 7584/1

Similar products:

- Miniature prop. pressure reducing valves type PM, PMZ: Page 200

Prop. amplifier:

- Type EV1M (module): Page 276
- Type EV1G (module): Page 276
- Type EV1D (module): Page 276
- Type EV22K (card version): Page 276

Additional electrical components:

- Programmable logical valve control type PLVC: Page 278

See also section "Devices for special applications":

– Proportional valves

2.3 Circulation valve type CNE

The pressure controlled 2-way directional valve automatically switches one (low pressure) of two circuits feeding a hydraulic system into idle circulation as soon as the adjusted pressure is achieved or exceeded by the high pressure circuit. The valve is retained in this shifting position, enabling idle circulation, via the higher pressure being picked up and transmitted by a control oil duct. This valve also serves as a pressure limiting valve for the low pressure circuit.
Contrary to version CNE 2, CNE 21 features an additional thread seal and CNE 22 and 23 a thread seal plus a piston seal.
The idle circulation valves type CNE are screw-in valves where the mounting hole can be easily manufactured.

Features and benefits:
- Compact design
- Easily produced mounting hole

Intended applications:
- Accumulator charged systems
- Jigs

Nomen-clature:	2-way circulation valve
Design:	Screw-in valve
Adjustment:	Tool adjustable
p_{max}: **$p_{max\ adjust}$:**	500 bar 450 bar
Q_{max}:	30 lpm

Design and order coding example

CNE 2 | C | - 50

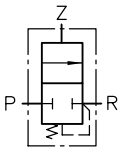
- - 50: Pressure setting [bar]
- C: Pressure range
- CNE 2: Basic type, size

Pressure controlled 2-way valve type CNE

Additional versions:
- Additionally sealed tapped journal to minimize the internal leakage loss (type CNE 21)
- Additionally sealed tapped journal and piston to minimise leakage loss (type CNE 22 and CNE 23)

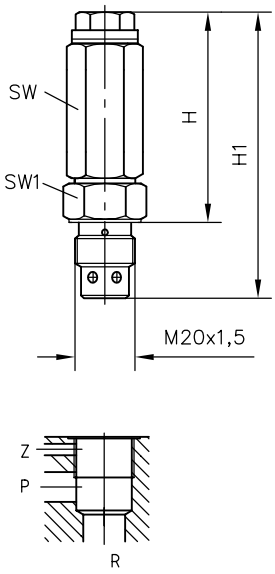
Function

CNE

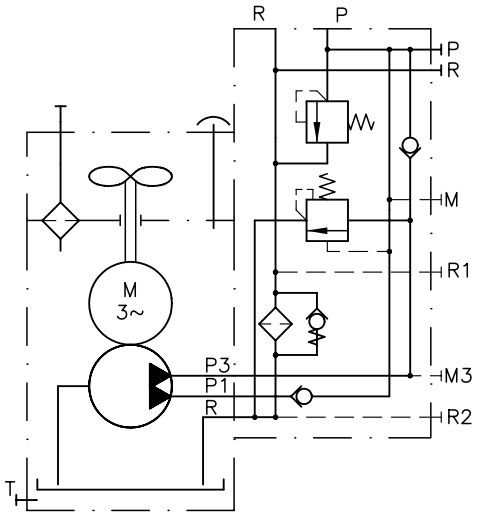


General parameters and dimensions

CNE 2



Order example:
HK448/1-HH..-AN21F2
Circulation valve integrated in connection block type AN 21 F2 for compact hydraulic power packs type HK with two pump circuits



	Q_{max} [lpm]	Oper. pressure p_{max} [bar] with		Dimensions [mm]			
		P	Z	H	H1	SW = a/f	SW1
CNE 2 CNE 21 CNE 23	30	E: 30 D: 45 C: 60 B: 75 A: 90 M: 120 L: 150	500	70	96	22	24
CNE 22	30	C: 320 B: 450	500	120	147	30	27

Associated technical data sheets:
- Idle circulation valves type CNE: D 7710 NE

Similar products:
- Two-stage valves type NE: Page 206
- Switch units type CR: Page 164
- Shut-off valves type LV, ALZ: Page 208
- Switching valves type AE: Page 184

Connection blocks:
- Two-stage connection blocks type NA: D 6905 A/1
- Connection blocks type AN, AL: D 6905 A/1

See also section "Devices for special applications"
- Screw-in valves and installation kits and devices for up to 700 bar

Pressure valves

2.3 Two stage valves type NE

Two stage valves are used for hydraulic systems fed by two stage pumps (low and high pressure). They unit the flow from both pumps, automatically switch the low pressure circuit to idle circulation as soon as the adjusted pressure is achieved or exceeded by the high pressure circuit and safeguard both pumps from excessive pressure above the set figures. These valves are intended for use together with 3/3- or 4/3-way directional valves controlling hydraulic cylinders. Bottom ram presses and single acting hydraulic cylinders are better controlled by switch units type CR.

Features and benefits:

- Max. operating pressure 700 bar
- Direct mounting to hydraulic power packs
- Direct combination with valve control

Intended applications:

- Presses
- Test benches
- Hydraulic tools

Nomen-clature:	Two stage valve (high pressure (HP) / low pressure (LP) stage)
Design:	Individual valve for pipe connection
Adjustment:	Tool adjustable
p_{max}:	500 ... 700 (HP) / 30 ... 80 (LP) bar
Q_{max}:	25 (HP) / 180 (LP) lpm

Design and order coding example

NE 20 **- 650/20**

Pressure setting [bar] High- /low pressure

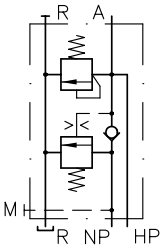
Basic type NE 20, 70 and 80

Additional versions:

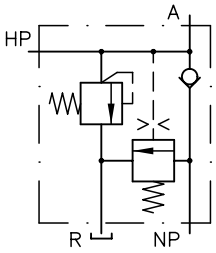
- Direct mounting at hydraulic power packs type MP and RZ
- Valve banks type BV can be directly mounted (type NE 21)

Function

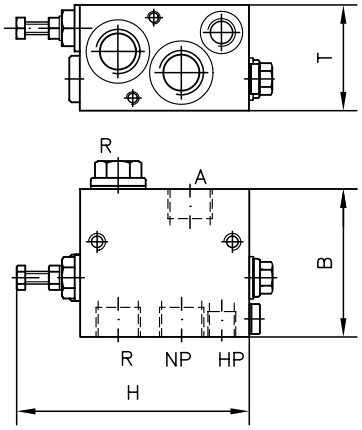
NE 20



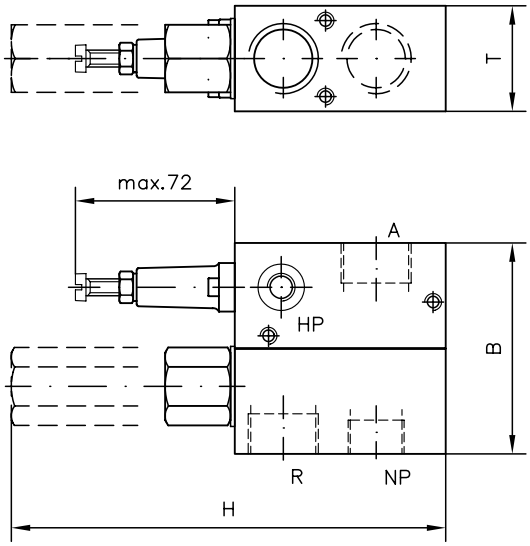
NE 70, NE 80



NE 20



NE 70, NE 80



	Q_{max} [lpm]		p_{max} [bar]		Ports (BSPP)			Dimensions [mm]			m [kg]
	HD	ND	HD	ND	A, R	HP	NP	H	B	T	
NE 20	10	40	20 ... 700	16 ... 80	G 1/2	G 1/4	G 1/2	110	70	50	2.1
NE 70	16	100	(0) ... 500	(0) ... 60	G 1	G 1/4	G 3/4	131	100	50	3.4
NE 80	25	180	(0) ... 500	(0) ... 30	G 1 1/4	G 3/8	G 1	259	120	60	7.0

Associated technical data sheets:

- Two-stage valves type NE: D 7161

Pumps:

- Compact hydraulic power packs type MP, MPN, MPW, MPNW: Page 22
- Dual-stage pump type RZ: Page 62

Similar products:

- Idle circulation valves type CNE: Page 204
- (Press) switch units type CR: Page 164
- Directional seated valves type VB: Page 130

See also section “Devices for special applications”:

- Press control
- Devices for up to 700 bar

Pressure valves

2.3 Shut-off valves type LV and ALZ

These shut-off valves automatically switch the pump delivery flow into idle circulation as soon as the adjusted pressure is achieved. There is a check valve upstream of the consumer port A preventing any return flow via the port R . The idle circulation switching position is interrupted as soon as the pressure in the consumer port drops approx. 13% under the set pressure figure. The self controlled valves type LV do not require any flow pulsation whereas type ALZ is a piloting valve. Both types are mostly used as accumulator charge valves, and should be installed as near to the pump as possible.

Features and benefits:

- Various means of adjustment
- Various additional functions

Intended applications:

- General hydraulics
- Test benches

Nomenclature:	**Shut-off valve (idle circulation valve, direct controlled or piloted)**
Design:	**Individual valve for pipe connection Individual valve Manifold mounting**
Adjustment:	**Tool adjustable manually adjustable**
p_{max}:	**350 bar**
Q_{max}:	**120 lpm**

Design and order coding example

LV 10 P ALZ 3 G	**D CR**	**- 180 - 250**

Pressure setting [bar]

Pressure range

- Tool adjustable (-)
- Manually adjustable (R)

Basic type, size, design

Type LV, size 10, 20, 25

- Pipe connection (-)
- Manifold mounting (P)
- Design with low switching hysteresis (type LV 25)

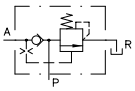
Type ALZ, size 3 to 5

- Pipe connection (G)
- Manifold mounting (P)
- Arbitrary idle pump circulation via 2/2-way solenoid valve

Function

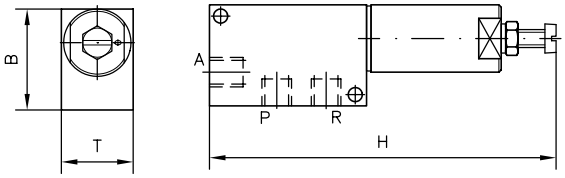
LV, ALZ

For pipe connection:

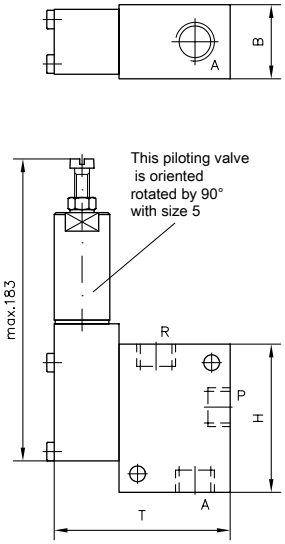


Manifold mounting valve:

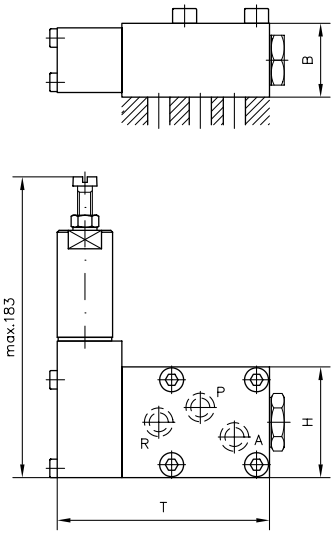
LV..



ALZ..G..



ALZ..P..



	Control	Q_{max} [lpm]	Pressure range: p_{max} [bar]	Ports (BSPP)[1]	Dimensions [mm]			m [kg]
					H	B	T	
LV 10	Direct	12	F: 60 E: 140 D: 240 C: 350	G 1/4	155	45	32	0.9
LV 20, LV 25		25	F: 80 E: 140 D: 220 C: 350	G 3/8	205	50	32	1.2
ALZ 3 G	Piloted	50	F: 60 E: 140 D: 240 C: 350	G 1/2	80	40	99	2.0
ALZ 4 G		80		G 3/4	94	40	109	2.4
ALZ 5 G		120		G 1	105	63	135	4.3
ALZ 4 P		80		G 3/4	60	40	119	2.1
ALZ 5 P		120		G 1	80	40	133	4.3

1) For pipe connection versions only

Associated technical data sheets:

- Shut-off valves type LV: D 7529
- Shut-off valves type ALZ: D 6170-ALZ
- Shut-off valves type AL: D 6170

Similar products:

- Release valves type AE: Page 184
- Connection blocks type AL: Page 32

Pressure valves

2.3 Pressure controlled shut-off valves type DSV and CDSV

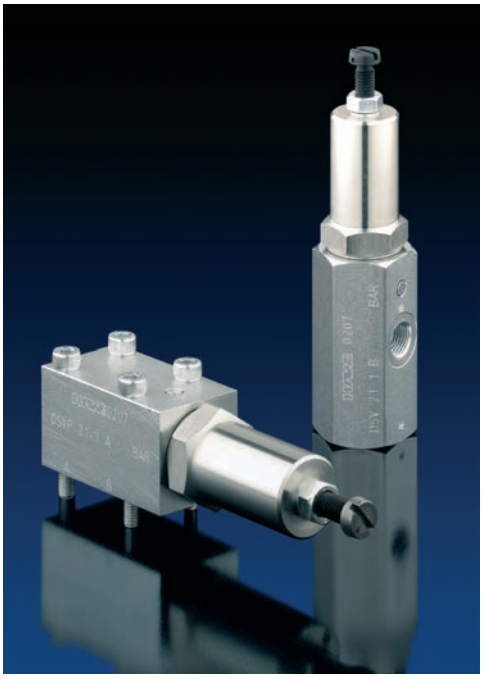
These pressure-controlled shut-off valves in the seated valve version block the flow to consumers located downstream without any leakage as soon as the set pressure value is reached or exceeded in the consumer line B. The valves will open again if the pressure on the inlet side A drops below the set value defined by the spring tension. While type DSV is designed for manifold mounting or pipe connection, type CDSV is a screw-in valve with easily machined mounting holes. It is frequently used to safeguard pressure gauges, for example.

Features and benefits:

- Various adjustment options
- Various additional functions

Intended applications:

- General hydraulic systems
- Test benches
- (Pressure gauge) protection valve



Nomen-clature:	**Shut-off valve**
Design:	**Individual valve for pipe connection Manifold mounting Screw-in valve**
Adjustment:	**Tool adjustable manually adjustable**
p_{max}:	**600 bar**
Q_{max}:	**60 lpm**

Design and order coding example

CDSV 1 | A | - 1/4 | - 400

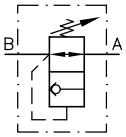
- **Pressure setting [bar]**
- **Design** with connection block (-1/4) / Cartridge valve (-)
- **Pressure range** Tool adjustable (-) or manually adjustable (R)
- **Basic type, size** Type CDSV (cartridge valve), size 1

DSV 21-1 | B | - 200

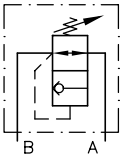
- **Pressure setting [bar]**
- **Pressure range** Tool adjustable (-) or manually adjustable (R)
- **Basic type, size** Type DSV (pipe connection), type DSVP (manifold mounting), size 1, 2, 3

Function

CDSV 1, DSV 2

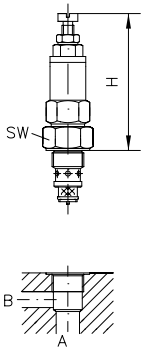


DSVP 2

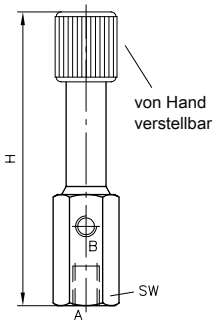


General parameters and dimensions

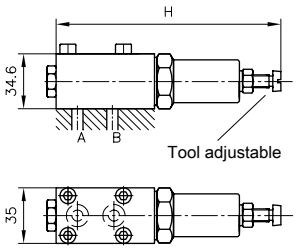
CDSV 1
Screw-in valve



DSV 2-2
Version for pipe connection



DSVP 21-1
Manifold mounting valve



	Design	Size	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	H_{max} [mm]	SW = a/f	m [kg]
CDSV 1	Screw-in valve	1	10	C: 120 B: 350 A: 600	M 16 x 1.5	69	SW 22	0.13
DSV 2[1)]	Version for pipe connection	1	20	D: 40 C: 100 B: 220 A: 600	G 1/4	185	SW 36	0.7
		2	40	D: 20 C: 60 B: 120 A: 400	G 3/8	193	SW 36	0.9
		3	60	D: 20 C: 60 B: 120 A: 400	G 1/2	193	SW 46	1.1
DSVP 2[1)]	Manifold mounting valve	1	20	D: 40 C: 100 B: 220 A: 600	G 1/4	181	-	1.1

1) Manifold mounting valve only in size 1

Associated technical data sheets:
- Shut-off valves type DSV, DSVP: D 3990
- Shut-off valves type CDSV: D 7876

See also section "Devices for special applications":
- Screw-in valves and installation kits
- Devices for up to 700 bar

2.3 Load holding valves type LHK, LHDV, and LHT

Load-holding valves are pressure valves that always act on the outlet side of double-acting consumers. They block the outlet duct with their set pressure (pressure setting approx. 15% above the max. load pressure), generating a counter force to a pushing (negative) load. Therefore the pump will have to feed the inflow side with residual pressure in order to drop the load.

Type LHK valves are intended for use in applications that are not particularly prone to oscillations.

Load-holding valves of type LHT and type LHDV featuring special damping properties are especially well suited for applications together with prop. directional spool valves ("Load Sensing" directional spool valves) e.g. type PSL/PSV.

Many additional options are available such as shock valves and shuttle valves with or without restrictor check valve (delayed release of hydraulic brakes) etc.

Features and benefits:

- Operating pressures up to 420 bar
- Various adjustment options
- Various configurations

Intended applications:

- Cranes
- Construction machinery
- Lifting devices

Nomen-clature:	**Load holding valve (over center valve, for one sided or alternating load direction) Single or twin valve**
Design:	**Individual valve for pipe connection Individual valve Manifold mounting Screw-in valve Version for banjo bolt mounting**
p_{max}:	**360 ... 450 bar**
Q_{max}:	**250 lpm**

Design and order coding example

LHK44 | G | - 11 | - 160

- **- 160** — **Pressure setting load-holding pressure [bar]**
- **- 11** — **Design** Various housing designs available
- **G** — **Dampening** Without/with, or with restrictor check valve
- **LHK44** — **Basic type, size** Type LHK (valve only, without shock valve), size 2 to 4

Additional versions:

- Some available with release ratio 1 : 2 and 1 : 7
- Version available as assembly kit

LHDV33	- 25WD	- B	6	-200/200-240/240

Pressure setting [bar] Load-holding pressure/load-holding pressure - shock valve pressure/shock valve pressure

Nozzle Release ratio may be altered with different orifice combinations in the range between 1 : 1.2 and 1 : 8.9

Flow

Additional elements

- With shock- and suction valves
- With shuttle valves for brakes
- With restrictor check valve

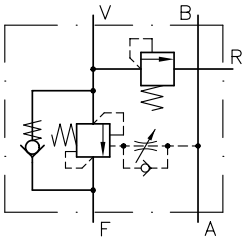
Basic type, size Type LHDV (with tailored dampening characteristics), size 3
Type LHT, size 2, 3 and 5

Additional versions:

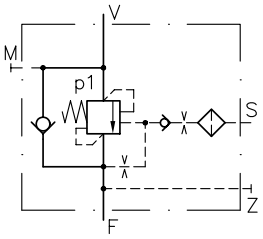
- Cartridge valve versions
- Type LHT
- Type LHTE, with discharge pressure compensation

Function

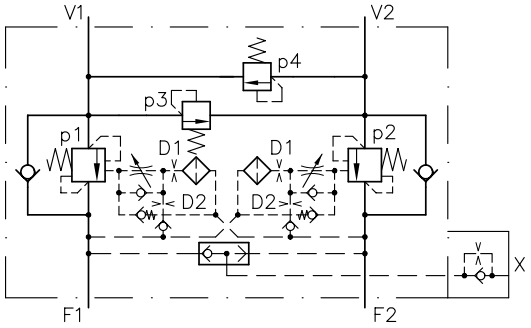
LHK 33 G-15-...



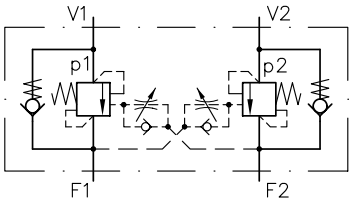
LHT 33 P-11-...



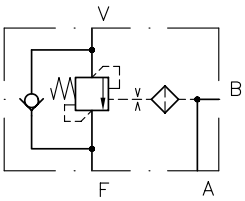
LHDV 33 G-25WD-...



LHK 44 G-21-...

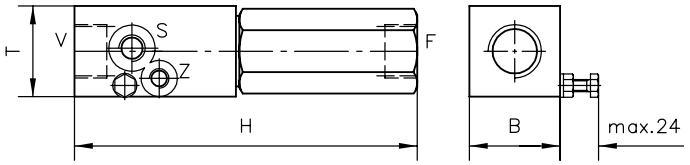


LHT 21 H-14-...

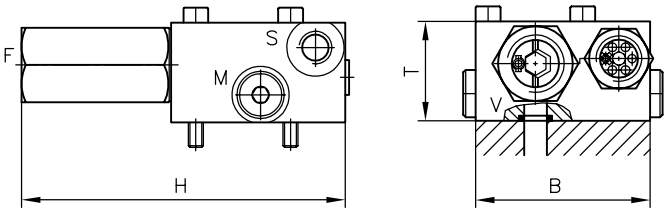


General parameters and dimensions

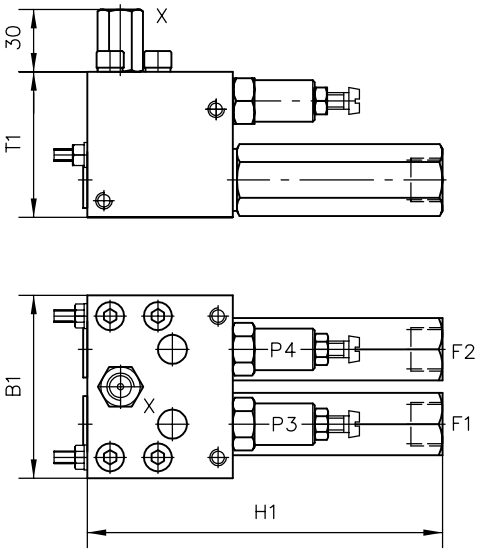
LHK 44 G - 11 - 160
Individual valve



LHT 33 P - 15
Individual valve



LHDV 33 - 25 WD - B 6 - 200/200 - 240/240
Twin valve

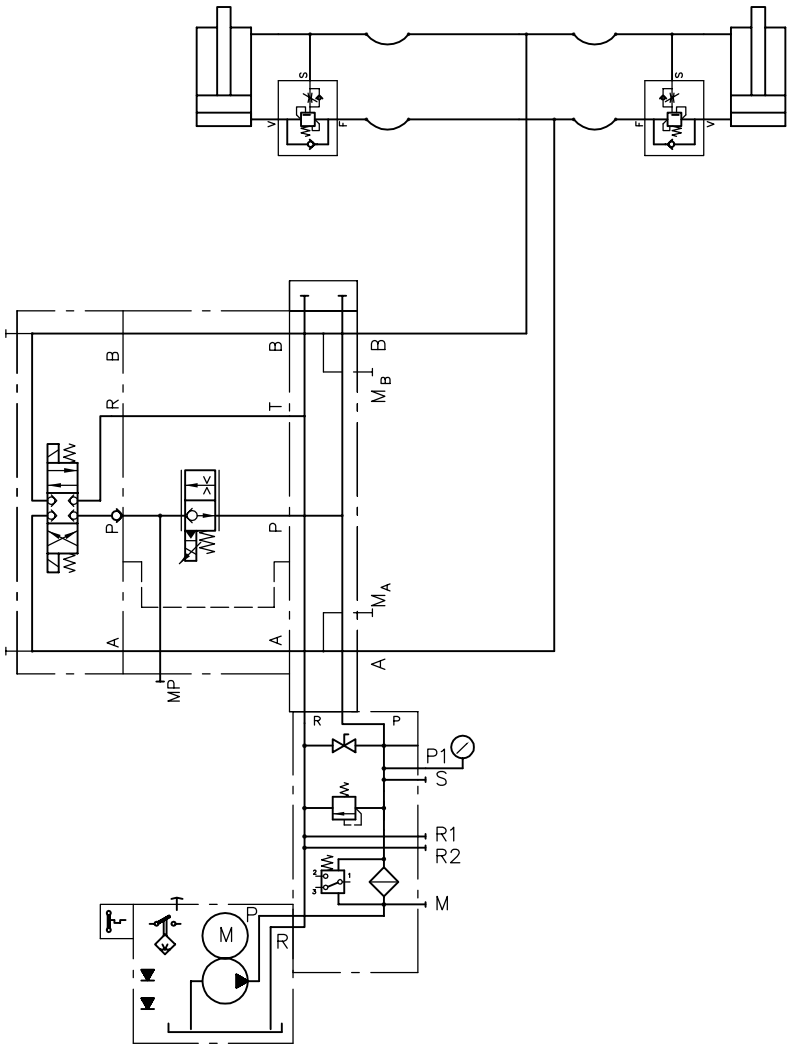


	Design	Q_{max} [lpm]	p_{max} [bar]	Release ratio	Ports (BSPP)	Dimensions [mm]			m [kg]
						H/H1	B/B1	T/T1	
LHK 22	Individual valve	20	400	1 : 4.6	G 3/8	97	32	32	0.5
	Twin valve[2)]					98	60	30	2.7
LHK 33	Individual valve	60	360	1 : 4.4	G 1/2	123	40	40	1.0
	Twin valve[2)]					125...291	80	40...60	2.7
LHK 44	Individual valve	100	350	1 : 4.4	G 3/4	170	45	45	1.6
	Twin valve[2)]					170	90	50	3.5
LHDV 33	Individual valve[2)]	80	420	1 : 8...1 : 1.2[1)]	G 1/2	170	50	40	1.8
	Twin valve					170	88	70	4.7
LHT 2	Individual valve	25	400	1 : 8, 1 : 4	G 1/4	132	40	24.8	1.2
	Twin valve					132	50	24.8	0.8
LHT 3	Individual valve[2)]	130	450	1 : 7...1 : 0.53 [1)]	G 1/2	128	70	40	1.6
LHT 5	Individual valve[2)]	250	450	1 : 6...1 : 0.79[1)]	G 1	113	50	50	1.0

1) Release ratio can be altered simply by changing the orifice
2) Note: Design may be significantly different to the illustrated version!

Example circuit:

LHK 33-G 11-210
MPN 44-H 13,1-B 55 L20-SKT
-A 1 D 10V E150-2
-BA 2-NBVP 16 G/R-GM/NZP 16 VP 20/3
-1-G 24
-X 84 V-9/250
-3 x 400/230V 50 Hz



Associated technical data sheets:

- Load holding valves type LHK: D 7100
- Type LHDV: D 7770
- Type LHT: D 7918

Additional integrable functions:

- Prop. directional spool valves type PSL, PSV,PSLF: Page 104
- Prop. directional spool valves type PSLF, PSVF: Page 110

See also section "Devices for special applications":

- Industrial trucks
- Mobile hydraulics
- Screw-in valves and installation kits

2.4 Metering valves

Flow control valves

with electro-proportional actuation type SE and SEH

Throttles type Q, QR, QV and FG

Flow control valves

Type	Nomenclature/Design	Adjustability	p_{max}	Q_{max}
SF, SD, SK, SU	**2-way and 3-way flow control valve** ■ Individual valve for pipe connection ■ Manifold mounting valve	- Mechanical - Solenoid	315 bar	0,3 ... 130 l/min
SB, SQ, SJ	**2-way metering valve, lowering brake valve** ■ Insert valve ■ Version with housing for pipe connection	- Tool adjustable	315 bar	0,25 ... 400 l/min
SE, SEH	**2-way and 3-way flow control valve** ■ Individual valve for pipe connection ■ Manifold mounting valve	- Electro-proportional	315 bar	0,1 ... 120 l/min

Flow dividers

Type	Nomenclature/Design	Adjustability	p_{max}	Q_{max}
TQ, TV	**Flow divider with or without priority division** ■ Individual valve for pipe connection ■ Manifold mounting valve	- Non-adjustable	300 ... 350 bar	7,5 ... 200 lpm nom. total flow

Orifices, restrictor check valves

Type	Nomenclature/Design		p_{max}	Q_{max}
EB, BE, BC	**Orifice, restrictor check valve** ■ Plug-in valve ■ Insert valve ■ Version with housing for pipe connection		400 ... 700 bar	0,5 ... 120 l/min

Throttles and throttle shut-off valves

Type	Nomenclature/Design	Adjustability	p_{max}	Q_{max}
Q, QR, QV, FG	**Throttle, restrictor check valve** ■ Screw-in valve ■ Individual valve for pipe connection Angle valve Banjo bolt Swivel fitting	- Tool adjustable	300 ... 400 bar	0 ... 80 lpm
ED, RD, RDF	**Throttle, restrictor check valve** ■ Individual valve for pipe connection	- Tool adjustable, - Manually adjustable	500 bar	12...130 lpm
CQ, CQR, CQV	**Throttle, restrictor check valve** ■ Screw-in valve	- Tool adjustable	700 bar	50 l/min
AV, AVT, CAV	**Throttle and shut-off valve** ■ With and without bypass check valve ■ Individual valve for pipe connection ■ Screw-in valve	- Tool adjustable, - Manually adjustable	500 ... 630 bar	50 l/min

Metering valves

2.4 Flow control valves type SF, SD, SK, and SU

The flow control valves type SF, SD, SK and SU are available in 2 and 3-way versions. They enable continuous adjustment of the oil flow settings in oil-hydraulic systems. With the type SU, a choice can be made between two constant flows.
The flow rate is kept constant within a close tolerance regardless of the system pressure and viscosity of the hydraulic oil.
Additional control functions (pressure-limiting valve and idle circulation valve integrated in the valve or implemented externally via Z control port) enable adjustment to specific requirements.
The 2-way flow control valves are available with bypass check valve and bridge circuit for free selection of the flow direction.
The various actuation modes make these flow control valves suitable for a broad range of applications.

Features and benefits:

- Various actuation modes
- Also in combination with bypass check valves

Intended applications:

- Construction machinery
- Machine tools
- General hydraulic systems

Nomen-clature:	2-way flow control valve 3-way flow control valve
Design:	Individual valves for pipe mounting Manifold mounting
Adjustment:	Mechanical ■ Adjusting knob ■ Roller actuation ■ Adjusting screw Solenoid (switching between two constant consumer flows)
p_{max}:	315 bar
Q_{max}:	0,3 ... 130 lpm

Design and order coding example

SF 3 - 3	/15	- S	- G24	- 120

Pressure setting [bar] of the pressure limiting valve (S)

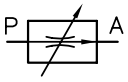
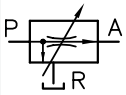
Solenoid voltage G 12, G 24, WG 110 and WG 230

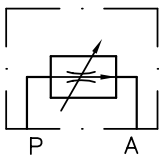
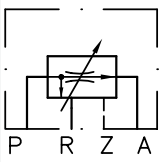
Mounting and add. valve
- Pipe connection (no coding)
- Manifold mounting (P)
- Valve with bypass check valve (R, PR)
- Check valve bridge circuit (B)
- Pressure-limiting valve (S)
- Pressure-limiting and circulation valve (S-WN1F, S-WN1D)

Flow Flow steps via orifices Q_{max} : 3, 6, 15, 36, 50, 60, 70, 90, 130 lpm

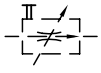
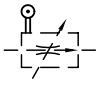
Basic type, design, size
- Type SD, with turn-knob
- Type SD with adjusting knob actuation
- Type SK with roller actuation (open version)
- Type SU, solenoid actuation, switching between to fixed values (only size 3 and only with pipe mounting design)
- Version as 2-way- (-2) and 3-way- (3) flow control valve
- Size 3 to 5
- Size 3 to 5

Function

2-way	3-way
Pipe mounting	
	

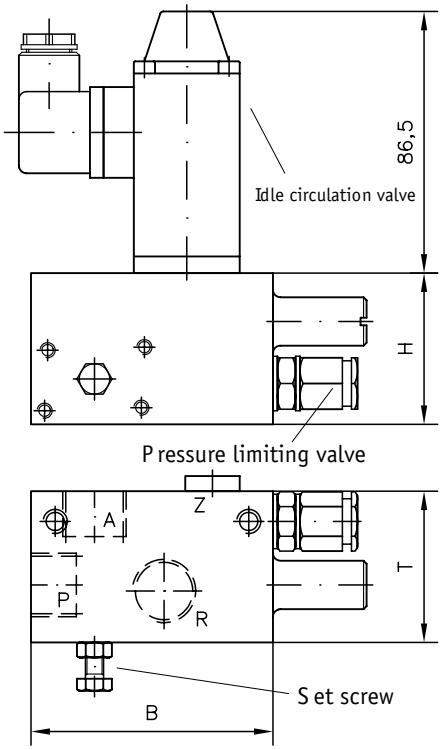
2-way	3-way
Manifold mounting valve	
	

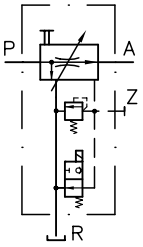
Actuations:

SF ...	SD ...	SK ...	SKR ...	SU
				
Set screw SW 10 adjustment travel 5 mm	Adjusting knob, adjustment travel 3.8 turns	Roller actuation Unshielded version (SK), Shielded version (SKR) Actuation travel 15,5 ... 17 mm, Actuation force 30 ... 70 N		Solenoid 12V DC, 24V DC, 110V AC, 230V AC

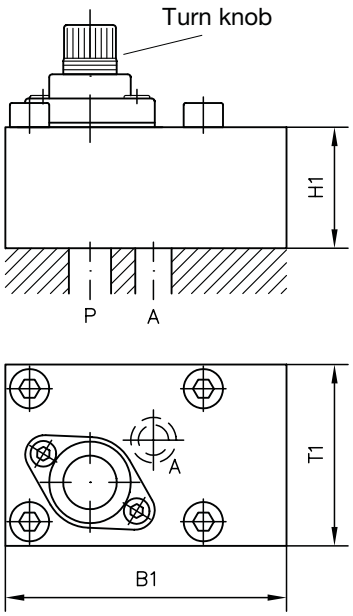
General parameters and dimensions

Version for pipe connection





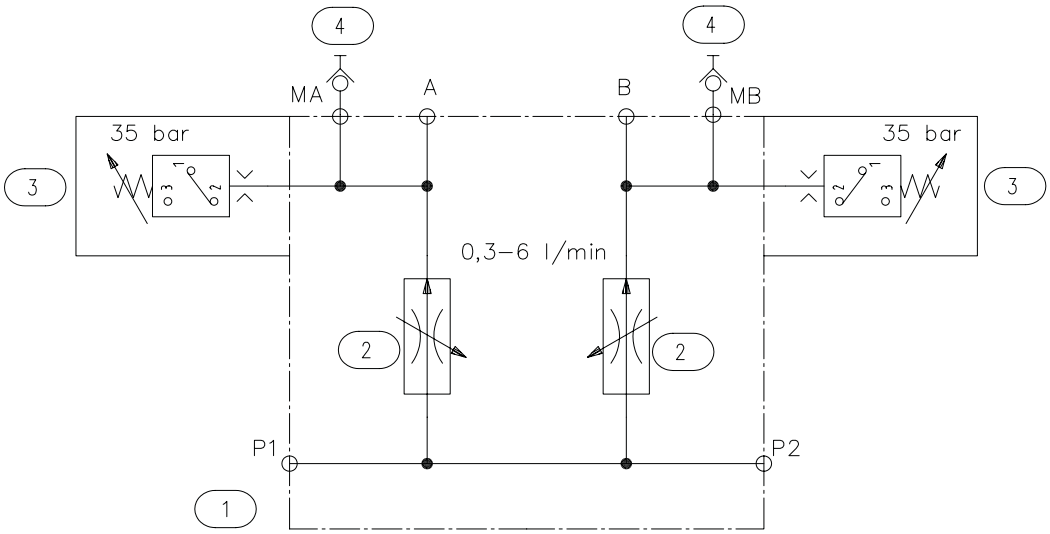
Manifold mounting valve



		Q_{max} [lpm][1]	Ports (BSPP)[2]	Dimensions [mm]						m [kg][3]
2-way	3-way			H	H 1	B	B 1	T	T1	
S. 2-3		0,3 ... 60	G 1/2	50	40	80	60	50	60	1,4 ... 2,1
	S. 3-3			50	40	80	93	50	60	1,4 ... 2,1
S. 2-4		0,6 ... 90	G 3/4	60	50	88	70	60	70	2
	S. 3-4			60	50	88	100	60	70	2,0 ... 2,6
S. 2-5		1,0 ... 130	G 1	70	50	100	80	70	80	3,1
	S. 3-5			70	50	100	106	70	80	2,8 ... 3,7

1) Different Q_{max} available, see Design and order coding example: "Orifice steps"
2) For pipe connection versions
3) Depending on actuations

Item	Number	Description
4	2	SMK 20-G 1/4-PC
3	2	DG 364-35
2	2	SD 2-3/6P
1	1	20 201 H 00



Associated technical data sheets:

- 2-way and 3-way flow control valves type S: D 6233

Similar products:

- Drop rate braking valves type SB, SQ: Page 222
- Prop. flow control valves type SE, SEH: Page 224

Plugs:

- With LED etc.: D 7163

Metering valves

2.4 2-way flow control valves type SB, SQ and SJ

The 2-way metering valves (lowering brake valves) type SB or SQ are preferentially used for flow control tasks of single-acting cylinders. In doing so, the lowering speed is largely kept constant regardless of the size of the load. The integrated sliding metering orifice enables completely free flow in the opposite direction. While with type SB, there is a slight load dependence preventing the occurrence of oscillations (e.g. required for fork lift trucks), type SQ has largely load-independent Δp-Q characteristics.
These flow control valves are preferentially used to limit control flows in pilot circuits. The DSJ version for flow limitation in both flow directions is intended for double-acting consumers.

Features and benefits:
- Oscillation damping or load-independent
- Compact screw-in valve

Intended applications:
- General hydraulic systems
- Industrial trucks
- Lifting equipment

Nomenclature:	2-way flow control valve (drop rate braking valve)
Design:	Screw-in type with housing for in-line installation
Adjustment:	Fixed (pre-set) Tool adjustable from outside
p_{max}:	315 bar
Q_{max}:	0,25 ... 400 lpm

Design and order coding example

SB 2 | 1 | C | - 30

Response flow [l/min] Desired factory set response flow within the respective range

Design Adjustable or non adjustable version
- Screw-in version (C)
- Version with housing for pipe mounting (E, F, G)

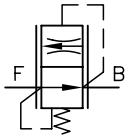
Additional versions
- With metric of UNF-thread
- With thread adaptor
- As banjo bolt and/or with swiveling screw fitting

Adjustment range Adjustable response flow

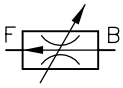
Basic type, size Type SB, SQ and SJ (without one-way orifice), size 0 to 5
Type DSJ (Q_{max} = 20 lpm, p_{max} = 300 bar) Flow control function in both directions e.g. for double acting cylinders

Function

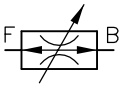
SB, SQ



SJ



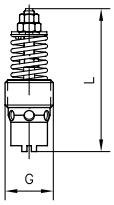
DSJ



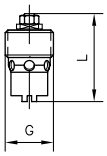
General parameters and dimensions

Screw-in valve ...C

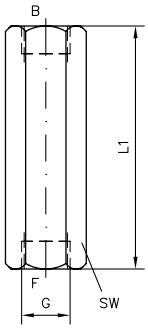
SB, SQ



SJ



With housing...G



	Coding for adjustment range of the set response flow from ... to ... [lpm] below						Ports (BSPP)	Dimensions [mm]			m [g]
	1	3	5	7	9	90	G (Series)	L	L1 max	SW = a/f	
SB 0	1...1.6	1.6...2.5	2.5...4	4...6.3	6.3...10	10...15	G 1/4 (A)	39	78	19	13
SJ 0[1]								24	-	-	35
SB 1	2.5...4	4...6.3	6.3...10	10...16	16...25	25...35	G 3/8 (A)	43	82	22	23
SQ 1											
SB 2	16...21	21...28	28...37	37...50	50...67[2]	-	G 1/2 (A)	49	96	27	40
SQ 2											
SB 3	37...50	50...67	67...90	90...120	120...150[2]	-	G 3/4 (A)	61	106	32	80
SQ 3											
SB 4	80...100	100...125	125...160	160...200	200...250	-	G 1 (A)	78	145	41	150
SB 5	170...200	200...236	236...280	280...335	335...400	-	G 1 1/4 (A)	94	160	50	300
DSJ 1	1.0...21.0						G 1 1/4 (A)	39	78	19	30

1) Type SJ 0 without coding: adjust. range 0.25 ... 1.2 lpm
2) Not for type SQ..

Associated technical data sheets:

- Lowering brake valves type SB, SQ: D 6920
- 2-way flow control valves type SJ: D 7395
- 2-way flow control valves type CSJ: D 7736
- Double-acting 2-way flow control valves type DSJ: D 7825

See also "Devices for special applications":

- Industrial trucks
- Screw-in valves and installation kits

2.4 Flow control valves type SE and SEH with electro-proportional actuation

The flow control valves type SE and SEH are used for continuous adjustment of the operating speed of connected hydraulic consumers regardless of pressure. They can be used as 2-way or 3-way flow control valves and are available with proportional electrical, directly actuated (type SE) or proportional electro-hydraulic, piloted (type SEH) control orifice adjustment (each available with normal position as open or closed). They help to achieve fully automated operating cycles with individually preselected acceleration and deceleration phases.

A piloted pressure-limiting valve and an electrically switchable circulation valve (3-way controller) or a bypass check valve and check valves in a bridge circuit for free selection of the flow direction (2-way controller) can be selected as additional elements.

Features and benefits:

- Electrical control of consumer operating speeds
- Automation of operating cycles

Intended applications:

- Construction machinery
- Machine tools
- General hydraulic systems

Nomen-clature:	**2-way flow control valve 3-way flow control valve**
Design:	**Individual valve for pipe mounting or Screw-in valve**
Adjustment:	**Electro-proportional**
p_{max}:	**315 bar**
Q_{max}:	**0,1 ... 120 lpm**

Design and order coding example

SE 2-3 | /30F | - P | - G24

Solenoid voltage — Prop. solenoid
- 12 V DC, 24 V DC
- Controls via prop. amplifier or PLVC

Design and port size
- Pipe connection
- Manifold mounting (P)

Flow [lpm] — Nom. flow of the metering orifice
- Deenergized open
- Deenergized closed (coding F

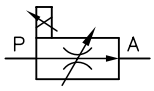
Orifice steps Q_{max} : 3, 6, 10, 15, 22, 30, 36, 50, 70, 90, 120 lpm

Basic type, size — Type SE, with non-piloted metering orifice, size 3, 4
Type SEH, with piloted metering orifice, size 2 to 5
- Available as 2- and 3-way flow control valve

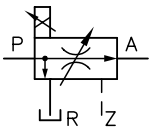
Function

SE, SEH

2-way
Pipe connection

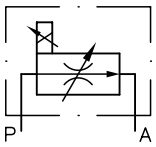


3-way
Pipe connection

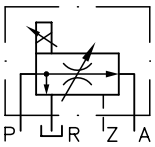


1)

2-way
Manifold mounting valve



3-way
Manifold mounting valve



1) No Z port with type SEH 3-2

Additional functions for flow control valves:

2-way flow control valve

- Version with bypass check valve
- Version with check valve in bridge circuit for free selection of the flow direction

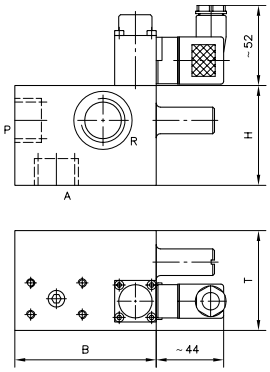
3-way flow control valve

- Version with pressure-limiting valve
- Version with pressure-limiting valve and circulation valve (for pipe connection versions only)
- Version with compulsory closed position of the pressure compensator
  when not actuated type ...F0
- Version with automatic circulation type ...B 0.6

General parameters and dimensions

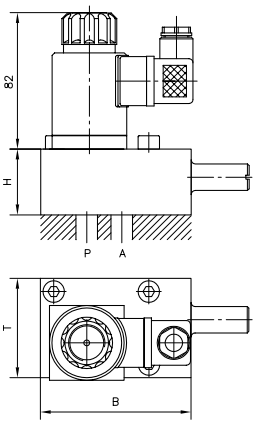
SEH

Version for pipe connection



SE

Manifold mounting valve

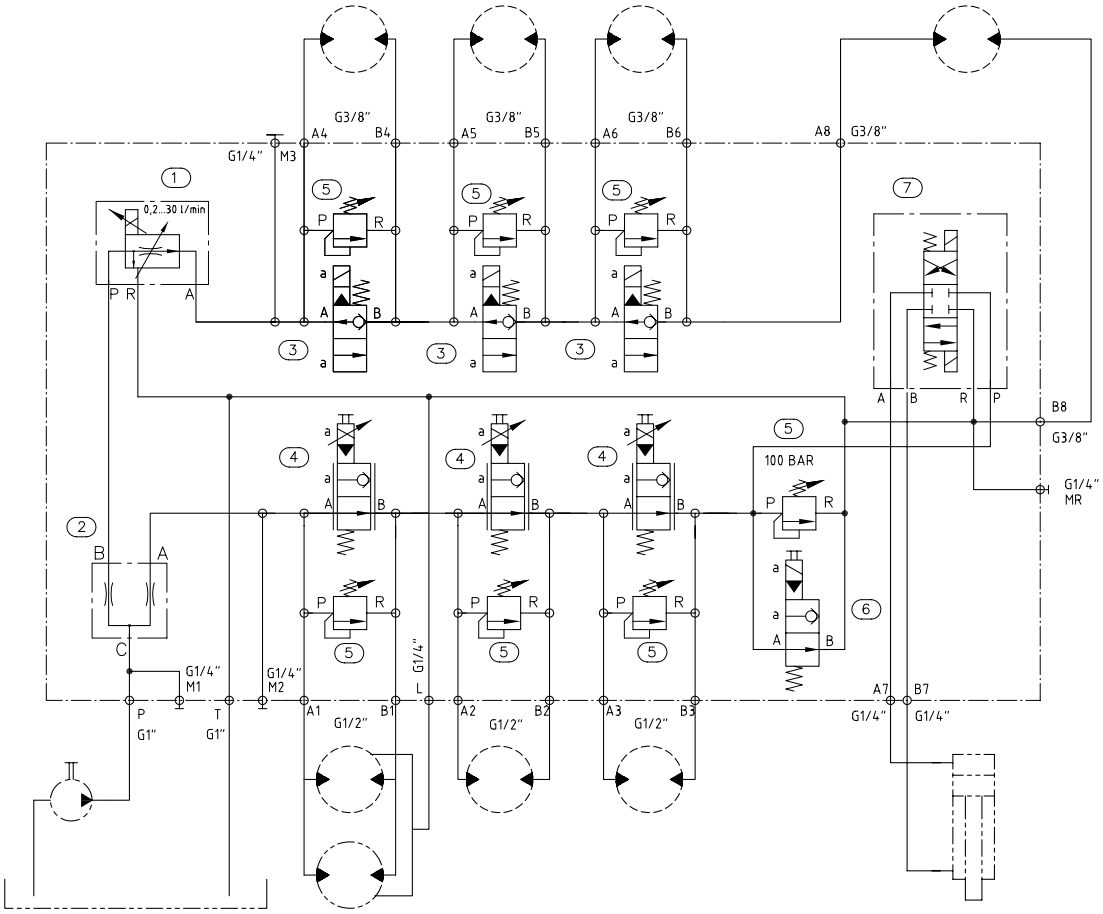


Basic type and size			Q_{max} [lpm][1]	p_{max} [bar]	Ports (BSPP)[2]	Dimensions [mm]			m_{max} [kg]
2-way	3-way					H	B	T	
SE 2-3	SE 3-3	Directly actuated	0,3 ... 50	315	G 1/2	110 ... 120	80 ... 91	50 ... 60	2,2
SE 2-4	-		0,6 ... 70	315	G 3/4	120 ... 130	85 ...100	60 ... 70	2,2
-	SE 3-4		0,6 ... 90	315	G 3/4				
SEH 2-2	SEH 3-2	Hydraulically piloted	0,1 ... 30	315	G 3/8	115	55 ... 70	40	1,6 ... 3,3
SEH 2-3[3]	SEH 3-3		0,3 ... 50	315	G 1/2	92,5	80 ... 93	50 ... 60	1,6 ... 3,3
-	SEH 3-4		0,6 ... 90	315	G 3/4	102,5	95 ... 100	60 ... 70	1,6 ... 3,3
-	SEH 3-5		1,0 ... 120	315	G 1	112,5	100	70	1,6 ... 3,3

1) Different Q_{max} available, see Design and order coding example: "Orifice steps"
2) For pipe connection versions
3) For manifold mounting versions only

Circuit example

① SEHD 3-3/30 FP-X 24
② TQ 4 P-A 5/2
③ EM 31 V-X24
④ EMP 31 S-X 24
⑤ MVH 6 C
⑥ EM 31 S-X24
⑦ SWPN 2-G-X24



Associated technical data sheets:
- Proportional flow control valves type SE, SEH: D 7557/1

Similar products:
- Flow control valves type SD etc.: Page 218

Proportional amplifier:
- Type EV1M (module): Page 276
- Type EV1G (module): Page 276
- Type EV22K2 (card version): Page 276
- Programmable logical valve control type PLVC: Page 278

See also section "Devices for special applications":
– Proportional valves

2.4 Flow dividers type TQ and TV

The flow dividers type TQ divide (collect) total flow entering (exiting) at port C. The distribution is independent of working pressure at ports A and B, and may be divided equally or unequally in predetermined portions.
Type TV flow dividers feature privilege division. A variable flow entering at port C is divided into a partial flow Q_A, which is kept constant, and a residual flow Q_B. As soon as one consumer's movement is stopped, the flow to the other is either reduced to a minimal flow (type TQ) or completely reduced to leakage flow (type TV). It is possible to overcome this design feature by simulating flow via a pressure-limiting valve.
These valves are used for applications where one pump is required to supply two unevenly loaded hydraulic consumers, which must be driven simultaneously and independently (type TQ) or if one consumer simply requires a constant flow (type TV).

Features and benefits:
- Accurate flow division

Intended applications:
- Steering systems
- Synchronized cylinder movement

Nomen-clature:	**Flow dividers with or without priority division**
Design:	**Individual valve for pipe mounting Manifold mounting**
Adjustment:	**Non-adjustable**
p_{max}:	**300 ... 350 bar**
Q_{max}:	**7,5 ... 200 lpm (nom. total flow)**

Design and order coding example

TV3P		- 2,0
TQ 32	- A	- 3

Coding Flow indicator

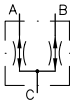
Design (A – equal division ratio)

Basic type, size
- Pipe connection (no coding)
- Manifold mounting (P)

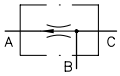
Type TQ, size 2 to 5
Type TV, flow divider with privilege division, size 3

Function

TQ
Pipe connection

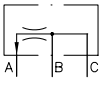


TV



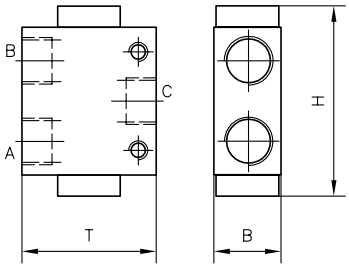
TQ.P
Manifold mounting valve

TV.P

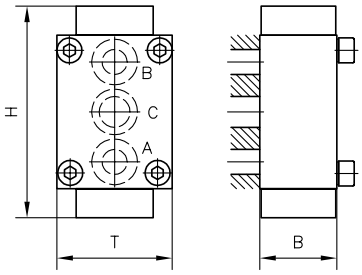


General parameters and dimensions

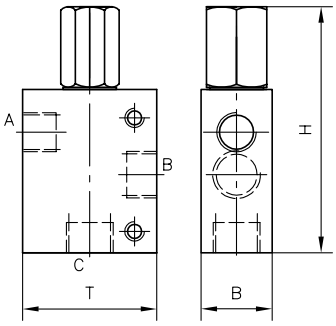
TQ...
Pipe mounting



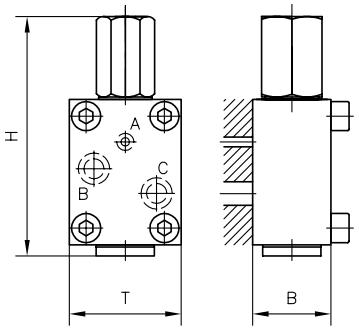
TQ .P
Manifold mounting



TV 3..
Pipe mounting



TV 3P
Manifold mounting



	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)[1]			Dimensions[mm]			m [kg]
			A	B	C	H	B	T	
TQ 2..	7.5 ... 70	350	G 1/4, G 3/8	G 1/4, G 3/8	G 3/8	79	30	50	0.6
TQ 3..	7.5 ... 70	350	G 3/8, G 1/2	G 3/8, G 1/2	G 1/2	85	30	60	0.6 ... 0.7
TQ 3P	7.5 ... 70	350	-	-	-	79	30	50	0.7
TQ 4	80 ... 120	350	G 1/2	G 1/2	G 3/4	110	40	60	1.5
TQ 4P	80 ... 120	350	-	-	-	110	40	60	1.6
TQ 5	140 ... 200	350	G 3/4	G 3/4	G 1	134	50	80	3.0
TQ 5P	140 ... 200	350	-	-	-	134	50	80	3.1
TV 3..	60	300	G 3/8	G 1/2	G 1/2	109	30	60	1.0
TV 3P	60	300	-	-	-	106	35	50	1.0

1) For pipe mounting versions only

Associated technical data sheets:

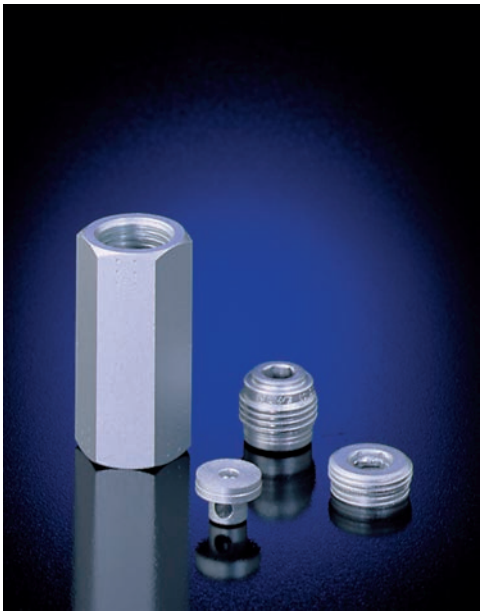
- Flow dividers type TQ: D 7381
- Flow dividers type TV: D 7394

2.4 Orifices and restrictor check valves type EB, BE, and BC

The orifice inserts type EB are part of the flow valves, whereas the restrictor check valves type BE and BC are a combination of a flow and check valve.
These valves are preferentially used to limit flows when switching directional valves (e.g. flow limitation to Qmax and avoidance of excessively rapid accumulator draining). The restrictor check valves type BC and BE are designed as a hole or slot orifice and enable free flow in the direction F → B and throttle function in the opposite direction.
Type BC is spring loaded and can be screwed into normal threaded holes (point angle 118°).
Type EB orifice inserts can be used in the P gallery of manifold mounting valves, for example.

Features and benefits:
- Max. 700 bar
- Simple design and installation

Intended applications:
- General hydraulics
- Winch controls
- Hydraulic pilot systems



Nomenclature:	**Orifice Restrictor check valve**
Design:	**Orifice insert Screw-in valve Version with housing for in-line installation**
p_{max}:	**400 ... 700 bar**
Q_{max}:	**0,5 ... 120 lpm**

Design and order coding example

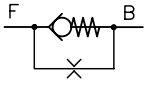
BC1 **- 0,8** **G**

Design with housing For pipe connection, type BC, BE (E; F, G)
Orifice Hole or slot type orifice, diameter in mm
Basic type, size Type BC, size 1 to 3

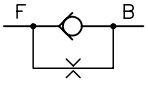
Additional versions
- With/without metric thread (type BC and BE)

Function

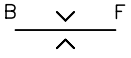
BC
Screw-in valve



BE

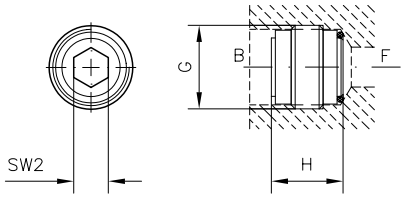


EB
Orifice insert

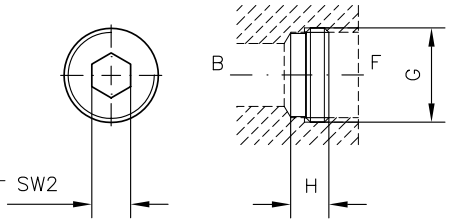


General parameters and dimensions

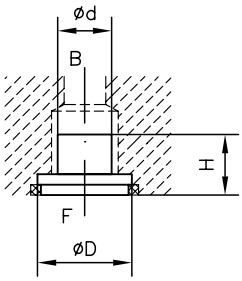
BC..
Screw-in valve



BE ..



EB..
Orifice insert



	Q_{max} [l/min]	p_{max} [bar]	Thread	Dimensions				m [g]
				H [mm]	G / D	SW = a/f 1/∅d	SW = a/f 2	
BC 1	20	700	G 1/4 A	13	G 1/4 A	SW 8	SW 4	6
BC 2	35	700	G 3/8 A	15	G 3/8 A	SW 9	SW 5	10
BC 3	60	500	G 1/2 A	18	G 1/2 A	SW 12	SW 8	24
BE 0	12	500	G 1/8 A	5	G 1/8 A	SW 4	-	2
BE 1	25	500	G 1/4 A	6	G 1/4 A	SW 5	-	4
BE 2	40	500	G 3/8 A	7	G 3/8 A	SW 8	-	6
BE 3	70	450	G 1/2 A	7.5	G 1/2 A	SW 10	-	10
BE 4	120	400	G 3/4 A	9	G 3/4 A	SW 12	-	18
EB 0	6	500	-	1.8	9	5.6	-	2
EB 1	10	700	-	1.8	11	7.5	-	4
EB 2	40	700	-	9	18	12.8	-	6
EB 3	100	500	-	11.5	22	16	-	10
EB 4	120	500	-	10	28	25	-	18

Associated technical data sheets:
- Restrictor check valves type BC: D 6969 B
- Restrictor check valves type BE: D 7555 B
- Orifice inserts type EB: D 6465

Similar products:
- Insert check valves type RK, RB, RC, RE, ER: Page 242
- Screw-in flow valves type BSE, QSE, MSE: D 7121
- Restrictor check valves type RD, ED, RDF: Page 234

See also section "Devices for special applications":
– Screw-in valves and installation kits

Metering valves

2.4 Throttles type Q, QR, QV, and FG

Throttles are a type of metering valve. The valve types Q, QR and QV are subdivided into five sizes and are used to limit the flow in accumulator and control circuits. They are designed as slot-type throttles (complete stroke) and are therefore impervious to micro-contaminants (no edge filter effect).
The precision throttle valves type FG are preferentially used for adjusting the switching time of directional valves, preventing pressure surges and damping oscillations. The throttle effect is achieved via the effective thread length.
The settings can only be adjusted using tools.

Features and benefits:
- Different installation options
- Simple design

Intended applications:
- General hydraulic systems

Nomen-clature:	Throttle Restrictor check valves
Design:	Cartridge Individual valve for pipe mounting ■ Corner housing ■ Banjo bolt ■ Swivel fitting
Adjustment:	Tool adjustable
p_{max}:	300 .... 400 bar
Q_{max}:	0 ... 80 lpm

Design and order coding example

QR 20		
FG 1	- H 6	

Version with housing
- Without labelling as a screw-in valve
- Available as a banjo bolt and/or with swivel fitting

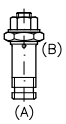
Basic type, size, function
- Throttles type Q, type QR, type QV and precision throttles type FG, subdivided into 5 sizes
- Throttle direction and free flow direction function
- Slot-type throttles, available with or without built-in check valve

Diagram of devices:

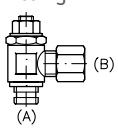
FG

Throttle screw

Banjo bolt



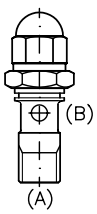
Swivel fitting



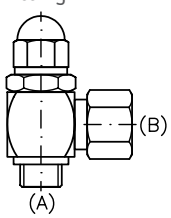
Q

Throttle screw

Banjo bolt



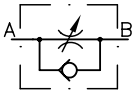
Swivel fitting



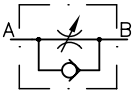
Function

FG, Q

FG 1, QR

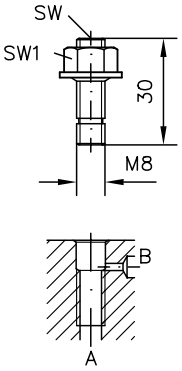


FG2, QV

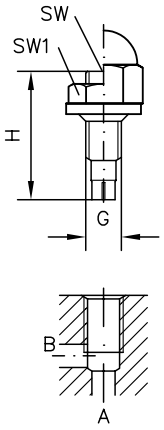


General parameters and dimensions

FG..



Q..



	Q_{max} [lpm][1)]	p_{max} [bar]	Dimensions				m [g]
			H [mm]	G	SW = a/f	SW =a/f 1	
FG, FG1, FG2	0,15	300	30	M 8	SW 4	SW 13	15
Q20, QR20, QV20	12	400	32	M 8 x 1	SW 4	SW 13	15
Q30, QR30, QV30	25	400	36	M 10 x 1	SW 5	SW 17	25
Q40, QR40, QV40	50	400	41	M 12 x 1.5	SW 6	SW 19	40
Q50, QR50, QV50	90	400	46	M 14 x 1.5	SW 8	SW 22	55
Q 60, QR60, QV60	120	315	58	M 16 x 1.5	SW 10	SW 24	100

1) These figures apply for valves fully opened (observe red indicator) with a back pressure of approx. 50 bar (throttled direction of flow)

Associated technical data sheets:

- Throttles type Q, QR, QV: D 7730
- Precision throttles type FG: D 7275

Similar products:

- Throttles type CQ, CQR, CQV: Page 236
- Throttle and restrictor check valves type ED, RD and RDF: Page 234
- Restrictor check valves and orifice inserts type EB, BE, BC: Page 230

See also chapter "Equipment for special applications":

– Screw-in and insert valves

2.4 Throttles and restrictor check valves type ED, RD, and RDF

The throttles type ED, RD and RDF are metering valves and are used to influence the flow in single and double-acting consumers. The two smallest sizes are designed as a combination of a slot-type and annular gap throttle to improve adjustability. The larger sizes are pure annular gap throttles. With RD restrictor check valves, the check valve function is performed by a shim that responds to the smallest oil flow movement. With the restrictor check valves type RDF, a nozzle or orifice disc takes on the check valve function. The type ED is designed as a pure throttle.

Features and benefits:
- Sensitively adjustable
- Wear-resistant

Intended applications:
- General hydraulic systems

Nomen-clature:	Throttle Restrictor check valves
Design:	Individual valve for pipe mounting Screw-in valve
Adjustment:	Manually adjustable (handle, adjusting knob) Tool adjustable
p_{max}:	500 bar
Q_{max}:	12...130 lpm

Design and order coding example

RD 11 RDF 21	/1,0	- K

Adjustability
- Type ED and RD only
- Without labelling = manually (wing bolt/lock nut)
- K = tool adjustable (setting spindle/lock nut)

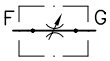
Fixed throttles

Diameter in mm, type RDF
- 0.4 - 0.6 (in increments of 0.1)
- 0.8 - 2.0 (in increments of 0.2)
- 2.5 - 5.5 (in increments of 0.5)

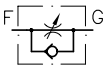
Basic type, size
- Type ED, type RD, type RDF, size 1 to 5
- Slot-type throttles, available with or without built-in check valve

Function

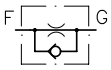
ED



RD

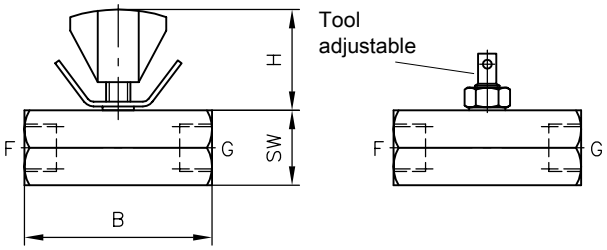


RDF

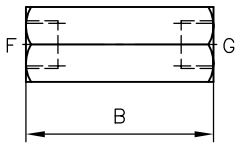


General parameters and dimensions

ED.. and RD..



RDF..



1)	Q_{max} [lpm] 2)	p_{max} [bar]	Ports (BSPP)	Dimensions [mm]			m [g]
				H	B	SW = a/f	
ED 11..	12	500	G 1/4	23.5	52	SW 24	180
RD 11..				23.5			
RDF 11/..				-			
ED 21..	30	500	G 3/8	24	52	SW 27	215
RD 21..				24			
RDF 21/..				-			
ED 31..	60	500	G 1/2	32.5	62	SW 32	340
RD 31..				32.5			
RDF 31/..				-			
ED 41..	80	500	G 3/4	41	72	SW 41	655
RD 41..				41			
RDF 41/..				-			
ED 51..	130	500	G 1	46.5	82	SW 46	835
RD 51..				46.5			
RDF 51/..				-			

1) The throttle diameter with type RDF canbe only altered by replacing the orifice. Depending on size, diameters between 0.6 and 4 mm are available.
2) These figures correspond to completely opened throttle and represent a back pressure of approx. 50 bar (throttled direction of flow)

Associated technical data sheets:

- Throttle and restrictor check valves type ED, RD and RDF: D 7540, D 2570

Similar products:

- Throttles type Q, QR, QV, FG: Page 232
- Restrictor check valves type CQ, CQR, CQV: Page 236
- Restrictor check valves type EB, BE, BC: Page 230

See also section “Devices for special applications”:

– Devices up to 700 bar

Metering valves

2.4 Throttles and restrictor check valves type CQ, CQR, and CQV

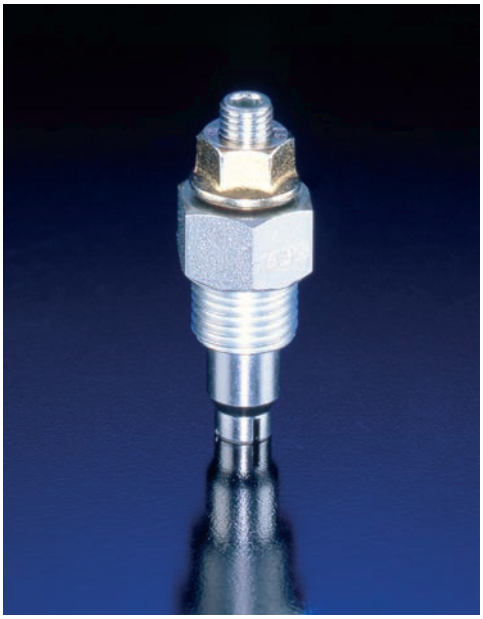
The throttles type CQ, CQR and CQV are metering valves and are used to influence the flow in single and double-acting consumers. The throttles described here are designed as slot-type throttles and are therefore impervious to micro-contaminants (no edge filter effect). The check valve function of types CQR and CQV is performed by a shim that guarantees short response times. The double spindle seal enables leakage-free adjustment, even under pressure.

Features and benefits:

- Leak-free adjustment under pressure
- Operating pressure up to 700 bar

Intended applications:

- Speed regulation in hydraulic lifting devices



Nomen-clature:	**Throttle Restrictor check valves**
Design:	**Screw-in valve**
Adjustment:	**Tool adjustable Manually**
p_{max}:	**700 bar**
Q_{max}:	**50 lpm**

Design and order coding example

CQV 2 - D - 1/4

Single connection blocks
- For pipe connection (1/4, 3/8)
- Manifold mounting (in combination with type CQ and CQV only)

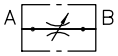
Adjustability in operation
- Without labelling = tool adjustable
- D = Turn knob (with lock nut)
- D3 = Turn knob, diameter 35 mm (without lock nut)

Basic type, size

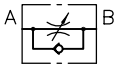
Type CQ, type CQR, type CQV, size 2
Slot-type throttles, available with or without built-in check valve
- Version with precision control range (size 22)
- Version with pressure compensator (flow control function)

Function

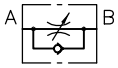
CQ 2, CQ 22



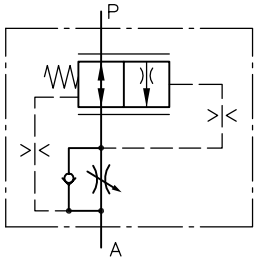
CQR 2, CQR 22



CQV 2, CQV 22

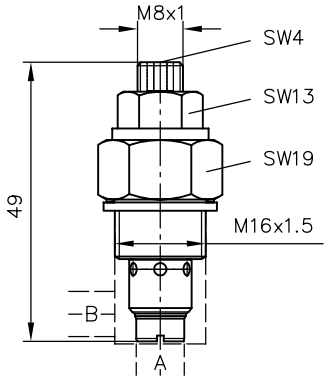


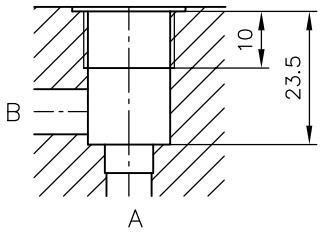
CQ 2 - P - DW



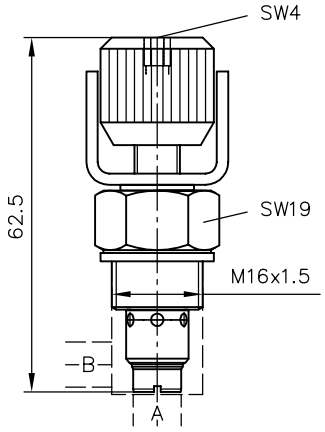
General parameters and dimensions

CQ 2., CQR 2., CQV 2.

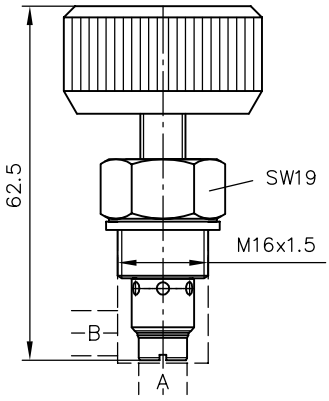




D



D3



	Q_{max} [lpm]	p_{max} [bar]
CQ 2 / CQ 22	50 / 20	700
CQR 2 / CQR 22		
CQV 2 / CQV 22		

Associated technical data sheets:

- Throttle and restrictor check valves type CQ, CQR, CQV: D 7713

Similar products:

- Throttle and restrictor check valves type ED, RD and RDF: Page 234
- Throttles type Q, QR, QV, FG: Page 232

See also section "Devices for special applications":

– Devices for up to 700 bar

2.4 Throttle and shut-off valves type AV, AVT, and CAV

The throttle and shut-off valves type AVT, AV and CAV (in various sizes) are metering valves and are designed as screw-in valves in the versions AV...E and CAV. They help to generate a pressure difference between the inlet and outlet side to regulate the speed of cylinders in accumulator circuits and the flow in control circuits, or to completely shut off a consumer line (e.g. to safeguard a pressure gauge). With AV valves, the throttle effect is caused by an annular gap, which is created by a valve cone entering a valve seat hole (needle valve). CAV valves create the variably adjustable pressure difference by means of a slot (slot-type throttle, sensitively adjustable and impervious to micro-contaminants). Versions with an integrated check valve enable free flow in one direction.

Features and benefits:

- Various configurations
- Sensitive adjustment and complete shut off possible

Intended applications:

- General hydraulic systems

Nomenclature:	Throttle and shut-off valve with/without by-pass check valve
Design:	Individual valve for pipe mounting Screw-in valve
Adjustment:	Manually adjustable (handle, adjusting knob) Tool adjustable
p_{max}:	500 ... 630 bar
Q_{max}:	50 ... 100 lpm

Design and order coding example

AV 3AVT 10 CAV 1V	- K	- 1/4

Thread size — Version with connection block for pipe connection (type CAV)

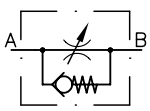
Means of adjustment — Tool adjustable; Manually (adjustable)

Basic type, size — Type AV, size 2, 3; Type AVT, size 6... 16; Type CAV, size 1, 2

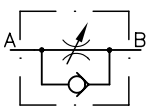
Function

AV, AV.E, AVT, CAV

CAV..R

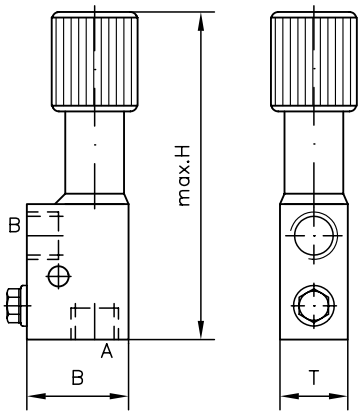


CAV..V, AV..R, AV..RE

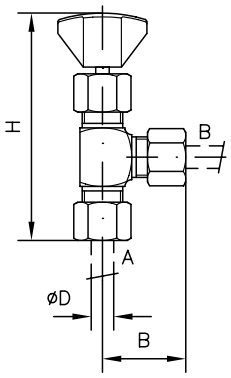


General parameters and dimensions

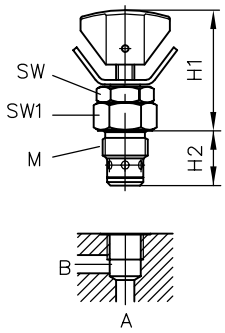
AV..
Valve for pipe connection



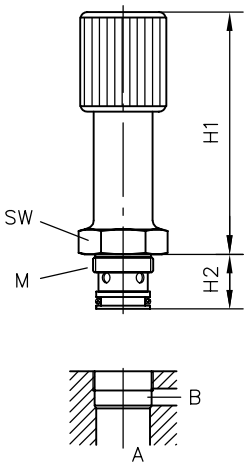
AVT..



CAV..
Screw-in valve



AV..E



	Q_{max} [lpm][1)]	p_{max} [bar]	Connection size M	Dimensions [mm]							m [kg]
				H	H1	H2	B	T	SW = a/f	SW= a/f 1	
AV 2	40	500	G 1/2 (BSPP)	145	-	-	45	30	-	-	0.6
AV 3	100	400	G 3/4 (BSPP)	198	-	-	60	40	-	-	1.7
AV 2E	40	500	M 28 x 1.5	-	115	25	-	-	SW 36	-	0.6
AV 3E	100	400	M 40 x 1.5	-	143	38	-	-	SW 46	-	1.0
AVT 6	12	630	6 mm	91	-	-	31	-	-	-	0.14
AVT 8	25	630	8 mm	94	-	-	32	-	-	-	0.18
AV 10	30	630	10 mm	94	-	-	34	-	-	-	0.23
AVT 12	50	630	12 mm	114	-	-	38	-	-	-	0.32
AVT 16	100	400	16 mm	123	-	-	43	-	-	-	0.44
CAV 1	30	500	M 16 x 1.5	-	42	19	-	-	SW 17	SW 22	0.05
CAV 2	50	500	M 20 x 1.5	-	51	21	-	-	SW 22	SW 24	0.07

1) This figures do apply with a back pressure of approx. 10 bar (throttled flow direction)

Associated technical data sheets:
- Shut-off valves type AVT: D 7690
- Throttle and shut-off valves type AV: D 4583
- Throttle and shut-off valves type CAV: D 7711

Similar products:
- Throttle and restrictor check valves type ED, RD and RDF: Page 234
- Throttles type Q, QR, QV, FG: Page 232

See also section "Devices for special applications":
- Screw-in valves and installation kits
- Devices for up to 700 bar

2.5 Check valves

Check valves type RK/RB, RC, RE and ER

Check valves and pre-fill valves type F

Check valves

Type	Design	p_{max}	Q_{max}
RK/RB, RC, RE, ER	**Check valve** ■ Insert valve ■ Plug-in valve ■ Version with housing for pipe connection	400 ... 700 bar	6 ... 320 lpm
CRK, CRB	**Check valve** ■ Screw-in valve	500 bar	30 .. 80 lpm
B	**Check valve** ■ Individual valve for pipe connection	500 bar	15 ... 160 lpm

Releasable check valves

Type	Design	Actuation	p_{max}	Q_{max}
CRH, RHC	**Check valve with hydraulic release** ■ Insert valve ■ Screw-in valve	- Hydraulic	500 ... 700 bar	8 ... 200 lpm
HRP	**Check valve with hydraulic release** ■ Manifold mounting valve	- Hydraulic - Electro-hydraulic	700 ... 500 bar	20 ... 400 lpm
RH, DRH	**Check valve with hydraulic release, twin check valve** ■ Individual valve for pipe connection ■ Manifold mounting valve	- Hydraulic	700 ... 400 bar	15 ... 160 lpm

Pre-fill valves

Type	Design	Actuation	p_{max}	Q_{max}
F	**Check valve with hydraulic release (pre-fill valve)** ■ Valve in wafer design	- Hydraulic	400 bar	100 ... 7000 lpm

Line rupture safety valve, shuttle valves

Type	Design	Adjustability	p_{max}	Q_{max}
LB	**Line rupture safety valve** ■ Insert valve ■ Version with housing for pipe connection	- Tool adjustable	700 bar	4 ... 160 lpm
WV, WVC	**Shuttle valve** ■ Individual valve for pipe connection ■ Insert valve ■ Screw-in valve		700 bar	6 ... 150 lpm

Check valves

2.5 Check valves type RK/RB, RC, RE, and ER

Check valves type RK, RB, RC, RE and ER are used to block the flow in one direction and enable free flow in the opposite direction. RK/RB check valves are spring-loaded, sturdily designed and dirt-resistant ball seated valves.
The screw-in check valves type RC may be installed in both directions with the spring-loaded valve shim enabling rapid switching sequences. The check valve type RE is a shim-type check valve without spring pre-load. This enables a very compact and simple method of blocking the oil flow in one direction. This valve can be used as a "foot valve" in the suction pipe of pumps, for example.
The mounting hole for all screw-in check valves can be easily machined with a standard twist drill (point angle 118°).
The insert check valves type ER feature a spring-loaded, ball seated design and are primarily used in manifold-mounted versions of seated valves.

Features and benefits:
- Operating pressures up to 700 bar
- Easily machined mounting holes
- Sturdy

Intended applications:
- General hydraulic systems
- Hydraulic pre-loading

Nomen-clature:	**Check valve**
Design:	**Screw-in valve Valve insert With housing for in-line installation**
p_{max}:	**400...700 bar**
Q_{max}:	**6...320 lpm**

Design and order coding example

RC 2 **- E**

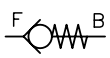
Design with housing For pipe connection (E, F, G), type RK, RB and RC

Basic type, size Screw-in check valve
Type RK, RB, size 0 ... 4
Type RC, size 1 ... 3
Type RE, size 0 ... 4
Type RE, ER (check valve insert), size 0 to 4

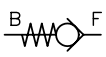
Additional versions:
- Type RK with increased open-up pressure
- Type ER, stainless (size 01 ... 31)
- Type RK, RB, RC and RE with metric thread

Function

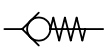
RK
Ball seated valves



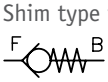
RB



ER



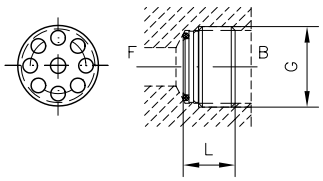
RC
Shim type valves



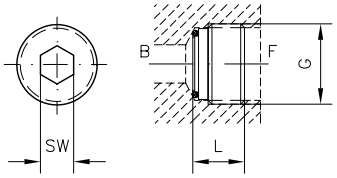
RE

General parameters and dimensions

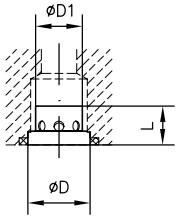
RK..



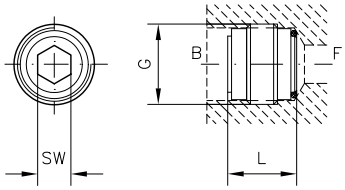
RB..



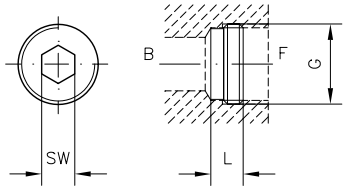
ER..



RC..



RE..



	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	Dimensions [mm]		m [g]
RK 0/RB 0	**10**	**700**	**G 1/8 A**	**7.2/7.9**	**SW 5**	**5**
RK 1/RB 1	20	700	G 1/4 A	9/10.3	SW 7	5
RK 2/RB 2	50	700	G 3/8 A	11.2/11.7	SW 6	15
RK 3/RB 3	80	500	G 1/2 A	13.5/13.2	SW 8	15/20
RK 4/RB 4	120	500	G 3/4 A	17.5/17.5	SW 12	35/40
RK 6	320	300	G 1 1/4	55	-	135
RC 1	20	700	G 1/4 A	13	SW 4	6
RC 2	35	700	G 3/8 A	15	SW 5	13
RC 3	60	500	G 1/2 A	18	SW 8	24
RE 0	12	500	G 1/8 A	5	SW 4	2
RE 1	25	500	G 1/4 A	6	SW 5	4
RE 2	40	500	G 3/8 A	7	SW 8	6
RE 3	70	450	G 1/2 A	7.5	SW 10	10
RE 4	120	400	G 3/4 A	9	SW 12	18
				L	**D/D1**	**m[g]**
ER 0	6	500	G 1/8 A	5.6	6.1/4.6	0.5
ER 1	12	500	G 1/4 A	5.6	8.6/6.5	1
ER 2	30	500	G 3/8 A	8	14/10.5	5
ER 3	65	500	G 1/2 A	10	17/13	9
ER 4	120	400	G 3/4 A	17.5	28/21	40

Associated technical data sheets:

- Insert check valves type ER: D 7325
- Check valves type RE: D 7555 R
- Check valves type RC: D 6969 R
- Check valves type RK, RB: D 7445

Similar products:

- Check valves type CRK, CRB: Page 244
- Check valves type B: Page 246
- Restrictor check valves type EB, BE, BC: Page 230

See also section "Devices for special applications":

- Screw-in valves and installation kits
- Devices for up to 700 bar

Check valves

2.5 Check valves type CRK and CRB

The check valves type CRK and CRB are used to block the flow in one direction and allow free flow in the opposite direction.
The mounting hole can be closed with a simple tapped plug or with a locking tapped plug if necessary.

Features and benefits:
- Cartridge valves

Intended applications:
- General hydraulics

Nomen-clature:	Check valve
Design:	Screw-in valve
p_{max}:	500 bar
Q_{max}:	30 ... 80 lpm

Design and order coding example

CRK 2	- 1/4

Individual connection block for pipe connection

Basic type Check valves type CRK and CRB, size 1 to 3
- With/without tapped plug
- With/without tapped blockage/plug combination

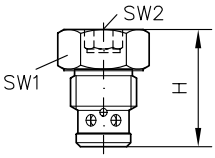
Function

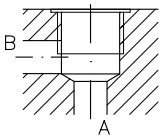
CRK

CRB

General parameters and dimensions

CRK, CRB





	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	Dimensions			m [g]
				H [mm]	SW = a/f 1	SW = a/f 2	
CRK 1 / CRB 1	30	500	M 16 x 1.5	31	SW 22	SW 8	70
CRK 2 / CRB 2	50		M 20 x 1.5	35	SW 24	SW 10	110
CRK 3	80		M 24 x 1.5	38	SW 30	SW 12	125

Associated technical data sheets:

- Check valves type CRK, CRB: D 7712

Similar products:

- Check valves type RK, RB, RC, RE, ER: Page 242

See also section “Devices for special applications”:

- Screw-in valves and installation kits
- Devices for up to 700 bar

Check valves

2.5 Check valves type B

These check valves type B are available in three housing designs with internal and/or external thread, enabling in-line installation for any requirement.
Use as a foot valve for the suction pipes of pumps is possible due to the low opening pressures.

Features and benefits:
- Max. flow 160 lpm
- Pipe installation

Intended applications:
- General hydraulics

Nomen-clature:	**Check valve**
Design:	**Individual valve for in-line installation**
p_{max}:	**500 bar**
Q_{max}:	**15 ... 160 lpm**

Design and order coding example

B 1 - 2

Basic type, with housing, size Check valve type B, version with housing 1 to 3, size 1 to 7

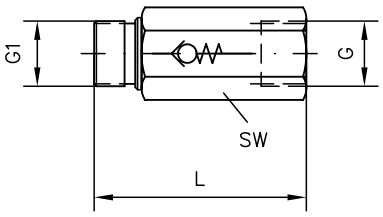
Additional versions:
- Open-up pressure 3 bar

Function

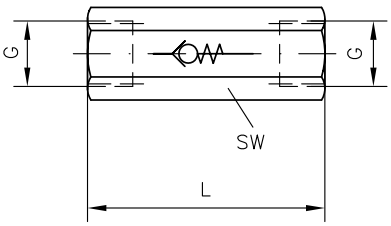
B

General parameters and dimensions

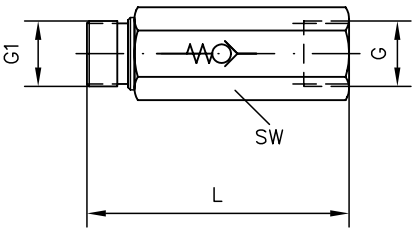
B 1



B 2



B 3



Basic type	Size	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)		Dimensions		m [kg]
				G	G1	L [mm]	SW = a/f	
B 1 B 2 B 3	-1	15	500	G 1/4	G 1/4 A	50 ... 60	SW 19	0.11
	-2	20		G 3/8	G 3/8 A	58 ... 67	SW 24	0.16
	-3	30		G 1/2	G 1/2 A	60 ... 66	SW 27	0.19
	-4	45		G 3/4	G 3/4 A	70 ... 78	SW 36	0.36
	-5	75		G 1	G 1 A	94 ... 114	SW 41	0.65
	-6	120		G 1 1/4	G 1 1/4 A	110 ... 130	SW 55	1.3
	-7	160		G 1 1/2	G 1 1/2 A	115 ... 136	SW 60	1.5

Associated technical data sheets:

- Check valves type B: D 1191

Similar products:

- Check valves type RK, RB, RC, RE, ER: Page 242

See also section "Devices for special applications"

- Devices for up to 700 bar

Check valves

2.5 Screw-in check valves with hydraulic release type CRH and RHC

The screw-in check valves with hydraulic release type CRH and RHC are used in hydraulic circuits together with design related, leaking directional valves, as a hydraulically actuated drain, or idle circulation valves.
The valves type RHC with and without pre-release (for high pressures and large consumer volumes) are designed as insert valves. The mounting hole (also sealing surface) is to be machined with a standard twist drill (point angle 118°).
Different variants extend the range of applications.
The type CRH is a screw-in valve for very easily machined mounting holes.

Features and benefits:

- Cartridge valve
- Pressures up to 700 bar
- Flows up to 200 lpm
- Sturdy

Intended applications:

- Industrial hydraulics
- Construction machinery

Nomen-clature:	**Check valve with hydraulic release**
Design:	**Valve insert Screw-in valve**
Actuation:	**Hydraulic**
p_{max}:	**500 ... 700 bar**
Q_{max}:	**8 ... 200 lpm**

Design and order coding example

CRH 3 V

Function Without pre-release (-)
With pre-release (V)

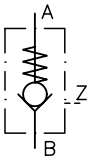
Basic type, size Screw-in check valve with hydraulic release
Type CRH, size 1 to 3 and
Type RHC, size 1 to 6

Additional versions:

- With increased release ratio (approx. 4.2 : 1)
- With sealed tapped journal and control piston
- Wth hydraulic relieve of the control piston (type RHCE)

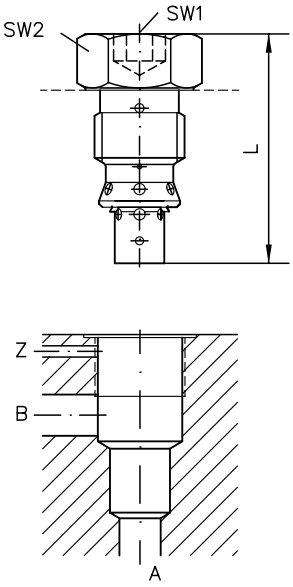
Function

CRH, RHC

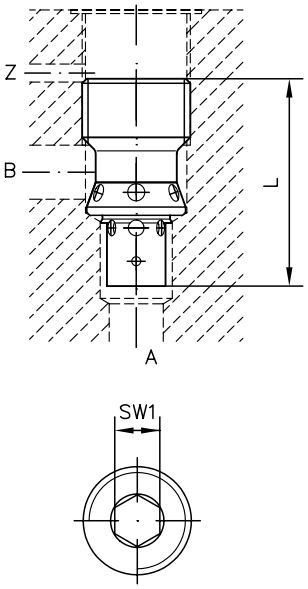


General parameters and dimensions

CRH



RHC



	Q_{max} [lpm]	p_{max} [bar]	Release ratio	Ports (BSPP)	Dimensions			m [g]
			p_a / p_z		L [mm]	SW = a/f 1	SW = a/f 2	
CRH 1	30	500	2.6	M 16 x 1.5	47	SW 8	SW 22	60
CRH 2	50	500	2.6	M 20 x 1.5	53	SW 10	SW 24	90
CRH 3	80	500	2.5	M 24 x 1.5	61	SW 12	SW 30	150
RHC 1	15	700	2.6	M 16 x 1.5	32	SW 6	-	20
RHC 2	25	700	2.6	M 20 x 1.5	37.5	SW 8	-	40
RHC 3	55	700	2.5	M 24 x 1.5	47	SW 10	-	70
RHC 4	100	500	2.5	M 30 x 1.5	56	SW 12	-	140
RHC 5	150	500	2.8	M 36 x 1.5	67.5	SW 14	-	250
RHC 6	200	500	2.5	M 42 x 1.5	97	SW 19	-	500

Associated technical data sheets:
Check valves with hydraulic release type:

- Type CRH: D 7712
- Type RHC: D 7165

Similar products:

- Type RHV: D 3056
- Type HRP: Page 250
- Type RH: Page 252

See also section "Devices for special applications":

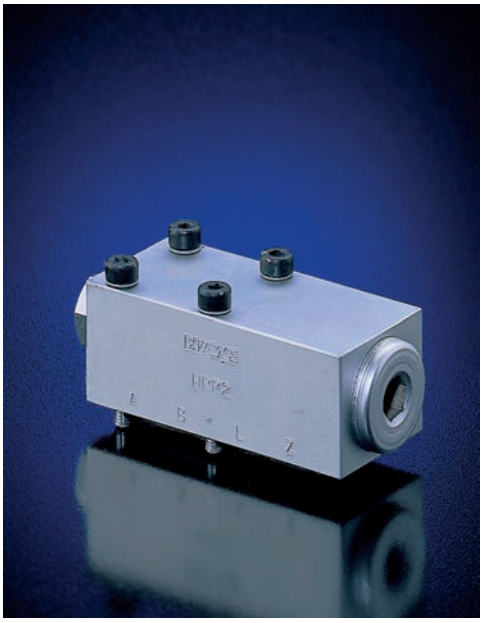
- Screw-in valves and installation kits
- Devices for up to 700 bar

2.5 Check valves with hydraulic release type HRP

The check valves type HR with hydraulic release, are designed as manifold mounting valves and are available in six sizes. These valves are used in hydraulic circuits with design related, leaking directional valves, as hydraulically actuated drain, or idle circulation valves. The check valve type HRP can be ordered also with a pre-release to suppress decompression surges for circuits with high pressure and high consumer flows.

This valve is extremely tolerant to residual pressure in the return duct (port B), as the rear side of the actuation piston is de-pressurised via a drain port.

Another option allows opening of the check valve via the load pressure on the consumer side, controlled by a flange-mounted solenoid valve.



Features and benefits:

- Manifold mounting valve for max. pressure 700 bar
- Flows up to 400 lpm
- Electrically controlled
- With pre-release for smooth switching

Intended applications:

- Industrial and mobile hydraulics

Nomen-clature:	**Check valve with hydraulic release**
Design:	**Manifold mounting valve**
Actuation:	**Hydraulic Electro-hydraulic**
p_{max}:	**700 ... 500 bar**
Q_{max}:	**20 ... 400 lpm**

Design and order coding example

HRP 4 | V | - B 0,4 | - WH 1H B 0,4-G24

Optionally with directly mounted 3/2-way directional seated valve — For arbitrary open-up or for use as 2/2-way directional seated valve

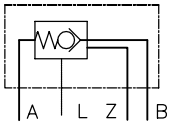
Optionally with orifice insert at control port Z — For preventing decompression surges

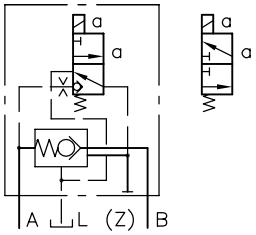
Function — Without pre-release (-)
With pre-release (V)

Basic type, size — Check valve with hydraulic release HRP, size 1 to 7

Function

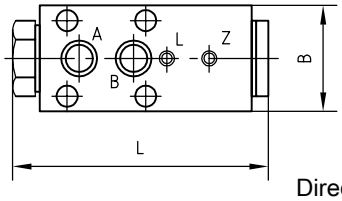
HRP

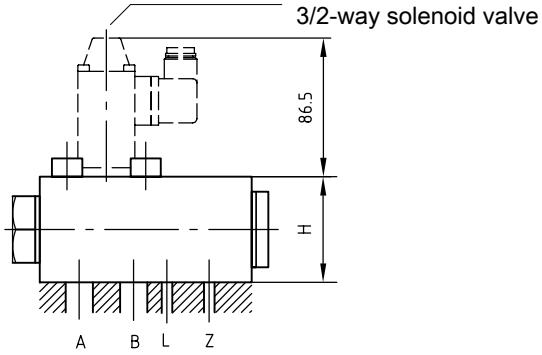




General parameters and dimensions

HRP





	Q_{max} [lpm]	p_{max} [bar]	Release ratio	Dimensions [mm]			m [kg]
			p_A / p_Z	H	B	L	
HRP 1	20	700	2.9	20	25	74.5	0.25
HRP 2	35	700	3.9	25	30	78	0.4
HRP 3	50	500	4.3	35	35	83	0.7
HRP 4	80	500	3.8	35	50	103.5	1.2
HRP 5	140	500	4.0	40	60	120.5	1.9
HRP 7 V	400	500	3.0	63	100	190	8.0

Associated technical data sheets:

- Releasable check valves type HRP: D 5116

Similar products:

- Releasable check valves type RH: Page 252
- Releasable check valves type RHV: D 3056
- Releasable check valves type CRH, RHC: Page 248
- Releasable twin check valve type DRH: Page 252

See also section “Devices for special applications”:

– Devices for up to 700 bar

Check valves

2.5 Check valves with release type RH and DRH

Check valves with hydraulic release are used to block one or both hydraulic consumer pipes or as a hydraulically actuated drain or circulation valve. The valves type RH and DRH are also available with pre-release for one or both sides of the connection to suppress decompression surges for circuits with high pressures and high consumer flows.

Features and benefits:

- Pressures up to 700 bar
- With pre-release for smooth switching

Intended applications:

- Blocking of leak-free hydraulic cylinders in connection with a directional spool valve control suffering from leaking oil
- Return flow relief if return oil flows that are greater than the permissible flow for the directional valve are experienced due to the surface ratio, when introducing a double-acting hydraulic cylinder
- Hydraulically actuated drain or circulation valve

Check valve with hydraulic release or releasable double check valve	**Check valve with hydraulic release or twin check valve**
Design:	**Individual valve for** ■ **Pipe connection** ■ **Manifold mounting**
Hydraulic	**Hydraulic**
400...700 bar	**400...700 bar**
15...160 lpm	**15...160 lpm**

Design and order coding example

RH 3 V

Function Without pre-release (-)
With pre-release (V)

Basic type, size Releasable check valve RH, size 1 to 5

DRH 3 LSS - 30 /100

Pre-charge pressure [bar]

Pressure setting [bar]

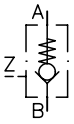
Basic type, size, function Releasable double check valve DRH, size 1 to 5

Additional versions:

- With pre-release (one or both sides)
- With shock valves (for hydraulic motors)
- With safety valve preventing slow pressure rises
- With leakage port preventing unintended open-up when pressure migrated from the control side
- Manifold mounting version (type DRH3P)

Function

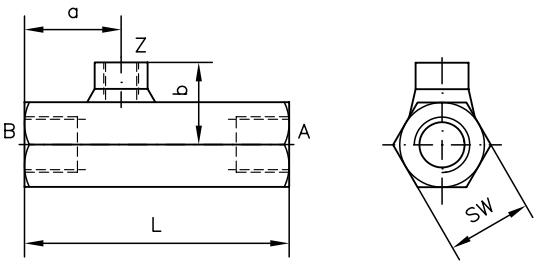
RH



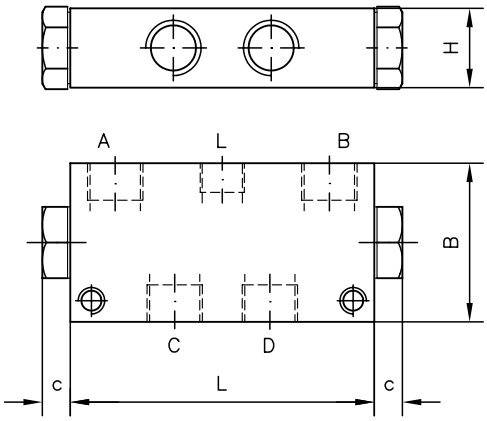
DRH

General parameters and dimensions

RH..



DRH..



	Q_{max} [lpm]	p_{max} [bar]	Release ratio $p_{A(B)}/p_Z$	Tapped ports (BSPP)		Dimensions [mm]				m [kg]
				A, B, C, D	Z	L	a	b	SW = a/f	
RH 1	15	700	2.7	G 1/4	G 1/4	84	31.5	27	SW 24	0.4
RH 2	35	700	3	G 3/8		90	32	28.5	SW 27	0.4
RH 3	55	500	2.4	G 1/2		100	36.5	31	SW 32	0.6
RH 4	100	500	2.4	G 3/4		126	45	35.5	SW 41	1.3
RH 5	160	500	3	G 1		143	52	38	SW 46	1.8
						L	B	H	c	
DRH 1	16	500	2.5	G 1/4	-	70	45	20	8	0.5
DRH 2	30	500		G 3/8		89	60	30	10	1.2
DRH 3	60	500		G 1/2		115	60	30	13	1.6
DRH 4	90	400		G 3/4		150	70	40	15.5	2.9
DRH 5	140	400		G 1		195	80	50	17	5.5

Associated technical data sheets:

- Releasable check valves type RH: D 6105
- Releasable twin check valves type DRH: D 6110

Similar products:

- Type RHV: D 3056
- Type CRH and RHC: Page 244
- Type HRP: Page 250

See also section "Devices for special applications":

– Devices for up to 700 bar

2.5 Check valves and pre-fill valves type F

Check valves and pre-fill valves type F are check valves. They are designed as spring-loaded disc seat valves. The check valves type F enable free flow in one direction and block flow in the opposite direction.
As a pre-fill valve (check valve with hydraulic release), they are used for example in top ram presses for draining and replenishing press cylinders during opening and closing in rapid traverse mode.
The smaller sizes may be optionally equipped with a pre-release device (decompression at high pressures via the valve) to prevent decompression surges.

Features and benefits:
- Wafer design
- Extremely large flows, up to 7000 lpm

Intended applications:
- Press control systems
- Injection moulding machines

Nomen-clature:	Check valve Check valve with hydraulic release (pre-fill valve)
Design:	Intermediate section between pipe flanges
Actuation:	Hydraulic
p_{max}:	400 bar
Q_{max}:	100 ... 7000 lpm

Design and order coding example

F25

Basic type, size Check valve type F, size 25 to 200

F80B-36 **V**

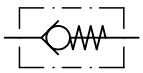
Additional versions: Without pre-release (-)
With pre-release (V), size 25 to 80

Basic type, size Pre-fill valves type F, size 25 to 200

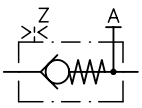
Additional functions
- With holes in the mounting flange (B)
- For fluids type HFA type F125-60-HFA

Function

Check valve

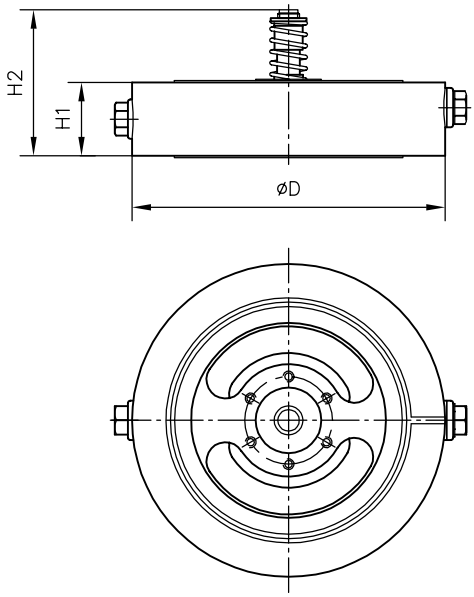


Pre-fill valve

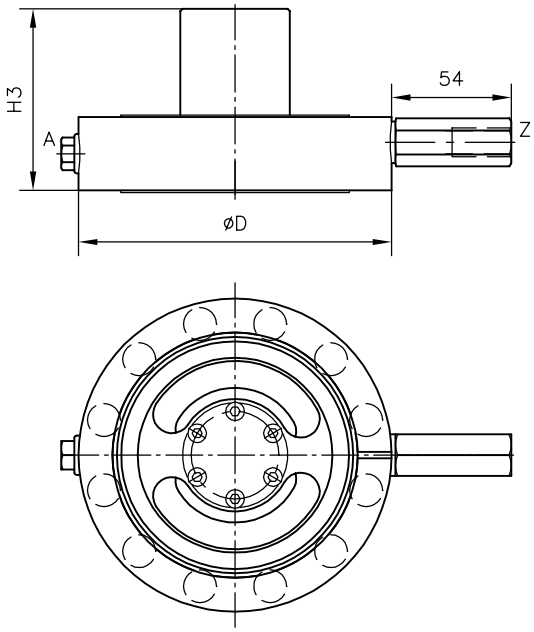


General parameters and dimensions

Check valve



Pre-fill valve



Basic type and size		Q_{max} [lpm]	p_{max} [bar]	Release ratio	Dimensions [mm]				m [kg]	
Check valve	Pre-fill valve			p_A / p_Z	D	H1	H2	H3	Check valve	Pre-fill valve
F 25	F 25-12	100	400	4.3	83	26	36	43	1	1.1
F 32	F 32-16	160		3.6	93	27	45	55	1	1.2
F 40	F 40-20	250		3.9	108	28	48.5	60	1.4	1.7
F 50	F 50-25	400		4.2	128	29	59	72	2	2.4
F 63	F 63(B)-30	630		4.2	143	33.5	69	83	2.8	3.4
F 80	F 80(B)-36	1000		4.5	169	38.5	83	97.5	4.4	5.2
F 100	F 100(B)-45	1600		4.3	212	44	97	118	9.9	11.7
F 125	F 125(B)-60	2500		4.3	248	51	127	155	15.8	19.6
F 160	F 160-76	4000		4.3	310	70	182	233	43	50
F 200	F 200-100	7000	320	4.0	420	150	250	300	114	120

Associated technical data sheets:

- Check valves and pre-fill valves type F: D 6960

See also section “Devices for special applications”:

– Press controls

Check valves

2.5 Line rupture safety valves type LB

The line rupture safety valves type LB are check valves. They are available as insert valves or with housing for pipe connection.
The line rupture safety valve, which is generally mounted directly on the consumer (cylinder)serves to block a consumer in the event of a break in a pressurised pipe, i.e. if the hydraulic counter pressure subsides. It therefore prevents an uncontrolled decline in the load. A flow in excess of the setpoint results in a shim that has been lifted off the valve seat with spring force being pressed onto the housing seat by the flow forces, and consequently the valve closes.
Two versions – one for completely stopping the load and one with an orifice hole for a slow decrease – enable this valve to be used for various requirements.

Features and benefits:
- Pressures up to 700 bar

Intended applications:
- Industrial trucks
- Lifting devices

Nomen-clature:	**Line rupture safety valve**
Design:	**Valve insert with housing for in-line installation**
Adjustment:	**Tool adjustable**
p_{max}:	**700 bar**
Q_{max}:	**4 ... 160 lpm**

Design and order coding example

LB 2 | G | 1,0 | - 25

Response flow [lpm] Response flow Q_A

With/without orifice Orifice diameter 0.5 / 0.8 / 1.0 / 1.2 / 1.5 / 2 (dep. on type and size)

Design
- Screw-in valve (C)
- Design with housing (F, G)
- Fitting

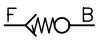
Basic type, size: Line rupture safety valve type LB, size 2 to 4
- Design with metric thread
- Design with UNF thread

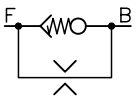
Function

LB

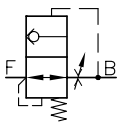
Simplified

Series | With orifice

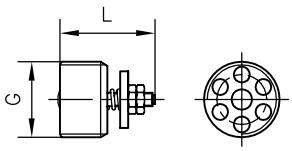


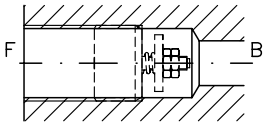


Detailed

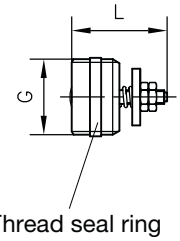


LB ..C
Screw-in valve

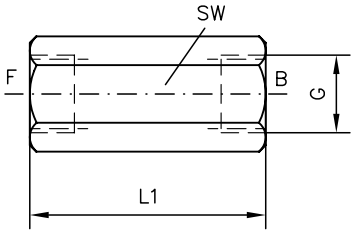




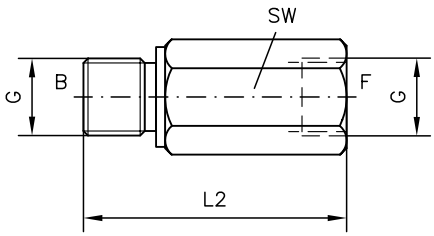
LB 11(21)C



LB ..G
Valve with housing



LB ..F



	Q_{max} [lpm]	p_{max} [bar]	Ports (BSPP)	Dimensions [mm]				m [g][2]
				L	L1	L2	SW = a/f	
LB 1 (C, G, F)	4 ... 25	500	G 1/4 (A)	17.5	48	50	a/f 19	6 / 70
LB 11 C[1]	4 ... 25	700	G 1/4 (A)	17.5	--	--	--	6 / 70
LB 2 (C, G, F)	6.3 ... 50	500	G 3/8 (A)	21	52	58	a/f 22	12 / 100
LB 21 C[1]	6.3 ... 45	700	G 3/8 (A)	25	--	--	--	12 / 100
LB 3 (C, G, F)	16 ... 80	500	G 1/2 (A)	25	60	65	a/f 27	21 / 170
LB 4 (C, G, F)	25 ... 160	500	G 3/4 (A)	30.5	72	78	a/f 36	45 / 375

1) The mounting thread is sealed additionally.
2) Mass for screw-in valve versions with housing

Associated technical data sheets:
- Line rupture safety valves type LB: D 6990
- Line rupture safety valves type LB.E as a screw joint: Sk 6990 E

See also section "Devices for special applications"
- Industrial trucks
- Hydraulics for mobile applications
- Screw-in valves and installation kits

Check valves

2.5 Shuttle valves type WV and WVC

Shuttle valves are stop valves with two inlets and one outlet. There is a ball in the inside of the valve, which can travel from one inlet to the other. It will automatically block the one inlet with the lower pressure. This way the higher inlet pressure is automatically led to the outlet port.
The version for pipe connection is incorporated in a T-fitting. The WVC version is designed as an insert valve.

Features and benefits:
- Max. pressure 700 bar
- Insert and housing versions

Intended applications:
- For Load-Sensing systems
- Often in mobile hydraulics

Nomen-clature:	**Shuttle valve**
Design:	**Individual valve for pipe mounting Valve insert Screw-in valve**
p_{max}:	**700 bar**
Q_{max}:	**6 ... 150 lpm**

Design and order coding example

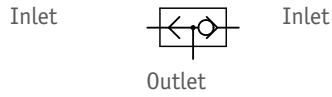
WV 10 **- S**

Design
- High pressure version (S)
- Low pressure version (L)

Basic type, size
Type WV for pipe connection, size 6 to 18
Type WVC and WVH as cartridge valve, size 1

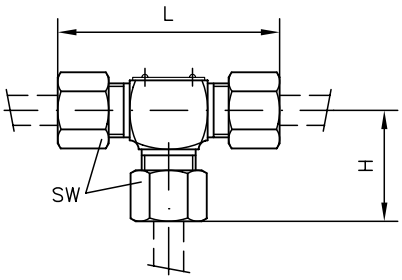
Function

WV, WVC, WVH

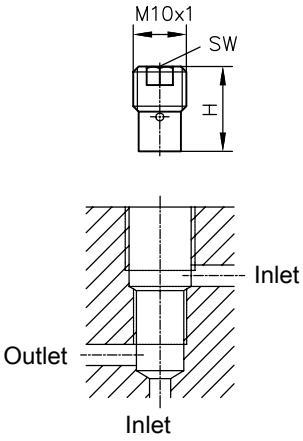


General parameters and dimensions

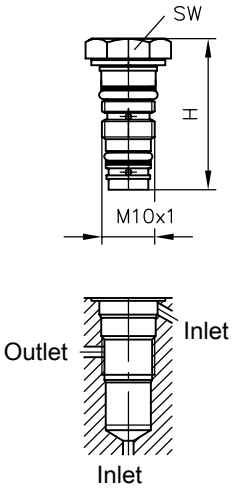
WV..



WVC 1



WVH 1



	Q_{max} [lpm]	p_{max} [bar]	External pipe ∅ [mm]	Mounting thread	Dimensions [mm]			m [g]
					L	H	SW = a/f	
WV 6 - S	6	700	6	-	62	31	SW 17	120
WV 8 - S	15		8		64	32	SW 19	170
WV 10 - S	25	500	10		68	34	SW 22	225
WV 12 - S	40		12		76	38	SW 24	290
WV 14 - S	60		14		80	40	SW 27	320
WV 16 - S	100		16		86	43	SW 30	390
WV 18 - L	150	315	18		80	40	SW 32	340
WVC 1	6		-	M 10 x 1	--	16	SW 5	7
WVH 11	3	700	-	M 10 x 1	--	28.5	SW 14	10

Associated technical data sheets:

- Shuttle valves type WV and WVC: D 7016

Similar products:

- Shuttle valves type WVH: **Sk 7962**

See also section "Devices for special applications":

- Screw-in valves and installation kits