



HAWE Products

Our current product range



Solutions for a World under Pressure

HAWE
HYDRAULIK

HAWE product range – Contents

1 HAWE product range – Contents 2

2 Pumps 8

2.1	Individual pumps	8
2.2	Hydraulic power packs	38



Compact hydraulic power packs
type KA und KAW



Prop. directional spool valve
type PSL und PSV

3 Valves 80

3.1	Directional spool valves	80
3.2	Directional seated valves	120
3.3	Pressure valves	166
3.4	Flow valves	210
3.5	Check valves	238



Hydraulic clamps
type HSE und HSA



Pressure switches
type DG

4 Hydraulic cylinders and hydrostatic motors 260

Hydraulic clamps type HSE and HSA	262
Axial piston motor type M60N	264



Electronic accessory components
type PLVC

5 Hydraulic accessories 266

Diaphragm accumulator type AC	268
Piston type accumulator type HPS	270
Pressure switch type DG	272
Pressure filter type PFM	274
Fittings	276

6**Electronics****278**

Electronic accessory components	280
Programmable logic valve control type PLVC	282
CAN node type CAN-IO	284

7**Appendix****286**

Hydraulic fluids – notes for selection	286
Formulas and units	291
Adresses of Offices and Representatives	298

Headquarter

HAWE Hydraulik SE

Streitfeldstr. 25

D-81673 München

PO Box 800804 D-81608 München

Tel. +49 89 37 91 00 - 1000

Fax: +49 89 37 91 00 - 9 1000

e-mail: info@hawe.dewww.hawe.de

Introduction

HAWE Hydraulik develops and produces hydraulic components and solutions for many sectors of the machine engineering and plant engineering industries. Fixed and variable displacement pumps, hydraulic power packs, hydraulic pumps, valves, hydraulic accessories and electronic components. The consistent modular system enables quick reaction to customer wishes and the assembly of tailor-made solutions from standard products. Due to a flexible production system, the manufacture and assembly of large quantities is just as possible as a batch size of 1.

The service range includes advice, project planning, comprehensive documentation, construction of prototypes, manufacture and assembly of various quantities, installation, maintenance and service.

All pressurised parts are made of steel. Pressures of up to 700 bar are possible, which above all makes application in mid-pressure ranges particularly safe and long lasting.

Sustainable solutions are a part of the corporate responsibility of HAWE Hydraulik. This is how the company has been operating for years with certified environmental and energy management, and has been systematically implementing occupational safety and health protection. Since 2011, HAWE Hydraulik has been a member of Global Compact, an initiative of the United Nations, thus clearly demonstrating its respect for human rights and labour standards and its commitment to environmental protection and the fight against corruption.

The family-run company HAWE Hydraulik was founded in 1949 and today is comprised of 2,200 employees in the headquarters in Munich, in seven production sites as well as five sales offices in Germany and 14 international subsidiaries. Approximately 30 sales partners in many countries around the globe support the worldwide sales.

In addition to this product overview, further technical information sheets on the individual components are available. To optimise the selection, configuration and specification of the products, HAWE sales staff will be glad to be of assistance (contact details in "Addresses of offices and representatives" attached or info@hawe.de).

Headquarters Munich



HAWE plant in Freising



HAWE plant in Dorfen



HAWE plant in Kaufbeuren

**HIGH VERTICAL RANGE OF
MANUFACTURE ENSURES THE
HIGHEST LEVEL OF QUALITY**



HAWE plant in Sachsenkam



All dimensions in mm, subject to change!

Our vertical range of manufacture ensures superior quality!

Efficiency:

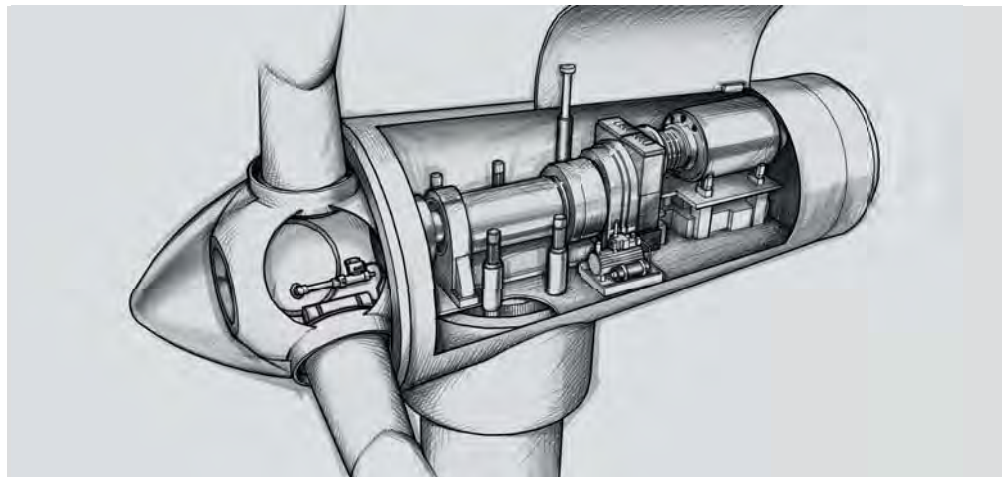
Example: Machine tools

- Compact hydraulic power packs with small tank capacity
- Zero leakage directional seated valves instead of directional spool valves
- Accumulator charged operation with idle pump circulation

Example: Truck mounted cranes

- Variable displacement axial piston pumps with clever controller technique
- Well-engineered Load-Sensing systems
- Quick response and directional spool valves with minimized leakage

HAWE Proportional directional spool valve:
Sensible and powerfull fine adjustability for all mobile application with a maximum of robustness. Also in harsh environments and up to 420 b



Flexibility:

Example: Tractors for logging and agriculture

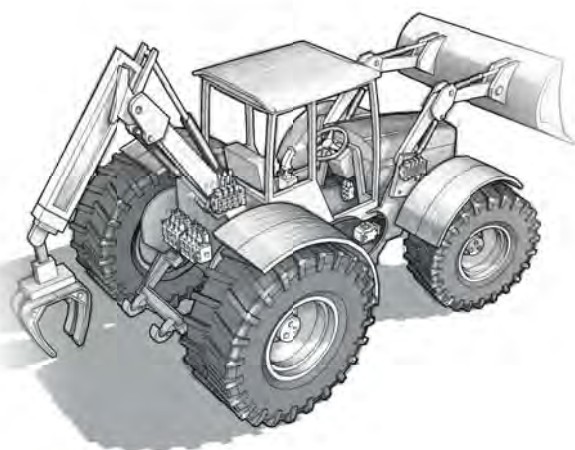
- Accurate controls that can be easily customized and extended
- One product covering all functions (boom, supports, steering etc.)
- Various sizes can be combined, additional function can be integrated

Example: Food processing

- Versatile, compact hydraulic power packs
- AC or DC-drive for low and high pressure applications
- All required functions can be implemented via directly mounted modular valve banks

We offer a wide range of various directional seated valves to ensure a safe and powerful functionality of your machine.






Reliability:

Example: Wind energy plants

- Sturdy long-lived components ensure long service life
- Modular design eases maintenance
- Hydraulic controls also for severe ambient conditions (hot, cold, moist, etc.)

Example: Construction machines

- Well proven systems consisting of pump, hydraulic controls, over-center valve and electronics
- Modular electronic controls perfectly fitting the hydraulics
- Various approved solutions for oscillation dampening



We provide with our compact hydraulic power packs energy efficient solutions for brake controls.

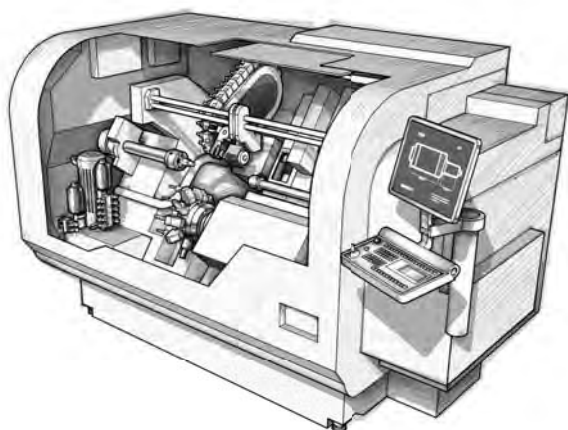
Technology:

Example: Tools with hydraulic drive

- High power density via compact design
- Wide range of modular high pressure components (max. 700 bar)
- Two-stage pumps efficiently generate the necessary working pressure

Example: Hydraulic presses

- Hydraulic power controlled reliable and smooth
- Decentralized hydraulic controls via compact hydraulic power packs
- Various solutions for synchronous operation



SOLUTIONS FOR A WORLD UNDER PRESSURE

2.1 Individual pumps

Radial piston pump type R, RG and RZ	12
Variable displacement axial piston pump type V30E	16
Variable displacement axial piston pump type V30D	20
Variable displacement axial piston pump type V80M	24
Variable displacement axial piston pump type V40M	26
Variable displacement axial piston pump type V60N	28
Variable displacement axial piston pump type K60N	32
Air-driven hydraulic pump type LP	34
Hand pump type H, HE and HD	36



*Radial piston pump
type R and RG*



*Variable displacement
axial piston pump
type V60N*

Radial piston pumps

Type	Nomenclature/version	Features	p _{max} (bar)	V _{max} (cm ³ /rev.)
R, RG, RZ	Radial piston pump / Dual-stage pump <ul style="list-style-type: none"> Individual pump Motor pump Hydraulic power pack 	Features and benefits: <ul style="list-style-type: none"> High level of efficiency Compact design Max. 14 separate pressure outlets Available from the modular product range as a hydraulic power pack with valve banks 	R: 700 HP/LP: RZ: 700/200	R - 7631: 1.59 R, RG - 6010: 4.58 R, RG - 6011: 10.7 R, RG - 6012: 21.39 R, RG - 6014: 42.78 R, RG - 6016: 64.18 RZ - 7631: 1.59/7.9 RZ - 6910: 4.58/26 RZ - 6911: 10.7/89.6 RZ - 6912: 21.39/89.6 RZ - 6914: 42.78/89.6 RZ - 6916: 64.18/89.6

Axial piston pumps

Type	Nomenclature/Design	Features	p _{max} (bar)	V _{max} (cm ³ /rev.)
V30D	Variable displacement axial piston pump <ul style="list-style-type: none"> Individual pump Pump combination 	Features and benefits: <ul style="list-style-type: none"> Low-noise emissions Wide range of controllers Full torque available at the second pump in tandem pump applications 	Operation/Peak 350/420	045: 45 075: 75 095: 95 115: 115 140: 140 160: 160 250: 250
V30E	Variable displacement axial piston pump <ul style="list-style-type: none"> Individual pump Pump combination 	Features and benefits: <ul style="list-style-type: none"> Low noise emissions Wide range of controllers Full torque available at the second pump in tandem pump applications 	Operation/Peak 095: 350/420 160: 350/420 270: 350/420	095: 95 160: 160 270: 270
V80M	Variable displacement axial piston pump <ul style="list-style-type: none"> Individual pump Pump combination 	Features and benefits: <ul style="list-style-type: none"> Low-noise Wide range of controllers Full torque available at the second pump in tandem pump applications 	Operation/Peak 400/450	200: 202
V60N	Variable displacement axial piston pump <ul style="list-style-type: none"> Individual pump Pump combination 	Features and benefits: <ul style="list-style-type: none"> Optimized power-to-weight ratio High self-suction speed Wide range of controllers 	Operation/Peak 60: 350/400 90: 350/400 110: 350/400 130: 400/450	60: 60 90: 90 110: 110 130: 130
V40M	Variable displacement axial piston pump <ul style="list-style-type: none"> Individual pump Pump combination 	Features and benefits: <ul style="list-style-type: none"> Optimized power-to-weight ratio High self-suction speed Different shaft and flange versions 	Operation/Peak 380/400	28: 28 45: 46
K60N	Fixed displacement axial piston pump <ul style="list-style-type: none"> Individual pump 	Features and benefits: <ul style="list-style-type: none"> Good performance/weight ratio High self-suction speed Different shaft and flange versions 	400	012: 12.6 017: 17.0 025: 25.4 034: 34.2 047: 47.1 064: 63.5 084, 984: 83.5 108, 9108: 108

Air-driven hydraulic pumps

Type	Nomenclature/Design	Features	p _{max} (bar)	V _{max} (cm ³ /stroke)
LP	Air-driven hydraulic pump <ul style="list-style-type: none"> Individual pump Hydraulic power pack 	Features and benefits: <ul style="list-style-type: none"> High operating pressures Suitable for explosion-proof systems and equipment No electrical energy Hydraulic power packs with direct valve mounting 	80: 700 125: 1500 160: 1500	80: 6.00 125: 28.30 160: 28.30

Hand pumps

Type	Nomenclature/Design	Features	p _{max} (bar)	V _{max} (cm ³ /stroke)
H, HE, HD	Hand pump <ul style="list-style-type: none"> single-acting double-acting 	Features and benefits: <ul style="list-style-type: none"> Sturdy design Hand pumps with integrated tank Safety and drain valve 	H - 16: 350 H - 20: 220 H - 25: 150 HE - 3: 800 HE - 4: 600 HD - 13: 350 HD - 20: 220 HD - 30: 150	H - 16: 6.00 H - 20: 9.40 H - 25: 14.70 HE - 3: 3.00 HE - 4: 4.00 HD - 13: 13.00 HD - 20: 20.00 HD - 30: 30.00

Individual pumps

2.1

Radial piston pump type R, RG and RZ

Radial piston pumps are a type of hydraulic pump. They consist of valve-controlled pump cylinders that are arranged radially.

The radial piston pump type R, RG and RZ has a closed pump housing. Therefore, besides use as a motor pump outside an oil tank, installation in the container of a hydraulic power pack is also possible. The radial piston pump is available with several pressure outlets which enable the same or several different volumetric flows. Type RZ is a classic dual-stage pump consisting of a radial piston pump and a gear pump. The radial piston pump type RG has plain bearings which have a longer storage life. This type is therefore used in extreme operating conditions.

Extremely high volumetric flows can be achieved by arranging up to 6 radials in parallel. When the radial piston pump is used in the hydraulic power pack, it is suitable for use as a highly compact control system. Connection blocks and valve banks can be mounted on the cover plate of the hydraulic power packs.

- Features and benefits:
- High level of efficiency
 - Compact design
 - Max. 14 separate pressure outlets
 - Available from the modular product range as a hydraulic power pack with valve banks

- Intended applications:
- Press construction
 - Jig construction
 - Testing and laboratory devices
 - Lubricating systems



Nomenclature:	Radial piston pump
Design:	Individual pump; dual-stage pump
p _{max} •	700 bar
Q _{max} •	91.2 lpm (V _g = 64.18 cm³/rev)

Design and order coding example

RZ 0,9 / 2 - 16

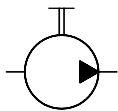
Sizes

Delivery flow gear pump [lpm]

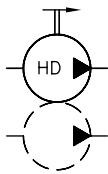
- Basic type, delivery flow [lpm]
- Type R (version with roller bearing)
 - Type RG (version with plain bearing)
 - Type RZ (dual-stage pump)
- Additional versions:
- With several pressure ports
 - With separate ports for the flow of one or two pump elements (Q_{max} = 4,4 lpm)
e.g. as control oil supply

Function

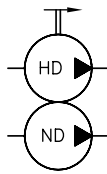
Individual pump type R and RG



Individual pump type RZ
only high-pressure section,
low-pressure section is
installed by customer



Individual pump type RZ
High and low-pressure section

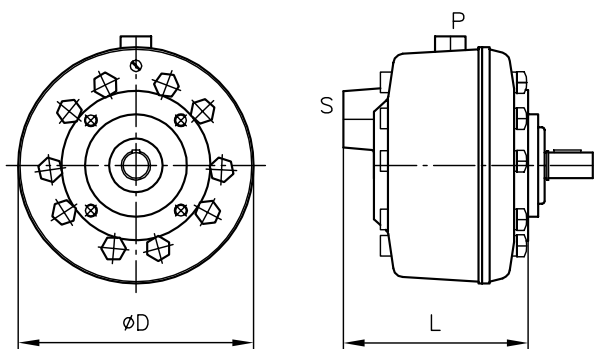


Pump with several pressure
outlets (example for an individual
pump)

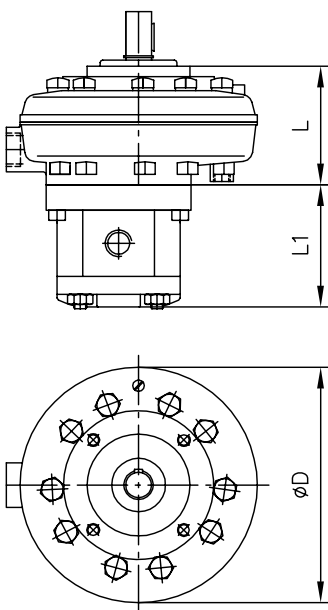


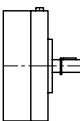
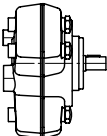
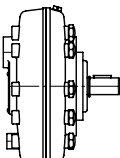
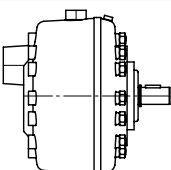
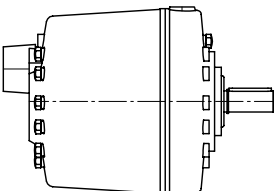
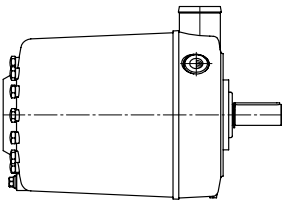
General parameters and dimensions

Individual pump type R and RG



Individual pump type RZ



Design		Number of cylinders	Delivery flow Q_{pu} (lpm) (approximate reference value at 1450 rpm) and max. pressure p_{max} (bar)						Dimensions [mm]		
			700 bar	550 bar	450 bar	250 bar	160 bar	P_N [kW]	D	L	m [kg]
7631		2	0.18	0.28	0.43	0.92	-	0.25...0.55	130	53/58	3.2
		3	0.27	0.42	0.64	1.35	-				
		5	0.46	0.7	1.08	2.27	-				
6010/ 6910		1	0.3	0.5	0.8	1.7	2.2	0.25...3	174	82.5/85.5	3.1
		2	0.6	1.0	1.6	3.3	4.4				
		3	0.9	1.5	2.5	5.1	6.5				
6011/ 6911		5	1.4	2.6	4.2	8.3	10.9	0.55...5.5	185	86/85	5.8
		7	2.1	3.7	5.8	11.8	15.3				
6012/ 6912		10	2.7	5.3	8.2	16.8	21.7	2.2...11	185	146/125	10.5
		14	4.0	7.4	11.6	23.5	30.4				
6014/ 6914		20	6.1	11.0	17.4	35.0	43.4	5.5...22	218	250/221	24.2
		28	8.0	15.0	23.0	47.0	60.8				
6016/ 6916		42	12.7	22.0	34.5	70.0	91.2	11...30	238	311/320	39.1

- The data listed represent only a selection of the various different versions

1) Standard motor, design IM B 35 for motor pumps or IM B 5 for hydraulic power packs

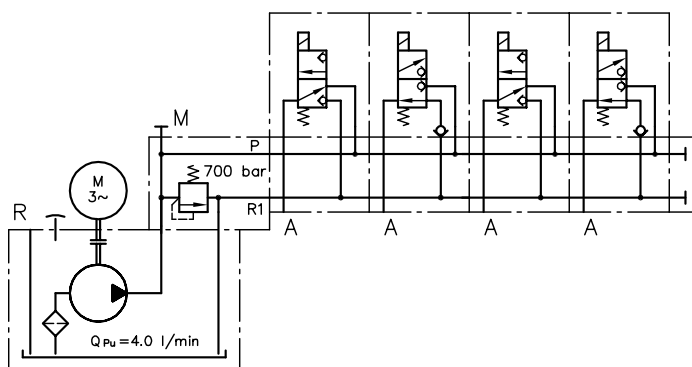
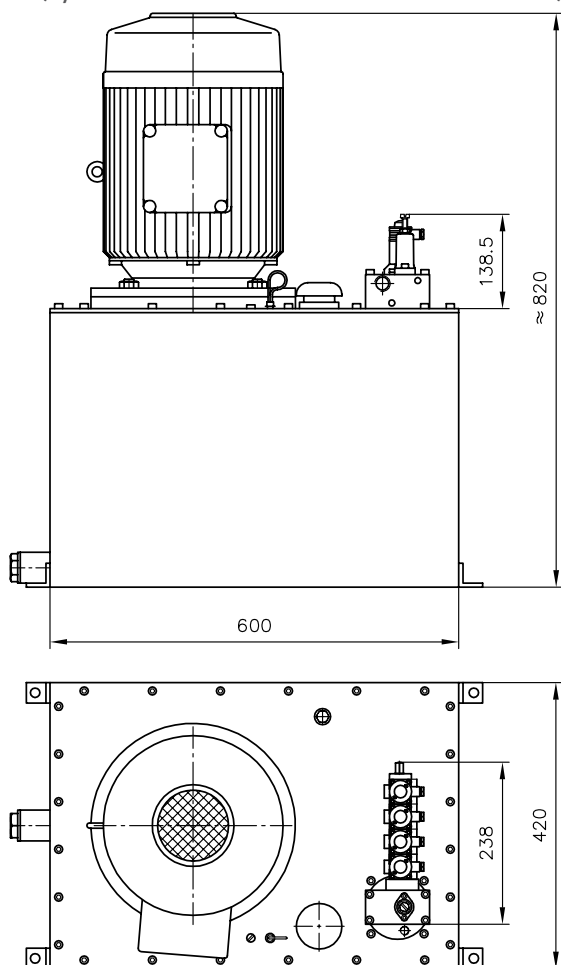
Gear pump

Size	Delivery flow Q_{pu} [lpm] and max. pressure p_{max} [bar]			Dimensions [mm]	m [kg]
	120 bar	80 bar	40 ... 60 bar	L1	
/1	5,2	8,8	11,3	70 ... 86	1,2
/2	12,3	16	37	96 ... 132	3,1
/3	24	110	135	140 ... 178	8,4

- The data listed represent only a selection of the various different versions

Circuit example:

R 4,0/B 50 A 700 - VB 11 DM - HRHR - 1 - G 24 - V 5,5



Associated technical data sheets:

- [Radial piston pump type R and RG: D 6010](#)
- [Motor pump and hydraulic power pack type R and RG: D 6010 H](#)
- Radial piston pumps with several pressure ports type R, RG: [D 6010 D](#), [D 6010 DB](#)
- [Radial piston pump type R and RG with one main pressure connection and one or two ancillary pressure connections: D 6010 S](#)

Directly mountable valve banks:

- Type VB: [Page 132](#)
- Type BWH(N): [Page 138](#)
- Type SWR: [Page 92](#)

Individual pumps

2.1

Variable displacement axial piston pump type V30E

Variable displacement axial piston pumps adjust the geometric delivery volume from maximum to zero. As a result they vary the volumetric flow that is provided to the loads. The axial piston pump type V30E is designed for open circuits in mobile hydraulics and works according to the swash plate principle. It is available with the option of a thru-shaft for operating additional hydraulic pumps in series. The sturdy pump is particularly suitable for continuous operation in challenging applications. The range of pump controllers allows the axial piston pump to be used in a variety of applications.

Features and benefits:

- Low noise emissions
- Wide range of controllers
- Full torque available at the second pump in tandem pump applications

Intended applications:

- Machines for forestry and agricultural purposes
- Cranes and lifting equipment
- Construction machines



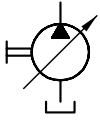
Nomenclature:	Variable displacement axial piston pump
Design:	Individual pump Multiple pump
p _{max} :	Nominal pressure 350 bar, peak pressure 420 bar
V _{g max} :	95 ... 270 cm³/rev

Design and order coding example

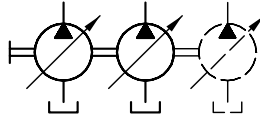
V30E	- 095	R	S	F	N	- 1	- 1	- XX	/LSP	/120	- 200
											Pressure specification [bar]
											Torque setting [Nm]
											Controllers
											Release
											Pivoting angle indicator
											Housing version
											Seal material
											Flange version
											Shaft version
											Rotation direction
											Nominal size
											Basic type

Function

Individual pump



Multiple pump



Controller

Pressure controller:

- Pressure controller (P, Pb)
- Electro-proportional pressure controller (P-PMVPS)

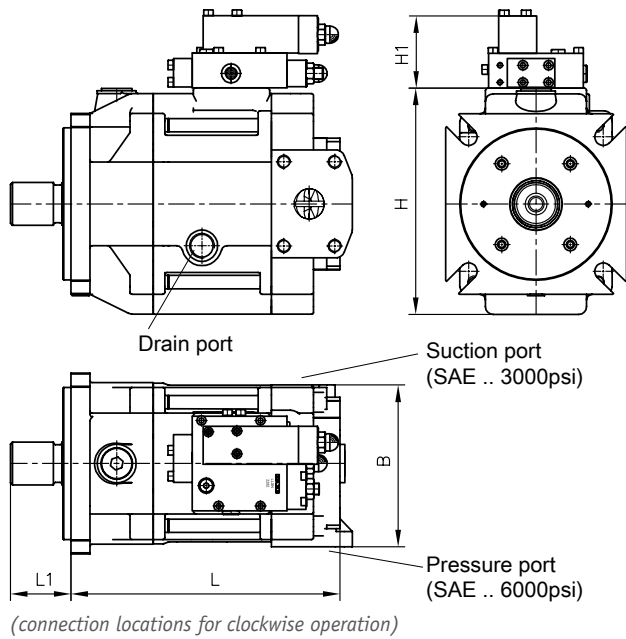
Delivery flow controller

- Load-sensing controller with integrated pressure limitation (LSP, LSPb)
- Load-sensing controller with integrated pressure limitation and electrical pump direction switching (LSP-BVPM)
- Electro-hydraulic delivery flow controller with integrated pivoting angle pick-up and control electronics for adjustment of setpoint and actual value (EM.CH)

Power controller:

- Power controller (L)
- Power controller (Lf, Lf1)

General parameters and dimensions



Parameters

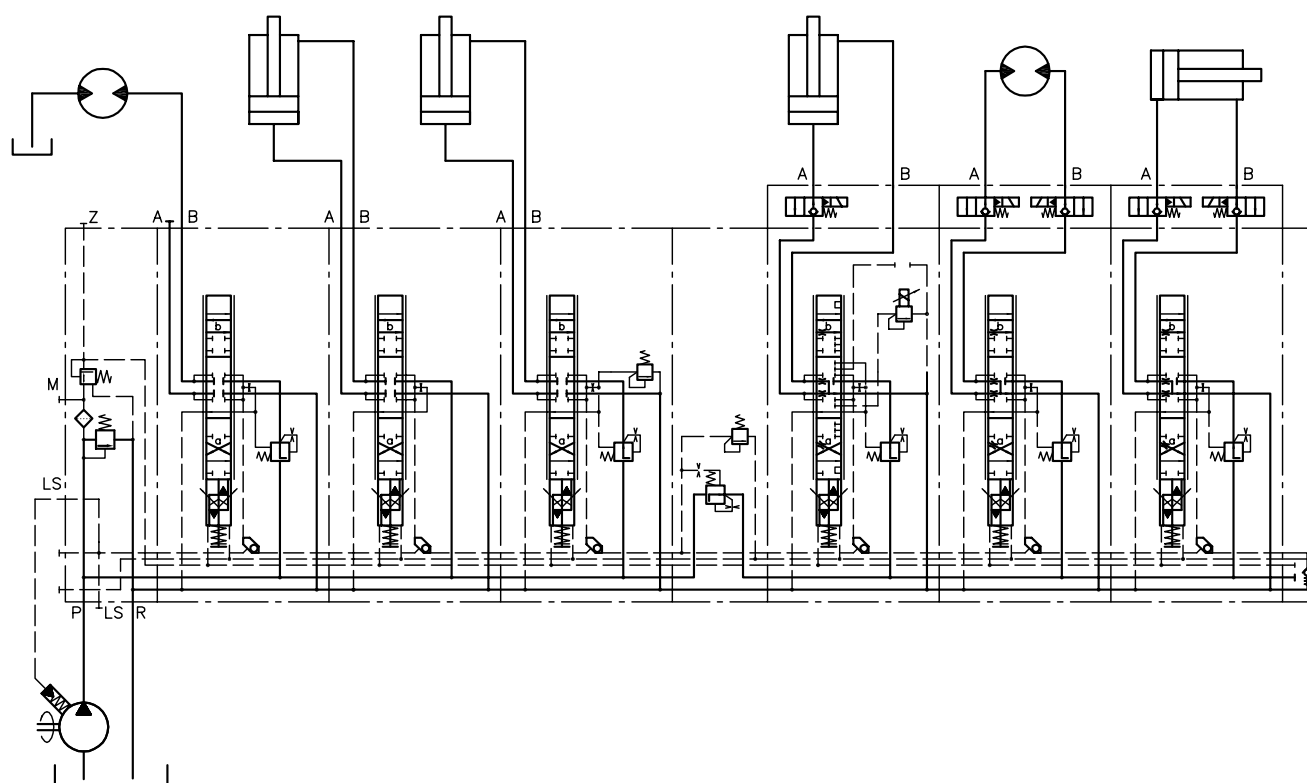
	Geom. delivery volume	Nom. pressure	Max. speed	Dimensions [mm] approx.					m [kg]
	V_g [cm ³ /rev]	$p_{nom} (p_{max})$ [bar]	n [rpm]	L	L1	H	H1	B	(with controller)
V30E - 095	95	350 (420)	2500	296	75	236	36	190	57
V30E - 160	160		2100	332	75	273	36	212	77
V30E - 270	270		1800	399	88	326	36	266	129

Ports

	Pressure port	Suction port	Drain port
V30E - 095	1 1/4" SAE J518	2 1/2" SAE J518	G 3/4
V30E - 160	1 1/4" SAE J518	2 1/2" SAE J518	G 3/4
V30E - 270	1 1/2" SAE J518	3" SAE J518	G 1

Example circuit:

V30E-270-LSF N-2-1/03-LSN-320



Associated technical data sheets:

- Variable displacement axial piston pump type V30E: [D 7960 E](#)

Similar products:

- Variable displacement axial piston pump type V30D: [Page 20](#)
- Variable displacement axial piston pump type V40M: [Page 26](#)
- Variable displacement axial piston pump type V60N: [Page 28](#)
- Fixed displacement axial piston pump type K60N: [Page 32](#)
- Axial piston motor type M60N: [Page 264](#)
- Axial piston motor type V80M: [Page 24](#)

Suitable proportional directional spool valve:

- Type PSL/PSV sizes 2, 3 and 5: [Page 106](#)
- Type PSLF/PSVF sizes 3, 5 and 7: [Page 112](#)

Suitable accessories:

- Proportional amplifier type EV1M3: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)

Individual pumps

2.1 Variable displacement axial piston pump type V30D

Variable displacement axial piston pumps adjust the geometric delivery volume from maximum to zero. As a result they vary the volumetric flow that is provided to the loads. The axial piston pump type V30D is designed for open circuits in industrial hydraulics and works according to the swash plate principle. It is available with the option of a thru-shaft for operating additional hydraulic pumps in series.

The sturdy pump is particularly suitable for continuous operation in challenging applications. The range of pump controllers allows the axial piston pump to be used in a variety of applications.

Features and benefits:

- Low-noise emissions
- Wide range of controllers
- Full torque available at the second pump in tandem pump applications

Intended applications:

- Presses
- Industrial plants
- Marine cranes and winches
- Power pack assembly



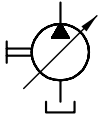
Nomenclature:	Variable displacement axial piston pump
Design:	Individual pump Multiple pump
p_{max}:	Nominal pressure 350 bar, peak pressure 420 bar
$V_{g\ max}$:	45 ... 250 cm ³ /rev

Design and order coding example

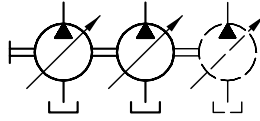
V30D	- 095	R	SF	N	- 1	- 1	- XX	/LN	-2	/120	- 200
											Pressure specification [bar]
											Torque setting [Nm]
											Additional versions e.g. stroke limitation
											Controller See section "Controller" Chapter , "Function"
											Release
											Pivoting angle indicator With/without pivoting angle indicator
											Housing version With/without thru-shaft
											Seal material <ul style="list-style-type: none"> ■ NBR (N) ■ EPDM (E) ■ FKM (V)
											Shaft version/flange version <ul style="list-style-type: none"> ■ Spline shaft DIN 5480 (D) ■ Spline shaft SAE J744 (S) ■ Parallel key (K)
											Rotation direction Anti-clockwise (L), clockwise (R)
											Nominal size
Basic type											

Function

Individual pump



Multiple pump



Controller

Pressure controller:

- Pressure controller (N)
- Pressure controller with remote-control port (P, Pb)

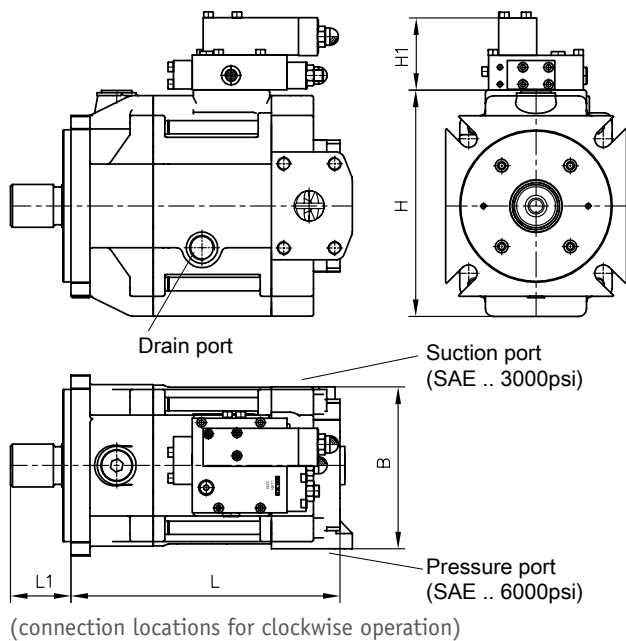
Delivery flow controller

- Load-sensing controller (LS)
- Load-sensing controller with integrated pressure limitation (LSN)
- Delivery flow controller for setting a constant, speed-independent volumetric flow (Q, Qb)
- Electro-proportional delivery flow controller with rising characteristic (V)
- Hydraulic-proportional delivery flow controller with rising characteristic (VH)

Power controller:

- Power controller (L)
- Power controller, hydraulically adjustable (Lf1)

General parameters and dimensions



Parameters

	Geom. delivery volume	Nom. pressure	Max speed	Dimensions [mm]					m [kg]
	V_g [cm ³ /rev]	p_{nom} (p_{max}) [bar]	n [rpm]	L	L1	H	H1	B	(with controller)
V30D - 045	45	350 (420)	2600	268	68	150	82	160	40 (46)
V30D - 075	75		2400	310	80	170	86	178	60 (66)
V30D - 095	95		2200	341	93	196	87	196	70 (76)
V30D - 115	115	250 (300) ¹⁾	2000	341	93	196	87	196	70 (76)
V30D - 140	140	350 (420)	2200	363	90	212	85	212	85 (91)
V30D - 160	160	250 (300) ¹⁾	1900	363	90	212	85	212	85 (91)
V30D - 250	265	350 (420)	1800	432	115	224	97	272	130 (136)

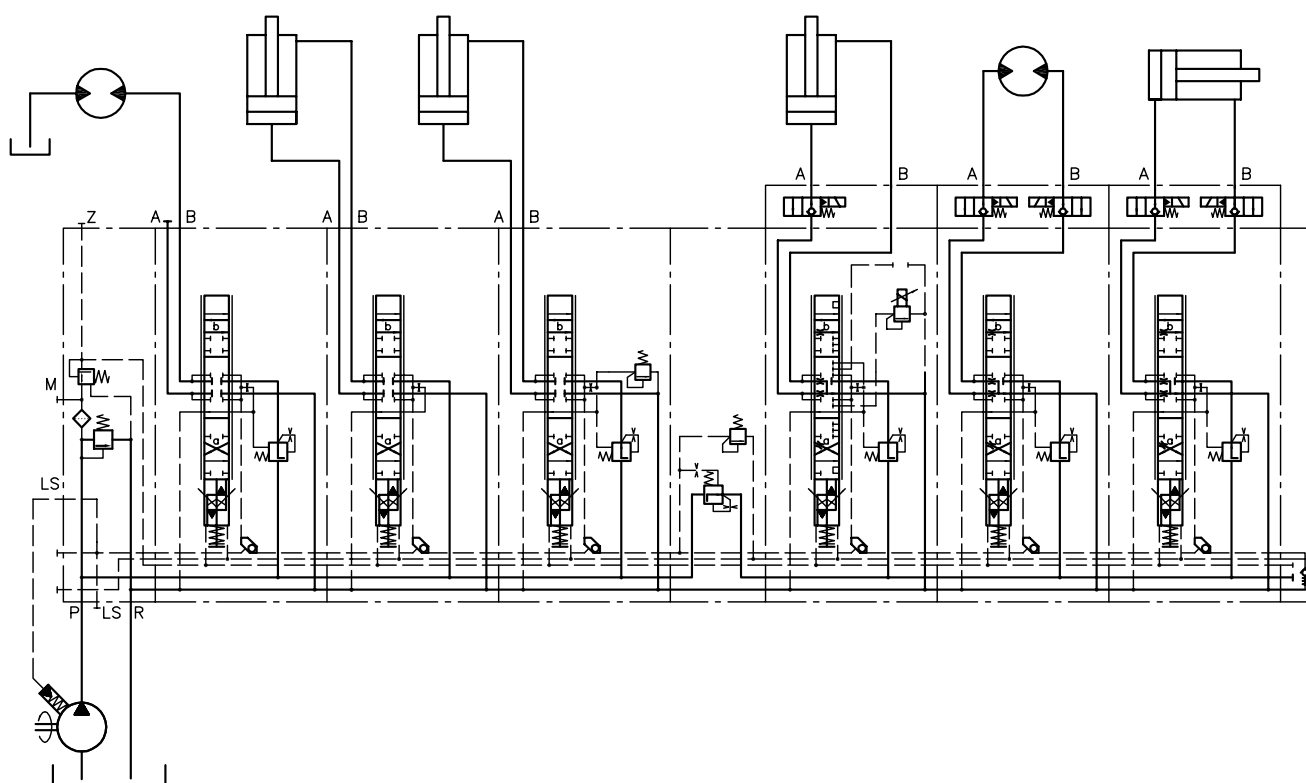
1) Higher pressure is possible with reduced geom. delivery flow

Ports

	Pressure port	Suction port	Drain port
V30D - 045	3/4" SAE J518	1 1/2 " SAE J518	G 1/2
V30D - 075	1" SAE J518	2" SAE J518	G 3/4
V30D - 095	1 1/4" SAE J518	2" SAE J518	G 3/4
V30D - 115	1 1/4" SAE J518	2" SAE J518	G 3/4
V30D - 140	1 1/4" SAE J518	2 1/2 " SAE J518	G 3/4
V30D - 160	1 1/4" SAE J518	2 1/2 " SAE J518	G 3/4
V30D - 250	1 1/2" SAE J518	3" SAE J518	M 33x 2

Example circuit:

V30D-250-LSF N-2-1/03-LSN-320


Associated technical data sheets:

- Variable displacement axial piston pump type V30D: [D 7960](#),

Similar products:

- Variable displacement axial piston pump type V30E: [Page 16](#)
- Variable displacement axial piston pump type V40M: [Page 26](#)
- Variable displacement axial piston pump type V60N: [Page 28](#)
- Variable displacement axial piston pump type V60N: [Page 28](#)
- Variable displacement axial piston pump type V80M: [Page 24](#)

Suitable proportional directional spool valve:

- Type PSL/PSV 2, 3 and 5: [Page 106](#)
- Type PSLF/PSVF 3, 5 and 7: [Page 112](#)

Additional electrical components:

- Proportional amplifier: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)
- CAN node type CAN-IO: [Page 284](#)
- Other electronic accessories [See "Electronics"](#)

Individual pumps

2.1

Variable displacement axial piston pump type V80M

Variable displacement axial piston pumps adjust the geometric delivery volume from maximum to zero. As a result they vary the volumetric flow that is provided to the loads. The axial piston pump type V80M is designed for open circuits in mobile hydraulics and works according to the swash plate principle. It is available with the option of a thru-shaft for operating additional hydraulic pumps in series.

The sturdy pump is particularly suitable for continuous operation in challenging applications. The range of pump controllers allows the axial piston pump to be used in a variety of applications.

Features and benefits:

- High speed
- High nominal pressure
- Less installation space
- Full torque available at the second pump in tandem pump applications

Intended applications:

- Machines for forestry and agricultural purposes
- Cranes and lifting equipment
- Construction machines



Nomenclature:	Variable displacement axial piston pump
Version:	Individual pump Multiple pump
p _{max} •	Nominal pressure 400 bar, peak pressure 450 bar
V _{g max} :	200 cm³/rev

Design and order coding example

V80M-200R-S-F-N-1-1-XX/LN-2/120-200

Basic type

Nominal size

Rotation direction

Shaft version

Flange version

Seals

Versions with housing

Pivoting angle indicator

Release

Controller

Additional versions

Torque setting [Nm]

Pressure specification [bar]

- NBR (N)
- FKM (V)
- DIN (W)
- SAE (F)
- Spline shaft (DIN 5480) (D)
- Spline shaft and flange SAE (S)

Counter clockwise (L), clockwise (R)

With/without thru-shaft

With/without pivoting angle indicator

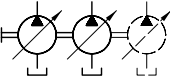
See section "Controller"

Function

Individual pump



Multiple pump



Controller

Pressure controller:

- Pressure controller (N)

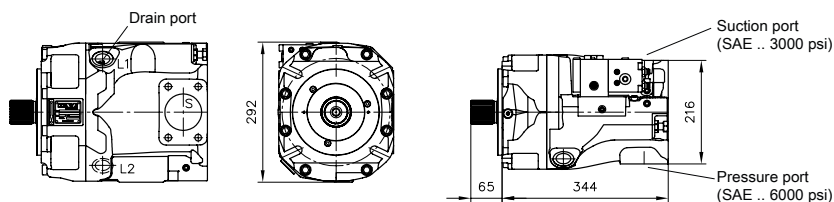
Delivery flow controller:

- Load-sensing controller (LSN)

Power controller:

- Power controller (L)

General parameters and dimensions

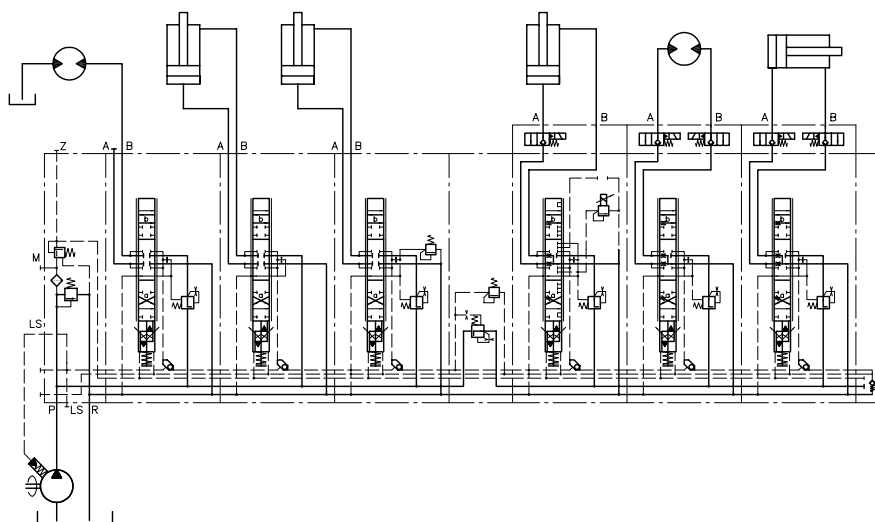


(connection locations for clockwise operation)

Parameters

	Geom. delivery volume V_g [cm ³ /rev]	Nominal pressure p_{nom} (p_{max}) [bar]	Self-suction speed n [min ⁻¹]	Ports			m [kg] (with controller)
				Drain port	Suction port	Pressure port	
V80M - 200	200	400 (450)	1800	G 1	3"	1 1/2"	130 (136)

Circuit example:



Associated technical data sheets:

- Variable displacement axial piston pump V80M: [D 7962 M](#)

Similar products:

- Variable displacement axial piston pump type V40M: [Page 26](#)
- Variable displacement axial piston pump type V60N: [Page 28](#)
- Fixed displacement axial piston pump type K60N: [Page 32](#)
- Axial piston motor type M60N: [Page 264](#)

Suitable prop. directional spool valve:

- Type PSL/PSV sizes 2, 3 and 5: [Page 106](#)
- Type PSLF/PSVF sizes 3, 5 and 7: [Page 112](#)

Suitable accessories:

- Prop. amplifier type EV1M3: ["Electronic accessory components"](#)
- Programmable logic valve control type PLVC: [Page 282](#)

Individual pumps

2.1

Variable displacement axial piston pump type V40M

Variable displacement axial piston pumps adjust the geometric delivery volume from maximum to zero. As a result they vary the volumetric flow that is provided to the loads. The axial piston pump type V40M is designed for open circuits in mobile hydraulics and works according to the swash plate principle. It is available with the option of a thru-shaft for operating additional hydraulic pumps in series. The pump is normally attached to the power take-off of diesel engines. The range of pump controllers allows the axial piston pump to be used in a variety of applications.

- Features and benefits:**
- Optimized power-to-weight ratio
 - High self-suction speed
 - Different shaft and flange versions

- Intended applications:**
- Machines for forestry and agricultural purposes
 - Cranes and lifting equipment
 - Truck-mounted concrete pumps
 - Municipal trucks



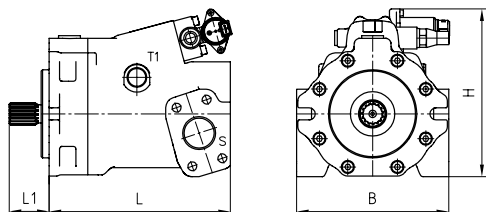
Nomenclature:	Variable displacement axial piston pump
Version:	Individual pump Multiple pump
p _{max} :	Nominal pressure 380 bar, peak pressure 400 bar
V _{g max} :	45 cm³/rev

Design and order coding example

V40M	- 045	R	T	X	V	- 2	- 0	- 00	/LS-DA	- C 23
										Thru-shaft version
										Controllers
										Load-sensing controller:
										▪ Load-sensing controller with integrated pressure limitation (LS-DA)
										Pressure controller:
										▪ Electro-proportional pressure controller with falling characteristic (P1R1)
										Release
										Additional function
										Housing version
										▪ Axial ports
										▪ Radial ports with thru-shaft
										▪ Radial ports
										Seal material
										FKM (V)
										Flange version
										Flange SAE-B 2-hole J 744 (X)
										Shaft version
										Spline shaft SAE-B J 744 (H)
										Spline shaft SAE-BB J 744 (T)
										Rotation direction
										Anti-clockwise (L), clockwise (R)
										Nominal size
										- 028: Medium pressure version (250 bar)
										- 028 H: High pressure version (380 bar)
										- 045: Medium pressure version (250 bar)
										- 045 H: High pressure version (380 bar)

Basic type

Function

General parameters and dimensions

Parameters

	Geom. delivery volume	Nom. pressure	Self-suction speed	Dimensions [mm]				m [kg]
	V_g [cm ³ /rev]	p_{nom} (p_{max}) [bar]	n [rpm]	L	L1	H	B	
V40M - 028	28,7	250 (320)	3200	182	41	170	172	16
V40M - 028 H		380 (400)						
V40M - 045	46,5	250 (320)	2900	212	46	186	175	21
V40M - 045 H		380 (400)						

Ports

	Drain port T.	LS connection	Suction port	Pressure port P
V40M - 028	3/4-16 UNF-2B	M12 x 1.5	1 1/4" SAE J518	3/4" SAE J518
V40M - 028 H				
V40M - 045	7/8-14 UNF-2B	M12 x 1.5	1 1/2" SAE J518	1" SAE J518
V40M - 045 H				

Associated technical data sheets:

- Variable displacement axial piston pump type V40M: [D 7961](#)

Similar products:

- Variable displacement axial piston pump type V60N: [Page 28](#)
- Variable displacement axial piston pump type V30D: [Page 20](#)
- Variable displacement axial piston pump type V30E: [Page 16](#)
- Fixed displacement axial piston pump type K60N: [Page 32](#)
- Axial piston motor type M60N: [Page 264](#)

Prop. directional spool valve:

- Type PSL/PSV sizes 2, 3 and 5: [Page 106](#)
- Type PSLF/PSVF sizes 3, 5 and 7: [Page 112](#)

Load holding valves:

- Type LHK, LHDV, LHT: [Page 206](#)

Individual pumps

2.1 Variable displacement axial piston pump type V60N

Variable displacement axial piston pumps adjust the geometric delivery volume from maximum to zero. As a result they vary the volumetric flow that is provided to the loads. The axial piston pump type V60N is designed for open circuits in mobile hydraulics and works according to the swash plate principle. It is available with the option of a thru-shaft for operating additional hydraulic pumps in series.

The pump is fitted above all to the power take-off on commercial vehicle transmissions. The range of pump controllers allows the axial piston pump to be used in a variety of applications.

Features and benefits:

- Optimized power-to-weight ratio
- High self-suction speed
- Wide range of controllers

Intended applications:

- Machines for forestry and agricultural purposes
- Cranes and lifting equipment
- Truck-mounted concrete pumps
- Municipal trucks

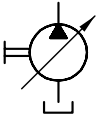


Nomenclature:	Variable displacement axial piston pump
Design:	Individual pump Multiple pump
p_{\max}:	Nominal pressure 400 bar, peak pressure 450 bar
$V_{g \max}$:	60 ... 130 cm ³ /rev

Design and order coding example

V60N	- 110	R	S	F	N	- 1	- 0	- 03	/LSNR	-2	- 320
Pressure specification [bar]											
Stroke limitation With/without max. stroke limitation											
Controller See section "Controller" Chapter , "Function"											
Release											
Additional function											
Housing version <ul style="list-style-type: none"> ▪ Axial ports ▪ Radial ports with thru-shaft ▪ Radial ports 											
Seal material <ul style="list-style-type: none"> ▪ NBR (N), FKM (V) 											
Flange version <ul style="list-style-type: none"> ▪ Flange ISO 7653-1985 (Y, P) ▪ Flange ISO 3019-2 (G) ▪ Flange SAE J744 (X, Z, F) 											
Shaft version <ul style="list-style-type: none"> ▪ ISO 14 parallel key splined shaft (D) ▪ Spline shaft DIN 5480 (M) ▪ Spline shaft SAE J744 (H, U, T, S, Q) 											
Rotation direction Anti-clockwise (L), clockwise (R)											
Nominal size											
Basic type											

Function



Controller

Pressure controller

- Pressure controller (NR, NXR)
- Electro-proportional pressure controller with rising characteristic (PR)
- Electro-proportional pressure controller with falling characteristic (P1R)

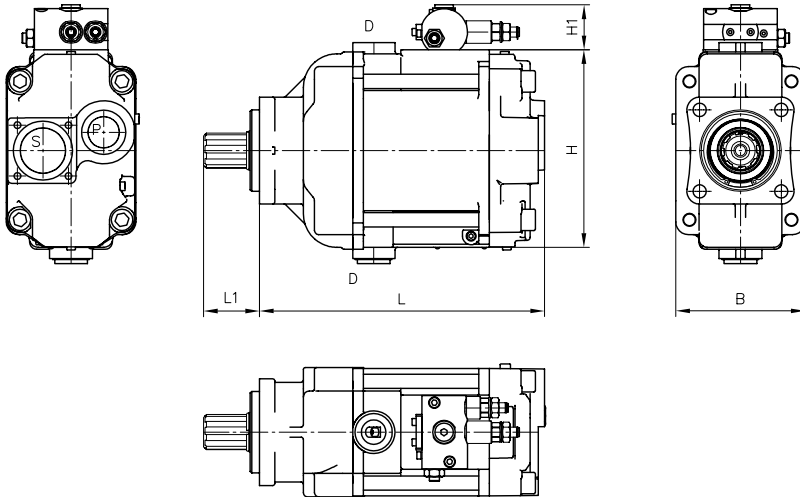
Delivery flow controller

- Load-sensing controller with integrated pressure limitation (LSNR, LSNRT)
- Delivery flow controller for setting a constant, speed-independent volumetric flow (QNR)
- Electro-proportional delivery flow controller with rising characteristic (V)
- Electro-proportional delivery flow controller with falling characteristic (V1)

Power controller

- Power controller (L, /ZL)

General parameters and dimensions



Parameters

	Geom. delivery volume	Nom. pressure	Max. speed	Dimensions [mm]					m [kg]
	V_g [cm ³ /rev]	$p_{nom} (p_{max})$ [bar]	n [rpm]	L	L1	H	H1	B	
V60N - 060	60	350 (400)	2500	254	55	177	45	115	24
V60N - 090	90		2300	278	55	184	45	120	27
V60N - 110	110		2200	280	55	194	45	125	30
V60N - 130	130	400 (450)	2100	270	55	210	45	130	31

Ports

	Pressure port P	Suction port S	Drain port D	LS connection
V60N - 060	G 3/4	1 1/2" SAE J518	G 3/4	G 1/4
V60N - 090	G 1			
V60N - 110				
V60N - 130				

Example circuit

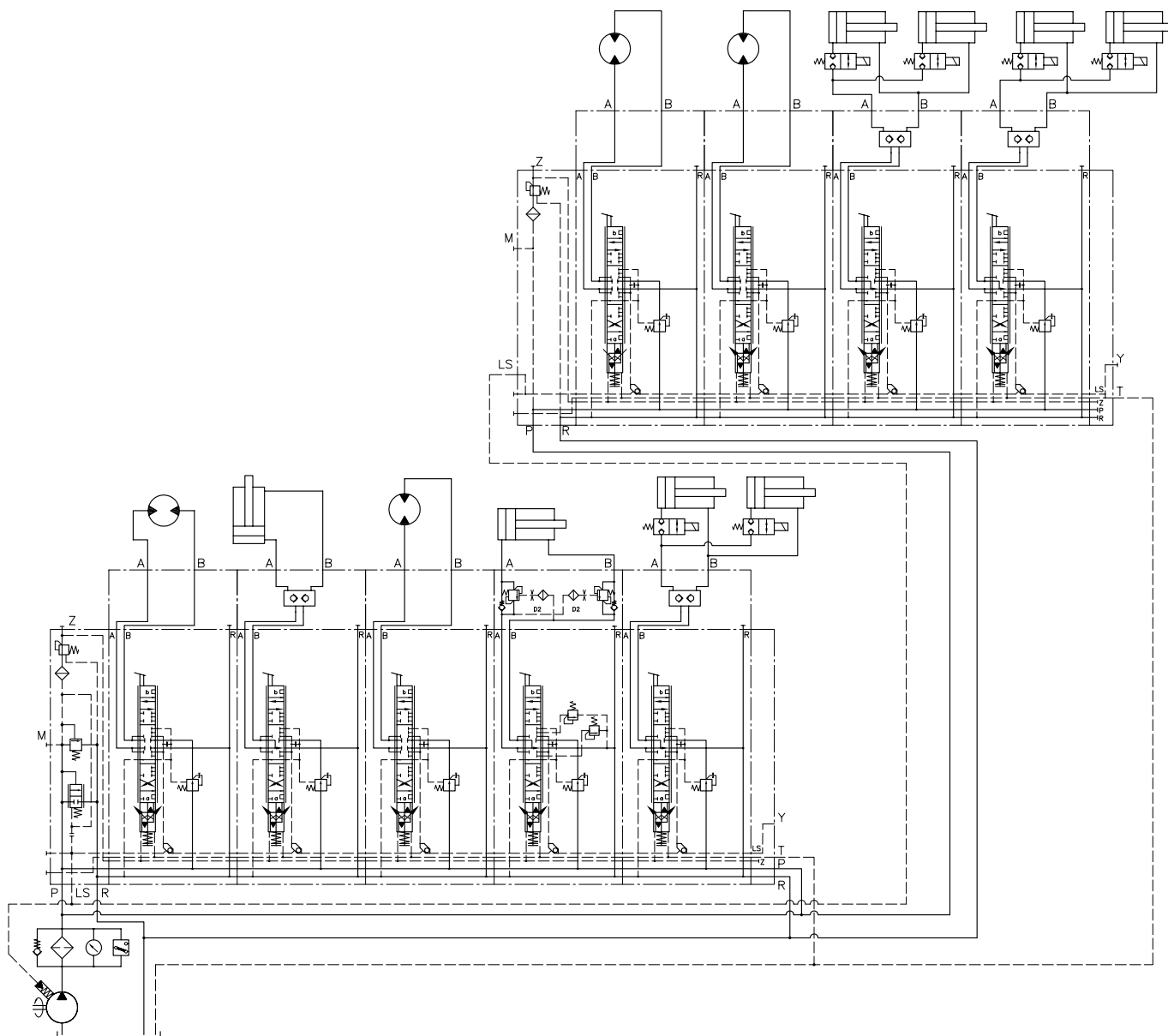
V60N-130 RSFN-1-0-0.00/LSNR-2-250

PSV 31/D280-2

- A 2 L 25/25/EA1/2
- A 2 H 40/40/EA1/2 DRH
- A 2 L 25/25/EA1/2
- A 2 H 3/3 A 100 B 100/EA1/2 AL-0-D 4/120-BL-0-D 4/120
- A 2 H 3/3/EA1/2 DRH
- E 18-G 24

PSV 31-1

- A2 L 25/25/EA1/2
- A2 L 25/25/EA1/2
- A2 H 3/3/EA1/2 DRH
- A2 H 3/3/EA1/2 DRH
- E 1 - G24



Associated technical data sheets:

- [Variable displacement axial piston pump type V60N: D 7960 N](#)

Similar products:

- Variable displacement axial piston pumps type V40M: [Page 26](#)
- Variable displacement axial piston pump type V30E: [Page 16](#)
- Variable displacement axial piston pump type V30D: [Page 20](#)
- Axial piston motor type M60N: [Page 264](#)
- Variable displacement axial piston pump type V80M: [Page 24](#)
- Fixed displacement axial piston pump type K60N: [Page 32](#)

Suitable prop. directional spool valves:

- Type PSL/PSV sizes 2, 3 and 5: [Page 106](#)
- Type PSLF/PSVF sizes 3, 5 and 7: [Page 112](#)

Suitable load-holding valves:

- Type LHK, LHDV, LHT: [Page 206](#)

Individual pumps

2.1

Variable displacement axial piston pump type K60N

Axial piston pumps have a constant delivery volume and therefore deliver a constant volumetric flow at a specific speed.

The axial piston pump type K60N is designed for open circuits in mobile hydraulics and operates based on the bent axis principle.

The pump is fitted mainly to the power take-off on commercial vehicle transmissions.

Features and benefits:

- Good performance/weight ratio
- High self-suction speed
- Different shaft and flange versions

Intended applications:

- Machines for forestry and agricultural purposes
- Cranes and lifting equipment
- Truck-mounted concrete pumps
- Municipal trucks



Nomenclature:	Variable displacement axial piston pump
Design:	Individual pump
p _{max} •	400 bar
V _{g max} •	12... 130 cm ³ /rev

Design and order coding example

K60N

- 064

R

S

F

N

- S - F12

Additional versions

Bypass valve

Seal material

▪ NBR (N), FKM (V)

Flange version

▪ DIN ISO 7653 (Y)

▪ SAE-C, SAE-B J 744 (F)

Shaft version

▪ ISO 14 parallel key splined shaft (D)

▪ SAE-C, SAE-B J 744 spline shaft (S)

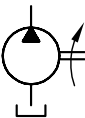
Rotation direction

Counter clockwise (L), clockwise (R)

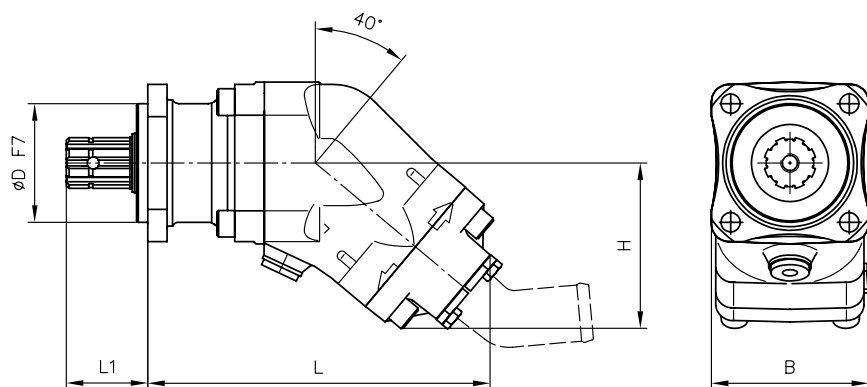
Nominal size

Basic type

Function



General parameters and dimensions



Parameters

	Geom. delivery volume	Nom. pressure	Self-suction speed	Dimensions [mm]					m [kg]
	V_g [cm ³ /rev]	$p_{nom} (p_{max})$ [bar]	n [rpm]	L	L1	H	B	ØD	
K60N - 012	12,6	400	3300	207	48	145	95	80/101.6/--	7,5
K60N - 017	17,0	400	3200						
K60N - 025	25,4	400	2550	209	53	156	118	80/101.6/--	8,5
K60N - 034	34,2	400	2250						
K60N - 040	41,2	400	2200	246	67	185	143	80/101.6/127	15,5
K60N - 047	47,1	400	2200						
K60N - 056	56,0	400	2100						
K60N - 064	63,6	400	2050						
K60N - 084	83,6	400	1700	276	72	212	160	80/--/127	27,0
K60N - 090	90,7	400	1700						
K60N - 108	108,0	400	1700	276	85	231	180	80/--/127	29,5
K60N - 130	130,0	350	1600						

Associated technical data sheets:

- Fixed displacement axial piston pump type K60N: [D 7960 K](#)

Similar products:

- Variable displacement axial piston pump type V30D: [Page 20](#)
- Variable displacement axial piston pump type V30E: [Page 16](#)
- Variable displacement axial piston pump type V40M: [Page 26](#)
- Variable displacement axial piston pump type V60N: [Page 28](#)
- Variable displacement axial piston pump type V80M: [Page 24](#)
- Axial piston motor type M60N: [Page 264](#)

Suitable prop. directional spool valves:

- Type PSL/PSV sizes 2, 3 and 5: [Page 106](#)
- Type PSLF/PSVF sizes 3, 5 and 7: [Page 112](#)

Suitable load-holding valves:

- Type LHK, LHDV, LHT: [Page 206](#)

Individual pumps

2.1

Air-driven hydraulic pump type LP

Air-driven hydraulic pumps are pneumatically driven, reciprocally acting plunger pumps. They operate as pneumatic pressure boosters with oscillating movement and automatic stroke reversal control.

The air-driven hydraulic pump type LP can generate up to 1500 bar. It is available as an individual pump or as a hydraulic power pack with different tank sizes and valve banks. The delivery flow is dependent on the air pressure set and the flow resistance currently present. It can decay to standstill.

Applications are in laboratory presses, in fixture construction, in lubrication systems or in potentially explosive atmospheres.

- Features and benefits:**
- High operating pressures
 - Suitable for explosion-proof systems and equipment
No electrical energy
 - Hydraulic power packs with direct valve mounting

- Intended applications:**
- Construction and construction materials machinery
 - Fixture construction
 - Testing and laboratory equipment



Nomenclature:	Air driven hydraulic pumps
Design:	Individual pump
$p_{hydraulic\ max}$:	160...1500 bar
$p_{air\ max}$:	10 bar
Q_{max} :	0.9...12 lpm

Design and order coding example

LP 125 - 16E /S 81

Additional elements

- Suction parts for hydraulic pumps

Design

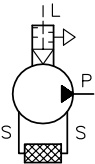
Hydraulic pump

- Ready-to-connect version
- Individual version for self-installation

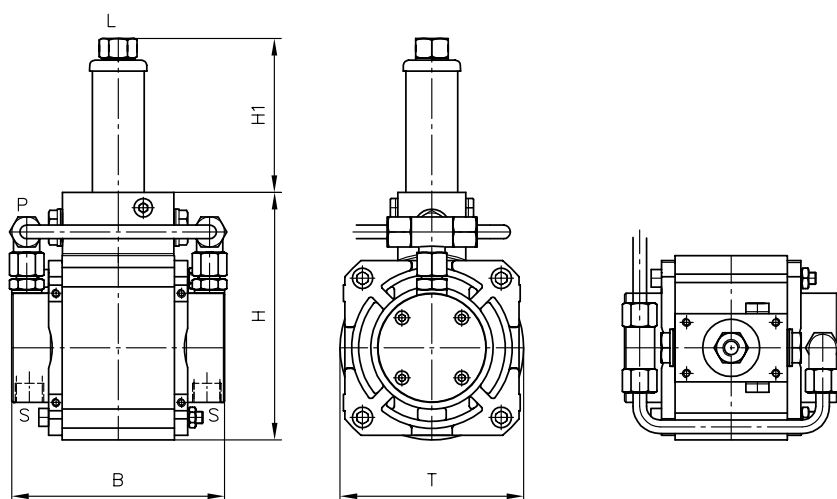
Basic type, size

Type LP, size 80, 125, 160

Function



General parameters and dimensions



Basic type and size		p_{max} [bar]	Pressure ratio	Geom. volume per double stroke V_{hydr} [cm ³]	Tapped port (air) Pipe diameter for pressure connection (hydr)	Dimensions [mm]				m [kg]
						H	H1	B	T	
LP80-	8	700	1 : 200	1.5	G 1/4 Æ6 mm	119	94	121	85	5
	...									
	16	240	1 : 24	6						
LP125-	8	1500	1 : 243	2	G 3/8 Æ8 mm, Æ10 mm	159	114	156	135	8.5
	...									
	30	160	1 : 16	28.3						
LP160-	8	1500	1 : 400	2	G 1/2 Æ8 mm, Æ10 mm	228	136	156	175	11.5
	...									
	30	265	1 : 24	28.3						

Associated technical data sheets:

- [Air-driven hydraulic pump type LP: D 7280](#)
- [Hydraulic power pack type LP: D 7280 H](#)

Valve banks :

- Type VB: [Page 132](#)
- Type BWH(N): [Page 138](#)

Individual pumps

2.1

Hand pump type H, HE and HD

Hand pumps are a type of hydraulic pump. They generate a volumetric flow manually. The hand pump type H and HE is single-acting. It draws in oil in one direction and pumps it in the opposite direction. The hand pump type HD is double-acting. It pumps and draws in the same quantity of oil in the pressure line during the forward and backward movement of the hand lever. The hand pump type H, HE and HD is available for pipe connection and manifold mounting. The hand pump is particularly suitable as an emergency pump or for test benches.

- Features and benefits:**
- Sturdy design
 - Hand pumps with integrated tank
 - Safety and drain valve

- Intended applications:**
- Shipbuilding
 - Mining machinery
 - Fixture construction
 - Testing and laboratory equipment



Nomenclature:	Piston pump
Design:	Single acting hand pump Double acting hand pump
p _{max} :	150 ... 800 bar
V _{max} :	4 ... 64 cm ³ /stroke

Design and order coding example

HD 13

AS

- K 0,5

- 110

Pressure setting (bar)

With/without tank

Usable volume V_{use}, 0,35 l and 0,5 l

Additional elements

- Drain valve (A)
- Pressure limiting valve (tool or manually adjustable) (S)

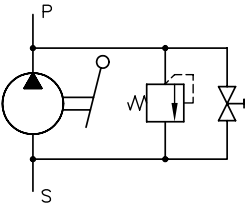
Basic type, size

Type H (single-acting, open design),
Type HE (single-acting, encapsulated design)
Type HD (double-acting, encapsulated design)

- With/without pressure resistant suction port
- Versions for manifold mounting

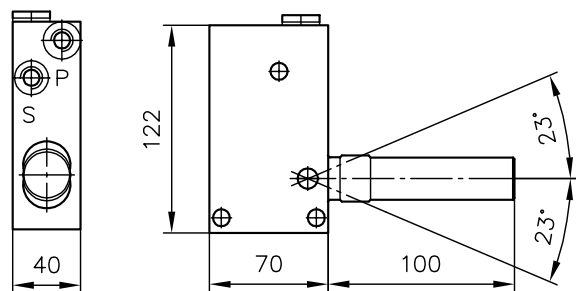
Function

Design with pressure limiting valve and drain valve

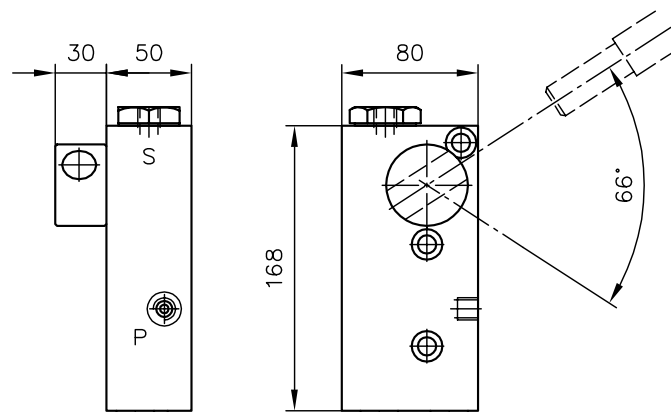


General parameters and dimensions

H..



HE.. and HD..



	p_{\max} [bar]	V_{\max} [cm ³ /stroke]	Tapped ports (BSPP)		m [kg]
			P	S	
H 16	350	6	G 1/4	G 1/4	3.1
H 20	220	9.4			
H 25	150	14.7			
HE 3	800	3	G 1/4	G 1/4 and G 3/8	4.8
HE 3	800	3			
HD 13	350	13			
HD 20	220	20			
HD 30	150	30			

Associated technical data sheets::

- Manual pump type H, HD and HE: [D 7147/1](#)

2.2 Hydraulic power packs

Compact hydraulic power pack type NPC	44
Compact hydraulic power pack type HC and HCW	46
Compact hydraulic power pack type KA and KAW	50
Compact hydraulic power pack type MP and MPN	54
Compact hydraulic power pack type HK, HKF and HKL	58
Radial piston pump type R, RG and RZ	62
Air-driven hydraulic pump type LP	66
Connection block type A, B and C	68
Valve bank (nominal size 6) type BA	70
Valve bank (directional seated valve) type BVH	76



Compact hydraulic power packs
type KA and KAW



Compact hydraulic power packs
type HK, HKF and HKL



Valve bank
type BVH



Air-driven hydraulic pump
type LP

Compact hydraulic power pack

Type	Nomenclature/Design	Tank volume (l)	p _{max} (bar)	V _{max} (cm ³ /rev.)
NPC	Radial piston pump <ul style="list-style-type: none"> With integrated electric motor Direct current supply Version <ul style="list-style-type: none"> Oil immersed compact hydraulic power pack for short period operation 	Fill volume 1.0 Usable volume 0.65	750	11: 0.46 12: 0.46
HC, HCW	Radial piston or gear pump <ul style="list-style-type: none"> With integrated electric motor 3-phase or 1-phase version Version <ul style="list-style-type: none"> Oil immersed compact hydraulic power pack for intermittent operation 	Fill volume - vertical approx. 1.16-2.5 - horizontal approx. 0.95-2.3 Usable volume - vertical approx. 0.50-1.5 - horizontal approx. 0.50-1.1	HP/LP: 700/180	1: 0.76 2: 1.59
KA, KAW	Radial piston or gear pump <ul style="list-style-type: none"> With integrated electric motor 3-phase or 1-phase version Version <ul style="list-style-type: none"> Oil immersed compact hydraulic power pack for intermittent operation 	KA 2 Fill volume approx. 3.9-11.1 Usable volume - vertical approx. 1.85-8.95 - horizontal approx. 1.5-4.8 KA 4 Fill volume approx. 13-31 Usable volume - vertical approx. 5-25 - horizontal approx. 6-16 -	HP/LP: 700/180	HP/LP: 2: 3.61/7.9 4: 9.17/30.2
MP, MPN	Radial piston pump and/or gear pump <ul style="list-style-type: none"> With integrated motor Single- or dual-circuit pump Version <ul style="list-style-type: none"> Oil immersed compact hydraulic power pack for intermittent or load/no load operation 	Fill volume approx. 17-100 Usable volume approx. 10-75	HP/LP: 700/220	HP/LP: MP - 1: 0.95/4.76 MP - 2: 1.59/26 MP - 4: 9.17/60
HK, HKF, HKL	Radial piston pump and/or gear pump <ul style="list-style-type: none"> With integrated motor 3-phase version Version <ul style="list-style-type: none"> Oil immersed compact hydraulic power pack for continuous and intermittent operation 	HK 2 Fill volume approx. 2.77 Usable volume approx. 0.85 HK 3 Fill volume approx. 4.65-6.1 Usable volume approx. 1.45-2.90 HK 4, HKF 4 Fill volume approx. 5.8-15.4 Usable volume approx. 1.9-11.1 HKL 3 Fill volume approx. 3.7-13 Usable volume approx. 1.7-9.1	HP/LP: 700/180	HP/LP: HK - 2: 1.59 HK - 3: 4.58/4.8 HK - 4: 9.17/17.0 HKF - 4: 9.17/17.0 HKL - 3: 6.11/14.5

Hydraulic power packs

Type	Nomenclature/Design	Tank volume (l)	p _{max} (bar)	V _{max} (cm ³ /rev.)
R, RG, RZ	Radial piston pump	Fill volume approx. 9-55	R: 700	R - 7631: 1.59
		Usable volume approx. 6-45	HP/LP: RZ: 700/220	R, RG - 6010: 4.58 R, RG - 6011: 10.7 R, RG - 6012: 21.39 R, RG - 6014: 42.78 R, RG - 6016: 64.18 RZ - 7631: 1.59/7.9 RZ - 6010: 4.58/26 RZ - 6011: 10.7/89.6 RZ - 6012: 21.39/89.6 RZ - 6014: 42.78/89.6 RZ - 6016: 64.18/89.6
LP	Air-driven hydraulic pump	Fill volume approx. 5.8-33 Usable volume approx. 3.8-28	80: 700 125: 700 160: 700	

Connection blocks/mounted valves

Type	Nomenclature/Design	p _{max} (bar)	Q _{max} (lpm)
A, B, C	Connection blocks <ul style="list-style-type: none"> For completion of hydraulic power packs Version <ul style="list-style-type: none"> Add-on valve enabling pipe connection or mounting of valves 	700	20
BA	Valve bank <ul style="list-style-type: none"> Directional spool valve Directional seated valve Version <ul style="list-style-type: none"> Valve bank enabling pipe connection Actuation <ul style="list-style-type: none"> solenoid, pressure-actuated or manual, mechanical 	500	50
BVH	Valve bank <ul style="list-style-type: none"> Directional seated valve Zero leakage Version <ul style="list-style-type: none"> Valve bank enabling pipe connection 	400	20

Efficiency from the modular system

Hydraulics are based on a simple principle: using fluid pressure media, power is transmitted and motion generated. This principle can be transferred to a broad range of applications. The product range in the modular system – the result of the consistent development philosophy of HAWE Hydraulik – enables the creation of tailor-made solutions and systems.

Standardised components and individual combination options ensure increased efficiency at the optimum cost-benefit ratio.

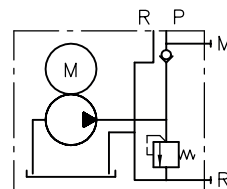
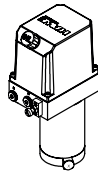
- Various components complement each other to form a complete product range
- Enables solutions tailor-made to the customer



Compact hydraulic power packs

Type NPC

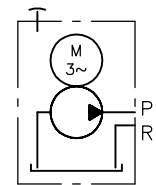
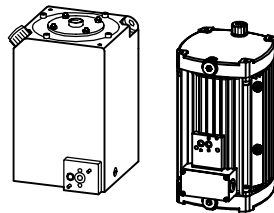
for compact controllers
with 5...10% operating time
($P_{\max} = 700 \text{ bar}$, $Q_{\max} = 2.1 \text{ lpm}$)



e.g.
NPC 11 K/0,31

Type HC, HCW, KA, KAW

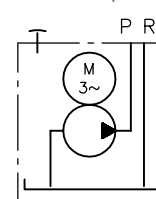
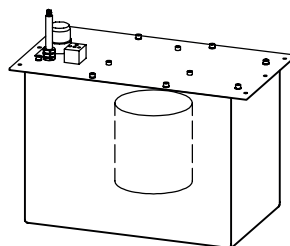
for compact controllers
with 10...30% operating time
($P_{\max} = 700 \text{ bar}$, $Q_{\max} = 20.1 \text{ lpm}$)
in 4 sizes, also as dual-circuit pump



e.g.
HC 14/2,0
KA 24 SKS/0,36

Type MP, MPN, MPW, MPNW

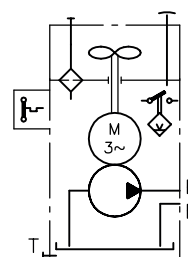
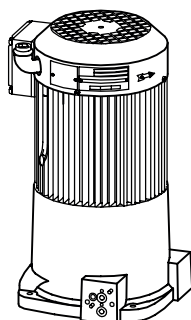
for controls in standby mode or
load/no load operation
($P_{\max} = 700 \text{ bar}$, $Q_{\max} = 15 \text{ lpm}$)
in 5 sizes, also as dual-circuit pump,
tank size can be selected



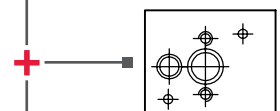
e.g.
MP 24-H 1,77/B 10
MPN 44 - H 5,6 - B 25.20

Type HK, HKF, HKL

for compact controls also in continuous operation ($P_{\max} = 700 \text{ bar}$,
 $Q_{\max} = 16 \text{ lpm}$) in 3 sizes, also as dual
and triple-circuit pump



e.g.
HK 449 ST/1-H 5,0



Shared connection
diagram

Order examples

NPC 11 K/0,31 - 1/320 - R - 24
 KA 44 LFK/H 2,5
 MPN 44 - HZ 0,9/12,3 - B 25.20
 HK 449 ST/1 - H 5,0 -
 C 16 -

Compact hydraulic power packs

B31/450 - EM11 V - 13 - G 24
 NE 21 - 320/25 -
 AS 1 F 2/300 -
 AP 34 - 43/24 -

Connection blocks

BWH 1 - NW - 33 - G 24

VB 21 GM - RH - 3 - G 24
 BVZP 1 F 23 - G 52/22 - H 14 N 15/0 - 1 - 1 - G 24
 BWN 1 F - HJ 5 - 1 - 1 - G 24

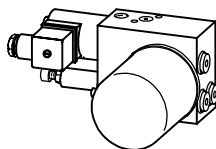
Directly mounted valve banks

The practical modular system enables completely individual combinations.

Connection blocks

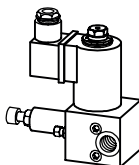
Type A

e.g. AS1F2/300-G24



Type B

e.g. B31/450-EM11V-13-G24



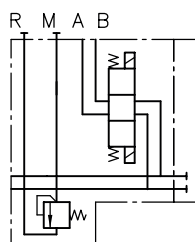
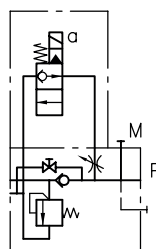
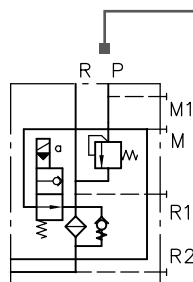
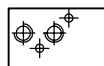
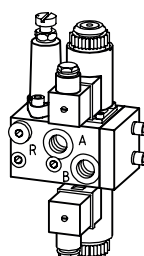
Type C

e.g. C5



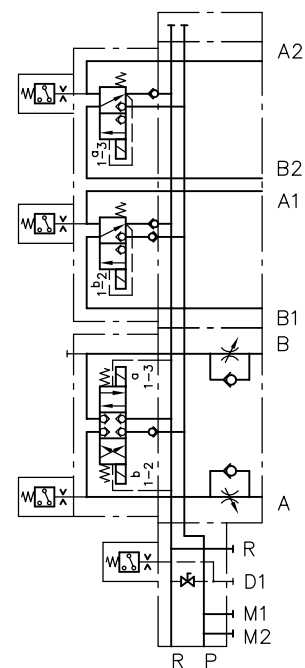
Type SKC, SWC

e.g. SWC1/150-L-1-G24



Directly mounted valve bank

Connection diagram for pipe connection or
 fitting of a directional control valve bank
 e.g. BVZP1F23-G52/22-N14H15/0-1-1G24



Compact hydraulic power packs

2.2 Compact hydraulic power pack type NPC

Compact hydraulic power packs are a type of hydraulic power pack. They are characterised by a highly compact design, since the motor shaft of the electric motor also acts as the pump shaft.

The ready-for-connection compact hydraulic power pack type NPC is suitable for hydraulic systems with operating mode S2. Type NPC includes a DC motor. The power pack is available in a horizontal or vertical version. Either single-circuit systems or dual-circuit systems can be selected. A radial piston pump or an external gear pump can be used as a hydraulic pump.

The compact hydraulic power pack type NPC is suitable for use as a highly compact control system, since the pressure-limiting valve is integrated and valve banks can be directly mounted.

Features and benefits:

- Very low space requirements and easy to transport
- Supplied with direct current at 12V DC or 24V DC
- Particularly suited to mobile applications and construction site operation
- Long service life and excellent reliability achieved by using radial piston pumps
- Environmentally sound thanks to low oil fill volumes and minimum amount of oil to be disposed of
- Low costs for hydraulic fluid
- Co-ordinated range of valves and accessories from the modular system

Intended applications:

- Riveting
- Brakes for wind power plants
- Hydraulic jigs
- Crimping
- Embossing



Nomenclature:	Radial piston pump with integrated electric motor (version for 3-phase mains)
Design:	Oil immersed compact hydraulic power pack for short period operation
p _{max} :	750 bar
Q _{max} :	approx. 1.36 lpm (V _g = 0.09 - 0.76 cm ³ /rev)

Design and order coding example

NPC 11 / 0,87 - 1/170 - R - G12 BWN 1 - NN - 35 - 1 - G12

NPC 11

/ 0,87

- 1/170

- R

- G12

BWN 1 - NN - 35 - 1 - G12

Valve assembly

▪ BWN1, BWH1, VB01

▪ can be mounted directly, without connection blocks according to [D 7470 B/1](#), [D 7302](#)

Motor voltage

12V DC or 24V DC

Check valve

With/without check valve

Pressure limiting valve and setting

▪ 1 = Tool adjustable

▪ 2 = Manually adjustable

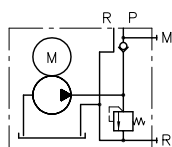
Delivery flow [lpm]

Basic type, size

Type NPC, size 11 and 12

Function

Symbol:



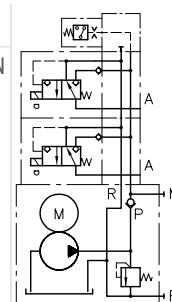
Example circuitry:

NPC 11 / 0,87 - 1/170 - R - G 12

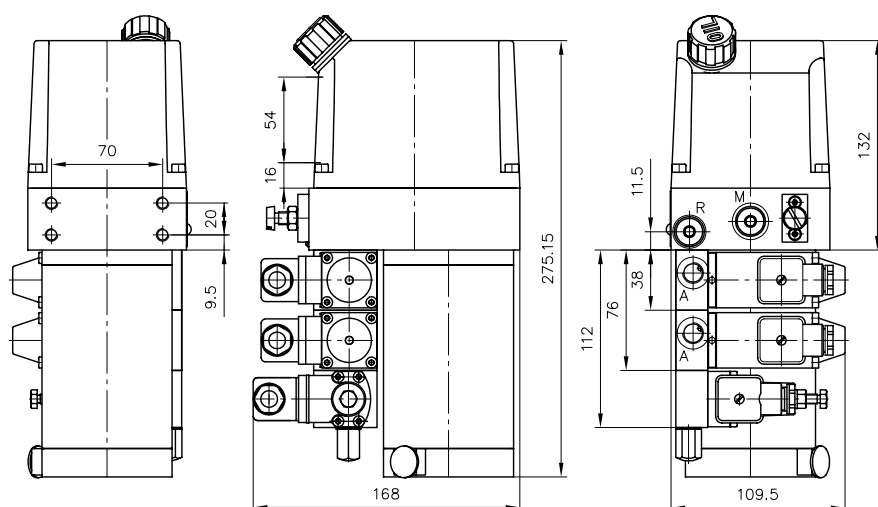
Compact hydraulic power pack type NPC, pump delivery flow approx. 0.87 lpm

BWN 1 - NN - 35 - 1 - G 12

Directly mounted valve bank type BWN with two valve sections and pressure switch for gallery P, solenoid voltage 12V DC



General parameters and dimensions



	Delivery flow						Max. pressure		
	Q _{pu} [lpm]						p _{max} [bar]	P _N [kW]	
NPC 11 (24 V)	0.2	0.31	0.44	0.61	0.87	1.05	750	0.1/0.3	6
NPC 11 (12 V)								0.1/0.25	6
NPC 12 (24 V)	0.4	0.65	0.94	1.28	1.71	2.14	750	0.6	8
NPC 12 (12 V)								0.6	8

Associated technical data sheets:

- Compact hydraulic power pack type NPC: [D 7940](#)

Directly mountable valve banks:

- Type VB: [Page 132](#)
- Type BWH, BWN: [Page 138](#)
- Pressure switches type DG: [Page 272](#)
- Electronic pressure transducer type DT: [D 5440 T/1](#), [D 5440 T/2](#)

Compact hydraulic power packs

2.2 Compact hydraulic power pack type HC and HCW

Compact hydraulic power packs are a type of hydraulic power pack. They are characterised by a highly compact design, since the motor shaft of the electric motor also acts as the pump shaft.

The ready-for-connection compact hydraulic power pack type HC and HCW includes an electric motor which runs in oil. The stator is securely attached to the housing (tank). The compact hydraulic power pack is suitable for hydraulic systems with operating mode S2 or S3. The heat is dissipated via surface convection so that no external cooler is usually necessary.

Either single-circuit systems or dual-circuit systems can be selected. A radial piston pump or external gear pump can be used as a hydraulic pump.

The compact hydraulic power pack type type HC and HCW is suitable as a highly compact control system, since connection blocks and valve banks can be directly mounted.

Features and benefits:

- Long service life and excellent reliability achieved by using radial piston pumps
- Low oil fill volumes make it environmentally sound thanks to small amount of oil to be disposed of and low costs for hydraulic fluid
- Co-ordinated range of valves and accessories from modular system
- Suitable for vertical and horizontal installation

Intended applications:

- Clamping systems on machine tools and jigs
- Rivets and clinching equipment
- Welding robots
- Lubrication systems

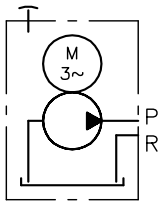


Nomenclature:	Radial piston pump with integrated electric motor (3-phase or 1-phase version)
Design:	Oil immersed hydraulic power pack for intermittent service (S3-service)
p _{max} :	Radial piston pump 700 bar Gear pump 180 bar
Q _{max} :	Radial piston pump approx. 4.4 lpm (V _g = 1.6 cm ³ /rev) Gear pump approx. 3.4 lpm (V _g = 1.3 cm ³ /rev)
V _{usable max} :	8 l

Design and order coding example

HC24	/0,6	- A1/400	- BWH1F-HH-1-1-G24	- 400V 50 Hz
				Motor voltage 3 ~ 400V 50 Hz, 3 ~ 460V 60 Hz 1 ~ 230V 50 Hz, 1 ~ 110V 60 Hz (3~phase motor)
Optional directly mounted directional valve bank				
Connection block				
Pump version	Single circuit pump <ul style="list-style-type: none">▪ Radial piston pump H (3-, 5- or 6-cylinders) or gear pump Z Dual circuit pump <ul style="list-style-type: none">▪ Combinations:<ul style="list-style-type: none">▪ Radial piston pump - gear pump▪ Radial piston pump - radial piston pump			
Basic type, size	Type HC (3-phase motor) and type HCW (1-phase motor, power reduction of 30 ... 50% depending on size), size 1 to 2, type HCG (direct current motor), size 1 <ul style="list-style-type: none">▪ Horizontal version with low profile (type HC..L) or vertical version▪ Usable volume V_{usable} 0.5 l to 1.1 l▪ With/without fluid level gauge▪ With DC-motor (Type HCG) for short time operation			

Function



Example circuit:

HC 24/0.64 -

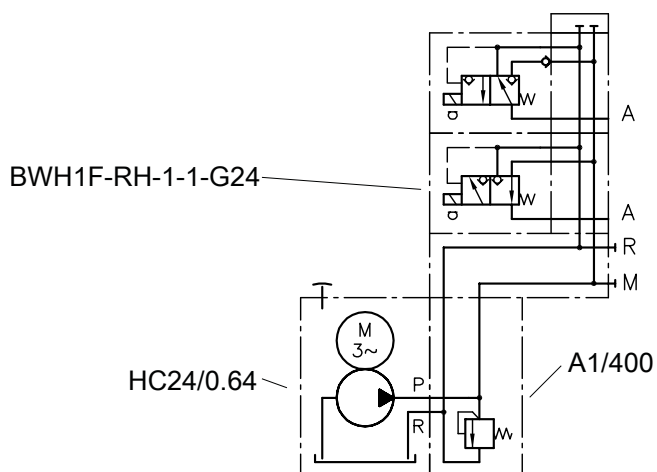
Hydraulic power pack type HC, size 24, pump delivery flow approx. 0.64 lpm

- A1/400

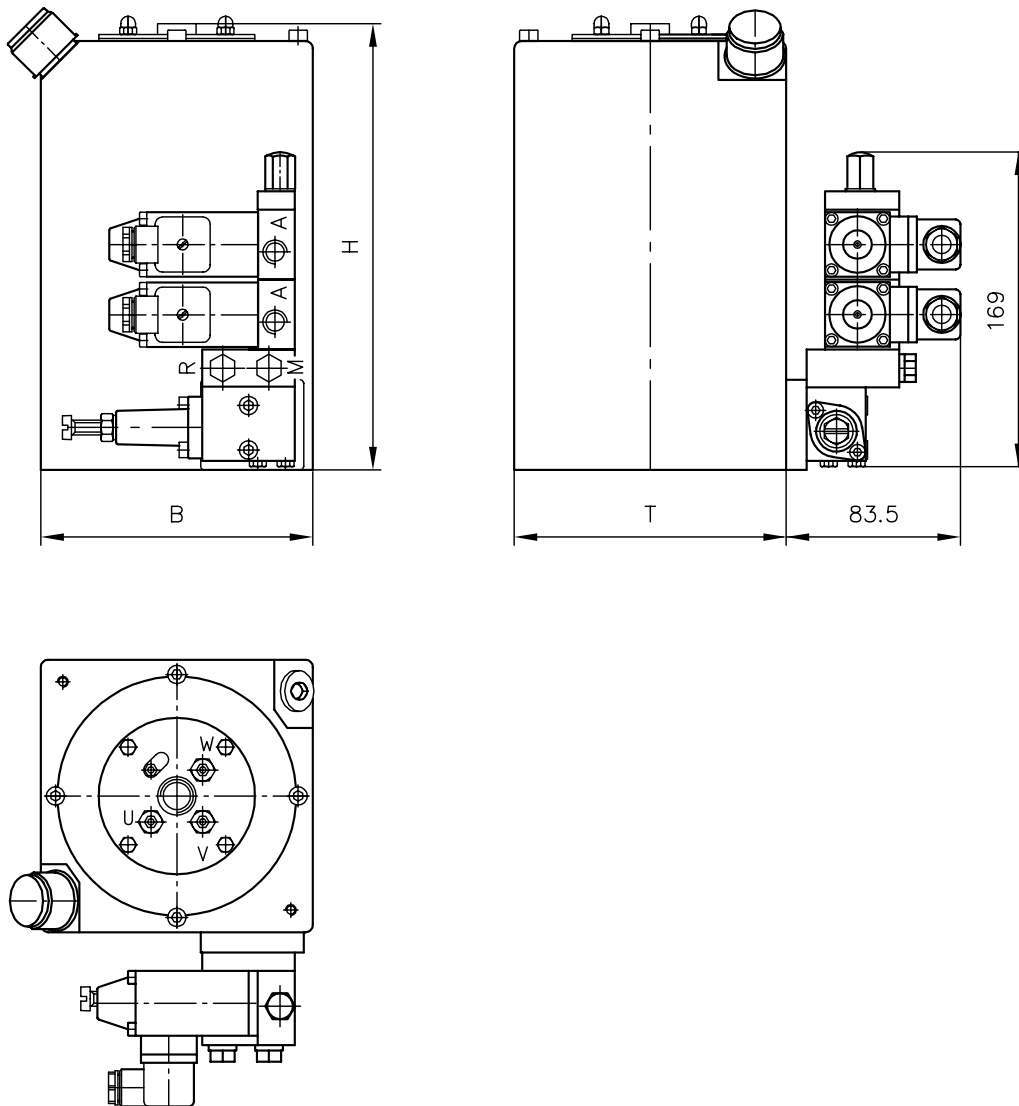
Connection block type A and pressure-limiting valve (400 bar)

- BWH1F - RH1 - 1 - 1 - G 24

Directly mounted valve bank type BWH1



General parameters and dimensions



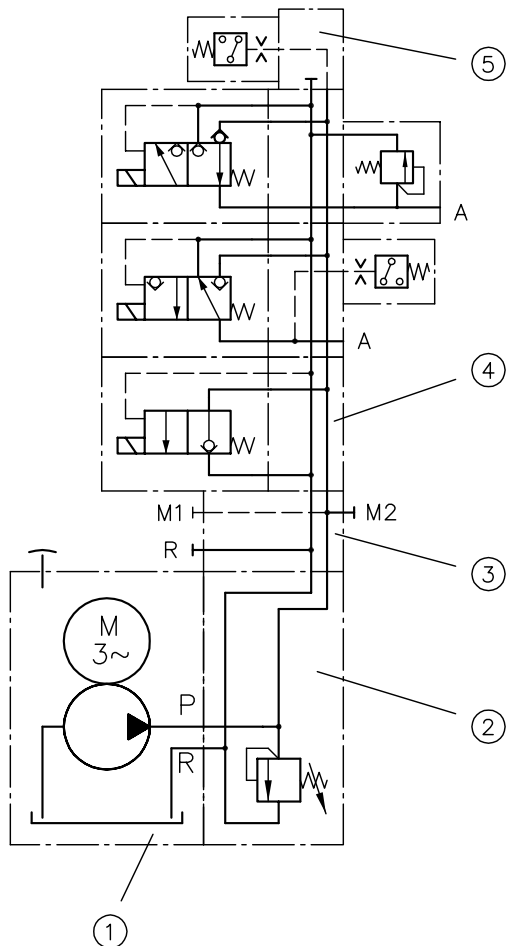
	Radial piston pump (3 cyl.)			Gear pump					Dimensions [mm]		
	Max. pressure	Delivery flow		Max. pressure	Delivery flow						
	p _{max} [bar]	Q _{pu} [lpm] 50 Hz	Q _{pu} [lpm] 60 Hz	p _{max} [bar]	Q _{pu} [lpm] 50 Hz	Q _{pu} [lpm] 60 Hz			P _N [kW] ¹⁾	m [kg] ²⁾	H
HC 14	700 - 160	0.2 - 1.05	0.2 - 1.2	-	-	-	0.18	6.3	197	120	120
HC 12	600 - 120	0.4 - 2.15	0.5 - 2.5	-	-	-	0.25				
HC 24	700 - 185	0.27 - 2.27	0.3 - 2.7	150	0.4 - 1.6	0.5 - 1.9	0.55	10.1	243	148	148
HC 22	700 - 140	0.52 - 4.41	0.6 - 5.3	150	0.9 - 3.4	1.1 - 4	0.55				

1) The actual power input depends on the respective operation pressure and can be up to $1.5 \times P_N$

2) Without oil filling

Example circuit:

HC 24/0.64 - A2/400
 - BWH 1 F 1-DH3 R/230-33-G24
 - 3x400V 50Hz



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

Associated technical data sheets:

- [Compact hydraulic power pack type HC and HCW: D 7900](#)
- [Compact hydraulic power pack type HCG: D 7900 G](#)

Connection blocks:

- Types A, B and C: [Page 68](#)

Directly mountable valve banks:

- Type VB: [Page 132](#)
- Type BWH, BWN: [Page 138](#)

Directly mountable valve banks:

- Type SWR, SWS: [Page 92](#)
- Type BA: [Page 70](#)
- Type BVH: [Page 76](#)

Compact hydraulic power packs

2.2

Compact hydraulic power pack type KA and KAW

Compact hydraulic power packs are a type of hydraulic power pack. They are characterised by a highly compact design, since the motor shaft of the electric motor also acts as the pump shaft.

The ready-for-connection compact hydraulic power pack type KA and KAW includes an electric motor which runs in oil. The stator is securely attached to the housing (tank). The compact hydraulic power pack is suitable for hydraulic systems with operating mode S2, S3 or S6. The heat is dissipated via surface convection so that no external cooler is usually necessary.

For systems with high loads, an external fan that enables additional heat dissipation can be optionally mounted on the housing. The fan is powered by a separate motor independently of the pump motor. Type KA includes a 3-phase motor, while type KAW includes a 1-phase motor. The compact hydraulic power pack type KA and KAW is available in horizontal and vertical versions. Modules can be added to the tank so that different usable oil volumes are possible. Either single-circuit systems or dual-circuit systems can be selected. A radial piston pump or external gear pump can be used as a hydraulic pump.

The compact hydraulic power pack type KA and KAW is suitable as a highly compact control system, since connection blocks and valve banks can be directly mounted.

Features and benefits:

- Additional separately driven fan for maximum utilisation of power
- Fill/usable volumes can be flexibly extended by modular tank extensions
- Long service life and excellent reliability achieved by using radial piston pumps
- Low oil fill volumes make it environmentally sound thanks to small amount of oil to be disposed of and low costs for hydraulic fluid
- Co-ordinated range of valves and accessories from modular system
- Suitable for vertical and horizontal installation
- Optimum efficiency thanks to suboil motor cooling, direct transmission of force and cleverly designed heat dissipation

Intended applications:

- Brake and rotor adjustment modules on wind turbines
- Clamping systems on machine tools and appliances
- Torque wrenches
- Rivets and clinching equipment
- Presses
- Handling systems

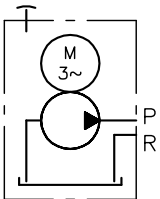


Nomenclature:	Radial piston or gear pump with integrated motor single or dual circuit pump
Design:	Oil immersed hydraulic power pack for intermittent or load/no load operation (S3-service)
p _{max} :	Radial piston pump 700 bar Gear pump 180 bar
Q _{max} :	Radial piston pump approx. 7 lpm (V _g = 2.29 cm ³ /rev) Gear pump approx. 24.1 lpm (V _g = 7.9 cm ³ /rev)
V _{tank max} :	2 ... 10 l

Design and order coding example

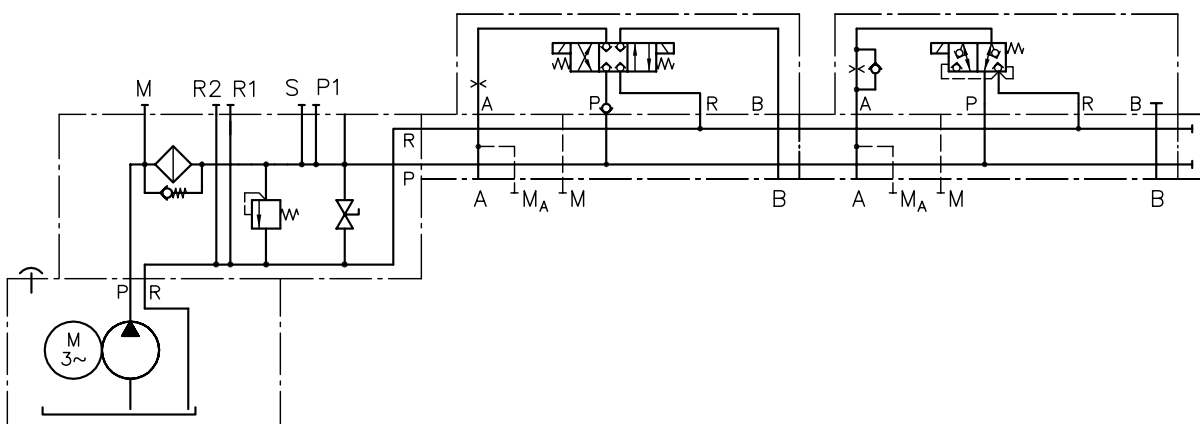
KA28	22	L1	KFTP	/HZ0,59/8,8	- ...	- 3x400V	- G1/2x300
							Oil drain hose
					Motor voltage	3 ~ 400V 50 Hz, 3 ~ 460V 60 Hz, 3 ~ 690V 50 Hz, 1 ~ 230V 50 Hz, 1 ~ 110V 60 Hz (1~phase motor)	
					Valve design		
			Pump version	Single circuit pump <ul style="list-style-type: none">▪ Radial piston pump H or gear pump Z Dual circuit pump <ul style="list-style-type: none">▪ with joint connection pedestal for pressure connections P1 and P3▪ Combinations: Radial piston pump - radial piston pump (HH) and radial piston pump - gear pump (HZ)			
			Additional function	<ul style="list-style-type: none">▪ Oil sight glass▪ Filling gauge with float switch▪ Temperature switch▪ Silica gel filter (instead of breather filter)▪ Additional fans▪ Various electrical connection variants (type KA...S)			
			Installation position	Horizontal version with low installation heights (type KA..L) or vertical version (type KA..S)			
			Tank size [l]				
Basic type, size	Type KA (3~phase motor) and KAW (1~phase motor, power reduction 30 ... 50% dep. on size), size 2 and 4						

Function

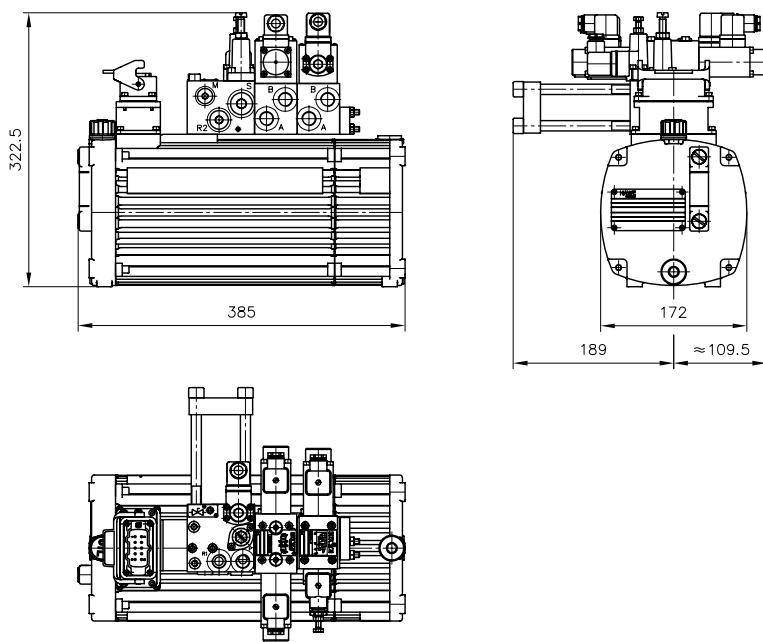


KA 231 LKP/H 0.59 - A1 D 10-B 400-3/380 - BA 2

- NBVP 16 G/R/AB 2.0 - M/O
 - NBVP 16 Y/ABR 1.5/4 - M/O
 - 1 - G 24



General parameters and dimensions



	3-cylinder radial piston pump			6-cylinder radial piston pump			Gear pump			
	p_{\max} [bar]	Q_{\max} [lpm] 50 Hz	Q_{\max} [lpm] 60 Hz	p_{\max} [bar]	Q_{\max} [lpm] 50 Hz	Q_{\max} [lpm] 60 Hz	p_{\max} [bar]	Q_{\max} [lpm] 50 Hz	Q_{\max} [lpm] 60 Hz	P_N [kW]
KA 21	700 - 45	0,63 - 10,02	0,76 - 12,05	360 - 55	1,26 - 7,84	1,52 - 9,42	170 - 60	2,23 - 6,7	2,68 - 8,04	0,55
KA 22	700 - 140	0,63 - 0,02	0,76 - 12,05	700 - 180	1,26 - 7,84	1,52 - 9,42	170 - 55	2,23 - 22,04	2,68 - 26,47	1,1
KA 23	700 - 60	0,31 - 4,89	0,37 - 5,93	485 - 30	0,62 - 9,79	0,75 - 11,85	170 - 50	1,09 - 4,90	1,32 - 5,94	0,37
KA 24	700 - 160	0,31 - 4,89	0,37 - 5,93	700 - 80	0,62 - 9,79	0,75 - 11,85	170 - 65	1,09 - 10,74	1,32 - 13,04	0,75
KA 26	700 - 160	0,63 - 10,02	0,76 - 12,05	700 - 205	1,26 - 7,84	1,52 - 9,42	170 - 65	2,23 - 22,04	2,68 - 26,47	1,4
KA 28	700 - 185	0,31 - 4,89	0,37 - 5,93	700 - 90	0,62 - 9,79	0,75 - 11,85	170 - 75	1,09 - 10,74	1,32 - 13,04	1,0

	3-cylinder radial piston pump			6-cylinder radial piston pump			Gear pump			
	p_{\max} [bar]	Q_{\max} [lpm] 50 Hz	Q_{\max} [lpm] 60 Hz	p_{\max} [bar]	Q_{\max} [lpm] 50 Hz	Q_{\max} [lpm] 60 Hz	p_{\max} [bar]	Q_{\max} [lpm] 50 Hz	Q_{\max} [lpm] 60 Hz	P_N [kW]
KA 42	700 - 220	0,84 - 11,8	2,0 - 14,4	700 - 110	3,3 - 23,8	4,0 - 28,9	200 - 130	1,6 - 18,0	2,0 - 22,0	- 2,6 - 3,9
KA 44	700 - 220	1,6 - 5,98	1,01 - 7,25	700 - 110	1,68 - 11,97	2,04 - 14,53	200 - 130	0,84 - 9,1	1,01 - 11,1	- 1,5 - 2,2 - 3,0

Example circuit:

KA 281 S16K/H3.61-FSHS-24VDC

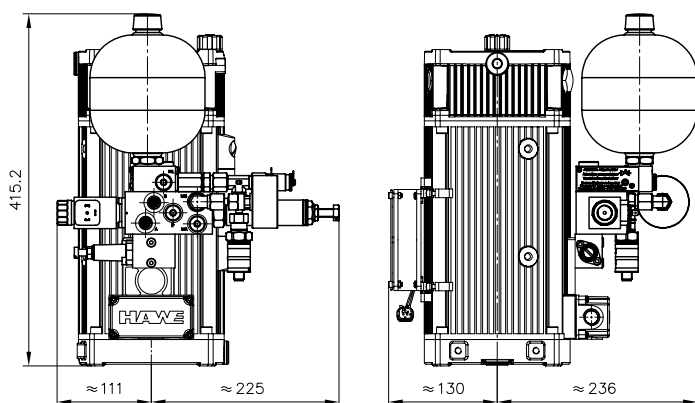
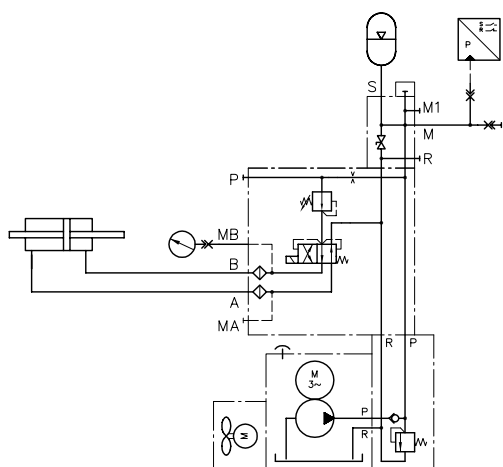
-A 14/230

-BVH 11 W/CZ52/117GM/B3,5H

-82 - AC1002/130/3A

-XM 24

3x400V 50Hz


Associated technical data sheets:

- Compact hydraulic power packs type KA: [D 8010](#), [D 8010-4](#)

Similar products:

- Type HC, HCG: [Page 46](#)

Suitable connection blocks:

- Types A, B and C: [Page 68](#)

Directly mountable valve banks:

- Type VB: [Page 132](#)
- Type BWH, BWN: [Page 138](#)
- Type SWR, SWS: [Page 92](#)
- Type BA: [Page 70](#)
- Type BVH: [Page 76](#)

Compact hydraulic power packs

2.2

Compact hydraulic power pack type MP and MPN

Compact hydraulic power packs are a type of hydraulic power pack. They are characterised by a highly compact design, since the motor shaft of the electric motor also acts as the pump shaft.

The ready-for-connection compact hydraulic power pack type MP, MPW, MPN and MPNW includes an electric motor which runs in oil. The stator is securely attached to the housing (tank). The compact hydraulic power pack is suitable for hydraulic systems with operating mode S2, S3 or S6. The heat is dissipated via surface convection so that no external cooler is usually necessary. Type MP and MPN includes a 3-phase motor, while type MPW and MPNW includes a 1-phase motor. Different tank sizes enable different usable oil quantities. Either single-circuit systems or dual-circuit systems can be selected. A radial piston pump, external gear pump or internal gear pump can be used as a hydraulic pump.

The compact hydraulic power pack type MP, MPW, MPN and MPNW is suitable as a highly compact control system, since connection blocks and valve banks can be directly mounted.

Features and benefits:

- Intermittent or load/no load operation S3 or S6
- Long service life and excellent reliability achieved by using radial piston pumps
- Low oil fill volumes make it environmentally sound thanks to small amount of oil to be disposed of and low costs for hydraulic fluid
- Two-stage valves and switch units for press controls can be directly mounted
- Co-ordinated range of valves and accessories from modular system
- Dual-circuit pumps available

Intended applications:

- Brake and rotor adjustment modules on wind turbines
- Counterbalance as well as machine tools
- Presses and other shaping machines
- Handling and clamping systems on machine tools and jigs
- Lubrication systems



Nomenclature:	Radial piston and/or gear pump with integrated motor single or dual circuit pump
Design:	Oil immersed hydraulic power pack for intermittent or load/no load operation (S2-/S3-/S6-service)
p _{max} :	Radial piston pump 700 bar (high pressure) Gear pump 220 bar (low pressure)
Q _{max} :	13.1 lpm (high pressure) (V _g = 10.7 cm ³ /rev) 83 lpm (low pressure) (V _g = 61 cm ³ /rev)
V _{t max} :	approx. 100 lpm

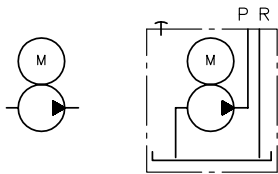
Design and order coding example

MPN 44	- H 1,5	- B10.20	D	- ...	- 3 ~ 230V 50 Hz
					Motor voltage 3 ~ 230/400V Δy 50 Hz, 3 ~ 500V y 50 Hz, 1 ~ 230V 50 Hz, 1 ~ 110V 60 Hz (1-phase motor)
					Valve mounting
					Additional options <ul style="list-style-type: none"> ▪ Filling gauge ▪ Float switch ▪ Temperature switch ▪ Various means of electrical connection
					Design <ul style="list-style-type: none"> ▪ For installation in self-made oil tanks: as individual pump or cover plate version ▪ With tank, usable volume V_{usable} 10 l to 75 l
					Pump version
					Single-circuit pump <ul style="list-style-type: none"> ▪ Radial piston pump H or gear pump Z ▪ Internal gear pump IZ
					Dual-circuit pump <ul style="list-style-type: none"> ▪ Combinations: <ul style="list-style-type: none"> ▪ Radial piston pump - radial piston pump (HH, only MPN) ▪ Radial piston pump - gear pump (HZ)
					Basic type, size Type MP (3-phase motor) and MPW (1-phase motor), sizes 1 and 2 Type MPN (3-phase motor) and MPNW (1-phase motor), size 4 1-phase motor, power reduction by 30 ... 50% depending on size

Function

Single stage pump

(radial piston pump, gear pump)

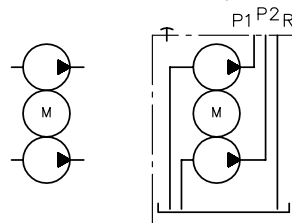


Installation
pump

Hydraulic power pack
(incl. tank)

Dual stage pump

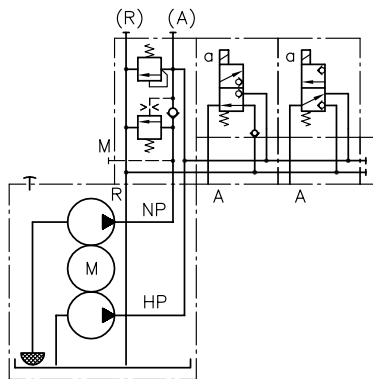
(radial piston/gear pump,
gear pump/gear pump)



Installation
pump

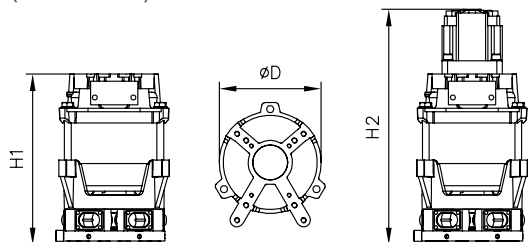
Hydraulic power pack
(incl. tank)

Example circuit:

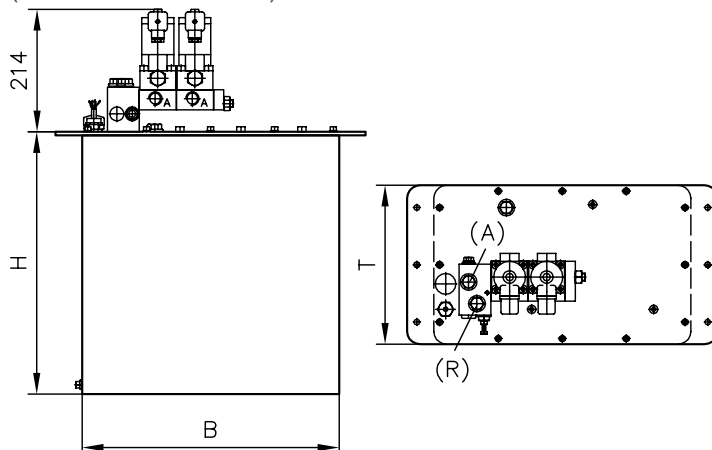


General parameters and dimensions

Single-circuit pump, dual-circuit pump (without tank)



Compact hydraulic power pack (tank with mounted valves)



	Radial piston pump (3 cyl.)			Gear pump					Dimensions [mm]		
	Max. pressure	Delivery flow		Max. pressure	Delivery flow						
	p _{max} [bar]	Q _{pu} [lpm] 50 Hz	Q _{pu} [lpm] 60 Hz	p _{max} [bar]	Q _{pu} [lpm] 50 Hz	Q _{pu} [lpm] 60 Hz			P _N [kW] ¹⁾	m [kg] ²⁾	H1 ²⁾
MP 14	700 - 220	0,27 - 1,07	0,32 - 1,28	150 - 15	0,5 - 6,9	0,6 - 8,29	0,25	5,2/5,0	183/228	249	124
MP 12	700 - 250	0,53 - 2,1	0,64 - 2,52	150 - 60	2 - 6,9	2,4 - 8,28	0,37				
MP 24	700 - 310	0,46 - 1,73	0,55 - 2,08	150 - 35	2 - 12,3	2,4 - 14,76	0,75	9,1/7,7	195/291	322,5	140
MP 22	700 - 260	0,88 - 3,51	1,06 - 4,21	150 - 18	4 - 41,4	4,8 - 49,68	0,55				
MPN 42	700 - 250	2,39 - 7,33	2,87 - 8,8	200 - 60	8,46 - 30,02	10,2 - 36,02	2,1	12,9	251/258	431	165
MPN 44	700 - 250	1,53 - 5,37	1,84 - 6,44	200 - 55	5,37 - 25,99	6,4 - 31,19	2,1				
MPN 46	700 - 250	3,16 - 11,12	3,8 - 13,34	200 - 40	12,41 - 71,73	14,89 - 86,08	3,0	18,5	274/281	454	
MPN 48	700 - 330	2,36 - 4,06	2,83 - 4,87	220 - 60	4,16 - 34,91	4,99 - 41,89	3,0				
MPN 404	700 - 340	3,1 - 3,49	3,7 - 4,19	220 - 45	2,7 - 68,16	2,25 - 81,79	4,2	26,4	298/313	486	

1) The actual power input is dependent on the respective operation pressure and can be up to $1.5 \times P_N$

2) Values apply to radial piston pump/gear pump versions

Version with tank:

Size	Tank size	H [mm]	W [mm]	D [mm]
MP 1.	B 3	225	216	136
MP 1., MP 2.	B 5	265	258	160
MP 2., MPN 4.	B 10	358	324	200
MPN 4.	B 25	458	402	250
	B 55	470	560	350
	B 110	495	560	350
	B 25 L	283	623	250
	B 55 L	305	560	350

Example circuit:

MPN 44-Z 8.8-B 10 KT

-AS 1 F 3/160

-BA 2

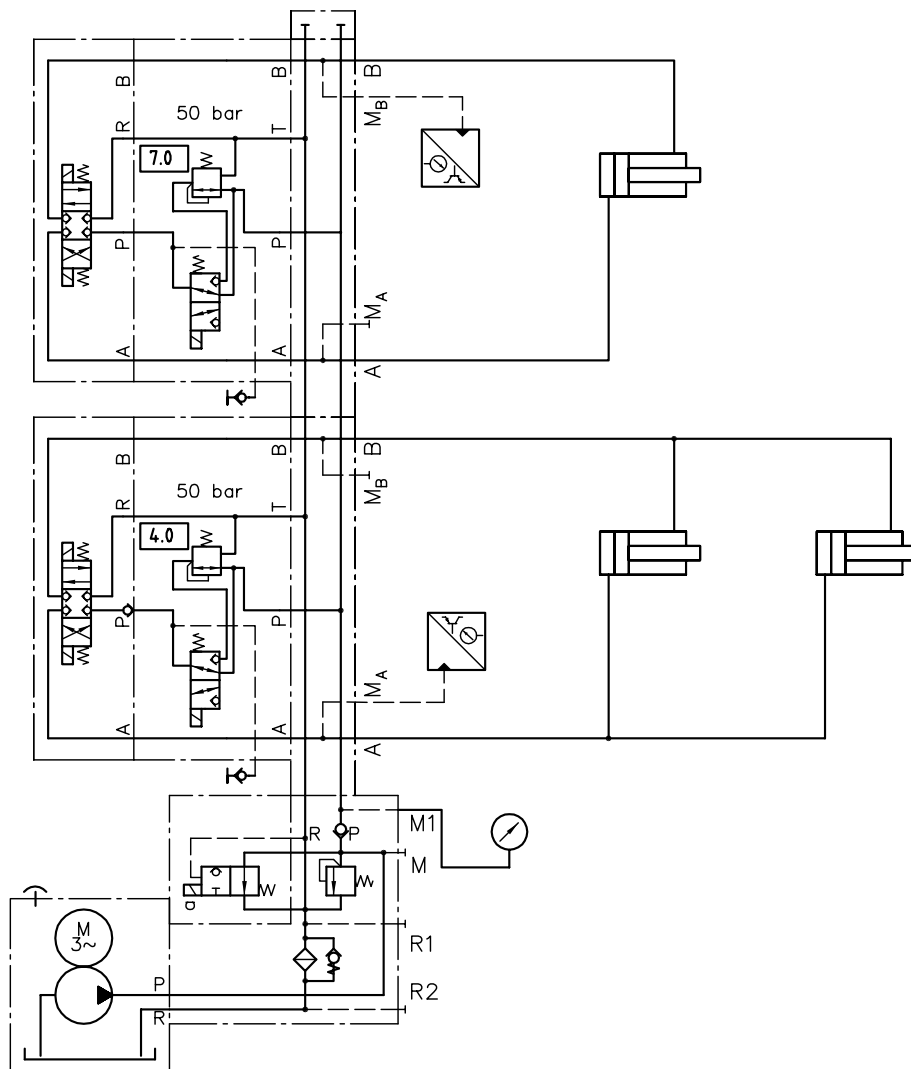
-NBVP 16 G/R-GM/NZP 16 LZ 5/50-G 8 MA/GM/3-X 84 V-DG 5E-250-1/4

-NBVP 16 G-GM/NZP 16 LZ 5/50-G 8 MA/GM/3-X 84 V-DG 62

-1-G 24

-X 84 V-9/250

-3 x 400/230 V 50 Hz


Associated technical data sheets:

- Compact hydraulic power packs type MP, MPW: [D 7200](#), [D 7200 H](#)
- [Compact hydraulic power pack type MPN and MPNW: D 7207](#)

Connection blocks:

- Types A, B and C: [Page 68](#)

Directly mountable valve banks:

- Type VB: [Page 132](#)
- Type BWH, BWN: [Page 138](#)

- Type SWR, SWS: [Page 92](#)
- Type BA: [Page 70](#)
- Type BVH: [Page 76](#)

Compact hydraulic power packs

2.2

Compact hydraulic power pack type HK, HKF and HKL

Compact hydraulic power packs are a type of hydraulic power pack. They are characterised by a highly compact design, since the motor shaft of the electric motor also acts as the pump shaft.

The ready-for-connection compact hydraulic power pack type HK, HKF, HKL and HKLW includes an electric motor which runs in oil. The stator is securely attached to the housing (tank). The compact hydraulic power pack is suitable for hydraulic systems with operating mode S2, S3 or S6. A fan, which effectively dissipates the heat from the hydraulic system, is mounted on the housing. In the case of type HKF, the fan is powered by a separate motor independently of the pump motor. For type HK, HKL and HKLW, the fan is securely attached to the motor shaft. An external cooler is not generally required. Type HK, HKF and HKL includes a 3-phase motor, while type HKLW includes a 1-phase motor. The compact hydraulic power pack type HK and HKF has a vertical housing, while type HKL and HKLW has a horizontal housing. Single-circuit, dual-circuit or triple-circuit systems can be selected. A radial piston pump, an external gear pump or an internal gear pump can be used as a hydraulic pump.

The compact hydraulic power pack type HK, HKF, HKL and HKLW is suitable as a highly compact control system, since connection blocks and valve banks can be directly mounted.

Features and benefits:

- Suited for permanent and intermittent operation (S1/S6 service)
- Additional separately driven fan for maximum utilisation of power
- 3 sizes enable wide field of application
- Radial piston pumps ensure long service life and high reliability
- Small filling volume minimize costs for fluid and fluid disposal
- Matching valve and accessories from a modular system
- Available as single to triple circuit pump

Intended applications:

- Clamping systems on machine tools and turning centres
- Welding machines, roboter
- Endurance test benches
- Endurance test bench construction
- Torque wrench



Nomenclature:	Radial piston pump and/or gear pump with integrated motor (version for 3-phase mains)
Design:	Oil immersed compact hydraulic power pack for permanent and intermittent operation (S1/S6 service)
pmax:	700 bar (radial piston pump) 180 bar (gear pump)
Qmax:	Radial piston pump (high pressure) approx. 13 lpm (Vg = 9.15 cm³/rev) Gear pump (low pressure) 24 lpm (Vg = 17.0 cm³/rev)
Vusable max:	approx. 11.1 l

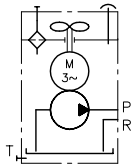
Design and order coding example

HK 34	8	LST	- H 3,6	3 x 400V 50Hz
Motor voltage 3 ~ 230/400V Δ y 50 Hz, 3 ~ 265/460V Δ y 60 Hz 1 ~ 230V 50 Hz, 1 ~ 115V 60 Hz (1~phase motor)				
Pump version Single circuit pump <ul style="list-style-type: none"> Radial piston pump H, gear pump Z, internal gear pump IZ Dual circuit pump with joint connection pedestal for pressure ports P1 and P3 <ul style="list-style-type: none"> Combinations: <ul style="list-style-type: none"> Radial piston pump - radial piston pump (HH) Radial piston pump - gear pump (HZ) Dual circuit pump with separate connection pedestals <ul style="list-style-type: none"> Radial piston pump H or gear pump Z 				
Additional functions <ul style="list-style-type: none"> Temperature and level switch, single or double version Additional leakage port (Type HK 4.L) 				
Tank size Type HK: Usable volume V_{usable} 0.85 l to 15.4 l, Type HKL: Usable volume V_{usable} 1.7 l to 9.1 l <ul style="list-style-type: none"> Various filler neck designs 				
Basic type, size Type HK, size 2 to 4, type HKF (with auxiliary blower for increased cooling), size 4 Type HKL (3~phase motor) and HKLW (1~phase motor), size 3				
Additional versions: <ul style="list-style-type: none"> With molded motor With frequency-controlled drive 				

Function

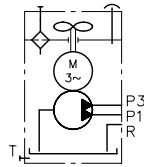
Single stage pump

(radial piston pump, or gear pump)

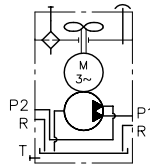


Dual stage pump

(radial piston/radial piston pump, or gear pump/gear pump, or radial piston pump/gear pump)



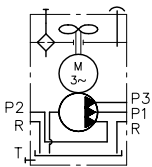
Joint pump pedestal



Separate pump pedestals

Triple-circuit pump

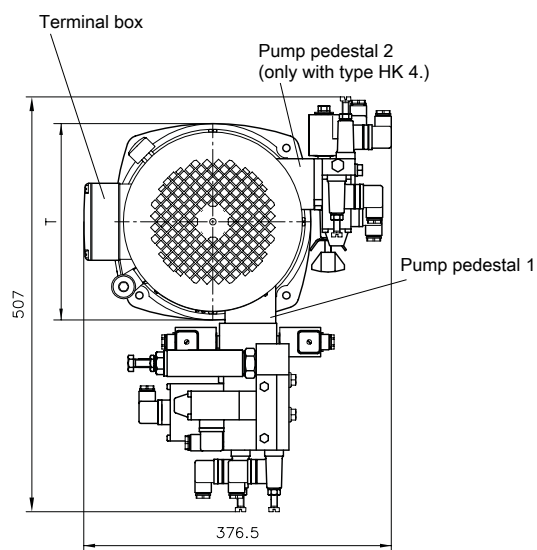
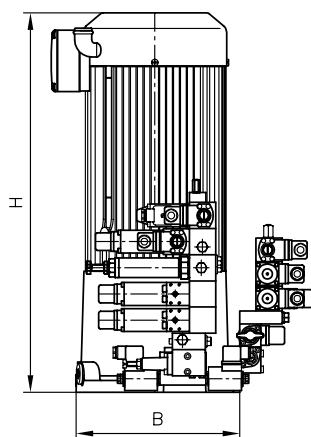
(only radial piston pump)



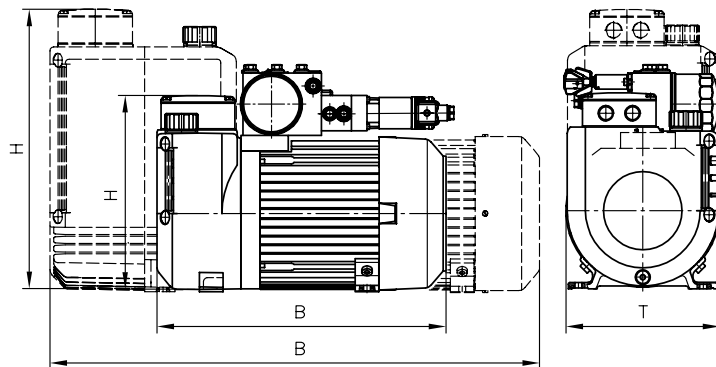
Separate pump pedestals

General parameters and dimensions

HK..



HKL..



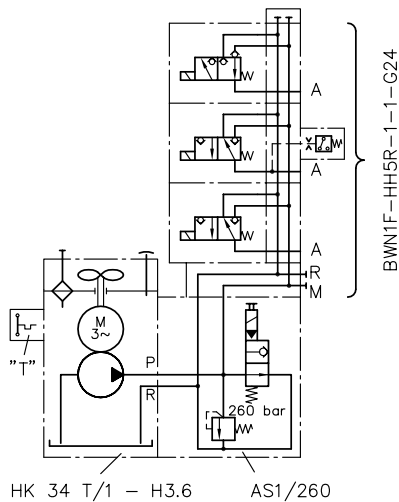
	Radial piston pump			Gear pump							
	Max. pressure	Delivery flow		Max. pressure	Delivery flow						
	p _{max} [bar]	Q _{pu} [lpm] 50 Hz	Q _{pu} [lpm] 60 Hz	p _{max} [bar]	Q _{pu} [lpm] 50 Hz	Q _{pu} [lpm] 60 Hz		P _N [kW] ¹⁾	H _{max}	B	T
HK 24	700 - 220	0.46 - 1.77	0.55 - 2.12	-	-	-	0.55	340	196	196	13
HK 33	560 - 100	1.25 - 6.5	1.5 - 7.8	170 - 100	2.7 - 6.9	3.24 - 8.28	0.8	405	212	212	20.5
HK 34	700 - 170	1.25 - 6.5	1.5 - 7.8	170 - 160	2.7 - 6.9	3.24 - 8.28	1.1	405	212	212	20.5
HK(F) 43	610 - 90	2.08 - 13.1	3.36 - 15.72	170 - 80	4.5 - 16	3.29 - 19.2	1.5	460	240	240	29
HK(F) 44	700 - 130	2.08 - 13.1	2.5 - 15.72	170 - 110	4.5 - 24	3.29 - 28.8	2.2	460	240	240	29
HK(F) 48							3	833	240	240	40
HKL(W) 32	700 - 220	1.65 - 8.7	1.98 - 10.44	170 - 130	2.7 - 11.3	3.24 - 13.56	1.8	358	617	196	19.2
HKL(W) 34											
HKL 38	700 - 220	1.65 - 8.7	1.98 - 10.44	170 - 130	2.7 - 11.3	3.24 - 13.56	2.2	358	617	196	22.2

1) The actual power input is dependent on the respective operation pressure and can be up to $1.5 \times P_N$

Example circuits:

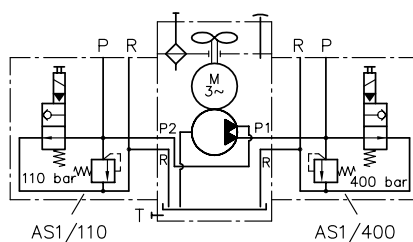
HKF 489 LD-DT55T65/1P11M-Z11,3

Compact hydraulic power pack HKF 489 with drain port (coding L) float switch with two switch points (coding D-D); temperature switch with two switch points (coding T55 T65) with Harting plugs coding P1 and oil filler (coding P11).



HK44 /1-H 2.5-Z 6.9-AS1/400-AS1/110-G24

Compact hydraulic power pack type HK 44 with radial piston pump H 2.5 and gear pump Z 6.9 on separate pump pedestals, each with connection block (type AS1/..) with pressure-limiting valve (400 bar and 110 bar) and idle circulation valve (connection of valve banks possible)



Associated technical data sheets:

- [Compact hydraulic power pack type HK 4: D 7600-4](#)
- [Compact hydraulic power pack type HK 3: D 7600-3](#)
- [Compact hydraulic power pack type HK 2: D 7600-2](#)
- [Compact hydraulic power pack type HKL and HKLW: D 7600-3L](#)

Connection blocks:

- Types A, B and C: [Page 68](#)

Directly mountable valve banks:

- Type VB: [Page 132](#)
- Type BWH, BWN: [Page 138](#)
- Type SWR, SWS: [Page 92](#)
- Type BA: [Page 70](#)
- Type BVH: [Page 76](#)

Standard power packs

2.2

Radial piston pump type R, RG and RZ

Radial piston pumps are a type of hydraulic pump. They consist of valve-controlled pump cylinders that are arranged radially.

The radial piston pump type R, RG and RZ has a closed pump housing. Therefore, besides use as a motor pump outside an oil tank, installation in the container of a hydraulic power pack is also possible. The radial piston pump is available with several pressure outlets which enable the same or several different flows. Type RZ is a classic dual-stage pump consisting of a radial piston pump and a gear pump. The radial piston pump type RG has plain bearings which have a longer storage life. This type is therefore used in extreme operating conditions.

Extremely high volumetric flows can be achieved by arranging up to 6 radials in parallel. When the radial piston pump is used in the hydraulic power pack, it is suitable for use as a highly compact control system. Connection blocks and valve banks can be mounted on the cover plate of the hydraulic power packs.

- Features and benefits:**
- High level of efficiency
 - Compact design
 - Max. 14 separate pressure outlets
 - Available from the modular product range as a hydraulic power pack with valve banks

- Intended applications:**
- Press construction
 - Jig construction
 - Testing and laboratory devices
 - Lubricating systems



Nomenclature:	Radial piston pump
Design:	Motor pump Hydraulic power pack
p _{max} :	700 bar
Q _{max} :	91.2 lpm (V _g = 64.18 cm ³ /rev)
V _{tank max} :	approx. 470 l

Design and order coding example

R 11,6

/ M 7,5

K

Options

- Fluid level gauge, float switch
- Temperature switch

Function, drive

Motor pump

- With/without industrial standard motor (output P_N in kW)

Hydraulic power packs

- Tank version, with/without standard motor
- Cover plate version (for installation on customer furnished tanks), with/without industrial standard motor

Basic type, delivery flow [lpm]

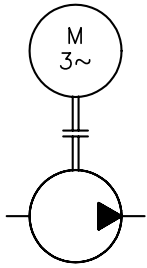
- Type R (version with roller bearing)
- Type RG (version with plain bearing)
- Type RZ (dual-stage pump)

Additional versions:

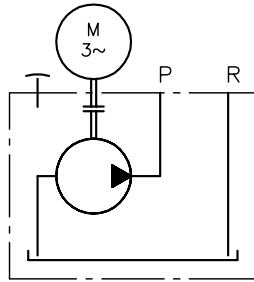
- With several pressure ports

Function

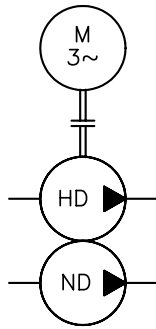
Motor pump type R and RG



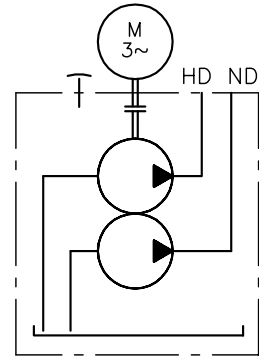
Hydraulic power pack type R and RG



Motor pump type RZ

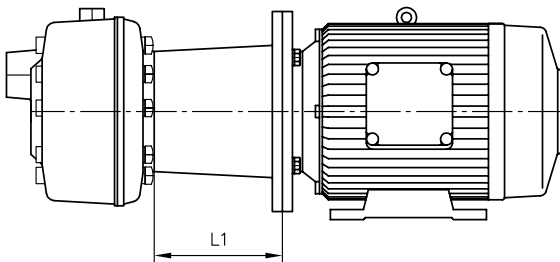


Hydraulic power pack type RZ

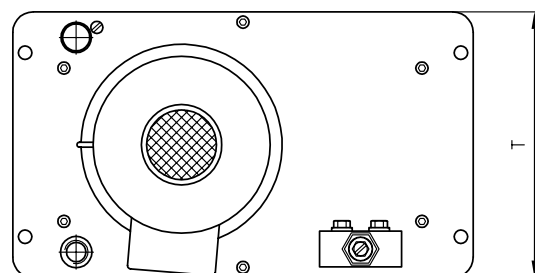
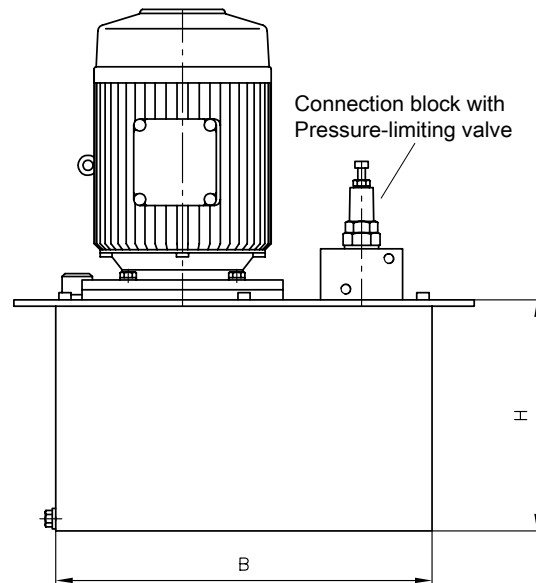


General parameters and dimensions

Motor pump type R and RG



Hydraulic power pack type R, RG and RZ



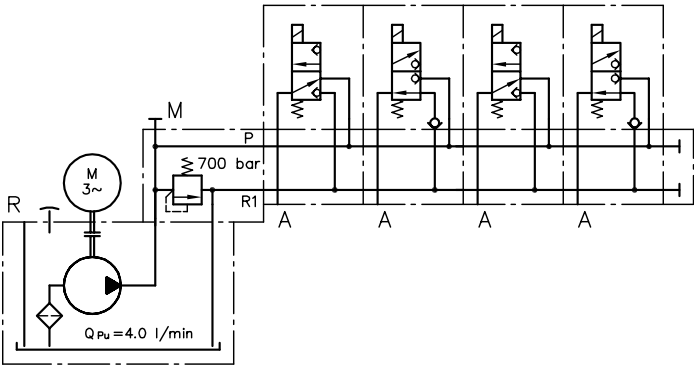
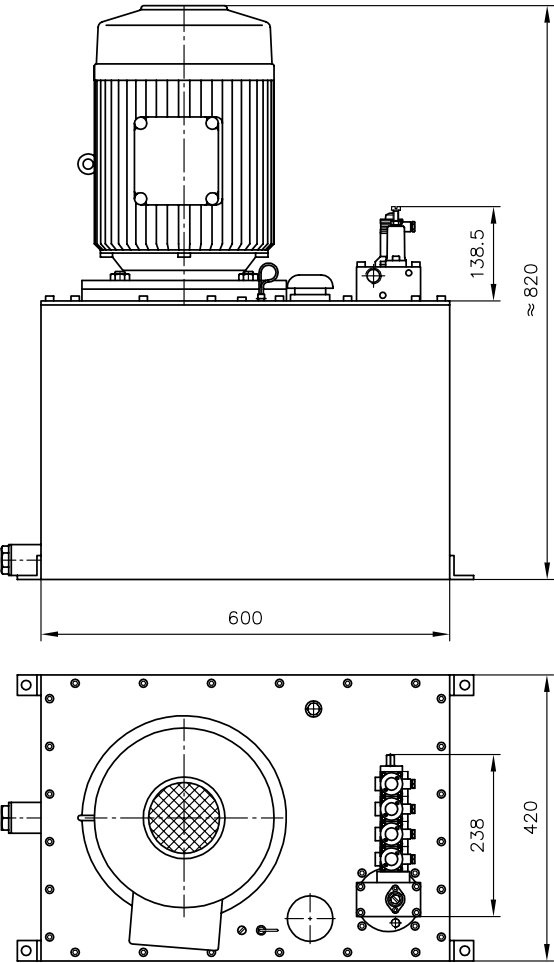
For dimensions of motor pumps and hydraulic power packs, see [Page 62](#)

Hydraulic power pack:

Tank size	H [mm]	B [mm]	T [mm]	V _{max} tank [l]
B 6	230	253	315	9.3
B 13	230	368	260	17
B 20	320	368	260	25
B 30	320	448	320	39
B 40	320	448	440	55
B 50	403	600	420	85
B 75	478	600	420	107
B 100	536	650	500	152
B 160	666	650	500	193
B 250	575	1000	600	309
B 400	825	1000	600	469

Circuit example 1:

R 4,0/B 50 A 700 - VB 11 DM - HRHR - 1 - G 24 - V 5,5



Standard power packs

2.2

Air-driven hydraulic pump type LP

Air-driven hydraulic pumps are pneumatically driven, reciprocally acting plunger pumps. They operate as pneumatic pressure boosters with oscillating movement and automatic stroke reversal control.

The air-driven hydraulic pump type LP can generate up to 1500 bar. It is available as an individual pump or as a hydraulic power pack with different tank sizes and valve banks. The delivery flow is dependent on the air pressure set and the flow resistance currently present. It can decay to standstill.

Applications are in laboratory presses, in fixture construction, in lubrication systems or in potentially explosive atmospheres.

Features and benefits:

- High operating pressures
- Suitable for explosion-proof systems and equipment
 - No electrical energy
- Hydraulic power packs with direct valve mounting

Intended applications:

- Construction and construction materials machinery
- Fixture construction
- Testing and laboratory equipment

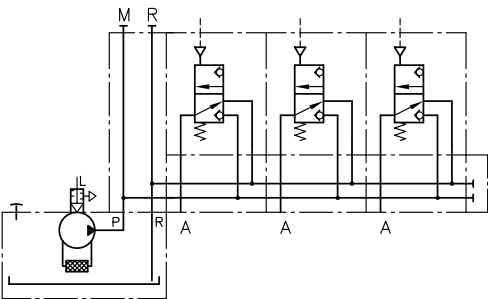


Nomenclature:	Air driven hydraulic pumps
Design:	Hydraulic power pack
Phydraulicmax :	160...1500 bar
pairmax :	10 bar
Qmax:	0.9...12 lpm

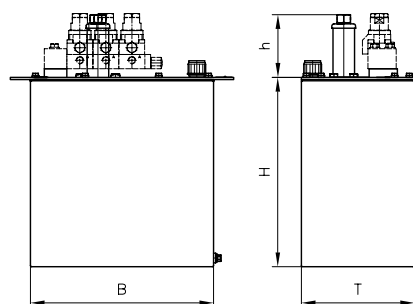
Design and order coding example

LP 125 - 16	/B4	VB 11 LP - HHH - 1
	Valve mounting	<ul style="list-style-type: none">▪ Valve bank type VB▪ Valve bank type BWN and BWH
	Design	Hydraulic power pack <ul style="list-style-type: none">▪ Tank version, usable volume V_{usable} 5 l to 28 l▪ Cover plate version (for installation in self-manufactured oil tanks)
Basic type, size	Type LP, size 80, 125, 160	

Function



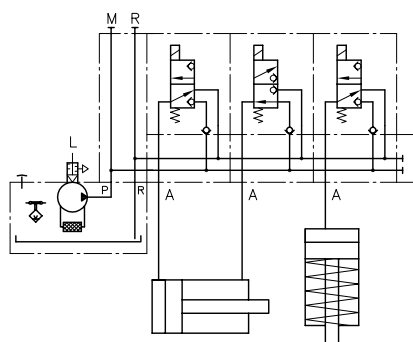
General parameters and dimensions



Basic type and size	B	H	T	h	V _{max} tank (l)	m (kg)
LP 80-..B4	200	242,5	200	94	7	5,7
LP 125-..B4	200	242,5	200	110	5,8	5,7
LP 125-..B10	324	332,5	200	132	16,6	8,5
LP 125-..B25	402	410	250	130	34	15,1
LP 160-..B10	324	332,5	200	132	13,5	8,5
LP 160-..B25	402	410	250	130	33	15,1

Example circuit:

LP 125-10/B 10 D
 -VB 11 LM-NRN-1-G 24



Hydraulic power pack in tank, version with air-driven hydraulic pump type LP125-10, tank size B10 as well as float switch D (normally closed) and valve bank type VB11 attached.

Associated technical data sheets:

- [Air-driven hydraulic pump type LP: D 7280](#)
- [Hydraulic power pack type LP: D 7280 H](#)

Valve banks :

- Type VB: [Page 132](#)
- Type BWH(N): [Page 138](#)

Mounted valves

2.2 Connection block type A, B and C

A mounted valve represents the connecting link between the hydraulic power pack and the hydraulic control. Mounted valves can be combined with compact hydraulic power packs, for example.

A valve bank can be directly attached to the connection block type A such that a compact hydraulic control unit is produced. As standard the type A contains a pressure-limiting valve that can be supplemented with a pressure or return filter, or an idle circulation valve, among other items. The connection block type B controls single-acting cylinders, e.g. in pallet lifting equipment. The integrated pressure-limiting valve limits the maximum lifting force. The lowering speed is adjusted using the integrated throttle. The connection block type C has only a pump and return port and is used in hydraulic systems with decentral valve blocks.

The connection blocks type A, B and C can be combined, e.g. with the compact hydraulic power packs type KA, HK and MPN.

Features and benefits:

- Enables compact and sturdy direct mounting of ongoing components at the compact power packs of HAWE Hydraulik
- Intermediate plates enable versatile addition of other components
- Efficient and space saving solution for mounting individual valves or valve banks to single and dual circuit pumps
- Pressure and return filter, pressure limiting valves, switches etc. can be integrated

Intended applications:

- Lifting devices
- Machine tools
- Modules for braking or rotor blade adjustment at wind power systems
- Tracking systems for solar panels and parabolic antennas

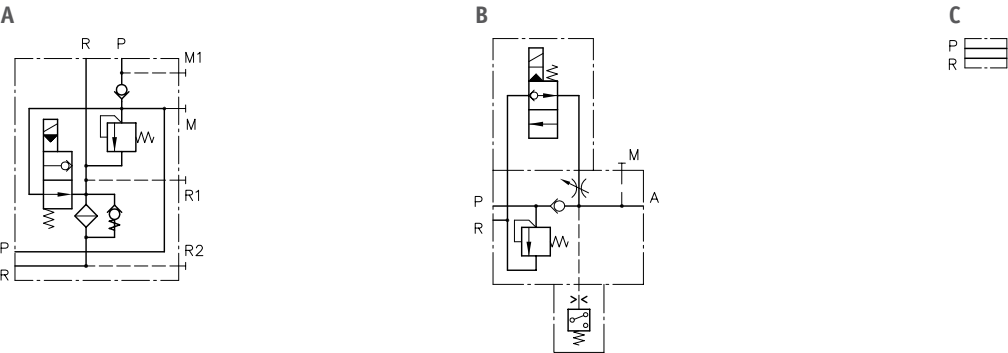


Nomenclature:	Connection blocks to the completion of hydraulic power packs
Design:	Add-on valve enabling pipe connection or direct mounting of valve banks
p_{max}:	700 bar
Q_{max}:	approx. 20 lpm

Design and order coding example

AS3F2	/420	- G24
	Solenoid voltage 12V DC, 24V DC, 230V AC	
	Pressure setting (bar)	
Basic type	Type A, B, C see table	

Function



Options, type A, B, C

Type A with pressure-limiting valve (pre-set or manually adjustable, also with unit approval)

- For direct pipe connection
- To attach valve banks

Options:

- Check valve in P gallery
- Prop. pressure-limiting valve
- Return filter, Pressure filter
- Idle circulation valve (solenoid-actuated)
- Shut-off valve, accumulator charging valve

Type C without additional elements

- For direct pipe connection

Options:

- For pipe connection (pump side) of all type A, B connection blocks (Type C15, C16 - connection block with hole pattern of the pump, type C36)

Type B with pressure-limiting valve to actuate single- and double-acting cylinders

- For direct pipe connection

Options:

- Check valve in P gallery
- Throttle for regulating the drain speed
- Idle circulation valve open or closed in neutral position
- Pressure switch in P gallery
- Automatic clamping and releasing via the pressure switch (type B..DW)

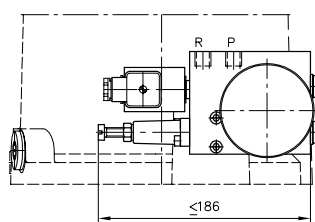
Additional versions

- Connection blocks for dual-stage pumps
- Intermediate blocks for dual-stage pumps type S, V, C30
- Spacer plates for single and dual-circuit pumps type U.
- Additional intermediate block for second pressure stage type V, S

General parameters and dimensions

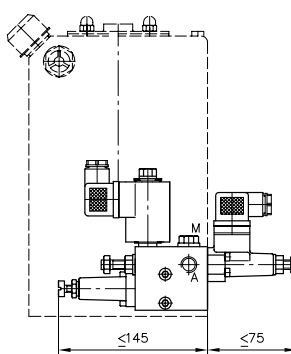
AS ..

Example: HK 44/1 - H 2.08 - **ASX 3 F2/400 - G 24**



B..

Example: HC 14/1.95 - **B 31/180 - EM 11V - 13/3 - G 24**



Associated technical data sheets:

- [Connection blocks type A for hydraulic power packs: D 6905 A/1](#)
- [Connection block type AX, with unit approval: D 6905 TUV](#)
- [Connection blocks type B for hydraulic power packs: D 6905 B](#)
- [Connection block type C 5 and C 6: D 6905 C](#)

Suitable compact hydraulic power packs:

- see "Compact hydraulic power packs" section

Products with shared connection diagram:

- Two-stage valve type NE 21: [Page 200](#)
- Switch units type CR: [Page 156](#)

Suited valve banks for combination:

- Type VB: [Page 132](#)
- Type BWH, BWN: [Page 138](#)
- Type SWR, SWP, SWS: [Page 92](#)
- Type BA: [Page 70](#)
- Type BVH: [Page 76](#)

Mounted valves

2.2

Valve bank (nominal size 6) type BA

A valve bank combines different valves for operating independent consumers. The directional valve bank type BA consists of several valve sections that are fitted to sub-plates with NG 6. Using these items compact control blocks can be assembled flexibly. The intermediate plates type NZP make possible additional functions and contain, e.g., pressure-reducing valves, shock valves, load-holding valves etc. An intermediate plate can be inserted between the sub-plate and the valve. The valve bank type BA can be flange-mounted directly on the compact hydraulic power pack.

Features and benefits:

- Sub-plates for flexible combination of directional valve types with NG 6 (CETOP) standard connection pattern
- Valve bank can be flange mounted directly on the connection block of a compact hydraulic power pack or connected as a separately arranged valve bank for pipe connection
- Pressure switches and/or any other monitoring elements can be connected directly
- Additional elements, such as orifices, throttles and check valves for connections P, R, A and B can be integrated
- Hydraulic accumulator can be mounted directly

Intended applications:

- Clamping systems on machine tools and equipment
- Process control on deforming machine tools
- Brake and rotor adjustment modules on wind turbines



Nomenclature:	Sub-plates/directional seated valve, zero leakage
Version:	Valve section with sub-plates for pipe connection
Actuation:	Solenoid Pressure-operated <ul style="list-style-type: none">▪ Hydraulic▪ Pneumatic Manual Mechanical <ul style="list-style-type: none">▪ Pin▪ Roller
p _{max} :	400 bar
Q _{max} :	20 lpm

Design and order coding example

BA2 A5	NBVP16	S					/0		
	NBVP16	G	B0,8 R	/ABR2,0/BBR1,5	/A3B9/400	/S	/3		
	NSWP2	G	B0,6 R	/ABR1,0/BBR1,5	/50	/S	/0	- 1	- G24

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

End plate

- Drain valve with/without pressure switches
- with one or two accumulator ports with/without release valve and/or with/without drain valve

Sub-plate

- Check valves with release
- Throttle
- Additional pressure gauge connections

Additional elements in R Return pressure stop

Pressure switch/pressure gauge in A and/or B

Additional elements in A, B Throttle check valve in A and/or B
Throttle valve in A and/or B

Additional elements in P Check valve
Orifice



Circuit symbol of the directional valve

- Valve sections**
- Directional valves**
- Type NSMD2, NSWP2, NBVP16, NBMD16, NG...-1, NZP16
- Intermediate plates for series connection**
- Type CZ: with pressure-reducing valve in P gallery
- Intermediate plates for parallel connection type NZP**
- with throttle and/or throttle check valves
 - with pressure-reducing valves
 - with short-circuit and by-pass valves
 - for random switching of a 2nd speed

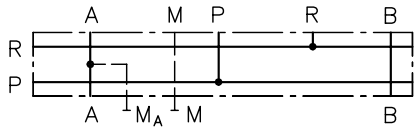
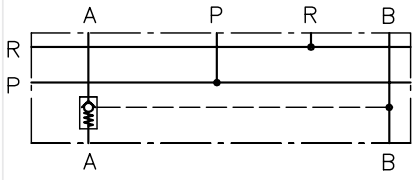
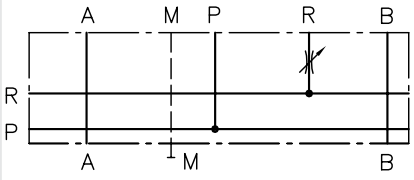
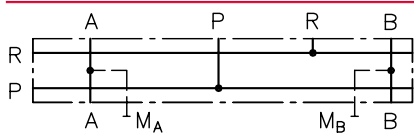
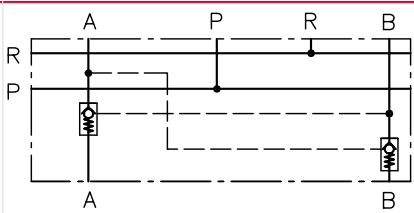
- Connection block**
- Direct mounting onto type A, AF etc. connection blocks (for type KA, MP, MPN, HC, HK(F), HKL compact hydraulic power packs)
 - Variant for pipe connection with/without pressure-limiting valve (A5)

Function

Connection blocks/adapter plates:

BA2 ..	BA2 A5	BA2 A8
Direct mounting onto type A, AF etc. connection blocks at type KA, MP, MPN, HC, HK(F), HKL compact hydraulic power packs	Version for pipe connection without pressure- limiting valve	Like version BA2 A5 but with check valve in R
		

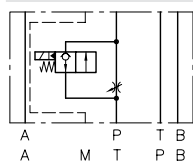
Sub-plates for plate assembly valve

BA2.../0	BA2.../1	BA2.../2
		
BA2.../3	BA2.../5	
		

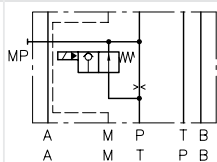
Valve section additional options

Intermediate plates for 2nd speed with orifice/throttle in P and T gallery

/NZP16(T)V/P(T)Q20...

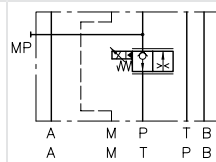


/NZP16(T)S/P(T)B...

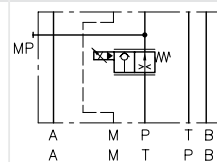


Intermediate plate for variable speed adaptation via proportional throttle in P and T gallery

/NZP16(T)VP



/NZP16(T)SP



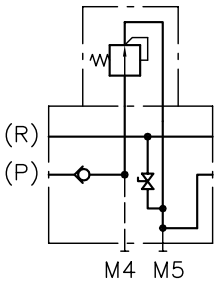
Example: .../NZP16TV/TB1.0/...

Type B1.0 orifice and type EM21V by-pass valve in T gallery

Example: .../NZP16VP/...

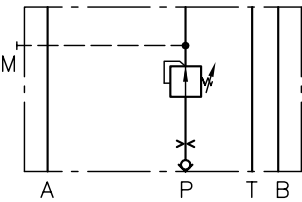
Type EMP21V proportional throttle valve in P gallery

Intermediate plate (series connection) with pressure-reducing valve for pressure reduction of the subsequent P gallery
 .../CZ...



Example: BAZ-CZ2/180/5R
 Type CDK3 pressure-reducing valve set to 180 bar with check valve

Intermediate plates (parallel connection) with pressure-reducing valve in P gallery
 .../NZP16(26)CZ...



Example: .../NZP16CZ08/350/B0.8R/...
 Type CDK0.8 pressure-reducing valve set to 350 bar with orifice and check valve in P gallery

Actuations:

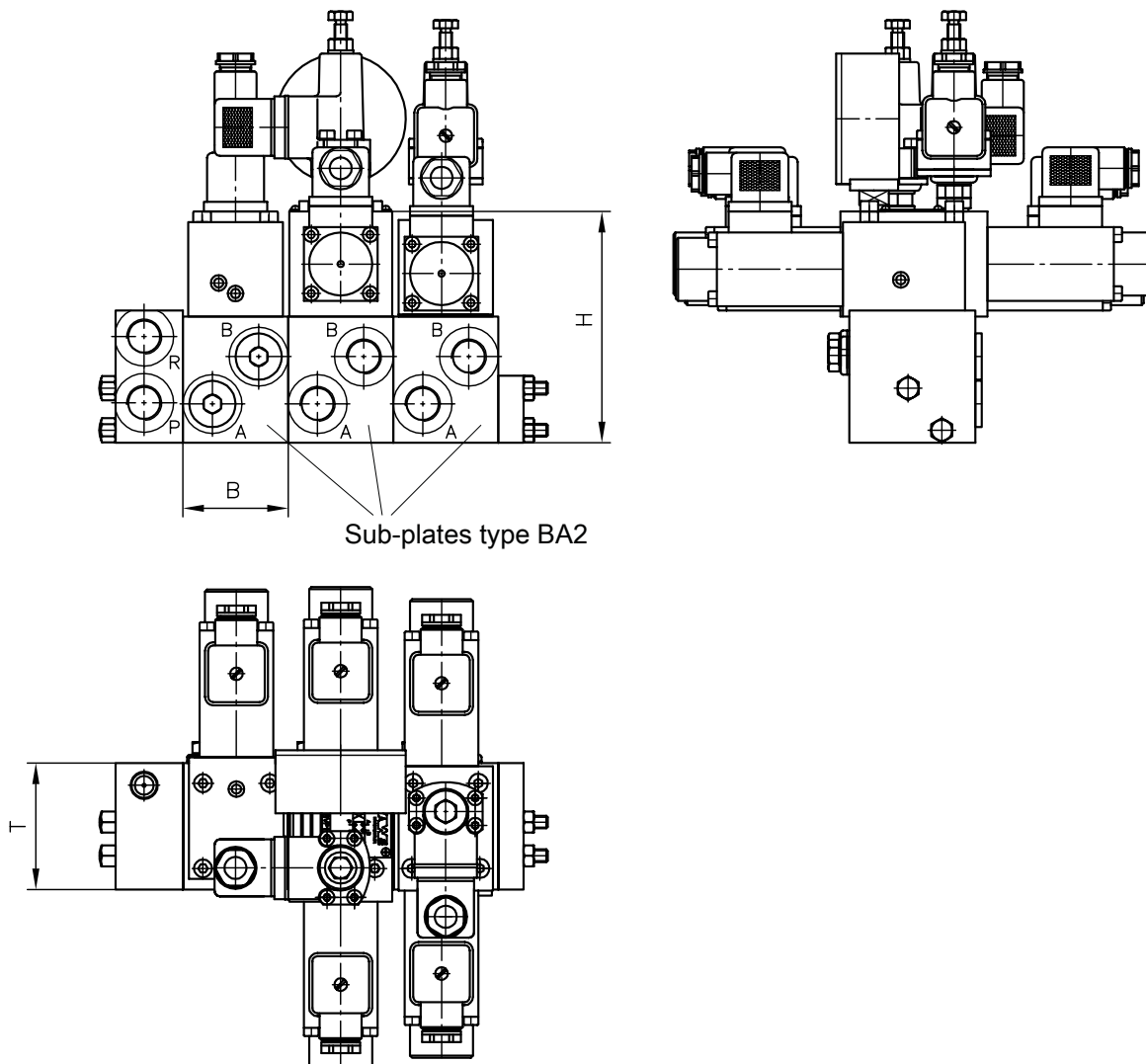
M:	Solenoid actuation ($p_{max}= 400$ bar)	P:	Pneumatic
GM:	Solenoid actuation ($p_{max}= 250$ bar)	A:	Manual actuation
H:	Hydraulic actuation	T:	Pin
		K:	Roller

End plates

-1	-6	-422	-8	-80/-8W	-880(88W)/...
Series	with drain valve	with drain valve and pressure switches	with accumulator port and drain valve	with accumulator port and release valve	with two accumulator ports and release valve

General parameters and dimensions

Mounted valve type BA



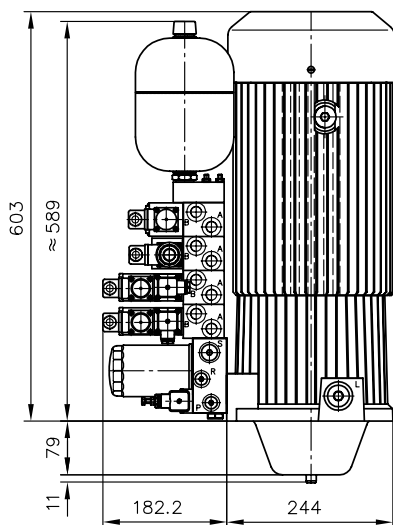
	Q_{\max} [lpm]	p_{\max} [bar]	Ports (BSPP)	Dimensions [mm]			m [kg]
			A, B, P, R, M	H	B	T	Valve section
BA2	20	400	G 1/4, G 3/8	139	50	60	0,8

HK 449 LDT/1 - Z16
 - AL21R F2 - F/50/60 - 7/45

Type HK compact hydraulic power pack size 4;
 connection block with accumulator
 charging valve, setting: 50 bar,
 pressure-limiting valve,
 setting: 60 bar,
 filter and pressure switch,
 setting: 45 bar

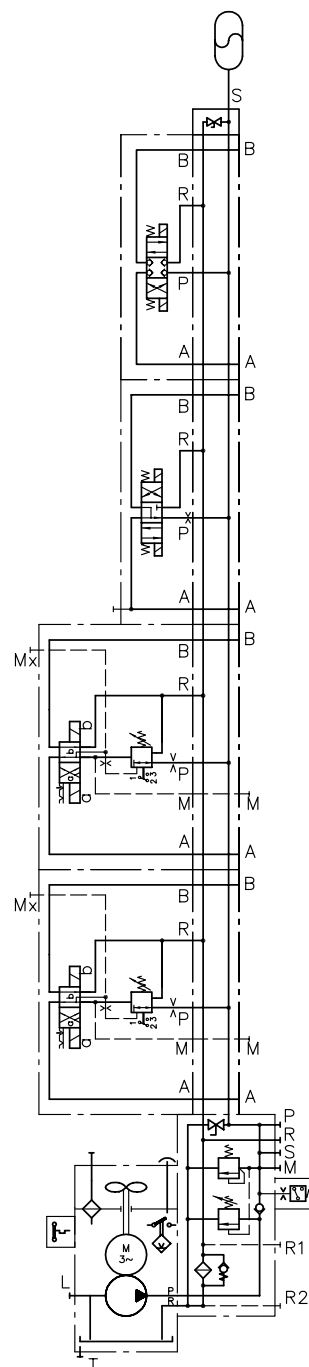
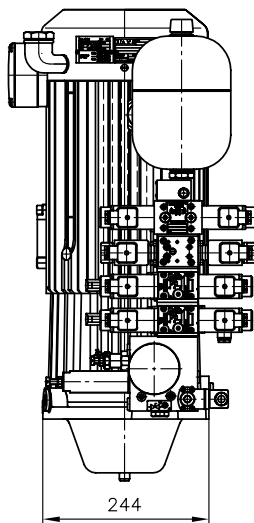
Parameters of the example circuit:

- $Q_{Pu} = 16 \text{ lpm}$ (at 1450 rpm)
- $p_{\max Pu} = 110 \text{ bar}$
- $p_{\text{system}} = 60 \text{ bar}$
 (pressure-limiting valve setting)
- $p_{\text{switch-off feature}} = 50 \text{ bar}$
- $V_{\text{load}} = \text{approximately } 5 \text{ l}$



- BA2
 - NSMD2W/GRK/B2.0/0
 - NSMD2W/GRK/B2.0/0
 - NSWP2D/B2.0/20/1
 - NBVP16G/0
 - 8 - AC2001/35 - L24

Type BA2 valve bank with four industrial standard valves mounted on sub-plates, two clamping functions for work piece clamping with combined option to adjust pressure and pressure switches, two additional functions for indexing and tool clamping



Associated technical data sheets:

- Valve bank (nominal size 6) type BA: [D 7788](#)
- Intermediate plate type NZP: [D 7788 Z](#)

Suitable compact hydraulic power packs:

- See chapter on hydraulic power packs

Suitable connection block:

- Type A: [Page 68](#)

Suited products for combination:

- Clamping module type NSMD: [D 7787](#)
- Directional spool valves type NSWP: [Page 88](#)
- Directional spool valve type SWPN: [D 7451 AT](#)
- Directional seated valves type NBVP: [Page 146](#)

Suitable accessories:

- Pressure switches type DG: [Page 272](#)
- Hydraulic accumulators type AC: [Page 268](#)

Suitable plugs:

- Line connector type MSD and others: [D 7163](#)

Mounted valves

2.2

Valve bank (directional seated valve) type BVH

A valve bank combines different valves for operating independent consumers. The valve bank type BVH comprises several directional seated valves that are connected in parallel. As cone valves the directional seated valves have zero leakage in the closed state. The valve sections are connected using banjo screws. 2/2, 3/2, 4/2 and 4/3 directional seated valves are available. Depending on the functional requirement, pressure reducing valves, pressure switches, check valves, restrictors or restrictor check valves are integrated into the valve section. The valve bank can be attached directly to the compact hydraulic power pack.

- Features and benefits:**
- Very flexible expansion options and maintenance of valve banks at end user
 - Compact and lighter design

- Intended applications:**
- Clamping systems on machine tools and equipment
 - Clamping systems on deforming machine tools
 - Brake and rotor adjustment modules on wind turbines



Nomen-clature:	Valve sections Directional seated valve Zero leakage
Version:	Valve sections for pipe connection
Actuation:	Solenoid
p_{max}:	400 bar
Q_{max}:	20 lpm

Design and order coding example

BVH 11	M/CZ/35/M/R/2	- 8	- G24
		Solenoid voltage	12V DC, 24V DC, 110V AC, 230V AC
		End plate	<ul style="list-style-type: none">▪ With tapped plugs at P, R▪ With accumulator port and drain valve
	Valve sections	<ul style="list-style-type: none">▪ With individual pressure reduction (parallel connection)▪ Additional elements:<ul style="list-style-type: none">▪ Pressure-reducing valves▪ Orifice and/or check valve in P gallery▪ Orifice or restrictor check valve for A▪ Return pressure block in R gallery▪ Pressure switches for A	
Basic type	Type BVH 11 for direct mounting onto connection blocks type A etc. (for compact hydraulic power packs type KA, MPN, HC, HK, HKF, HKL)		

Function

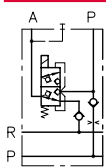
Connection blocks/adaptor plates:

BVH

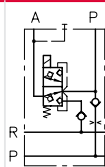
Direct mounting onto connection blocks type A etc.
for compact hydraulic power packs type KA, MPN, HC, HK, HKF, HKL

Valve sections:

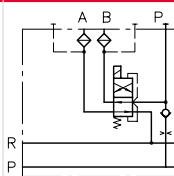
H



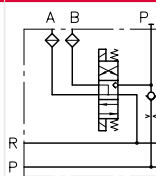
M



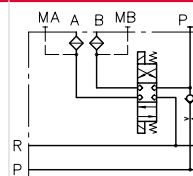
W



D



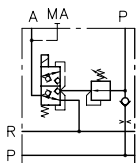
G



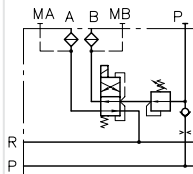
Additional options for the valve sections:

Individual pressure reduction (parallel connection)

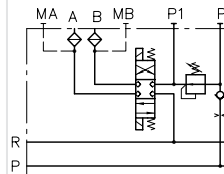
BVH 11 H/CZ...



BVH 11 W/CZ...

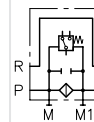


BVH 11 G/CZ...



Pressure filter

BVH 11 ZD



Actuations:

M: Solenoid actuation ($p_{\max} = 400$ bar)

GM: Solenoid actuation ($p_{\max} = 250$ bar)

End plates:

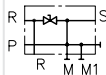
-1

Tapped plug at P, R



-81

with accumulator port and drain valve



General parameters and dimensions

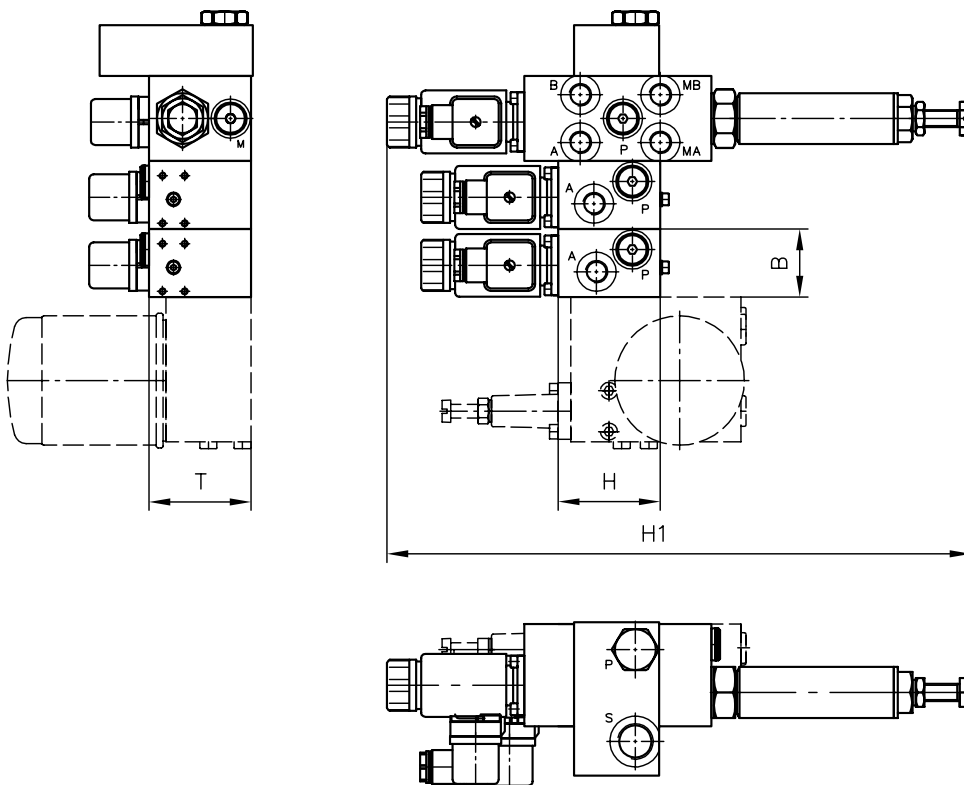
(A1F1/310)

- BVH 11 H/M/R/2
- BVH 11 M/M/R B2.5/3
- BVH 11 W/CZ 5/35/M/R/22 - 81 - G 24

Type BVH valve bank for direct mounting at type A connection block

Valve section 1 with 3/2-way function circuit symbol H, P check valve (coding R), no pressure switch (coding 2)
Valve section 2 with 3/2-way function circuit symbol M, check valve and orifice in P gallery (coding R, B, 2, 5) and pressure switch for A (coding 3)
Valve section 3 with 4/2-way function circuit symbol W, individual pressure-reducing valve set to 35 bar (coding CZ5/35) and check valve in P gallery (coding R), no pressure switch
End plate for accumulator port (coding 8) and 24V DC solenoid voltage

Mounted valve type BVH



	Q_{\max} [lpm]	p_{\max} [bar]	Ports (BSPP)	Dimensions [mm]				m [kg]
			A, B, P, R, M	H	H1	B	T	Valve section
BVH	20	400	G 1/4	60	343	40/50	60	0,8

Example circuit:

KA 281 SKT/Z 9.8

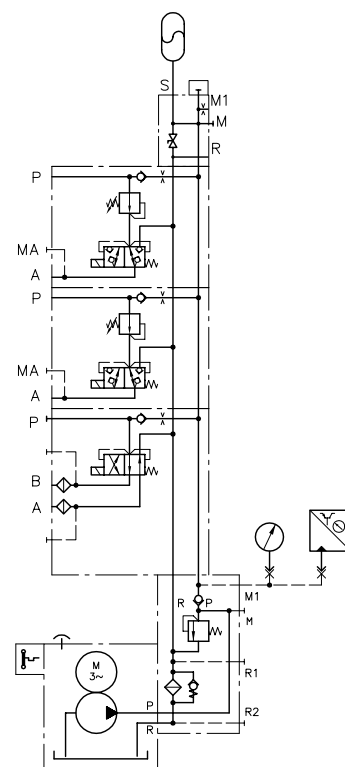
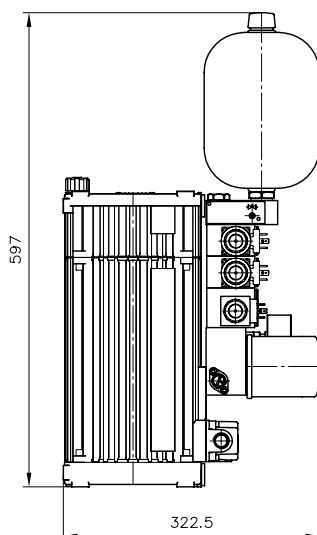
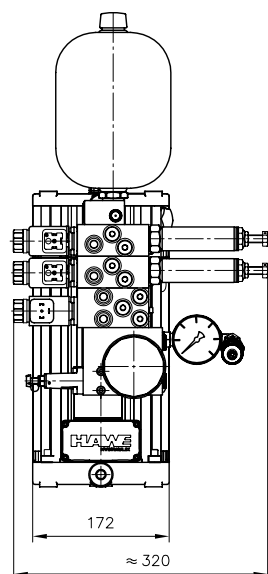
- AX 3 F 1 E/120
- BVH 11 W/M/RH/2
- BVH 11 M/CZ5/35/M/RHB 2.5
- BVH 11 M/CZ5/35/M/RHB 2.5
- 82-X 24 - AC 2001/60/3/A 3x400V 50 Hz

Type KA compact hydraulic power pack
 1 kW motor output;
 Connection block with return filter
 and TÜV-approved safety valve
 set to 120 bar

Type BVH valve bank with three valve segments, two
 clamping functions with individually adjustable clamping
 pressure

Parameters of the example circuit:

- $Q_{Pu} = 9.8 \text{ lpm}$ (at 1450 rpm)
- $p_{\max Pu} = 170 \text{ bar}$
- $p_{\text{system}} = 120 \text{ bar}$
- $p_{\text{switch-off feature}} = 50 \text{ bar}$
- $V_{\text{load}} = \text{approximately } 3 \text{ l}$



Associated technical data sheets:

- [Valve bank \(directional seated valve\) type BVH: D 7788 BV](#)

Compact hydraulic power packs:

- See section "Compact hydraulic power packs"

Connection blocks:

- Type A: [Page 68](#)

Combinable products:

- Directional seated valves type NBVP: [Page 146](#)
- Pressure reducing valves type CDK, DK: [Page 188](#)

Accessories:

- Pressure switches type DG: [Page 272](#)
- Hydraulic accumulators type AC: [Page 268](#)

Plug:

- [Line connector type MSD and others: D 7163](#)

3.1 Directional spool valves

Directional spool valve type SG and SP	84
Directional spool valve type SW, SWP and NSWP	88
Directional spool valve bank type SWR and SWS	92
Directional spool valve type HSF	96
Proportional directional spool valve type EDL	98
Directional spool valve bank type DL	102
Proportional directional spool valves type PSL and PSV	106
Proportional directional spool valve type PSLF, PSLV and SLF	112
Clamping module type NSMD	116



*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} (bar)	Q _{max} (lpm)
SG, SP	Directional spool valve, individual valve <ul style="list-style-type: none"> Individual valve for pipe connection Individual manifold mounting valve 	- Solenoid - Manual - Mechanical - Pressure-actuated	400	SG - 0: 12 SP - 1: 12 SG - 1: 20 SG - 2: 30 SG, SP - 3: 50 SG, SP - 5: 100
SW, SWP, NSWP	Directional spool valve, individual valve <ul style="list-style-type: none"> For pipe connection Individual manifold mounting valve Directional spool valve, valve bank <ul style="list-style-type: none"> With sub-plates Combination with hydraulic power packs 	- Solenoid	315	SW - 1: 12 SWP - 1: 12 SW, SWP, NSWP - 2: 25
SWR, SWS	Directional spool valve, valve bank <ul style="list-style-type: none"> Connected in series Combination with hydraulic power packs 	- Solenoid	315	SWR - 1: 12 SWS - 2: 25
HSF	Directional spool valve, individual valve <ul style="list-style-type: none"> Individual manifold mounting valve 	- Electro-hydraulic - Hydraulic	400	3: 80 4: 160

Proportional directional spool valve

Type	Nomenclature/version	Actuation	p _{max} (bar)	Q _{max} (lpm)
EDL	Prop. directional spool valve (Load-Sensing), valve bank <ul style="list-style-type: none"> Connected in series 	- Solenoid	320	50
PSL, PSV	Prop. directional spool valve (Load-Sensing), valve bank <ul style="list-style-type: none"> Connected in series 	- Manual - Electro-hydraulic - Pressure	2: 420 3: 420 5: 400	2: 60 3: 120 5: 270
PSLF, PSVF, SLF	Prop. directional spool valve (Load-Sensing), individual valve <ul style="list-style-type: none"> Individual manifold mounting valve Valve bank <ul style="list-style-type: none"> With sub-plates 	- Manual - Electro-hydraulic - Pressure	3: 420 5: 400 7: 420	3: 120 5: 270 7: 500

Valve combinations

Type	Nomenclature/version	Actuation	p _{max} (bar)	Q _{max} (lpm)
NSMD	Combination of directional spool valve and pressure-reducing valve As individual valve <ul style="list-style-type: none"> Individual manifold mounting valve As valve bank <ul style="list-style-type: none"> Valve banks are available with type BA 	- Solenoid	120	80

Directional spool valves

3.1

Directional spool valve type SG and SP

Directional spool valves are a type of directional valve. They control the direction of movement and the velocity of single and double-acting hydraulic consumers.

The directional spool valve type SG is available as a single valve for pipe connection. Type SP is available as a valve for manifold mounting. Due to the robust design the directional spool valve type SG and SP reaches operating pressures up to 400 bar. It is of versatile use due to different types of actuation.

Intended applications include mobile hydraulics, in particular in special vehicles, in municipal trucks and in shipbuilding.

Features and benefits:

- Sturdy design
- Suited for maritime applications
- Various actuation variants

Intended applications:

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



Nomen-clature:	Directional spool valve
Design:	Individual valve for pipe connection or manifold mounting
Actuation:	Solenoid Manual <ul style="list-style-type: none">▪ With automatic spring return▪ With detent Mechanical <ul style="list-style-type: none">▪ Roller head▪ Pin head Pressure (only or combined with manual actuation) <ul style="list-style-type: none">▪ Hydraulic▪ Pneumatic
p _{max} :	200 ... 400 bar
Q _{max} :	12 ... 100 lpm

Design and order coding example

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

Pressure setting pressure limiting valve [bar]

Actuation mode

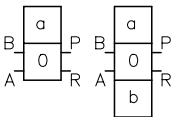
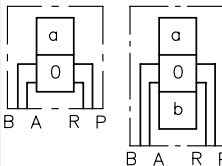
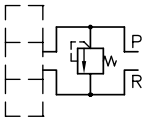
Pressure limiting valve

- 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

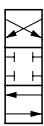
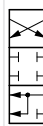

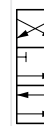

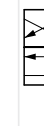
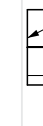
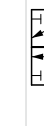
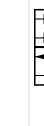
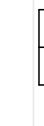






Basic type and size Directional spool valve SG 0 to 5, SP 1, SP 3, SP 5
Directional spool valves type SP for manifold mounting, sizes 1, 3, 5

Function

Basic symbol

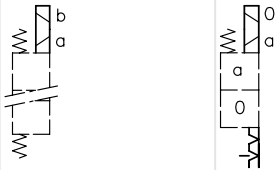


SG	SP
Individual valve for pipe connection	Individual valve for manifold mounting
	
With pressure-limiting valve	
	

Switching symbol



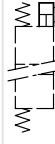
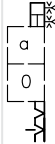

G	C	D	E	N	W	R	V	Z	U
									
L	F	H	Y	S	X				
									

- Switching symbol Z, U, X: only for size 2, 3 and 5

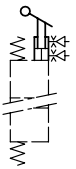
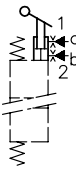
Actuations:

Manual		Solenoid	
A, AK	C, CK	ME, MD	MU
Spring return	Detent		
			
Solenoid voltage: 12V DC, 24V DC, 110V AC, 230V AC			

Actuations:

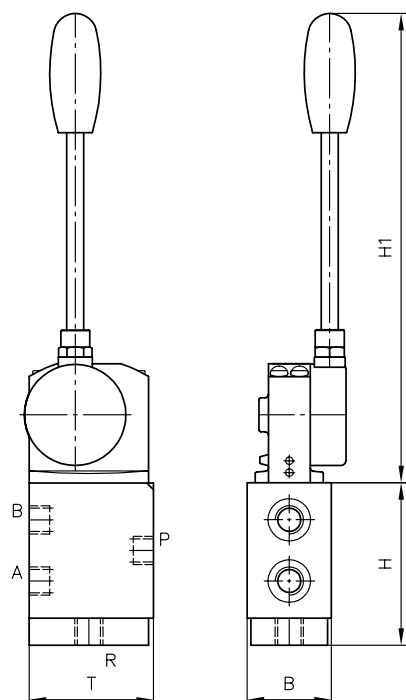
Mechanical		Pressure		
RE, RD	BE, BD	NE, ND	NU	NM
Roller head	Pin head	Pneumatic		Hydraulic
				
Actuation forces: 90 - 280 N (according to size)		Control pressures: pneumatic 5 - 10 bar hydraulic 12 - 20 bar		

Actuations:

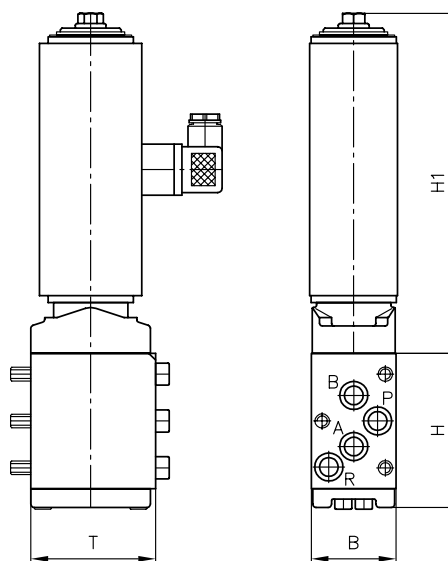
Double acting	
KD	KM
Pneumatic / manual	Hydraulic / manual
	
Control pressure: Pneumatic 5 ... 10 bar Hydraulic 12 ... 20 bar	

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 valve type SG and SP: [D 5650/1](#)
- Actuations:
 - Manual operation for directional spool valves, type S: [D 6511/1](#)
 - Electrical operation for directional spool valves type S: [D 7055](#)
 - Mechanical operation for directional spool valves, type S: [D 5870](#)
 - Pressure actuation for directional spool valves: [D 6250](#)

Plugs:

- Line connector type MSD and others: [D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

Directional spool valves

3.1 Directional spool valve type SW, SWP and NSWP

Directional spool valves are a type of directional valve. They control the direction of movement and the velocity of single and double-acting hydraulic consumers. The directional spool valve type NSWP and SWP is available as a valve for manifold mounting. Type NSWP is available with a nominal size 6 hole pattern (NG 6). Type SW is available as a single valve for pipe connection. The directional spool valve type NSWP can be flexibly adapted to different control tasks by means of additional functions in the pump line and/or on the consumer side (e.g. restrictors, restrictor check valves). Intended applications for the directional spool valve type NSWP, SWP and SW include industrial hydraulics, in particular machine tools.

Features and benefits:

- Compact valve banks
- Simple actuation of proportional functions
- Various versions
- Can be combined with NG6 sub-plates (type BA2)

Intended applications:

- Machine tools
- Construction and construction material 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

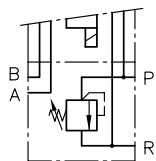
Design and order coding example

NSWP2	G	/M	/R	/ ABR1,0	/50	/G24	- 3/8	
								Indiv. connection block for direct installation in the pipe G 3/8 (type NSWP and SWP2)
								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
								▪ black/white solenoid or proportional solenoid
								▪ Solenoid with detent
								▪ 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

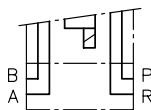
Sub-plate for pipe connection

- 1/4 S(R)



Sub-plate with pressure limiting valve¹⁾

- 3/8



Sub-plate²⁾

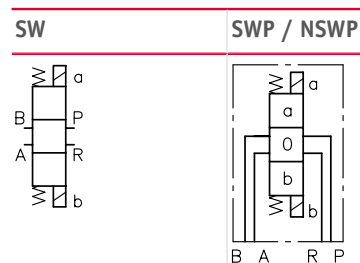
1) Only for type SWP 1

2) Only for type NSWP and SWP 2

Valve sections

Basic symbol

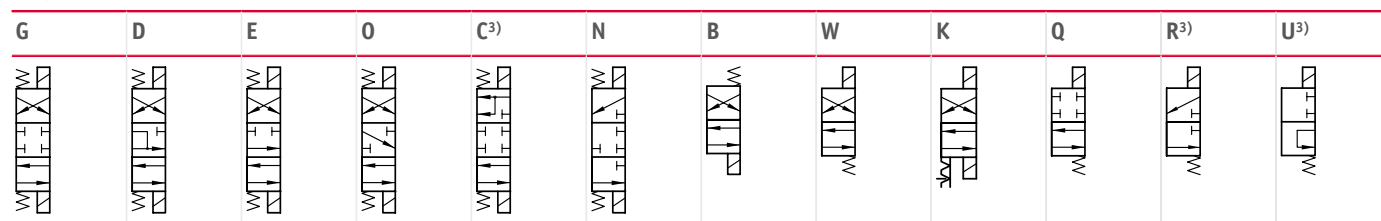
Individual valve



Valve sections

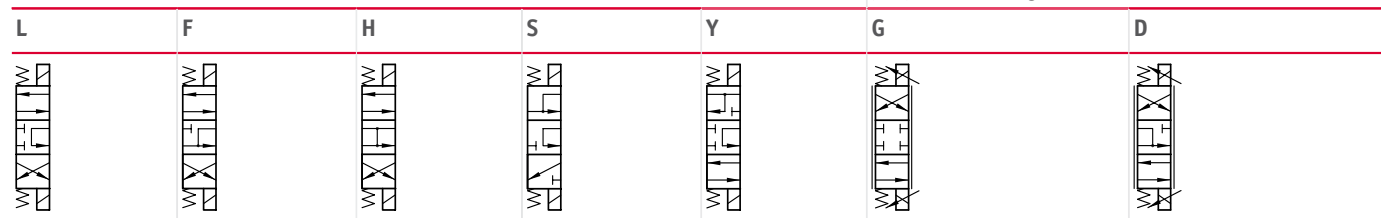
Switching symbol

May be connected either in parallel or in series within a valve bank



Only connected in series within a valve bank (only type SW1)

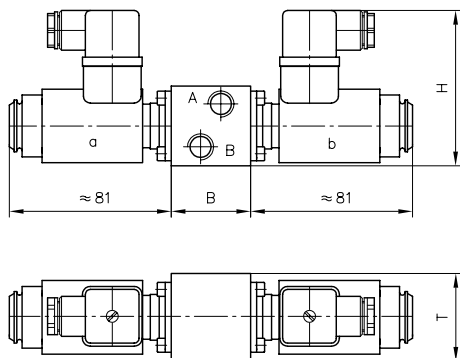
Spool for proportional adjustment



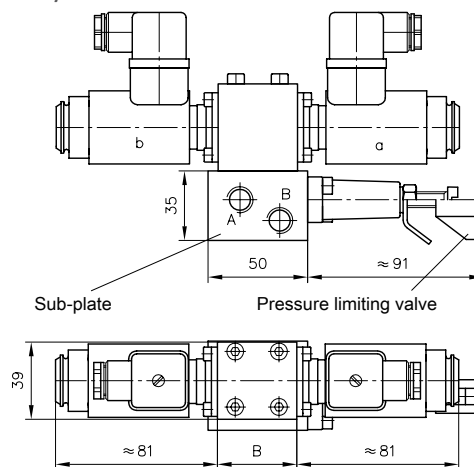
3) Only for type SWR 1

General parameters and dimensions

SW



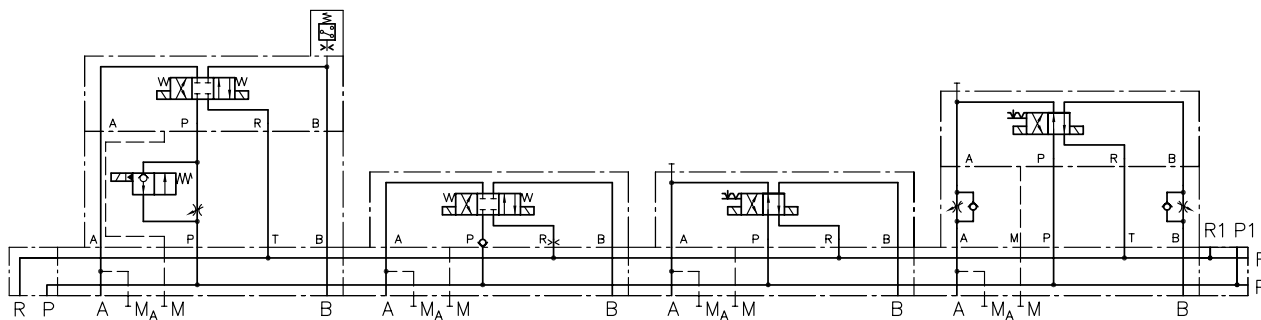
SWP/NSWP2



	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 1:

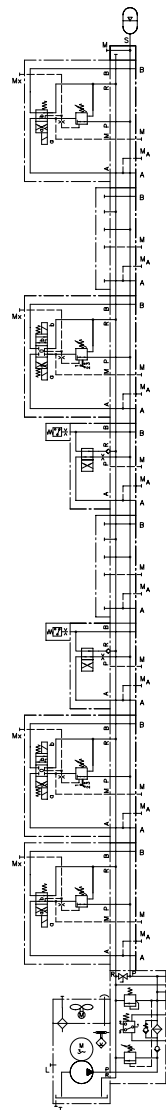
BA2-A5
 -NSWP2G/M/03/NZP16V/PQ20/0
 -NSWP2G/M/R/B1,0
 -NSWP2K/M/20/0
 -NSWP2K/M/20/NZP16Q33/0
 -2-L24



Circuit example 2:

HKF44V9LD/1-Z16

- AL21D10V-F60/80-2
- BA2-NSMD2K/G/B2/O
- NSMD2G/GRK/B2/O
- NSWP2W/M/B1,0/06/S/O
- NG6X/O
- NSWP2W/M/B1,0/06/S/O
- NSMD2G/GRK/B2/O
- NG6X/O
- NSMD2K/G/B2/O
- 80-AC2001/40-X24



Combinable products:

- Valve bank type BA: [Page 70](#)
- 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 92](#)
- Clamping modules type NSMD: [Page 116](#)

Associated technical data sheets:

- [Directional spool valve type SW: D 7451](#)
- [Directional spool valve type NSWP 2: D 7451 N](#)

Plugs:

- [Line connector type MSD and others: D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

Directional spool valve

3.1

Directional spool valve bank type SWR and SWS

Directional spool valves are a type of directional valve. They control the direction of movement and the velocity of single and double-acting hydraulic consumers.

The directional spool valve bank type SWS is available with series connection. The consumers can be operated with on-off or proportional control. Versions are available for usage in potentially explosive atmospheres. By means of additional functions in the pump line, in the intermediate plates (longitudinal and sandwich valve combination) and ancillary blocks the directional spool valve bank can be flexibly adapted to different control tasks.

Intended applications include mobile hydraulics, in particular civil engineering, hydraulic tools and material handling.

- Features and benefits:**
- Can be combined for forklift trucks with lifting modules
 - Proportional movements can also be controlled independently of the load
 - Extensive range of ancillary blocks
 - Compact and extremely space-saving dimensions

- Intended applications:**
- Material handling
 - Wind turbines
 - Construction and construction materials
 - Handling and assembly techn.
 - Municipal trucks



Nomenclature:	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/adaptor plate

- Pressure limiting valve (for pipe connection)
- Idle circulation valve
- 3-way flow controller

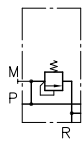
Basic type, size

Type SWR 1 and SWS 2

Function

Connection blocks:

A 6



With tool adjustable pressure limiting valve
(for pipe connection)

F/D

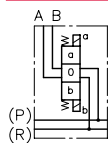


For direct mounting onto hydraulic power packs
(type KA, HC, MP, HK)

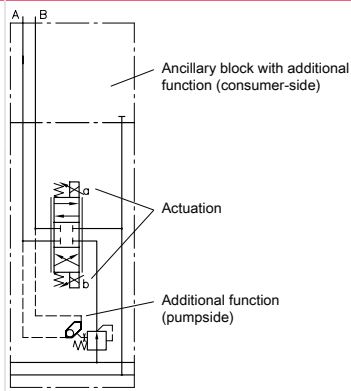
Valve sections:

Basic symbol

SWR 1

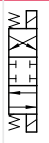


SWS 2

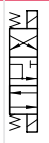


Symbol

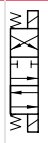
G



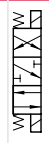
D



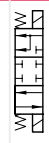
E



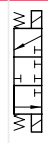
O



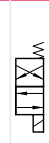
C



N



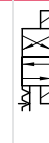
B



W



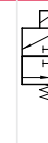
K



Q



R

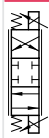


U



Spool valves suited for prop. actuation

G



D



Additional versions for valve sections:

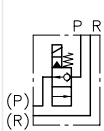
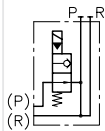
- b/w solenoids with stroke limitation
- prop. solenoids with stroke limitation
- solenoids also available in ATEX-compliant version ($p_{\max} = 210$ bar)

End plates (SWR 1/SWS 2):

Series

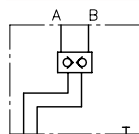
With circulation valve

With lockable pump output

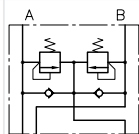


Ancillary block type SWS 2 with additional functions (consumer side):

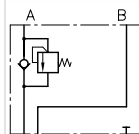
Releasable check valve



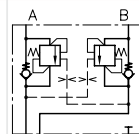
Shock valve



Sequence valve

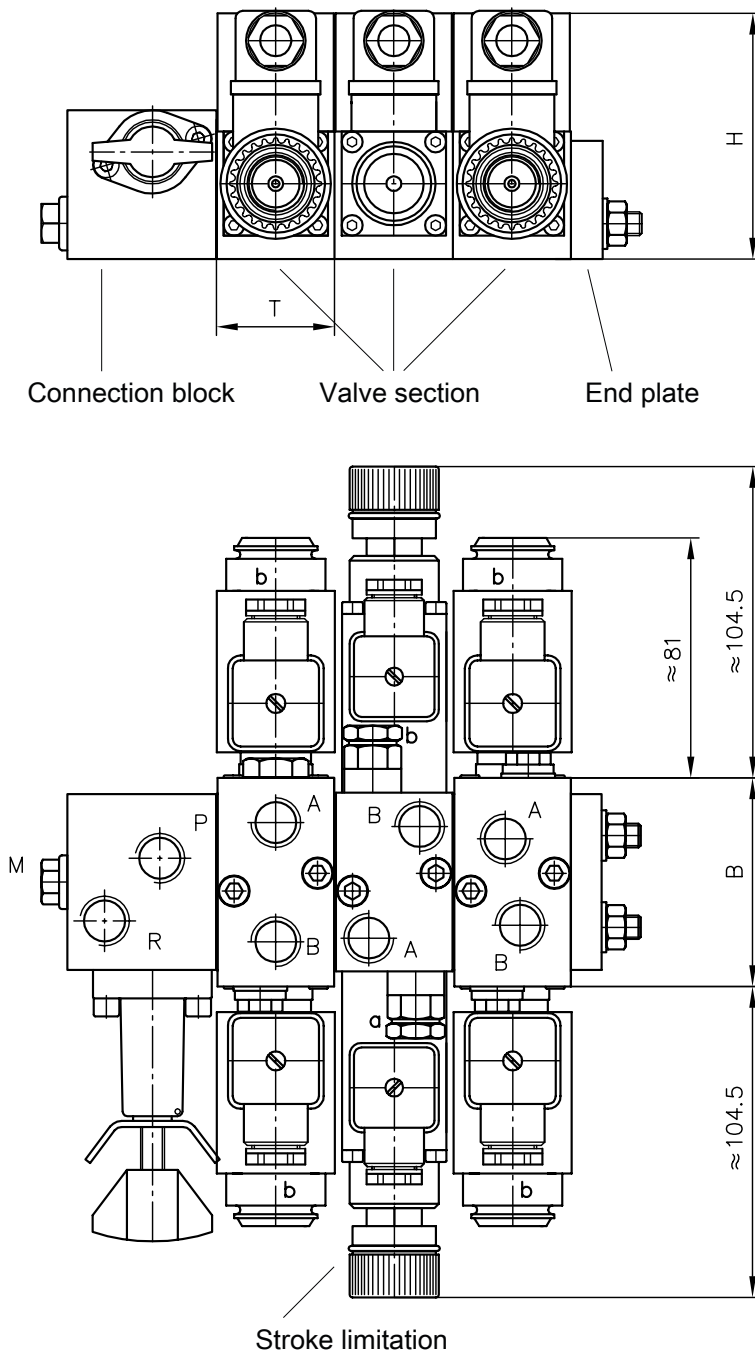


Over center valve



General parameters and dimensions

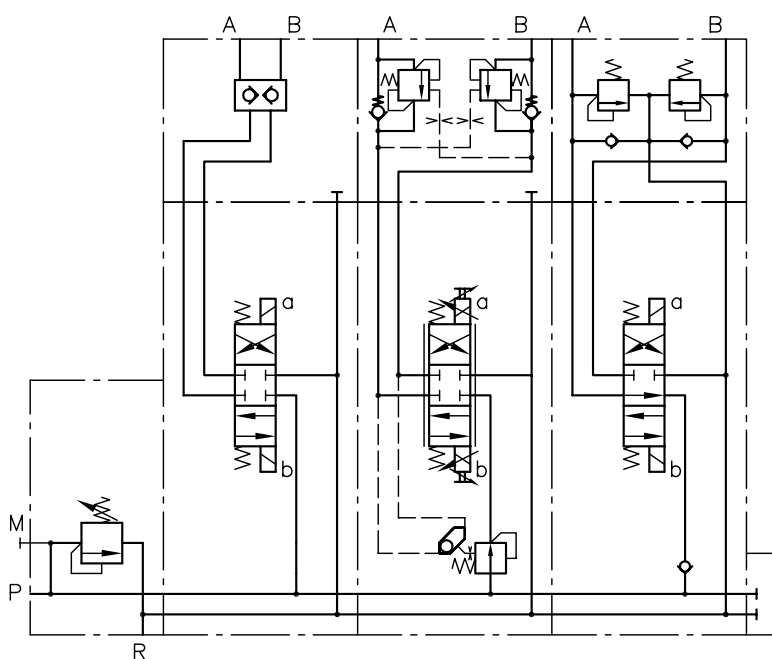
SWR 1, SWS 2



	Q_{\max} [lpm]	p_{\max} [bar]	Ports	Dimensions [mm]			m_{\max} [kg]	
				H	B	T		
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 type SW: D 7451](#)
- [Directional spool valve bank type SWS: D 7951](#)

Suited products for combination:

- Pressure switches type DG3..., DG5.E: [Page 272](#)

Suitable plugs:

- [Line connector type MSD and others: D 7163](#)
- With economy circuit: [D 7813](#), [D 7833/1](#)

Directional spool valve

3.1

Directional spool valve type HSF

Directional spool valves are a type of directional valve. They control the direction of movement and the velocity of single and double-acting hydraulic consumers. The directional spool valve type HSF is a manifold mounting valve. Due to the robust design, it reaches operating pressures of up to 400 bar. Adjustable threaded throttles are used to adjust the response time. Harsh switching operations and decompression surges, particularly in the event of high pressure and large consumer volumes, can be avoided this way.

Features and benefits:

- Smooth switching for large flows
- Suitable for high pressures due to steel housing

Intended applications:

- Mining machinery (incl. oil production)
- Cranes and lifting equipment
- Construction and construction materials machinery
- Material handling (industrial trucks, etc.)



Nomenclature:	Directional spool valve
Design:	Individual valve for manifold mounting
Actuation:	Electro-hydraulic Hydraulic
p _{max} :	400 bar
Q _{max} :	80 ... 160 lpm

Design and order coding example

HSF4

/C321

- L

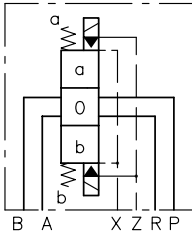
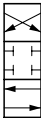





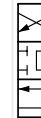
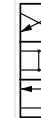

- 1

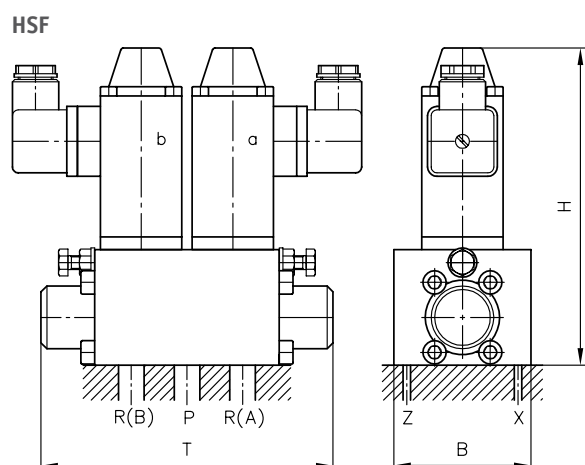
- G24

- 300

					Pressure setting pressure limiting valve [bar]
					Solenoid voltage 12V DC, 24V DC, 98V DC, 205V DC, 110V AC, 230V AC
				End plate	Internal or external control oil return
				Valve sections	With/without adjustable switching speed
				Connection block	<ul style="list-style-type: none">▪ With/without pressure limiting valve (tool or manually adjustable)▪ Internal or external control oil supply (max. 160 bar)
Basic type and size	Type HSF: Manifold mounting				

Function
Valve sections:

Basic symbol	Symbol								
HSF	G	D	E	C	W	B	L	H	F
 <p>Manifold mounting valve</p>									
	All flow pattern symbols also available with adjustable response time								

General parameters and dimensions


	Q_{max} [l/min]	p_{max} [bar]	Dimensions [mm]			m [kg]
			H	B	T	
HSF 3	80	400	137	59	126	2,8
HSF 4	160	400	157	70	184	5

Associated technical data sheets::

- Directional spool valve type PSL and PSV: [D 7700-2](#); [D 7700-3](#)
- Directional spool valve type HSF: [D 7493 E](#)
- Directional spool valve type HSL: [D 7493 L](#)

Plugs:

- Line connector type MSD and others: [D 7163](#)
- With economy circuit: [D 7813](#), [D 7833/1](#)

Directional spool valve

3.1

Proportional directional spool valve type EDL

Proportional directional spool valves are a type of directional valve. They control the direction of movement and the velocity of individual or multiple hydraulic consumers actuated simultaneously. Control is independent of the load and continuous. The directional spool valve type EDL with series connection is actuated directly. The flows for the individual consumers can be individually adjusted. By means of additional functions in the intermediate plates (longitudinal and sandwich valve combination) and ancillary blocks the proportional directional spool valve can be flexibly adapted to different control tasks.

The directional spool valve type EDL can be combined directly with the proportional directional spool valve type PSL and PSV in size 2. It is used in mobile hydraulics, in particular in civil engineering and hydraulic tools.

- Features and benefits:**
- One product for various control functions and small volume quantities
 - Energy-saving closed-centre systems
 - Compact and lightweight design
 - Modular system can be directly combined with type PSL/PSV-2

- Intended applications:**
- Construction and construction materials machinery
 - Cranes and lifting equipment
 - Machines for forestry and agricultural purposes
 - Municipal trucks



Nomenclature:	Directly Prop. directional spool valves as per load-sensing principle
Version:	Valve bank in series connection
Actuation:	solenoid-actuated
p _{max} •	320 bar
Q _{max, consumer} •	3 ... 40 l/min
Q _{pu max} •	Approx. 80 l/min

Design and order coding example

EDL

- DA2

L

40/25

E

/2

- G24

Solenoid voltage

12V DC, 24V DC

▪ Actuated via prop. amplifier or PLVC

Ancillary blocks

Confirmation

Type E, EI

Volumetric flow

Volumetric flow indicator, side A, B (3...40)

Spool

Type L, H

Spool block

Block with input controller

Basic type

Type EDL Directly actuated prop. directional spool valve

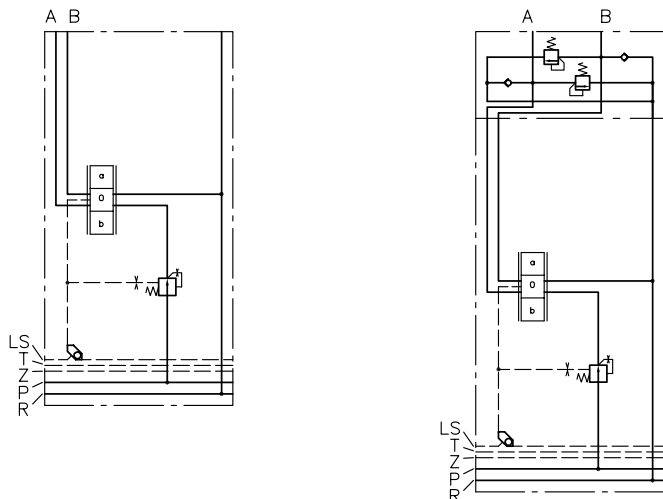
Function

Valve sections:

Circuit symbol



Versions of valve sections:



Additional functions in the ancillary block:

- Shock and servo-suction valves
- Load-holding valves
- Check valves with release, no leakage
- Floating and block functions can be switched

Characteristic values for max. volumetric flows:

	Q _{A, B}				
Size 2	3	6	10	25	40

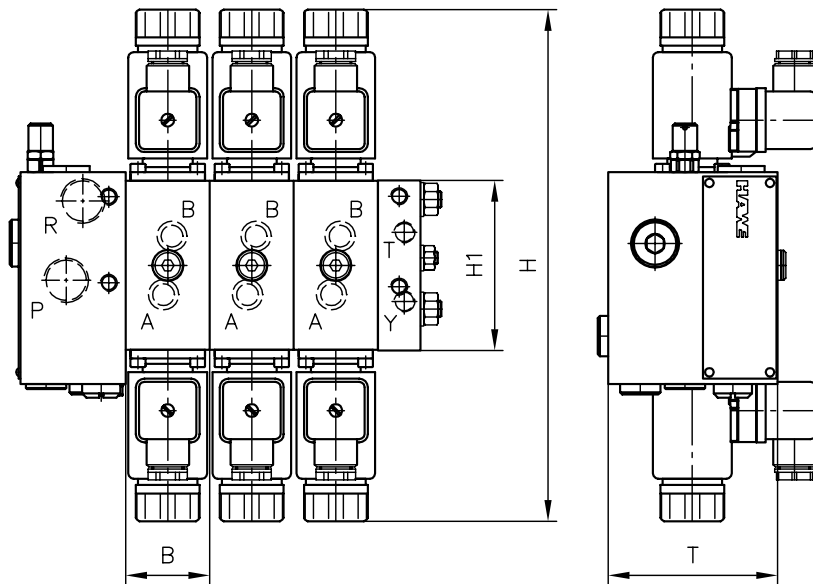
- Characteristic value corresponds to the max. volumetric flow [lpm] of input controller versions at the consumer ports A and/or B
- Volumetric flows for A and/or B can be selected separately

Actuations:

Basic type	Brief description	Circuit symbol (example)
E	Electromagnetic with stroke limitation	
EI	Electromagnetic without stroke limitation	

General parameters and dimensions

PSL/EDL

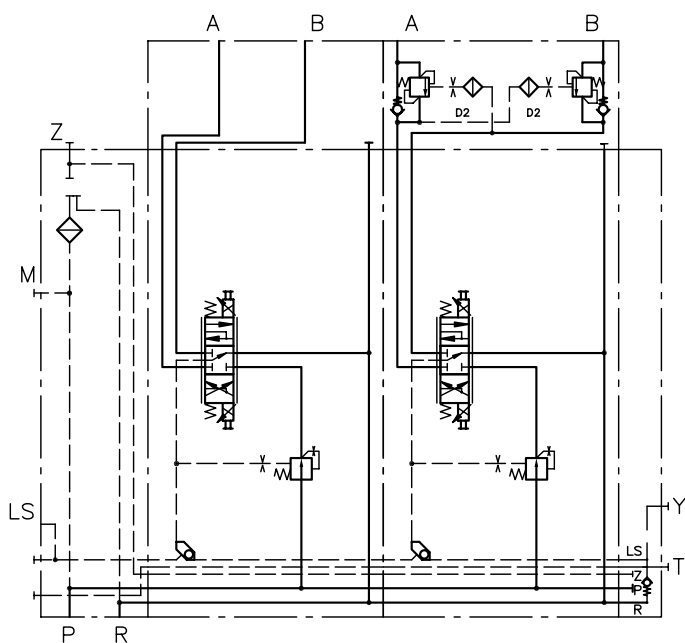


	Flow [lpm]		Oper. pressure [bar]	Ports (BSPP)		Dimensions [mm]				m [kg]
	Q_{\max}	$Q_{pu \max}$	p_{\max}	P, R	A, B	H	H1	B	T	Per valve section ¹⁾
EDL	3 ... 40	80	320	G 1/2, 3/4-16 UNF-2B	G 3/8, 3/4-16 UNF-2B	Approx. 241	Approx. 80	40	64	1.8 ... 2.9

1) Dep. on actuation and additional functions

Example circuit:

PSV 3-2
 - DA2M40/25/E/2
 - DA2M25/16/E/24L-0-A4/210-B10-B4/210
 - E4
 -G24


Associated technical data sheets:

- [Proportional directional spool valve type EDL: D 8086](#)
- [Proportional directional spool valve, type PSL and PSV size 2: D 7700-2](#)
- [Proportional directional spool valve, type PSL, PSM and PSV size 3: D 7700-3](#)
- [Proportional directional spool valve, type PSL, PSM and PSV size 5: D 7700-5](#)
- [Connection block type HMPL and HMPV for proportional directional spool valve: D 7700 H](#)

Directional spool valve

3.1

Directional spool valve bank type DL

Throttling directional spool valves are a type of directional valve. They continuously and manually meter the volumetric flow in hydraulic systems with single and double-acting consumers.

The throttling directional spool valve type DL influences the speed of the consumer by throttling the pump circulation via a parallel circuit (bypass control). The close fit of the spool in the throttling directional spool valve means that the leakage is limited to a minimum for lifting functions.

The throttling directional spool valve type DL is suitable for applications in material handling and for lifting equipment.

Features and benefits:

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

Intended applications:

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



Nomenclature:	Throttling directional spool valve
Design:	Valve bank, featuring integrated by-pass idle pump circulation
Actuation:	Manual: <ul style="list-style-type: none">▪ Spring return, detent
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
							<ul style="list-style-type: none">▪ Directional spool valve▪ Valve section options:<ul style="list-style-type: none">▪ Intermediate plate with pressure-limiting valve for all downstream valve sections▪ Additional functions on the consumer side in the ancillary block (e.g. double check valves, shock valves, load-holding valves etc.) (size 3)
							Port size
							G 1/4, G 3/8, G 1/2 (BSPP)
							Connection block
							<ul style="list-style-type: none">▪ With/without pressure limiting valve▪ With shock valve
							Basic type, size
							Type DL, sizes 1 to 4

Function

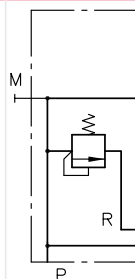
Connection blocks:

DL .5



Without pressure-limiting valve

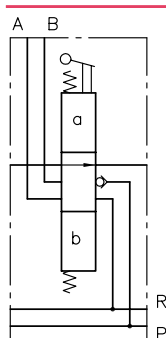
DL .1



With pressure-limiting valve

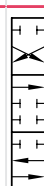
Valve sections:

Basic symbol



Symbol

G and B



D



E



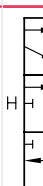
N



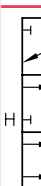
R



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.)
- 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

End plates:

2

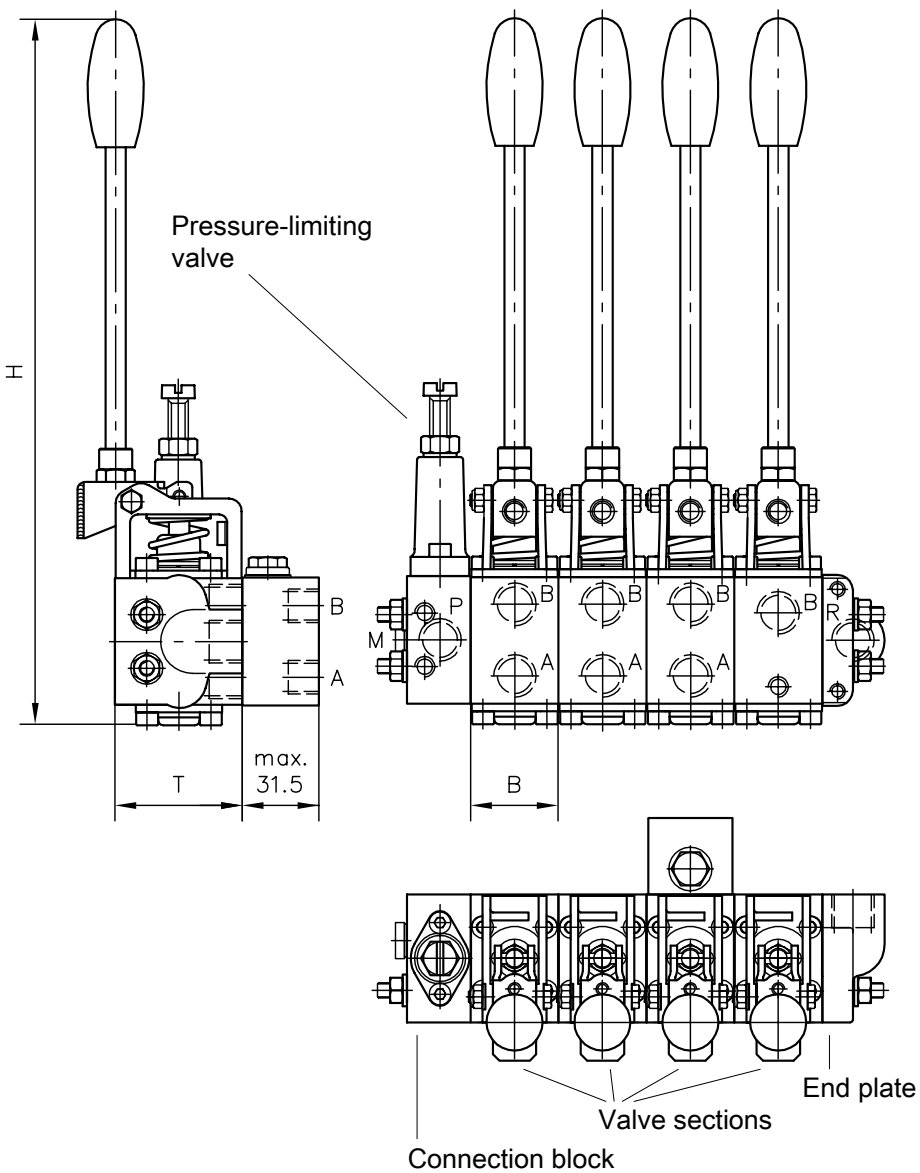


Standard end plate with port R

3



End plate for subsequent connection of a DL



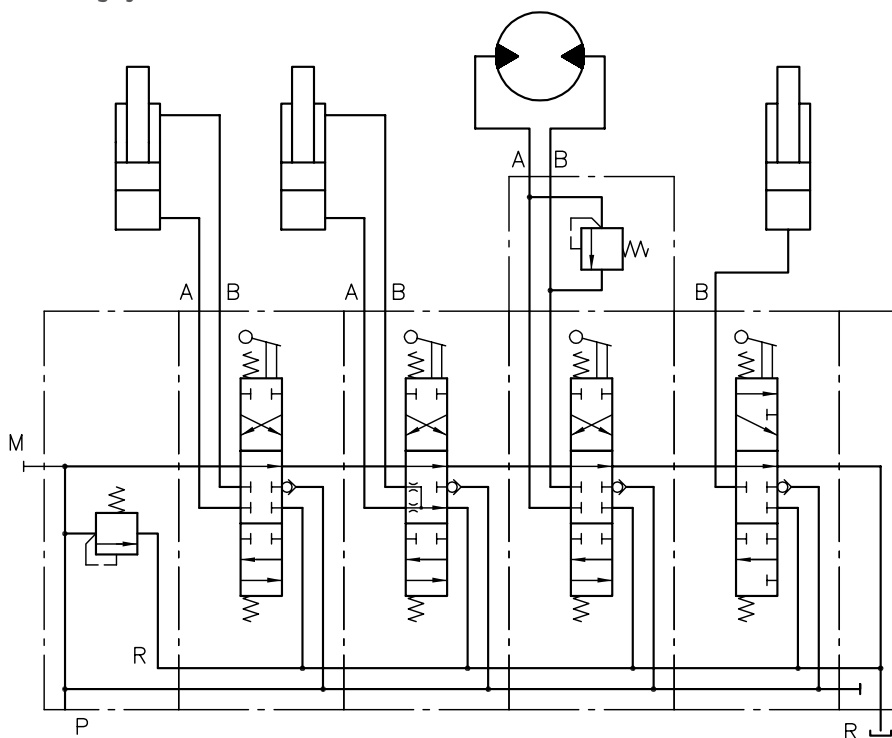
	Q _{max} [lpm]	p _{max} [bar]	Tapped ports			Dimensions [mm]			m [kg]
			Characteristic value	A, B	H, P, R	H	B	T	
DL 1	12 ... 16	315	1	G 1/4	G 1/4	approx. 192	31,5	45	0,5
DL 2	20 ... 30	315	1	G 1/4	G 3/8	approx. 278	34,5	50	0,85
			2	G 3/8	G 3/8				
DL 3	30 ... 60	250	2	G 3/8	G 1/2	approx. 351	39,5	60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

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)

Switching symbol



Associated technical data sheets:

- [Directional spool valve bank type DL: D 7260](#)

Directional spool valves

3.1 Proportional directional spool valves type PSL and PSV

Proportional directional spool valves are a type of directional valve. They control the direction of movement and the velocity of individual or multiple hydraulic consumers actuated simultaneously. Control is independent of the load and continuous. The proportional directional spool valve type PSL is suitable for constant pump systems and type PSV for control pump systems with a pressure/flow controller. The volumetric flows and load pressures for the individual consumers can be individually adjusted. The proportional directional spool valve type PSL and PSV can be adapted to various control tasks, e.g. for safety functions. All sizes can be combined with each other. The proportional directional spool valve type PSL and PSV is used in mobile hydraulics, in particular in crane and lifting equipment, construction and mining machinery, drilling equipment as well as in offshore and marine technology.

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:

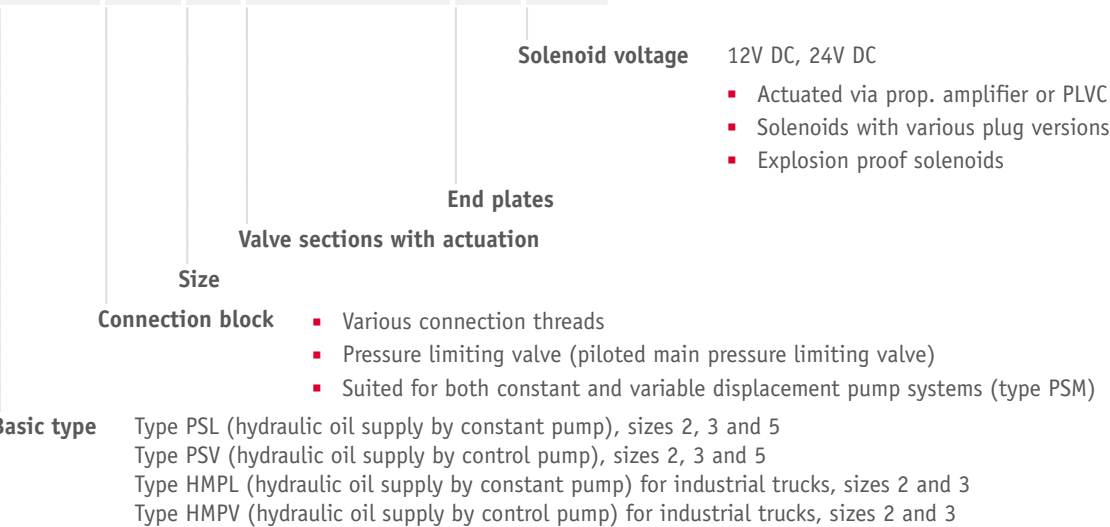
- Construction/construction material machinery
- Mining machinery (incl. oil production)
- Cranes and lifting equipment
- Machines for forestry and agricultural purposes



Nomenclature:	Prop. directional spool valves as per load-sensing principle
Version:	Valve bank in series connection
Actuation:	Manual <ul style="list-style-type: none">▪ Return spring▪ Detent Electro-hydraulic Pressure-actuated <ul style="list-style-type: none">▪ Hydraulic▪ Pneumatic
p _{max} †	400 ... 420 bar
Q _{max. consumer} †	3 ... 240 lpm
Q _{pu max} †	approx. 300 lpm

Design and order coding example

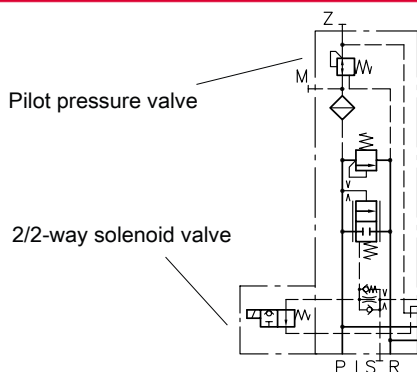
PSL41F /380 - 3 - A2J40/40/EA/3 - E4 - G24



Function

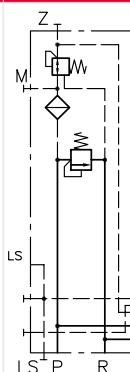
Connection blocks:

PSL



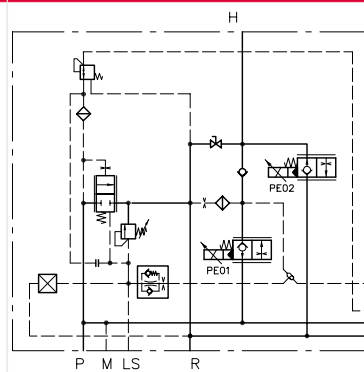
Connection block for constant pump systems with integrated 3-way controller, pressure-limiting valve and LS shutdown

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:

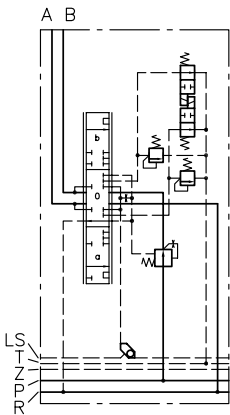
Basic symbols

Circuit symbol

	L	M	F	H	J	B	R	O	G

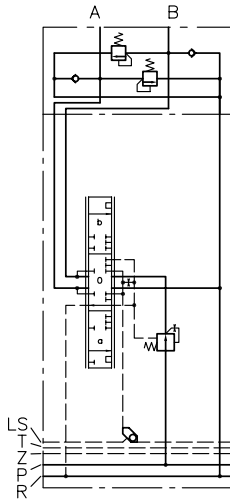
Versions of valve sections:

- 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
- Version with direct CAN actuation



Additional functions in the ancillary block:

- Shock and servo-suction valves
- Load-holding valves
- Differential circuits
- Check valves with release, zero-leakage
- Floating and block functions can be switched
- Proportional seated valves in accordance with [D 7490/1](#) for lifting and lowering functions with 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.
- Version with 2-way input controller and check valve function, or damping elements


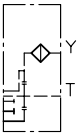
Actuations:

Basic type	Brief description	Circuit symbol (example)
A	Manual actuation	 Combination of electro-hydraulic and manual actuation
C	Detent (continuous)	
K	Manual actuation via mechanical joystick	
E EA EI CAN EA CAN	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:

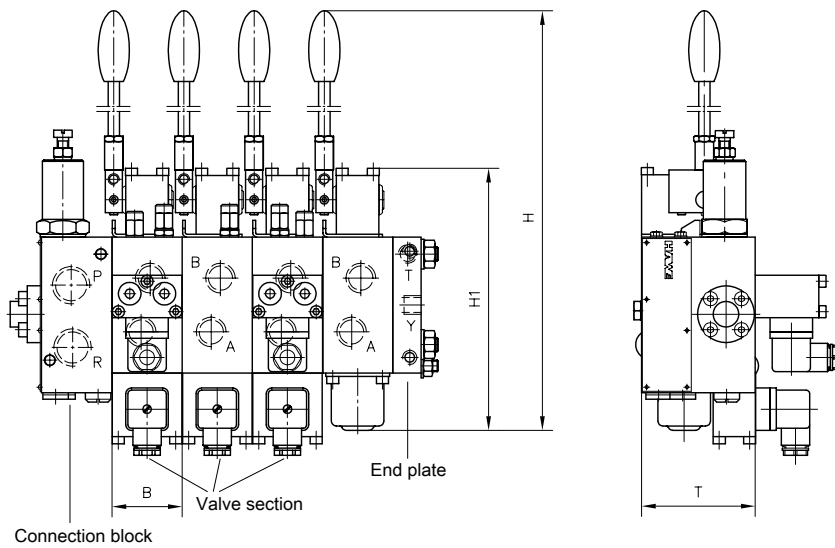
E1	E2
 Standard end plate	 With additional Y-port for LS-input signal

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

General parameters and dimensions

PSL

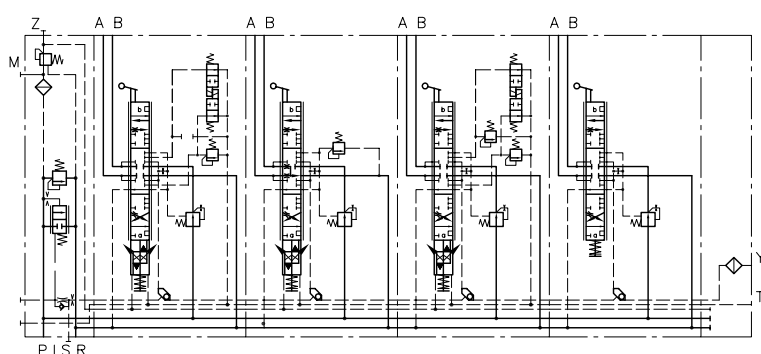


	Flow [lpm]		Oper. pressure [bar]	Ports (BSPP)		Dimensions [mm]				m [kg]
	Q_{max}	$Q_{pu\ max}$	p_{max}	P, R	A, B	H	H1	B	T	Per valve section ¹⁾
PSL/PSV 2	3 ... 54	80	420	G 1/2, 3/4-16 UNF-2B	G 3/8, 3/4-16 UNF-2B	approx. 272	approx. 150	40	60	1.8 ... 2.9
PSL/PSV 3	3 ... 120	200	420	G 1/2, G 3/4, G 1, 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) - Circuit 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)



Products suitable for combination:

- Load-holding valves type LHT, LHDV: [Page 206](#)
- Joystick: [Proportional pressure-reducing valve type KFB 01: D 6600-01](#)

Additional electrical components:

- Proportional amplifier: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)
- CAN node type CAN-IO: [Page 284](#)
- Other electronic accessories [See "Electronics"](#)

Associated technical data sheets:

- [Proportional directional spool valve, type PSL and PSV size 2: D 7700-2](#)
- [Proportional directional spool valve, type PSL, PSM and PSV size 3: D 7700-3](#)
- [Proportional directional spool valve, type PSL, PSM and PSV size 5: D 7700-5](#)
- [CAN Actuation for proportional directional spool valves type PSL/PSV: D 7700 CAN](#)

Associated technical data sheets:

- [Connection block type HMPL and HMPV for proportional directional spool valve: D 7700 H](#)
- [Proportional directional spool valve type EDL: D 8086](#)

Directional spool valve

3.1

Proportional directional spool valve type PSLF, PSLV and SLF

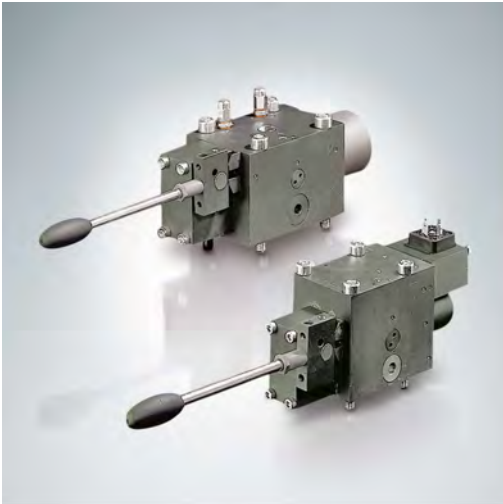
Proportional directional spool valves are a type of directional valve. They control the direction of movement and the velocity of individual or multiple hydraulic consumers actuated simultaneously. Control is independent of the load and continuous. The proportional directional spool valve type PSLF is suitable for constant pump systems and type PSVF for control pump systems with a pressure/flow controller. The proportional directional spool valve type PSLF and PSVF is available as an individual manifold mounting valve or in the valve bank. The volumetric flows and load pressures for the individual consumers can be individually adjusted. The directional spool valve can be adapted to different control tasks. Connections on the rear permit easy access to the valve for servicing, even in tight installation spaces. All sizes can be combined with each other. The proportional directional spool valve type PSLF and PSVF is used in mobile hydraulics, in particular in crane and lifting equipment, construction and mining machinery, drilling equipment as well as in offshore and marine technology.

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
- Cranes and lifting equipment
- Offshore and marine technology
- Mining machinery



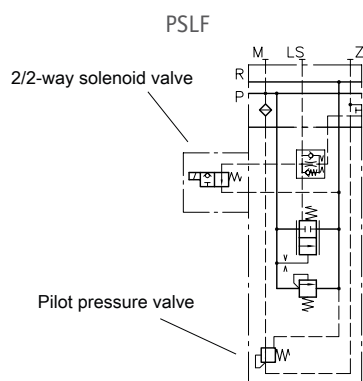
Nomen-clature:	Prop. directional spool valve acc. to the Load-Sensing principle
Design:	Individual manifold mounting valve Valve bank via individual manifold mounting valves
Actuation:	Manual <ul style="list-style-type: none">▪ Return spring▪ Detent Electro-hydraulic Pressure <ul style="list-style-type: none">▪ Hydraulic▪ Pneumatic
p _{max} •	400 ... 420 bar
Q _{max, consumer} •	3 ... 500 lpm
Q _{pu max} •	approx. 1000 lpm

Design and order coding example

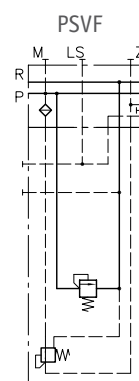
PSLF	A1/380/4	- 3	- A2J40/40/EA/3	- E2	- G24	
						Solenoid voltage 12V DC, 24V DC <ul style="list-style-type: none"> Operated using a proportional amplifier or PLVC Magnets with different plug versions Explosion-proof magnets
						End plates
						Valve sections with actuation
						Size
						Connection block <ul style="list-style-type: none"> Various connection threads 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:



Connection block for constant pump systems with integrated 3-way controller, pressure-limiting valve and LS shutdown



Connection block for control pump systems with and 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
- Proportional adjustable pressure limitation

Valve sections:

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

Coding for max. consumer flow:

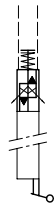
	Q _{A, B}							
Size 3	3	6	10	16	25	40	63	80
Size 5	16	25	40	63	80	120	160	
Size 7	120	160	250	320	400			

- Key figure corresponds to the max. volumetric flow (lpm) at the consumer ports A and/or B of input controller versions
- Volumetric flows for A and/or B can be selected individually
- Increasing the control pressure enables 60 lpm (size 2), 120 lpm (size 3), 240 l/min (size 5) and 500 l/min (size 7) per consumer port side.
- Version with 2-way input controller and check valve function



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)
- Proportional pressure limitation of individual functions
- Sub-plates with different additional functions
- Sub-plates for ancillary blocks
- Sub-plates for a combination of different sizes
- 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

Actuations:

Basic type	Brief description	Symbol (example)
A	Manual actuation	 <p>For combination of electro-hydraulic and manual actuation</p>
C	Detent (stepless)	
E	Electro-hydraulic actuation	
EA	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:

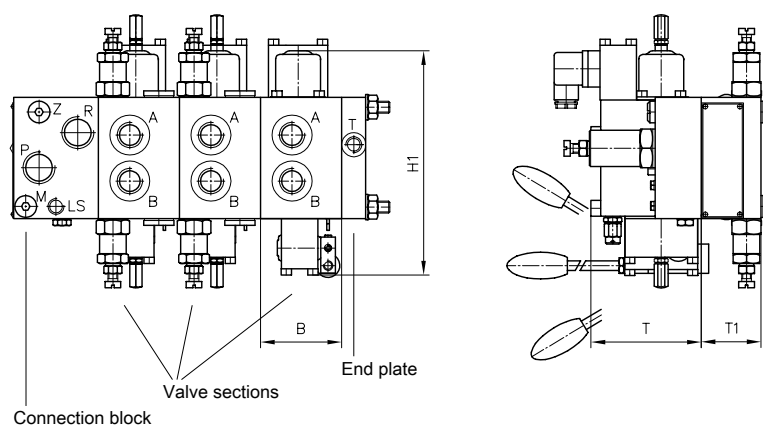
E1	E2
 <p>End plate (std.)</p>	 <p>With additional Y-port for LS-input signal</p>

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)

General parameters and dimensions

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"	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 1/4"	approx. 305	106	101	95	13	23

1) Per valve section depending on actuation and additional functions

2) Per valve section complete with sub-plate

Products suitable for combination:

- Load-holding valves type LHT, LHDV: [Page 206](#)
- Joystick: [Proportional pressure-reducing valve type KFB 01: D 6600-01](#)

Additional electrical components:

- Proportional amplifier: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)
- CAN node type CAN-I/O: [Page 284](#)
- Other electronic accessories [See "Electronics"](#)

Associated technical data sheets:

- Prop. directional spool valve type PSLF/PSVF: [Page 112](#)

Directional spool valve

3.1 Clamping module type NSMD

Clamping modules combine a directional spool valve, pressure reducing valve and pressure switch.

The clamping module type NSMD has the standard connection pattern nominal size NG 6. It controls force-actuated clamping devices, e.g. hydraulically actuated hollow and solid clamping cylinders for automatic lathes. The device is used to clamp and release a clamping cylinder. It regulates the clamping pressure and monitors it. The clamping pressure is adjusted at the downstream pressure switch using a manual, mechanical or electrical-proportional adjustment device. A special safety circuit monitors the switching position of the valve.

Throttling options in the spool end position and/or rapid and creeping movements are possible as an additional function for one or both consumer ports. The clamping module type NSMD can be combined with other valves as a valve bank type BA to form a valve block.

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.)



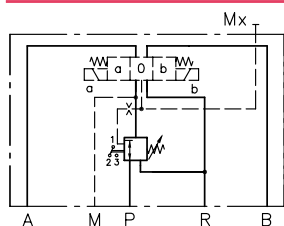
Nomenclature:	Valve combination consisting of: <ul style="list-style-type: none">▪ Directional spool valve (4/3-, 4/2-way function)▪ Pressure reducing valve with tracked pressure switch
Design:	Individual valve for manifold mounting (Valve banks with sub-plates type BA are available)
Actuation:	Solenoid
p_{max}:	120 bar
Q_{max}:	25 lpm

Design and order coding example

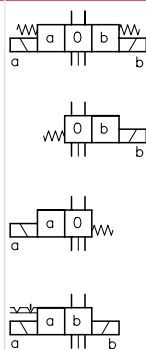
NSMD 2	D1	60	R	- G24
				Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC Solenoids with various plug versions
				Means of adjustment for the clamping pressure <ul style="list-style-type: none">▪ Slotted head screw + hexagon nut▪ Wing screw + wing nut▪ Lockable turning handle▪ Electro-proportional adjustment with/without additional function monitoring
				Additional functions <ul style="list-style-type: none">▪ Throttle▪ Rapid and creeping movement (one or both directions)
				Function <ul style="list-style-type: none">▪ 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



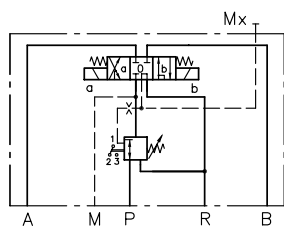
Symbols

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

Further functions:

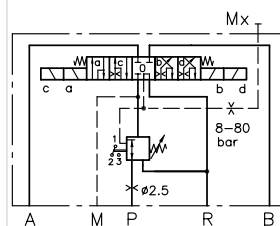
G1/MD

Pressure reducing function and throttle in switching positions a and b



G/MM6

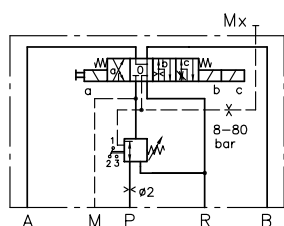
Rapid traverse and creeping in both directions



G/MMDA7

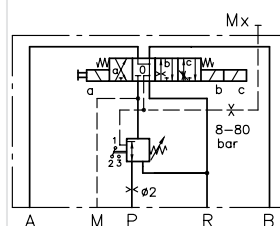
Rapid traverse and creeping in one direction featuring also a limitation for rapid traverse (switching position a, c) rapid traverse in opposing direction (switching position b)

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

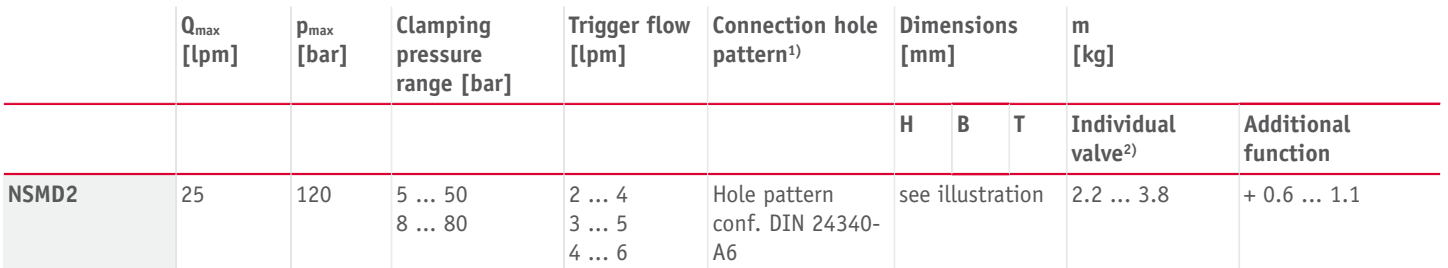


G/MMA7

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



NSMD2 K...



- 1) Fix points: 1/3
- 2) Depending on circuit symbol and actuation type

Circuit example:
NSMD2K/M/GDK/B2,5-G24

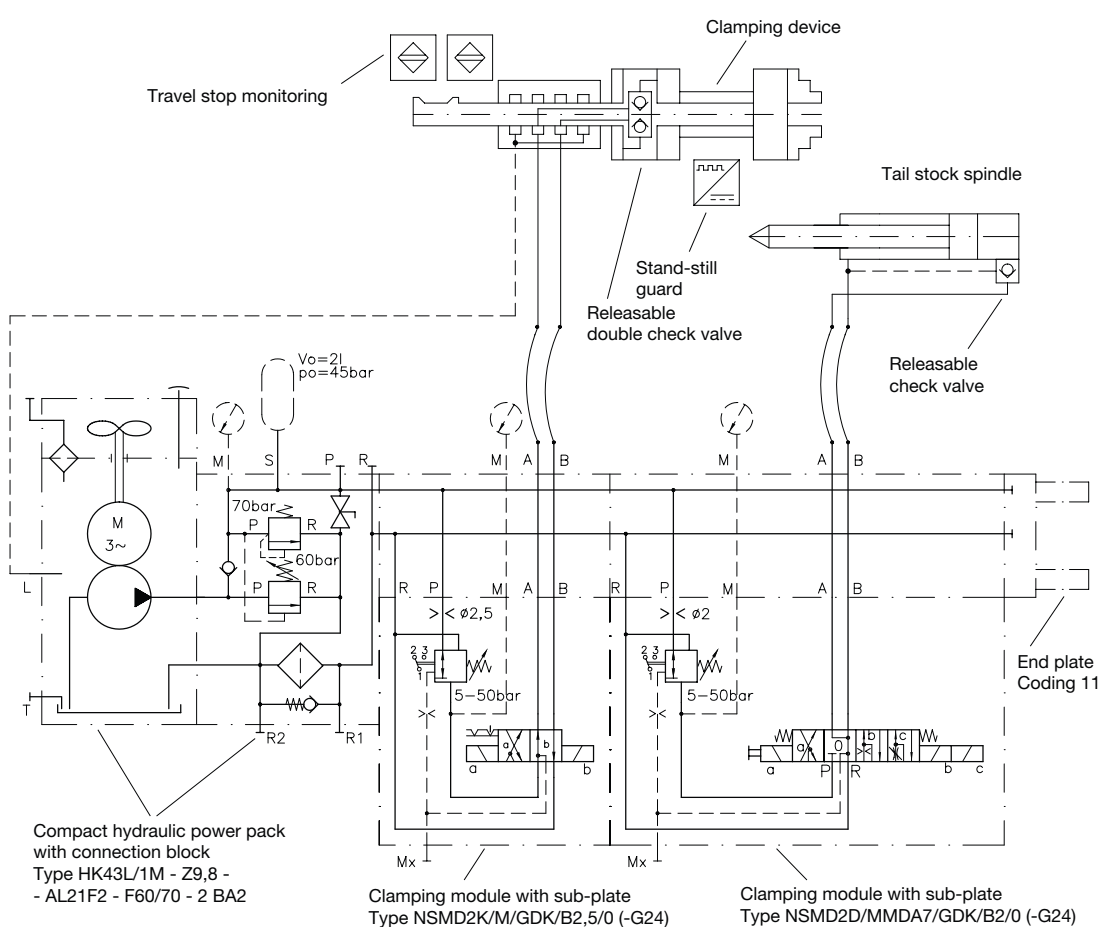
Clamping module type NSMD size 2 with industrial standard (DIN 24340-A6) connection hole pattern, flow pattern symbol K, detented version, clamping pressure range G, 5-50 bar and min. operational flow 2-4 lpm. The actuation for the adjustment of the clamping pressure and tracked pressure switch takes place by means of wing screw and wing nut. An orifice ΔE 2.5 mm is installed in the P gallery, solenoid voltage 24V DC

NSMD2G1/MD/E4VK/B1-G12

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 ΔE 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 module type NSMD: [D 7787](#)

Products:

- Directional valves type NSWP2: [Page 88](#)
- Directional seated valves type NBVP16: [Page 146](#)

Plates:

- Valve banks type BA2: [Page 70](#)
- Intermediate plate type NZP: [D 7788 Z](#)

Plugs:

- Line connector type MSD and others: [D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

3.2 Directional seated valves

Directional seated valve type G, WG and others	126
Valve bank (directional seated valve) type VB	132
Directional seated valve type WN and WH	136
Valve bank (directional seated valve) type BWN and BWH	138
Directional seated valve type EM and EMP	142
Directional seated valve type BVG, BVP and NBVP	146
Directional seated valve type BVE	150
Directional seated valve type VP	152
Lifting/lowering valve type HSV	154
Switch unit type CR	156
Lifting module type HMT and HST	158
Directional seated valve type VH, VHR, and VHP	162
Directional seated valve type VZP	164



*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} (bar)	Q _{max} (lpm)
G, WG and Others	Directional seated valve with various actuations <ul style="list-style-type: none"> Individual valve for manifold mounting 	- Solenoid - Pressure - Manual	0: 500 1: 700 2: 700 3: 400 4: 350	0: 6 1: 12 2: 25 3: 65 4: 120
VB	Directional seated valve, zero leakage, valve bank <ul style="list-style-type: none"> For pipe connection For combination with hydraulic power packs 	- Solenoid - Pressure - Manual	01: 500 11: 700 21: 700 31: 400 41: 350	01: 6 11: 12 21: 25 31: 60 41: 120
WN, WH	Directional seated valve, zero leakage, individual valve <ul style="list-style-type: none"> Individual valve for manifold mounting Combination with connection block for pipe connection 	- Solenoid	WN - 1: 350 WH - 1: 450 WH - 2, 3, 4: 350	WN - 1: 5 WH - 1: 8 WH - 2: 15 WH - 3: 30 WH - 4: 60
BWH, BWN	Directional seated valve, zero leakage, valve bank <ul style="list-style-type: none"> For pipe connection For combination with hydraulic power packs 	- Solenoid	BWN - 1: 350 BWH - 1: 450 BWH - 2, 3: 315	BWN - 1: 5 BWH - 1: 8 BWH - 2: 15 BWH - 3: 30
VZP	Directional seated valve, zero leakage, individual valve <ul style="list-style-type: none"> Individual valve for manifold mounting 	- Solenoid	450	15
EM, EMP	Directional seated valve, zero leakage, individual valve <ul style="list-style-type: none"> Screw-in valve Combination with connection block for pipe connection Combination with connection block for swivel fitting 	- Solenoid	EM - 1: 450 EM - 2: 400 EM - 3: 400 EM - 4: 350 EMP - 2: 400 EMP - 3: 400 EMP - 4: 350	EM - 1: 20 EM - 2: 40 EM - 3: 80 EM - 4: 160 EMP - 2: 40 EMP - 3: 80 EMP - 4: 160
BVG, BVP, NBVP	Directional seated valve, zero leakage, individual valve <ul style="list-style-type: none"> For pipe connection Individual valve for manifold mounting 	- Solenoid - Hydraulic - Pneumatic - Manual	400	20
BVE	Directional seated valve, zero leakage, individual valve <ul style="list-style-type: none"> Screw-in valve Combination with connection block for pipe connection Combination with connection block for manifold mounting 	- Solenoid	1: 500 3: 400 5: 400	1: 20 3: 70 5: 300

Type	Nomenclature/Design	Actuation	p _{max} (bar)	Q _{max} (lpm)
VP	Directional seated valve, zero leakage, individual valve <ul style="list-style-type: none"> Individual valve for manifold mounting 	<ul style="list-style-type: none"> - Solenoid - Hydraulic - Pneumatic 	400	15

Valve combinations

Type	Nomenclature/Design	Actuation	p _{max} (bar)	Q _{max} (lpm)
HSV	<ul style="list-style-type: none"> Individual valve for pipe connection 	- Solenoid	21: 315 22: 315 61: 350 71: 400	21: 20 22: 30 61: 60 71: 120
CR	<ul style="list-style-type: none"> Individual valve for pipe connection 	- Solenoid - Manual	HP/LP: 400/60	HP/LP: 4: 8/80 5: 20/160
HMT, HST	<ul style="list-style-type: none"> Valve bank 	- Solenoid	315	HST - 2: 40 HST - 3: 80 HMT - 3: 90

Manually actuated seated valves

Type	Nomenclature/Design	Actuation	p _{max} (bar)	Q _{max} (lpm)
VH, VHR, VHP	Directional seated valve, zero leakage	- Manual	VH, VHR, VHP - 1: 700	VH, VHR, VHP - 1: 12
	<ul style="list-style-type: none"> ▪ Individual valve for pipe connection ▪ Individual valve for manifold mounting ▪ Valve bank 		VH, VHR - 2: 500	VH, VHR - 2: 25

Directional seated valves

3.2

Directional seated valve type G, WG and others

Directional seated valves are a type of directional valve. As ball valves they have zero leakage in the closed state.

The directional seated valve type G, WG, H, P, K, T and D is available as a 2/2, 3/2, 4/2, 3/3 and 4/3 directional seated valve with different actuation types. Actuation using a hand lever enables switchable pressures of up to 700 bar.

Appropriate connection blocks make possible direct pipe connection. The directional seated valves are available as a combination of valves in a 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

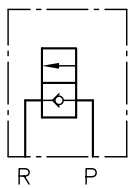
Design and order coding example

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: <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Size 1 also available with industrial connection hole pattern NG 6 (CETOP), type NG
					Function <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Solenoid (G, WG) Hydraulic (H) Pneumatic (P) Mechanical (K, T, F, D)

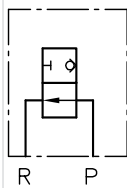
Function

2/2-way directional valve

R2

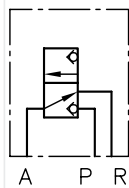


S2

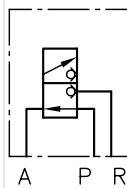


3/2-way directional valve

3

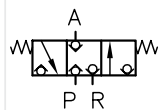


Z3



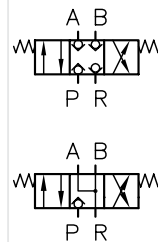
3/3-way directional valve

21, 39



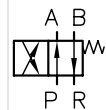
4/3-way directional valve

22, 48, 49

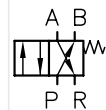


4/2-way directional valve

4

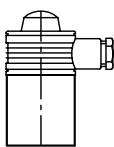
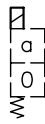
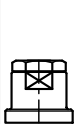
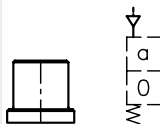
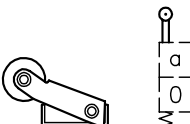
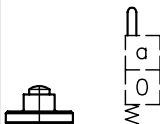
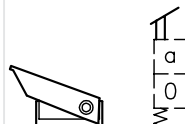
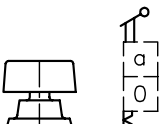


Z4



- 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

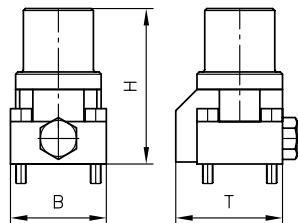
Actuation:

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 $p_{\text{contr. max}}$ [bar]:		Shifting force [N]:		Shifting force [N]:		Shifting torque [Ncm]:					
		400... 700		15		25... 80		51... 20		25... 80		45... 98	
		Control pressure $p_{\text{contr. min}}$ [bar]:		Shifting travel [mm]:		Shifting travel [mm]:		20.5... 45					
		9... 16		2.5... 4		10.5... 30		4 and 5					

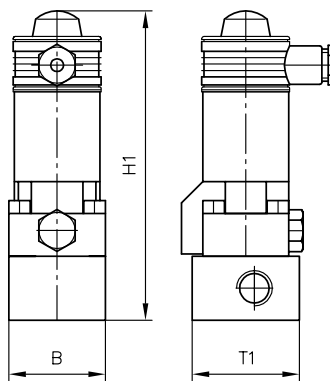
- Valve with solenoid actuation also available in ATEX-compliant version (24V DC)

General parameters and dimensions

Individual valve



Valve with connection block



Size	Dimensions						m_{\max} [kg]
	H_{\max}	$H1_{\max}$	B		T_{\max}	T1	
			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

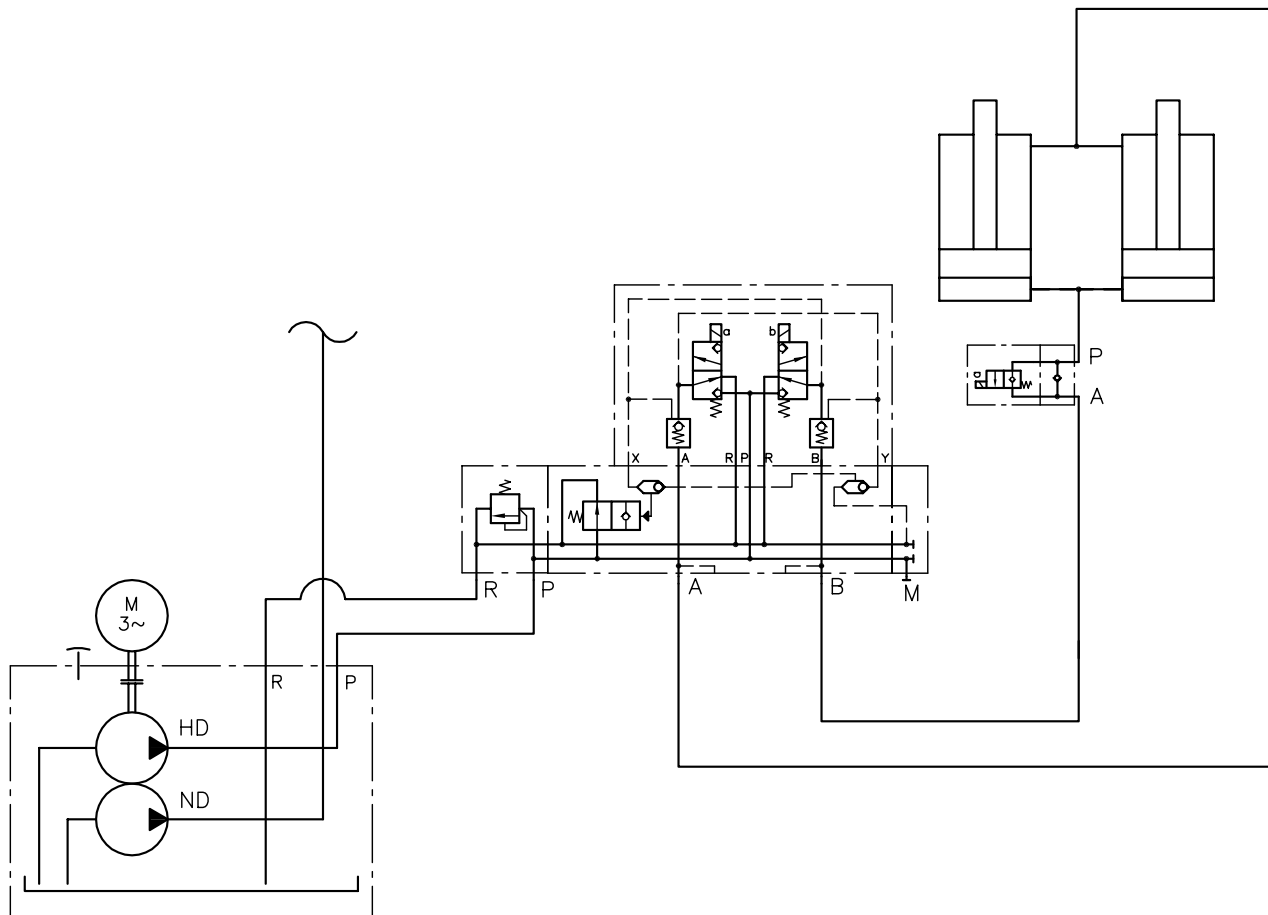
Size	Q_{\max} [lpm]	p_{\max} [bar]		Pressure		Mechanical		Manual		Ports (BSPP)
		G	WG	H	P	K	T	F	D	P, R, A, B
0	6	300... 500		500	-	-		-	500	G 1/4
12	12	350... 500 (700)		500... 700		400... 700		400... 700		G 1/4 and G 3/8
2, 22	25	350... 500 (700)		500		400... 500		400... 500		G 3/8 and G 1/2
3	65	350... 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 valve type G, WG and others: D 7300](#)
- [Directional seated valve type NG, NGW and others: D 7300 N](#)
- [Directional seated valve type G, WG and others with lift monitoring: D 7300 H](#)

Valve banks:

- Valve banks type VB: [Page 132](#)

Plugs:

- [Line connector type MSD and others: D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

Directional seated valves

3.2

Valve bank (directional seated valve) type VB

A valve bank combines different valves for operating independent consumers. The valve bank type VB comprises several directional seated valves of type G, WG among others that are connected in parallel. The directional seated valves as ball valves have zero leakage in the closed state. They are attached to sub-plates. These sub-plates are clamped between the initial block (P and R port) and the end plate via tension rods. Pressure switches or pressure-limiting valves can be integrated into the pumps and/or consumer lines. 2/2 and 3/2- 4/2, 3/3 and 4/3 directional seated valves are available with different types of actuation. The valve bank can be attached directly to the compact hydraulic power pack.

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



Nomenclature:	Directional seated valve, zero leakage
Design:	Valve bank for pipe connection
Actuation:	Solenoid Pressure: Hydraulic, Pneumatic Manual: Hand lever, Turn knob
pmax:	500 ... 700 bar
Qmax:	6 ... 120 lpm

Design and order coding example

VB12

F

M

DCNR5

1

WG230

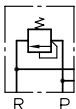



	Solenoid voltage	12V DC, 24V DC, 110V AC, 230V AC
	Port size	G 1/4 (1), G 3/8 (2), G 1/2 (3) (BSPP)
	Valve sections	Symbols: 2/2-way directional valve, 3/2-way directional valve, 3/3-way directional valve, 4/3-way directional valve, 4/2-way directional valve
	Valve section options	<ul style="list-style-type: none">▪ 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	<ul style="list-style-type: none">▪ 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	<ul style="list-style-type: none">▪ With pressure reduction for gallery P or throttle for port A (parallel connection)
	Actuation	
	Connection block/adapter plate	<ul style="list-style-type: none">▪ For pipe connection▪ For direct mounting at compact hydraulic power packs▪ For direct mounting at hydraulic power packs

Basic type, size

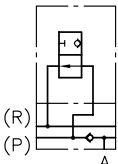
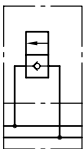
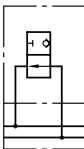
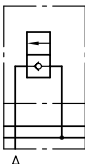
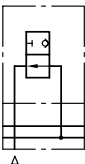
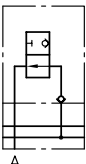
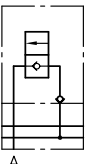
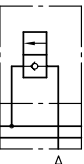
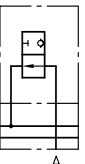
Type VB, size 01, 12, 21, 31, 41

Function

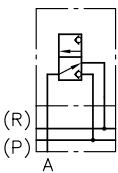
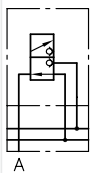
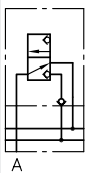
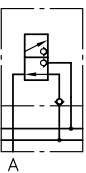
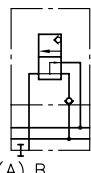
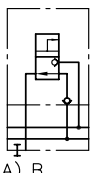
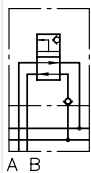
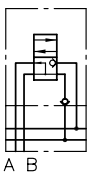
Connection blocks:

A -1/..	C, D, E	F	G
 <p>For pipe connection, with tool adjustable pressure limiting valve (/..- pressure specification in bar)</p>	 <p>For mounting onto hydraulic power packs type R, Z and RZ, depending on tank and size</p>	 <p>For mounting onto compact hydraulic power packs (type KA, HC, MP, MPN, HK)</p>	

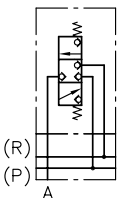
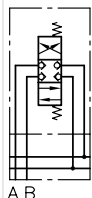
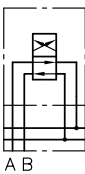
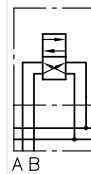
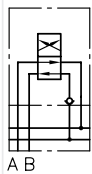
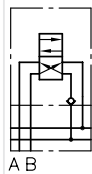
Valve sections:

A	D	F	B	C	E	Q	P	O
								

- A not for VB 01, VB 11 only with tapped ports G 1/4

H	L	N	R	Y	I	S	T
							

Simplified flow pattern



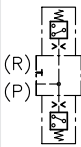
J, G39	G, G49	HX	LX	NX	RX
					

Simplified flow pattern

Simplified flow pattern

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

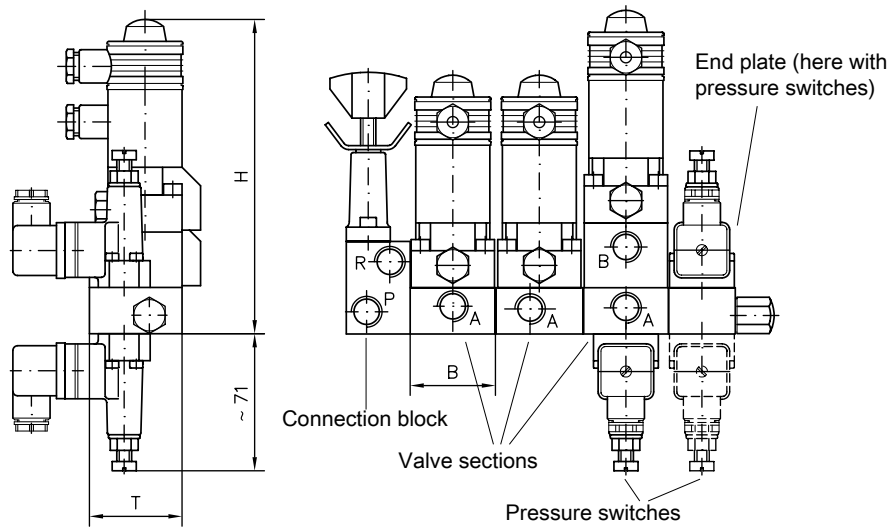
End plates:

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

- /2, /3 ... /65 only available for VB01 and VB11

General parameters and dimensions

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

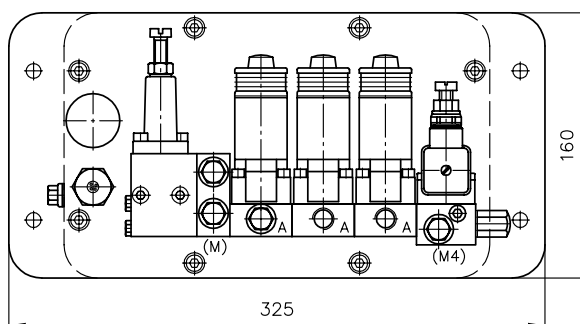
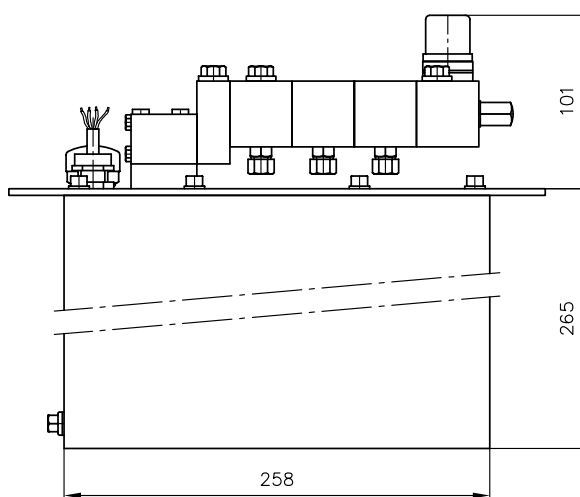
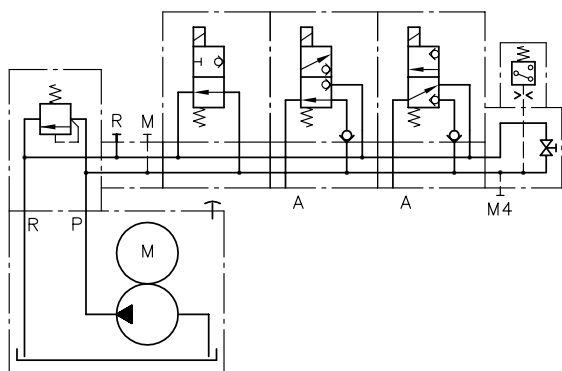
Compact hydraulic power pack type MP size 2, connection block with pressure limiting valve (tool adjustable)

- VB01FM - FRN/32 - 1 - WG230

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 54](#)
- Type HC, HCW, HCG: [Page 46](#)
- Type HK, HKF, HKL: [Page 58](#)
- Type NPC: [Page 44](#)
- Type KA, KAW: [Page 50](#)
- Connection blocks type A: [Page 68](#)

Suites hydraulic power packs:

- Type R: [Page 62](#)
- Type RZ: [Page 12](#)

Corresponding pamphlets (data sheets):

- Valve bank (directional seated valve) type VB: [D 7302](#)

Suited valves:

- Directional seated valves with various actuations: [Page 126](#)

Accessories:

- Pressure switches type DG 3., DG 5 E: [Page 272](#)
- Pressure reducing valves type CDK: [Page 188](#)

Plugs:

- Line connector type MSD and others: [D 7163](#)
- Economy circuit type MSD: [D 7813](#), [D 7833](#)

Directional seated valves

3.2 Directional seated valve type WN and WH

Directional seated valves are a type of directional valve. As ball valves they have zero leakage in the closed state.

The directional seated valves type WN and WH are valves for manifold mounting. 2/2 and 3/2 directional seated valves are available. These are also available combined as 3/3 and 4/3 directional seated valves. The type WH contains internal pressure relief. As a result the permissible operating pressure is higher than the type WN.

Appropriate connection blocks make possible direct pipe connection. The directional seated valves are available as a combination of valves in a valve bank type BWN and BWH.

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.

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



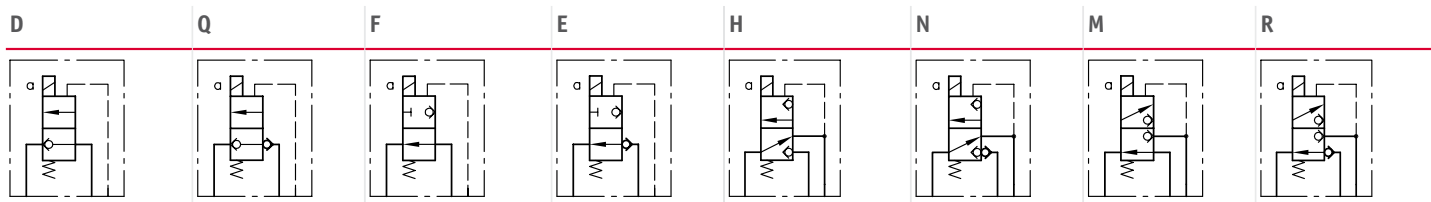
Nomenclature:	Directional seated valve, zero leakage
Design:	Individual valve, manifold mounting combination with connection blocks for pipe connection
Actuation:	Solenoid
p _{max} :	350 ... 450 bar
Q _{max} :	5 ... 60 lpm

Design and order coding example

WN1 H 1 - 1/4 - G24

	Solenoid voltage	12V DC, 24V DC, 110V AC, 230V AC <ul style="list-style-type: none">▪ Versions with M12-plug and 8-Watt solenoid
	Indiv. connection block	Port size G 1/4, G 3/8, G 1/2 (BSPP) <ul style="list-style-type: none">▪ By-pass check valve or pressure limiting valve between P and R
	Additional elements	<ul style="list-style-type: none">▪ Return pressure stop for port R▪ Check valve insert for port P▪ Pressure limiting valve
	Function	<ul style="list-style-type: none">▪ 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	

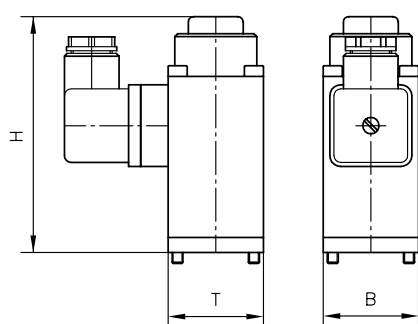
Function



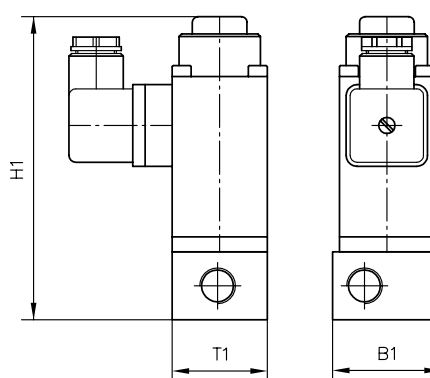
- Symbols show type WH
View type WH
- Type WN 1 without de-pressuring duct for the solenoid (add. leakage duct is not necessary)
Type WN1 without solenoid relief (no overflow oil line)

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	87	35	35	0.6	112	40	35	0.9
WH 1	8	450	G 1/4	87	35	35	0.6	112	40	35	0.9
WH 2	15	350	G 1/4	95.2 ... 101.7	35	35	0.65 ... 0.7	125.2 ... 131.7	40	40	1.0
WH 3	30	350	G 3/8	93.5 ... 103.5	45	45	1.2 ... 1.3	128.5 ... 138.5	50	50	1.8
WH 4	60	350	G 1/2	118 ... 133	60	60	2.7 ... 3.0	158 ... 173	70	70	3.6 ... 4.0

Associated technical data sheets:

- [Directional seated valve type WN and WH: D 7470 A/1](#)

Valve banks:

- Type BWN1, BWH: [Page 138](#)

Plugs:

- [Line connector type MSD and others: D 7163](#)
- With economy circuit: [D 7813](#), [Economy circuit type MSD 4 P55: D 7833](#)

Directional seated valves

3.2

Valve bank (directional seated valve) type BWN and BWH

A valve bank combines different valves for operating independent consumers.

The valve bank type BWN or BWH comprises several directional seated valves of type WN or WH that are connected in parallel. The directional seated valves as ball valves have zero leakage in the closed state. They are attached to sub-plates. These sub-plates are clamped between the initial block (P and R port) and the end plate via tension rods. Pressure switches or pressure-limiting valves can be integrated into the pumps and/or consumer lines.

2/2 and 3/2- directional seated valves . Combined these are also available as 3/3 and 4/3 directional seated valves. The valve bank can be attached directly to the compact hydraulic power pack.

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



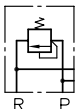


Nomenclature:	Directional seated valve, zero leakage
Design:	Valve bank <ul style="list-style-type: none">▪ For pipe connection▪ Combination with hydraulic power packs
Actuation:	Solenoid
p _{max} :	350 ... 450 bar
Q _{max} :	5 ... 60 lpm

Design and order coding example

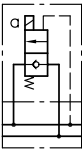
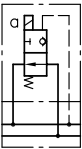
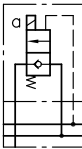
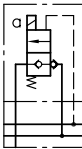
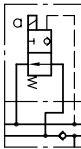
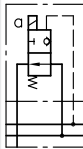
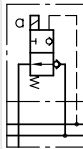
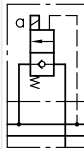
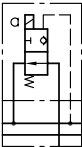
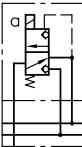
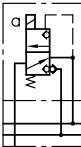
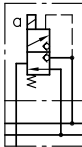
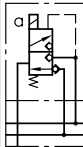
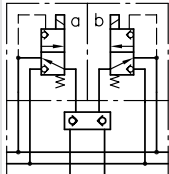
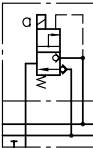
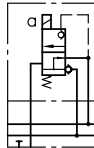
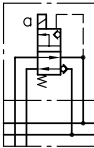
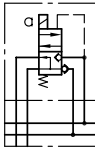
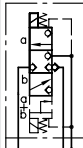
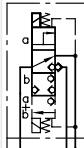
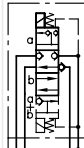
BWH2	A-1/300	- FH5N5	- 1	- 1	- G24
					Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC <ul style="list-style-type: none"> Versions with M12-plug and 8-Watt solenoid
					Port size G 1/4, G 3/8 (BSPP)
					End plate <ul style="list-style-type: none"> With one or two pressure switches With accumulator drain valve With additional pressure limiting valve in gallery P
					Valve sections <ul style="list-style-type: none"> Directional valves type WH or WN Valve section options: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> Pressure reducing valve Indiv. sub-plate with pressure switch Separation plate for gallery P
					Connection block/adaptor plates <ul style="list-style-type: none"> 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/adaptor plates:

A-1/...	C	F
 <p>For pipe connection, with tool adjustable pressure-limiting valve (/...- pressure specification in bar)</p>	 <p>For mounting onto hydraulic power packs</p>	 <p>For mounting on compact hydraulic power packs with connection block (type KA, HC, MP, MPN and HK)</p>



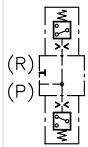
Valve sections:

D	F	B	Q	A	C	E	D
							
O	H	N	M	R	K		
							
I	Y	S	T	J	U	L	
							

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.

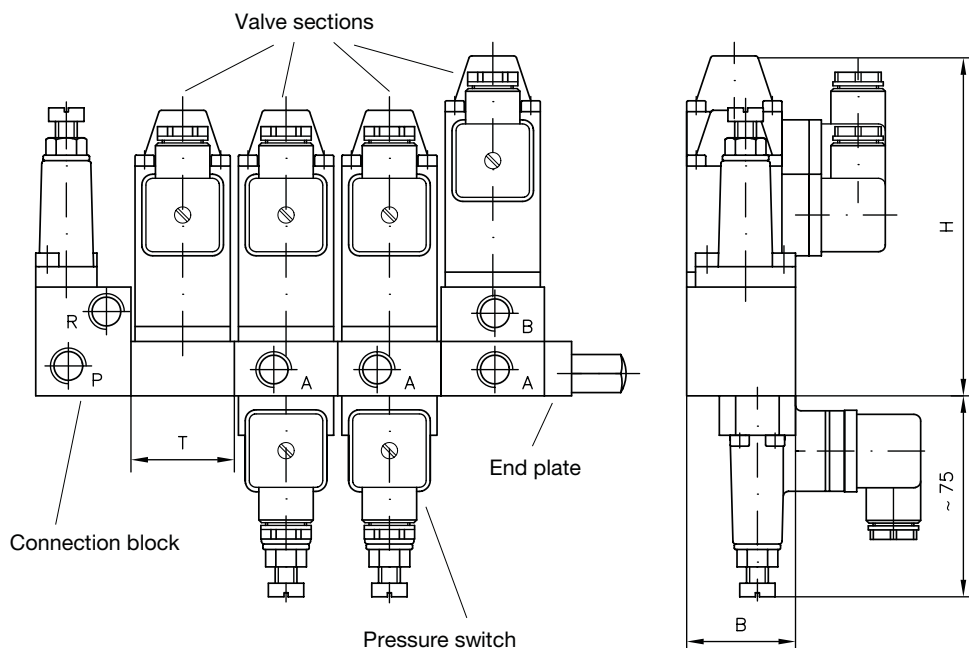
End plates:

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

General parameters and dimensions

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

- Weight m [kg] per individual element: + 0.3 kg per pressure switch fitted

Associated publications:

- Valve bank (directional seated valve) type BWN and BWH: [D 7470 B/1](#)
- Directional seated valve type WN and WH: [D 7470 A/1](#)

Connection block:

- Type A: [Page 68](#)

Compact hydraulic power packs:

- Type HC, HCW, HCG: [Page 46](#)
- Type HK, HKF, HKL: [Page 58](#)

- Type NPC: [Page 44](#)
- Type KA, KAW: [Page 50](#)

Hydraulic power packs:

- Type R: [Page 62](#)

Hydraulic accessories:

- Pressure switches type DG 3.., DG 5E: [Page 272](#)
- Pressure reducing valves type CDK: [Page 188](#)

Directional seated valves

3.2 Directional seated valve type EM and EMP

Directional seated valves are a type of directional valve. As cone valves they are tightly sealed without leakage in the closed state.

The directional seated valves type EM and EMP are screw-in valves. 2/2-way directional seated valves with direct or pilot-controlled electromagnetic actuation are available. The directional seated valve type EM is available as a switching valve or damped switching (soft-shift). Type EMP is a proportionally switching directional seated valve.

Appropriate connection blocks make possible direct pipe connection or manifold mounting. You can obtain additional components, e.g. a drain valve, bypass throttle valve, pressure switch or flow control valve.

Features and benefits:

- Zero leakage in blocked state
- Directly switching up to approx. 3 lpm and piloted up to 160 lpm
- Minimized flow resistance 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.

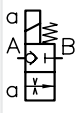
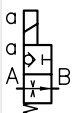
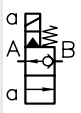
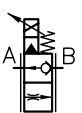
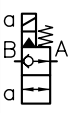
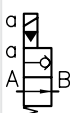
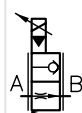
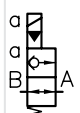


Nomenclature:	Directional seated valve, zero leakage
Design:	Screw-in valve Combination Combination with connection block for pipe connection Combination with connection block for swivel fitting Combination with connection block for manifold mounting
Actuation:	Solenoid
P _{max} :	450 bar
Q _{max} :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

Design and order coding example

EM 21	V	- 3/8	- G24
		Solenoid voltage	12V DC, 24V DC, 110V AC, 230V AC
		Connection blocks	Versions with <ul style="list-style-type: none">▪ 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		<ul style="list-style-type: none">▪ V - 2/2-way valve (NC-type)▪ S - 2/2-way valve (NO-type)
Basic type, size			<ul style="list-style-type: none">▪ Type EM: Switching valve, size 1 to 4▪ Type EMP: Prop. valve, size 1 to 4

Function

	Flow in arrowed direction	Arbitrary flow direction	Flow in arrowed direction	Arbitrary flow direction		
	Energized open		Energized closed			
Directly actuated	<div>EM .1 D</div> 		<div>EM .1 DS</div> 			
Pilot actuated	<div>EM .1 V</div> 	<div>EMP .1 V</div> 	<div>EM .2 V</div> 	<div>EM .1 S</div> 	<div>EMP .1 S</div> 	<div>EM .2 S</div> 

Example circuit:

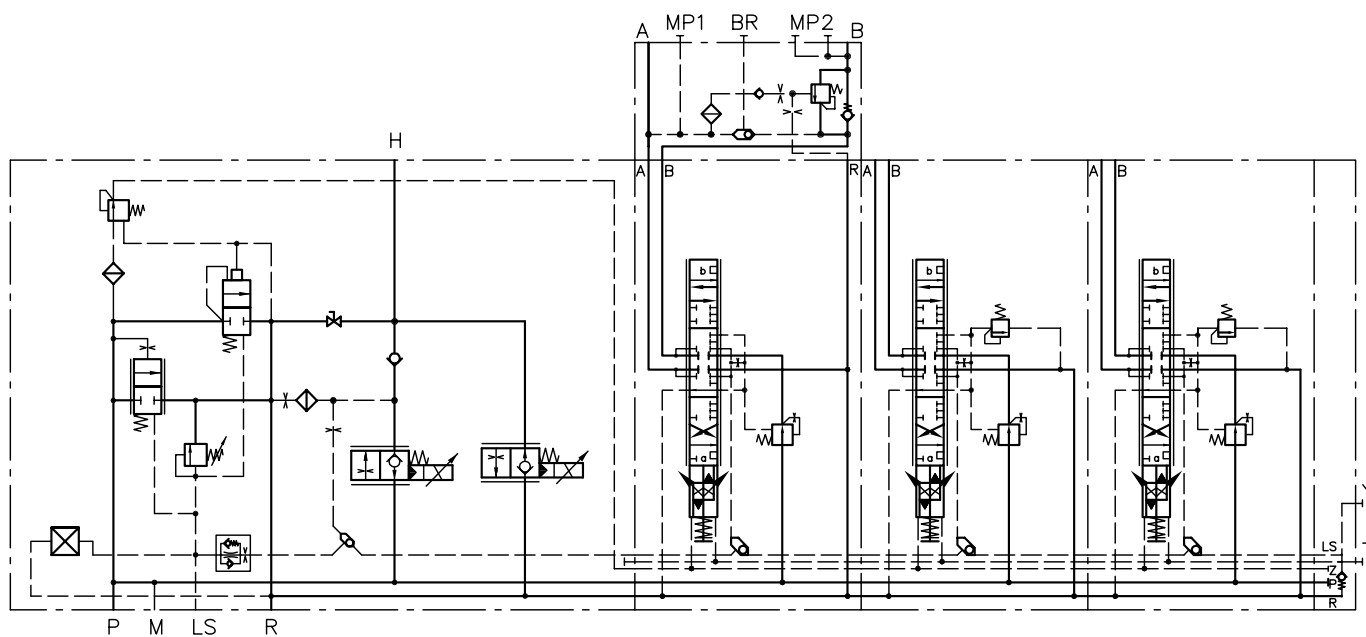
HMPL 5 US 1/PVPV/250-3

- A2 L 25/25/EI/3 BL 5 D7/120

- 32 L 25/25 C160/EI

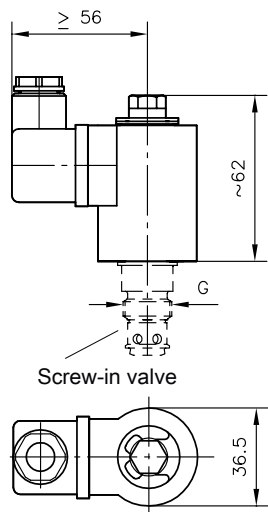
- 32 L 63/63 C220/EI

- E4 - AMP 12 K4

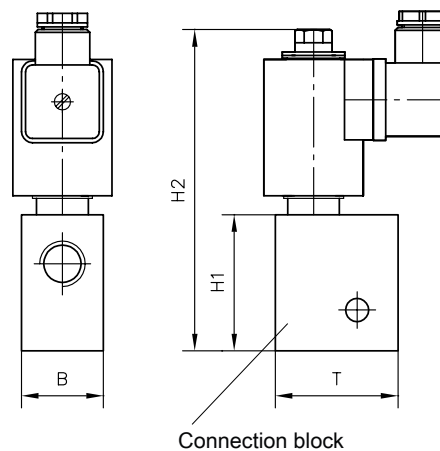


General parameters and dimensions

Screw-in valve



Valve compl. with connection block for pipe connection



	Q_{\max} [lpm]	p_{\max} [bar]	Screw-in valve		Valve with connection block					
			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. cast, aluminium).

Example circuit:

KA 442 LFK/HH 13.1/13.1

-SS-A 1 F 3/200

-BA 2

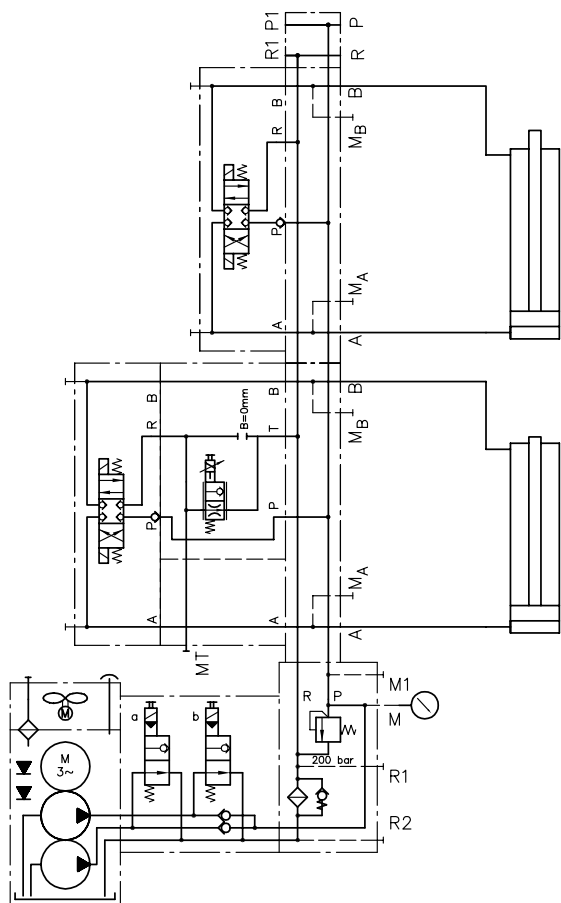
-NBVP 16 G/R-GM/NZP 16 TSPG/TB 0/3

-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 106](#)
- Lifting/lowering valves type HSV: [Page 154](#)
- Lifting modules type HST, HMT etc.: [Page 158](#)

Associated technical data sheets:

- Directional seated valves type EM, EMP: [D 7490/1](#), [D 7490/1 E](#)

Accessories:

- Pressure switches type DG 3.., DG 5E: [Page 272](#)
- Lowering brake valves type SB, SQ, SJ: [Page 218](#)
- Suitable proportional amplifier: [Page 280](#)

Plugs:

- Line connector type MSD and others: [D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

Directional seated valves

3.2 Directional seated valve type BVG, BVP and NBVP

Directional seated valves are a type of directional valve. As cone valves they are tightly sealed without leakage in the closed state.

The directional seated valve type BVG is installed directly in the pipe. The valves type BVP and NBVP are valves for manifold mounting. The type NBVP has the standard connection pattern nominal size NG 6. 2/2, 3/2, 3/3 and 4/3 directional seated valves are available with different types of actuation. All connections can be subjected to the same pressures. Depending on the functional requirement, e.g. a check valve, a (consumer-side) restrictor and/or restrictor check valves is/are integrated into the type NBVP. The type NBVP is used together with other valves in the valve bank type BA to completely control the hydraulics.

Features and benefits:

- Explosion-proof design
- 4th switching position on 4/3 directional valves
- 8-Watt solenoid

Intended applications:

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



Nomenclature:	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 ... 50 lpm

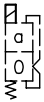
Design and order coding example

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

	Actuations:	Solenoid, hydraulic, pneumatic, manual
	Connection size or connection block	
	Additional elements	<ul style="list-style-type: none">▪ 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	<ul style="list-style-type: none">▪ 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 NBVP (with standard connection diagram NG 6), size 1	

Actuations:

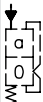
Solenoid



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

Hydraulic



Control pressure:
 $p_{\text{contr. min}} = 24 \text{ bar}$
 $p_{\text{contr. max}} = 320 \text{ bar}$

Pneumatic



Control pressure:
 $p_{\text{contr. min}} = 2 \dots 3.5 \text{ bar}$
 $p_{\text{contr. max}} = 15 \text{ bar}$

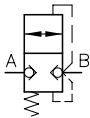
Manual



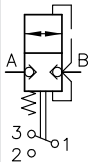
Actuation torque:
approx. 1.5 ... 3 Nm

Function

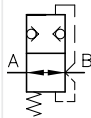
R



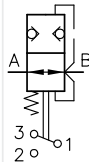
RK



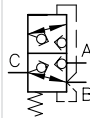
S



SK

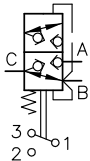


Z

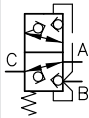


- Further circuit symbols available

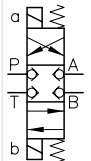
ZK



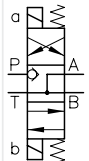
Y



G



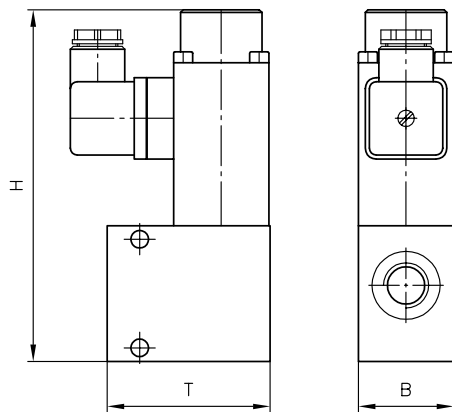
D



- additional switching symbols available
- **G, D:** only for type NBVP16

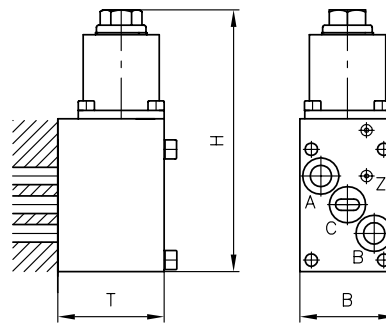
General parameters and dimensions

BVG



Version for pipe connection
(solenoid actuation)

BVP, NBVP



Version for base manifold mounting
(hydraulic actuation)

	Q_{\max} [lpm]	p_{\max} [bar]	Ports (BSPP)	Dimensions [mm]			m_{\max} [kg]
				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

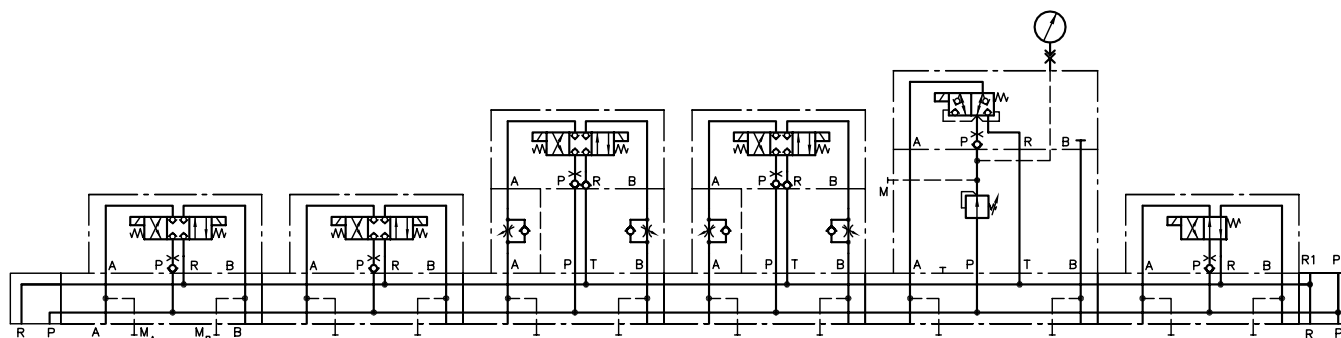
¹⁾ with solenoid actuation GM.. and WGM

- BVE: screw-in valve, also available with connection block for pipe connection

Example circuit:

BA2A5

- NBVP16G/B2.0R/3
- NBVP16G/B2.0R/3
- NBVP16G/R/S/NZP16Q22/3
- NBVP16G/R/S/NZP16Q22/3
- NBVP16Y/B2.0R/2/NZP16CZ5/50/3 - X84V - 9/100A
- NBVP16W/B2.0R/3
- 2 - LM24



Associated technical data sheets:

Directional seated valves

- [Directional seated valve type BVG 1 and BVP 1: D 7765](#)
- [Directional seated valve type NBVP 16: D 7765 N](#)

Products:

- Type BA: [Page 70](#)
- Type NZP: [Page 70](#)
- Type BVH: [Page 76](#)

Plugs:

- [Line connector type MSD and others: D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

Directional seated valves

3.2 Directional seated valve type BVE

Directional seated valves are a type of directional valve. As cone valves they are tightly sealed without leakage in the closed state.

The directional seated valve type BVE is a screw-in valve. 2/2 and 3/2 directional seated valves are available. All connections can be subjected to the same pressures.

Optionally a version for highly viscous media (e.g. lubricating grease) is available.

Appropriate connection blocks make possible direct pipe connection or manifold mounting.

Features and benefits:

- Any flow direction
- No interaction between actuation elements and medium
- No resinification or sticking as a result of increased temperatures is possible.
- For highly viscous media (e.g. lubricating grease)

Intended applications:

- Lubrication systems
- Mining machinery
- Construction and construction material machinery
- Handling and mounting technology



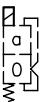
Nomenclature:	Directional seated valve, zero leakage
Design:	Individual valve for pipe connection Individual valve for manifold mounting
Actuation:	Solenoid
p _{max} •	500 bar
Q _{max} •	20 ... 300 lpm

Design and order coding example

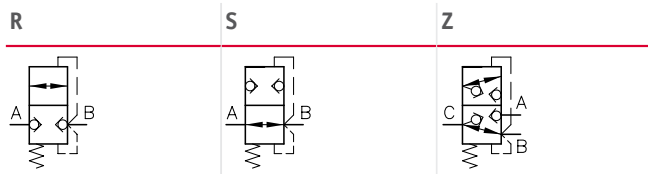
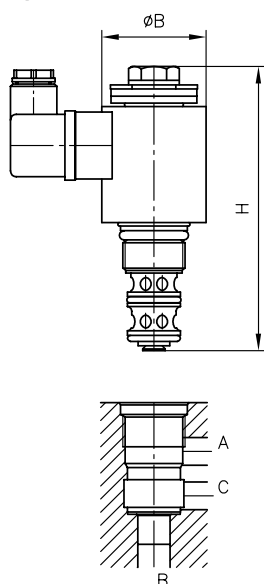
BVE1	- R	-B1,0	- G 24	- 3/8
Port size or connection block				
Actuations Solenoid				
Additional elements ▪ Orifice in one port				
Function ▪ 2/2-way directional valve (R, S) ▪ 3/2-way directional valve (Z)				
Basic type, size Type BVE, size 1, 3 and 5				

Actuations:

Solenoid



Solenoid voltages: 12V DC, 24V DC, 110V AC, 230V AC

Function

General parameters and dimensions
BVE


	Q_{\max} [lpm]	p_{\max} [bar]	Dimensions [mm]		m_{\max} [kg]
			H_{\max}	B_{\max}	
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

Associated technical data sheets:
Directional seated valves

- Directional seated valve type BVE: [D 7921](#)

Similar products

- Type BA: [Page 70](#)
- Type NZP: [Page 70](#)
- Type BVH: [Page 76](#)
- Type BVG, BVP, NBVP: [Page 146](#)

Suitable plugs:

- Line connector type MSD and others: [D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

Directional seated valves

3.2 Directional seated valve type VP

Directional seated valves are a type of directional valve. As cone valves they are tightly sealed without leakage in the closed state.

The directional seated valve type VP is a valve for manifold mounting. 2/2, 3/2 and 4/2 directional seated valves with different types of actuation are available. All connections can be subjected to the same pressures.

The directional seated valve type VP is suitable above all for highly viscous media (e.g. lubricating grease). Appropriate connection blocks make possible direct pipe connection.

- Features and benefits:**
- Any flow direction
 - No interaction between actuation elements and medium
 - No sticking or resinification as a result of increased temperatures is possible.
 - Suitable for highly viscous media (e.g. lubricating grease)
 - Explosion-proof version

- Intended applications:**
- Lubricating systems
 - Mining machinery
 - Construction and construction materials machinery
 - Handling and assembly technology



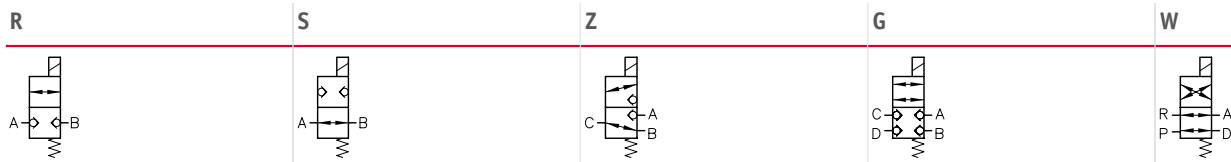
Nomenclature:	Directional seated valve, zero leakage
Design:	Manifold mounting
Actuation:	Solenoid Hydraulic Pneumatic
p _{max} :	400 bar
Q _{max} :	15 lpm

Design and order coding example

VP1	- R	- 3/4	- G24
			Actuation <ul style="list-style-type: none">▪ 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 <ul style="list-style-type: none">▪ 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	

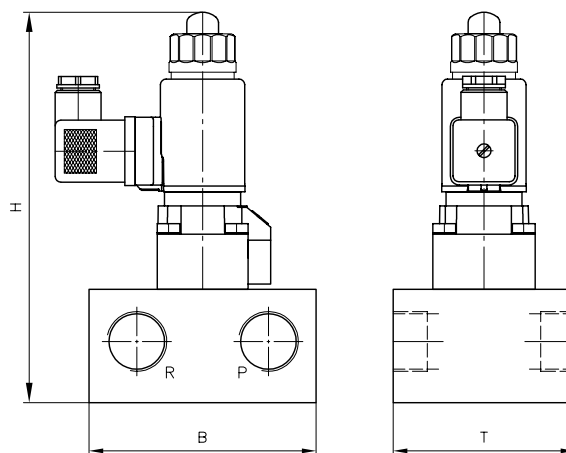
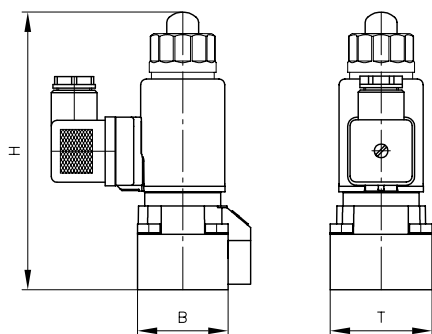
Function



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} : Values apply for electro-magnetic actuation

Associated technical data sheets:

- Directional seated valve type VP: [D 7915](#)

Similar products:

- Directional seated valve type BVG1, BVP1, NBVP16:
[Page 146](#)
- Directional seated valve type BVE:
[Page 150](#)

Plugs:

- Line connector type MSD and others: [D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

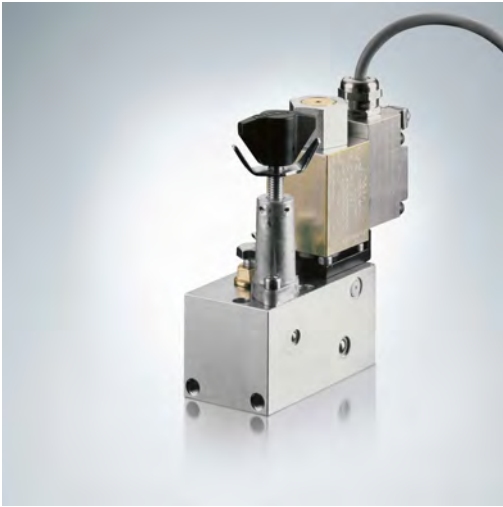
Directional seated valves

3.2 Lifting/lowering valve type HSV

Lifting-lowering valves are a combination of directional valves and metering valves. The valve block type HSV provides the function of a 2/2-way directional seated valve with electrical actuation for lowering the load. Adjustable throttle valves or flow control valves independent of the load control the lowering speed. An integrated pressure-limiting valve limits the permissible load. The lifting/lowering valve type HSV is used to control lifting equipment with single-acting cylinders.

- 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



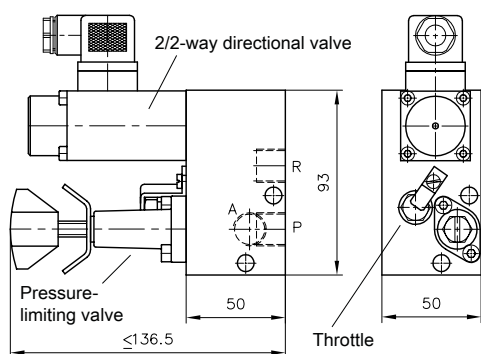
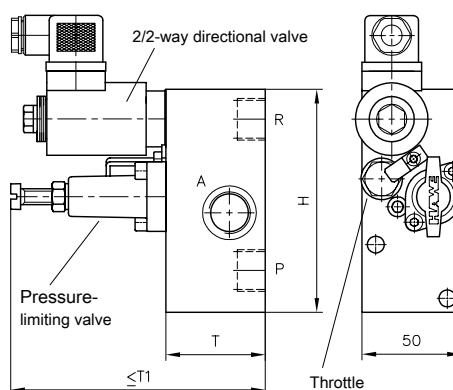
Nomen- clature:	Valve combination consisting of: <ul style="list-style-type: none">▪ 2/2-way directional seated valve, solenoid actuated▪ Pressure-limiting valve▪ Check valve optional▪ Throttle or 2-way flow control valve
Design:	Individual valve for pipe connection
Actuation:	Solenoid
p_{max}:	315 ... 400 bar
Q_{max}:	20 ... 120 lpm

Design and order coding example

HSV21	- R1	- R-150	- G24
			Solenoid voltage 12V DC, 24V DC, 110V AC, 230V AC HSV 21 and HSV 22 in explosion-proof version
			Pressure limiting valve Manually or tool adjustable, pressure setting in bar
			Function
Basic type, size	Type HSV, sizes, 2, 4 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 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 71	120	315	G 3/4	G 3/4	100	80	160	3.1

Associated technical data sheets:

- [Lifting/lowering valve type HSV: D 7032](#)

Plugs:

- [Line connector type MSD and others: D 7163](#)
- [With economy circuit: D 7813, D 7833](#)

Directional seated valves

3.2 Switch unit type CR

Switch units combine the function of a directional seated valve with a pressure valve and check valve. They control dual stage pumps, a combination of high-pressure pump and low-pressure pump, in bottom and top ram presses. The low-pressure circuit and the high-pressure circuit are combined for rapid movement.

If the low-pressure value is reached or exceeded, the switch unit type CR switches the low-pressure circuit to circulation. The high-pressure pump carries out the pressing action. The switch unit hydraulic release acts automatically. It initiates surge-free decompression that relieves the press. In the closed state the switch unit has zero leakage.

The switch unit type CR can be attached directly to hydraulic power packs type MPN and RZ.

Features and benefits:

- Special valve for controlling upstroke 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:

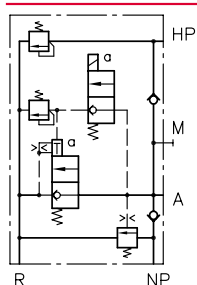
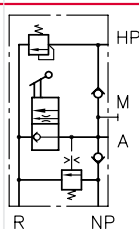
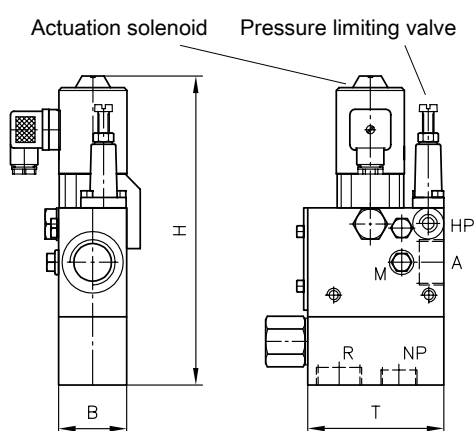
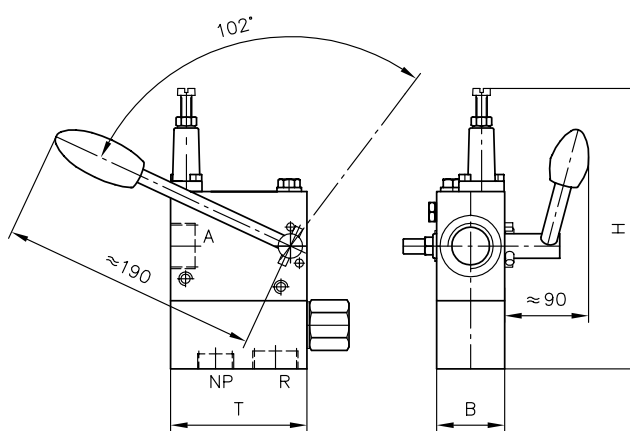
- Machine tools (presses)
- Woodworking and processing machinery
- Printing and paper technology
- Foodstuff and packaging machinery



Nomenclature:	Valve combination consisting of: <ul style="list-style-type: none">▪ 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 NP (0) ... 60 bar
Q _{max} :	HP 8... 20 lpm NP 80 ... 160 lpm A → R 200 ... 300 lpm

Design and order coding example

CR4	M-WG230	- 400/60
		Pressure settings [bar] High-/low pressure
	Actuation mode	<ul style="list-style-type: none">▪ 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	(0) ... 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	(0) ... 60	G 1	G 1/4	G 3/4	G 1/4	max. 202	50	100	4.7
CR 5M	20	160	300	400	(0) ... 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 unit type CR: [D 7150](#)

Similar products:

- Two-stage valves type NE: [Page 200](#)

Hydraulic power packs:

- Hydraulic power packs type RZ: [Page 62](#)
- Compact hydraulic power packs type MP, MPN, MPNW, MPW: [Page 54](#)

Plugs:

- Line connector type MSD and others: [D 7163](#)

Directional seated valves

3.2

Lifting module type HMT and HST

Lifting modules or hoist control valves are a combination of directional valves and pressure control valves. They are used to control a lifting function. The volumetric flow is controlled or limited proportionally both on lifting and also on lowering.

In the lifting module type HMT and HST directional seated valves are used that ensure the load is held securely. 2-way pressure control valves are used to limit the maximum volumetric flow.

Valve sections of type SWS can be attached space-savingly to the lifting module to control additional functions. The lifting module type HMT and HST is suitable for use in industrial trucks and agricultural machinery.

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: <ul style="list-style-type: none">▪ 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

HMT34D	- 1/250	- G/MP/0/2	- 31EP - G 24
			End plate <ul style="list-style-type: none">▪ 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	Various intermediate blocks for mast tilting, mast shifting, auxiliary hydraulics 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 <ul style="list-style-type: none">▪ Connection blocks type SWR, SWS<ul style="list-style-type: none">▪ With flow divider▪ With/without pressure limiting valve▪ With shut-off valve for P and H (lift)	
Basic type	Lifting modules and hoist control valves		

Drive concept an field of application:

	Drive concept		Application					
	1	2	Scissor lift	Miniature stacker, Walkie stacker	Counter balance truck	Reach truck	Order picker (warehouse)	
							no man aloft	man aloft
HST	x	x	x	x	x	x	x	x
HMT		x			x	x	x	(x)

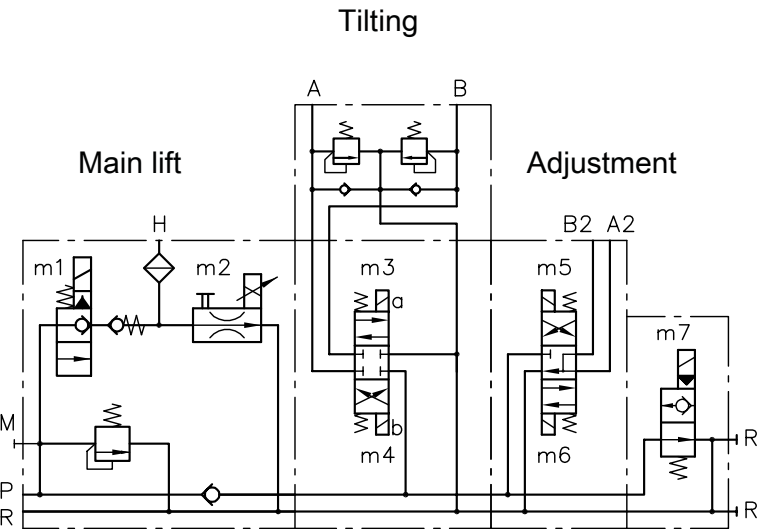
Drive concept:

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

Circuit examples:

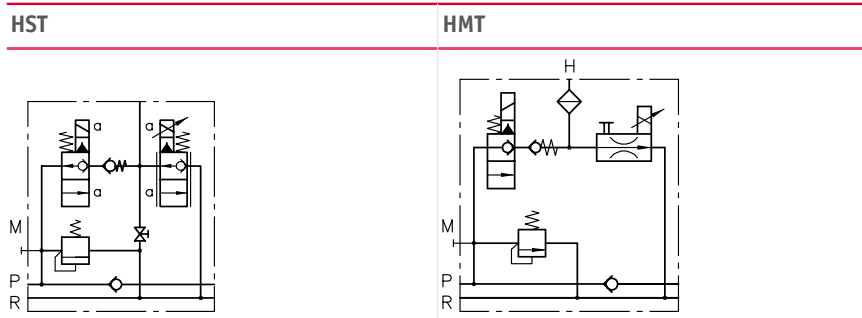
HMT 34-1/200-70F
-G/M/0/2 AN40 BN130
-D/M/0/02
-31E-P12/G 24

Lifting module type HMT, size 3, connection size 4 with pressure-limiting valve (set to 200 bar), output controller with 70 l control orifice closed in normal position; segment G with shock and servo-suction valves (set values 40 and 130 bar) in ancillary block; end plate with idle circulation valve open in neutral position, proportional solenoid voltage for flow control valves 12V DC, solenoid voltage for directional spool valve and directional seated valves 24V DC

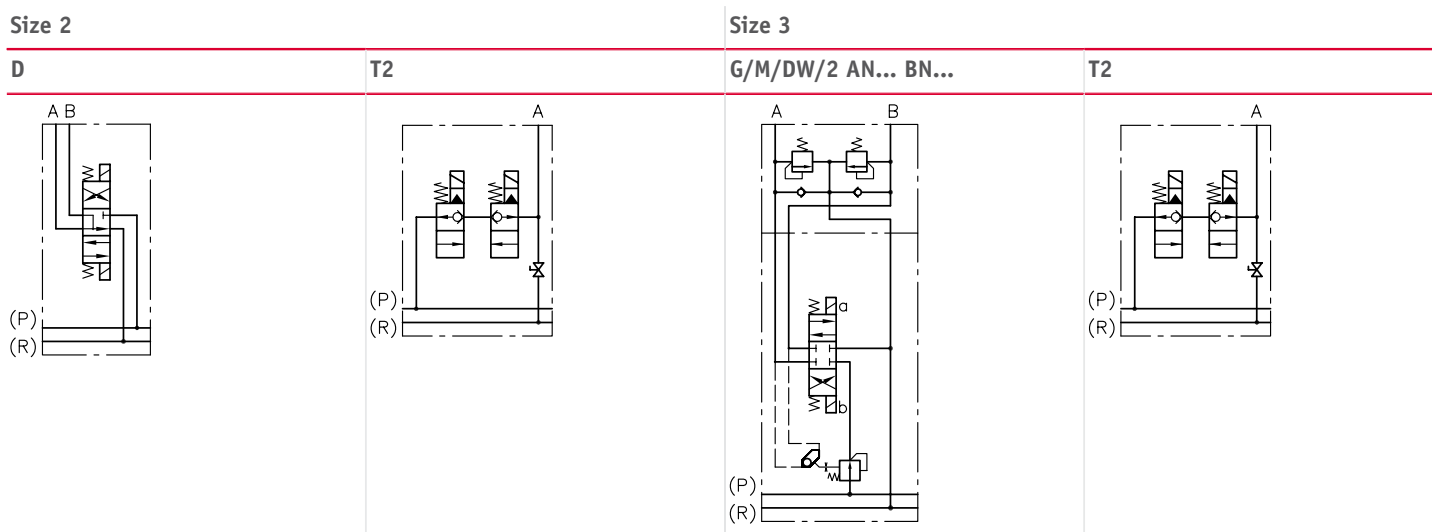


Function

Lifting modules and connection blocks:

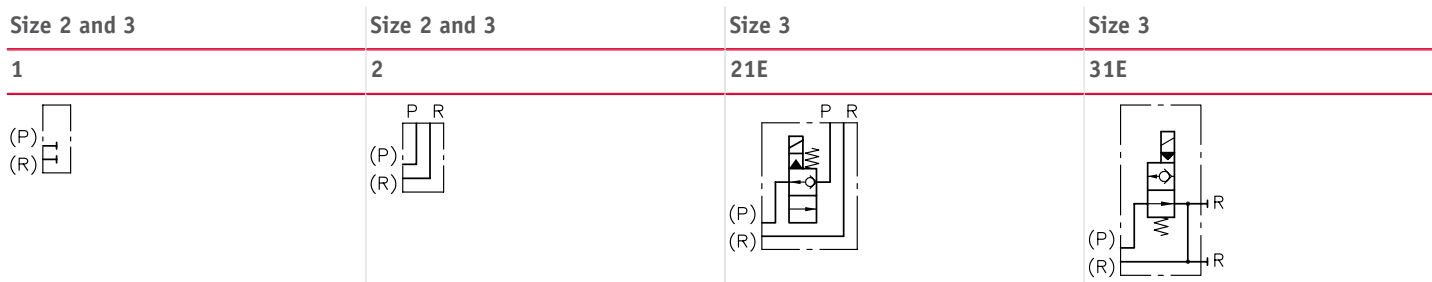


Intermediate blocks (main and initial lift):



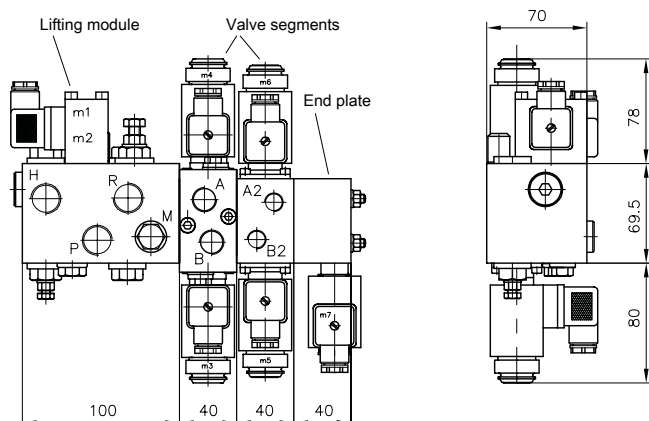
- Size 2: Hole pattern SWR 1, size 3: Hole pattern SWR 2/SWS 2

End plates:

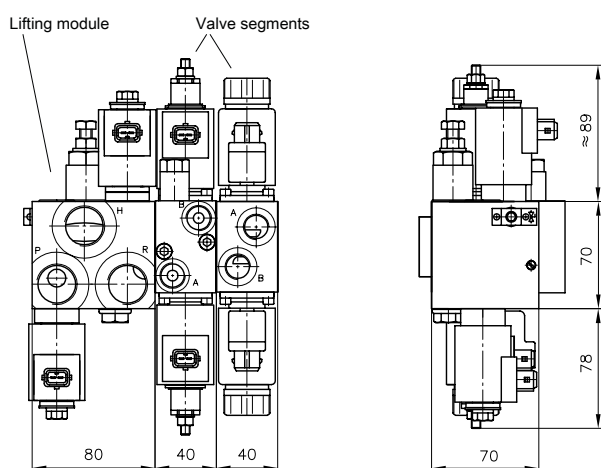


General parameters and dimensions

HMT 34 ...



HST 3 ...



	Q _{max} [lpm]	p _{max} (bar)	Note	Ports (BSPP)
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
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

Associated technical data sheets:

- Type HMT: **Sk 7758 HMT ff**
- Type HST: **Sk 7650 HST ff**

Information on additional lifting modules on inquiry

Similar products:

- Directional spool valves type SWR, SWS 2: [Page 92](#)
- Connection blocks type HMPL and HMPV: [Page 106](#)

Plugs:

- [Line connector type MSD and others: D 7163](#)
- With economy circuit: [D 7813](#), [D 7833](#)

Directional seated valves

3.2 Directional seated valve type VH, VHR, and VHP

Directional seated valves are a type of directional valve. As ball valves they have zero leakage in the closed state. A hand lever operates the eccentric shaft that controls the plunger for opening or closing the valve seats. The actuation via the hand lever is undertaken with automatic centring in the neutral position or with a notch. The directional seated valve type VH is suitable for pipe connection. The directional seated valve bank type VHR comprises several valves of type VH that have been clamped together connected in parallel via a tension rod to form a valve bank. The directional seated valve type VHP is available as a valve for manifold mounting.

Features and benefits:

- Pressures up to 700 bar manually switchable
- 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:

- Construction and construction materials machinery
- Offshore and marine technology
- Process engineering systems
- Oil hydraulics and pneumatics



Nomenclature:	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

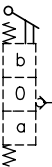
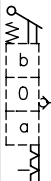
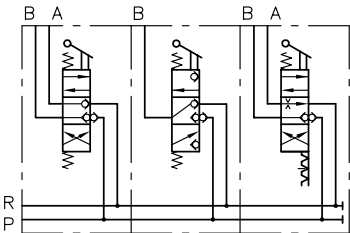
VH 1	H1
VHR 1	G1/N1/E2

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

- Additional versions:**
- Actuation with contact switch for zero position monitoring (K), optionally for single valves and valve banks

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

Actuation:

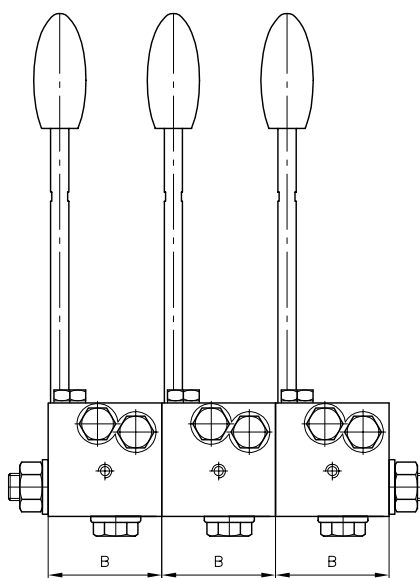
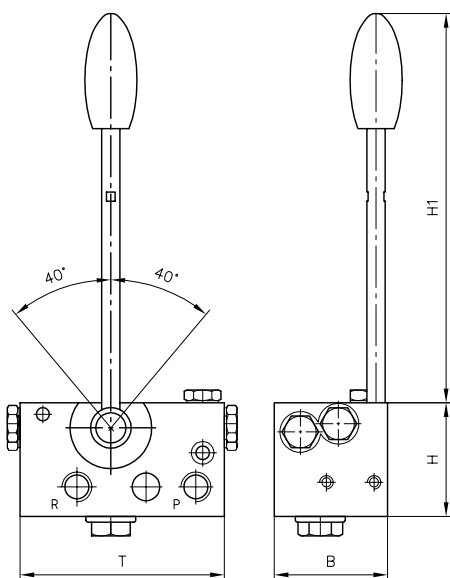
Return spring	Detent	
		Symbol type VHR.. 

- Spring return: automatic return to zero position only up to approx. 50 bar. At pressures over 50 ... 700 bar the lever must be reset manually.

Function
Basic symbols
Symbol

VH	VHP	VHR	G	E	M	N	D	H	L	S

- On type VHR max. 7 or 5 valves (size 1 or 2) can be combined
- Type H, L and S only as single valve, 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 valve type VH, VHP and VHR: D 7647](#)

Similar products:

- Directional seated valves type BVG 1, BVP 1: "[Directional seated valve type BVG, BVP and NBVP](#)"
- [Directional seated valve type NBVP 16: D 7765 N](#)

Directional seated valves

3.2

Directional seated valve type VZP

The seated valve type VZP is a manifold mounting valve that is designed as a zero-leakage, cone-seated valve in one size.

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 or 3/3-way function, or two independent 3/2 and 2/2-way individual functions. Compared with individual valves for manifold mounting of conventional layout, the advantages are lower spatial requirements and the possibility of directly mounting pressure switches for monitoring the consumer pressure. A particularly compact option is to combine several valves connected in parallel in one valve bank (type BVZP).

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



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

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

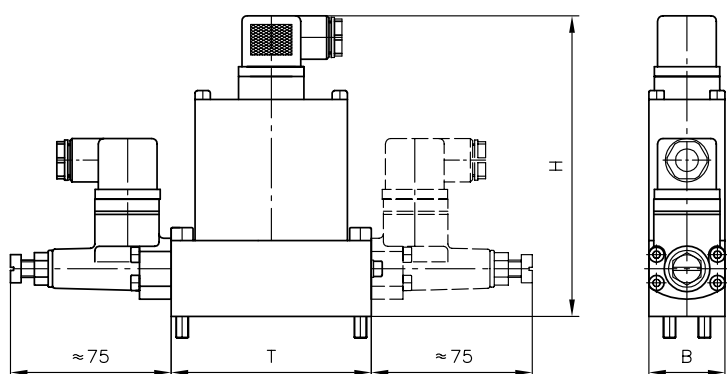
- The 4. shifting position illustrates mode, when both solenoids are energized

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 valve type VZP: D 7785 A

Accessories:

- Pressure switches type DG 3.., DG 5E: [Page 272](#)

Plugs:

- Line connector type MSD and others: D 7163

3.3 Pressure valves

Pressure-limiting valve type MV, SV and DMV	170
Pressure control valve type CMV, CMVZ, CSV and CSVZ	174
Pressure-limiting valve, pilot-controlled type DV, AS etc.	176
Sequence valves with check valve type VR	178
Proportional pressure-limiting valve type PMV and PDV	180
Pressure-reducing valve type ADC, ADM, ADME and AM	182
Pressure-reducing valve type ADM and VDM	184
Pressure-reducing valve type CDK, CLK, DK, DLZ and DZ	188
Proportional pressure-reducing valve type PM and PMZ	192
Proportional pressure-reducing valve type PDM	194
Proportional pressure-reducing valve type KFB and FB	196
Pressure-controlled shut-off valve type CNE	198
Two-stage valve type NE	200
Shut-off valve type LV and ALZ	202
Pressure-dependent shut-off valve type DSV and CDSV	204
Load-holding valve type LHK, LHDV and LHT	206



*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} (bar)	Q _{max} (lpm)
MV, SV, DMV	<ul style="list-style-type: none"> Individual valve for pipe connection or manifold mounting Screw-in valve, assembly kit 	<ul style="list-style-type: none"> - Tool adjustable - Manually adjustable 	MVG - 13, 14: 700 MV, SV - 4: 700 MV, SV - 5: 700 MV, SV - 6: 700 MV - 8: 700 DMV - 4: 350 DMV - 5: 350 DMV - 6: 350 DMV - 8: 315	MVG - 13, 14: 8 MV, SV, DMV - 4: 20 MV, SV, DMV - 5: 40 MV, SV, DMV - 6: 70 MV, SV, DMV - 8: 160
CMV(Z), CSV(Z)	<ul style="list-style-type: none"> Screw-in valve Directly controlled 	<ul style="list-style-type: none"> - Tool adjustable - Manually adjustable 	CMV, CMVZ: 500 CSV, CSVZ: 315	CMV - 1: 20 CMVZ, CSVZ - 2: 40 CMV, CSV - 2: 40 CMV, CSV - 3: 60
DV, AS	<ul style="list-style-type: none"> Individual valve for pipe connection or manifold mounting 	<ul style="list-style-type: none"> - Tool adjustable - Manually adjustable 	DV: 420 AS: 350	DV - 3: 40 AS - 3: 50 DV, AS - 4: 80 DV, AS - 5: 120
VR	<ul style="list-style-type: none"> Insert valve Version with housing 	<ul style="list-style-type: none"> - Tool adjustable 	315	1: 15 2: 40 3: 65 4: 120
PMV, PDV	<ul style="list-style-type: none"> Individual valve for pipe connection or manifold mounting 	<ul style="list-style-type: none"> - Electro-proportional 	PMV - 4: 700 PMV - 5: 450 PMV - 6: 320 PMV - 8: 180 PDV - 3: 350 PDV - 4: 350 PDV - 5: 350	PMV - 4: 16 PMV - 5: 60 PMV - 6: 75 PMV - 8: 120 PDV - 3: 40 PDV - 4: 80 PDV - 5: 120

Pressure-reducing valves (also proportional)

Type	Design	Adjustability	p_{\max}/p_A (bar)	Q_{\max} (lpm)
ADC, ADM, ADME, AM	<ul style="list-style-type: none"> Screw-in valve for pipe connection 	- Tool adjustable	ADC - 1: 300/25 ADM, ADME - 1: 315/70 AM - 1: 400/100	ADC, AM - 1: 2 ADME - 1: 8 ADM - 1: 10
ADM, VDM	<ul style="list-style-type: none"> Individual valve for pipe connection or manifold mounting Directly controlled or piloted 	- Tool adjustable - Manually adjustable	ADM: 320/250 VDM: 400/300	ADM - 11: 12 ADM - 21, 22: 25 ADM - 32, 33: 60 VDM - 3: 40 VDM - 4: 70 VDM - 5: 120
CDK, CLK, DK, DLZ, DZ	<ul style="list-style-type: none"> Screw-in valve (2-way principle) Combination with connection block 	- Tool adjustable - Manually adjustable	CLK, DLZ: 400/380 CDK, DK, DZ: 500/450	22
PM, PMZ	<ul style="list-style-type: none"> Assembly kit Individual valve for manifold mounting 	- Electro-proportional	40/30	PM: 2 PMZ: 2
PDM	<ul style="list-style-type: none"> Individual valve for pipe connection or manifold mounting 	- Electro-proportional	11, 12: 320/320 21, 22: 320/180 3: 350/350 4: 350/350 5: 350/350	11, 12: 12 21, 22: 20 3: 40 4: 80 5: 120
KFB, FB	<ul style="list-style-type: none"> Individual valve for pipe connection 	- Manual	120/30	2

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

Type	Nomenclature/Design	Adjustability	p _{max} (bar)	Q _{max} (lpm)
CNE	<ul style="list-style-type: none"> 2-way idle circulation valve Screw-in valve 	- Tool adjustable	2: 500 21: 500 22: 420 23: 500	30
NE	<ul style="list-style-type: none"> Two-stage valve (high-pressure/low-pressure stage) Individual valve for pipe connection 	- Tool adjustable	HP/LP: 20, 21: 700/55 70: 500/60 80: 500/30	HP/LP: 20, 21: 10/40 70: 16/100 80: 25/180
LV, ALZ	<ul style="list-style-type: none"> Shut-off valve (idle circulation valve, directly controlled or piloted) Individual valve for pipe connection or manifold mounting 	- Tool adjustable - Manually adjustable	350	LV - 10: 12 LV - 20: 25 LV - 25: 25 ALZ - 3: 50 ALZ - 4: 80 ALZ - 5: 120
DSV, CDSV	<ul style="list-style-type: none"> Individual valve for pipe connection or manifold mounting Screw-in valve 	- Tool adjustable - Manually adjustable	CDSV: 600 DSV: 400	CDSV - 1: 8 DSV - 21-1: 20 DSV - 2-2: 40 DSV - 2-3: 60

Load-holding valves

Type	Nomenclature/Design	Adjustability	p _{max} (bar)	Q _{max} (lpm)
LHK, LHDV, LHT	Load-holding valve, over centre valve <ul style="list-style-type: none"> Individual valve for pipe connection or manifold mounting Screw-in valve, version for banjo bolt mounting 	- fixed - adjustable	LHK - 2: 400 LHK - 3: 360 LHK - 4: 350 LHDV - 33: 420 LHT - 2: 400 LHT - 3: 420 LHT - 5: 400	LHK - 2: 20 LHK - 3: 60 LHK - 4: 100 LHDV - 33: 80 LHT - 2: 28 LHT - 3: 130 LHT - 5: 250

Pressure valves

3.3 Pressure-limiting valve type MV, SV and DMV

Pressure-limiting valves and sequence valves are types of pressure control valves. Pressure-limiting valves safeguard the system against excessive system pressure or limit the operation pressure. Sequence valves generate a constant pressure difference between the inlet and outlet flow.

Type MV and SV is a directly controlled valve that is damped as standard. Undamped variants are also available for special operating conditions. Versions that correspond to the Pressure Equipment Directive 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



Nomenclature:	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 1

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

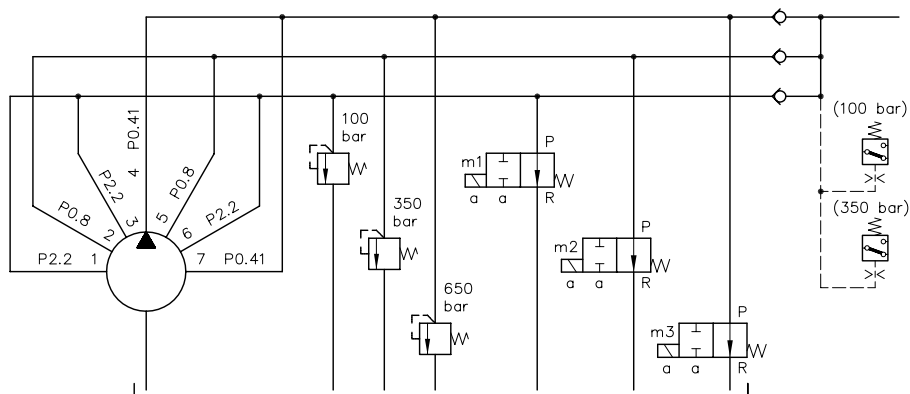
- Multiple pressure limiting valves (2, 3, 4, 5 valves in parallel)
- Pressure-limiting valves with unit approval (TÜV valves) (type MVX, MVXS, MVEX, MVPX, SVX, size 4, 5 and 6)
- Various actuations: ball head for controls via cam, lever etc. (type MVG and MVP only)

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 reflux 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

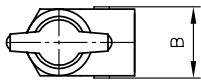
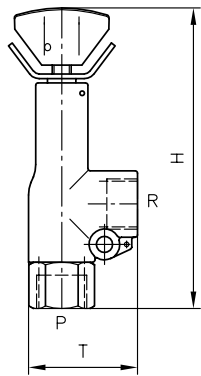
- 1) Only size 4, 5, 6, and 8
Type MVG and MVGC only size 13 and 14

Example circuit:

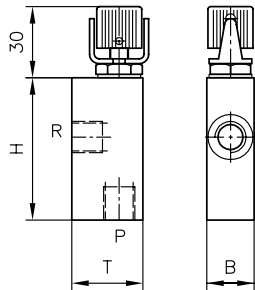


General parameters and dimensions

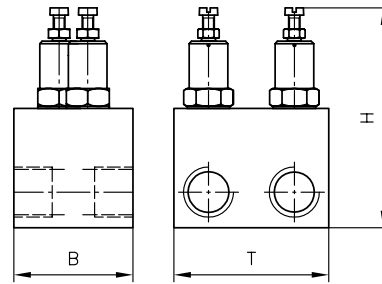
MV, MVS



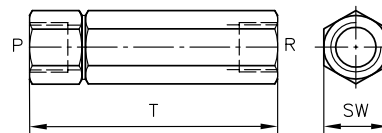
MVG



DMV



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 A: 700/75	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 valve type MV, SV and DMV: D 7000/1](#)
- [Pressure-limiting valve and pre-load valve type MVG, MVE, and MVP: D 3726](#)
- [Pressure-limiting valve \(installation kit\) type MV: D 7000 E/1](#)
- [Multiple pressure-limiting valve type MV: D 7000 M](#)
- [Pressure-limiting valve, with unit approval type MV .X: D 7000 TUV](#)

Similar products:

- Pressure control valves for screwing in type CMV, CSV: [Page 174](#)
- Pilot-controlled pressure control valves type DV: [Page 176](#)
- Pilot-controlled pressure control valves type A: [Page 176](#)

Pressure valves

3.3

Pressure control valve type CMV, CMVZ, CSV and CSVZ

Pressure-limiting valves and sequence valves are types of pressure control valves. Pressure-limiting valves safeguard the system against excessive system pressure or limit the operation pressure. Sequence valves generate a constant pressure difference between the inlet and outlet flow.

Type CMV and CSV is a directly controlled valve that is damped as standard. Undamped variants are also available for special operating conditions. Versions that correspond to the Pressure Equipment Directive are also available. Type CMVZ and CSVZ is not influenced by the pressure conditions downstream and is therefore suitable for use in loss-free sequence control systems.

Valve type CMV and CSV can be screwed-in and can be integrated into control blocks. The necessary mounting holes are straightforward to make.

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



Nomenclature:	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]

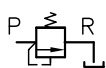
Adjustability (while pressurized) Tool or manually adjustable

Pressure range Pressure ranges B, C, E and F

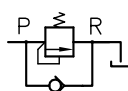
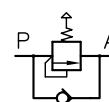
Basic type, size Type CMV (pressure limiting valve), size 1 to 3
Type CSV (pressure difference valve), size 2 to 3

Additional versions:

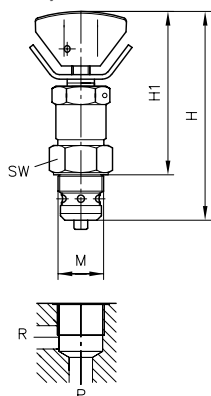
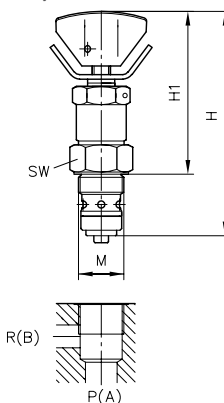
- Sequence valves CMVZ or CSVZ
- Version with unit approval type CMVX
- Undamped version (CMV)

Function
CMV

CMVZ


Pressure limiting valve (port R pressure resistant)

CSV

CSVZ


Sequence valves with by-pass check valve

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	M 16 x 1.5	SW 22	78	57	90
	2	40	E: 160	M 20 x 1.5	SW 24	94	72	160
	3	60	C: 315	M 24 x 1.5	SW 30	114	83	275
CSV, CSVZ	2	40	B: 500	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 valve type CMV, CMVZ, CSV and CSVZ: [D 7710 MV](#)
- Pressure-limiting valve, with unit approval type CMVX: [D 7710 TUV](#)

Similar products:

- Pressure-limiting valves type MV, SV etc.: [Page 170](#)
- Miniature pressure-limiting valves type MVG etc.: [Page 170](#)

- Pilot-controlled pressure control valves type DV: [Page 176](#)
- Pilot-controlled pressure control valves type AS: [Page 176](#)

Pressure valves

3.3

Pressure-limiting valve, pilot-controlled type DV, AS etc.

Pressure-limiting valves are a type of pressure control valve. They safeguard the system against excessive system pressure or limit the operation pressure.
The pressure-limiting valve type DV and AS is pilot-controlled. Type AS also has 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

DV3GHR-WN1F-24-200

DV3

G

H

R

- WN 1F- 24

- 200

Pressure setting [bar]

2/2-way directional seated valve

Adjustability in operation

Pressure range

Line connection

Basic type, size

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

Tool adjustable or manually adjustable (R)

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

▪ N: 2 to 100 bar

▪ H: 5 to 420 bar

Pipe connection or manifold mounting

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

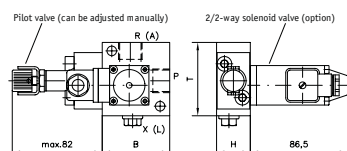
AE



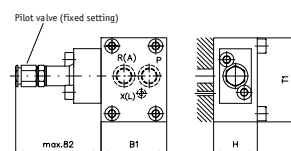
Release valve (remote controlled), combined function as pressure limiting valve possible (type ASE)

General parameters and dimensions

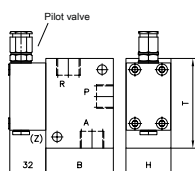
DV..G



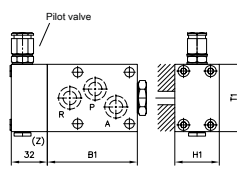
DV...P



A..G



A...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

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:

- Pressure-limiting valve, pilot-controlled type DV, DVE and DF: [D 4350](#)
- Pressure valve with check valve type AL, AE and AS: [D 6170](#)

Similar products:

- Pressure-limiting valves type MV, SV etc.: [Page 170](#)
- Miniature pressure-limiting valves type MVG etc.: [Page 170](#)
- Pressure-limiting valves type CMV(Z): [Page 174](#)

Pressure valves

3.3 Sequence valves with check valve type VR

Pre-load valves, also called sequence valves are a type of pressure control valve. They generate a largely constant pressure gradient between the inlet and outlet on the valve. In the opposite direction the flow can pass freely. In the normal position the valve has minor leakage.

The sequence valve type VR is available as a screw-in valve and in a housing version for in-line installation.

The primary application area is in return lines for oscillation damping, mainly in lifting equipment, lifting platforms, handling systems and in lifting gantries as fall protection.

Features and benefits:

- Compact screw-in valve

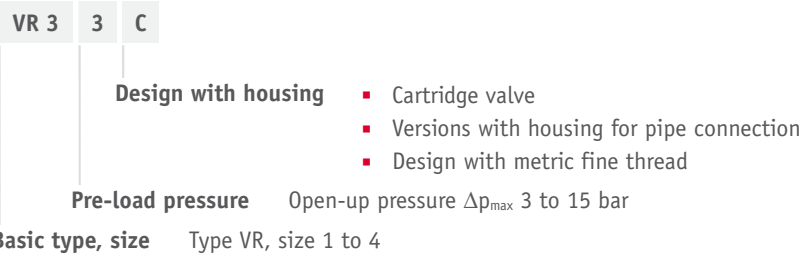
Intended applications:

- Lifting equipment
- Lifting platforms
- Handling technology



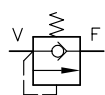
Nomenclature:	Sequence valve
Design:	Screw-in valve Combination with housing for pipe connection
Adjustment:	Fixed (non-adjustable)
p _{max} :	315 bar
Δp _{max} :	15 bar
Q _{max} :	120 lpm

Design and order coding example

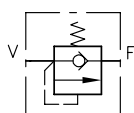


Function

VR



Screw-in valve

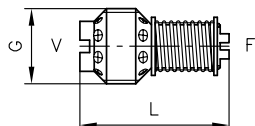


Version with housing for pipe connection

General parameters and dimensions

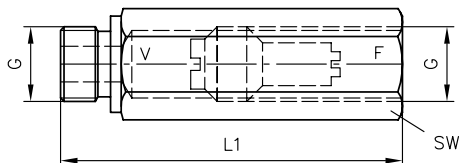
VR 3 3 C

Insert valve



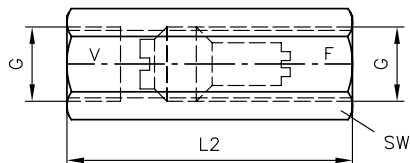
VR 4 9 E

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 be altered

2) Individual valve/design with housing

Associated technical data sheets:

- Pre-load check valve type VR: [D 7340](#)

Similar products:

- Pressure-limiting valves type MV, SV etc.: [Page 170](#)
- Miniature pressure-limiting valves type MVG etc.: [Page 170](#)
- Pilot-controlled pressure control valves type DV: [Page 176](#)
- Pressure-limiting valves type CMV: [Page 174](#)

Pressure valves

3.3 Proportional pressure-limiting valve type PMV and PDV

Proportional pressure-limiting valves are a type of pressure control valve. They remotely control the pressure in hydraulic systems continuously and electrically.

The pressure-limiting valve type PMV is a directly actuated valve in a spring-loaded ball version. The pressure can be set to up to 700 bar. The pressure-limiting valve type PDV is a pilot valve in a piston version, where pressures up to 350 bar can be set. The pressure-limiting valve type PMV and PDV is available as a single valve for pipe connection or as a manifold mounting valve.

The proportional pressure-limiting valve is particularly suitable for maximum pressure limitation in hydraulic systems.

Features and benefits:

- Max. operating pressure 700 bar
- Precise control

Intended applications:

- General hydraulics
- Test benches
- Mining machinery



Nomenclature:	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	H	- G24
PMVP4	- 44	- G24

- Solenoid voltage**
- Prop. solenoid
- 12V DC, 24V DC
 - Control using proportional amplifier or PLVC

Pressure range [bar]

- Basic type, port size, size**
- Type PMV (pipe connection), type PMVP (manifold mounting)
- Optionally with separate control oil supply, i.e. pressure reduction right above 0 bar, zero-leakage in the main pump circuit (type PMVS, PMVPS)
- Type PDV.G (pipe connection), type PDV.P (manifold mounting)
- Additionally with 2/2-way solenoid valves for arbitrary idle circulation

Function

PMV, PDV



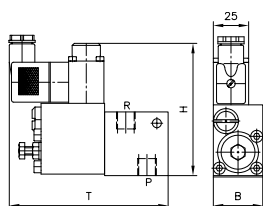
Pipe connection



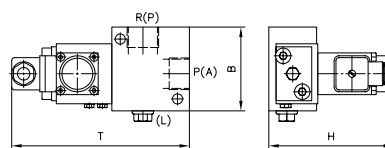
Manifold mounting valve

General parameters and dimensions

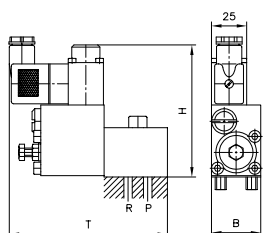
PMV



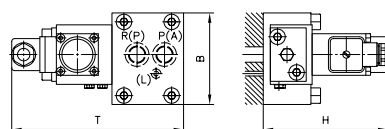
PDV..G



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:

- [Proportional pressure-limiting valve type PMV and PMVP: D 7485/1](#)
- [Proportional pressure-limiting valve type PDV and PDM: D 7486](#)
- [Proportional pressure-limiting valve type NPMVP: D 7485 N](#)
- [Intermediate plate type NZP: D 7788 Z](#)

Additional electrical components:

- Proportional amplifier: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)
- CAN node type CAN-IO: [Page 284](#)
- Other electronic accessories [See "Electronics"](#)

Pressure valves

3.3 Pressure-reducing valve type ADC, ADM, ADME and AM

Pressure reducing valves are a type of pressure control valve. They maintain a largely constant outlet pressure even at a higher and changing inlet pressure.

The pressure reducing valve type ADC and AM is suitable for the supply of control circuits with low oil consumption. These valves feature an override compensation, i.e. acting like a pressure-limiting valve if the secondary pressure exceeds the set pressure e.g. due to external forces. There is a design-related leakage flow.

Features and benefits:

- Compact design
- Numerous configurations

Intended applications:

- For control oil supply in pilot circuits



Nomenclature:	Pressure reducing valve
Design:	Screw-in valve Valve for pipe connection
Adjustment:	Fixed (non-adjustable)
p _{max} P:	300 ... 400 bar
p _{max} A:	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

R(T)
P A

Screw-in valve

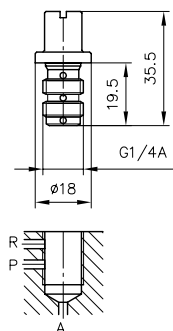
R(T)
P A

Pipe installation

General parameters and dimensions

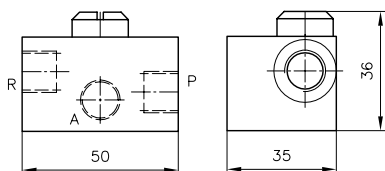
ADC 1-.25

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

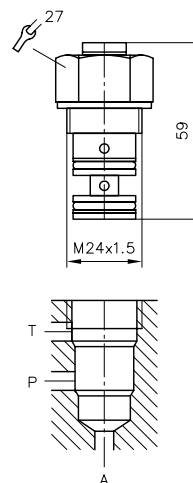


AM 1 - 20 -1/4

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

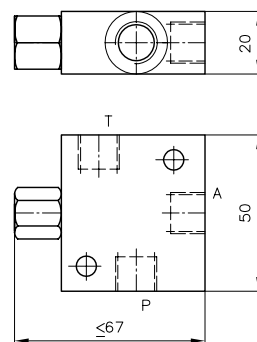


ADME 1-...



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
ADC 1	2	300	15, 25	G 1/4	0.03	Pipe installation
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:

- Pressure-reducing valve type ADC, ADM, ADME and AM: [D 7458](#)

Similar products:

- Pressure reducing valves type ADM, VDM: [Page 184](#)
- Pressure reducing valves type CDK: [Page 188](#)

- Prop. pressure reducing valves type PDM: [Page 194](#)
- Miniature prop. pressure reducing valves type PM, PMZ: [Page 192](#)

Pressure valves

3.3

Pressure-reducing valve type ADM and VDM

Pressure reducing valves are a type of pressure control valve. They maintain a largely constant outlet pressure even at a higher and changing inlet pressure.

The pressure reducing valve type ADM is directly controlled, the type VDM is hydraulically pilot-controlled. These valves feature an override compensation, i.e. acting like a pressure-limiting valve if the secondary pressure exceeds the set pressure e.g. due to external forces. There is a design-related leakage flow.

Features and benefits:

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

Intended applications:

- General hydraulics
- Jigs
- Test benches



Nomenclature:	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} :	300 ... 400 bar
p _{max A} :	250 ... 400 bar
Q _{max} :	120 lpm

Design and order coding example

ADM 22

D

R

- 250

Pressure setting [bar]

Adjustability in operation

Pressure range

Basic type, size

▪ Tool adjustable (-)

▪ Manually adjustable (R)

▪ Adjustable with turn knob (self-locking -V/lockable -H)

Pressure ranges for outlet pressure at A

Type ADM (non-piloted), size 1 to 3

VDM 5

H

R

- 250

Pressure setting [bar]

Adjustability in operation

Pressure range

Basic type, size

▪ Tool adjustable (-)

▪ Manually adjustable (R)

Pressure ranges for outlet pressure at A

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

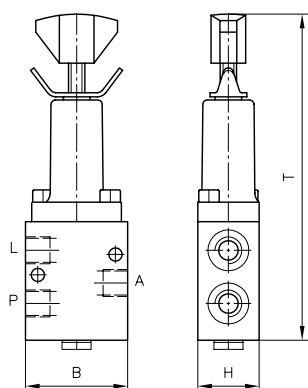


Manifold mounting valve

General parameters and dimensions

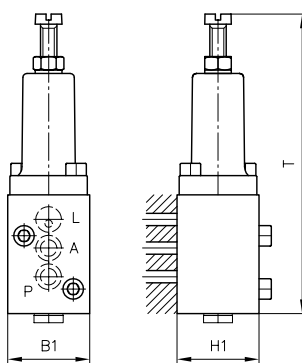
ADM 22 DR

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)



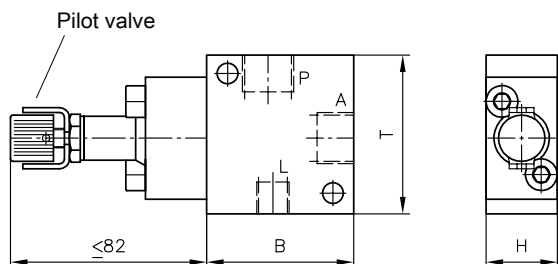
ADM...P

Manifold mounting valve



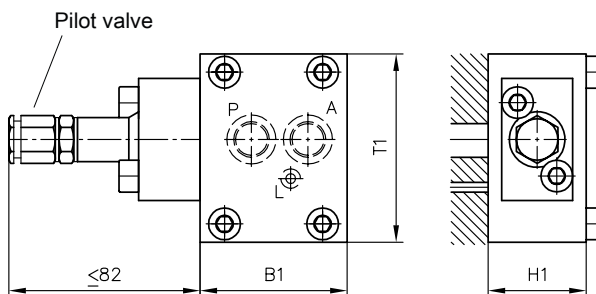
VDM...G

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			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) For pipe connection versions

3) Version for pipe connection / manifold mounting

Pressure valves

3.3 Pressure-reducing valve type CDK, CLK, DK, DLZ and DZ

Pressure reducing valves are a type of pressure control valve. They maintain a largely constant outlet pressure even at a higher and changing inlet pressure.

The pressure reducing valve type CLK features an override compensation, i.e. acting like a pressure-limiting valve if the secondary pressure exceeds the set pressure e.g. due to external forces. The pressure reducing valve type DK features a tracked pressure switch, e.g. pressure and switch are set simultaneously with an adjustment device.

All versions have zero leakage when in the closed state. The valve type CDK and CLK can be screwed-in and can be integrated into control blocks. The necessary mounting holes are straightforward to make.

Features and benefits:

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

Intended applications:

- General hydraulic systems
- Jigs
- Test benches



Nomenclature:	Pressure reducing valve (2-way valve)
Design:	Screw-in valve combination with a connection block for <ul style="list-style-type: none">▪ 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

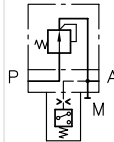


Screw-in valve

CLK

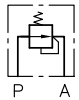


CDK 3. ...-1/4-DG3.



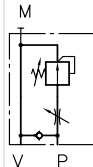
Version for pipe connection, a pressure switch type DG 3. May be installed as option, additional port for pressure gauge

CDK 3. ...-P



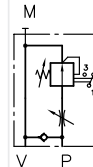
Manifold mounting valve

DZ, DLZ



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

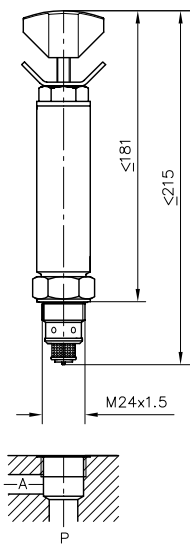
DK



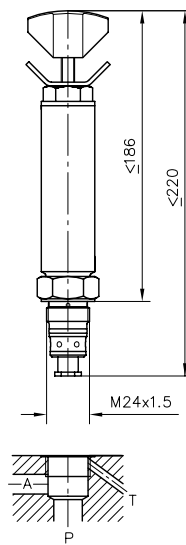
Manifold mounting valve with tracked pressure switch

General parameters and dimensions

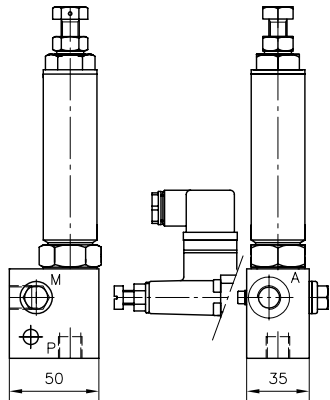
CDK 3..



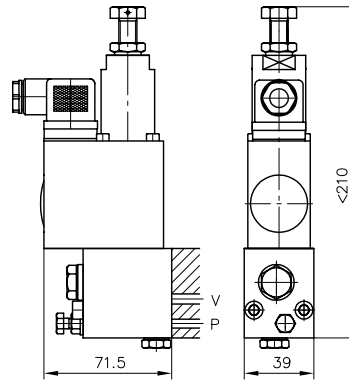
CLK 3..



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



DK 2.



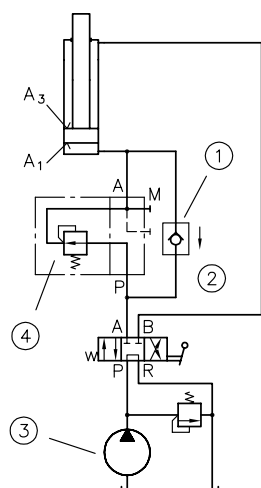
	Q _{max} [lpm]	Pressure range p _{max} [bar]		Ports (BSPP)	m [kg]
CDK 3.-..., CLK 3.-...	6... 22	..-08: 450 ¹⁾	..-2: 200..	-	0.7
CDK 3. ...-1/4-DG3.		..-081: 500 ¹⁾	..-21: 250..	G1/4	1.25
CDK 3. ...-P		..-1: 300..	..-5: 130..	-	1.4
DZ..., DLZ..., DK...		..-11: 380...	..-51: 165	-	

1) Only available as type CDK and DK

Circuit examples

Example of a version
with large flows $Q_{A \rightarrow P}$

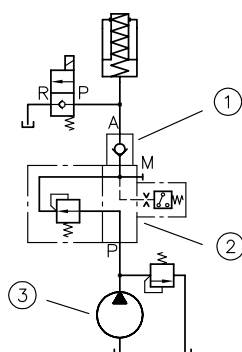
Example: $Q_P = 15 \text{ lpm}$ [formula]



Application example for large flows

- 1 e.g. type RK 2G in acc. with D 7445
- 2 $Q_{\text{return}} = 45 \text{ lpm}$
- 3 $Q_P = 15 \text{ lpm}$
- 4 Type CDK 3-2-1/4

Example of a version
with undesired return flow

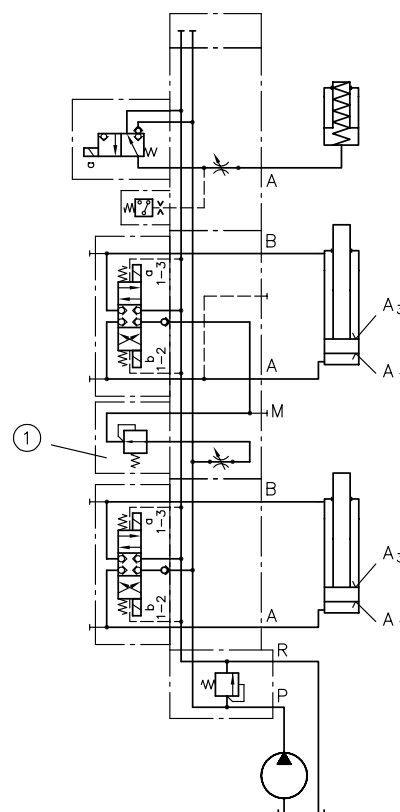


Application example for undesired return flow

- 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

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 valve type CDK: D 7745
- Pressure-reducing valve type CLK: D 7745 L
- Pressure-reducing valve type DK, DZ and DLZ: D 7941

Similar products:

- Pressure reducing valves type ADM, VDM, VDX: [Page 184](#)
- Miniature pressure reducing valves type ADC etc.: [Page 182](#)
- Prop. pressure reducing valves type PDM: [Page 194](#)

Intermediate plates:

- Intermediate plate type NZP: D 7788 Z

Accessories:

- Pressure switches type DG 3., DG 5 E: [Page 272](#)

Pressure valves

3.3 Proportional pressure-reducing valve type PM and PMZ

Proportional pressure-reducing valves are a type of pressure control valve. They remotely control the pressure in hydraulic systems continually and electrically.

The proportional pressure-reducing valve type PM and PMZ is a directly actuated valve with a piston and is controlled electro-proportionally. It continuously maintains a constant pressure on the secondary pressure side, independently of the inlet side. The proportional pressure-reducing valve type PM is available as a single valve. The proportional pressure-reducing valve type PMZ is a twin valve.

The proportional pressure-reducing valve type PM and PMZ is particularly suitable for use as a pilot valve for actuators.

Features and benefits:

- Compact design
- Numerous configurations
- Explosion-proof versions

Intended applications:

- For control oil supply in pilot circuits

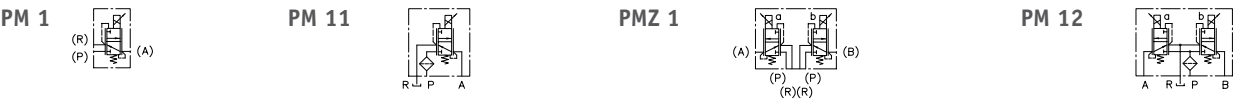


Nomenclature:	Prop. pressure reducing valve
Design:	Assembly kit Individual valve Manifold mounting
Adjustment:	Electro-proportional
p _{max} P:	40 bar
p _{max} A:	30 bar
Q _{max} :	approx.. 2 lpm

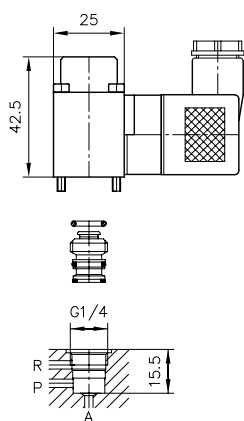
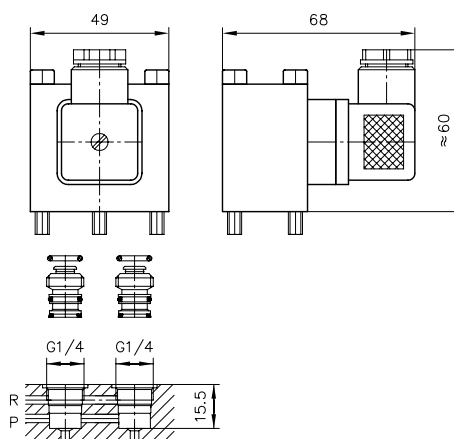
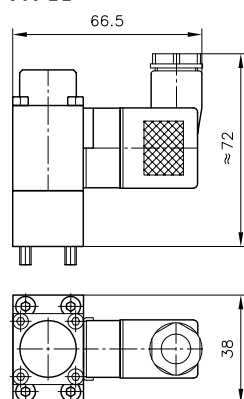
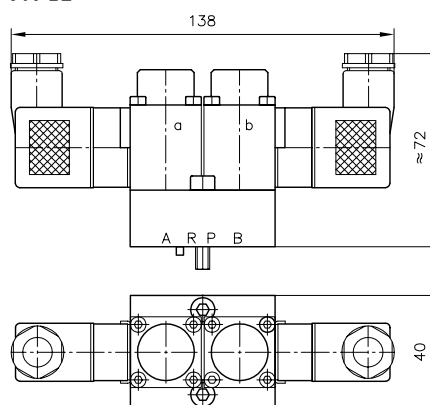
Design and order coding example

PM 1	- 11	B 0,6	- G24	- NBR
			Seals	Different materials NGR, FKM, EPDM
			Solenoid voltage	Prop. solenoid <ul style="list-style-type: none">▪ 12V DC, 24V DC▪ Control using proportional amplifier or PLVC Type PMZ also in an explosion-proof version
			Additional elements	<ul style="list-style-type: none">▪ 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			
				<ul style="list-style-type: none">▪ 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



General parameters and dimensions

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 ... 30
PMZ 1, PMZ 01		Twin valve	0 ... 30
PM 11	Valve for manifold mounting	Individual valve	0 ... 30
PM 12		Twin valve	0 ... 30

Associated technical data sheets:

- Proportional pressure-reducing valve type PM and PMZ: [D 7625](#)

Additional electrical components:

- Proportional amplifier: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)
- CAN node type CAN-IO: [Page 284](#)
- Other electronic accessories [See "Electronics"](#)

Pressure valves

3.3

Proportional pressure-reducing valve type PDM

Proportional pressure-reducing valves are a type of pressure control valve. They remotely control the pressure in hydraulic systems continually and electrically.

The proportional pressure-reducing valve type PDM is a piloted valve with a piston and is controlled electro-proportionally. The valve has an external control oil drain. It continuously maintains a constant pressure on the secondary pressure side, independently of the inlet side. The pressure reducing valve is available as a single valve for pipe connection or as a manifold mounting valve.

The proportional pressure-reducing valve PDM is particularly suitable for dynamic control of the pressure level in hydraulic systems.

- Features and benefits:
- Integrated overpressure function
- Intended applications:
- General hydraulic systems
 - Equipment
 - Test benches
 - Hydraulic tools



Nomenclature:	Prop. pressure-reducing valve (directly controlled or piloted)
Design:	Individual valve for pipe connection Individual valve Manifold mounting
Adjustment:	Electro-proportional
p _{max} P:	400 bar
p _{max} A:	5 ... 350 bar
Q _{max} :	120 lpm

Design and order coding example

PDMP 2 PDM 4 G	- 43	- G24
Solenoid voltage		
Prop. solenoid		
▪ 12V DC, 24V DC		
▪ Control using proportional 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)		

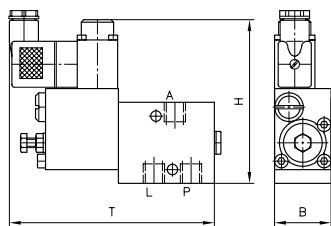
Function

PDM	
Valve for pipe connection:	Manifold mounting valve:

General parameters and dimensions

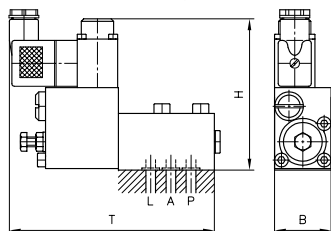
PDM 11, PDM 21, PDM 22

Valve for pipe connection

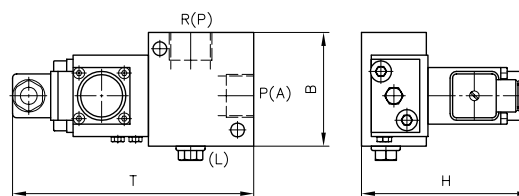


PDMP 11 and PDMP 22

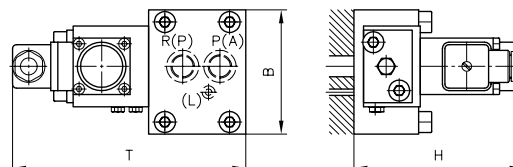
Manifold mounting valve



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	G 1/4	< 0.5	101	33	150	1.5
PDMP 11			42: 130 43: 200 44: 320	-		93,5	35	150	1.4
PDM 21/22		20	41: 45	G 1/4, G 3/8	< 0.5	101	38	157	1.6
PDMP 22			42: 70 43: 110 44: 180	-		96	40	157	1.3
PDM 3 G	Piloted	40	N: 130	G 1/2	< 0.8	100	65	150	1.8
PDM 4 G		80	M: 200	G 3/4		99.5	71	155	2.2
PDM 5 G		120	H: 350	G 1		104.5	73	170	2.7
PDM 4 P		80		-	-	99.5	78	150	2.7
PDM 5 P		120		-	-	104.5	81	178	3.2

1) For pipe connection versions

Associated technical data sheets:

- Prop. pressure reducing valves type PDM: [D 7486](#), [D 7584/1](#)

Additional electrical components:

- Proportional amplifier: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)
- CAN node type CAN-IO: [Page 284](#)
- Other electronic accessories [See "Electronics"](#)

Pressure valves

3.3 Proportional pressure-reducing valve type KFB and FB

Proportional pressure-reducing valves are a type of pressure control valve. They manually and continuously operate hydraulic actuators at a distance.
The proportional pressure-reducing valve type FB is available as a single valve for pipe connection. Type KFB is a valve bank and combines several valves.
The proportional pressure-reducing valve type FB and KFB is primarily used for remote control of the directional spool valve type PSL or PSV.

Features and benefits:

- Sturdy design
- Precise control

Intended applications:

- For control oil supply in pilot circuits

Additional versions:

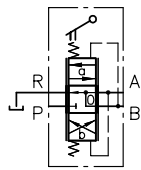
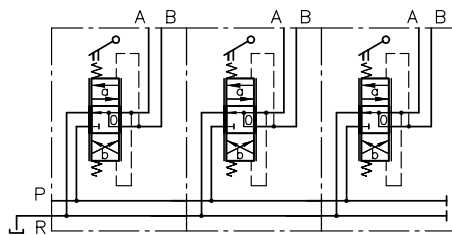
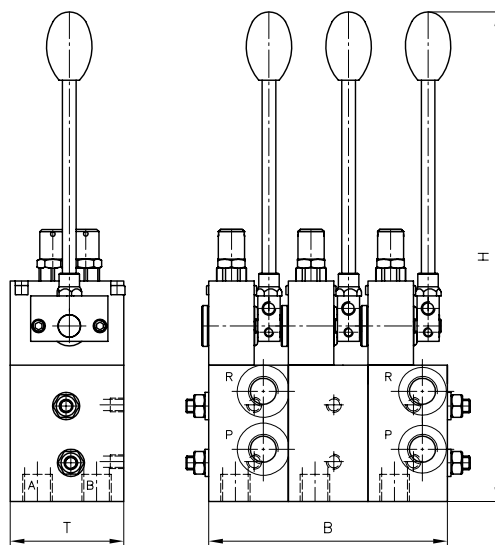
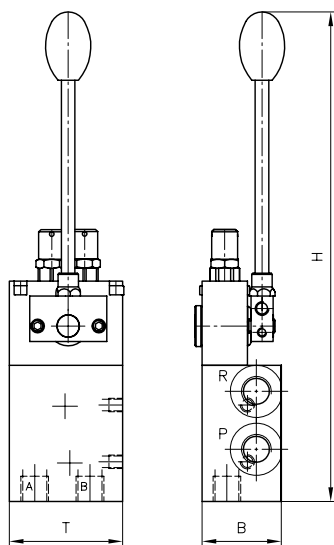
- With UNF thread



Nomenclature:	Proportional pressure-reducing valve Hydraulic joystick
Design:	Single valve / Valve bank in pipe connection
p _{max} :	30 bar
Q _{max} :	2 l/min

Design and order coding example

KFB01	A	/19	/F	1	
					Additional elements for actuation
					Without labelling - with hand lever 1 - Without hand lever 005 - with hand lever bent at an angle of 5° 015 - With hand lever bent at an angle of 15° 025 - With hand lever bent at an angle of 25° 030 - With hand lever bent at an angle of 30°
					Manual operation
					F - manual operation with return spring FC - detent
					Pressure range of prop. pressure-reducing valve
					Pressure ranges 4; 5.5; 7; 9; 11; 14; 19; 30
					Valve sections
					A - Front section M - Middle section E - End section
					Basic type, size
					Type KFB (valve bank) Type FB (single valve)

Function
Single valve

Valve bank

General parameters and dimensions
FB 01
KFB 01


	Q_{\max} [lpm]	Pressure range p_{\max} [bar]	Ports	Dimensions [mm]		
				H	B	T
FB 01	2	30	G 1/4	215,45	35	50
KFB 01	2	30	G 1/4	215,45	x · 35	50

Associated technical data sheets:

- [Proportional pressure-reducing valve type KFB 01: D 6600-01](#)

Pressure valves

3.3 Pressure-controlled shut-off valve type CNE

Shut-off valves or accumulator charging valves are a type of pressure control valve. They switch the delivery flow of a pump to unpressurised circulation if the pressure value set is reached. During this process the consumer side is separated from the idle circulation by a zero-leakage check valve. If the pressure drops in the consumer side, the idle circulation is interrupted and the oil fed to the consumer again.

Via a control line the higher pressure holds open the pressure-controlled 2 directional valve type CNE and with it the idle circulation. In the low-pressure circuit the valve acts simultaneously as a pressure-limiting valve.

The valve type CNE can be screwed-in and can be integrated into control blocks. The necessary mounting holes are straightforward to make.

- Features and benefits:**
- Compact design
 - Easily produced mounting hole
- Intended applications:**
- Accumulator charged systems
 - Jigs



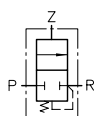
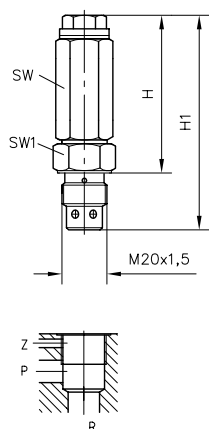
Nomenclature:	2-way circulation valve
Design:	Screw-in valve
Adjustment:	Tool adjustable
p _{max} •	500 bar
p _{max adjust} •	450 bar
Q _{max} •	30 lpm

Design and order coding example

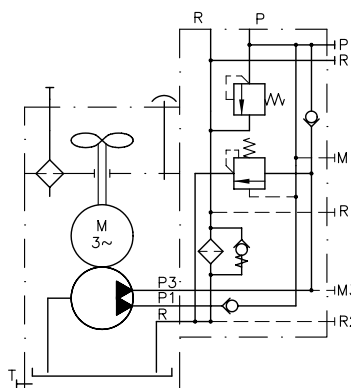
CNE 2 C - 50

Pressure setting [bar]
Pressure range
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	30	E: 30	500	70	96	22	24
CNE 21		D: 45					
CNE 23		C: 60					
		B: 75					
		A: 90					
		M: 120					
		L: 150					
CNE 22	30	C: 320	500	120	147	30	27
		B: 450					

Associated technical data sheets:

- Pressure-controlled shut-off valve type CNE: [D 7710 NE](#)

Similar products:

- Two-stage valves type NE: [Page 200](#)
- Switch units type CR: [Page 156](#)
- Shut-off valves type LV, ALZ: [Page 202](#)
- Switching valves type AE: [Page 176](#)

Connection blocks:

- Connection blocks type A for hydraulic power packs: [D 6905 A/1](#)

Pressure valves

3.3

Two-stage valve type NE

Two-stage valves are a type of pressure control valve. They are used in hydraulic systems that are supplied by dual stage pumps, a combination of high-pressure pump and low-pressure pump.

The two-stage valve type NE combines the two pump delivery flows into a common volumetric flow. It switches the low-pressure pump to unpressurised circulation if the pressure value set is reached. It protects both pumps against exceeding the high or low-pressure value set.

The two-stage valve type NE is used with directional valves to control double-acting hydraulic cylinders.

Features and benefits:

- Operating pressures up to 700 bar
- Direct mounting on hydraulic power packs
- Direct combination with valve control

Intended applications:

- Presses
- Test benches
- Hydraulic tools



Nomenclature:	Two stage valve (high pressure (HP) / low pressure (LP) stage)
Design:	Individual valve for pipe connection
Adjustment:	Tool adjustable
p _{max} :	500 ... 700 (HD) / 16 ... 80 (ND) 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

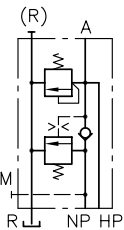
NE 20, 70 and 80

Additional versions:

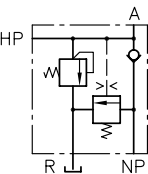
- Direct mounting at hydraulic power packs type MP and RZ
- Valve banks type BV can be directly mounted (type NE 21)

Function

NE 20

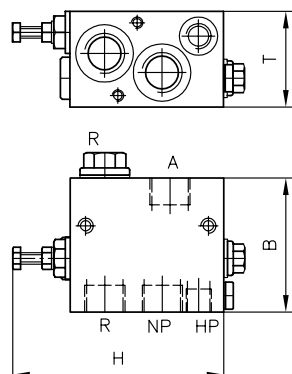


NE 70, NE 80

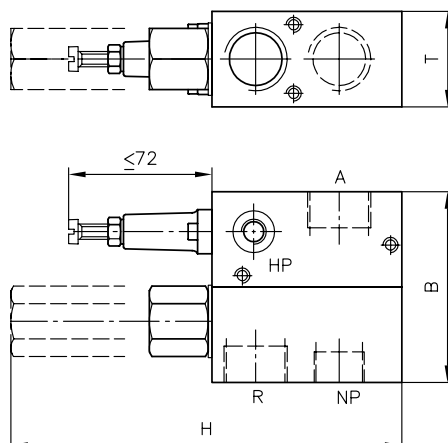


General parameters and dimensions

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 valve type NE: [D 7161](#)

Pumps:

- Compact hydraulic power packs type MP, MPN, MPW, MPNW: [Page 54](#)
- Dual-stage pump type RZ: [Page 62](#)

Similar products:

- Idle circulation valves type CNE: [Page 198](#)
- (Press) switch units type CR: [Page 156](#)
- Directional seated valves type VB: [Page 132](#)

Pressure valves

3.3 Shut-off valve type LV and ALZ

Shut-off valves or accumulator charging valves are a type of pressure control valve. They switch the delivery flow of a pump to unpressurised circulation if the pressure value set is reached. During this process the consumer side is separated from the idle circulation by a zero-leakage check valve. If the pressure drops in the consumer side, the idle circulation is interrupted and the oil fed to the consumer again.

The shut-off valve type LV and ALZ operates using automatically controlled (pulse independent) step switching in the pilot valve.

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 reflux 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

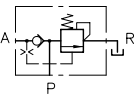
LV 10 P	D	- 180
ALZ 3 G	CR	- 250

	Pressure setting [bar]
	Pressure range <ul style="list-style-type: none">▪ Tool adjustable (-)▪ Manually adjustable (R)
Basic type, size, design	Type LV, size 10, 20, 25 <ul style="list-style-type: none">▪ Pipe connection (-)▪ Manifold mounting (P)▪ Design with low switching hysteresis (type LV 25) Type ALZ, size 3 to 5 <ul style="list-style-type: none">▪ Pipe connection (G)▪ Manifold mounting (P)

Function

LV, ALZ

For pipe connection:

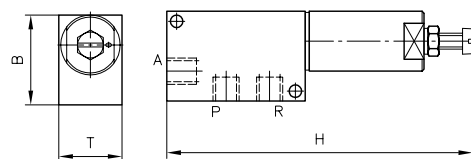


Manifold mounting valve:

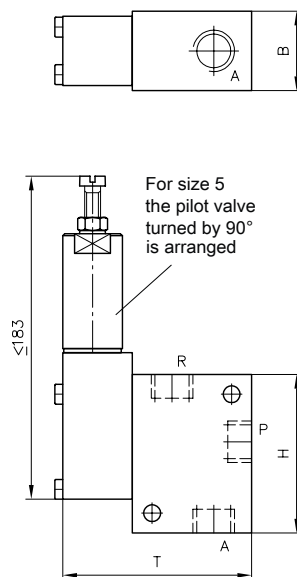


General parameters and dimensions

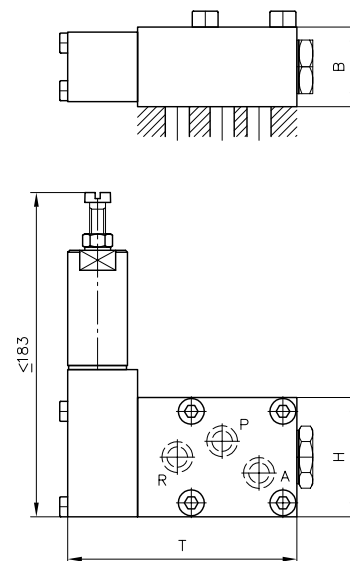
LV..



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 valve type LV: D 7529
- Shut-off valve type ALZ: D 6170 ALZ
- Pressure valve with check valve type AL, AE and AS: D 6170

Similar products:

- Release valves type AE: [Page 176](#)
- Connection blocks type AL: [Page 68](#)

Pressure valves

3.3 Pressure-dependent shut-off valve type DSV and CDSV

Pressure-dependent shut-off valves are a type of pressure control valve. When a set pressure value is reached and exceeded, they block the flow to consumer line B with zero leakage. The valves will open again if the pressure on inflow side A falls below the set value defined by the spring tension.

The pressure-dependent shut-off valve type DSV and CDSV is used as a safeguard pressure gauge, for example.

Features and benefits:

- Various adjustment options
- Various additional functions

Intended applications:

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



Nomenclature:	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

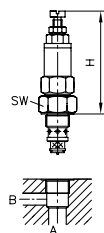
Type DSV (pipe connection), type DSVP (manifold mounting), size 1, 2, 3

Function
CDSV 1, DSV 2

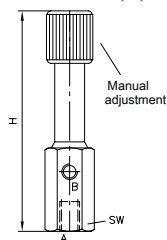
DSVP 2

General parameters and dimensions
CDSV 1

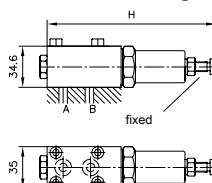
Screw-in valve


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 2¹⁾	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 2¹⁾	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:

- [Pressure controlled shut-off valves type DSV...: D 3990](#)
- [Pressure-dependent shut-off valve type CDSV: D 7876](#)

Pressure valves

3.3 Load-holding valve type LHK, LHDV and LHT

Load-holding valves are a type of pressure control valve. They prevent loads on cylinders or motors dropping in an uncontrolled manner. For this purpose they are pre-loaded with a pressure setting that is higher than the largest possible load. A hydraulic piston controls the opening of the valve to achieve the required lowering velocity.

The load-holding valve type LHK and LHT is suitable for applications without a tendency to large fluctuations. The load-holding valve type LHDV has special damping properties. It is used particularly in conjunction with proportional directional spool valves, e.g. type PSL and PSV.

Shock valves and shuttle valves with or without restrictor check valves can be fitted in the load-holding valve type LHK, LHDV and LHT, e.g. to relieve hydraulic brakes with a delay. 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.

Features and benefits:

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

Intended applications:

- Cranes
- Construction machinery
- Lifting devices



Nomenclature:	Load holding valve (over center valve, for one sided or alternating load direction) Single or twin valve
Design:	Individual or twin valve for pipe connection Individual or twin manifold mounting valve 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

				Pressure setting load-holding pressure [bar]
			Design	Various housing designs available
			Dampening	Without/with, or with restrictor check valve
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

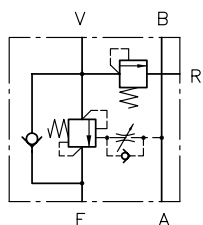
Type LHDV (with tailored dampening characteristics), size 3
Type LHT, size 2, 3 and 5

Additional versions:

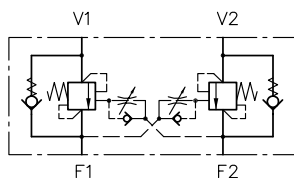
- Cartridge valve versions
- Type LHT
- Type LHTE, with discharge pressure compensation

Function

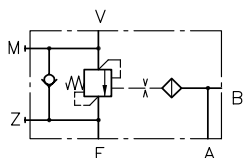
LHK 33 G-15-...



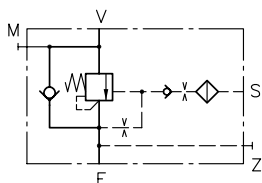
LHK 44 G-21-...



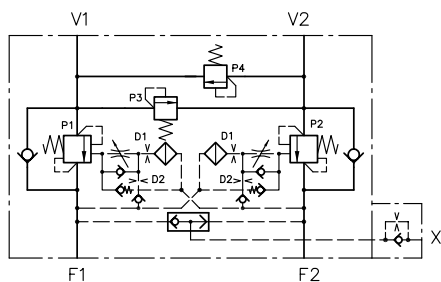
LHT 21 H-14-...



LHT 33 P-11-...



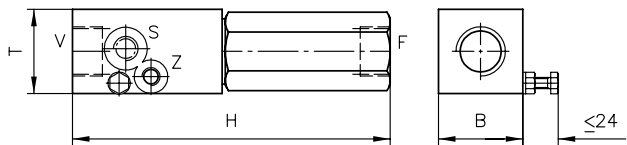
LHDV 33 G-25WD-...



General parameters and dimensions

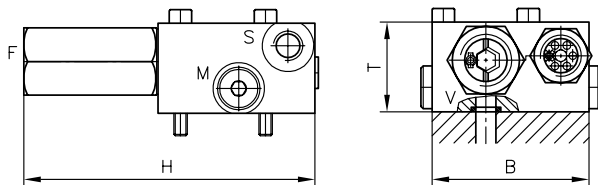
LHK 44 G - 11 - 160

Individual valve



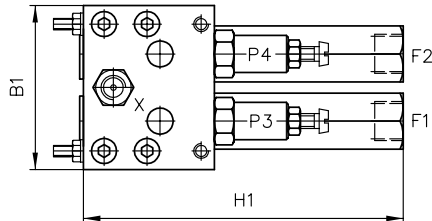
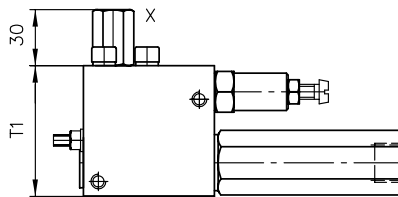
LHT 33 P - 15

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!

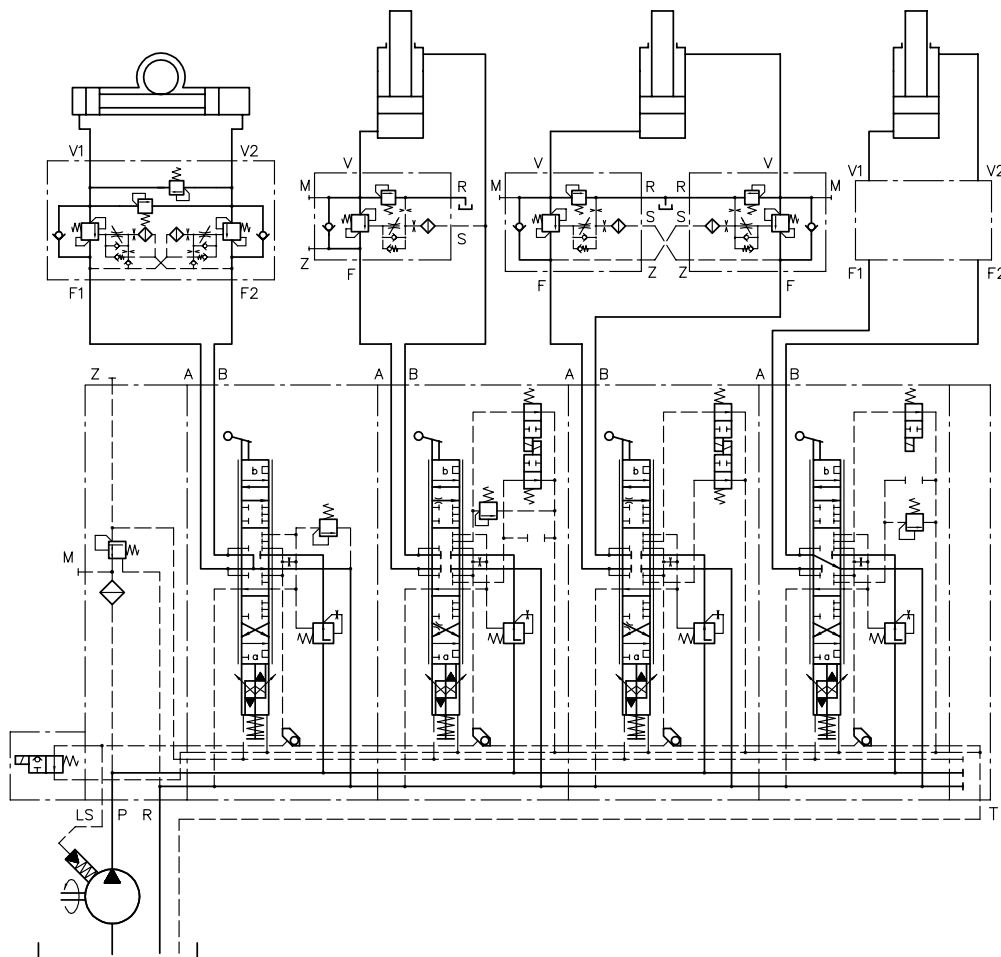
Example circuit:

LHDV 33-25-D6-180/180-200/200

LHDV 33 P-15-D6-280/300

LHDV 33 P-15-D6-280/300

LHK 33 G-21-... acc. to D 7100


Associated technical data sheets:

- [Load-holding valve type LHK: D 7100](#)
- [Load-holding valve type LHDV: D 7770](#)
- [Load-holding valve type LHT: D 7918](#)

Additional integrable functions:

- Proportional directional valves type PSL, PSV, PSLF: [Page 106](#)
- Proportional directional valves type PSLF, PSVF: [Page 112](#)

3.4 Flow valves

Flow control valve type SF, SD and SK	214
Flow control valve (lowering brake valve) type SB, SQ, SJ and DSJ	218
Proportional flow control valve type SE and SEH	220
Flow divider type TQ	224
Priority valve type PV	226
Restrictors and restrictor check valve type EB, BE, BC	228
Throttle valve type Q, QR, QV and FG	230
Throttle valve type ED, restrictor check valve type RD and RDF	232
Throttle valve and restrictor check valve type CQ, CQR and CQV	234
Throttle valve and shut-off valve type AV, AVT and CAV	236



*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} (bar)	Q _{max} (lpm)
SF, SD, SK	2-way and 3-way flow control valve <ul style="list-style-type: none"> Individual valve for pipe connection Manifold mounting valve 	- Mechanical	320	3: 60 4: 90 5: 130
SB, SQ, SJ, DSJ	2-way metering valve, lowering brake valve <ul style="list-style-type: none"> Cartridge valve Version with housing for pipe connection 	- Tool adjustable	315	SB, SQ, SJ - 0: 15 SQ, DSJ - 1: 25 SB - 1: 35 SB, SQ - 2: 67 SB, SQ - 3: 150 SB - 4: 250 SB - 5: 400
SE, SEH	2-way and 3-way flow control valve <ul style="list-style-type: none"> Individual valve for pipe connection Manifold mounting valve 	- Electro-proportional	320	SEH - 2: 30 SE, SEH - 3: 50 SE, SEH - 4: 90 SEH - 5: 120

Flow dividers

Type	Nomenclature/Design	Adjustability	p _{max} (bar)	Q _{max} (lpm)
TQ	Flow dividers <ul style="list-style-type: none"> Individual valve for pipe connection Manifold mounting valve 	- Non-adjustable	350	3: 70 4: 120 5: 200
PV	Priority valve <ul style="list-style-type: none"> Single valve for pump installation 		250	5: 120

Orifices, restrictor check valves

Type	Nomenclature/Design	p_{\max} (bar)	Q_{\max} (lpm)
EB, BE, BC	Orifice, restrictor check valve <ul style="list-style-type: none"> ■ Plug-in valve ■ Screw-in valves ■ Version with housing for pipe connection 	EB: 500	EB - 0: 6
			EB - 1: 12
		BE: 500	EB - 2: 40
			EB - 3: 100
			EB - 4: 120
		BC - 1: 700	
		BC - 2: 700	BE - 0: 12
		BC - 3: 500	BE - 1: 25
			BE - 2: 40
			BE - 3: 80
			BE - 4: 120
			BC - 1: 20
			BC - 2: 35
			BC - 3: 60

Throttles and throttle shut-off valves

Type	Nomenclature/Design	Adjustability	p _{max} (bar)	Q _{max} (lpm)
Q, QR, QV, FG	Throttle, restrictor check valve <ul style="list-style-type: none"> ▪ Screw-in valve ▪ Individual valve for pipe connection Angle valve Banjo bolt Swivel fitting 	- Tool adjustable	Q, QR, QV - 20, 30, 40, 50: 400 Q, QR, QV - 60: 315 FG: 320	Q, QR - 20: 12 Q, QR - 30: 20 Q, QR - 40: 40 Q, QR - 50: 60 Q, QR - 60: 80 QV - 20: 8 QV - 30: 12 QV - 40: 20 QV - 50: 30 QV - 60: 50 FG: 0.8
ED, RD, RDF	Throttle, restrictor check valve <ul style="list-style-type: none"> ▪ Individual valve for pipe connection 	- With tool, fixed, - Manually adjustable	500	11: 15 21: 35 31: 60 41: 100 51: 150
CQ, CQR, CQV	Throttle, restrictor check valve <ul style="list-style-type: none"> ▪ Screw-in valve 	- Tool adjustable	700	2: 50
AV, AVT, CAV	Throttle and shut-off valve <ul style="list-style-type: none"> ▪ Individual valve for pipe connection ▪ Screw-in valve 	- Tool adjustable, - Manually adjustable	AV - 2: 500 AV - 3: 400 AVT: 630 CAV: 500	AV - 2: 40 AV - 3: 100 CAV - 1: 15 CAV - 2: 25

3.4

Flow control valve type SF, SD and SK

Flow control valves are a type of flow valve. They generate a set constant volumetric flow, largely independently of the load.

The flow control valve type SD, SF and SK can be freely adjusted with different mechanical actuations. The flow control valve type SD, SF and SK is available as a 2-way and 3-way flow control valve. For type SD, the adjustment is made using the adjusting knob; for type SF using the adjusting screw; and for type SK using the roller actuation. The flow control valve type SD, SF and SK is available as a single valve for pipe connection or as a manifold mounting valve.

Pressure-limiting valves and randomly switchable idle circulation valves are additional options. The flow control valve type SD, SF and SK controls the operating speed of the hydraulic consumers.

- Features and benefits:**
- Various actuation types
 - Can also be combined with bypass check valves
 - Precise setting

- 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 <ul style="list-style-type: none">▪ Adjusting knob▪ Roller actuation▪ Adjusting screw
p _{max} •	315 bar
Q _{max} •	6 ... 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)

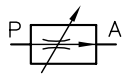
Flow Flow steps via orifices Q_{\max} : 3, 6, 15, 36, 50, 60, 70, 90, 130 lpm

Basic type, design, size

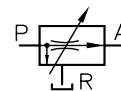
- Type SD, with turn-knob
- Type SD with adjusting knob actuation
- Type SK with roller actuation (open version)
- Type SU, solenoid actuation, switching between to fixed values (only size 3 and only with pipe mounting design)
- Size 3 to 5
- Size 3 to 5

Function

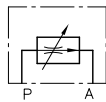
2-way, pipe connection



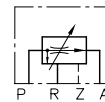
3-way



2-way, manifold mounting valve



3-way



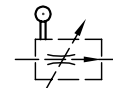
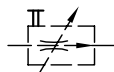
Actuation:

SF ...

SD ...

SK ...

SKR ...



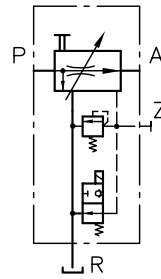
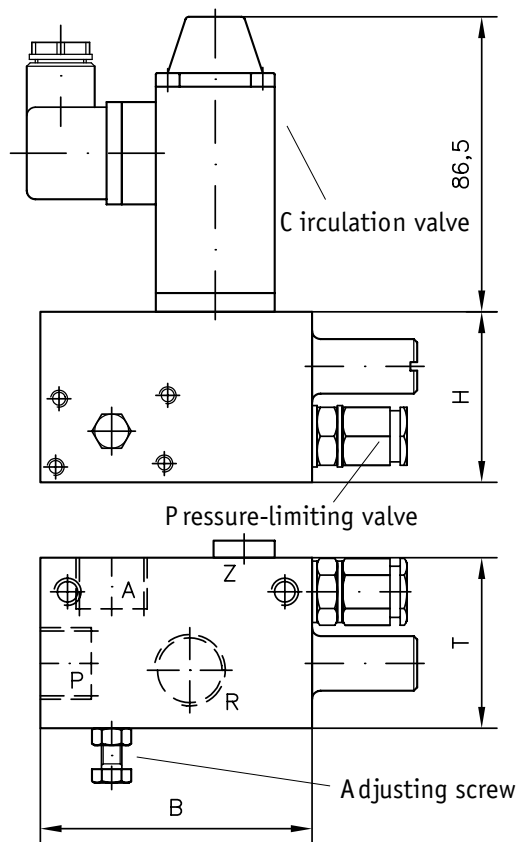
Set screw SW 10
adjustment travel 5 mm

Adjusting knob,
adjustment travel
3.8 turns

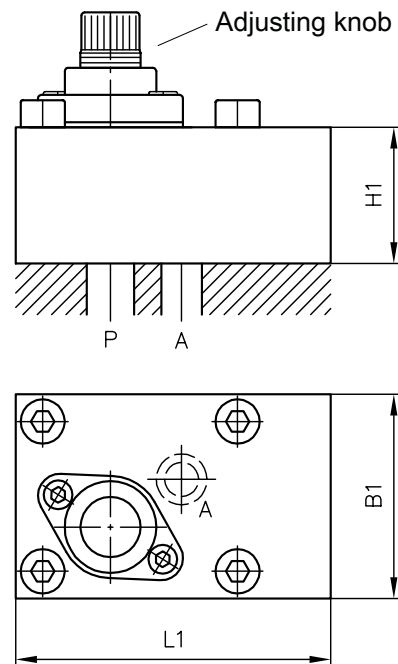
Roller actuation
Unshielded version (SK), Shielded version (SKR)
Actuation travel 15,5 ... 17 mm,
Actuation force 30 ... 70 N

General parameters and dimensions

Version for pipe connection



Manifold mounting valve



2-way	3-way	Q _{max} [lpm] ¹⁾	Ports (BSPP) ²⁾	Dimensions [mm]						m [kg] ³⁾
				H	H1	L	L1	B	B1	
S. 2-3		0,3 ... 60	G 1/2	50	40	80	93	50	60	1,4 ... 2,1
	S. 3-3			50	40	80	93	50	60	1,4 ... 2,1
S. 2-4		0,3 ... 90	G 3/4	60	50	85	100	60	70	2
	S. 3-4			60	50	85	100	60	70	2,0 ... 2,6
S. 2-5		1,0 ... 130	G 1	70	50	100	106	70	80	3,1
	S. 3-5			70	50	100	106	70	80	2,8 ... 3,7

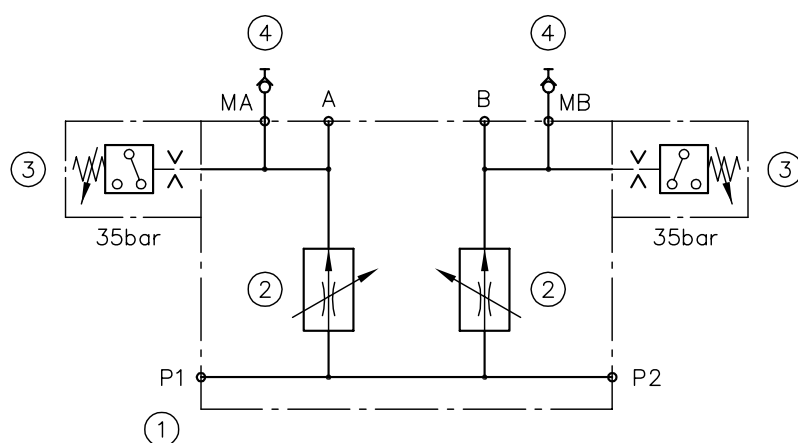
1) Different Q_{max} available, see Design and order coding example: "Orifice steps"

2) For pipe connection versions

3) Depending on actuators

Example circuit:

Position	Number	Designation
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:

- [Flow control valve type SD, SF and SK: D 6233](#)

Similar products:

- Lowering brake valves type SB, SQ: [Page 218](#)
- Prop. flow control valves type SE, SEH: [Page 220](#)

Plugs:

- [Line connector type MSD and others: D 7163](#)

Flow valves

3.4

Flow control valve (lowering brake valve) type SB, SQ, SJ and DSJ

Flow control valves are a type of flow valve. They generate a set constant volumetric flow, largely independently of the load.

The flow control valve type SB and SQ is available as a screw-in cartridge, a housing version with pipe connection or as a banjo screw version. Type SB has a slightly inclined characteristic curve for oscillation damping. Type SQ is largely independent of the load.

The freely movable sliding metering orifice enables greater flow in the opposite flow direction. No bypass check valve is therefore required. The flow control valve type SB and SQ is used to control the lowering speed of single-acting consumers.



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

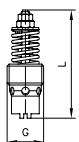
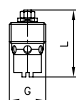
SB 21C - 30

	Response flow [l/min]	Desired factory set response flow within the respective range
Design	Adjustable or non adjustable version	
	<ul style="list-style-type: none">Screw-in version (C)Version with housing for pipe mounting (E, F, G)	
	Additional versions	
	<ul style="list-style-type: none">With metric or UNF-threadWith thread adaptorAs banjo bolt and/or with swiveling screw fitting	
Adjustment range	Adjustable response flow	
Basic type, size	Type SB, SQ and SJ, size	
	Type DSJ, flow control function in both directions for double-acting consumers	

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	L _{1 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 0¹⁾								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 3/8 (A)	39	78	19	30

1) Type SJ 0 without coding: adjust. range 0.25 ... 1.2 l/min

2) Not for type SQ..

Associated technical data sheets:

- [Flow control valve \(lowering brake valve\) type SB and SQ: D 6920](#)
- [Flow control valve type SJ: D 7395](#)
- [Flow control valve type CSJ: D 7736](#)
- [Flow control valve type DSJ: D 7825](#)

3.4 Proportional flow control valve type SE and SEH

Proportional flow control valves are a type of flow valve. They generate a constant volumetric flow independent of the load which can be controlled in an electro-proportional and remote way.

The flow control valve type SE has a directly actuated metering orifice, which has an advantage of approximately Q_{min} equal to zero in terms of the controllability. The flow control valve type SEH has a piloted metering orifice which is shown to be beneficial in dynamic systems with short reaction times. The flow control valve type SE and SEH is available as a single valve for pipe connection or as a manifold mounting valve. Pressure-limiting valves and randomly switchable idle circulation valves are additional options. The flow control valve type SE and SEH controls the operating speed of hydraulic consumers.

Features and benefits:

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

Intended applications:

- Construction machines
- Machine tools
- General hydraulic systems
- Mining machinery



Nomenclature:	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

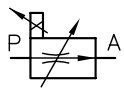
Design and order coding example

SE 2-3 /30F - P - G24

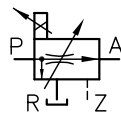
Basic type, size	Solenoid voltage	Prop. solenoid <ul style="list-style-type: none">▪ 12 V DC, 24 V DC▪ Controls via prop. amplifier or PLVC
	Design and port size	<ul style="list-style-type: none">▪ Pipe connection▪ Manifold mounting (P)
	Flow [lpm]	Nom. flow of the metering orifice <ul style="list-style-type: none">▪ Deenergized open▪ Deenergized closed (coding F)
		Orifice steps Q_{\max} : 3, 6, 10, 15, 22, 30, 36, 50, 70, 90, 120 lpm
		Type SE, with non-piloted metering orifice, size 3, 4 Type SEH, with piloted metering orifice, size 2 to 5 <ul style="list-style-type: none">▪ Available as 2- and 3-way flow control valve

SE, SEH

2-way
Pipe connection

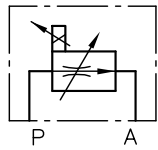


3-way
Pipe connection

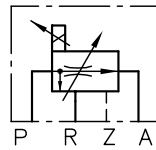


1)

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

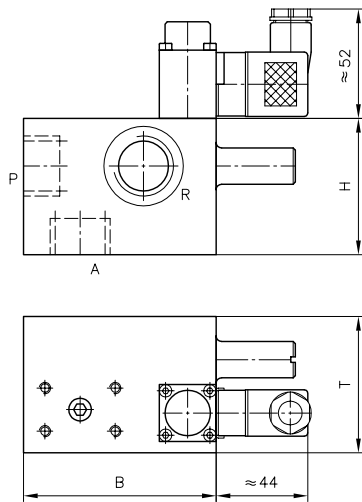
- Version with bypass check valve
- Version with check valve in bridge circuit for free selection of the flow direction

3-way flow control valve

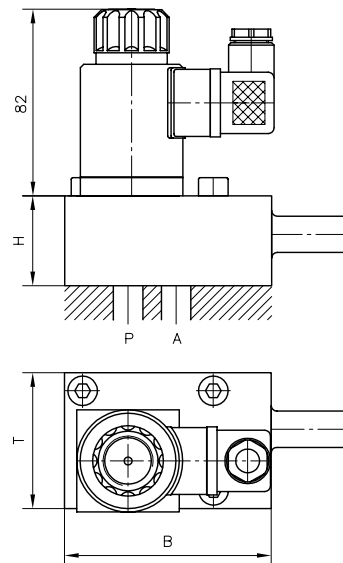
- Version with pressure-limiting valve
- Version with pressure-limiting valve and circulation valve (for pipe connection versions only)
- Version with compulsory closed position of the pressure compensator when not actuated type ...F0
- Version with automatic circulation type ...B 0.6

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	SE 3-4		0,6 ... 90	315	G 3/4	120 ... 130	85 ... 100	60 ... 70	2,2
SEH 2-2	SEH 3-2	Hydraulically piloted	0,1 ... 36	315	G 3/8	115	55 ... 70	39	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

-

- Proportional amplifier: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)
- CAN node type CAN-I/O: [Page 284](#)
- Other electronic accessories See "Electronics"

Flow valves

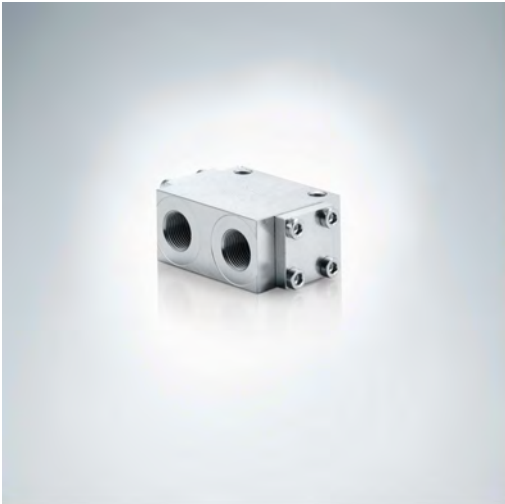
3.4

Flow divider type TQ

Flow dividers are a type of metering valve. They divide or add together a total volumetric flow either evenly or using a fixed ratio. The consumer pressures have no effect. The flow divider type TQ is, due to its simple design, an economical solution for simple dividing tasks, e.g. if two hydraulic consumers with varying loads supplied from one pump are to be moved simultaneously without interaction. Intended applications include mobile hydraulics and industrial hydraulics.

- Features and benefits:**
- Excellent dividing accuracy

- Intended applications:**
- Steering systems
 - Synchronous cylinders



Nomenclature:	Flow dividers
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

TQ 32

- A

- 2,0
- 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

Function

TQ

Pipe connection

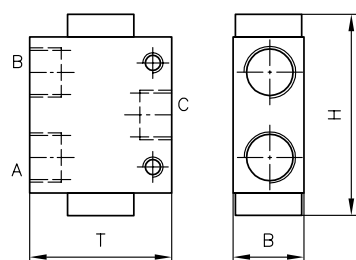
TQ.P

Manifold mounting valve

General parameters and dimensions

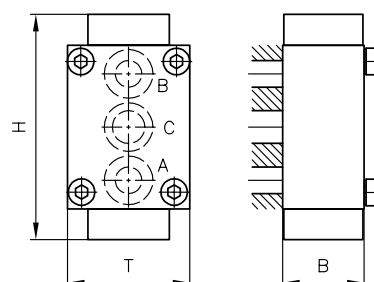
TQ...

Pipe mounting



TQ .P

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

1) For pipe mounting versions only

Associated technical data sheets:

- [Flow divider, type TQ: D 7381](#)

Flow valves

3.4 Priority valve type PV

Priority valves are a type of metering valve. They ensure that particularly critical consumers are always adequately supplied with hydraulic oil.

The priority valve type PV divides the pump volumetric flow into two circuits. The one circuit has priority of supply, for example the steering on the vehicle. The other circuit receives the remaining volumetric flow.

The valve is suitable for mounting directly on the hydraulic pump.

Features and benefits:

- Oscillation damping
- Compact mounted valve
- No additional pipework

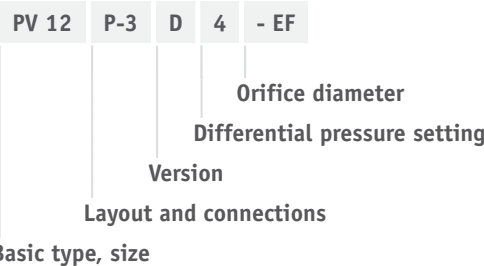
Intended applications:

- Machines for forestry and agricultural purposes
- Industrial trucks
- Construction machines
- Municipal trucks

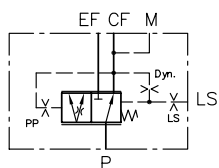


Nomenclature:	Priority valve
Version:	Single valve for pump installation
p_{max}:	250 bar
Q_{max}:	120 l/min

Design and order coding example

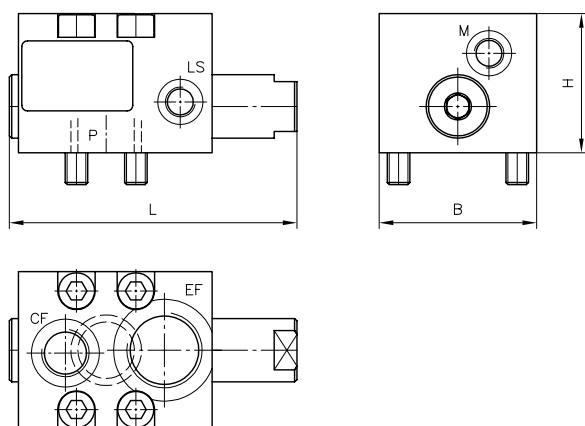


Function



General parameters and dimensions

Single valve



	Ports				Dimensions [mm]		
	P	EF	CF	M, LS	L	B	H
PV 12	G 1	G 1	G 1/2	G 1/4	127	69,5	61,5

Associated technical data sheets:

- Variable displacement axial piston pump type V30E: D 7960 E
- Variable displacement axial piston pump type V40M: D 7961
- Variable displacement axial piston pump type V60N: D 7960 N
- Fixed displacement axial piston pump type K60N: D 7960 K
- Proportional directional spool valve, type PSL and PSV size 2: D 7700-2
- Proportional directional spool valve, type PSL, PSM and PSV size 3: D 7700-3

3.4

Restrictors and restrictor check valve type EB, BE, BC

Restrictors are a type of flow valve. They are used as a local flow resistance that suddenly reduces the line cross-section. The reduction in the cross-section is very short. As a result the volumetric flow is only dependent on the pressure difference and not on the viscosity. The restrictor check valve type BE and BC combines the function of a metering valve with a check valve. The valve is available as a perforated restrictor or as a slotted restrictor. It limits the volumetric flow during the switching of directional valves. E.g. it limits the flow or prevents excessively quick accumulator emptying.

The orifice insert type EB is primarily used in valves for manifold mounting. As such an additional intermediate plate is not necessary.

- 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

BC1-0,8G

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

- Type BC and BE with metric thread

Function

BC

Screw-in valve

BE

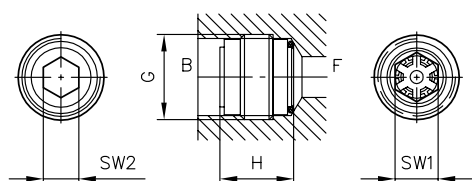
EB

Orifice insert

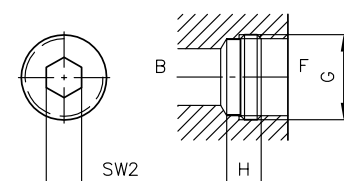
General parameters and dimensions

BC..

Screw-in valve

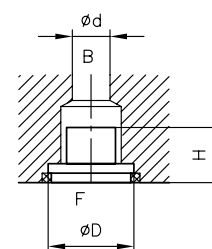


BE ..



EB..

Orifice insert



	Q_{max} [l/min]	p_{max} [bar]	Thread	Dimensions				m [g]
				H [mm]	G / D	SW = a/f 1/Æd	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 valve type BC: D 6969 B
- Restrictor check valve type BE: D 7555 B
- Orifice type EB: D 6465

Similar products:

- Insert check valves type RK, RB, RC, RE, ER: [Page 242](#)

- Restrictor check valves type RD, ED, RDF: [Page 232](#)

Flow valves

3.4 Throttle valve type Q, QR, QV and FG

Throttle valves are a type of flow valve. They affect the volumetric flow for single and double-acting consumers.
The valve type Q, QR, QV and FG can be integrated into control blocks or into the pipework as a banjo screw version.

- Features and benefits:**
- Different installation options
 - Simple design

- Intended applications:**
- General hydraulic systems



Nomenclature:	Throttle Restrictor check valves
Design:	Cartridge Individual valve for pipe mounting <ul style="list-style-type: none">▪ Corner housing▪ Banjo bolt▪ Swivel fitting
Adjustment:	Tool adjustable
p _{max} :	300 400 bar
Q _{max} :	0 ... 80 lpm

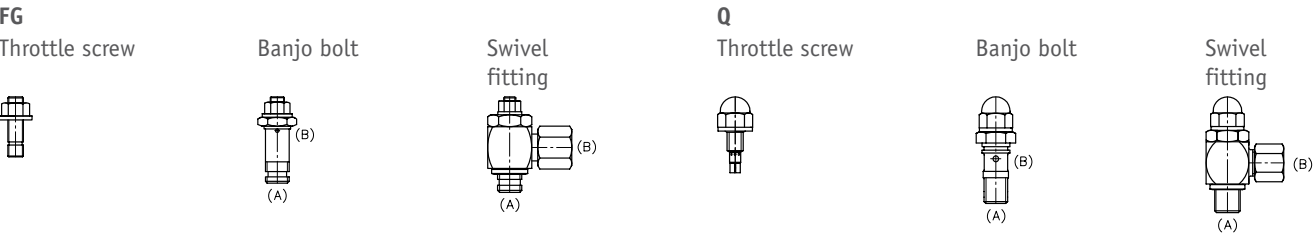
Design and order coding example

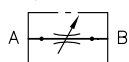
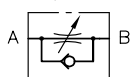
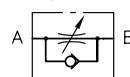
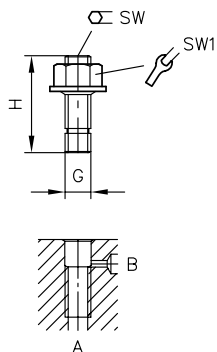
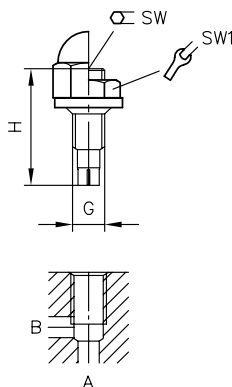
QR 20	- H 6	K
FG 1		

- 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:



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) The values apply to a fully opened valve (observe red marking) and a back pressure of approx. 50 bar (in a throttled direction)

Associated technical data sheets:

- Throttle valve and throttle check valve type Q, QR and QV: [D 7730](#)
- Throttle valve and throttle check valve type FG: [D 7275](#)

Similar products:

- Throttle valves type CQ, CQR, CQV: [Page 234](#)
- Throttle and restrictor check valves type ED, RD and RDF: [Page 232](#)

- Restrictor check valves and orifice inserts type EB, BE, BC: [Page 228](#)

Flow valves

3.4 Throttle valve type ED, restrictor check valve type RD and RDF

Throttle valves are a type of flow valve. They affect the volumetric flow for single and double-acting consumers.

The valve type ED, RD and RDF can be integrated directly in the line.

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

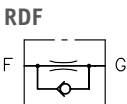
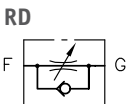
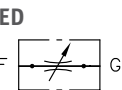
RD 11		- K
RDF 21	/1,0	

- 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)

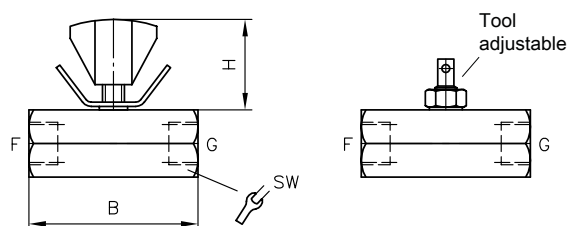
- Basic type, size**
- Type ED, type RD, type RDF, size 1 to 5
 - Slot-type throttles, available with or without built-in check valve

Function

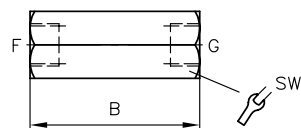


General parameters and dimensions

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 can be 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 230](#)
- Throttle valves type CQ, CQR, CQV: [Page 234](#)
- Restrictor check valves type EB, BE, BC: [Page 228](#)

3.4 Throttle valve and restrictor check valve type CQ, CQR and CQV

Throttle valves are a type of flow valve. They affect the volumetric flow for single and double-acting consumers.

The double spindle sealing permits leak-free adjustment also under pressure.

The valve type CQ, CQR and CQV can be screwed-in and can be integrated into control blocks. The necessary mounting holes are straightforward to make.

The throttles type CQ, CQR and CQV are flow 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

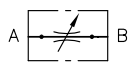
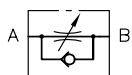
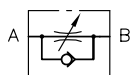
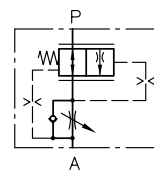
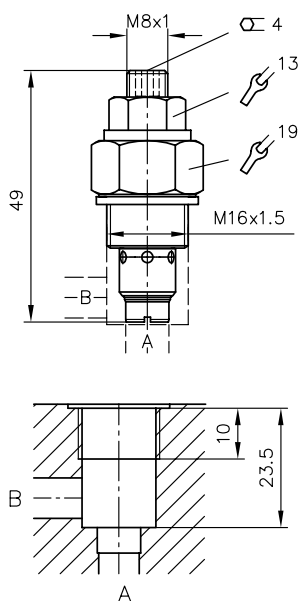
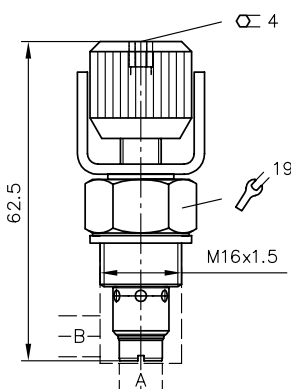
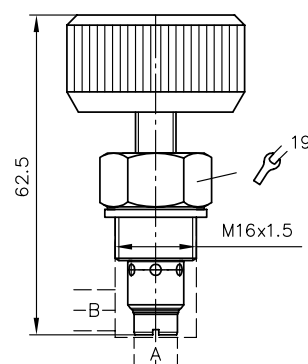


Nomen-clature:	Throttle Restrictor check valves
Design:	Screw-in valve
Adjustment:	Tool adjustable Manually
p _{max} :	700 bar
Q _{max} :	50 lpm

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 valve and throttle check valve type CQ, CQR and CQV:
[D 7713](#)

Similar products:

- Throttle and restrictor check valves
 type ED, RD and RDF: [Page 232](#)
- Throttle valves type Q, QR, QV, FG: [Page 230](#)

Flow valves

3.4 Throttle valve and shut-off valve type AV, AVT and CAV

Throttle and shut-off valves are a type of metering valve. With the aid of these valves a pressure gradient can be established between the inlet and outlet side. In this way the velocity of cylinders in accumulator circuits and the volumetric flow in control circuits can be regulated or a consumer line completely shut-off (e.g. to protect a pressure gauge). The throttle and shut-off valve type AV and AVT produces a throttling action by means of an annular gap. The valve type CAV, as a slotted throttle, is insensitive to micro contamination.

The valve type AV is available as a screw-in valve or angle valve for pipe connection. The type AVT is mounted in a T-housing and commercially available pipe screw connections permit direct pipe connection. The valve type CAV can be screwed-in and can be integrated into control blocks. The necessary mounting holes are straightforward to make.

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} •	400 ... 630 bar
Q _{max} •	12 ... 100 lpm

Design and order coding example

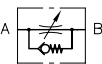
AV 3AVT 10 CAV 1V	- K	- 1/4
	Thread size	Version with connection block for pipe connection (type CAV)
	Means of adjustment	Tool adjustable Manually (adjustable)
Basic type, size	Type AV, size 2, 3 Type AVT, size 6... 12 Type CAV, size 1, 2	

Function

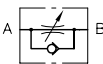
AV, AV.E, AVT, CAV



CAV..R



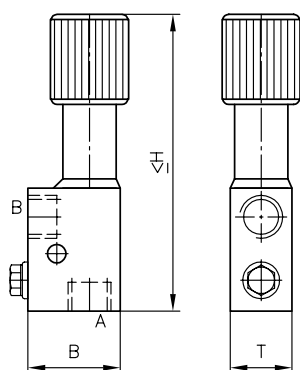
CAV..V, AV..R, AV..RE



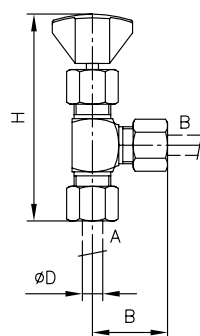
General parameters and dimensions

AV..

Valve for pipe connection

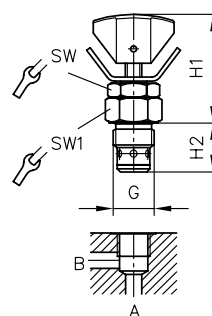


AVT..

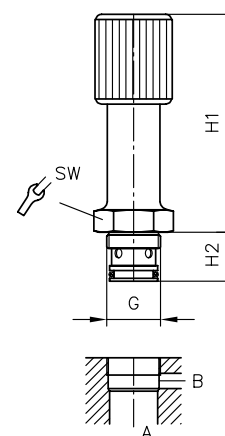


CAV..

Screw-in valve



AV..E



	Q _{max} [lpm] ¹⁾	p _{max} [bar]	Port size	Dimensions [mm]							m [kg]
			G	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
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) The values apply to a back pressure of approx. 10 bar (in a throttled direction)

Associated technical data sheets:

- Shut-off valve type AVT and AVM: [D 7690](#)
- Throttle valve and shut-off valve type AV: [D 4583](#)
- Throttle valve and shut-off valve CAV: [D 7711](#)

Similar products:

- Throttle and restrictor check valves type ED, RD and RDF: [Page 232](#)
- Throttle valves type Q, QR, QV,FG: [Page 230](#)

3.5 Check valves

Check valve type RK, RB, RC, RE and ER	242
Check valve type CRK and CRB	244
Check valve type B	246
Releasable check valve type CRH and RHC	248
Releasable check valve type HRP	250
Releasable check valve type RH and DRH	252
Check valve and pre-fill valve type F	254
Line rupture protection valve type LB	256
Shuttle valve type WV and WVC	258



Check valve type RK, RB, RC, RE and ER



Check valve and pre-fill valve type F

Check valves

Type	Design	p _{max} (bar)	Q _{max} (lpm)
RK, RB, RC, RE, ER	Check valve <ul style="list-style-type: none"> Insert valve Plug-in valve Combination with housing for in-line installation 	RK, RB - 0: 700 RK, RB, RC - 1, 2: 700 RK, RB, RC - 3: 500 RK, RB - 4: 500 RK - 6: 300 RE - 0, 1, 2: 500 RE - 3: 450 RE - 4: 400 ER - 01, 11, 12, 13, 21, 31: 500 ER - 41: 400	RK, RB - 0: 8 RK, RB, RC - 1: 20 RK, RB - 2: 50 RK, RB - 3: 80 RK, RB, RE - 4: 120 RK - 6: 320 RC - 2: 35 RC - 3: 60 RE - 0: 12 RE - 1: 25 RE - 2: 40 RE - 3: 70 ER - 01: 6 ER - 11: 12 ER - 12, 13: 15 ER - 21: 30 ER - 31: 65 ER - 41: 120
CRK, CRB	Check valve <ul style="list-style-type: none"> Screw-in valve 	500	CRK - 1: 30 CRK - 2: 50 CRK - 3: 80 CRB - 1: 20 CRB - 2: 30
B	Check valve <ul style="list-style-type: none"> Single valve for in-line installation 	500	1: 15 2: 20 3: 30 4: 45 5: 75 6: 120 7: 160

Releasable check valves

Type	Design	Actuation	p _{max} (bar)	Q _{max} (lpm)
CRH, RHC	Releasable check valve <ul style="list-style-type: none"> Screw-in valve 	- Hydraulic	CRH: 500 RHC - 1: 700 RHC - 2: 700 RHC - 3: 700 RHC - 4: 500 RHC - 5: 500 RHC - 6: 600	CRH - 1: 20 CRH - 2: 30 CRH - 3: 55 RHC - 1: 8 RHC - 2: 15 RHC - 3: 55 RHC - 4: 100 RHC - 5: 150 RHC - 6: 200
HRP	Releasable check valve <ul style="list-style-type: none"> Manifold mounting valve 	- hydraulic - electro-hydraulic	1: 700 2: 700 3: 500 4: 500 5: 500 7: 500	1: 20 2: 35 3: 50 4: 80 5: 140 7: 400
RH, DRH	Releasable check valve <ul style="list-style-type: none"> Single valve for in-line installation Manifold mounting valve 	- Hydraulic	RH - 1, 2: 700 RH - 3: 500 RH - 5: 500 DRH - 1: 500 DRH - 2: 500 DRH - 3: 400 DRH - 4: 400 DRH - 5: 400	RH - 1, 2: 15, 35 RH - 3: 55 RH - 5: 160 DRH - 1: 16 DRH - 2: 30 DRH - 3: 60 DRH - 4: 90 DRH - 5: 140

Pre-fill valves

Type	Design	Actuation	p _{max} (bar)	Q _{max} (lpm)
F	Releasable check valve (pre-fill valve) <ul style="list-style-type: none"> Valve in wafer design 	- Hydraulic	400	25: 100 32: 160 40: 250 50: 400 63: 630 80: 1000 100: 1600 125: 2500 160: 4000 200: 7000

Line rupture safety valve, shuttle valves

Type	Design	Adjustability	p _{max} (bar)	Q _{max} (lpm)
LB	Line rupture safety valve <ul style="list-style-type: none"> Screw-in valve Combination with housing for in-line installation 	- Tool adjustable	1: 500 2: 500 3: 500 4: 500 5: 300	1: 25 2: 50 3: 80 4: 160 5: 250
WV, WVC	Shuttle valve <ul style="list-style-type: none"> Single valve for in-line installation Screw-in valve 		WV - 6 S: 700 WV - 8 S: 700 WV - 10 S: 500 WV - 12 S: 500 WV - 16 S: 500 WV - 18 L: 315 WVC - 1: 315 WVC - 11: 500	WV - 6 S: 6 WV - 8 S: 15 WV - 10 S: 25 WV - 12 S: 40 WV - 16 S: 100 WV - 18 L: 160 WVC - 1: 6 WVC - 11: 6

Check valves

3.5

Check valve type RK, RB, RC, RE and ER

Check valves are a type of non-return valve. They block the oil flow in one direction and open in the opposite direction. In the closed state they have zero leakage.

The check valve type RK, RB, RC and RE can be screwed-in, type ER can be plugged-in. The spring-loaded ball check valve type RK, RB and ER is very robust and insensitive to soiling. The spring-loaded plate valve type RC can be screwed-in in any direction and is particularly suitable for fast switching sequences. Type RE is a plate valve without a spring.

Type ER can be integrated directly in valves for manifold mounting. As such an additional intermediate plate is not necessary for the check valve function. Type RE is suitable for isolating pressurising loads or as a foot valve for a pump intake line.

Features and benefits:

- Operating pressures up to 700 bar
- Easily machined mounting holes
- Sturdy

Intended applications:

- General hydraulic systems
- Hydraulic pre-loading



Nomenclature:	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

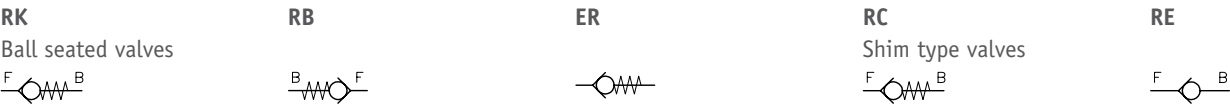
Basic type, size

Check valve installation
type RK, RB, size 0 ... 6
Type RC, size 1 ... 3
Type RE, size 0 ... 4
Type RE, ER (check valve insert), size 0 to 4

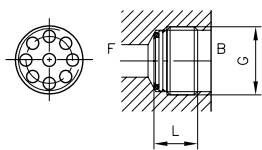
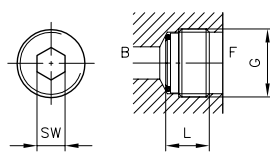
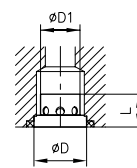
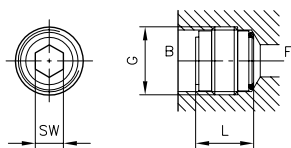
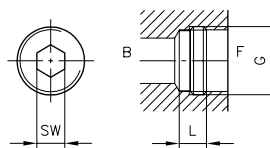
Additional versions:

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

Function



General parameters and dimensions

RK..

RB..

ER..

RC..

RE..


	Q_{\max} [lpm]	p_{\max} [bar]	Ports (BSPP)	Dimensions [mm]		m [g]
				L	SW	
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:

- Check valve type ER and EK: [D 7325](#)
- Check valve type RE: [D 7555 R](#)
- Check valves, type RC: [D 6969 R](#)
- Check valve type RK and 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 228](#)

Check valves

3.5

Check valve type CRK and CRB

Check valves are a type of non-return valve. They block the oil flow in one direction and open in the opposite direction. In the closed state they have zero leakage. The check valve type CRK and CRB can be screwed-in and can be integrated into control blocks. The necessary mounting holes are straightforward to make.

Features and benefits:

- Screw-in valves

Intended applications:

- General hydraulic systems



Nomen-clature:	Check valve
Design:	Screw-in valve
p _{max} •	500 bar
Q _{max} •	30 ... 80 lpm

Design and order coding example

CRK 2

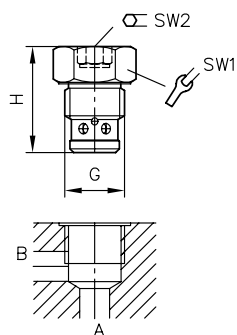
- 1/4

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 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 valve type CRK, CRB and CRH: [D 7712](#)

Similar products:

- Check valves type RK, RB, RC, RE, ER: [Page 242](#)

Check valves

3.5

Check valve type B

Check valves are a type of non-return valve. They block the oil flow in one direction and open in the opposite direction. In the closed state they have zero leakage.

The check valve type B is available in different housing forms and is suitable for direct in-line installation.

The check valve type B is suitable for usage as a foot valve for a pump intake line due to the low opening pressure.

- Features and benefits:**
- Flow up to 160 l/min
 - Pipe installation
- Intended applications:**
- General hydraulic systems



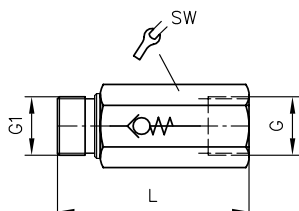
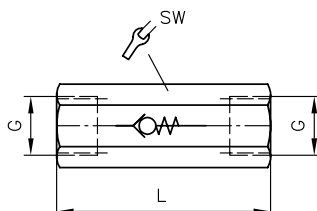
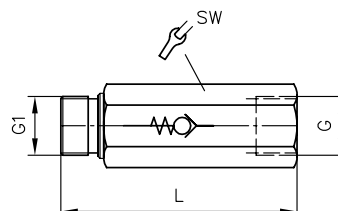
Nomen-clature:	Check valve
Design:	Individual valve for in-line installation
p _{max} :	500 bar
Q _{max} :	15 ... 160 lpm

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	-1	15	500	G 1/4	G 1/4 A	50 ... 60	SW 19	0.11
B 2	-2	20		G 3/8	G 3/8 A	58 ... 67	SW 24	0.16
B 3	-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](#)

Check valves

3.5

Releasable check valve type CRH and RHC

Check valves with hydraulic release are a type of check valve. They block one or both hydraulic consumer lines or are used as a hydraulically actuated drain or circulation valve. Check valve type CRH and RHC has zero leakage when closed. It can be screwed-in and can be integrated into control blocks. The necessary mounting holes are straightforward to make. Check valve type CRH and RHC is available with hydraulic release. Hydraulic release suppresses relief surges that can occur at high pressure and with a large consumer volume.

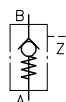
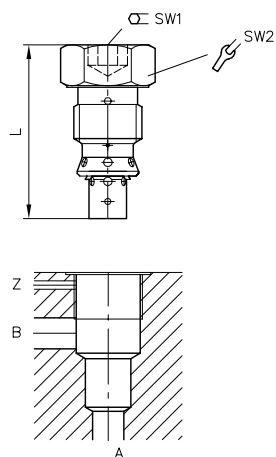
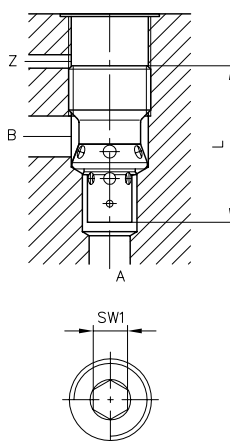
- Features and benefits:
- Screw-in cartridge
 - Pressures up to 700 bar
 - Flows up to 200 l/min
 - Sturdy
- Intended applications:
- Industrial hydraulics
 - Construction machines



Nomenclature:	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	Releasable check valve 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
	▪ With 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:
Releasable check valves

- Check valve type CRK, CRB and CRH: [D 7712](#)
- Releasable check valve type RHC and RHCE: [D 7165](#)

Similar products:

- Type HRP: [Page 250](#)
- Type RH: [Page 252](#)

Check valves

3.5

Releasable check valve type HRP

Check valves with hydraulic release are a type of check valve. They block one or both hydraulic consumer lines or are used as a hydraulically actuated drain or circulation valve. In the closed state the check valve type HRP has zero leakage. An overflow oil line relieves the rear of the control piston. Due to this separate relief the control behaviour of the valve is independent of the pressure in the return.

A solenoid valve can be optionally flange-mounted to arbitrarily control the check valve with the load pressure on the consumer side. The check valve type HRP is available with a hydraulic release. Hydraulic release suppresses relief surges that can occur at high pressure and with a large consumer volume.

- Features and benefits:**
- Manifold mounting valve for pressures up to 700 bar
 - Flows up to 400 l/min
 - Electrically controlled
 - With hydraulic release for smooth switching

- Intended applications:**
- Industrial and mobile hydraulics



Nomenclature:	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

Function

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

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

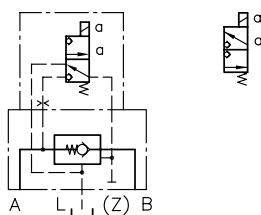
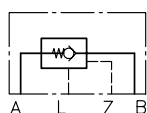
For preventing decompression surges

Basic type, size

Check valve with hydraulic release HRP, size 1 to 7

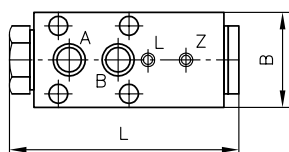
Function

HRP

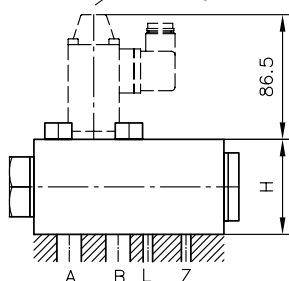


General parameters and dimensions

HRP



Directly mounted
3/2-way solenoid valve



	Q_{\max} [lpm]	p_{\max} [bar]	Release ratio p_A / p_Z	Dimensions [mm]			m [kg]
				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 valve type HRP: [D 5116](#)

Similar products:

- Releasable check valves type RH: [Page 252](#)
- Releasable check valve type RHV: [D 3056](#)
- Releasable check valves type CRH, RHC: [Page 248](#)
- Releasable twin check valves type DRH: [Page 252](#)

Check valves

3.5

Releasable check valve type RH and DRH

Check valves with hydraulic release are a type of check valve. They block one or both hydraulic consumer lines or are used as a hydraulically actuated drain or circulation valve. In the closed state the check valve type RH and DRH has zero leakage. The type DRH is a twin check valve for double-acting consumers. The check valve type RH and DRH is available with a hydraulic release. Hydraulic release suppresses relief surges that can occur at high pressure and with a large consumer volume.

- Features and benefits:**
- Pressures up to 700 bar
 - with hydraulic release for smooth switching
- Intended applications:**
- Blocking of leak-free hydraulic cylinders
 - Return flow relief
 - 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 <ul style="list-style-type: none">▪ 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

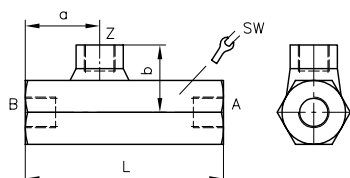
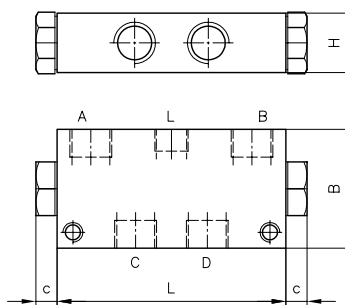
DRH 3 LSS	- 30	/100
Pre-charge pressure [bar]		
Pressure setting [bar]		
Basic type, size, function	Releasable double check valve DRH, size 1 to 5	
Additional versions:	<ul style="list-style-type: none">▪ With pre-release (one or both sides)▪ With shock valves (for hydraulic motors)▪ With safety valve 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 valve type RH: D 6105](#)
- [Releasable twin check valve type DRH: D 6110](#)

Similar products:

- [Releasable check valve type RHV: D 3056](#)
- Type CRH and RHC: [Page 244](#)
- Type HRP: [Page 250](#)

Check valves

3.5

Check valve and pre-fill valve type F

Check valves and pre-fill valves are a type of non-return valve. Check valves block the oil flow in one direction and open in the other direction. Pre-fill valves are check valves with hydraulic release. They are used, e.g. in top ram presses for draining and emptying the press cylinder on rapid closing and opening.

The check valve and pre-fill valve type F is a spring-loaded disk valve and has zero leakage in the closed state. The valve is attached directly to the cylinder and clamped between the base of the cylinder and the welding-neck flange. Alternatively the valve is installed in the line between the front faces of the welding-neck flanges.

The valve type F is available with hydraulic release. Hydraulic release suppresses relief surges that can occur at high pressure and with a large consumer volume.

- Features and benefits:**
- Wafer design
 - Extremely large flows, up to 7000 l/min
- 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

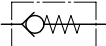
Additional versions: Without pre-release (-)
 With pre-release (V), size 25 to 80

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

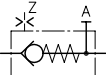
- Additional functions**
- With holes in the mounting flange (B)

Function

Check valve

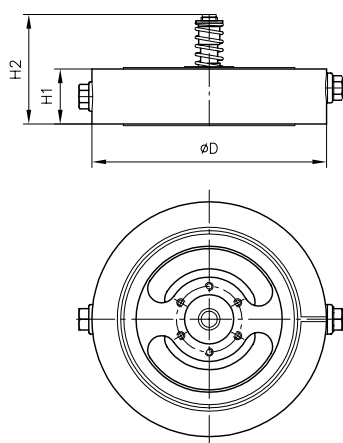


Pre-fill valve

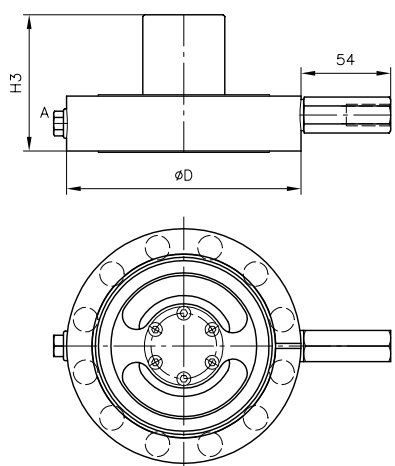


General parameters and dimensions

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 64	F 64-30	760		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 81	F 81-36	1200		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 101	F 101-45	1920		4.3	212	44	97	118	9.9		11.7
F 125	F 125(B)-60	2500	320	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		4.0	420	150	250	300	114		120

Associated technical data sheets:

- Check valve and pre-fill valve type F: [D 6960](#)

Check valves

3.5

Line rupture protection valve type LB

Line rupture protection valves, also called pipe rupture protection valves are a type of check valve. The valves are normally mounted directly on the cylinder. They prevent uncontrolled cylinder movement in the event of a pipe rupture or hose break. The line rupture protection valve type LB offers a high level of safety in the event of pressure peaks. It features reproducibly accurate, secure closing at the pre-set trigger volumetric flow. Higher volumetric flows causes a plate raised from the valve seat by a spring to be pressed onto the housing seat. The valve closes. A variant with restrictor bore in the valve plate permits a low volumetric flow in the check direction. Type LB is available as a screw-in valve and in a housing design for line installation. The pipe rupture protection valve type LB is used in industrial trucks, lifting platforms and lifting equipment.

- Features and benefits:
- Pressures up to 700 bar
- Intended applications:
- Industrial trucks
 - Lifting devices



Nomenclature:	Line rupture safety valve
Design:	Valve insert with housing for in-line installation
Adjustment:	Tool adjustable
p _{max} :	700 bar
Q _{max} :	4 ... 250 lpm

Design and order coding example

LB 2

G

1,0

- 25

Response flow [lpm]

Trigger volumetric flow Q_A in l/min

With/without orifice

Orifice diameter 0.5 / 0.8 / 1.0 / 1.2 / 1.5 / 2 (dep. on type and size)

Design

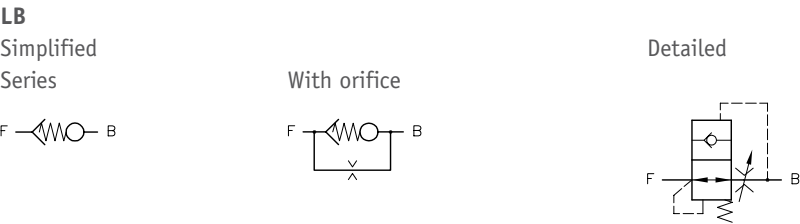
- Screw-in valve (C)
- Design with housing (F, G)
- Fitting

Basic type, size:

Line rupture safety valve type LB, size 2 to 4

- Version with imperial thread
- Version with metric thread
- Design with UNF thread

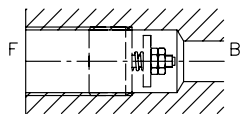
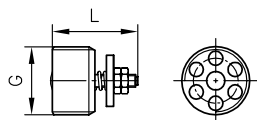
Function



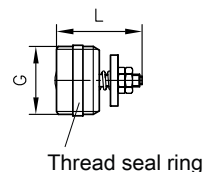
General parameters and dimensions

LB ..C

Screw-in valve

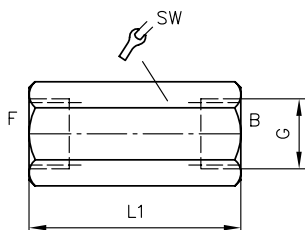


LB 11(21)C

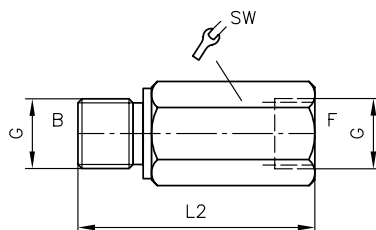


LB ..G

Valve with housing

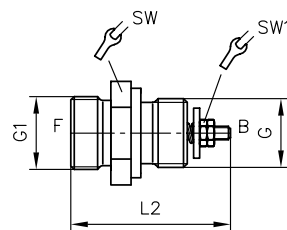


LB ..F



LB 3 E

LB 4 E



	Q _{max} [lpm]	p _{max} [bar]	Ports (BSPP)		Dimensions [mm]					m [g] ²⁾
			G	G1	L	L1	L2	SW = a/f	SW = a/f 1	
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
LB 3 E LB 4 E	4 ... 160	500	G 1/4 A - G 3/4 A	M18x1.5 - M36x2	-	-	46.8 - 64.4	SW 27 - SW 41	SW 7	150/210
LB 5	80 ... 200	300	G 1	-	38	-	-	-	-	102

1) Mounting thread, additionally sealed

2) Dimensions for insert valve and/or housing version

Associated technical data sheets:

- Line rupture protection valves, type LB: D 6990
- Line rupture safety valves type LB.E
as a screw joint: Sk 6990 E

Check valves

3.5

Shuttle valve type WV and WVC

Shuttle valves are a type of check valve. They have two inlets and one outlet. As soon as a pressure signal is present on at least one of the two inlets, an outlet signal is generated. The inlet with the higher pressure is automatically connected to the outlet. The other inlet with lower pressure is blocked by a ball (OR operator).

The shuttle valve type WV is integrated in a T-fitting for pipe connection. The type WVC is a screw-in valve. The shuttle valves can withstand pressures up to 700 bar and have low flow resistances.

They can be used for transmitting control pressures or control and operating volumetric flows.

Features and benefits:

- Pressures up to 700 bar
- Insert and housing versions

Intended applications:

- In load-sensing systems
- Often in mobile hydraulics
- Construction and construction materials machinery
- Cranes and lifting equipment
- Road vehicle construction



Nomenclature:	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

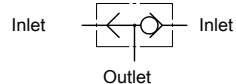
WV 10

- S

Design	<ul style="list-style-type: none">▪ 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

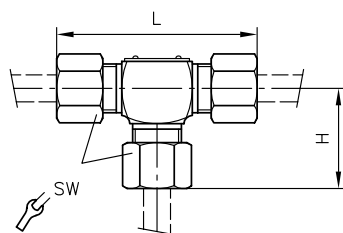
Function

WV, WVC, WVH

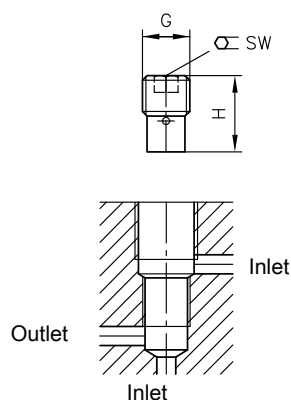


General parameters and dimensions

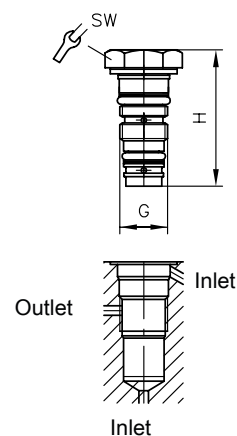
WV



WVC



WVH



	Q_{max} [lpm]	p_{max} [bar]	External pipe \varnothing [mm]	Mounting thread	Dimensions [mm]			m [g]
				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		10		68	34	SW 22	225
WV 12 - S	40	500	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 1	3	700	--	M 10 x 1	--	28.5	SW 14	10

Associated technical data sheets:

- Shuttle valve type WV and WVC: D 7016

Similar products:

- Shuttle valves type WVH: Sk 7962

Hydraulic cylinders and hydrostatic motors

Hydraulic clamps type HSE and HSA	262
Axial piston motor type M60N	264



*Hydraulic clamps
type HSE and HSA*



*Hydrostatic motor
Type M60N*

Hydraulic cylinders

Type	Nomenclature/Design	p_{\max} (bar)	H_{Stroke} (mm)
HSE, HSA	Hydraulic clamps <ul style="list-style-type: none"> ▪ Screw-in version ▪ Manifold mounting 	500	HSE - 12: 8 HSE - 16: 12 HSE - 20: 20 HSE - 24: 20 HSA - 32: 20 HSA - 40: 25

Hydrostatic motors

Type	Nomenclature/Design	p_{\max} (bar)	V_{\max} (cm ³ /rev.)
M60N	Fixed displacement axial piston motor	Operation/Peak: 350/400	012: 12.6 017: 17 025: 25.4 034: 34.2 047: 47.1 064: 63.5 084: 83.6 108: 108

Hydraulic cylinders

4

Hydraulic clamps type HSE and HSA

Hydraulic clamping cylinders generate a pressure-controlled clamping force at the piston. Without pressure the clamping pistons return to their initial position. The clamping cylinder type HSE is a screw-in cylinder. The type HSA is a screw-on cylinder. Very high forces can be transmitted in a very small space in fixtures. The clamping cylinder type HSE and HSA is used in machine tools, machining centres and chucks for clamping, fasten, lock or fix workpieces, tools or machine structures.

- Features and benefits:**
- Compact design
 - Operating pressure up to 500 bar

- Intended applications:**
- Clamping systems
 - Securing systems
 - Machine tools



Nomen-clature:	Hydraulic clamps
Design:	Screw-in version Manifold mounting
p _{max} :	500 bar
F _{max} :	60000 N

Design and order coding example

HSE 24

- 15

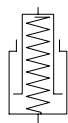
Stroke [mm]

Stroke H

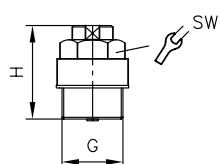
Basic type, piston diameter [mm]

Screw-in version type HSE

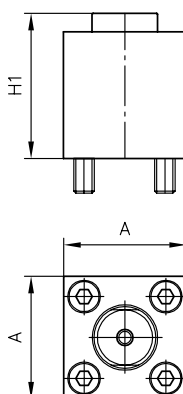
Manifold mounting version type HSA

Function
HSE, HSA

General parameters and dimensions
HSE ..

Hydraulic screw-in clamps


HSA ..

Manifold mounting hydraulic clamps



	Q_{\max} [lpm]	Stroke [mm]	F_{\max} [N]	Ports	Dimensions [mm]				m [kg]
			with 500 bar		H	H1	SW = a/f	A	
HSE 12	500	2 ... 8	5500	M 20 x 1.5	20.5 ... 32.5	-	SW 24	-	0.05 ... 0.08
HSE 16		3 ... 12	10000	M 24 x 1.5	26.5 ... 41.5	-	SW 24	-	0.08 ... 0.12
HSE 20		4 ... 20	15000	M 30 x 1.5	28.5 ... 56	-	SW 30	-	0.14 ... 0.3
HSE 24		5 ... 20	23000	M 36 x 1.5	34 ... 65	-	SW 36	-	0.25 ... 0.5
HSA 32		20	40000	-	-	71	-	60	1.6
HSA 40		25	60000	-	-	85	-	70	2.5

Associated technical data sheets:

- Hydraulic clamps type HSE and HSA: D 4711

Hydraulic cylinders and hydrostatic motors

4

Axial piston motor type M60N

Axial piston motors are constant motors. They have a constant displacement and therefore generate a fixed speed dependent on the volumetric flow.

The axial piston motor type M60N is designed for open and closed circuits and operates based on the bent axis principle.

The motor is particularly suitable for usage in mobile applications.

Features and benefits:

- Optimized power-to-weight ratio
-
- Different shaft and flange versions

Intended applications:

- Machines for forestry and agricultural purposes
- Fan drives
- Construction machines
- Municipal trucks

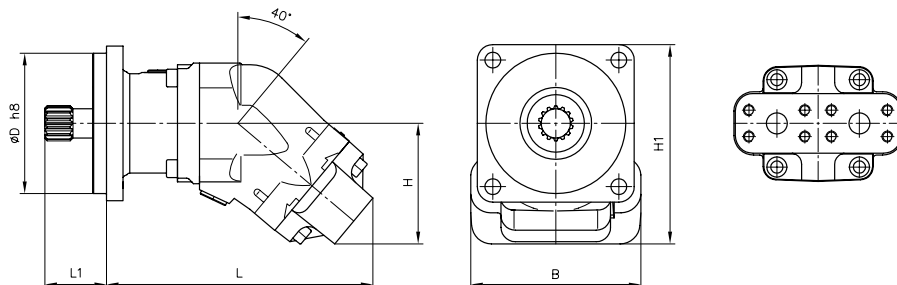


Nomenclature:	Axial piston fixed motor
Design:	Individual motor
p _{max} *	400 bar
V _{g max} *	12 ... 130 cm ³ /rev

Design and order coding example

M60N	- 064	B	S	F	N	- S1	00	-G
							Ports	
							Speed sensor	With/without speed sensor
							Version with housing	<ul style="list-style-type: none">▪ Axial version▪ Radial version
							Seals	NBR (N), FKM (V), HNBR (H)
							Flange version	<ul style="list-style-type: none">▪ Flange ISO 7653 - 1985▪ Flange SAE J744▪ Flange ISO 3019 - 2
							Shaft version	<ul style="list-style-type: none">▪ ISO 14 parallel key splined shaft▪ SAE J744 parallel key▪ SAE J744 spline shaft and flange▪ DIN 6885 parallel key
							Rotation direction	Any (B)
							Nominal size	
Basic type								

Function

General parameters and dimensions

Parameters

	Geom. displacement	Nom. pressure	Max. speed	Dimensions [mm]						m [kg]
	V_g [cm ³ /rev]	$p_{nom} (p_{max})$ [bar]	n [rpm]	L	L1	H	H1	B	ØD	
M60N- 012	12,6	350	7500	206	46	97	147,8	-	101,6	9
M60N- 017	17,0	350	7500	206	46	97	147,8	-	101,6	9
M60N- 025	25,4	350	5900	206	46	97	147,8	-	101,6	9
M60N- 034	34,2	350	5900	206	46	97	147,8	-	101,6	9
M60N- 040	41,2	350	5300	242	56	97	147,8	-	101,6	9
M60N- 047	47,1	350	5300	242	56	109	172,5	155	127	9
M60N- 056	56,7	350	5300	242	56	109	172,5	155	127	9
M60N- 064	63,5	350	5300	242	56	109	172,5	155	127	9
M60N- 084	83,6	350	4400	264	56/74	129	192.5/205.2	-	127/152.4	18/35
M60N- 090	90,7	350	4400	264	56/74	129	192.5/205.2	-	127/152.4	18/35
M60N- 108	108,0	350	4400	264	56/74	129	192.5/205.2	-	127/152.4	18/35
M60N- 130	130,0	350	4200	264	56/74	129	192.5/205.2	-	127/152.4	18/35

Associated technical data sheets:

- Variable displacement axial piston pump type V60N: [D 7960 N](#)

Similar products:

- Variable displacement axial piston pumps type V40M: [Page 26](#)
- Type V30D variable displacement axial piston pumps: [Page 20](#)
- Variable displacement axial piston pumps type V30E: [Page 16](#)
- Fixed displacement axial piston pump type K60N: [D 7960 K](#)

Suitable prop. directional spool valves:

- Type PSL/PSV sizes 2, 3 and 5: [Page 106](#)
- Type PSLF/PSVF sizes 3, 5 and 7: [Page 112](#)

Suitable load-holding valves:

- Type LHK, LHDV, LHT: [Page 206](#)

Hydraulic accessories

Diaphragm accumulator type AC	268
Piston type accumulator type HPS	270
Pressure switch type DG	272
Pressure filter type PFM	274
Fittings	276



*Pressure switches type DG
and analogous pressure sensors*

Pressure accumulators

Type	Nomenclature/Design	p _{max} (bar)	Capacity (dm ³)	Piston diameter
AC	Pressure accumulators <ul style="list-style-type: none"> Screw-in version 	13: 500 40: 400 202, 0725, 2002, 2825: 250 603: 330 1002, 3225: 210 1035, 2035: 350 1414: 140 2001: 100	13: 0.01 40: 0.04 202: 0.16 603: 0.60 0725: 0.08 1002, 1035: 1.00 1414: 1.40 2001, 2035: 1.95 2002: 1.90 2825: 2.80 3225: 0.32	-
HPS	Piston-type accumulator <ul style="list-style-type: none"> In-line installation 	350	40,00	80 ... 250 mm

Hydraulic accessories

Type	Nomenclature/Design	p _{max} (bar)
DG	Spring-loaded piston-type pressure switch, electronic pressure switch <ul style="list-style-type: none"> Manifold mounting Screw-in version Version for pipe connection 	1, 5E, 8: 600 3: 700 6: 400
PFM	Pressure filter	250
Fittings	Reducing connector, connection fitting, screen filter, wire mesh filter, pressure gauge <ul style="list-style-type: none"> Screw-in version Version for pipe connection 	350 ... 700

Hydraulic accessories

5

Diaphragm accumulator type AC

Diaphragm accumulators are a type of hydraulic accumulator. A diaphragm separates the compressible gas cushion from the hydraulic fluid.

The diaphragm accumulator type AC is used as a source of oil under pressure. It supports or increases the pump delivery flow or stores pressure energy, e.g. for an accumulator charge circuit.

With the aid of different fittings the hydraulic accumulator type AC can be integrated into a hydraulic system. Different installation orientations and installation positions are possible.

- Features and benefits:**
- Compact design
 - Option of integration into the HAWE modular system
 - Operating pressures up to 350 bar
- Intended applications:**
- Clamping systems
 - Jigs
 - Accumulator charging systems



Nomenclature:	Hydro-pneumatic accumulator
Design:	Screw-in version
p _{max} •	500 bar
V _{max} •	1,95 dm ³

Design and order coding example

AC 2001

/90

/3A

Connection thread (hydraulic side)

Gas pre-charge pressure [bar]

Basic type, size

Hydraulic accumulator type AC

AC 40

- 1/4

- 200

ACS 13

- 1/4

- 50

/110

Setting shut-off valve [bar]

Gas pre-charge pressure [bar]

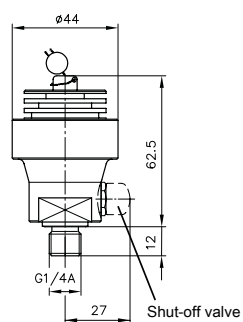
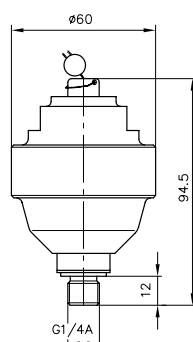
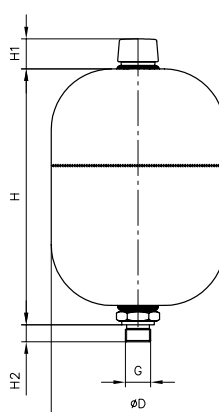
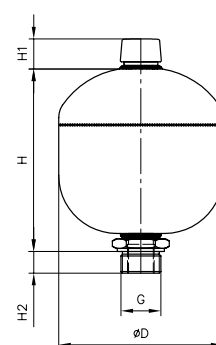
Connection thread

Basic type, nom. volume

Hydraulic miniature accumulator type AC and type ACS with shut-off valve, nom. volume in cm³

Function



General parameters and dimensions
AC(S) 13 - 1/4

AC 40 - 1/4

**AC 0725, AC 202,
AC 322, AC 1414**

**AC 603, AC 1002,
AC 2002, AC 2825**


	V ₀ [dm³]	p _{max} [bar]	Max. gas filling pressure p ₀ [bar]	Ports (BSPP)	Dimensions [mm]				m [kg]
					H	H1	H2	D	
Hydraulic miniature accumulator									
AC 13-1/4	0.013	500	250	G 1/4 A	see illustration				0.3
ACS 13-1/4	0.013	500	250	G 1/4 A	see illustration				0.3
AC 40-1/4	0.040	400	250	G 1/4 A	see illustration				0.65
Hydraulic accumulator									
AC 0725/1A	0.075	250	130	G 1/4 A	81	26.5	12	64	0.6
AC 202/2A	0.16	250	130	G 3/8 A	102	26.5	-	74	0.8
AC 322/2A	0.32	210	140	G 3/8 A	101.5	25	12	92.5	1.4
AC 603/3	0.6	330	200	G 1/2	149	23	-	115	3.3
AC 1002/22	1.0	210	140	M 22 x 1,5	151	25	18	136	3.5
AC 1414/2A	1.4	140	120	G 3/8 A	162	25	18	147	4.2
AC 2002/4	1.95	250	140	G 3/4	229	25	-	155	7.5
AC 2825/3	2.8	250	130	G 1/2	246	26.5	18	167	8.2

Associated technical data sheets:

- [Miniature hydraulic accumulators, type AC: D 7571](#)
- [Diaphragm accumulator type AC: D 7969](#)

Hydraulic accessories:

- Fittings type X84: [Page 276](#)

Similar products:

- Piston type accumulator type HPS: [Page 270](#)

Hydraulic accessories

5 Piston type accumulator type HPS

Piston type accumulators are a type of hydraulic accumulator. A freely moving piston separates the compressible gas cushion from the hydraulic fluid.

The piston type accumulator type HPS supports or increases the pump delivery flow or stores pressure energy. It is used in clamping hydraulics to compensate for volume changes in the event of temperature fluctuations, to cover any leakage losses or to dampen oscillations.

The piston type accumulator type HPS can be installed in different situations with the aid of suitable fastening clips.

Features and benefits:

- Compact design
- Option of integration into the HAWE modular system

Intended applications:

- Accumulator charging systems
- Construction machines
- Wind power plants
- Machine tools

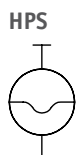


Nomenclature:	Piston accumulator
Operation pressure:	350 bar
Capacity:	0.1 - 40 dm ³
Internal piston diameter:	50 - 180 mm

Design and order coding example

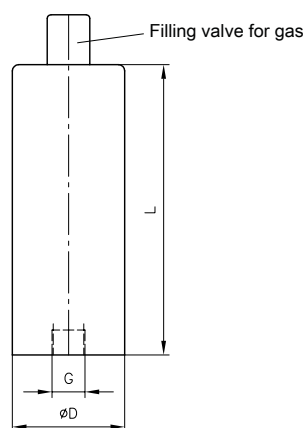
HPS 10	- 350	- 160	- 0050	
			Nom. volume	V_0 [dm ³]
			Int. diameter [mm]	
			max. operating pressure [bar]	350 bar
Basic type	Piston type hydraulic accumulator type HPS			

Function



General parameters and dimensions

HPS



	Nom. volume V_0 [dm ³]	p_{max} [bar]	Ports (BSPP)	Dimensions [mm]	
			G	D	L
HPS 10 - 350 - 050	0.1 ... 1.0	350	G 3/4	60	130 ... 588
HPS 10 - 350 - 080	0,4 ... 4,0		G 3/4	95	166 ... 883
HPS 10 - 350 - 100	2.0 ... 10.0		G 1	115	381 ... 1400
HPS 10 - 350 - 140	4.0 ... 25.0		G 1 1/2	160	418 ... 1783
HPS 10 - 350 - 160	6.0 ... 30.0		G 1 1/2	180	490 ... 1684
HPS 10 - 350 - 180	8.0 ... 40.0		G 1 1/2	205	496 ... 1754

- The data listed represent only a selection of the various differing versions

Associated technical data sheets:

- [Piston type accumulators, type HPS: D 7969 HPS](#)

Similar products:

- Diaphragm accumulator type AC: [Page 268](#)

Hydraulic accessories

5

Pressure switch type DG

Pressure switches open and close an electrical contact at a previously defined pressure. As soon as the pressure is reached, a further work step is started or stopped by an electrical signal.

The pressure switch type DG is available as a mechanical or electronic switch. The pressure can be adjusted up to 700 bar. The adjustment is made via a pushbutton, an adjusting knob, an adjusting screw or an adjusting ring.

The pressure switch is also available with two switching points for different pressures.

- Features and benefits:**
- Compact design
 - Option of integration into the HAWE modular system
 - Operating pressures up to 1000 bar

- Intended applications:**
- General hydraulic systems
 - Machine tools



Nomenclature:	Spring loaded piston type pressure switch Electronic pressure switch Pressure transducer
Design:	Screw-in version Manifold mounting Designed for pipe fittings
p _{max} :	0... 1000 bar

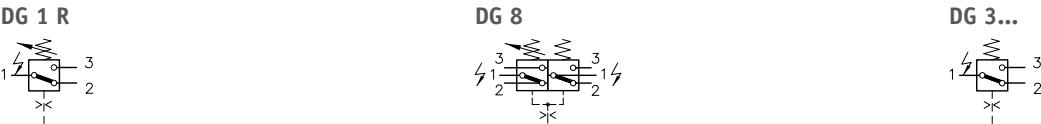
Design and order coding example

DG 1	RF	
DG 35	V	-YS 8

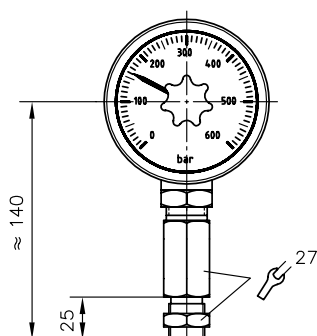
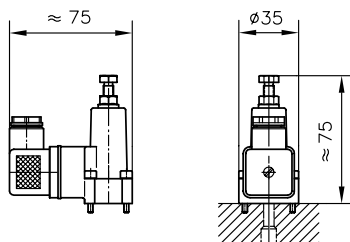
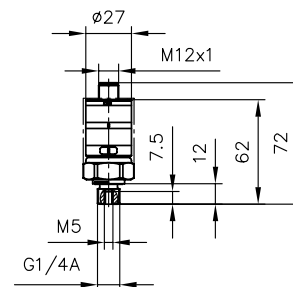
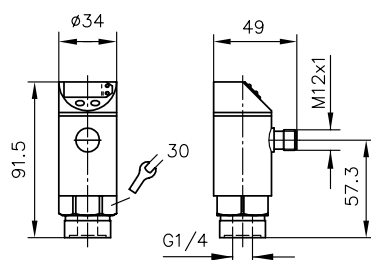
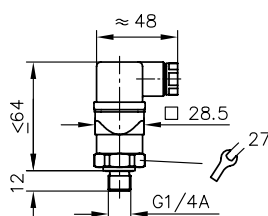
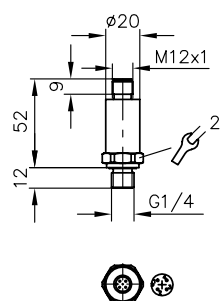
- Hydraulic connection
- With various tapped journals or to be mounted at fittings (type DG 3..)
 - Combination with various fittings
- Means of adjustment, mounting
- Manually adjustable (R) or Turn-knob (V, H = with lock) (type DG 3..)
 - Design with bezel for installation in control panels (F)

Basic type Pressure switch type DG
Type DG 1, 3, 8 (spring loaded piston type switch)
Type DG 5, DG 6 (Electronic pressure switch with two switch points)
Operating voltage 12 V DC, 24 V DC, 110 V AC, 230 V AC
Analogous pressure transducer type DT
Type DT 11
Type DT 2

Function



General parameters and dimensions

DG 1 R

DG 3 ..

DG 6.

DG 5 E

DT 11

DT 2


	Brief description	Adjustable pressure p_{max} [bar] ¹⁾	Ports (BSPP)	m [kg]
DG 1 R	Adjustment via turn-knob at the dial	20 ... 600	G 1/2 or G 1/4 A	1,3
DG 3..	Compact design for manifold mounting Adjustment via set screw	4 ... 700	G 1/4 or G 1/4 A ²⁾	0,3
DG 5 E	Electronic pressure switch with two switch points	0 ... 600	G 1/4 A	0,25
DG 6..		0 ... 400	G 1/4 A or M 5	0.08
DT 11	Analogous pressure sensor	0 ... 1000	G 1/4	0,08
DT 2		0 ... 600	G 1/4	0,7

1) The max. operating pressure of 700 bar is not influenced by the max. possible set pressure

2) For versions with adapter only

Associated technical data sheets:

- Pressure switch type DG: D 5440
- Electronic pressure switch type DG 5: D 5440 E/1
- Electronic pressure switch type DG 6: D 5440 F

Hydraulic accessories:

- Fittings type X, X 84: [Page 276](#)

Similar products:

- Electronic pressure transducer type DT 11: D 5440 T/2
- Electronic pressure transducer type DT 2: D 5440 T/1

5 Pressure filter type PFM

Pressure filters protect downstream hydraulic components against soiling. They are installed in the high-pressure line typically after the pump.

The pressure filter type PFM contains a filter element through which the fluid flows from the inside to the outside. It can be replaced without drips or soiling using standard tools. The ratio of size to performance is optimal, for this reason the filter has low pressure losses even after absorbing a large amount of soiling.

The pressure filter type PFM is used in machine tools, industrial trucks, lifting platforms and in general in oil hydraulics.

- Energy-efficient thanks to low back pressure
- Long change intervals due to high dirt-holding capacity
- Filter element replacement is simple and clean

Intended applications:

- Machine tools
- Industrial trucks
- Lifting platforms
- General oil hydraulics



Nomenclature:	Pressure filter
Version:	In-line installation Can be flanged
p_{max}:	250 bar
Q_{max}:	90 l/min

Design and order coding example

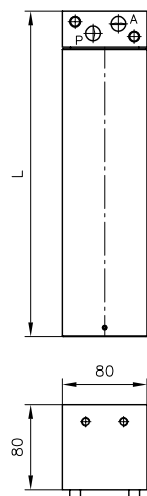
PFM4	-4	8	10	-R4	T	-VO	/-	
								Seal without = series KB = cold-resistant
								Visual clogging display VE = electrically 12/24V VO = visually VX = retrofittable - = without
								Installation position T = vertical D = suspended
								By-pass valve R4 = 4 bar X = without
								Filter fineness 10 µm
								Volumetric flow 5 = less than 40 l/min 8 = less than 90 l/min
								Port 4 = in-line installation UNF3 = in-line installation 7/8-14 UNF F = flange construction
Basic type	PFM4							

Function

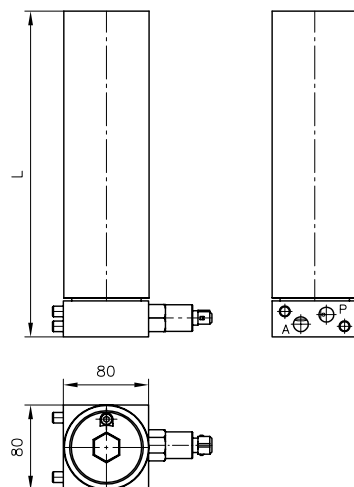


General parameters and dimensions

Flange construction with corner dimensions



In-line installation with corner dimensions



Type	Dimensions [mm]
	L
PFM4-45	234
PFM4-F5	236
PFM4-48	305
PFM4-F8	301

Associated technical data sheets:

- [Pressure filter type PFM: D 8040](#)

Hydraulic accessories

5

Fittings

A selection of hydraulic accessories is available for use in hydraulic systems. Measuring instruments, for example pressure gauges, are used for pressure monitoring and command devices, for example pressure switches, for pressure-controlled switching. Hydraulic accumulators are also available. Various fittings are available, which are used to connect these hydraulic devices to the pressure lines of HAWE hydraulic power packs and valves in various assembly situations. The devices can be combined using reducing connectors. Additional accessory parts such as screen and wire mesh filters safeguard the hydraulic devices against larger, stray impurities which may occasionally occur.

Features and benefits:

- Compact design
- Option of integration into the HAWE modular system
- Operating pressures up to 700 bar

Intended applications:

- General hydraulic systems



Nomenclature:	Reducing connector Connection fitting Screen filter Wire mesh filter Pressure gauge
Design:	Screw-in version for pipe connection
p _{max} :	350... 700 bar

Designs

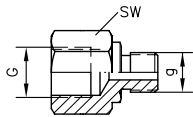
Reducing connectors (various dimensions)

G - g

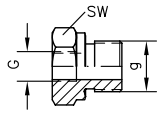
- Internal thread - external thread
- BSPP thread - metric thread
- BSPP thread - BSPP thread
- Metric thread - metric thread

G - g

- Metric thread - BSPP thread



SW 19 - 55
Example: G 1/2A - M 16 x 1.5



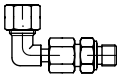
Example: G 1/2 - G 1A

Fittings

- Connection fitting with tapped journal G 1/4
- Connection fitting with fastening nut and internal port G 1/4
- Connecting pieces for attaching the cutting ring for external pipe diameter 6 to 20 mm
- Straight screw-in fitting
- Swivel fitting
- L-fitting



Example:
Straight fitting
type X... G



Example:
Elbow fitting
type X... V



Example:
Swivel fitting
type X... S

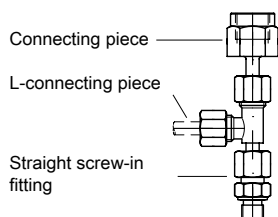
Symbol:



Fitting combinations

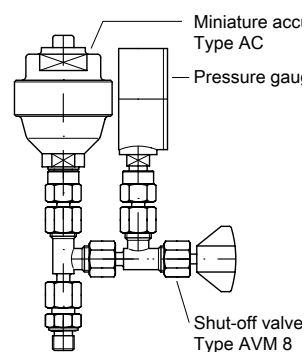
Consisting of:

- Connecting pieces
- Straight screw-in fitting
- Swivel fitting
- L-connecting pieces
- Elbow fitting
- AVM 8 shut-off valve
- Locking element



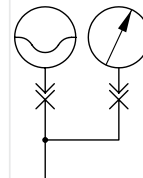
Example: **X 84T**

Symbol:



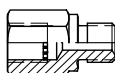
Example: **X 84U - AC 40/100-9/400**

Symbol:



Screen and wire mesh filters

- BSPP thread
- Metric thread
- Screw-in strainer type HFC (hole \varnothing 0.63 mm)
- Screw-in wire mesh filter disc type HFC.. F (filter fineness approx. 100 μ m)
- Also available with housing



Example:
HFE 3/8
 Strainer with housing (hole \varnothing approx. 0.5 mm), with connection thread G 3/8(A)



Example:
HFC 1/4 F
 Screw-in wire mesh filter disc for port G 1/4, filter fineness approx. 100 μ m

Symbol:



Associated technical data sheets:

- [Reducing connector: D 845](#)
- [Fitting type X: D 7065](#)
- [Fitting type X 84: D 7077](#)
- [High-pressure screen filter type HF: D 7235](#)
- Shut-off valves type AVM 8: [Page 236](#)

Electronic accessory components	280
Programmable logic valve control type PLVC	282
CAN node type CAN-IO	284



*Programmable logic valve controls
type PLVC*



Electronic amplifiers

General electronic accessory components

Type	Nomenclature/Design	Features
Electronic accessory components Type MSD etc., EV	<ul style="list-style-type: none"> Plugs with no special feature (standard) <ul style="list-style-type: none"> With rectifier circuit, - With clamp diode, - With LED with economy circuit Amplifier units for proportional solenoids Power supply units <p>Version</p> <ul style="list-style-type: none"> Plugs Modules with screw terminals Cards with terminal strip 	<p>Features and benefits:</p> <ul style="list-style-type: none"> Compact design Functions tailored to HAWE products

Electronic controls

Type	Nomenclature/Design	Features
PLVC, CAN-IO	<p>Programmable logic valve control</p> <ul style="list-style-type: none"> Modular system with <ul style="list-style-type: none"> Basic modules Extension modules CAN bus nodes Display Software 	<ul style="list-style-type: none"> Modular systems with extension and enhancement modules (Basic and expansion module) Flexible programming Different interfaces (RS 232, CAN bus, Profibus) All output parameters can be customised Software function modules (PLC programs)

6

Electronic accessory components

Proportional amplifiers actuate proportional solenoid valves by converting an input signal into a corresponding control current.

The proportional amplifier type EV is available as a module for assembly on a DIN rail or, alternatively, as a card for a card holder. Highly precise functions are possible thanks to the feedback measurement at the valve outputs.

The control parameters (I_{min} , I_{max} , dither, ramp times) are configured using pushbuttons or a potentiometer.

Features and benefits:

- Compact design
- Easy commissioning
- Functions tailored to HAWE products

Intended applications:

- For the actuation of proportional valves
- Switch cabinet installation in an industrial setting



Nomenclature:	<ul style="list-style-type: none">▪ Plugs with no special feature (standard)▪ With rectifier circuit▪ With clamp diode▪ With LED with economy circuit▪ Amplifier units for proportional solenoids▪ Power supply units
Design:	<ul style="list-style-type: none">PlugsModules with screw terminalsCards with terminal strip

Hauptparameter und Abmessungen

Plug for solenoid valves (single and twin solenoid)

Brief description	Application
No special feature (standard)	For all applications with no special requirements
Version with LED	Visual operation control and EMC protection (note prolonged cut-off times)
Version with clamp diode	For optimum EMC protection (note prolonged cut-off times)
Version with economy circuit	Increased functional security and prolonged service life of the solenoids by reducing the voltage (pulse width modulation) after a defined period. Recommended for use in areas with high ambient temperatures and/or for application where the solenoids are permanently energised (e.g. safety circuits)
Version with rectifier circuit	Enables use of DC solenoids when a power supply of 110V AC, 230V AC is available

Plugs with no special feature (DC voltage supply) or the version with rectifier circuit for power supply of 110V AC, 230V AC are included as standard in the scope of delivery of the solenoid valve.

Proportional amplifier

Features:		Adjustable parameters:
<ul style="list-style-type: none"> Constant current control (regardless of the power supply and changes in resistance of the solenoid due to heating effects) Improved EMC properties Use in a broad temperature range 		<ul style="list-style-type: none"> I_{\max} and I_{\min} setting Setting for ramp time up to 10 sec Reference voltage for potentiometric setpoint generator available Option to set dither amplitude and frequency
Type	Brief description	Application
EV 1 M EV 1 D	Module version (board only or built-in housing)	Suitable for installation in switch cabinets, secured with screw terminals
EV 22 K	Card version	Card suitable for control of two proportional solenoids. Use in card holder for one, or in a module rack for max. 3 amplifier cards

Power supply units for solenoid valves

Type	Brief description	Application
MNG	Power supply unit for input voltage 230V AC and output voltage 24V DC, max. power rating 5A	Power supply for solenoid-actuated hydraulic valves or electrical amplifiers for proportional solenoids

Associated technical data sheets:

Please check whether correct links are inserted

Plugs:

- Line connector type MSD and others: [D 7163](#)
- Economy circuit plug type MSE 28026 with adjustable economy voltage: [D 7832](#)

Electronic amplifiers:

- Proportional amplifier type EV1M3: [D 7831/2](#)
- Proportional amplifier type EV1D: [D 7831 D](#)
- Proportional amplifier type EV22K2: [D 7817/1](#)

Power supply units:

- Power supply unit type MNG: [D 7835](#)

Additional electrical components:

- Proportional amplifier: [Page 280](#)
- Programmable logic valve control type PLVC: [Page 282](#)
- CAN node type CAN-IO: [Page 284](#)
- Other electronic accessories [See "Electronics"](#)

Suitable products:

Lifting modules:

- Type HMT, etc.: [Page 158](#)

Prop. pressure valves:

- Type PM, PMZ: [Page 192](#)
- Type PMV, PDV: [Page 180](#)
- Type PDM: [Page 194](#)

- Prop. directional seated valves type EMP: [Page 142](#)
- Prop. directional spool valves type PSL, PSV: [Page 106](#)
- Prop. flow control valves type SE, SEH: [Page 220](#)

Electronic pressure sensors:

- Type DT 11 and DT 2: [Page 272](#)

6 Programmable logic valve control type PLVC

Programmable valve controls regulate and control complex mobile or stationary hydraulic systems.

The programmable valve control type PLVC is a freely programmable PLC with integrated proportional amplifiers. Highly precise functions are possible thanks to the feedback measurement at the valve outputs. The number of digital and analogue inputs and outputs can be configured variably.

The valve control is of modular design and can be expanded to suit the application. It can be very straightforwardly integrated into existing systems due to the existing interfaces.

- Modular systems with extension and enhancement modules (Basic and expansion module)
- Flexible programming
- Different interfaces (RS 232, CAN bus, Profibus)
- All output parameters can be customised
- Software function modules (PLC programs)

Intended applications:

- Construction machines
- Crane systems
- Complex lifting devices
- Machines for forestry purposes
- Machine tools and press construction



Nomenclature: Programmable logic valve control

Design: Modular concept with

- Basic modules
- Expansion modules
- CAN bus nodes
- Display
- Software

Hauptparameter und Abmessungen

	PLVC 41	PLVC 21	PLVC 8
Number of inputs ¹⁾			
Digital	27 (3 / 24)	13 (5 / 8)	17 (10 / 7)
Analogue	28 (4 / 24)	12 (4 / 8)	23 (11 / 12)
Frequency	3 (3 / -)	3 (3 / -)	3 (3 / -)
Emergency stop	x	x	x
Number of outputs ¹⁾			
Digital	16 (- / 16)	16 (8 / 8)	13 (- / 13)
Analogue (PWM)	16 (4 / 16)	4 (4 / -)	16 (16 / -)
Analogue (0 ... 10V)	1 (1/-)	--	--
Relay	8 (3 / 8)	4 (- / 4)	--
Auxiliary voltage	1 (5V DC)	--	--
Interfaces			
RS 232	x	x	x
CAN bus	x	x (- / x)	x (x / x)
Profibus	--	x	--
Power supply (10 ... 30V DC)	5A (10A)	5A	5A

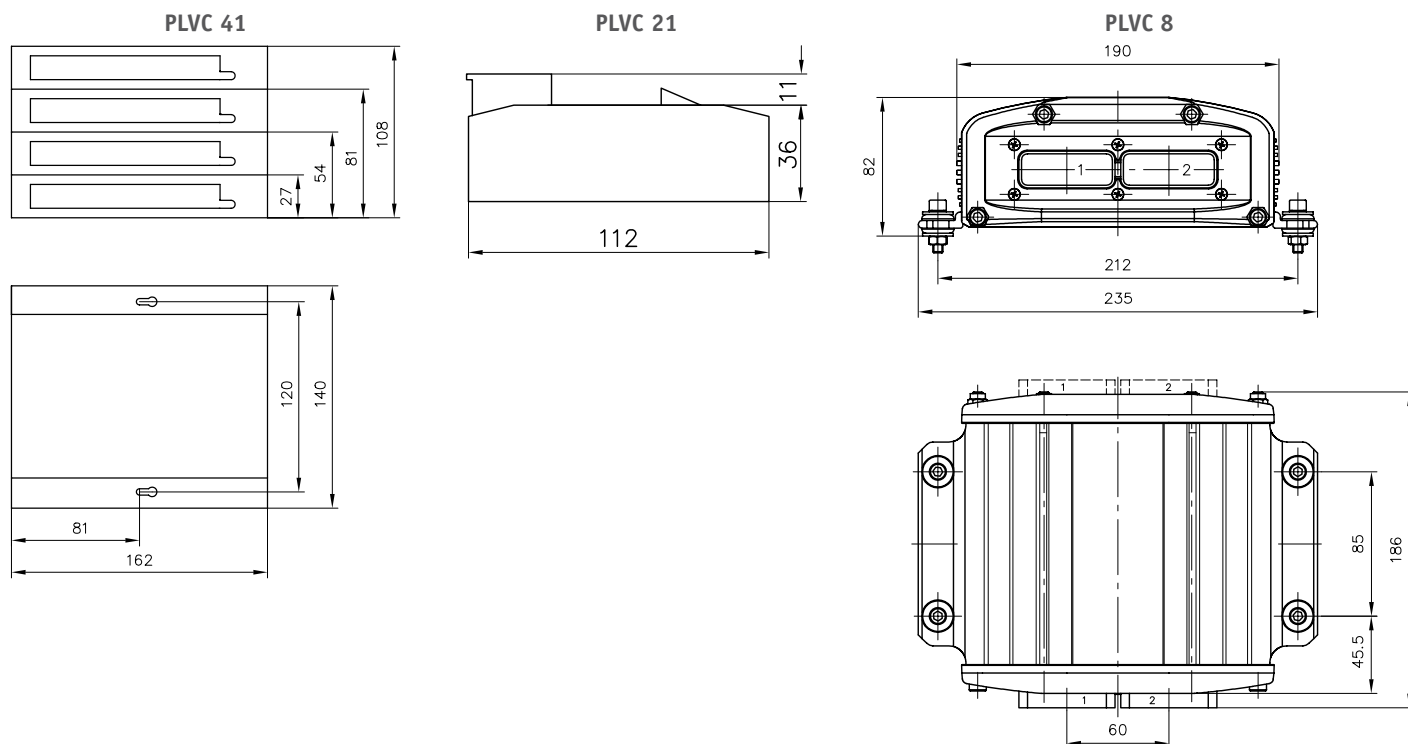
1) Always max. number of inputs and outputs, figures in brackets apply to basic modules and expansion modules

Software function packs (examples):

- Position measurement
- CAN bus communication
- Position and volumetric flow control
- Fault detection
- Controller for closed control circuits
- Ganging
- Electronic volumetric flow distribution
- Stability
- Limit load control
- Pressure control

Advantage: PLC programming using structured texts (ST) (see above) – The customer can customise the control at any time.

Dimensions



Programmable logic valve control:

- Programmable logic valve control with Profibus type PLVC 21: [D 7845-21](#)
- Programmable logical valve control type PLVC 41: [D 7845-41](#)
- Programmable logic valve control type PLVC 8: [D 7845 M](#)
- CAN node type CAN-IO: [D 7845-IO 14](#)

Proportional valves:

- Including type HMT lifting modules: [Page 158](#)
- Proportional directional spool valves type PSL, PSV: [Page 106](#)

Proportional valves:

- Proportional flow control valves type SE, SEH: [Page 220](#)
- Proportional pressure-reducing valve type PM, PMZ: [Page 192](#)
- Proportional pressure-limiting valve type PMV, PDV: [Page 180](#)
- Proportional pressure-reducing valve type PDM: [Page 194](#)

6 CAN node type CAN-IO

Programmable valve controls regulate and control complex mobile or stationary hydraulic systems.

The programmable valve control type CAN IO is a freely programmable PLC with integrated proportional amplifiers. The input and output parameters are set using logical operators. All outputs can also act as inputs.

It is possible to connect together several decentral CAN IO valve controls using the CAN bus.



Nomenclature: Programmable logic valve control

Design: **Modular concept with**

- Basic modules
- Expansion modules
- CAN bus nodes
- Display
- Software

Hauptparameter und Abmessungen

CAN-IO 14	
Number of inputs ¹⁾	
Digital	1
Analogue	6 (10)
Frequency	-
Emergency stop	-
Number of outputs ¹⁾	
Digital	4
Analogue (PWM)	4
Analogue (0 ... 10V)	-
Relay	-
Auxiliary voltage	-
Interfaces	
RS 232	x
CAN bus	x
Profibus	-
Power supply (10 ... 30V DC)	10A

1) Always max. number of inputs and outputs, values in brackets apply to basic modules and expansion modules

Appendix

7 Hydraulic fluids – notes for selection

The performance of a hydraulic system depends to a large extent on the quality of the hydraulic fluid used.

The hydraulic fluid should essentially be selected according to the operating conditions, such as

- Temperature (see viscosity classes)
- Device type (possible ban on certain hydraulic fluids due to undesired reactions with metals, seals etc.)
- Usage type (e.g. environmentally compatible hydraulic fluids)
- Surroundings (use of existing hydraulic fluids)

For HAWE devices the following viscosity and temperature ranges apply:

Temperature range:	Ambient: -40...+80°C, (Important: air-powered pumps type LP +5...+80°C) Hydraulic fluid: -25...+80°C Please observe viscosity range and any additional restrictions.
Start temperature:	Down to -40°C permissible Observe start viscosities as long as the steady-state temperature is at least 20K higher for subsequent operation! Biologically degradable or flammable hydraulic fluids generally not over max. +60...+70°C.
Viscosity range:	Min. approx. 4 mm ² /s, Max. approx. 1500 mm ² /s Optimum service approx. 10...500 mm ² /s

Mineral oils

Hydraulic fluid	Characteristics	Unusual features / restrictions
▪ Hydraulic oils HLP (DIN 51524 part 2)	Mineral oil with additives improving corrosion, oxidation and wear protection	Common hydraulic fluid
▪ Hydraulic oils HL (DIN 51524 part 1)	Mineral oil without wear protecting additives	Not suitable for any types of gear pump due to the lack of wear protection additives. <ul style="list-style-type: none"> ▪ No pumps and power packs with gear pumps type RZ, Z ▪ No compact hydraulic power packs HC, KA, MP, MPN, HK, HKL
▪ Hydraulic oils HVLP (DIN 51524 part 3)	Mineral oil with same additives as HLP, but with increased viscosity index for use in higher temperature ranges	The viscosity index correctors have a negative effect on the shearing resistance (viscosity loss approx. 30% when loaded), demulsifying properties and air release characteristics, for example. Only use if required due to temperature range. Oil manufacturer must be consulted!
▪ Undoped oils H e.g. <ul style="list-style-type: none"> - Lubricating oils (DIN 51517 part 1) - White oils (e.g. NSF H1) 	Mineral oil without additives	Due to lack of additives only suitable for systems in the standby mode (S2 or S3 mode) (low lubricity). White oils are mostly used in systems with possible contact with foodstuffs.
▪ Hydraulic oils PAO (tested in line with DIN 51524 part 2 and part 3)	Mineral oil with additives improving corrosion, oxidation and wear protection	See information on hydraulic oils HVLP
▪ Special fluids for aviation (MIL H-5606) for off-shore applications (NATO H 540)	Mineral oils are based as a rule on naphthenic oil with wide temperature range	Seals made of fluor rubber FPM might be required, depending on hydraulic fluid. Consult the oil manufacturer!
▪ Other mineral oils <ul style="list-style-type: none"> Engine oils HD ATF automatic transmission fluid (AQ A, suffix A) Diesel Test oil for diesel injection pump test 	Mineral oils which basically were developed for other application purposes	More or less suitable hydraulic fluids. Pay attention to the presence of oxidation and corrosion protection as well as material compatibility (above all in relation to the seals). Attention: increased leakage with directional spool valves. Oil manufacturer must be consulted!

Environmentally compatible hydraulic fluids ISO 15380

Hydraulic fluid	Characteristics	Unusual features / restrictions
<ul style="list-style-type: none"> Seed oil type HETG 	Fluids based on seed oils e.g. rape or sunflower with additives show only low temperature resistance (< 60...70°C)	Not suitable for compact power packs type HC, KA, MP, MPN, HK, HKL, all valves with wet armature solenoids as well as control systems utilizing many throttles. Fluids type HETG show a tendency to gum, ageing, and sticking at higher temperatures (> 60...70°C). Their use should be avoided!
<ul style="list-style-type: none"> Polyethyleneglycol HEPG PEG-Polyethylene (may be solved in water) PPG-Polypropylene (can't be solved in water) 	Fluids based on polyethylene glycol (PEG) Properties similar to mineral oil with regard to service life, lubricity and pressure resistance	No restrictions with regard to the operation behavior, but it <ul style="list-style-type: none"> Is harmful to standard enamel (does not apply to two-pot enamel) Will clog cellulose filters (use only glass fiber or metallic filters)! Shows bad lubrication characteristic with material pairings steel / light alloy or brass No pumps and power packs with gear pumps type RZ and Z Do not use compact hydraulic power packs type HC, KA, MP, MPN, HK, HKL No connection blocks with return filter type A.F., AF, BF, EF, FF
<ul style="list-style-type: none"> Synthetical ester HEES (carbon acid ester, diester, polyester) 	Similar qualities i.e. service life, lubricating characteristics and pressure resistance, like mineral oil	No restrictions with regard to the operation behavior. Contact with PVC should be avoided.

Flame-resistant hydraulic fluids ISO 12922

Hydraulic fluid	Characteristics	Unusual features / restrictions
<ul style="list-style-type: none"> HFA (pressurized water, emulsions) 	Oil in water emulsion, (water content > 80%) max. temp. range approx. 60°C	There is the danger of corrosion and cavitation due to the high water content, only use devices specially constructed for this purpose (radial piston pumps type R, directional seated valves type G) Max. pump pressure 50...60% (danger of cavitation) Min. oil content > 4% <ul style="list-style-type: none"> Do not use compact hydraulic power packs HC, KA, MP, MPN, HK, HKL – risk of short circuit No paper filters – risk of blockage No connection blocks with return filter type A.F., AF, BF, EF, FF
<ul style="list-style-type: none"> HFC 	Diluted (poly-) glycol solution (water content < 35%) max. temp. range up to approx. 60°C	No restrictions with regard to the operation behavior, but it <ul style="list-style-type: none"> No paper filters – risk of blockage No connection blocks with return filter type A.F., AF, BF, EF, FF Will clog cellulose filters (use only glass fiber or metallic filters)! Shows bad lubrication characteristic with material pairings steel/light alloy or brass No compact hydraulic power packs HC, KA, MP, MPN, HK, HKL
<ul style="list-style-type: none"> HFD HFDR phosphoric ester HFDU polyolester 	Fluids without water content, properties similar to mineral oil	Normal operation possible Restrictions: <ul style="list-style-type: none"> Requires seals out of FPM (FKM) (see also section "Seals") Oil manufacturer must be consulted!

Special fluids

Hydraulic fluid	Characteristics	Unusual features / restrictions
<ul style="list-style-type: none"> AT-Brake fluid 	Brake fluid based on glycol (DOT 4)	No restrictions with regard to the operation behaviour, but devices must be equipped with EPDM or SBR seals (see "Seals" section) No compact hydraulic power packs type HC, KA, MP, MPN, HK, HKL

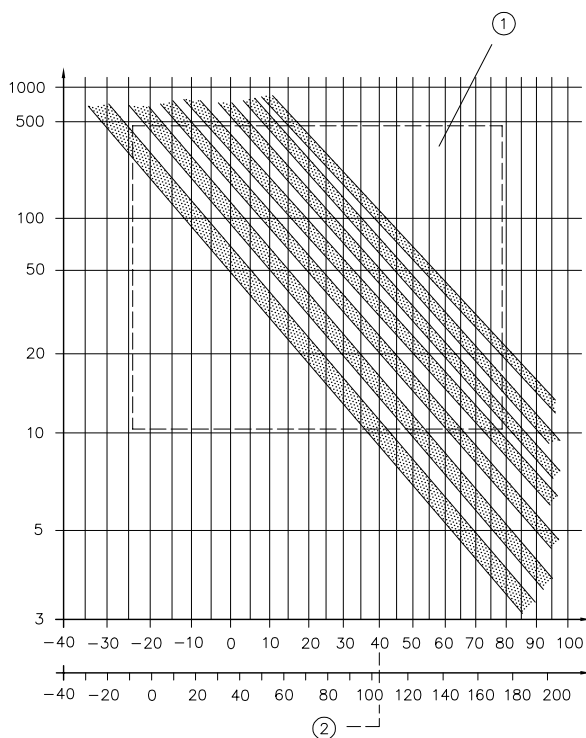
Selection of the viscosity

Of the 18 viscosity classes (ISO VG) listed in the standard "ISO viscosity classification for liquid lubricants" (ISO 3448), the areas ISO VG10 to ISO VG68 are relevant for hydraulic systems. The number after "ISO VG" corresponds to the nominal viscosity at a reference temperature of 40°C. The temperature behaviour displayed in the diagram corresponds to that of mineral hydraulic oils. The characteristic curve increase of HVLP and the environmentally compatible hydraulic fluids is flatter, indicating that the temperature effect is lower.

Due to manufacturer-related differences, the following benchmark figures are to be clarified and compared with the permissible viscosity ranges:

- Viscosity at 40°C
- Viscosity at the lowest (estimated or demanded) temperature
- Viscosity at the highest (estimated or demanded) temperature (to ensure sufficient service life of the seals not above 80°C!)

Temperature / viscosity curve



- Optimum range
- Reference temperature
ISO 3448

Guide lines for selection

- VG10, VG15
Systems intended for short time operation or use in the open or for clamping devices.
Systems intended for continuous operation (for use in the open, operation in winter only)
- VG22, VG32
General application (for use in the open, operation in summer only)
- VG46, VG68
Systems in tropical conditions at ambient temperatures up to 40°C or closed rooms

Filtration

Major malfunctions of a hydraulic system can be caused by contamination like fine wear particles and dust or bigger particles e.g. swarf, rubber from tubing or seals. Therefore the following filtration is recommended (after a thorough initial flushing):

Recommended purity of the hydraulic fluid	Recommended filter fineness	Devices	Note
ISO 4406 : 1999			
21/18/15...19/17/13	$\beta_{16...25} \geq 75$	Radial piston and gear pumps, valves, cylinders (use in general mechanical engineering)	The purity degree of the hydraulic fluid is especially important for the repeatability accuracy with proportional valves.

Recommended purity of the hydraulic fluid	Recommended filter fineness	Devices	Note
ISO 4406 : 1999			
20/17/14...18/15/12	$\beta_{6...16} \geq 75$	Prop. pressure and flow control valves	It should be noted that new hydraulic fluid "from the barrel" does not necessarily fulfil the highest cleanliness requirements.
19/17/14	$\beta_{6...16} \geq 75$	Variable displacement axial piston pumps	

Lower limits must be applied for pressure >250 bar

Service life

The aging of hydraulic fluids is caused by shearing processes, cracking induced by high temperatures (gumming), mixing with (condensed) water or reaction with other materials (e.g. metal) in the system (sludging). A major factor for the service life of the fluid is beside the anti-shear additives of the fluid the lay-out of the system e.g. tank size, operation temperature, number and design of throttling sections.

Besides the properties of the hydraulic fluid itself (e.g. due to additives for high shear stability), the design of the hydraulic control system (e.g. tank size, steady-state temperature, number and type of throttling points) has a major influence on this.

The following points are to be noted:

- Service temperature in the tank < 80°C
(mineral oils, hydraulic fluids with low water content) Avoid higher temperatures – Service life reduction – (+10K corresponds to half service life)
- Rotational conditions of hydraulic fluid $\frac{Q_{pump}[lpm]}{V_{circuit}[l]}$ (guideline)
 - approx. 0.2...0.4/min for conventional compact hydraulic power packs
 - approx. ...1/min in mobile hydraulics
 - approx. ...4/min for hydraulic power packs in standby or no load operation
- Control of the hydraulic fluid on a regular base (fluid level, contamination, coloring index, neutralization value etc.)
- Change of the hydraulic fluid on a regular base (depending on fluid type and application conditions)
Guideline:
 - approx. 4000 ... 8000 h (mineral oil)
 - approx. 2000 h (other hydraulic fluids)
 - or at least annually
 Take into account notes of the fluid manufacturer!

Change of the hydraulic fluid

Mixing different kinds of hydraulic fluid sometimes can cause unintended chemical reactions such as sludging, gumming etc.

Therefore the relevant manufacturers should be consulted when switching between different hydraulic fluids.

In all cases, the whole hydraulic system must be rinsed thoroughly.

Please observe the information in VDMA 24314.

Seals

Any question about the compatibility with seal material should be settled with the fluid manufacturer always before using a certain hydraulic fluid (except mineral oil and synthetic esters). A rough overview is given in the table at the start of this section. HAWE utilizes seals made of the follow- ing materials as standard:

- NBR (acrylonitrile rubber, e.g. Bunan, Perbunan) or HNBR (hydrated NBR).

Some devices are available on request with seals made of:

- FPM FPM (also FKM, fluor rubber) e.g. for fluids type HFD
 - The coding ...-PYD should be added to the coding for HAWE devices, e.g. WN1H-G24-PYD
- EPDM (ethylen propylen rubber) or SBR (styrene-butadiene rubber)
 - The coding ...-AT should be added to the coding for HAWE devices, e.g. WN1H-G24-AT (for brake fluid)

Storage of hydraulic components

The storage conditions for hydraulic components depend primarily on the seals used and the test bench oil with which the parts are moistened. The storability of rubber materials is generally influenced by the following factors:

- Warmth, light, humidity, oxygen, ozone

Furthermore, storage should be de-energised as far as possible and not result in any deformations. It has been shown that a storage temperature range of 15 to 20°C is optimum. The relative humidity should be approx. 65% (+/-10%). Exposure to direct sunlight or a light source with strong UV rays should be avoided.

Ozone-producing equipment (electric motors, high-voltage equipment) among other things must not be present in the storage room. If seals are packaged in plastic bags, these should not contain any plasticisers and, if necessary, should be impermeable to UV light. Details on storage of elastomers are also available in the following standards: DIN 7716/BS4F68:2012, MIL-HDBK-695, SAE ARP 5316, SAE AS 1933, DIN 9088.

Hydraulic oils can be stored for an unlimited period in sealed containers supplied by the manufacturer, as no chemical reactions take place. The presence of atmospheric oxygen, dust and moisture can lead to more or less rapid oxidation and resinification, depending on the type of oil and its additives.

A dark room with virtually constant temperature and humidity is recommended for storage of hydraulic components. The parts should be kept in a plastic bag to protect them from dust and continuous air exchange. In addition, a functional test (emergency manual override, dry switching) should be carried out on the device at least once a year to ensure operation when required.

With safety-related components, a six-monthly functional test on site and a regular factory inspection including seal replacement every 2 years are recommended.

The risk of corrosion of hydraulic components that are stored as described above is low, as most external parts are coated with a protective layer (galvanised, gas-nitrated) and moistened with oil.

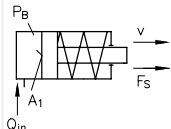
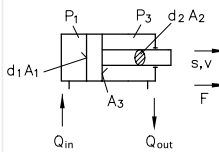
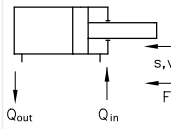
7 Formulas and units

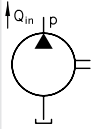
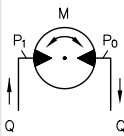
Hydraulic system and circuit design is limited only by the creativity of the application engineer. All basic circuit design begins with the ultimate actuator functions in mind however.

The most important condition for this is the definition or specification of relevant consumer variables, such as the loads (load forces, load torques or turning torques), motion functions (travel, speeds, rotational speeds, timing) etc.

Other factors that have an influence on the choice of hydraulic systems and components include noise emission values and thermal budget considerations.

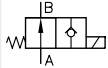



The following formulae and tables are non-binding and are intended to make producing the rough design for a hydraulic system easier.


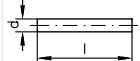
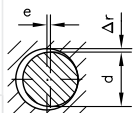
Equipment	Formulas and description		
General information	Basic equations (static, without any loss)		
	$Q=\frac{V}{t}$ $V=A \cdot s$ $F=p \cdot A$ $p=\frac{F}{A}$ $Q=A \cdot v$ $M=\frac{V \cdot p}{2 \pi}$ $v=\frac{s}{t}$	force volume A: Q: v: V: torque s: M:	Force Pressure Area Flow Speed Volume Time Travel (stroke) Torque
Equipment	Formulas and description		Symbol
Hydraulic cylinders			
▪ Single acting	$A[mm^2]=\frac{\pi}{4} d^2[mm]$ $v[\frac{m}{s}]=\frac{s[mm]}{1000t[s]}$ $F_s[N]=0,1 \cdot p_B[bar] \cdot A[mm^2]$ $p_B[bar]=\frac{-10F_s[N]}{A_1[mm^2]}$ $Q_{zu}[l/min]=0,06 \cdot A[mm^2] \cdot v[\frac{m}{s}]$	d: A: F _s : p _B : v: Q _{in} : s: t:	piston diameter [mm] piston area [mm ²] force [N] operating pressure [bar] Piston speed [$\frac{m}{s}$] inflow [lpm] stroke [mm] time [S]
			
▪ Double acting	Extending Basic equations (balance of forces): $A_1=\frac{\pi}{4} d_1^2 \approx 0,78d_1^2$ $A_3=\frac{\pi}{4} (d_1^2-d_2^2)$ $p_1 \cdot A_1=p_3 \cdot A_3-F$ $p_1=\frac{1}{A_1} (p_3 \cdot A_3-F)$ $Q_{zu}=A_1 \cdot v$ $Q_{ab}=A_3 \cdot v$	Simplified: $p_1[bar]=\frac{p_3[bar] \cdot A_3[mm^2]-10F[N]}{A_1[mm^2]}$ $F[N]=\frac{-p_1[bar] \cdot A_1[mm^2]+p_3[bar] \cdot A_3[mm^2]}{10}$ p ₃ is the result of flow resistance from pipes and valves for Q _{out} Attention: note possible pressure intensification!	
	Retracting Basic equations (balance of forces): $p_1 \cdot A_1=p_3 \cdot A_3+F$ $p_3=\frac{1}{A_3} (p_1 \cdot A_1-F)$ $Q_{zu}=A_3 \cdot v$ $Q_{ab}=A_1 \cdot v$	Simplified: $p_3[bar]=\frac{p_1[bar] \cdot A_1[mm^2]-10F[N]}{A_3[mm^2]}$ $F[N]=\frac{p_1[bar] \cdot A_1[mm^2]-p_3[bar] \cdot A_3[mm^2]}{10}$ p ₁ result of flow resistance from pipes and valves for Q _{out}	
	A ₁ : piston area [mm ²] A ₃ : rod side area [mm ²] d ₁ : piston ∅ [mm] d ₂ : rod ∅ [mm] F: force [N]	Q _{in} : inflow [lpm] Q _{out} : outflow [lpm] p ₁ : pressure, piston side [bar] p ₃ : pressure, rod side [bar] s: stroke, travel [mm]	

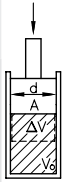
Equipment	Formulas and description			Symbol
Hydraulic pumps / hydraulic motors	Basic equations:	$\Delta p = p_1 - p_o^{1)}$	Simplified:	Hydraulic pump
	Geometric volume per revolution (piston pumps):	$V = A \cdot h$	$V[cm^3] \approx \frac{A[mm^2] \cdot h[mm]}{1000}$	
	Flow:	$Q = V \cdot n$	$Q[lpm] \approx \frac{V[cm^3] \cdot n[min^{-1}]}{1000}$	Hydraulic motor
	Middle torque:	$M = \frac{V \cdot \Delta p}{2 \pi}$	$M[Nm] \approx \frac{V[cm^3] \cdot \Delta p[bar]}{62}$	
	Power:	$P_{hydr} = \Delta p \cdot Q$	$P_{hyd}[kW] \approx \frac{\Delta p[bar] \cdot Q[lpm]}{612}$	
	Power consumption (pump):	$P_{mech} = \frac{\Delta p \cdot Q}{\eta_T} = \frac{M \cdot 2 \pi n}{\eta_T}^{2)}$	$P_{drive}[kW] \approx \frac{\Delta p[bar] \cdot Q[lpm]}{500}$	
	Power rating (motor):	$P_{max} = \Delta p \cdot Q \cdot \eta_T = M \cdot 2 \pi n \cdot \eta_T^{2)}$	$P_{out}[kW] \approx \frac{\Delta p[bar] \cdot Q[lpm]}{740}$ $\approx \frac{M[Nm] \cdot n[min^{-1}]}{12000}$	
V: displacement [cm ³] A: effective piston area [mm ²] h: double stroke [mm] n: rev. rating [rpm] M: middle torque [Nm] p: pressure [bar] Δp: effective pressure [bar] Q: flow [lpm] P _{hydr} : hydraulic performance [kW] P _{mech} : mechanical performance [kW] η _T : total efficiency (including volumetric and mechanical losses)			Guideline: A power rating of 1 kW for the drive is necessary to achieve a delivery flow of Q = 1 lpm with operating pressure p = 500 bar!	


¹⁾ p_o is calculated from line and valve resistance

²⁾ incl. degree of efficiency η_T ≈ 0.82

Equipment	Formulas and description	Symbol
Valves Directional valves Pressure valves Metering valves Check valves	Losses of pressure by streaming fluid The pressure loss in hydraulic systems consists of: <ul style="list-style-type: none"> Flow resistance of valves Flow resistance of pipes Flow resistance due to geometric shape (elbows etc.) Pressure losses Δp in the valves that are caused by the flow of fluid can be found in the Δp-Q characteristics of the relevant documentation. For the purposes of an initial rough design, a performance loss of approx. 20... 30% in the overall control system can generally be expected.	Examples: Directional valve  Pressure limiting valve  Flow control valve  Releasable check valve 

Equipment	Formulas and description		Symbol
Orifices (ideally, sharp edged) e.g. orifice inserts type EB; by-pass check valves type BC, BE	Basic equation: $Q \approx \alpha \cdot \frac{\pi}{4} d^2 \cdot \sqrt{\frac{2 \Delta p}{\rho}}$ Q: flow [lpm] Δp: flow resistance between A and B [bar] d: orifice diameter [mm] ρ: density (approx. 0.9 g/cm³) α: flow coefficient (approx. 0.78)	Simplified: $Q \approx 0.55 d^2 [mm] \cdot \sqrt{\Delta p [bar]}$ $d \approx 1.35 \cdot \sqrt{\frac{Q [lpm]}{\sqrt{\Delta p [bar]}}}$ $\Delta p \approx \left(\frac{1.82 \cdot Q [lpm]}{d^2 [mm]} \right)^2$	
Equipment	Formulas and description		Symbol
Pipes / hoses	The diameter of pipes and/or hoses should be selected in such a way that flow resistance is minimized. Basic equations: $Re = \frac{v \cdot d}{\nu} \cdot 10^3$ $\lambda_R = \frac{64}{Re}$ $\Delta p = \lambda_R \cdot \frac{l}{d} \cdot \frac{\rho}{2} v^2$		
	λR: pipe flow resistance coefficient Δp: flow resistance [bar] l: pipe length [m] d: pipe diameter [mm] ν: cinematic viscosity [mm²/s] Q: flow [lpm] Re: Reynolds No. (< 2300) ρ: density (approx. 0.9 g/cm³) v: Flow velocity [$\frac{m}{s}$]	Simplified: $Q [l/min] \leq 0,108 \cdot d [mm] \cdot v \left[\frac{mm^2}{s} \right]$ $d [mm] \geq \frac{9,2 \cdot Q [lpm]}{v \left[\frac{mm^2}{s} \right]}$ $\frac{\Delta p}{l} \left[\frac{bar}{m} \right] \approx \frac{6,1 \cdot v \left[\frac{mm^2}{s} \right] \cdot Q \left[\frac{l}{min} \right]}{d^4 [mm]}$	
Equipment	Formulas and description		Symbol
Flow resistance due togeometric shape (elbows etc.)	Basic equations: $\Delta p = \xi \cdot \frac{\rho}{2} v^2$ $v = \frac{Q}{A} = \frac{4Q}{\pi d^2}$		
	90° elbow	ξ = 0,15	
	straight pipe fitting	ξ = 0,5	
	elbow fitting	ξ = 1,0	
	Simplified: $\Delta p [bar] = 2,2 \cdot \xi \cdot \frac{Q^2 [lpm]}{d^4 [mm]}$		
	Δp: flow resistance [bar] ξ: flow resistance coefficient ν: cinematic viscosity [mm²/s] d: pipe diameter [mm] ρ: density (approx. 0.9 g/cm³)		
Equipment	Formulas and description		Symbol
Leakage losses (by concentric (e = 0) and eccentric gaps)	Basic equation: $Q_L = \frac{\pi \cdot d \cdot \Delta r^3}{12 \cdot \nu \cdot \rho} \cdot \frac{\Delta p}{l} (1 \text{ } 1,5 \cdot \epsilon^2)$ e: eccentricity [mm] Δr: gap [mm] Δp: Pressure difference [bar] d: diameter [mm] ν: cinematic viscosity [mm²/s] l: gap length [mm] ρ: density (approx. 0.9 g/cm³)	Simplified: $Q_L = 1848 \cdot \frac{d \cdot \Delta r^3}{\nu} \cdot \frac{\Delta p}{l} (1 \text{ } 1,5 \cdot \epsilon^2) \quad \epsilon = \frac{e}{\Delta r}$	

Equipment	Formulas and description		Symbol
Volumetric losses (due to pressure increase)	Basic equation: $\Delta V = \beta_p \cdot V_o \cdot \Delta p$ with $\Delta p = p_2 - p_1$		$F = \Delta p \cdot A$ 
	p_1 : pressure, start [bar] p_2 : pressure, end [bar] V_o : initial volume [l] ΔV : change in volume [l] β_p : compressibility	Simplified: $\Delta V = 0,7 \cdot 10^{-4} \cdot V_o \cdot \Delta p$ (with $\beta_p \approx 0,7 \cdot 10^{-4} \frac{1}{\text{bar}}$)	
Volumetric losses (due to temperature rise)	Basic equation: $\Delta V = \beta_T \cdot V_o \cdot \Delta \vartheta$ mit $\Delta \vartheta = \vartheta_2 - \vartheta_1$		
	ϑ_1 : temperature, start [°C] ϑ_2 : temperature, end [°C] $\Delta \vartheta$: temperature, difference [K] V_o : initial volume [l] ΔV : volume alteration [l] β_T : expansion coefficient	Simplified: $\Delta V = 0,7 \cdot 10^{-3} \cdot V_o \cdot \Delta \vartheta$ (mit $\beta_T \approx 0,7 \cdot 10^{-3} \frac{1}{K}$)	
Pressure increase caused by temperature rise (without volumetric compensation)		$\Delta V = 0,7 \cdot 10^{-4} \cdot \Delta p = 0,7 \cdot 10^{-3} \cdot \Delta \vartheta$ i.e. $\Delta \vartheta \approx 1 K \Leftrightarrow \Delta p \approx 10 \text{ bar}$	
	Note: A temperature rise of trapped oil volume will cause a pressure increase! (i.e. a pressure limiting valve will be required sometimes) Guideline: The pressure will rise by approx. 10 bar for 1 K of temperature increase.		

Equipment	Formulas and description		Symbol
Hydraulic accumulators Pressure alternations, isotherm (slow) adiabatic (quick)	Hydraulic accumulators are intended for the supply of pressurized fluid during sudden demands (quick, adiabatic pressure alternations), compensation of leakage losses or to dampen oscillations (slow, isotherm pressure alternations).		
	Basic equations:	$p_1=1,1 \cdot p_o$	
	isotherm (slow)	$\Delta V=V_1 \cdot \left(1-\frac{p_1}{p_2}\right)$	
	adiabatic (quick)	$\Delta V=V_1 \cdot \left(1-\left(\frac{p_1}{p_2}\right)^{0,71}\right)$	
	p _o : filling pressure for the gas [bar] p ₁ : lower operating pressure [bar] p ₂ : upper operating pressure [bar] V ₁ : initial volume [l] ΔV: volume alternation [l]		

Equipment	Formulas and description		
Cavitation	Approx. 9 % (volumetric) air are solved in oil at atmospheric pressure. There is the danger of bubble cavitation during atmospheric pressure below 0,2 bar. These situations can occur, accompanied by sudden noise, during suction process of pumps and cylinders as well as at extreme throttle sections. The hydraulic components where this occurs will show increased wear.		
Equipment	Formulas and description		
Thermal level Dissipation power and oil temperature	<p>The hydraulic power losses in a hydraulic system result in a temperature rise of the fluid and the equipment which is partly radiated to the surroundings via the surface of the system. They roughly amount 20 - 30% of the induced performance. The induced and the radiated heat will balance at some point after the warm-up of the system.</p> <p>Basic equations: $P_V = 0,3 \cdot P_{hydr}$ $\vartheta_{\text{ölmax}} \approx \vartheta_{Umg} + C \cdot \frac{P_V}{A}$</p> <table border="1"> <tr> <td> <p>Surface with unhindered circulation $c \approx 75$ Surface with bad circulation $c \approx 120$ with fan ($v \approx 2 \text{ m/s}$) $c \approx 40$ Oil/water radiator $c \approx 5$</p> </td><td> <p>Simplified: $\vartheta_{\text{ölmax}} \approx \vartheta_{Umg} + C \cdot \frac{0,3 \cdot P_{hydr} [kW]}{A [m^2]}$</p> </td></tr> </table> <p> P_V: performance loss, transformed in heat [kW] P_{hydr}: hydraulic performance [kW] $\vartheta_{\text{ölmax}}$: max. fluid temperature [°C] ϑ_{amb}: ambient temperature [°C] A: surface of the system (tank, pipes etc.) [m²] </p>	<p>Surface with unhindered circulation $c \approx 75$ Surface with bad circulation $c \approx 120$ with fan ($v \approx 2 \text{ m/s}$) $c \approx 40$ Oil/water radiator $c \approx 5$</p>	<p>Simplified: $\vartheta_{\text{ölmax}} \approx \vartheta_{Umg} + C \cdot \frac{0,3 \cdot P_{hydr} [kW]}{A [m^2]}$</p>
<p>Surface with unhindered circulation $c \approx 75$ Surface with bad circulation $c \approx 120$ with fan ($v \approx 2 \text{ m/s}$) $c \approx 40$ Oil/water radiator $c \approx 5$</p>	<p>Simplified: $\vartheta_{\text{ölmax}} \approx \vartheta_{Umg} + C \cdot \frac{0,3 \cdot P_{hydr} [kW]}{A [m^2]}$</p>		

Conversion table

Conversion table

Nomenclature	Codings	Unit	≈	Factor X	Unit
Pressure	p	$1 \frac{N}{mm^2}$	≈	10	bar
		1 MPa	≈	10	bar
		$1 \frac{kgf}{cm^2}$	≈	1	bar
		1 psi	≈	0.07	bar
Force	F	$1 \frac{kg \cdot m}{s^2}$	=	1	N
		1 lbf	≈	4.45	N
Length, travel, stroke	l, s, h	1 in	≈	25.4	mm
		1 ft	≈	304.8	mm
Torque	M	$1 \frac{kg \cdot m^2}{s^2}$	=	1	Nm
Performance	P	1 PS, 1 hp	≈	0.74	kW
Area	A	1 ft ²	≈	92903	mm ²
		1 in ²	≈	645.16	mm ²
Volume	V	1 ft ³	≈	28.92	l
		1 in ³	≈	$1.64 \cdot 10^{-2}$	l
		1 UK gal	≈	4.55	l
		1 US gal	≈	3.79	l
Temperature	T, θ	5 (°F-32)/9	≈	1	°C
Mass	m	1 lb	≈	0.45	kg
Cinematic viscosity	v	1 cST	=	1	$\frac{mm^2}{s}$

Germany**Headquarter**

HAWE Hydraulik SE
Streitfeldstr. 25
D-81673 München
PO Box 800804 D-81608 München
Tel. +49 89 37 91 00 - 1000
Fax: +49 89 37 91 00 - 9 1000
e-mail: info@hawe.de
www.hawe.de

Office Filderstadt

Felix-Wankel-Str. 41
D-70794 Filderstadt
Tel. +49 89 37 91 00 - 5000
Fax: +49 89 379100 - 9 5000
e-mail: vertrieb-filderstadt@hawe.de

Office Norderstedt

Werkstraße 6
D-22844 Norderstedt
Tel. +49 89 37 91 00 - 53 00
Fax: +49 89 37 91 00 - 9 53 00
e-mail: vertrieb-norderstedt@hawe.de

Office Kassel

Frankfurter Str. 229 b
D-34134 Kassel
Tel. +49 89 37 91 00 - 51 00
Fax: +49 89 37 91 00 - 9 51 00
e-mail: vertrieb-kassel@hawe.de

Office Hennef

Bonner Str. 12 d
D-53773 Hennef
Tel. +49 89 37 91 00 - 52 00
Fax: +49 89 37 91 00 - 9 52 00
e-mail: vertrieb-hennef@hawe.de

Office Freising

Kulturstr. 44
D-81653 Freising
Tel. +49 89 37 91 00 - 43 80
Fax: +49 89 37 91 00 - 9 43 80
e-mail: vertrieb-freising@hawe.de

International

For countries not listed:

HAWE Hydraulik SE

Mr. Werner Windstetter
Streitfeldstraße 25
D-81673 München
Tel. +49 89 37 91 00-0, -12 81
Fax: +49 89 37 91 00-12 69, -12 49
e-mail: info@hawe.de, w.windstetter@hawe.de
www.hawe.de

Egypt

Egyptian Hydraulic Engineering
Mr. Sameh Zeyada
22 Saudi Buildings Al - Sawah 11281
Cairo, Egypt
Tel. +20 224 5018-90
Fax: +20 224 5018-92
e-mail: s.zeyada@ehydraulic.com
www.ehydraulic.com

Angola

ZANANCHO HIDRÁULIC de ANGOLA
Mr. Filipe Armada
Estrada Direita do Zango, Polo Industrial de Viana / Zona Nova
Viana, Angola
Tel. +244 222 200 26 54
Fax: +244 222 012 059
e-mail: geral@zananchohidraulico.com
www.zanancho.pt

Argentina

FLUTECNO, S.R.L.
Mr. Juan Emina
Avda. Belgrano, 615, 1° Of. G, C1092AAG Buenos Aires
Argentina
Tel. +54 11 43435168
Fax: +54 11 43421083
e-mail: ventas@flutecno.com.ar
www.flutecno.com.ar

Australia

Hawe Hydraulics Australia PTY Ltd
Mr. Herbert Hirning
5/ 83-85 Montague Street
North Wollongong NSW 2500
PO Box 618 Fairymeadow 2520
Tel. +61 242 257 222
Fax: +61 242 297 622
e-mail: hhirning@hawe.com.au

Belgium

Doedijns Hydraulics N.V. België
Mr. Jelle Beuker
Langveld Park 10, P. Basteleusstraat 2
B-1600 Sint-Pieters-Leeuw
Tel. +32 23 617 401
Fax: +32 23 617 405
e-mail: jelle.beuker@doedijns.com
www.doedijns.com

Bosnia-Herzegovina

see
HAWE Hidravlika d.o.o. / Slovenia

Brazil

HIDRACOMP, LTDA
Mr. Lélío Ferrari
Rua Dr.Edgard Magalhaes Noronha, 704
BR-03480-000 Vila Nova York, Sao Paulo
Tel. +55 11 6721-1113
Fax: +55 11 6721-9302
e-mail: hidracomp@hidracomp.com.br
www.hidracomp.com.br

Bulgaria

Eurofluid Hydraulik Bulgaria OOD
Mr. Alexander Erschov
Vojeli Str. 3
BG-6100 Kazanlak
Tel. +359 431 634 77, +359 431 621 73
Fax: +359 431 644 74
e-mail: ehb_bg@abv.bg

Chile

MARCO Industrial SPA
Mr. Rodolfo Cerda R.
Los Gobelinos 2584, Renca, Santiago
Chile
Tel. +56 2 782 4400
Fax:
e-mail: rcerda@marco.cl
www.grupomarco.cl

China

HAWE Oil-Hydraulic Technology (Shanghai) Co., Ltd.
Ms. Wang Xiaodan
155 Jindian Road
201206 PuDong / Shanghai, P.R. China
Tel. +86 21 589 996 78
Fax: +86 21 505 508 36
e-mail: info@hawe.com.cn
www.hawe.de

Denmark

Fritz Schur Teknik AS
Mr. Jørgensen
Sydmarken 46
DK-2860 Søborg
Tel. +45 70 20 1616
Fax: +45 70 20 1615
e-mail: mail@fst.dk
www.fst.dk

Dubai

Doedijns Middle East and Africa FZE
Mr. Martijn Schols
P.O. Box # 261894, Jebel All Free, Zone
Dubai UAE
PO Box Dubai - UAE" Tel.
+971 4 815 7800
e-mail:
martijn.scholsdoedijns.com www.dgi-corp.com

Ecuador

Marco Ecuador
Mr. Jorge Sánchez
Av. Juan Tanca Marengo Km 0.5, No. 305
Guayaquil
Tel. +59 3 4229 2763
e-mail: jsanchez@marco.com.ec
www.marco.com.ec

Finland

HAWE Finland Oy
Mr. Mikko Vainio
Kellonsoittajantie 2
FIN-02770 Espoo
Tel. +358 10 82126-00
Fax: +358 10 82126-10
e-mail: info.finland@hawe.fi
www.hawe.fi

France

HAWE-Otelec S.A.S.
Mr. Jean-Marc Appéré
2 Rue Parc des Vergers, Parc d'activités des Vergers
F-91250 TIGERY
Tel. +33 169 471 010
Fax: +33 160 792 048
e-mail: hawe.otelec@hawe-otelec.fr

Greece

G. & I. Pangakis S.A.
Mr. Iannis Pangakis
Konstantinoupoleos 167
GR-10441 Athens
Tel. +30 210 88 10 750
Fax: +30 210 88 18 659
e-mail: info@pangakis.gr
www.pangakis.gr

Great Britain

Koppen & Lethem Ltd.
Mr. Allan Woodhead
3 Glenholm Park, Northern Rd. Industrial Estate, Newark
GB-Nottinghamshire NG24 2EG
Tel. +44 163 667 679 4
Fax: +44 163 667 105 5
e-mail: sales@koppen-lethem.co.uk
www.koppen-lethem.co.uk

Hong Kong

Melchers (H.K.) Ltd., Industrial Materials Dept.
Mr. Benjamin Becker
1210 Shun Tak Centre West Tower, 168-200 Connaught Road Central,
Hong Kong
Tel. +85 22 58 91 54-4
Fax: +85 22 55 96 55-2
e-mail: bbecker@melchers.com.hk

India

HAWE Hydraulics Pvt. Ltd.
Mrs. Cynthia Richard
No. 68, Industrial Suburb 2nd Stage, Yeshwanthpur
Bangalore 560 022, India
Tel. +91 80 419 520 00
Fax: +91 80 419 520 01
e-mail: contactus@haweindia.com

Indonesia

see
Singapore

Iraq

see

Doedijns Middle East and Africa FZE / Dubai

Israel

LYA Hydraulics & Pneumatics Ltd.

Mr. Yossi Shapira

9 Lev Pesach St. North Industrial Zone

IL-71293 Lod, Israel

Tel. +97 27 32 57 00 00

Fax: +97 27 32 57 00 99

e-mail: yossi@lya.co.il

www.lya.co.il

Italy

HAWE-Italiana S.r.l.

Mr. Udo Wolter

Via C. Cantù, 8

I-20092 Cinisello Balsamo (Milano)

Tel. +39 02 399 75-100

Fax: +39 02 399 75-101

e-mail: info@hawe.it

Japan

HAWE Japan Ltd.

Mr. Takao Yasuda

2-2, Yoshimoto-cho, Nakagawa-ku

J-Nagoya, Aichi, 454-0825, Japan

Tel. +81 52 365-1655

Fax: +81 52 365-1656

e-mail: info@hawe.co.jp

www.hawe.de

Jordan

see

Doedijns Middle East and Africa FZE / Dubai

Canada

HAWE North America, Inc.

Mrs. Dani Boon

9009-K Perimeter Woods Drive

Charlotte, NC 28216

Tel. +1 704 509-1600

Fax: +1 704 509-6303

e-mail: sales@hawehydraulics.com

www.hawehydraulics.com

Korea

HAWE Korea Co., Ltd.

Mr. WonSam Cho

27, 1-gil, 4-sandan, Seobuk-gu, Cheon-an,

Chungnam 331-814, South Korea

Tel. +82 41 585-3800

Fax: +82 41 585-3801

e-mail: info@hawe.kr

www.hawe.kr

Croatia

see

HAWE Hidravlika d.o.o. / Slovenia

Kuwait

see

Doedijns Middle East and Africa FZE / Dubai

Malaysia

see

Singapore

Morocco

Hydrautech Industrie Mécanique & Hydraulique Industrielles

Mr. Aziz Lakhdar

Rte.110 Km 14.800 Z.I Zenata

Casablanca

Tel. +21 2 624 026 887

e-mail: hydrautech.ind@gmail.com

Macedonia

see

HAWE Hidravlika d.o.o. / Slovenia

Mexico

see

HAWE North America Inc. / USA

New Zealand

see

Hawe Hydraulics Australia PTY Ltd / Australia

Netherlands

Doedijns Hydraulics B.V.

Mr. Jelle Beuker

P.O.Box 179

NL-2740 AD Waddinxveen

Tel. +31 182 302 888

Fax: +31 182 302 777

e-mail: jelle.beuker@doedijns.com

www.doedijns.com

Norway

Servi Hydranor AS
Mr. Børre Kleven
Haugenveien 10, Postboks 3230
N-1402 Ski
Tel. +47 64 97 97 97
Fax: +47 64 97 98 99
e-mail: post@servi.no
www.servi.no

Oman

see
Doedijns Middle East and Africa FZE / Dubai

Austria

HAWE Österreich GmbH
Mr. Andreas Schöller
Keltenstraße 5
A-3100 St. Pölten
Tel. +43 274 224 577
Fax: +43 274 224 588
e-mail: office@hawe.at
www.hawe.at

Peru

Marco Peruana S.A.
Mr. Helmut Castro Aquino
Av. Sáenz Peña 1439, Callao 1
Peru
Tel: +51 1 201 3800
Fax: +51 146 594 97
e-mail: hcastro@marco.com.pe
www.marco.com.pe

Philippines

see
Singapore

Poland

RDL Hydraulics Sp. z o.o
Mrs. Beata Block, Mr. Marcin Liss
Nowy Tuchom 10
PL-80-209 Chwaszczyno
Tel. +48 58 671 51 61
Fax: +48 58 671 51 64
e-mail: handlowy@rockfin.com.pl
www.rockfin.dl.pl

Portugal

ZANANCHO-HIDRÁULICO Lda.
Mr. Jorge Valente
Estrada Mata da Torre, 352 A-B-C Edificio Valente-Tires
PT-2785-291 São Domingos Rana, Lisboa
Tel. +35 121 444 037 4
Fax: +35 121 444 326 5
e-mail: jorge.valente@zanancho.pt
www.zanancho.pt

Qatar

see
Doedijns Middle East and Africa FZE / Dubai

Romania

FLUPEC S.R.L. Engineering & Trading
Mr. Daniel Vasile, Mr. Adrian Mihu
Str. Zidului Nr. 3
RO-550324 Sibiu
Tel. +40 269 206 138
Fax: +40 269 210 700
e-mail: office@flupec.ro
www.flupec.ro

Russia

InterPromTechnika
Mr. Artur Ivanov
Ulitsa Savushkina 83/3
197374 St. Petersburg
Tel. +7 812 318 02 92
Fax: +7 812 318 02 92
e-mail: info@interpromtechnika.ru
www.interpromtechnika.ru

Saudi Arabia

Dalil Al Souk Est.
Mr. Eng. Omar S. Alessa
P.O. Box 5874 Riyadh 11432
Saudi Arabia
Tel. +96 61 44 64 14-5
Fax: +96 61 44 64 18-9
e-mail: o.alessa@dalilalsouk.com
www.dalilalsouk.com

Sweden

PMC Hydraulics AB
Mr. Mikael Brunell
Askims Verkstadsväg 15
Box 1013, S-436 21 Askim
Tel. +46 31 289 840
Fax: +46 31 286 401
e-mail: info@pmchdraulics.se
www.pmchdraulics.se

Switzerland

HAWE-HYDRATEC AG
Mr. Kurt Hess
Dorfstrasse 37
CH-6035 Perlen
Tel. +41 417 474 000
Fax: +41 417 474 010
e-mail: info@hawe-hydratec.ch
www.hawe-hydratec.ch

Serbia / Montenegro

see
HAWE Hidravlika d.o.o. / Slovenia

Singapore

HAWE Hydraulik Singapore Pte. Ltd.
Mr. Chee Hoong Chan
25 International Business Park, #01-59/60, German Centre
Singapore 609916, Singapore
Tel. +65 656 283 61
Fax: +65 656 283 60
e-mail: chan.ch@hawe.com.sg
www.hawe.de

Slovakia Republic

Eurofluid Hydraulik SR s.r.o.
Mr. Andrej Galád
Racianska 71 (Areal VUZ)
SK-852 02 Bratislava 02
Tel. +42 12 49 10 22 66
Fax: +42 12 44 25 90 82
e-mail: eurofluid@eurofluid.sk
www.eurofluid.sk

Slovenia

HAWE Hidravlika d.o.o.
Mr. Kristian Les
Petrovče 225
SI-3301 Petrovče
Tel. +386 371 348 80
Fax: +386 371 348 88
e-mail: office@hawe.si
www.hawe.de

Spain

HAWE Hidráulica, S.L.U.
Mr. Antonio Polo
Polig. Ind. Almeda, c/. del Progrés, 139-141
E-08940 Cornellà de Llobregat, Barcelona, Spain
Tel. +34 934 751 370
Fax: +34 934 751 371
e-mail: hawe.hidraulica@hawe.es
www.hawe.de

South Africa

WALCH Engineering Co. (PTY) Ltd.
Mr. Marc Walch
6, Field Road, Lilianton, Boksburg North
SA-Witfield 1467, TVL
Tel. +27 118 261 411
Fax: +27 118 266 129
e-mail: walch@mweb.co.za

Taiwan

S.G.D. Engineering Co., LTD
Mr. Wan-Chin Yin, Mr. K. P. Chen
No.139-5, Mincheng St., Daliao District
Kaohsiung City 831, Taiwan (R.O.C.)
Tel. +886 773 532 77
Fax: +886 773 538 77
e-mail: kpchen@sgdeng.com.tw
www.sgdeng.com.tw

Thailand

Aerofluid Co. Ltd.
Mr. Kritsda
169/4 - 169/5 Moo 1, Rangsit-Nakhonnayok rd., Lampakkud
Thanyaburi
12110 Patumthanee, Thailand
Tel. +66 257 729 99
Fax: +66 257 727 00
e-mail: kritsda@aerofluid.com
www.aerofluid.com

Czech Republic

Eurofluid-Hydraulik CR, s.r.o.

Mr. Martin Hvězda

Chrást'any 9

CZ-270 01 Knezeves u Rakovníka

Tel. +42 031 358 262 0, +42 031 353 101 6, +42 031 358 261 5, +42 031 353 101 7

Fax: +42 031 358 261 6

e-mail: info@eurofluid.cz

www.eurofluid.cz

Vietnam

see

Singapore

Turkey

Entek Otomasyon Ürünlerli San. ve Tic. A.S.

Mr. Dogan K. Haciahmet

Mahmutbey Mah. Tasocagi Yolu Cad. No: 9 Entek Plaza

Bagcilar - Istanbul 34218

Tel. +90 850 201 4141

e-mail: dogan.haciahmet@entek.com.tr

Ukraine

Izumrud Ltd.

Mrs. Lesia Konukh

Dekabristov Str. 7

UK-02121 Kiev, Ukraine

Tel. +38 044 560-3367

Fax: +38 044 563-6160

e-mail: viklad@ukr.net

www.qidravlika.kiev.ua

Hungary

Jankovits Hidraulika Kft.

Mr. István Jankovits

Juharfa u. 20

HU-9027 Győr Ipari Park

Tel. +36 965 120 60

Fax: +36 96 4 195 37

e-mail: info@jankovitshidraulika.hu

USA

HAWE North America Inc.

Mrs. Dani Boon

9009-K Perimeter Woods Drive

Charlotte, NC 28216

Tel. +1 704 509-1599

Fax: +1 704 509-6302

e-mail: info@haweusa.com

www.haweusa.com

United Arab Emirates

see

Doedijns Middle East and Africa FZE / Dubai



HAWE Hydraulik SE
Streitfeldstraße 25
D-81673 Munich - Germany
Tel. +49 89 37 91 00 - 1000
Fax: +49 89 37 91 00 - 9 1000
info@hawe.de
www.hawe.de

Solutions for a World under Pressure

HAWE
HYDRAULIK