Directional seated valve banks type VB 01... to VB 41...

with directional valves acc. to D 7300

(This also lists individual valves with connection sub-plates for direct pipe connection)

Pressure p_{max} = 350 ... 500(700) bar; Flow Q_{max} = 6 ... 120 lpm

1. General

These valve banks consist of a connection block, laterally added directional valves (acc. to pamphlet D 7300) installed on individual sub-plates and an end plate. All is held together by a tension rod. The connection block incorporating a pressurized oil inlet and return outlet may also feature a pressure limiting valve. Two basic designs are available, either for pipe connection or direct mounting onto hydraulic power packs. The galleries for pressurized oil and return run through all sub-plates and thereby connect the valves in parallel. An end plate terminates the valve bank (not with size 4).

The valves are counted starting from the connection block. For data and notes concerning the individual valves (not being covered by this pamphlet), see D 7300.

2. Available versions, type coding

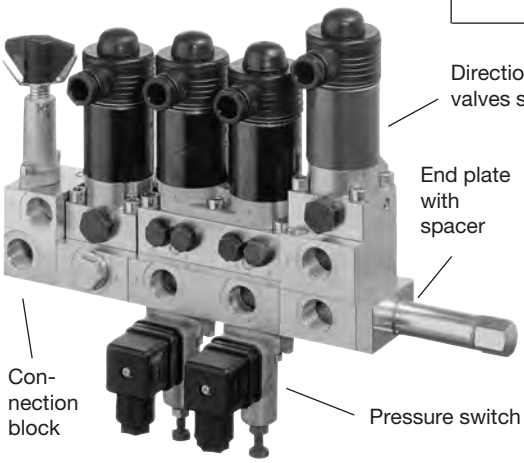
For total type coding overview, see sect. 7

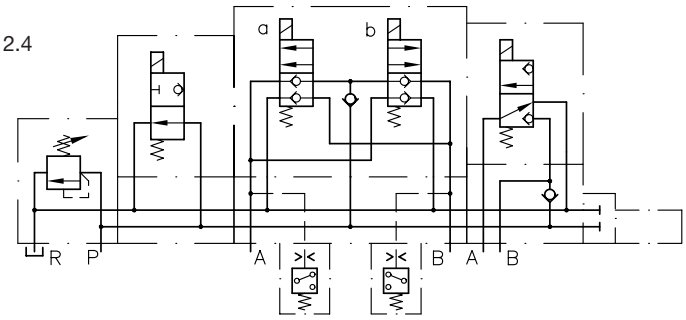
2.1 Order examples

Example 1: **VB11AM - 2/350 - F G45 S/11 - 2 - G24**

Directional valve bank for pipe connection
(Actuation mode is similar for all directional valves)

For assignment of the coding and main data, see sect. 2.2





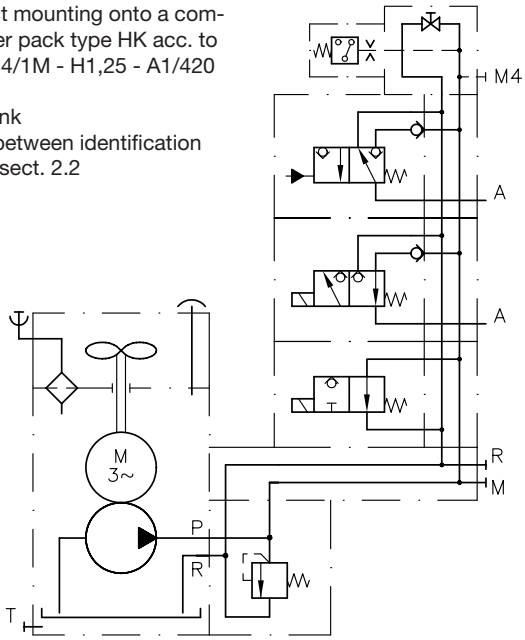
P = Inlet (from the pump)
R = Outlet (reflow to the tank)
A, B = Consumer ports

Example 2: HK 34/1M - H1,25 - A1/420 **- VB01 FMH - FR/N/32 - 1 - WG230**

Order coding of the pump

Valve bank for direct mounting onto a compact hydraulic power pack type HK acc. to D 7600-3, e.g. HK 34/1M - H1,25 - A1/420

Directional valve bank
For the correlation between identification and main data, see sect. 2.2



R = Return port
M, M4 = Pick-up port e.g. for a pressure gauge or a sensor
A = Consumer port

2.2

2.2 Type coding and general parameter

VB11AM - 2/350 - FG45S /11 - 2 - G24 (example 1 acc. to sect. 2.1)
VB01FMH - FR/N /32 - 1 - WG230 (example 2 acc. to sect. 2.1)

The slash indicates which valves (coding) feature which actuation mode (sequence). In this example, valves F and R are equipped with actuation M whereas valve N with actuation H.

Flow pattern (For identification of codings and additional features, see sect. 2.4

see end plate in sect. 2.3

Table 4: Ports

Coding	1	2	3	4	5
Ports conf. ISO 228/1 (BSPP) [1]	G 1/4	G 3/8	G 1/2	G 3/4	G 1
For valve banks	VB 01.. VB 11..	VB 11.. VB 21..	VB 21.. VB 31..	VB 31.. VB 41..	VB 41..

Table 3: Actuations for the directional valves

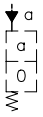
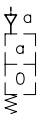
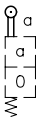
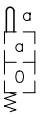
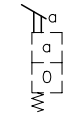
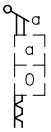
Coding	M standard	Nom. voltage: G 12 = 12V DC, G 24 = 24V DC, WG 230 = 230V AC 50 Hz. For further data, see D 7300	Other available actuations H	P	K	T	F	D
Actuation mode and symbol	solenoid 		hydraul. 	pneum. 	roller 	pin 	level 	turn-knob 
Available for	VB01 to VB41		VB01 to VB31	VB11 VB21 VB31	VB11 VB21 VB31	VB11 VB21	VB11 VB21 VB31	VB11 VB21

Table 2: Connection block or adapter plate

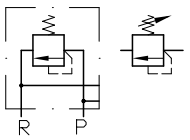
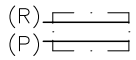
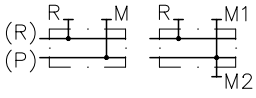
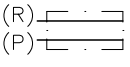
Coding and Design [16]	Available for valve bank	Pressure limiting valve	Spring-housing material	Direct connection to	Suited for pump type: Acc. to pamphlet	Symbol
A .-1/... (pressure specification in bar, e.g **AM-2/230**)	VB 01 to VB 41	tool adjustable	VB01 to VB31: die cast VB41: steel	pipes	Arbitrary, all pumps of the HAWE product range. (see also note below !)	
A .-2/...						
A .-3/...	VB 01 to VB 31	tool adjustable	steel [2]			
A .-4/...						
A .-5	VB 01 to VB 41	without				
C [8]	VB 01 VB 11 VB 21	without. The connection block of the hydraulic power pack features a pressure limiting valve		Tanks D6 to D30 B6 to B40	R.. D 6010H etc. [3] Z.. D 6820 RZ.. D 6910H	
D [8]	VB 11 VB 21 VB 31			Tanks D50 B50 and B75	R.. D 6010H Z.. D 6820 [5]	
E	VB 31			Tanks D100 and D250 B100 to B400	R.. D 6010H [4] Z.. D 6820 [5]	
F	VB 01 VB 11 VB 21			Tanks [10]	HK.. D 7600-... MP.. D 7200H HC.. D 7900 HCG.. D 7900G FP.. D 7310	F F1 
F1	VB 01					
G [9]	VB 11 VB 21			Tanks	MP.. D 7200H [7] RZ.. D 6910H [7]	VB11 VB21: Direct connection 

Table 1: Valve bank (basic type, size, sub-plate)

Coding		VB 01	VB 11	VB 21	VB 22	VB 31	VB 41
Pressure p_{max} (bar) [11]		500	700	500	700	400	350
Flow (lpm)	Q_{max} approx.	6	12	25	25	65	120
	perm. delivery flow [12]	≦ 6	5 12	11 25	11 25	20 60	> 60

Note:
When selecting the valve size, it is determined not only by the indiv. consumer flow but also by the resulting total flow dep. on the control sequence. As this can be higher than the pump delivery flow, e.g. with double acting cylinders (unequal areas) in a differential circuit.
Therefore the valve size should be selected according to the resulting total flow.

[1]) For pipe fittings with tapped journal, shape B DIN 3852 page 2

[2]) Required only, if pressure surges > 20 bar could occur during return flow. Such pressure surges may occur during decompression of chargable consumers.

[3]) Type VB...A... should be selected instead, as only a limited number of valves can be connected at P1 (interference with P2) at hydraulic power packs with two pressure outlets e.g. acc. to D 6010 DB, D 6010 S.

[4]) Valves are over dimensioned for flows < 17 lpm. Controls should employ type VB 21A.. or VB 11A.. (remotely installed)

[5]) Controls by means of directional spool valves are better suited in most cases for the low pressure range of gear pumps.

[7]) VB 11G.. for delivery flows < 10 lpm; VB 21G.. for delivery flows > 10 lpm (max. 25 lpm)

[8]) Not available with additional pressure switch mounted at the directional valve (see sect. 2.4.2)

[9]) May be directly mounted at type A51/.. to A61/.. (acc. to D 6905 A) or two stage valve type NE21 (acc. to D 7161)

[10]) May be combined with connection block type A... (acc. to D 6905 A and D 6905 AF/1). The max. permissible pressure depends on the selected flow pattern and actuation mode, see also D 7300, sect. 2 and 3.1.

[11]) The max. permissible pressure depends on the selected flow pattern and actuation mode, see also D 7300, sect. 2 and 3.1.

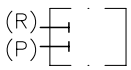
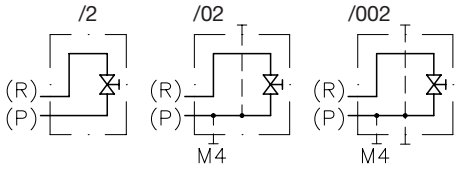
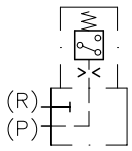
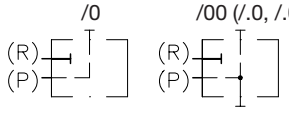
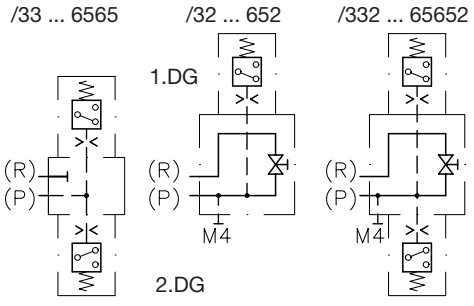
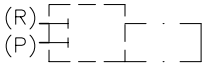
[12]) The back pressure figures listed in D 7300 should be observed if the pump delivery flow is in the area of Q_{max} of the selected valve.

[13]) Type VB 41 feature no end plate. Ports P and R are plugged at the last valve section.

[14]) Coding /56 must be used if two pressure switches (1. DG 35; 2. DG 36) are desired to prevent confusion with the coding for one pressure switch DG 365 (/65). Coding /65 (1. DG 36, 2. DG 35) must not be used!

[16]) Additional adapter plates (coding S and L) for direct mounting of valve banks type VB 11 onto air driven hydraulic power packs type LP see D 7280 H

2.3 End plate (For dimensional drawings. see sect. 3.1 and 3.2)

Coding together with valve bank [13]) VB 01 / VB 11 / VB 21 VB 31	Note	Symbol
(no coding	Standard e.g. VB11FM-FHH-1-G24	
/2	End plate with drain valve, e.g. for discharging a connected accumulator (see sect. 6.3) e.g. VB01FM-FHH/**2**-1-G24	
/02 **/002**	End plate with drain valve, prepared for retrofitting for one or two pressure switches e.g. VB11FM-FHH/**02**-1-G24	
/3 **/4** **/5** **/6** **/65**	End plate with one pressure switch (D 5440) 1. DG | 2. DG | Adjust. range /3 | 3 | DG 33 | 200 ... 700 bar /4 | 4 | DG 34 | 100 ... 400 bar /5 | 5 [14]) | DG 35 | 20 ... 250 bar /6 | 6 | DG 36 | 4 ... 12 bar /65 | 65 | DG 365 | 12 ... 170 bar e.g. VB01FM-FHH/**4**-1-G24	
/0 **/00** **(/.0, /0.)**	End plate prepared for retrofitting of one or two pressure switches e.g. VB11FM-FHH/**0**-1-G24 VB11FM-FHH/**04**-1-G24	
/33, /34.. **“** **“** **/56, /665, /6565** [14])	End plate with two pressure switches (for identification of the pressure switches, see coding /3 etc.) e.g. VB01FM-FHH/**63**-1-G24 VB11FM-FHH/**365**-1-G24	
/32 ... /652	End plate with drain valve and one pressure switch (for coding of the DG, see above) e.g. VB01FM-FHH/**52**-1-G24	
/332 **“** **“** **/65652**	End plate with drain valve and two pressure switches (for coding of the DG‘s, see above) e.g. VB01FM-FHH/**432**-1-G24	
/11 **/12** **/... 11** **/... 12**	**Spacers:** These spacers enable retrofitting of one (11) or two (12) valves including their sub-plate (see sect. 3.2 and 3.5). The corresponding coding should be added after the coding of the end plate. e.g. VB01FM-FHH/**11** VB01FM-FHH/**365 12** VB01FM-FHH/**62 11**	

2.4 Directional valves

2.4.1 Basic functions

Flow pattern codings (directional valve with corresponding sub-plate)

The symbols of the directional valves have to be completed by the symbols for the actuation mode.

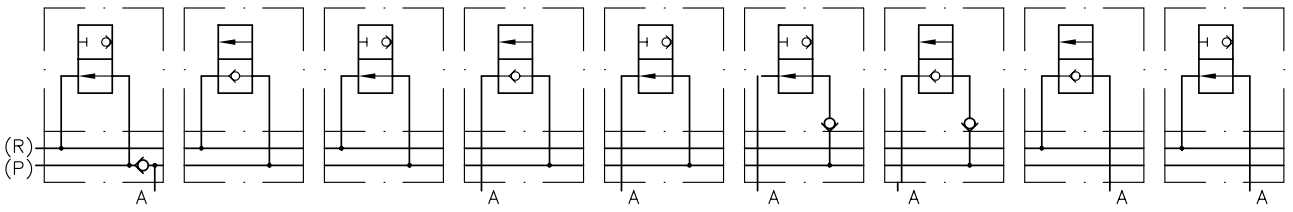
A maximum of 12 valves (VB 01 and VB 11) or 10 valves (VB 21, VB 31 and VB 41) may be combined in one valve bank, G and J are counted as 2 valves. Flow pattern A, D or F should be used only once and as 1st valve within the valve bank (1st in the sequence of the order coding). As an exception, flow pattern A should be the last within valve banks type VB 41 (last in the sequence of the order coding).

Attention: The sequence of the laterally added valves should be selected in such a way that valves which are actuated simultaneously are not neighboring (see sect. 6.1)

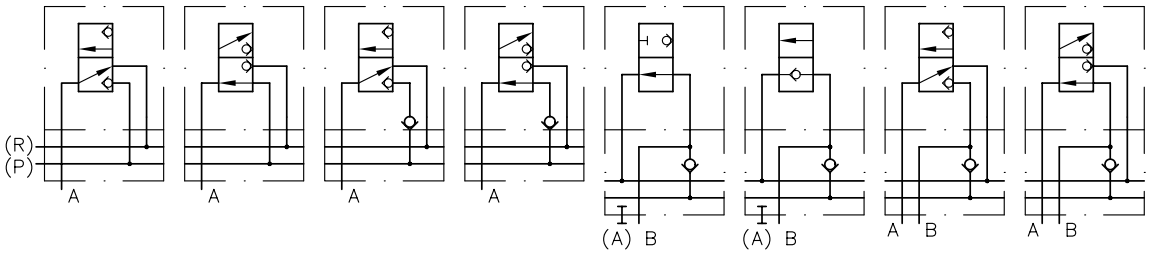
A, B = Consumer ports

P, R = Internal pump and reflow connections

A [1]	D	F	B	C	E	Q	P	O

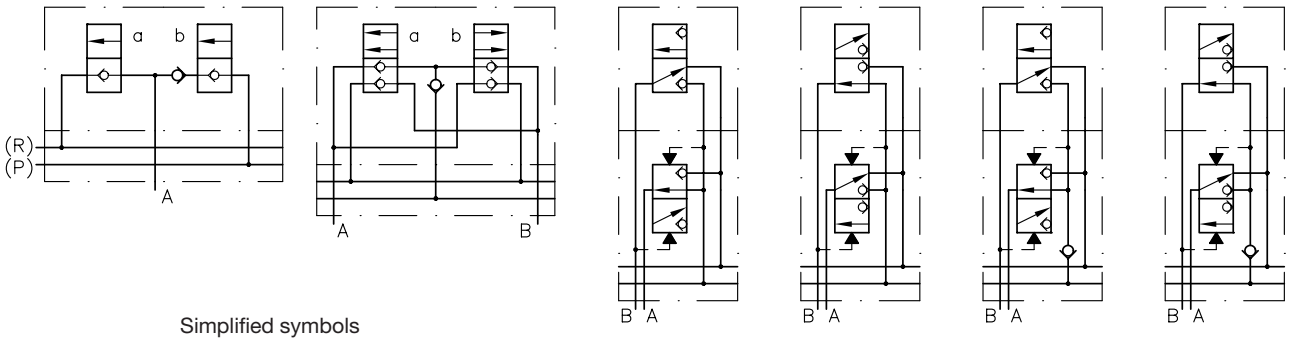


H	L	N	R	Y [2]	I [2]	S [2]	T [2]	

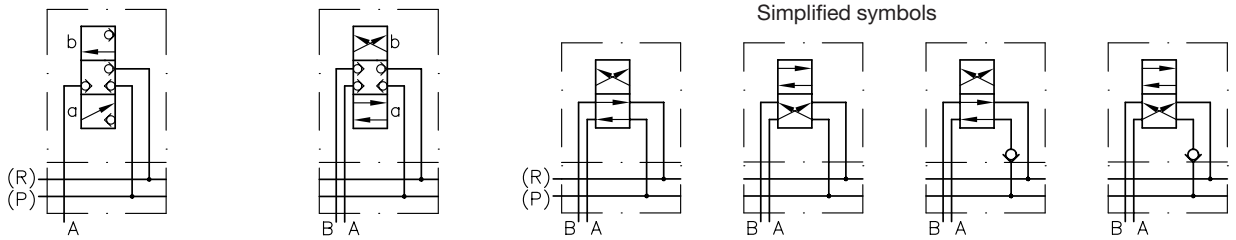


The simplified symbols for codings Y, I, S and T are illustrated below.

J	G	HX	LX	NX	RX
	not available for VB 41	only available for VB 11, only ports G 1/4			



Simplified symbols



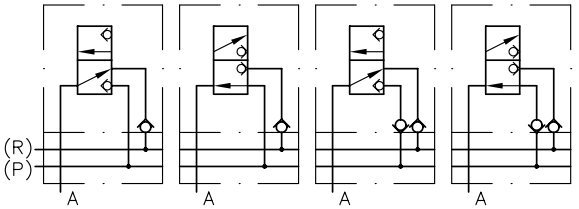
Simplified symbols

[1] not available for VB 01 (only ports G 1/4 with VB 11)

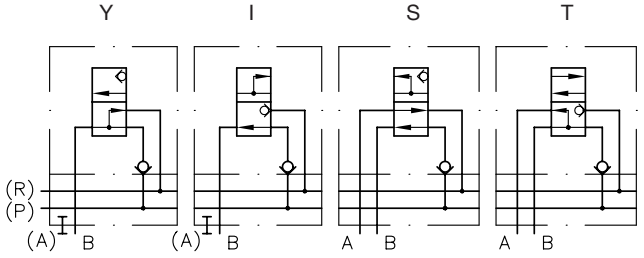
[2] not available for VB 41

Directional seated valves with return pressure stop, available for VB 01 and VB 11 (see notes in sect. 4.3)

K	M	U	V



Simplified symbols



2.4.2 Additional elements (pressure switches for VB 01 and VB 11)

For dimensions, see sect. 3.1.2

Pressure switch type DG 33, DG 34, DG 35, DG 36 or DG 365 acc. to D 5440				
Pressure switch				
Connected to	Coding	Type	Adjustment range	Note
port A or B	**2**	--	prepared for retrofitting	Can't be combined with flow pattern D, A, F, P, O, I and Y as well as valve banks with connection block C or D !
	3	DG 33	200 ... 700 bar	
	4	DG 34	100 ... 400 bar	
	5	DG 35	20 ... 250 bar	
	36	DG 36	4 ... 12 bar	
	65	DG 365	12 ... 170 bar	
port P	**62**	--	prepared for retrofitting	Can only be combined with flow pattern H, L, N and R, making an end plate with DG superfluoues. Can't be combined with valve banks utilizing connection block C or D!
	6	DG 33	200 ... 700 bar	
	7	DG 34	100 ... 400 bar	
	8	DG 35	20 ... 250 bar	
	66	DG 36	4 ... 12 bar	
	665	DG 365	12 ... 170 bar	

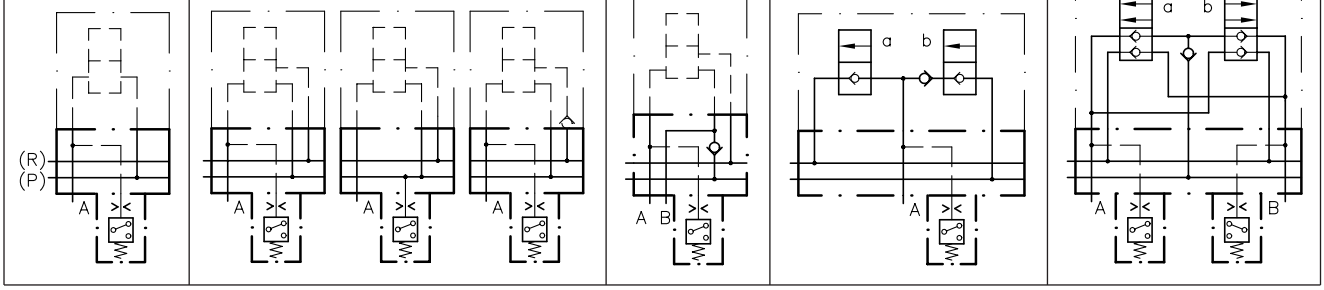
Order examples:
3/2-way directional valve coding H with one DG 33 at port A:
VB01FM - H3 - 1 - G24

4/3-way directional valve coding G with two pressure switches (DG 33 and 34) at ports A and B:
VB01FM - G34 - 1 - G24

DG33 at port A
DG34 at port B

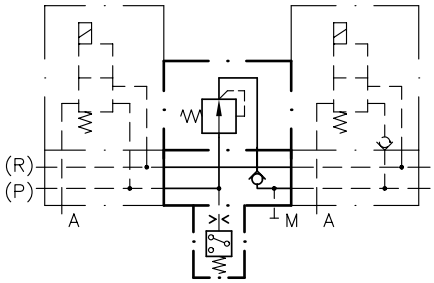
Flow pattern, available versions (codings) and symbols (examples)

2/2-way	3/2-way	4/2-way	3/3-way	4/3-way
B.. 2 C.. 3 E.. 4 Q.. 5 36 65	H.. 2 62 L.. 3 6 N.. 4 7 R.. 5 8 K.., M.. 36 66 U.., V.. 65 665	S.. 2 T.. 3 HX.. 4 LX.. 5 NX.. 36 RX.. 65	J.. 2 3 4 5 36 65	G.. 2 port A 3 port B 4 5 36 65
	DG at port A / DG at port P / with DG and return pressure stop		Example: J 36	Example: G 34



2.5 2-way pressure reducing valve for valve banks VB 01 and VB 11

Max. permissible inlet pressure 450 bar (P side).
They can be placed arbitrarily within the valve bank. The pressure reducing valve determines the pressure for all directional valves mounted downstream (secondary side) and the consumers connected to them, independent from simultaneous withdrawal of pressurized oil with a higher pressure level via directional valves located upstream (primary side).
Example: Clamping cylinders with low pressure setting or piloting valves for electro-hydraulic low-pressure remote control purposes.
The pressure reducing valves type CDK 3 (acc. to D 7745) are used here. These valves do not show any leakage in blocked state (pressure upstream is higher than the set secondary pressure) as they are designed as 2/2-way valves, acting like a seated valve in idle position. This prevents any return flow from the secondary side to the primary side (pump side) or any pressure drop.
It is necessary to install a pressure limiting valve in the consumer pipe if externally induced loads could cause unpermissible peak pressure.
For version with 3-way pressure reducing valve, see sect. 4.8.

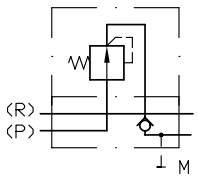


Order example: VB01 FM - HR **- CZ2/180/5R/4** - HH - 1 - G 24

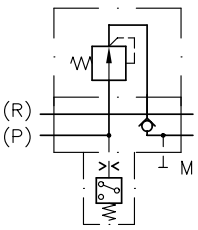
For individual order (example) e.g. as spare part, extension, own storage etc.

VB 11 - CZ5/130 /5R /7

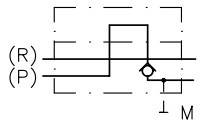
Example1: - CZ1/280/5R-...



Example 2: - CZ5/130/5R/7-...



Example 3: - CZX 5R-...



Pressure switch type DG 3.. acc. to D 5440	
(no coding)	without pressure switch
/2	DG may be retrofitted
/3	DG 33 200 ... 500 bar
/4	DG 34 100 ... 400 bar
/5	DG 35 20 ... 250 bar
/6	DG 36 4 ... 12 bar
/7	DG 365 12 ... 170 bar

Check valve in P gallery	
5R	with check valve

2-way pressure reducing valve [1]			
Coding		Utilized pressure reducing valve	Pressure range (bar) [2]
- CZ	**X**	without [3]	---
	081/...	CDK 3-081	50 ... 500
	08/...	CDK 3-08	50 ... 450
	1/...	CDK 3-1	30 ... 300
	2/...	CDK 3-2	20 ... 200
	5/...	CDK 3-5	15 ... 130
	25/...	CDK 32-5 [4]	8 ... 130
	55/...	CDK 35-5 [5]	15 ... 130

[1] There is only a tool adjustable version available. The adjustment can be altered after slackening the lock nut with an a/f 17 spanner (monitored by a pressure gauge).

[2] The secondary pressure setting is valid for flow Q = 0 lpm if the consumer is in its end position. It will drop slightly if there is a flow to the consumer.

[3] With tapped plug, prepared for retrofitting of a CDK 3-..

[4] Version with low pressure dependence at variable pump (inlet) pressure as well as use at low pressure settings (**Attention:** Max. flow 6 lpm).

[5] Version with low back pressure, however with a higher pressure dependence at variable pump (inlet) pressure.

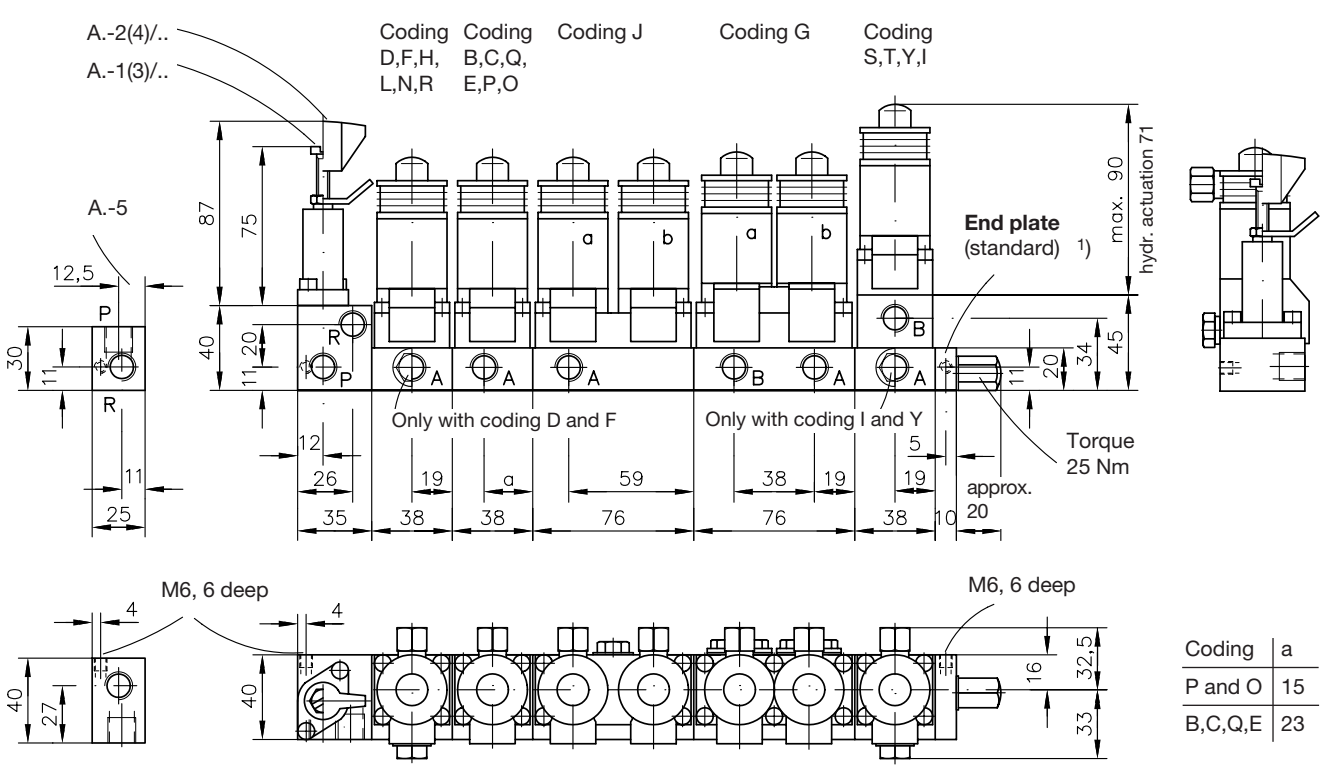
3. Unit dimensions

All dimensions are in mm, subject to change without notice!

3.1 Directional valve bank for installation in a pipe system

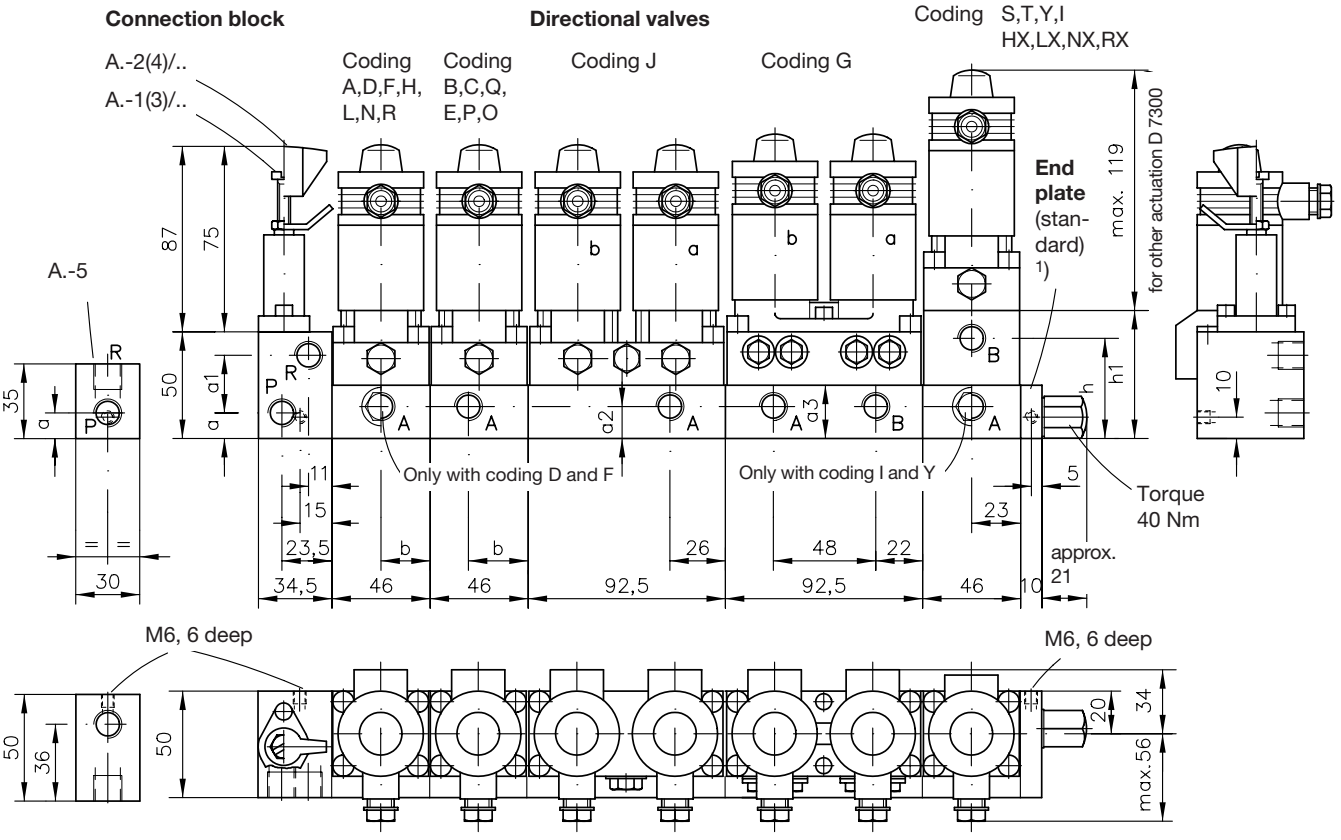
3.1.1 Valves without pressure switch

Type VB 01



Coding	a
P and O	15
B,C,Q,E	23

Type VB 11



Type	Ports A, B, P and R (BSPP)	a	a1	Coding A a2	Coding A a3	Other valves a2	Other valves a3
VB 11	G 1/4	12	27	20	30	15	25
	G 3/8	14	25	--	--	14	25

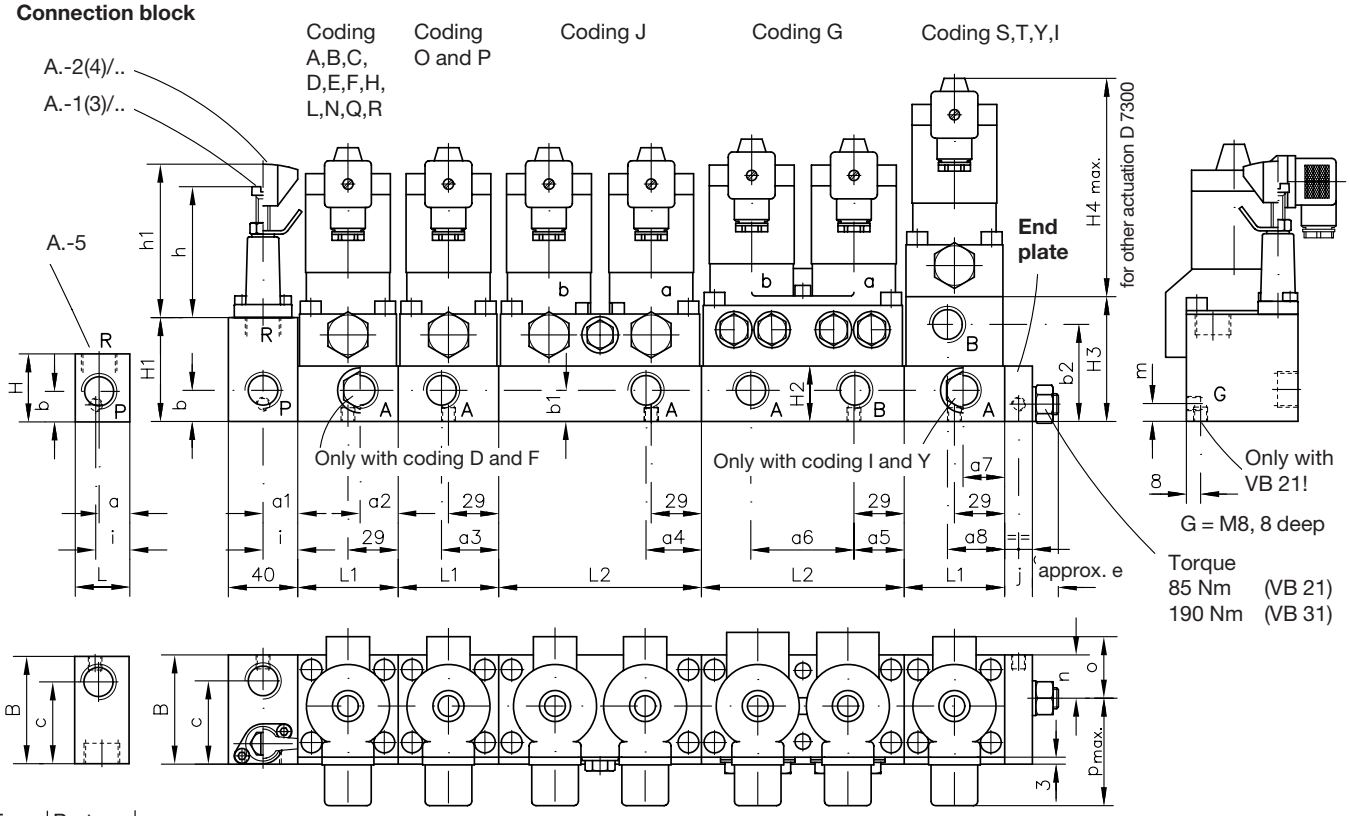
Valve coding	A	D,F,H, L,N,R	B,C, Q,E	P a. O	HX,LX, NX,RX
b	20	23	18	28	--
h	42				50.5
h1	55				60

1) For other end plates, see sect. 3.2

Type VB 21 and VB 31

Directional valves

Connection block



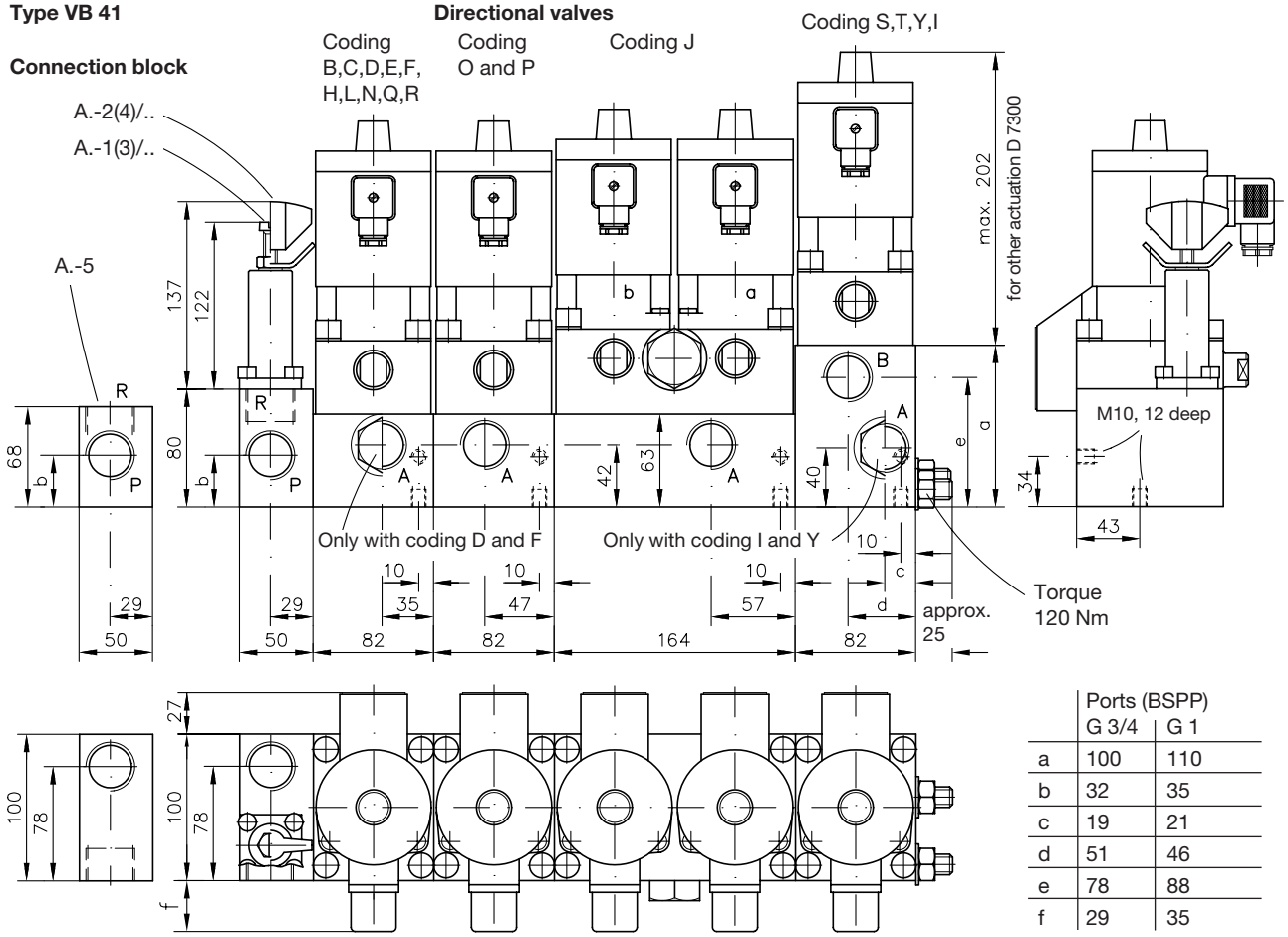
Type	Ports A, B, P and R [1]	B	H	H1	H2	H3	H4	L	L1	L2	a	a1	a2	a3	a4	a5	a6	a7	a8	b	b1	b2	c	e	h	h1	i	j	m	n	o	p
VB 21	G 3/8	63	42	60	32	72	148	32	58	117	18	20	22	33	32	28.5	60	22	33	18	20	56	48	15	80	91	20	16	10	25	43	65
	G 1/2																	24		20	18	58										
VB 31	G 1/2	80	50	55	40	90	162	40	72	145	23	23	28	44	52.5	34.5	76	28	46	22	25	66	63	32	90	104	23	20	15	32.5	56.5	81
	G 3/4																				22	68										

[1]) (BSPP)

Type VB 41

Directional valves

Connection block

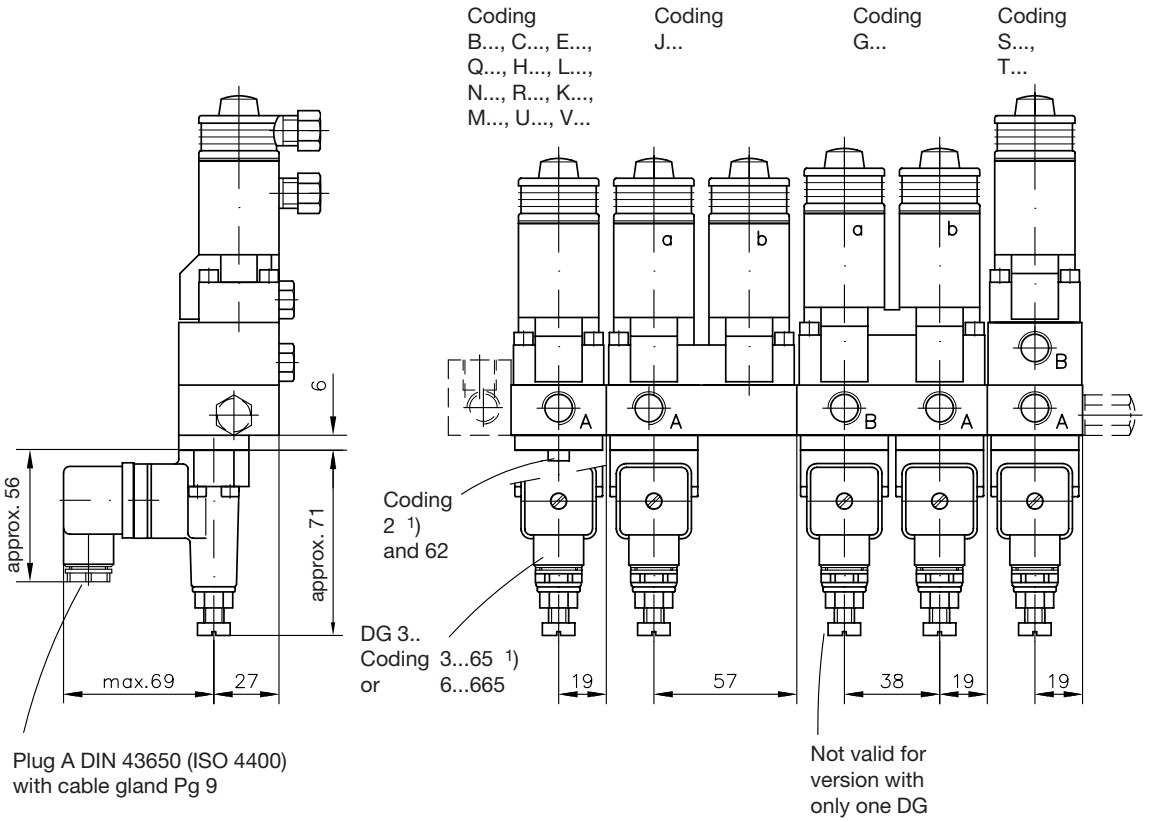


	Ports (BSPP) G 3/4	G 1
a	100	110
b	32	35
c	19	21
d	51	46
e	78	88
f	29	35

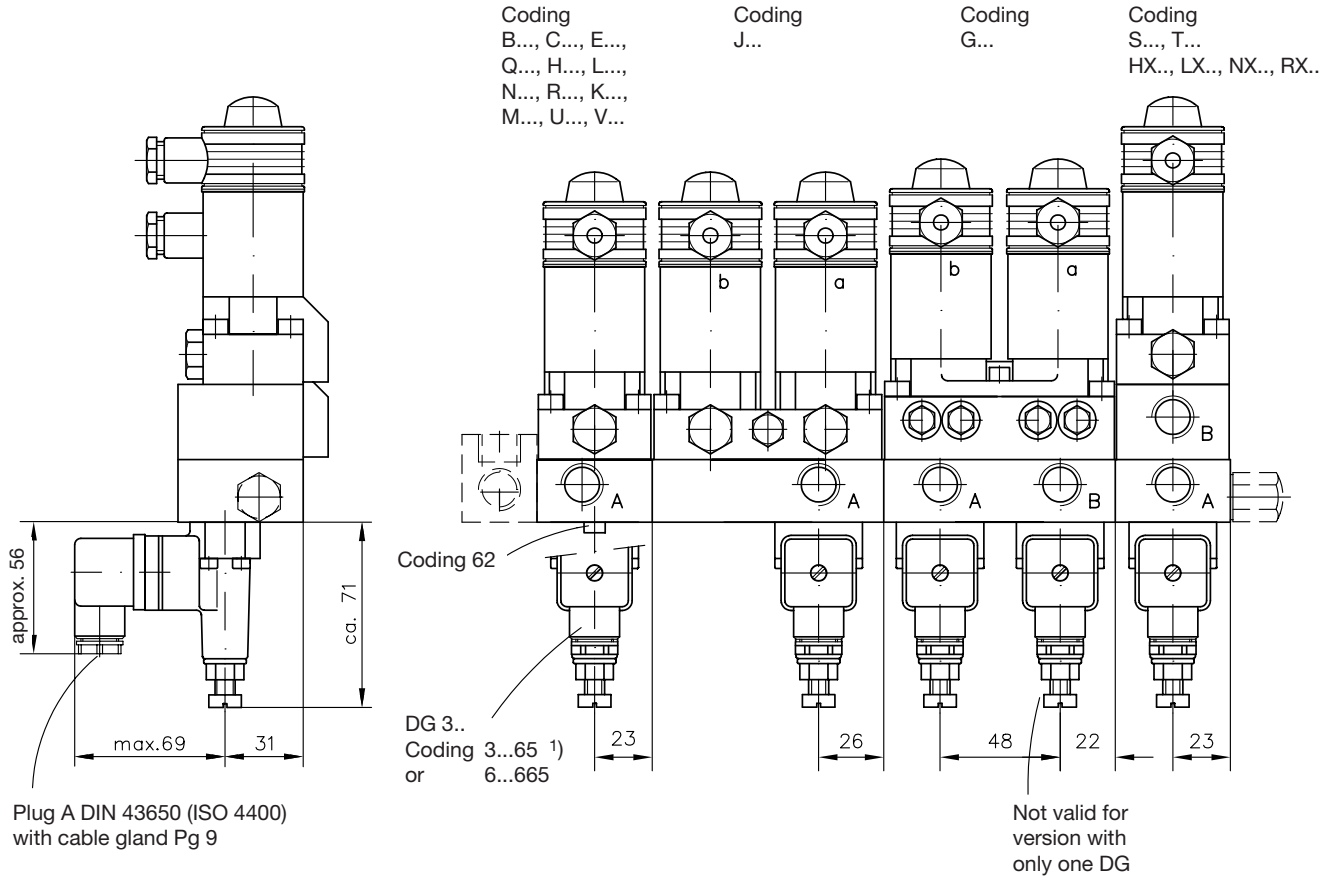
3.1.2 Version with pressure switch

For valve dimensions not illustrated, see sect. 3.1.1

Type VB 01...



Type VB 11...



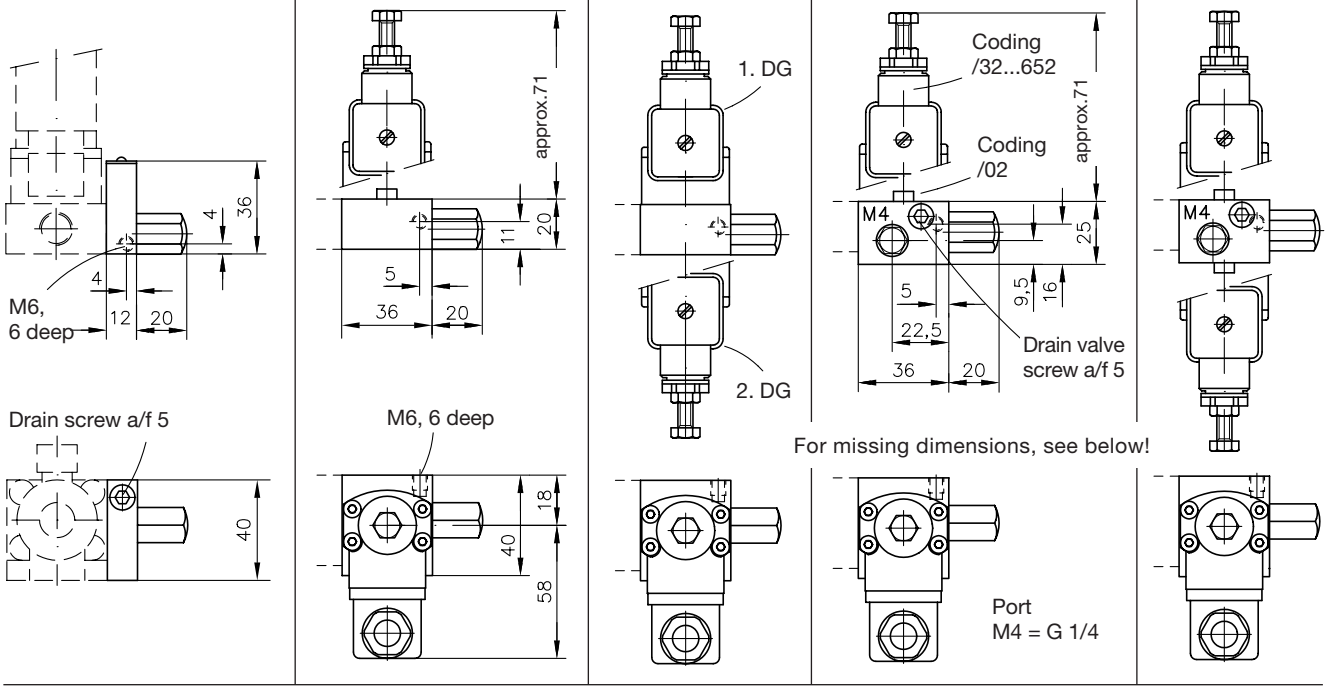
1) Illustration also valid for codings J, G, S and T

3.2 End plate

The standard version of the end plate (no coding) is illustrated at the corresponding valve bank drawings, see sect. 3.1 !

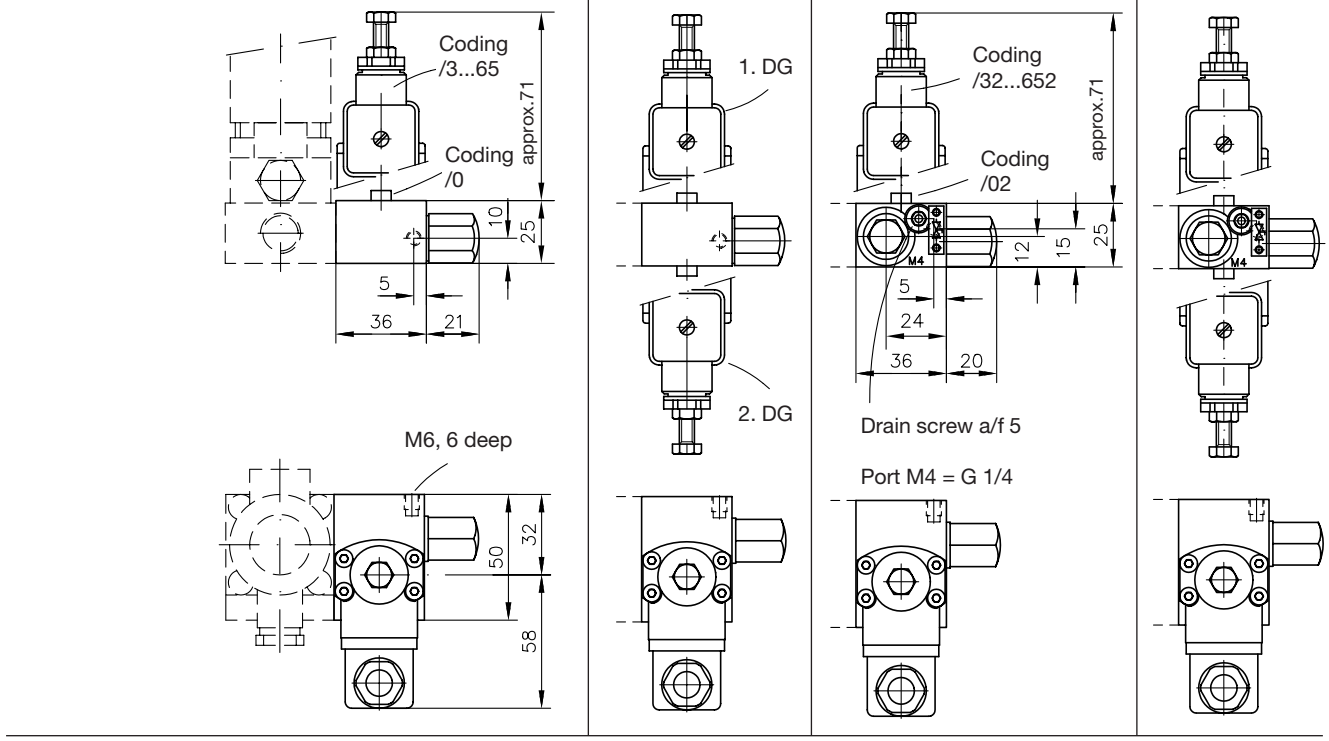
3.2.1 Additional versions for VB 01

Version without DG.., but with drain valve, coding /2	Version with one DG.., coding /3...65	Version with two DG.., coding /33...6565	Version with one (two) DG..and drain valve, coding /02 /32...652	/002 /332...65652

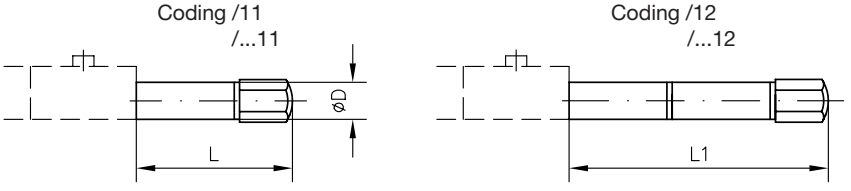


3.2.2 Additional versions for VB 11

Version with one DG.., coding /0 /3...65	Version with one DG.., coding /00 /.0, /0. /33...6565	Version with one (two) DG.. and drain valve, coding /02 /32...652	/002 /332...65652



3.2.3 Spacers for retrofitting of one or two valves (see also note in sect. 3.5)

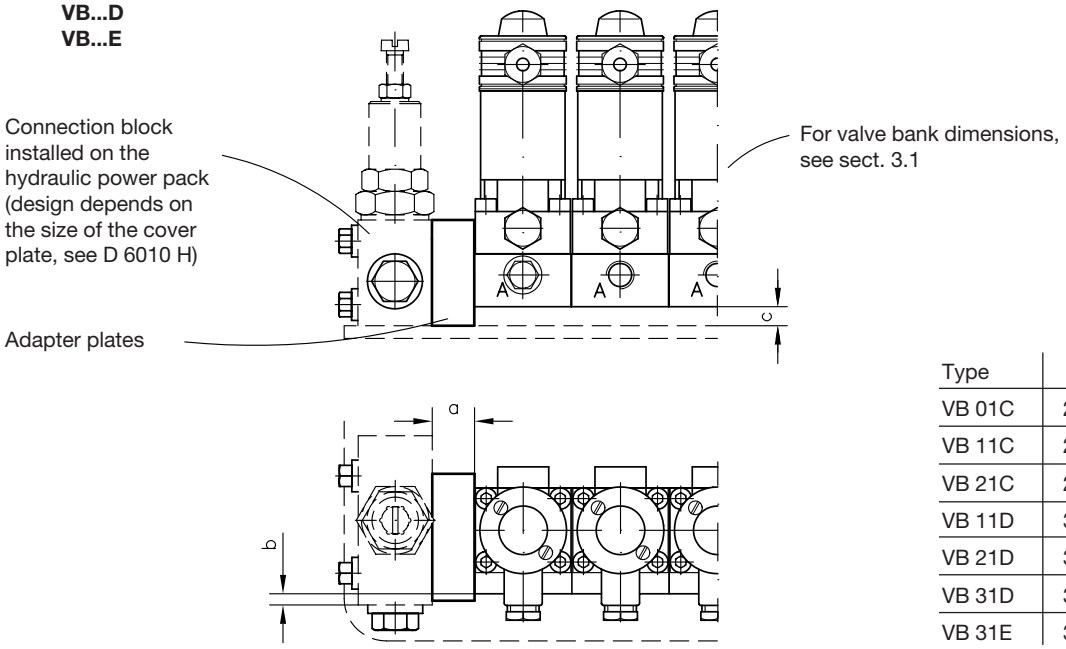


Type	L	L1	ØD
VB 01	59	97	14
VB 11	66	110.5	18

Dimensions valid for all end plates!

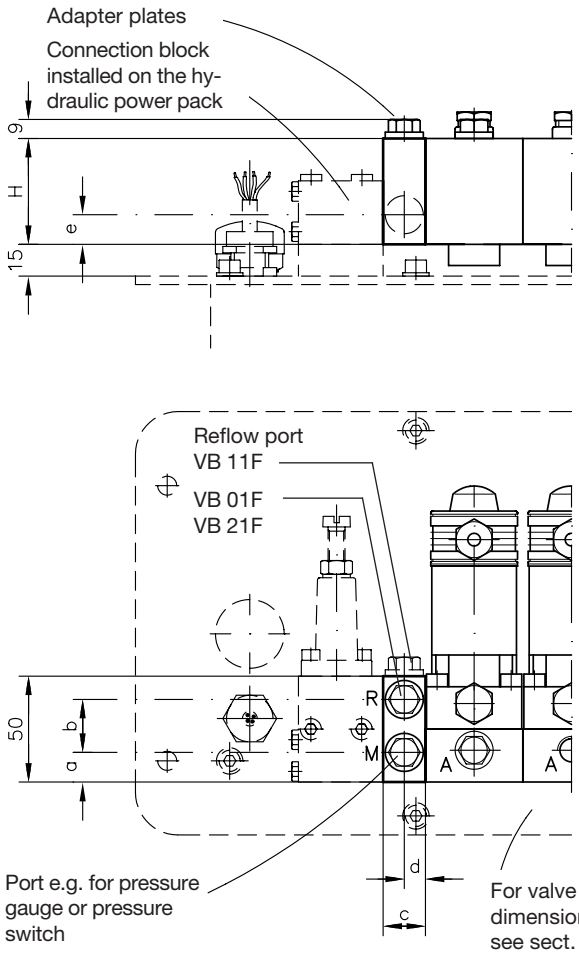
3.3 Direct mounting onto hydraulic power packs

Type VB...C
VB...D
VB...E

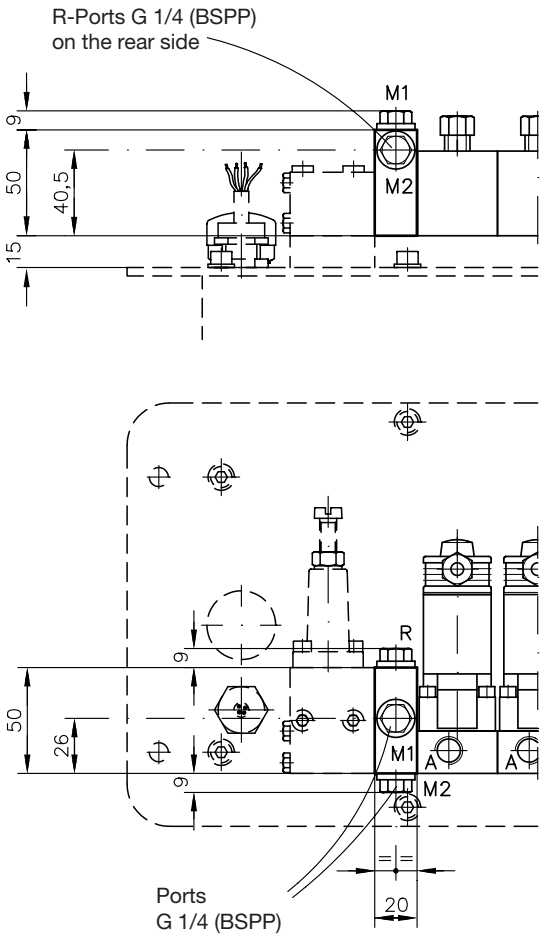


Type	a	b	c
VB 01C	20	5	9
VB 11C	20	2	9
VB 21C	20	2	9
VB 11D	30	12	5
VB 21D	30	14	5
VB 31D	35	14	5
VB 31E	30	19	5

Type VB 01F and VB 11F
VB 21F



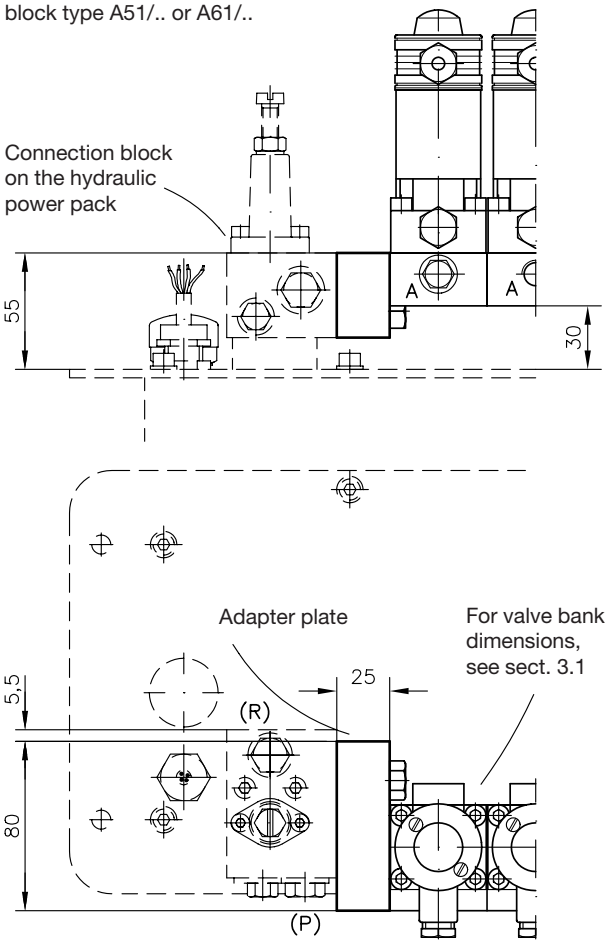
Type VB 01F1



Type	H	a	b	c	d	e	Ports M and R (BSPP)
VB 01F	50	14	25	20	10	--	G 1/4
VB 11F	60	30	--	25	15	20	G 1/4
VB 21F	75	11	26.5	25	12.5	--	G 1/4

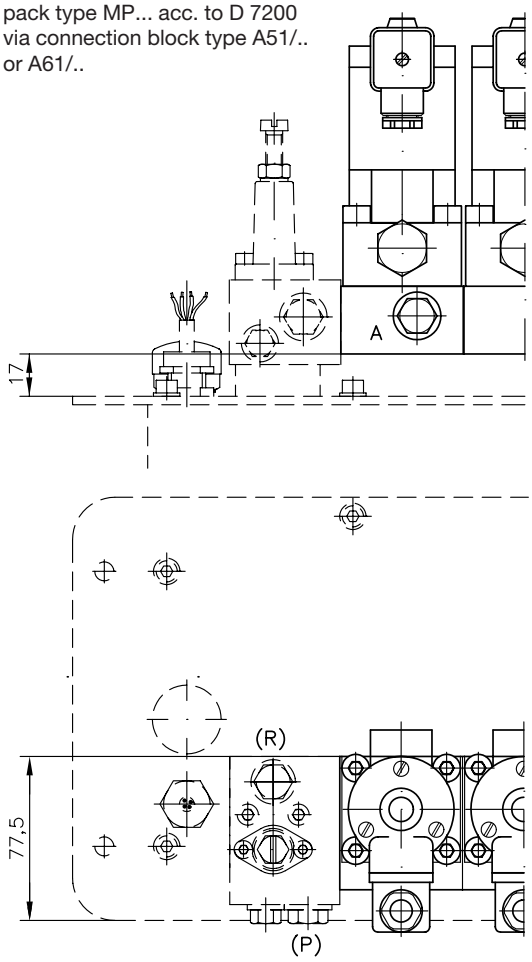
Type VB 11 G

Mounting onto hydraulic power pack type MP... acc. to D 7200 via connection block type A51/.. or A61/..



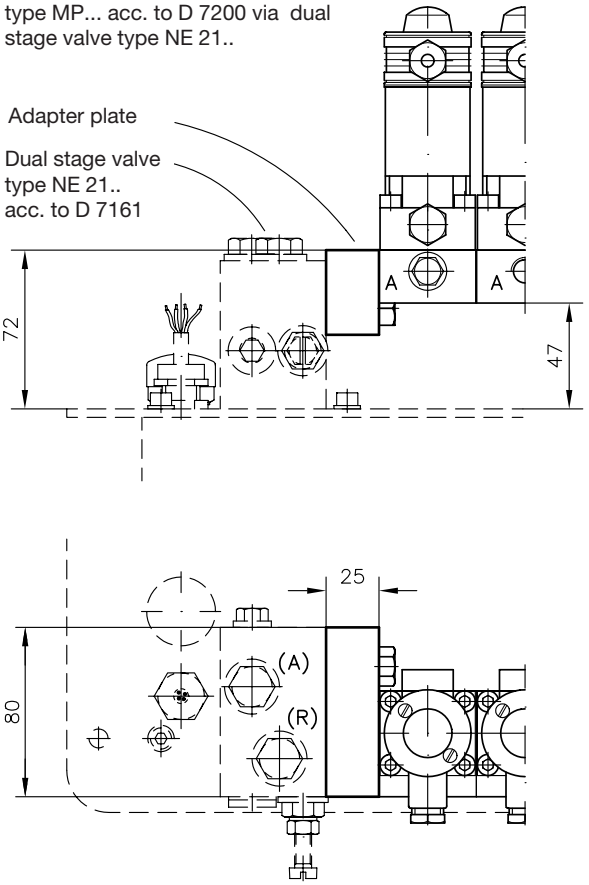
Type VB 21 G

Mounting onto hydraulic power pack type MP... acc. to D 7200 via connection block type A51/.. or A61/..



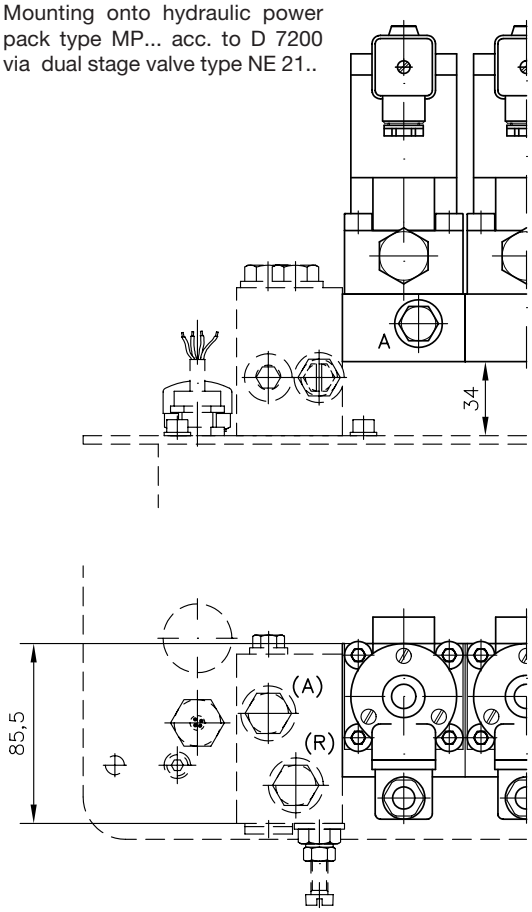
Type VB 11 G

Mounting onto hydraulic power pack type MP... acc. to D 7200 via dual stage valve type NE 21..



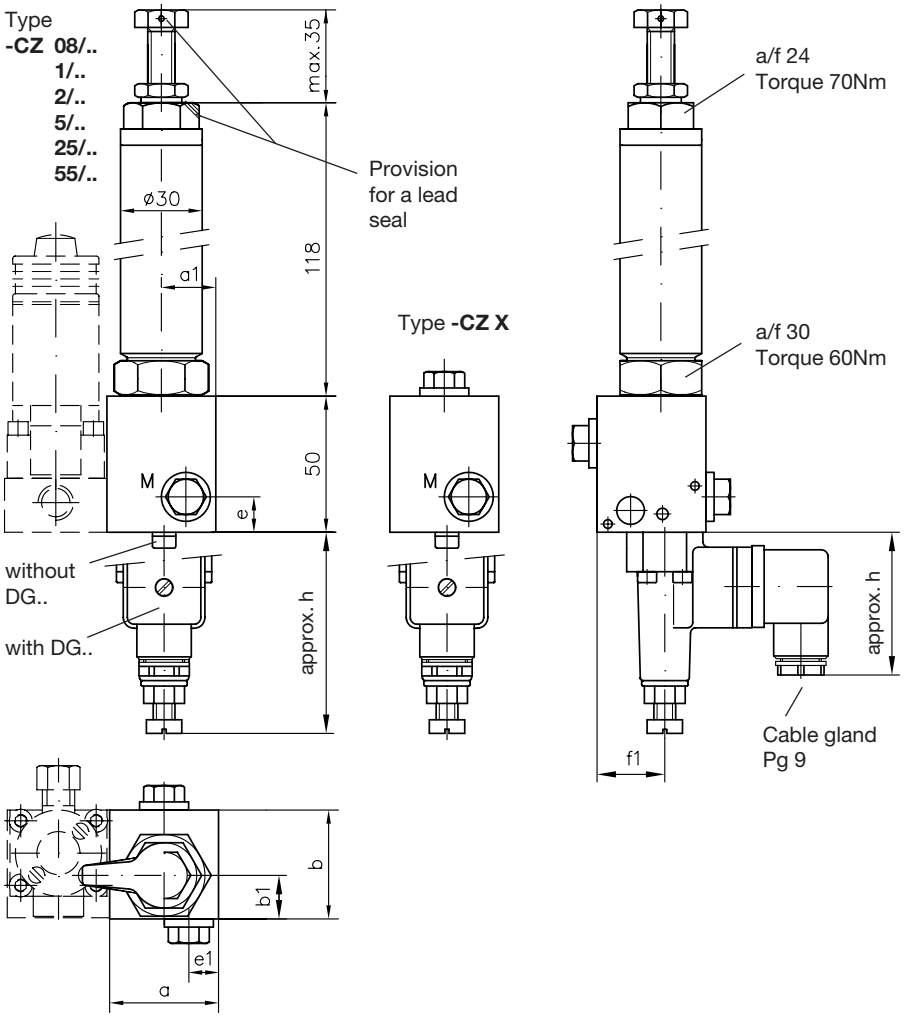
Type VB 21 G

Mounting onto hydraulic power pack type MP... acc. to D 7200 via dual stage valve type NE 21..



3.4 Directional valve bank with pressure reducing valve

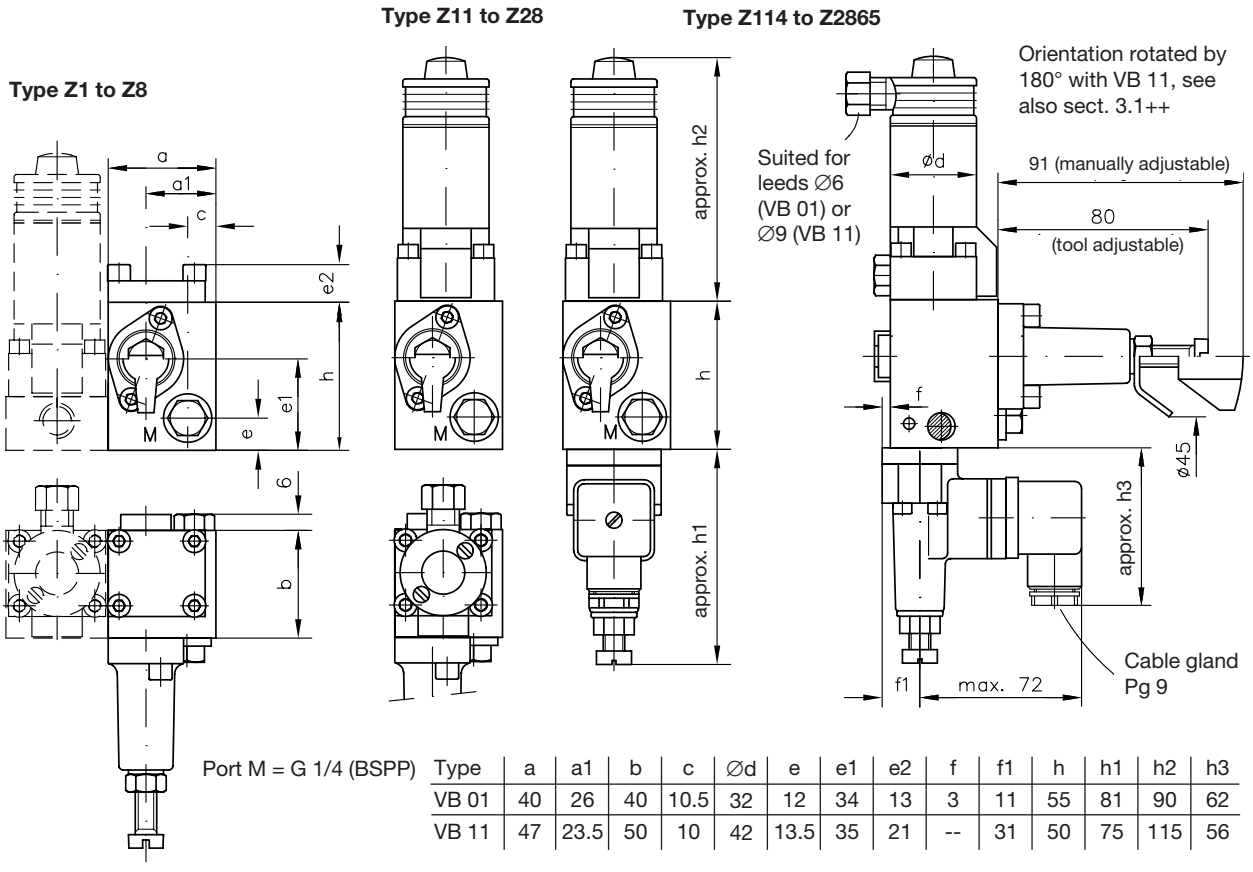
3.4.1 Type -CZ .., to be installed within valve banks type VB 01 and 11 (acc. to sect. 2.5)



	VB 01	VB 11
a	40	47
a1	20	23.5
b	40	50
b1	24	19
e	13	13.5
e1	11	9.5
f	3	--
f1	11	30
h	81	75
h1	62	53

Port M = G 1/4 (BSPP)

3.4.2 Type Z1 to Z2865, to be installation within valve banks type VB 01 and VB 11 (old version acc. to sect. 4.8)



Port M = G 1/4 (BSPP)

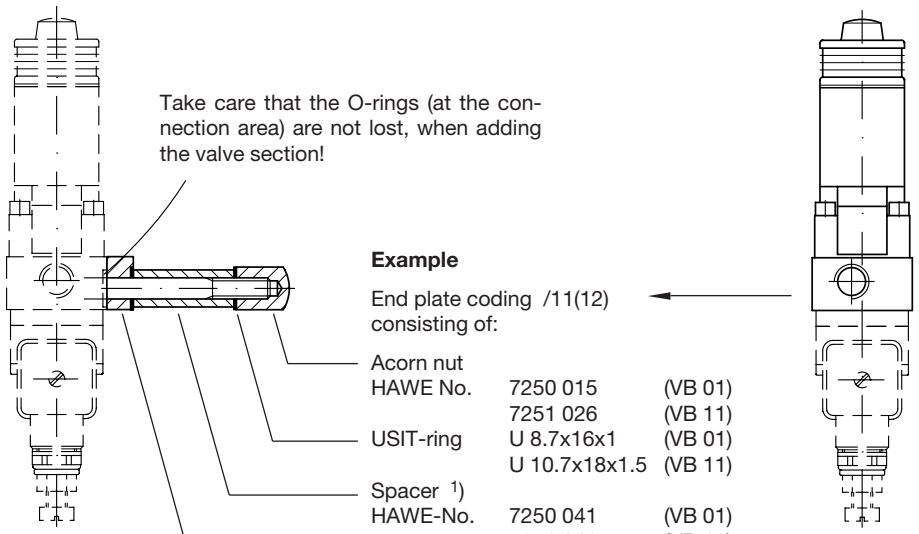
Type	a	a1	b	c	∅d	e	e1	e2	f	f1	h	h1	h2	h3
VB 01	40	26	40	10.5	32	12	34	13	3	11	55	81	90	62
VB 11	47	23.5	50	10	42	13.5	35	21	--	31	50	75	115	56

3.5 Individual valve sections

They are intended for retrofitting in valve banks, replacing the spacers after the end plate (/.1**1**; /.1**2** with VB 01 a. 11, see sect. 2.3 and 3.2 ++. Tension rods, corresponding to the total number of valve sections, have to be ordered additionally, if no spacers were installed or more sections should be added than spacers were installed. The order coding must contain the terms “valve section ...“ and ”for valve bank VB..“ in uncoded text.

Order example: Valve section **H - 1 - G24** For valve bank VB 01

- Flow pattern coding, acc. to sect. 2.4
- Port size, acc. to sect. 2.2
- Nom. voltage, acc. to sect. 2.2



Example

End plate coding /11(12) consisting of:

Acorn nut		
HAWE No.	7250 015	(VB 01)
	7251 026	(VB 11)
USIT-ring	U 8.7x16x1	(VB 01)
	U 10.7x18x1.5	(VB 11)
Spacer [1]		
HAWE-No.	7250 041	(VB 01)
	7251 041	(VB 11)
End plate with		
USIT-ring	U 8.7x16x1	(VB 01)
	U 10.7x18x1.5	(VB 11)

Retrofitting of a valve section

Assembly procedure:

1. Remove nut(s) and all parts after the last valve section from the tension rod(s)
2. Install the additional valve section
3. Reinstall seals, end plate and nut(s). For the correct torque, see table below. The USIT seal ring as well as the spacer are not required with coding /.11 or /.12 (only VB 01 or VB 11)

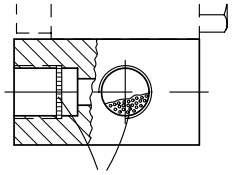
Size	Torque for the acron nut
VB 01	25 Nm
VB 11	40 Nm
VB 21	85 Nm
VB 31	190 Nm
VB 41	120 Nm

[1]) Two spacers with USIT-rings for end plate coding /.12 (version with spacers are only available with type VB 01 and 11).

4. Additional elements

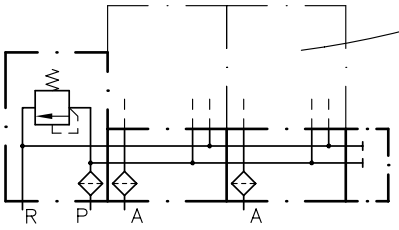
4.1 Fitted screen filters as standard

Directional seated valves are rather insensitive to very fine contamination. But coarse contamination that may occasionally be carried along with the fluid i.e. torn off particles of tubing, packing, scale, swarf can cause sudden operation disturbances, if they get stuck within the valve seat area, preventing the blocking of the passage. Therefore these valves are fitted with screen filter ex-works (see D 7300, sect. 4.2).
For further protection, the ports A, B, and P are fitted with fine screen filter discs as standard (only type VB 01 and 11). These screen filter elements should not be regarded as a replacement for the usual fluid filters. In practice, however, they provide sufficient protection against malfunctions in small hydraulic systems.
These screen filter elements should be checked first, if such malfunctions should occur. For the sake of simplicity, the filter elements are not explicitly shown in the symbols.



Filter elements

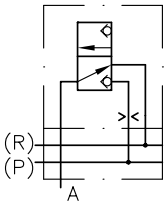
Directional valve bank	Screen filter D 7235 in ports A and B	P
VB 01 A a. ...F	HFC 1/4 F [1])	HFC 1/4 F
VB 11 A...	HFC 1/4 or HFC 3/8	
VB 11 F...	HFC 1/4 or HFC 3/8	HFC 1/4 F to 2.1 lpm, above none
VB 01 C	HFC 1/4 F [1])	Screen 5017 010 in the adapter plate
VB 11 C	HFC 3/8	



For detailed flow pattern symbols, see sect. 2.4.1

[1]) The depth of ports A(B) is reduced, therefore filter 6406 017 with reduced depth, see also D 7235. This should be also kept in mind, when ordering spare parts.

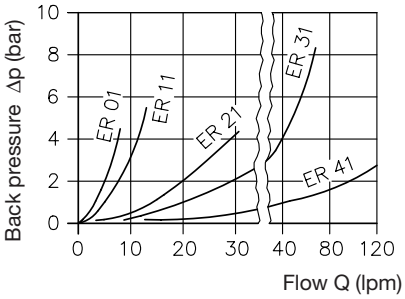
4.2 Orifice inserts



It must be stated in uncoded text, which valve (coding and position number starting from the connection block) should be fitted with which orifice, if one is required for functional reasons at the entries of valves B, C, O, P, H, L, Y, I, S, T and J. The orifices utilized are type EB.. acc. to D 6465.

Order example:
VB 11AM - 5 - FHHN - 2 - G 24
Valves H at pos. 2 and 3 with orifice insert type EB 1-0.8

Size	Orifice acc. to D 6465
VB 01	EB0 - 0.6
VB 11	EB1 - 0.8
VB 21	EB2 - 1.2
VB 31	EB3 - 2.5

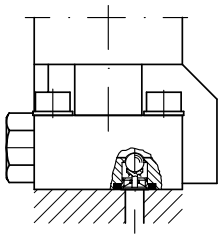


Viscosity 60 mm²/s during tests

4.3 Return pressure stop for 3/2-way directional valves (valve banks VB 01 and 11)

When several valves are operated in parallel, return pressure stops may be occasionally required. The return ports R of the 3/2-way directional valves, size 0 and 1 may be equipped with return pressure stops (coding K, M, U, V). They prevent pressure surges out of the common return pipe from entering unoperated, unloaded or easily moving consumers, where there is a connection A→R. Thus preventing uncontrolled movements. Such pressure surges can arise as a result of switching operations.
These check valves are unsuitable to block pressurized fluid, which might be apparent at R, depending on the operation sequence with other valves. A circuit with an external check valve would have to be created in this case.

This return pressure stop can be retrofitted, order as follows:
For valve banks VB 01: Return pressure stop 7332 000 a
VB 11: Return pressure stop 7332 000 b



(additional element S, acc. to D 7300, sect. 3.1, table 3)

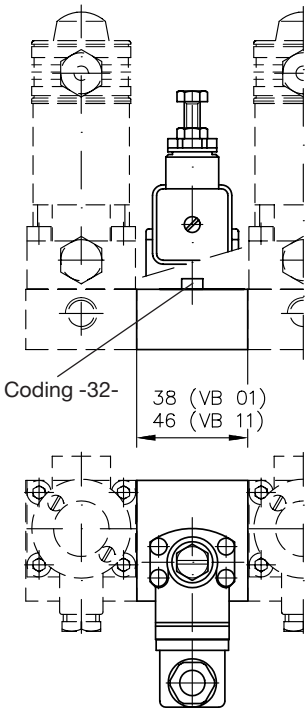
4.4 Sub-plate only featuring a pressure switch (valve banks VB 01 and 11)

They should be used if it is not possible to install a pressure switch at the end plate, due to spatial requirements. This sub-plate with pressure switch may be installed at any location within the valve bank.

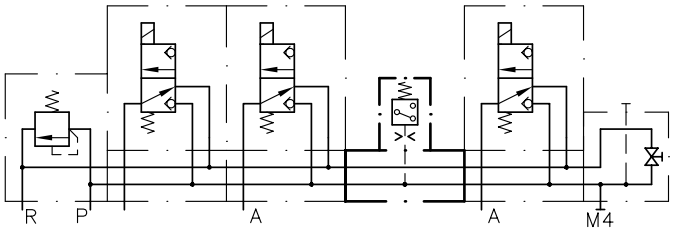
Order example: VB 11AM - 1/200 - HM **- 33** - H/02 - 1 - G 24

Basic type coding acc. to sect. 2.1++

Pressure switch acc. to D 5440	Coding of the sub-plate with DG..	Adjustment range (bar)
prep. for retrofitting	**- 32**	-
DG 33	**- 33**	200 ... 700
DG 34	**- 34**	100 ... 400
DG 35	**- 35**	20 ... 250
DG 36	**- 36**	4 ... 12
DG 365	**- 365**	12 ... 170



Symbol acc. to the order example



4.5 Versions with pressure limiting valve and throttle (valve banks VB 21 and 31)

This special 3/2-way directional valve features a pressure limiting valve and a throttle in its sub-plate. It is intended for press controls and may be located at any position within valve banks type VB 21.. or VB 31...

Order example: VB 21AM - 5 - F **R91/250** HQ - 3 - G 24

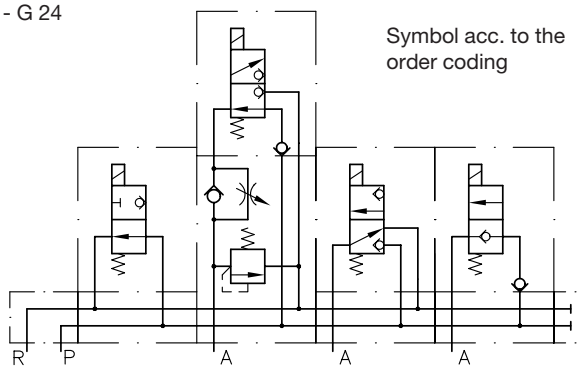
Flow pattern coding
H, L, N, R

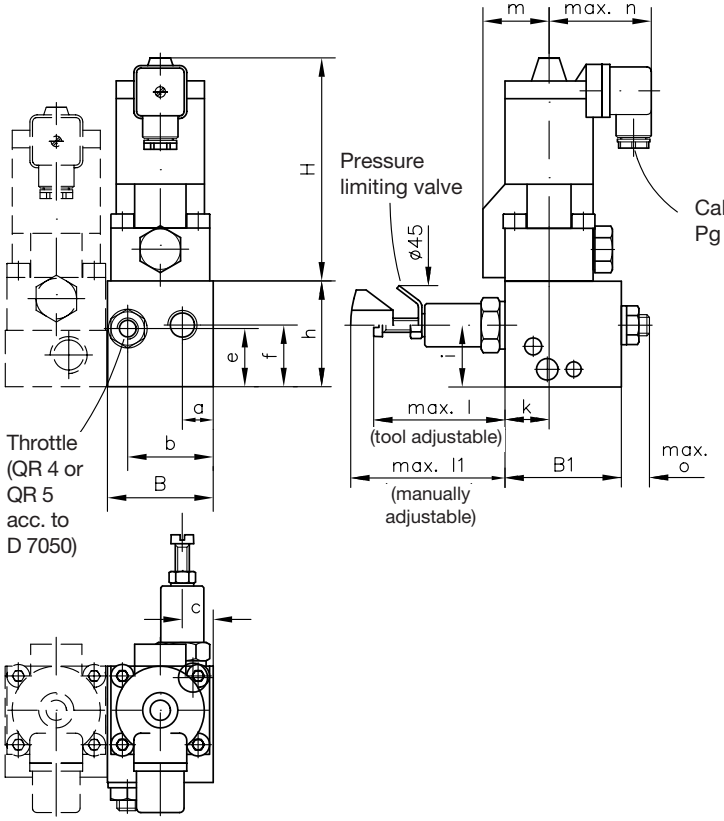
Throttle coding

Pressure limiting valve coding
tool adjustable **1/..**
manually adjustable **2/..**

Pressure setting of the pressure limiting valve

Symbol acc. to the order coding





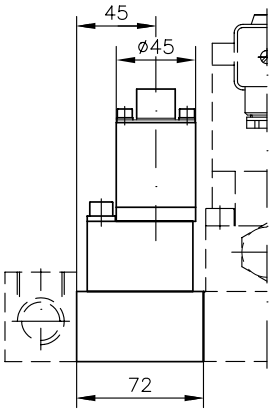
Port A, conforming ISO 228/1 (BSPP):
VB 21..-..91(2) /... -2 = G 3/8
-3 = G 1/2
VB 31..-..91(2) /... -3 = G 1/2

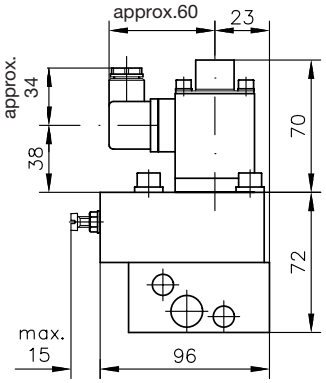
Type	B	B1	H	a	b	c	e	f
VB 21..	60	66	148	17.5	31	17.5	35	35
VB 31..	72	100	162	22	36	28	26	30

Type	h	i	k	l	l1	m	n	o
VB 21..	60	35	25	72	82	37.5	69	16
VB 31..	63	42	35	85	97	56.5	85	18

4.6 2-way flow control valves VB 31

The proportional 2-way flow control valves enable arbitrary velocity control for the connected consumers by opening a by-pass to the tank for the excess delivery.
This valve section should be located first within the valve bank (after the connection block).





Order example:

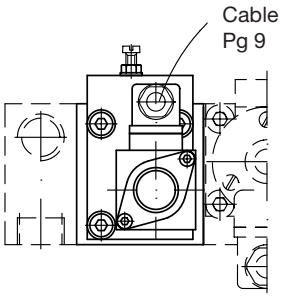
VB 31AM - 5 **- SE2 15/1** - HQ - 3 - G 24

Flow control valve

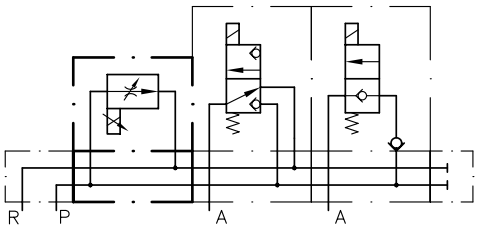
Flow

Coding	Metering orifice max. lpm
6	6
15	15
30	30
36	36
50	50

For more detailed data concerning the proportional flow control valve (type SE 2-2..), see D 7557/1!



Symbol acc. to the order coding



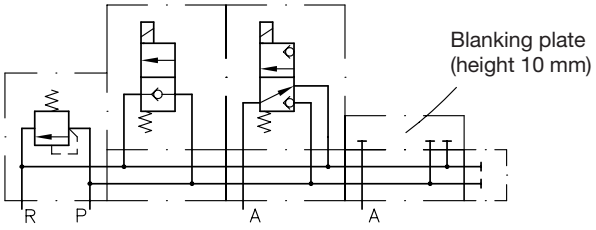
4.7 Blanking plate

An already assembled sub-plate with blanking plate can be used instead of a spacer (see sect. 2.3 end plates) enabling valves to be retrofitted. They can be fitted anywhere within the valve bank.
It has to be specified in uncoded text, which flow pattern coding should be retrofittable (determining the sub-plate type) and on which location (start numberizing after the connection block) within the valve bank.

Order example: VB 11 AM - 1/380 - FHH - 1 - G 12
Valve H with blanking plate at position 3
5000 099 (or 6540 039 (see below))

Individual parts (e.g. as spare parts):

Size	VB 01	VB 11	VB 21	VB 31	VB 41
Blanking plate	6540 039	5000 099	4900 099	5005 099	7070 099
3 O-rings NBR 90 Sh	3.7x1.78	5x1.5	10x2.2	13.95x2.62	DKAR 00119N9006
4 screws ISO 4762-	M5x12-	M6x20-	M8x20	M10x40	M12x50
	-12.9-galvanized				

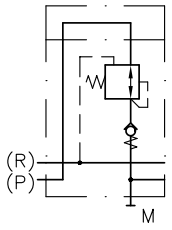
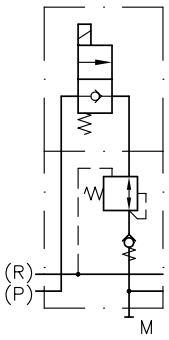
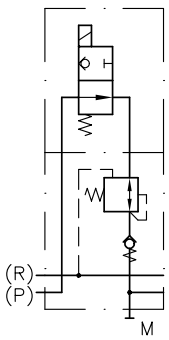
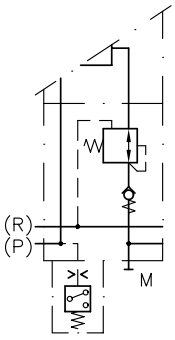


4.8 Pressure reducing valve as option for size VB 01 and VB 11

Pressure reducing valve, max. permissible inlet pressure 300 bar. For version up to 400 bar and functional description, see sect. 2.5.

The primary side can only be kept leakage-free (if necessary) with versions Z11 ... Z28 (Z114 ... Z2865) which features a prelocated 2/2-way seated valve. This is due to the functionally determined, permanent internal leakage even if there is no flow of pressurized oil to the secondary side. The 2/2-way seated valve must be actuated whenever pressurized oil is withdrawn. The secondary side is protected against leakage by a check valve downstream of the pressure reducing valve, so there is no loss of pressure if the secondary consumer is free of leaks and the pump is switched off.

However, this means that the pressure reducing valve cannot be used for secondary pressure limitation here, if the secondary pressure is exceeded due to external, rising forces acting on the consumer. The check valve prevents any return flow via the pressure reducing valve and therefore stops the consumer giving way i.e. the pressure in the consumer would rise. If necessary the consumer line would have to be safeguarded by its own pressure limiting valve and made flexible. For dimensional drawings, see sect. 3.4.2.

Pressure range (bar) adjustable from ... to [2]	Coding within the directional valve bank [1]						
	Standard version		with upstream located 2/2-way directional seated valve GR 2-0(1), WGR 2-0(1)		GS 2-0(1), WGS 2-0(1)		Vers. Z11 to Z28 with add. pressure switch acc. to D 5440 [3]
	tool adjustable	manually adjustable	tool adjustable	manually adjustable	tool adjustable	manually adjustable	
160 .. 250	**Z1**	**Z5**	**Z11**	**Z15**	**Z21**	**Z25**	**Z114 ... Z284** with DG34
60 ... 160	**Z2**	**Z6**	**Z12**	**Z16**	**Z22**	**Z26**	**Z115 ... Z285** with DG35
30 ... 120	**Z3**	**Z7**	**Z13**	**Z17**	**Z23**	**Z27**	**Z 116 ... Z286** with DG36
10 ... 30	**Z4**	**Z8**	**Z14**	**Z18**	**Z24**	**Z28**	**Z1165 ... Z2865** with DG365
Symbols tool adjustable manually adjustable							

[1] As single unit for own storage, replacement, etc. order coding is:
Size VB01 = ADV1 - Z13 - ...
VB11 = ADV11 - Z17 - ...
└ Nom. voltage (G 12, G 24, WG 230)

[2] Set value for secondary pressure (pressure gauge reading) at flow Q = 0 lpm (consumer in end position). The pressure drops a little if pressurized oil flows to the consumer.

[3] For adjustment ranges see section 2.5, table 4. Monitoring of the pump sided (primary) P duct.
Note: Version Z1 ... Z8 can't be used with pressure switch, as the leakage oil consumption would lead to permanent on/off switching of the pump being controlled by the DG. .

5. Mass (weight) approx. in kg, individual parts

Coding acc. to sect. 2.2		Connection block A.-1/.. A.-3/..	Connection block A.-2/.. A.-4/..	Connection block A.-5	Adapter plate (for mounting onto hydr. power packs) C	D	E	F F1	G	Complete directional seated valve [1] incl. sub-plate and its share of the tension rod A,B,C,D,E,F,H, L,N,O,P,Q,R	J	G	I, Y, S, T	HX, LX, NX, RX
suitable for	VB 01	0.5	0.4	0.2	0.5	--	--	0.4	--	0.6 [2]	1.3 [2]	1.4 [2]	1.3 [2]	--
	VB 11	0.7	0.7	0.4	0.3	0.6	--	0.5	0.6	1.1 [2]	2.3 [2]	2.5 [2]	2.3 [2]	2.4 [2]
	VB 21	1.2	1.2	0.5	0.4	0.8	--	0.5	--	2.0	4.6	4.7	4.6	--
	VB 31	1.4	1.4	1.1	--	1.0	1.0	--	--	4.5	9.1	9.2	9.1	--
	VB 41	3.0	3.0	1.9	--	--	--	--	--	8.9	18	--	18	--

suitable for	End plates acc. to sect. 2.3 Standard (no coding)	/2	/0 /00	/02 /002	/3 to /65	/33 to /6565	/32 to /652	/332 to /65652	Spacer /11	Spacer /12	Pressure reducing valve acc. to sect. 2.5 or 4.8 - CZ X	- CZ 08/.. to CZ 55/..	Z1 to Z8	Z11 to Z28	Z114 to Z2865
VB 01	0.1	0.1	--	0.3	0.5	0.8	0.6	0.9	0.1	0.1	0.5 [2]	1.2 [2]	1.1	1.3	1.6
VB 11	0.2	--	0.4	0.4	0.7	1.0	1.0	1.3	0.1	0.2	0.8 [2]	1.5 [2]	1.1	1.8	2.1
VB 21	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VB 31	0.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Additional elements

Blanking plate, see sect. 4.7	Sub-plate with DG, see sect. 4.4		Press control valve, see sect. 4.5		Flow control valve, see sect. 4.6
	VB 01	VB 11	VB 21	VB 31	VB 31
0.1	0.4	0.5	3.2	8.3	2.8

[1] Directional seated valve with solenoid actuation. For the weights with other actuation modes, see D 7300 sect. 3

[2] + 0.3 kg per pressure switch

6. Appendix

6.1 Solenoid heat built-up

Directional valve banks show slightly reduced heat dissipation to the surroundings due to the small distance between neighboring valve solenoids. It is therefore recommended to locate at least one unactuated valve between valves actuated simultaneously or for prolonged periods. Otherwise neighboring valves would hinder heat dissipation and heat each other up. This rule should be obeyed, if the duty cycle of the valves are very high.
If this is not possible it is recommended to use economy circuits acc. to D 7813, D 7832, D 7833. For size VB 01 and VB 11 an adapter ...-A.. is required, see D 7300, sect. 2.2.3.

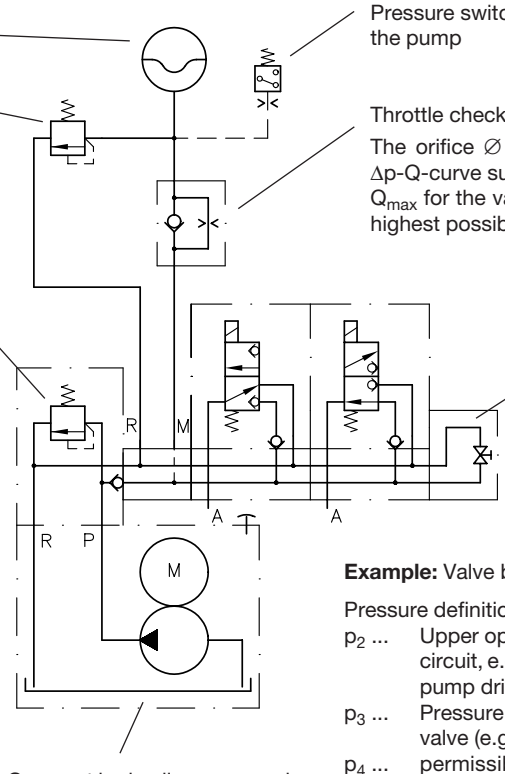
6.2 Application example for end plates with release valve acc. to section 2.3

Accumulator
permissible pressure p_4

Safety valve for accumulators
with TÜV approval [1]) D 7000 TÜV,
e.g. set to p_4 or $p_{3\ max}$

Main pressure limiting valve
[1]) set to p_3
e.g. connection block
A3/... acc. to D 6905 A

[1]) The unit approved accumulator safety valve safeguardes the hydraulic accumulator against unpermissible excess pressure. It is supplied with fixed pressure setting and lead seal e.g. at the highest permissible pressure. This may depend either on the accumulator (p_4) or on the hydraulic system ($p_{3\ max}$). Any adjustment to the max. operation pressure p_2 or $p_{2\ max}$, intended for the hydraulic system, usually takes place via the main pressure limiting valve, shut-off valve (e.g. D 7529, D 6170-ALZ) or other devices (e.g. pump cut-off or pump idle circulation activated by a pressure switch).



Compact hydraulic power pack
e.g. MP acc. to D 7200 H

Pressure switch, e.g. set on p_2, to switch-off the pump

Throttle check valve, e.g. RDF... D 7540
The orifice ∅ should be selected acc. to the Δp-Q-curve such that the permissible flow rate Q_{max} for the valve bank is not exceeded at the highest possible operating pressure p_2.

End plate
with discharge valve

Example: Valve bank VB 11FM - HM**/2** - 1 - G 24

Pressure definitions conforming CETOP RP62H

p_2 ... Upper operating pressure of the hydraulic circuit, e.g. also switch-off pressure for the pump drive

p_3 ... Pressure setting of the operating pressure valve (e.g. $p_{2\ max}$)

p_4 ... permissible operating pressure of the hydraulic accumulator

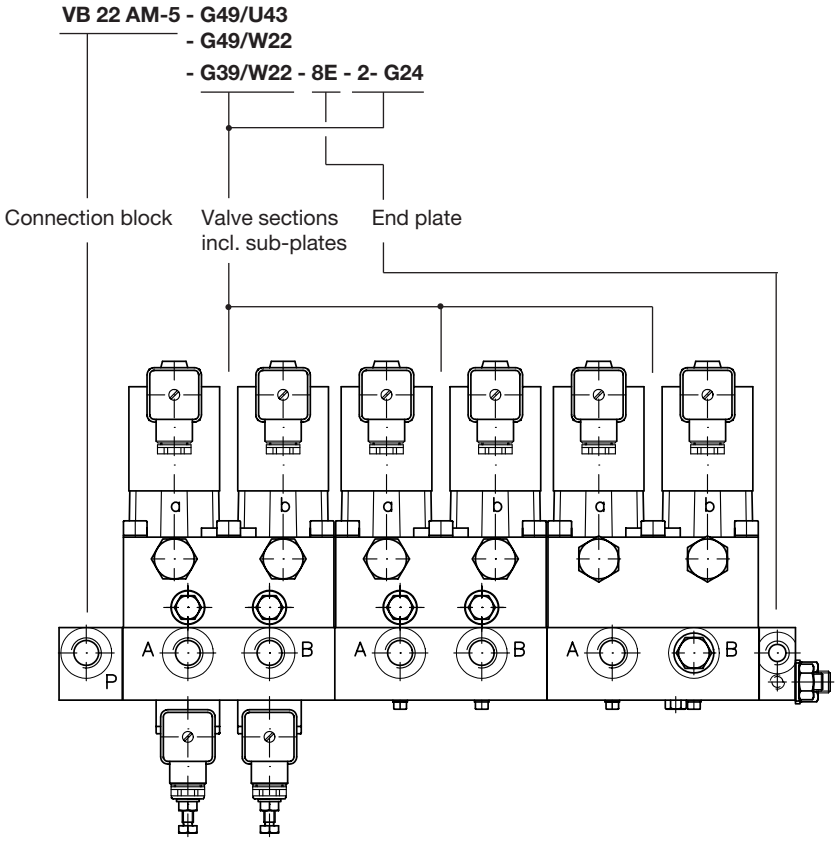
6.3 Valve bank Type VB 22 with 3/3- and 4/3-directional seated valve type G 39 resp. G 49 acc. to D 7300 (Supplement No. 76)

6.3.1 General information

This valve bank is especially designed to enable use of those directional seated valves described in supplement No. 76 (D 7300) at an raised operation pressure range between 500 and 700 bar. Main difference to type VB 21 is, that valve banks type VB 22 are held together via two instead of one tension rod. Additionally they enable utilization of sub-plates featuring idle circulation and shuttle valves. There are also pressure switches available monitoring the pressure at the consumer ports.

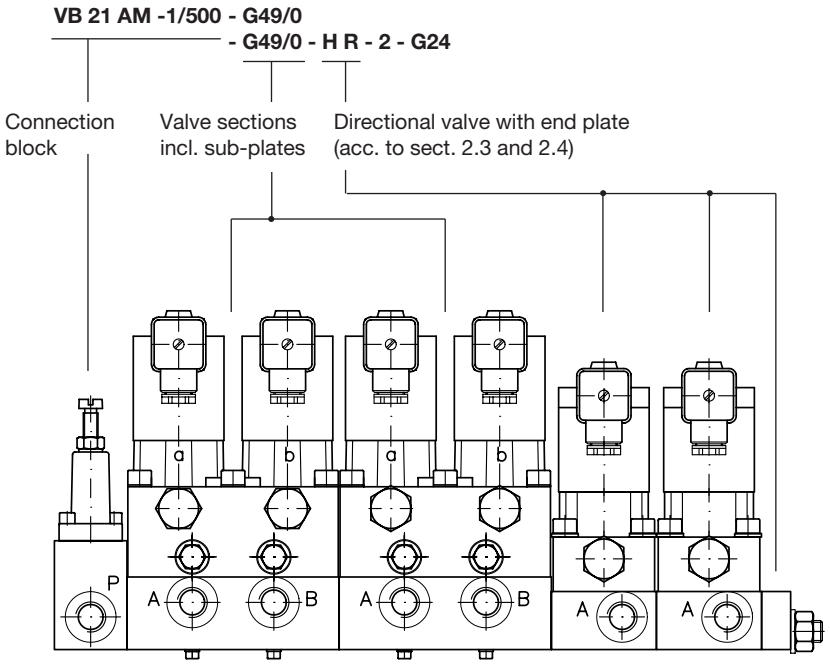
Example 1:

Valve bank with **two** tension rods and integrated idle circulation valve for operation pressure p_{max} = 700 bar.
Connection block without pressure limiting valve, valve sections with 4/3- or 3/3-way function and optional provision for pressure switches type DG 3. at port A and/or B.
Sub-plates /W, /U and end plates are prepared to operate the integrated idle circulation valve.



Example 2:

Valve bank with **one** tension rod for operation pressure p_{max} = 500 bar.
Connection block with pressure limiting valve, two valve sections with 4/3-way function and sub-plates /0 to enable combination with standard valve sections and end plates acc. to sect. 2.2 to 2.4.



6.3.2 Available versions, main data

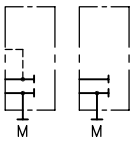
Order example: **VB 22 AM-5 - G49/U43**
- G49/W22
- G39/W22 - 8E - 2 - G24

Solenoid voltage **G12, G24**
WG110, WG230
(For data see table 3 and D 7300)

Table 9: Port thread

2	G 3/8 conf. ISO 228/1 (BSPP)
3/8-18 NPT	3/8-18 NPT conf. ANSI B1.20.1(3)

Table 8: End plates

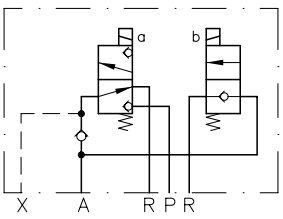
8E	Termination of a valve bank with sub-plate coding /U and /W	8E 1E 
1E	Termination of a valve bank with sub-plate coding /0	

Connection block
(Basic type and size,
for description see sect. 6.3.1)

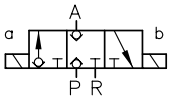
Flow and operation pressure
$Q_B \leq 25$ lpm; $p_{max} = 500$ bar
$Q_B \leq 12$ lpm; $p_{max} = 700$ bar

Table 5: Flow pattern symbols

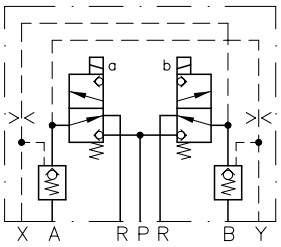
G 39



Simplified illustration



G 49



Simplified illustration

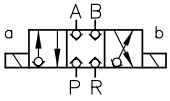


Table 7: Pressure switches type DG 3..acc. to D 5440 at consumer ports A or B

DG 3.. at
port B
port A

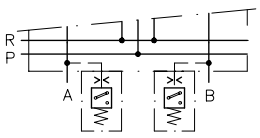
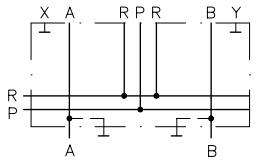
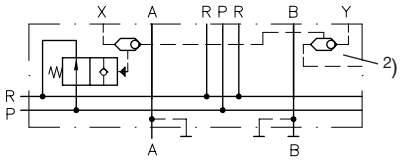
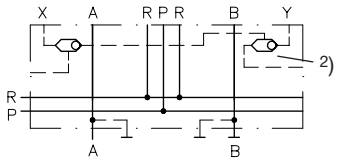
2	Prepared for retrofitting of a DG 3.. Intermediate plates (see sect. 6.3.3) are required when sub-plates type U or W are used		
3	DG 33	200 ... 700 bar	
4	DG 34	100 ... 400 bar	
5	DG 35	20 ... 250 bar	
6	DG 36	4 ... 12 bar	
7	DG 365	12 ... 170 bar	

Table 6: Sub-plate (identical for flow pattern symbols G 39 and G 49)

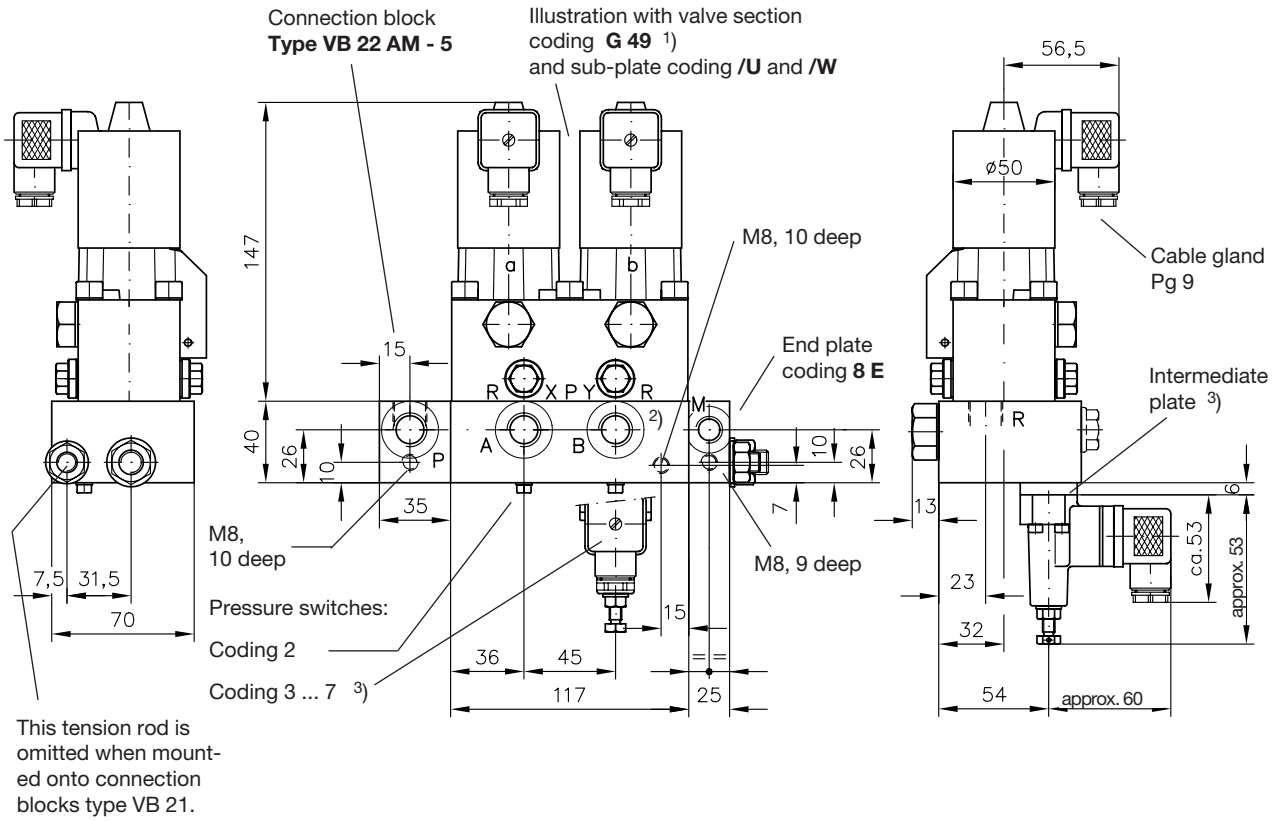
/0	Sub-plate without additional elements. Can't be combined with sub-plates coding /U and /W!	
/U [1]	Sub-plate with idle circulation valve and shuttle valves Circulation pressure $\Delta p = 7$ bar at $Q = 25$ lpm $\Delta p = 4.5$ bar at $Q = 12$ lpm (Should be always installed as first sub-plate within a valve bank!)	
/W [1]	Sub-plate with shuttle valve subsequent to a valve section with the sub-plate coding /U.	

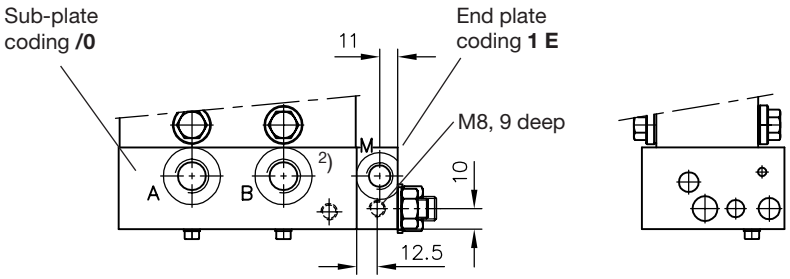
[1] The idle circulation valve is automatically activated via a sequence of shuttle valves and the control galleries X and Y.

[2] Omitted with symbol coding G 39

6.3.3 Unit dimensions

All dimensions in mm, subject to change without notice !





Ports:

	ISO 228/1 (BSPP)	ANSI B1.20.1(3)
P and R	G 3/8	G 3/8-18 NPT
A and B	G 3/8	G 3/8-18 NPT
M	G 1/4	G 1/4-18 NPT

Mass (weight):

Connection block	VB 22 M	= approx. 0.7 kg
Valve sections	G 39, G 49	= approx. 3.7 kg
Sub-plates	/0, /U, /W	= approx. 2.3 kg + 0.3 kg per pressure switch DG 3..
End plates	8 E, 1 E	= approx. 0.5 kg

1) Identical dimensions for G 39

2) Port B is blocked with a tapped plug, when a valve section type G 39 is mounted.

3) Mounting of the intermediate plate part No. 7250 036 with O-ring 3.5x1.2; AU, 90 Sh and 2 socket head screws DIN 6912-M5x6-8.8-A2K

7. Type overview

Order examples:

VB01 F1M - H6 H36 Z16 H /4 65 - 1 - WG230
VB11 AM -1/350 - F H R 3 G35 H /3 2 11 - 2 - G24
VB21 GMF - R H H H /H - 3 - G24

Size	01	11	21	31	41
Suffixes in uncoded text:					
Adapter version for solenoid plug (see also D 7300)	●	●			
Blanking plate (sub-plate without valve), sect. 4.7	●	●			
Orifice in the pump gallery (type EB. acc. to D 6465, sect. 4.2)	●	●	●	●	
Nom. voltage (sect. 2.2)					
G 12, G 24, WG 230 12 and 24V DC or 230V AC (for other voltage see D 7300, sect. 4.1.2)	●	●	●	●	●
Port size (sect. 2.2)					
1 Tapped ports G 1/4	●	●			
2 Tapped ports G 3/8		●	●		
3 Tapped ports G 1/2			●	●	
4 Tapped ports G 3/4				●	●
5 Tapped ports G 1					●
End plate (sect. 2.3) [1]					
(without) Standard	●	●	●	●	
/2 End plate with drain valve	●				
/3, /4, /5, /6, /65 With one pressure switch DG 3..	●	●			
/33, /34, /35, /36, /265 With two pressure switches DG 3..	●	●			
/44, /45, /46, /465					
/55, /56, /565, /66, /665, /6565					
/0, /00, /.0, /0 Prepared for retrofitting of one (two) pressure switches		●			
/32, /42, /52, /62, /652 With drain valve and one pressure switch DG 3..	●	●			
/332 ... /65652 With drain valve and two pressure switches DG 3..	●				
/02 Prepared for retrofitting of one DG 3..	●	●			
/002 Prepared for retrofitting of two DG 3..	●				
/.11, /12 Spacer for retrofitting of one or two valves	●	●			
Valve sections - additional elements (sect. 2.4.2) [1]					
2 Prepared for retrofitting of one pressure switch DG 3.. (connected to the consumer port)	●				
62 Prepared for retrofitting of one pressure switch DG 3.. (connected to the pump gallery), only coding H, L, N, R	●	●			
3, 4, 5, 36, 65 Pressure switch DG 3.. (connected to the consumer port), two pressure switches with coding G	●	●			
6, 7, 8, 66, 665 Pressure switch DG 3.. (connected to the pump gallery), only coding H, L, N, R	●	●			
91/.., 92/.. Suffix for press control valves (only with coding R), sect. 4.5			●	●	
Valve sections (sect. 2.4, 2.5, 4)					
D,F,B,E,Q,A,C,P,O,I,Y 2/2-way function (seated valve), coding A not available for size 41	●	●	●	●	●
H,N,M,R,S,T 3/2-way function (seated valve)	●	●	●	●	●
K,M,U,V 3/2-way function (seated valve with return pressure stop)	●	●			
HX,LX,NX,RX 4/2-way function (seated valve)		●			
J 3/3-way function (seated valve combination)	●	●	●	●	●
G 4/3-way function (seated valve combination)	●	●	●	●	
-CZX [2] **and** **-CZ08** to **CZ55/..** 2-way pressure reducing valve with pressure specification, reducing the pressure for the subsequent system. For options, see sect. 2.5	●	●			
Z1.. to **Z2865** 3-way pressure reducing valve (previous design) sect. 4.8	●	●			
SE2../1- 2-way flow control valve (sect. 4.6)				●	
-33, -34, -35, -36, -365 Pressure switch installed on individual sub-plate (sect. 4.4) [1]	●	●			
Actuations (sect. 2.2), available combinations					
M Solenoid	●	●	●	●	●
H Hydraulic	●	●	●	●	
P, K, F Pneumatic, roller resp. level		●	●	●	
T Pin		●	●		
D Turn knob	●	●	●		
Connection blocks for pipe mounting (sect. 2.2)					
A.-1/.., A.-2/.. With pressure limiting valve with pressure specification (manually or tool adjustable	●	●	●	●	●
A.-3/.., A.-4/.. With pressure limiting valve with pressure specification (manually or tool adjustable (all steel design)	●	●	●	●	
A.-5 No pressure limiting valve	●	●	●	●	●
Adapter plates for mounting onto hydraulic power packs					
C For type R (D 6010 H ++) and Z (D 6820)	●	●	●		
D For type R (D 6010 H ++) and Z (D 6820)		●	●	●	
E For type R (D 6010 H ++) and Z (D 6820)				●	
F, F1 For type HC (D 7900), HCG (D 7900 G), MP (D 7200 H), FP (D 7310) and HK (D 7600-...) type F1 for size VB 01 only	●	●	●		
G For type MP acc. to D 7200 H or RZ acc. to D 6910 H together with connection block A51/.., A61/.. or two stage valve NE21 acc. to D 7161		●	●		
Basic type and size (sect. 2.2)					
VB 01, VB 11, VB 21, VB 31, VB 41 Type and size	●	●	●	●	●

[1] DG = Pressure switch type DG 3.. acc. to D 5440

[2] With tapped plug, prepared for retrofitting of a CDK 3(32, 35)-..