

# Valve banks type BWN and BWH

with directional valves acc. to D 7470 A/1

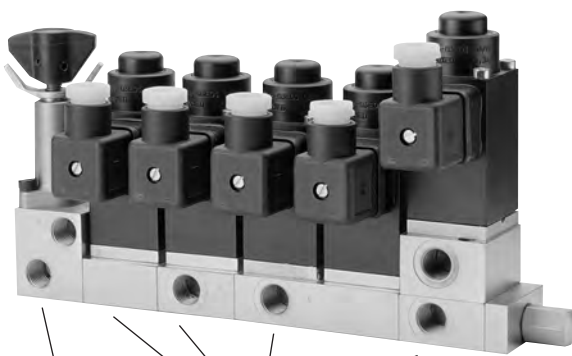
Pressure  $p_{max}$  = 350 ... 450 bar  
 Flow  $Q_{max}$  = 5 ... 30 lpm

## 1. General information

The directional valves WN 1 or WH 1(2 and 3) type (acc. to D 7470 A/1) are mounted on sub-plates. These valve banks are laterally arranged between a connection block and an end plate, all held together and hydraulically connected via a tie rod. The connection block, with inlet for pressurised oil and outlet for the return, is available in differing versions: With/without pressure limiting valve or as an adapter to mount the valve bank on hydraulic power units. The galleries for pressurised oil and return run through all sub-plates and connect the mounted valves in parallel.

The valves are counted starting from the connection block. For more detailed data and notes concerning the individual valves refer to D 7470 A/1.

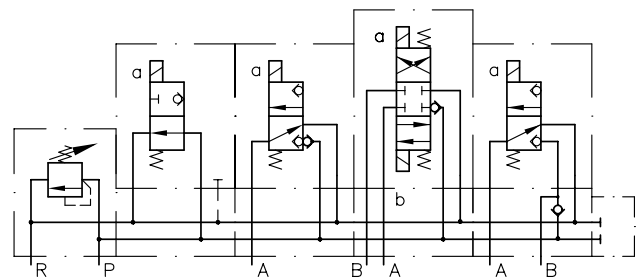
### Directional valve bank into basic version



Connection block    Directional valve    End plate

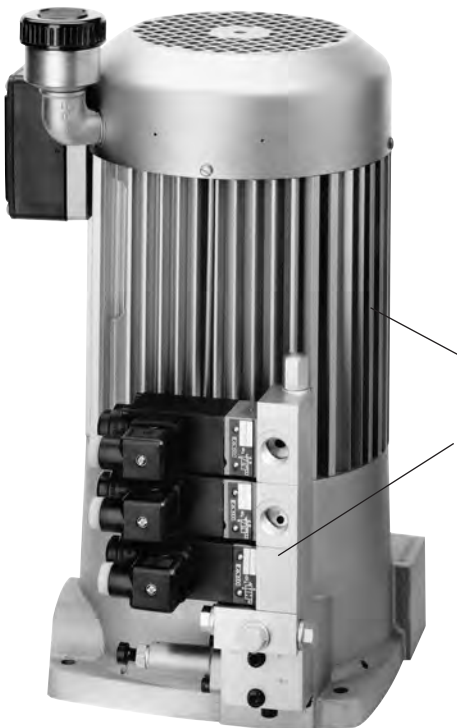
Order example and flow pattern symbol corresponding to the photo

**BWN 1 A - 2/120 - FNGS - 1 - 1 - G 24**



### Directional valve bank for direct mounting at a compact hydraulic power pack

Here e.g. HK 44/1 M - H 6,0 - A1/200 (acc. to D 7600-4)



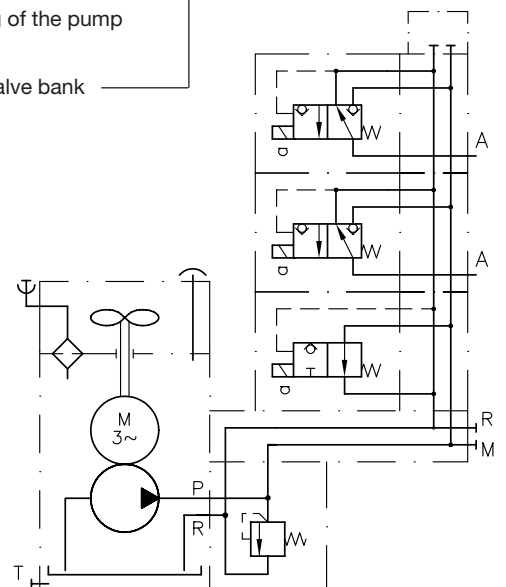
Compact hydraulic power pack  
 Directional valve bank

Order example and flow pattern symbol corresponding to the photo

**HK 44/1 M - H 6,0 - A1/200 - BWN 2 F - FHH - 1 - 1 - G 24**

Order coding of the pump

Directional valve bank

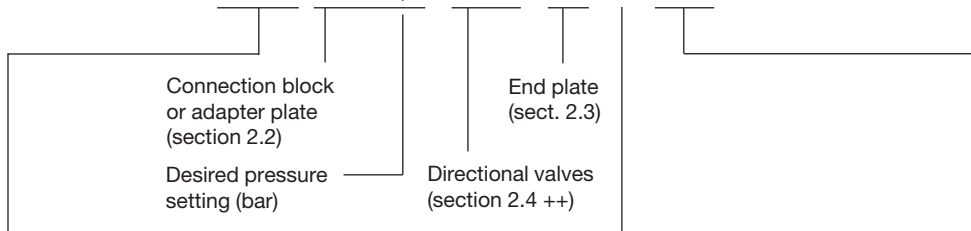


## 2. Available versions

For complete type overview ref. to section 7, page 23

### 2.1 Type coding and general parameter

Order examples: **BWN 1 A - 2/120 - FNGS - 1 - 1 - G 24**  
**BWH 2 F - FHH - 35 - 1 - G 24**



**Table 1:** Basic type

Coding	Valves acc. to D 7470 A/1	Pressure p <sub>max</sub> (bar)	Flow Q <sub>max</sub> (lpm)
<b>BWN 1</b> <sup>9)</sup>	WN 1..	350 (300) <sup>8)</sup>	5 (6) <sup>8)</sup>
<b>BWH 1</b> <sup>9)</sup>	WH 1..	450	8
<b>BWH 2</b>	WH 2..	350	15
<b>BWH 3</b>	WH 3..	350	30

**Table 2:** Port size

Coding	1	2
Ports ISO 228/1 (BSPP)	G 1/4	G 3/8
Directional valve bank	BWN 1 BWH 1 BWH 2	BWH 3

**Table 3:** Actuation solenoid

<b>G 12</b>	12 V DC
<b>G 24</b>	24 V DC
<b>WG 110</b>	110 V AC 50 and
<b>WG 230</b>	230 V AC 60 Hz

For further voltage and notes ref. to see D 7470 A/1 sect. 2.2.2

### 2.2 Connection blocks and adapter plates

Type of installation	Suited for				Coding Design	Pressure limiting valve		Symbols
	BWN 1	BWH 1	BWH 2	BWH 3		Adjustability	Spring housing	
For installation into the piping system.  Use port R always as reflow (p <sub>R</sub> < 20 bar)					<b>A - 1/...</b>	Adjustable with tools	Zinc die-cast (standard)	
					<b>A - 2/...</b>	Manually		
					<b>A - 3/...</b>	Adjustable with tools		
					<b>A - 4/...</b>	Manually	Steel <sup>6)</sup>	
					<b>A - 5</b>	Without		
Direct mounting at compact hydraulic power packs <sup>1)</sup>					<b>AP-14-../..</b> <b>AP-34-../..</b>	Without check valve With check valve		
					Coding	41	42	43
					Pressure range from...to (bar)	5... ...180	5... ...290	5... ...440
Mounting on hydr. power packs <sup>1)</sup>					<b>F</b>	A 1/.. to A 4/..	Connection block incl. pressure limiting valve at the hydraulic power pack	
					<b>F</b>	A 13/.. to A 43/..		
					<b>F1</b> <sup>5)</sup>	A 1/.. to A 4/..		
					<b>L</b> <sup>2)</sup>	Without DBV		
Connection onto valve banks					<b>S</b>	A 1/.. to A 4/..		
					<b>C</b> <sup>2)</sup> <sup>3)</sup>	A .. to E ..		
					<b>D</b> <sup>4)</sup> <sup>2)</sup>	A .. and B ..		
					<b>K</b>	Without pressure limiting valve		

**1) Note:**

- 1) Pump delivery flows (dep. on motor speed) must not exceed the max. permissible flow rate of the utilized valve, see D 7470 A/1 sect. 2.1. Note max. pressure p<sub>max</sub>!
- 2) Not with additional pressure switches acc. to sect. 2.4.3, alternative see section 2.5.2
- 3) Only for tank size B6 ... B40
- 4) Only for tank size B50 and B75

- 5) For accumulator and pressure gauge connections: see also Sk 6900 H(M) as well as Sk 7200 M(N)
- 6) Only in case of pressure surges (> 20 bar) in the return line e.g. as a result of decompression surges from accumulating consumers etc. A return pressure stop (acc. to D 7470 A/1, sect. 2.1) might be necessary, (only with BWN(H) 1 or with BWH 2)
- 7) Only type BWH 2(3): Restricted No. of valves at ports P1 and P2 (over size). A separate orientation is to be preferred utilizing BWH 2(3) A-..., when more valves are required in a valve bank
- 8) Figures in brackets apply to directional spool valves, flow pattern symbol W, WX
- 9) For combinations of directional spool valves type BWN 1 with BWH 1, see sect. 5.6

**2.3 End plate**

Coding On DG..	Two DG..	Notes (DG stands for pressure switch)	Symbols	Coding 2
<b>1</b>		Standard	Coding 1 	
<b>2</b>		With drain valve, e.g. to discharge a connected accumulator (see sect. 5.5)		
<b>3.</b>		For type BWN(H) 1 and BWH 2: With pressure switch acc. to D 5440 for monitoring the P duct 1.DG   2.DG .2   /2 = Without pressure switch, but retrofitting is possible (only with coding 4. and 5.) .3   /33 = DG 33 Adjustm. range: 200 ... (700) bar .4   /34 = DG 34 100 ... 400 bar .5   /35 = DG 35 40 ... 250 bar .6   /36 = DG 36 4 ... 12 bar .65   /65 = DG 365 12 ... 170 bar	Coding 33 to 365 	Coding 42 to 465 
<b>33</b> <b>34</b> <b>35</b> <b>36</b> <b>365</b>	<b>3./..</b> <sup>1)</sup>  Example: 33/65			
<b>4.</b>		For type BWN(H) 1: With additional drain valve (ref. to coding 2) and port for pressure gauge connection G 1/4 (see also sect. 5.5) For DG specification, see coding 3 above.	Coding 3./.. DG.. Nr. 1 	Coding 4./.. DG.. Nr. 1 
<b>42</b> <b>43</b> " " <b>465</b>	<b>4./..</b> <sup>1)</sup>  Example: 42/35			
<b>5.</b>	1.DG  MVP 4.. or MVPX 4..	For type BWN(H) 1: With additional drain valve (ref. to coding 2.), port for pressure gauge G 3/8 and mounted pressure limiting valve type MVP 4 or MVPX 4 acc. to D 7000/1 or D 7000 TÜV (see also sect. 5.5) Example: 54 - MVPX 4E/150 For DG specification, see coding 3 above (1.DG).	DG.. Nr. 2 	Coding 4./.. DG.. Nr. 2 
<b>52-</b> " " <b>565-</b>			Coding 52 to 565 	
<b>11</b> <b>12</b> <b>21</b> <b>22</b> <b>3..1</b> <b>3..2</b> <b>4..1</b> <b>4..2</b> <b>5..1</b> <b>5..2</b>	<b>3./..1</b> <b>3./..2</b> <b>4./..1</b> <b>4./..2</b>	<b>Spacers:</b> These spacers enable retrofitting of one (..1) or two (..2) valves including their sub-plate (see sect. 3.2 and 4.2). The corresponding coding should be added after the coding of the end plate.  Examples: -12 -21 -341- -432- -33/652- -42/351- -5652-MVPX4E/150 etc.	Coding ..1 and ..2 (spacers) 	

<sup>1)</sup> Version with two pressure switches not with type BWN(H) 1 C, D, S and L or BWH 2(3) C, D.  
 An additional section is available with pressure switch (sect. 2.5.2) as alternative

## 2.4 Directional valves

### 2.4.1 Directional valves type BWN 1 (basic function)

- Coding of the available flow pattern symbols (individual directional valve with corresponding sub-plate = valve section) <sup>1)</sup>
- Maximum 10 valves can be combined; Flow pattern symbols J, U, V, L, K, G, and GX are to be counted as 2 valves.
- Idle circulation valves D, F or A should be placed as first valve within the valve bank (first valve coding) to minimize the back pressure.
- Directional valve banks slightly reduce the heat dissipation to the surrounding because of the small distance between neighboring valve solenoids. It is therefore advisable to locate at least one unactuated valve between valves actuated simultaneously or for longer periods. Otherwise neighboring valves would hinder heat dissipation and heat each other up. This rule should be obeyed, when the duty cycle of the valves is above 60% ED.  
It is recommended to employ economy circuits acc. to D 7813, D 7832, D 7833, if this is not possible.

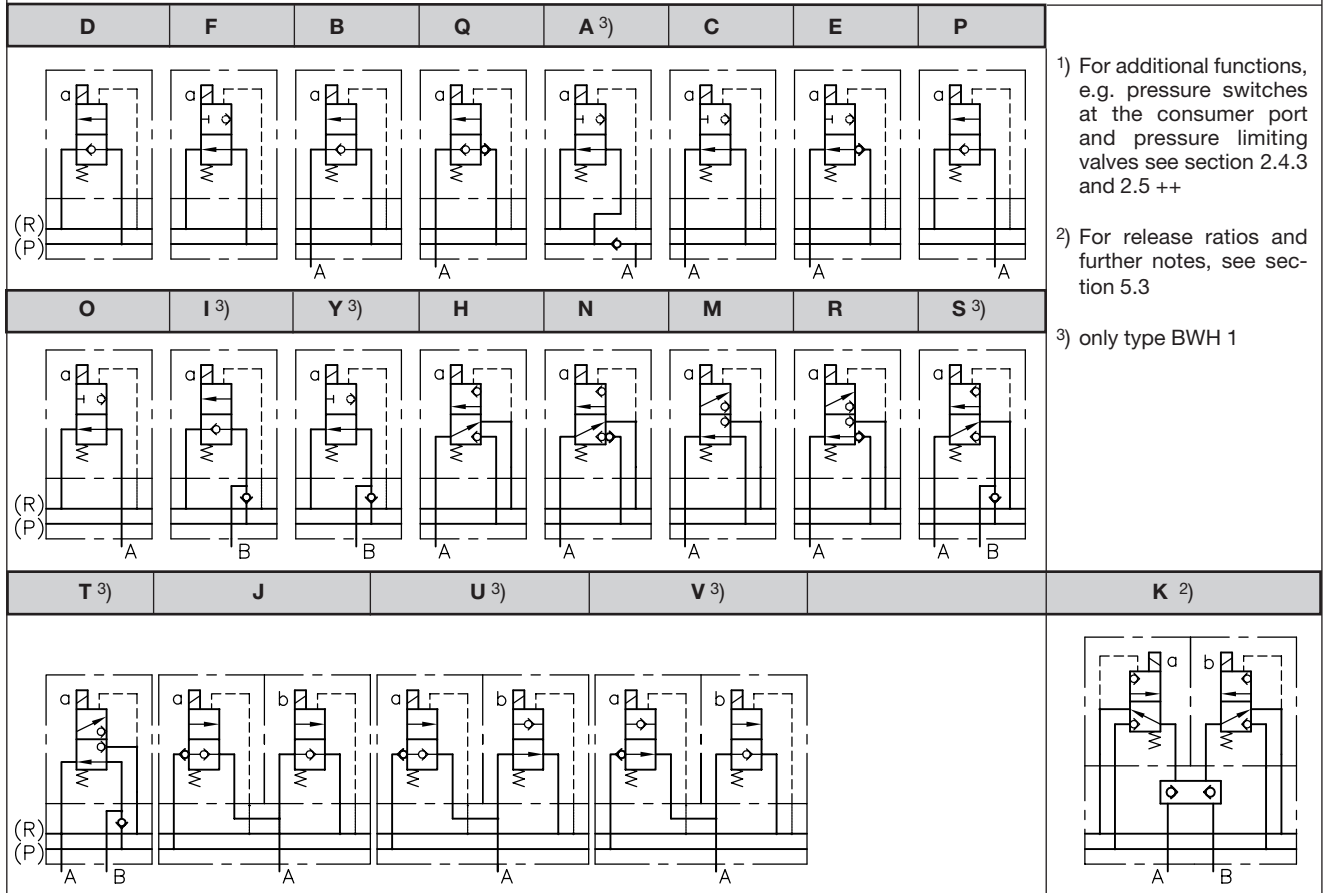
Directional seated valves								Directional spool valves													
D	F	B	Q	A	C	E	P	W	WX												
(R) (P)		A	A	A	A	A	A	B A	B A												
O	I	Y	H	N	M	R	S	X													
(R) (P)		A	B	B	A	A	A			A B											
T	J	U		V		X		K <sup>2)</sup>													
(R) (P)		A B	A	A	A			A B	A B												
	<p>Special characteristic of symbol Q, N, J, U and L: If these valves are only seldom activated and their temperature rises from cold to operating temperature due to neighbouring valves and/or due to oil flow through P and R galleries, since thermal expansion of enclosed oil is hindered, the pressure in the enclosed space may rise so high that the operating force of the solenoid is exceeded and the valve does not respond when energised. In such cases, use pressure compensated valves type WH 1. Pressure increase due to pump after-running (when the motor has been switched off) can cause similar effects if the BWN valve bank is directly mounted and an simultaneously energised idle circulation valve is missing. In this case WH 1.. should be used also. Accumulators (e.g. sect. 5.5) also prevent pressure increases.</p>							X													
(R) (P)	<p>Directional valves with additional return pressure stop:</p>																				
	<p>When several valves are operating in parallel, an return pressure stop is required sometimes. It prevents pressure surges out of the common return pipe from entering unoperated, unloaded or easily moving consumers, whenever there is a connection A→R, thus preventing uncontrolled movements. 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 employed instead.</p>																				
<table border="1"> <tr> <td>D1; F1</td> <td>H1</td> </tr> <tr> <td>A1; P1</td> <td>M1</td> </tr> <tr> <td>O1; I1</td> <td>N1</td> </tr> <tr> <td>Y1; J1</td> <td>R1</td> </tr> <tr> <td>U1; L1</td> <td>S1</td> </tr> <tr> <td>V1</td> <td>T1</td> </tr> </table>	D1; F1	H1	A1; P1	M1	O1; I1	N1	Y1; J1	R1	U1; L1	S1	V1	T1									
D1; F1	H1																				
A1; P1	M1																				
O1; I1	N1																				
Y1; J1	R1																				
U1; L1	S1																				
V1	T1																				

1) For additional functions, e.g. pressure switches at the consumer port and pressure limiting valves, see section 2.4.3 and 2.5 ++

2) For release ratios and further notes see sect. 5.3

**2.4.2 Directional valves type BWH 1, BWH 2 and BWH 3**

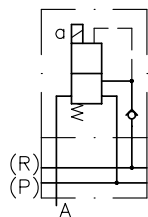
- Coding of the available flow pattern symbols (individual directional valve with corresponding sub-plate = valve section) <sup>1)</sup>
- Maximum 10 valves can be combined; Flow pattern symbols J, U, V, L, and K are to be counted as 2 valves.
- Idle circulation valves D, F or A should be placed as first valve within the valve bank (first valve coding) to minimize the back pressure.
- Directional valve banks slightly reduce the heat dissipation to the surrounding because of the small distance between neighboring valve solenoids. It is therefore advisable to locate at least one unactuated valve between valves actuated simultaneously or for longer periods. Otherwise neighboring valves would hinder heat dissipation and heat each other up. This rule should be obeyed, when the duty cycle of the valves is above 60% ED.  
It is recommended to employ economy circuits acc. to D 7813, D 7832, D 7833, if this is not possible.



Directional valves with additional return pressure stop (not available with type BWH 3!):

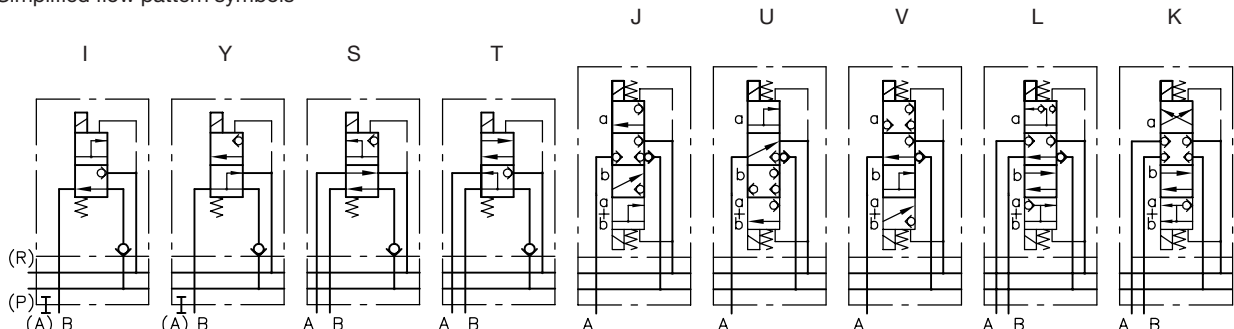
1 = **BWN 1 / BWH 1**  
2 = **BWH 2**

<b>D1</b> (1)	<b>H1</b> (1, 2)
<b>F1</b> (1)	<b>M1</b> (1, 2)
<b>A1</b> (1)	<b>N1</b> (1, 2)
<b>P1</b> (1)	<b>R1</b> (1, 2)
<b>O1</b> (1)	<b>S1</b> (1, 2)
<b>I1</b> (1)	<b>T1</b> (1, 2)
<b>Y1</b> (1)	
<b>J1</b> (1)	
<b>U1</b> (1)	
<b>V1</b> (1)	
<b>L1</b> (1)	



When several valves are operating in parallel, an return pressure stop is required sometimes. It prevents pressure surges out of the common return pipe from entering unoperated, unloaded or easily moving consumers, whenever there is a connection A→R, thus preventing uncontrolled movements. 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 employed instead.

Simplified flow pattern symbols



**2.4.3 Directional valves with integrated additional elements**

**Pressure switches** (DG 33, DG 34, DG 35, DG 36 oder DG 365 nach D 5440) at ports **A, B, and P**

Not available for directional spool valves coding W(WX) and G(GX) acc. to sect. 2.4.1!

Mounted pressure switch

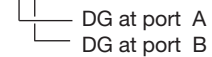
Position	Coding	Suited for		DG...	Adjustment range	Note
		BWN 1 BWH 1	BWH 2			
At port A or B	2	●		--	Prepared for retrofitting	Can't be combined with directional seated valves, coding D, A, F, P, O, I, Y, S, T or valve banks BWN(H)..C (D, S, L) as well as 1. valve within valve bank BWN(H) 1(2) P!
	3	●		33	200 ... (700) bar 1)	
	4	●	●	34	100 ... 400 bar	
	5	●	●	35	40 ... 250 bar	
	36	●	●	36	4 ... 12 bar	
	364	●	●	364	4 ... 50 bar	
	365	●	●	365	12 ... 170 bar	
At port P 2)	62	●		--	Prepared for retrofitting	Available version: directional seated valves, coding H, M, N and R. Makes end plates coding 33 ... 365 superfluous. Can't be combined within valve bank BWN(H)..C (D, S, L) or as 1. valve within valve bank BWN(H) 1(2) P!
	6	●		33	200 ... (700) bar 1)	
	7	●		34	100 ... 400 bar	
	8	●		35	40 ... 250 bar	
	66	●		36	4 ... 12 bar	
	664	●		364	4 ... 50 bar	
	665	●		365	12 ... 170 bar	

**Order examples:**

3/2-way directional valve with one DG at port A:  
BWN1A-H4-1-1-G 24

3/2-way directional valve with return pressure stop and one DG in the pump gallery:  
BWH1F-H18 R166 -1-1-G 24

4/3-way directional valve with two DG at ports A and B  
BWH2A-K4 5-1-1-G 24



1) Makes only sense in combination with BWH 1

**Attention:**

Do not exceed  $p_{max}$ !

Observe perm. pressure for BWN 1 (acc. to D 7470 A/1 sect. 2.2.2).

Valve type, available versions (codings) and symbols (examples)

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

**3/2-way directional valve with a DG at port A (only type BWN 1 and BWH 1)**

For technical data of the pressure limiting valve, see D 7000 E/1, type MVF 4..

Order example: BWH1A-1/200- **M/150 J/100** - 1-1-G 24

Basic type coding acc. to section 2 ++

3/2-way directional seated valve (acc. to sect. 2.4.1 and 2.4.2) with integrated pressure limiting valve 2):

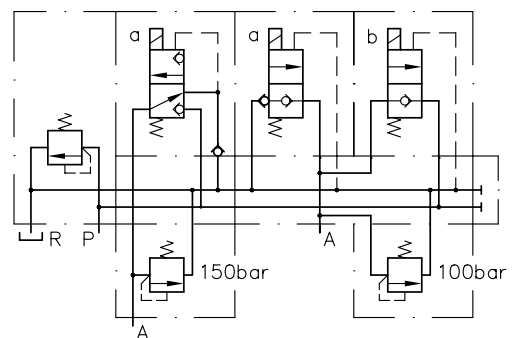
**H(1)/...; M(1)/...; N(1)/...; R(1)/...;**  
**J(1)/...; U(1)/...; V(1)/...**

2) When used as second pressure stage, available with tapped plug at port A.

When ordering, indicate in uncoded text: e.g. BWN1A-1/200-M/150 RH/100-1-1-G 24 with tapped plug No. 2749 003 at the third valve section (coding H/100). With coding H(1), M(1), N(1), R(1) a combination with pressure switches is not available.

Not available in combination with valve bank BWN(H) 1C (S, L)!

Flow pattern symbol acc. to the order example





**Version with pressure limiting valve and pressure switch at port A (only for type BWN 1 and BWH 1)**

For technical data of the pressure limiting valve type MVF 4..., see D 7000 E/1 or for the pressure switch type DG..., see D 5440

Order example: BWH1A5 - H **J4/250** - 1-1-G 24

Symbols (examples)

J4/250

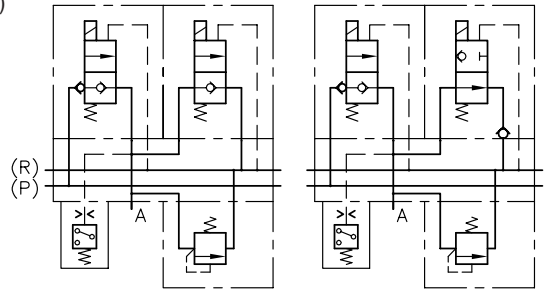
U15/180

Basic type coding acc. to section 2 ++

3/3-way directional seated valve (acc. to sect. 2.4.1 and 2.4.2) with directly mounted pressure limiting valve and pressure switch:

**Attention:**  
Not available in combination with valve bank BWN(H) 1 C(S, L)!  
Only available as 1. valve within a valve bank BWN(H) 1P -.. with coding J2/.. or U2/..!

- J2 (3, 4, 5, 36, 65) /...
- U2 (3, 4, 5, 36, 65) /...
- V2 (3, 4, 5, 36, 65) /...



**2/2-way directional seated valve with miniature pressure limiting valve (only for type BWN 1 and BWH 1)**

Intended use: For arbitrary activation of various pressure stages in pre-control circuits or other hydraulic circuits with low pump delivery flow.

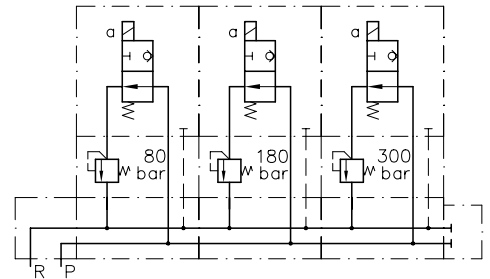
Order example: BWN 1A5 - **F/80 F/180 F/300** -1-1-G 24

Basic type coding acc. to section 2 ++

2/2-way directional seated valve (acc. to sect. 2.4.1 and 2.4.2) with integrate pressure limiting valve

**F/...** Operation pressure  $p_{max} = 320$  bar  
**D/...** Flow = approx. 2 lpm  
Pressure specification (bar) for the pressure limiting valves

Flow pattern symbol corresponding to the order example



**2.5 Additional sections**

**2.5.1 Pressure reducing valves as additional section (only type BWN 1, BWH 1 and BWH 2)**

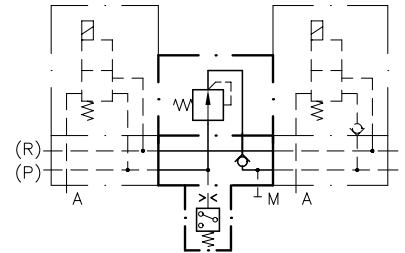
Max. permissible inlet pressure 400 bar

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 (coding „CZ“) and type CLK acc. to D 7745 L (coding „LZ“) 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.

A check valve prevents any reflow from the secondary side to the primary side (pump side) or any pressure drop. Coding CZ: It is necessary to install a pressure limiting valve in the consumer pipe if externally induced loads could cause unpermissible peak pressure. For old version with 3-way pressure reducing valve, see sect. 4.4.



Order examples: BWN 1 A-1/120 - **CZ2/180/5R/4** -HH-1-G 24

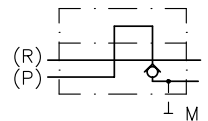
Symbol

Coding - **CZ X**

BWH 2 A-2/280 - **LZ1/250/5R/2** -NN-1-X 24

For individual order BWN 1- CZ5/130 /5R /7

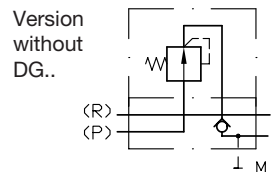
(example) e.g. as spare part, retrofitting, own storage etc.



2-way pressure reducing valve <sup>1)</sup>		
Coding	Utilized pressure reducing valve	Pressure range (bar) <sup>2)</sup>
<b>X</b>	Without <sup>4)</sup>	---
<b>08/...</b>	CDK 3-08	50 ... 450
<b>- CZ 1/...</b>	CDK 3-1	30 ... 300
<b>- LZ 2/...</b>	CDK 3-2	20 ... 200
<b>5/...</b>	CDK 3-5	15 ... 130
<b>25/...</b>	CDK 32-5 <sup>5)</sup>	8 ... 130
<b>55/...</b>	CDK 35-5 <sup>5)</sup>	15 ... 130

Pressure switch DG 3.. acc. to D 5440	
(no coding)	Without pressure switch <sup>6)</sup>
<b>/2</b>	DG may be retrofitted
<b>/3</b>	DG 33 200 ... (700) bar <sup>3)</sup>
<b>/4</b>	DG 34 100 ... 400 bar
<b>/5</b>	DG 35 20 ... 250 bar
<b>/6</b>	DG 36 4 ... 12 bar
<b>/7</b>	DG 365 12 ... 170 bar
<b>5R</b>	Check valve in gallery P

Coding - **CZ 08 to 55/..**



Version with DG.. see order example above

<sup>1)</sup> Only tool adjustable available. Adjustment can be altered (monitored by a pressure gauge) after slackening the lock nut with a spanner a/f 17  
<sup>2)</sup> 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.

<sup>3)</sup> Use of this version doesn't make much sense due to the high primary side pressure.  
<sup>4)</sup> With tapped plug, prepared for retrofitting of a CDK 3(32, 35)-..  
<sup>5)</sup> For details, see D 7745  
<sup>6)</sup> Not with type BWH 2 and coding LZ

**2.5.2 Individual sub-plate with pressure switch (for type BWN 1 and BWH 1)**

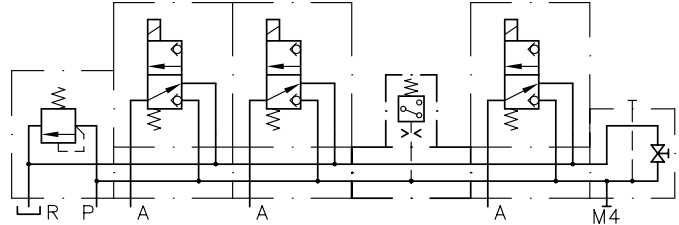
When it isn't possible to install a pressure switch at the end plate e.g. when there is not enough space, it can be mounted on an individual sub-plate at any position within the valve bank.

Order example: **BWN1A-1/200-HM-33-H-42-1-G 24**

Basic type coding acc. to sect. 2 ++

Pressure switch DG 3. acc. to D 5440	Coding for sub-plate with DG 3.	Adjustment range (bar)
-	<b>32</b> <sup>1)</sup>	prepared
33	<b>33</b>	200 ... 450
34	<b>34</b>	100 ... 400
35	<b>35</b>	20 ... 250
36	<b>36</b>	4 ... 12
364	<b>364</b>	4 ... 50
365	<b>365</b>	12 ... 170
DG 5 E-250	<b>5 E2</b>	0 ... 250
DG 5 E-400	<b>5 E4</b>	0 ... 400
DG 5 E-600	<b>5 E6</b>	0 ... 600

Symbol acc. to order example



1) Prepared for retrofitting of a pressure switch, only avail. for type BWN 1 and BWH 1

**2.5.3 Directional valve coding H with return pressure stop and pressure switch (only type BWN 1 and BWH 1!)**

The directional seated valve represented in the symbol allows arbitrary blocking of the pump gallery. A return pressure stop is additionally integrated in the pump gallery.

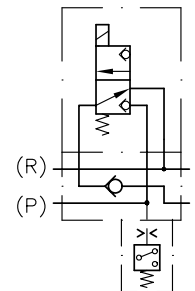
Order example: **BWN1A-1/150 - H8XX NN-1-1-G 24**

Basic type coding

Available coding H

Coding for sub-plate with check valve acc. to section 2 ++

Coding for pressure switch	DG..	Adjustment range (bar)	
<b>62</b>	--	Prepared for retrofitting	
<b>6</b>	33	200 ... 450	Only with BWH 1
<b>7</b>	34	100 ... 400	With BWN 1.. and BWH 1..
<b>8</b>	35	20 ... 250	
<b>66</b>	36	4 ... 12	
<b>664</b>	364	4 ... 50	
<b>665</b>	365	12 ... 170	



**2.5.4 Separation plate for P duct (for type BWN 1 and BWH 1!)**

When due to functional reasons two separate control circuits are intended (e.g. independent flow or pressure figures), a space saving layout can be achieved with this separation plate, still using one joint return duct. The use of an end plate featuring a pressure gauge port M4 (e.g. coding -42) is recommended, as this may be utilized as secondary pressure inlet.

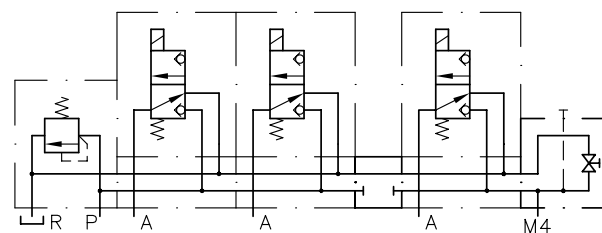
Order example: **BWN1A-5-HH-X-H-42-1-G 24**

Symbol acc. to order example

Basic type coding acc. to sect. 2 ++

Coding for the separation plate

Coding for the end plate with pressure connection M4



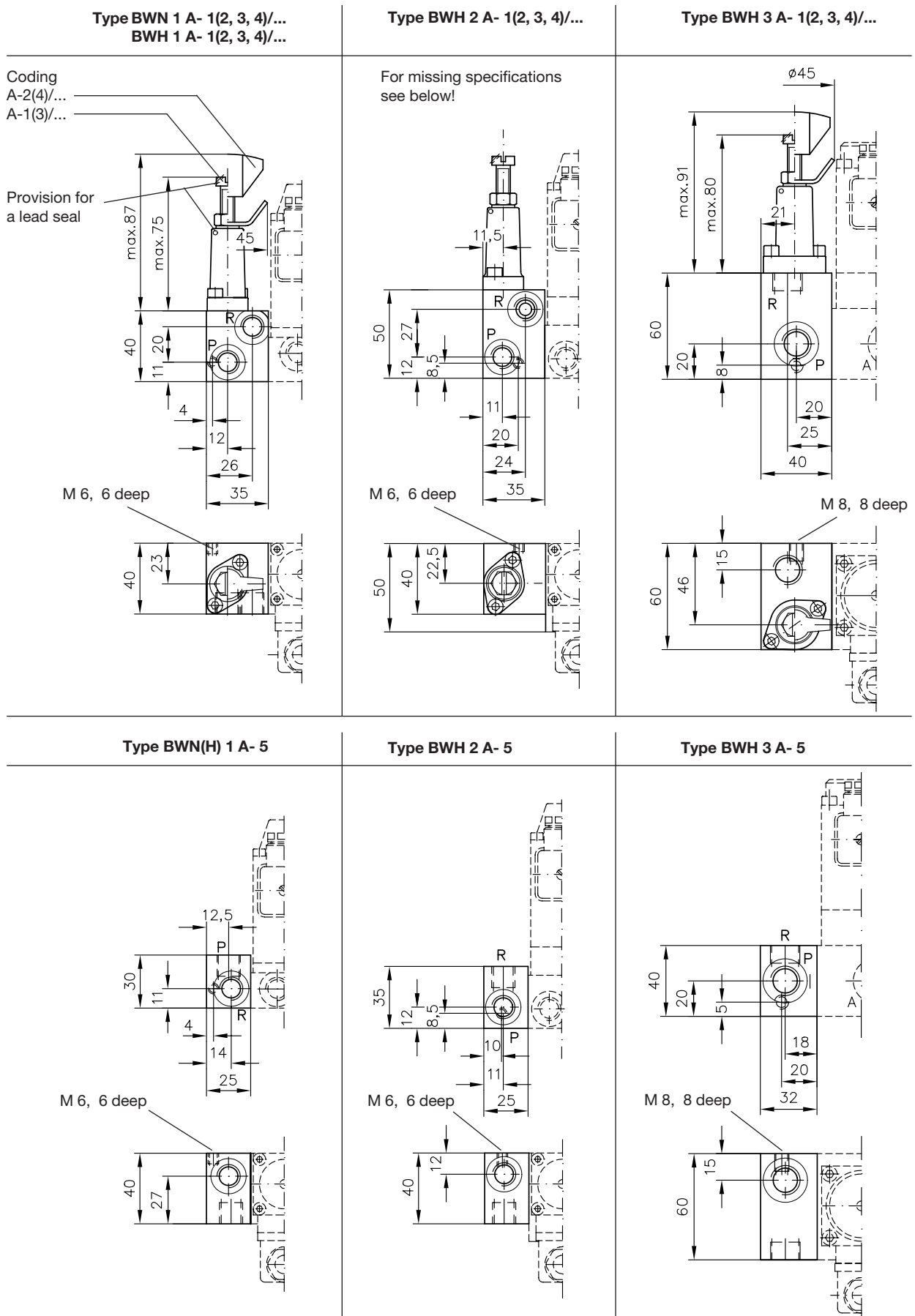


### 3. Unit dimensions

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

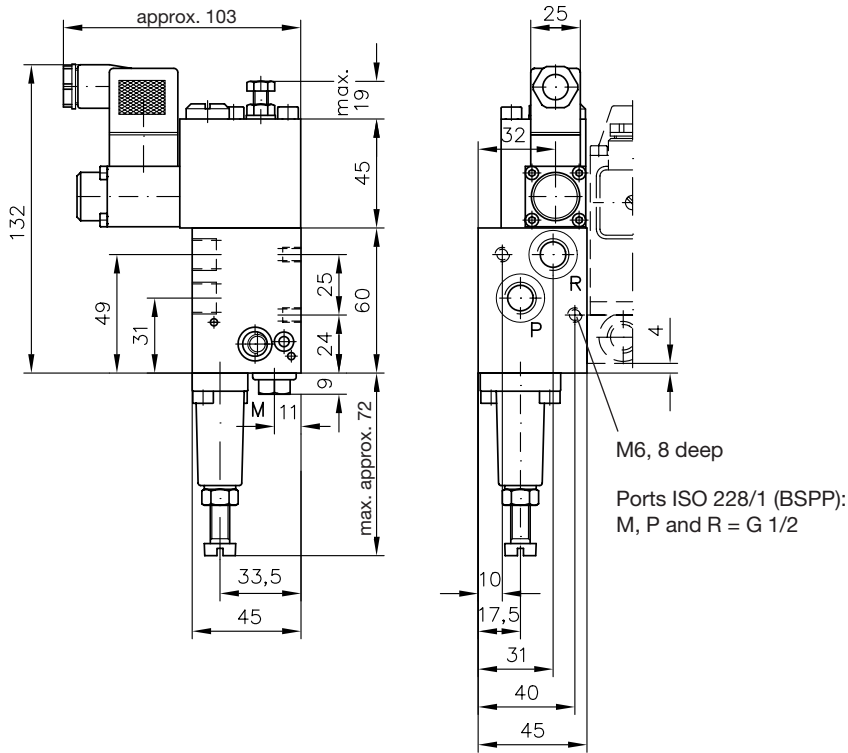
#### 3.1 Connection blocks and adapter plates acc. to section 2.2

##### 3.1.1 Connection blocks



Ports ISO 228/1 (BSPP): A, B, P, R = G 1/4 (BWN(H) 1 and BWH 2)  
G 3/8 (BWH 3)

**Type BWN(H) 1 AP 1 and BWN(H) 1 AP 3**



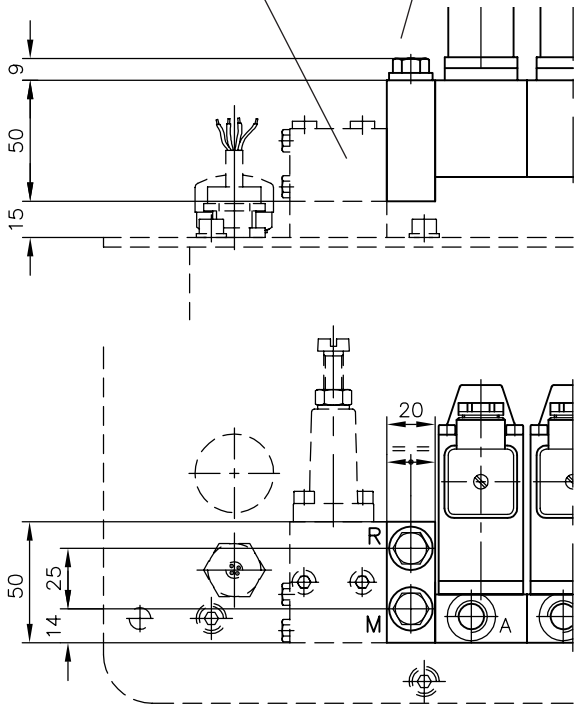
**3.1.2 Adapter plates**

The illustration below shows lateral installation e.g. with hydraulic power packs type MP (acc. to D 7200 H) or hydraulic power packs (acc. to D 6010 H).

The photo on the cover page illustrates erect installation with compact hydraulic power packs type HK (acc. to D 7600-..), HC (acc. to D 7900) or HCG (D 7900 G).

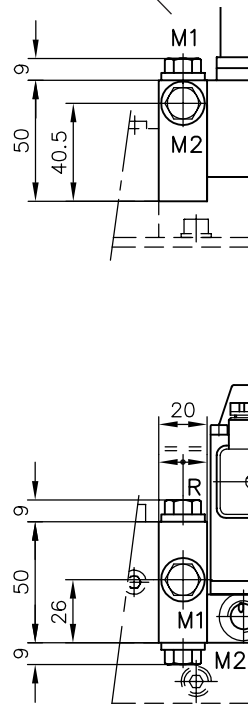
**Type BWN 1 F  
BWH 1 F**

Connection block A1/..to A4/.. Version F and S  
(hydraulic power pack)



**Type BWN 1 F1  
BWH 1 F1**

Version F1

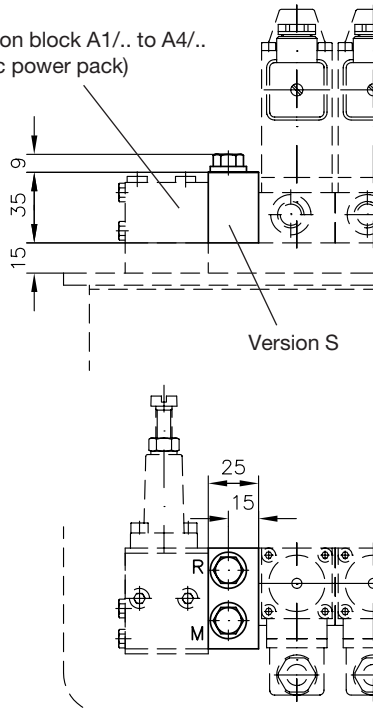


**Note:** Port R (G 1/4 BSPP) may be used as additional reflow port.  
Pressure port M, M1 and M2 (G 1/4 BSPP) e.g. for connecting a pressure gauge or a pressure switch

**Type BWN(H) 1 S**

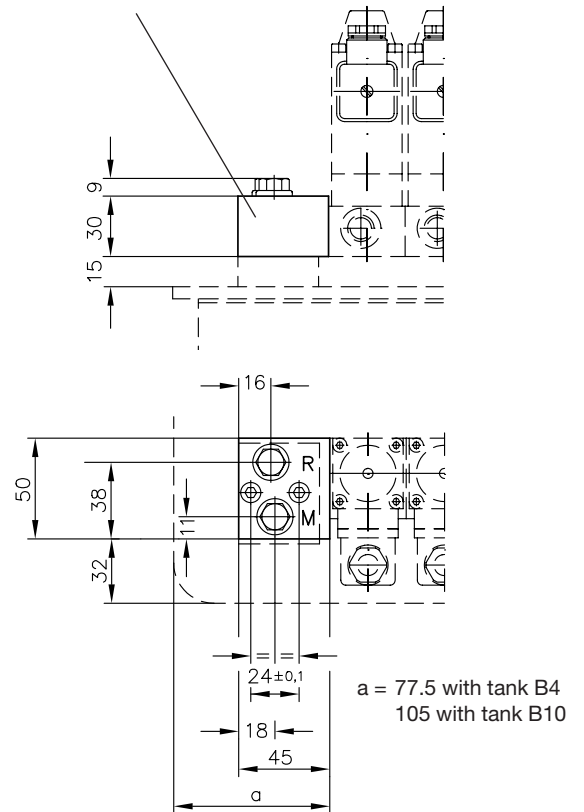
Adapter plate for direct mounting onto hydraulic power packs type LP, acc. to D 7280 H

Connection block A1/.. to A4/.. (hydraulic power pack)



**Type BWN(H) 1 L**

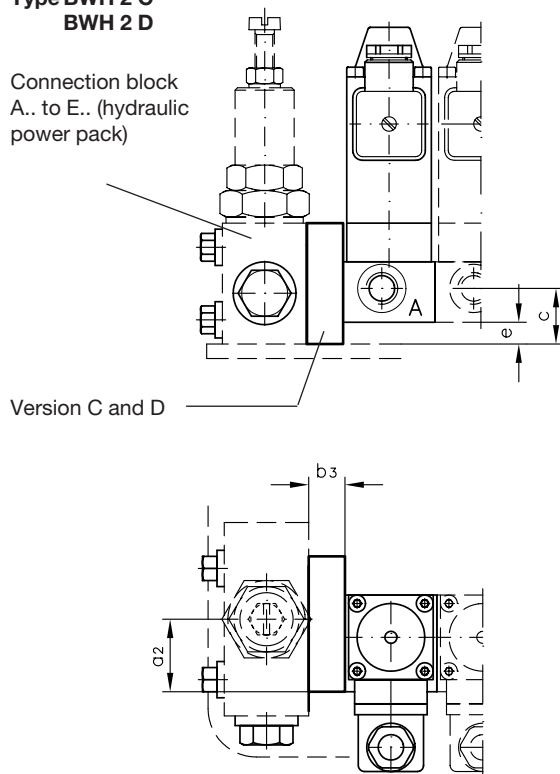
Adapter plate for direct mounting onto hydraulic power packs type LP, acc. to D 7280 H



**Note:** Port R (G 1/4, BSPP) may be used as additional reflow port.  
Pressure ports M (G 1/4, BSPP) e.g. for connecting a pressure gauge or a pressure switch

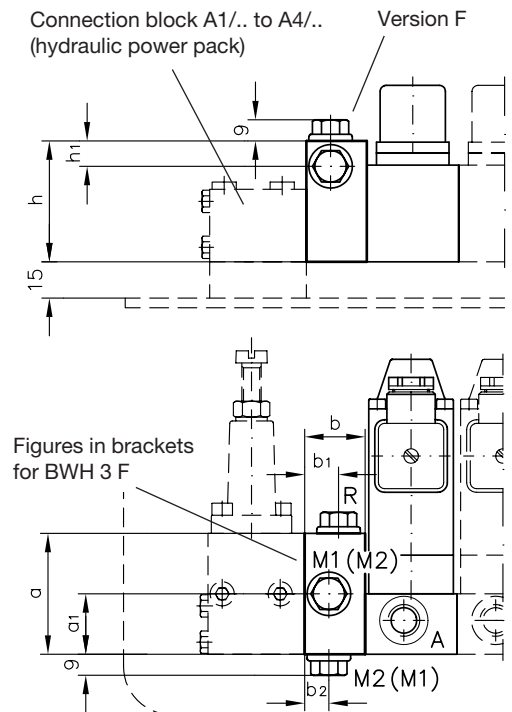
**Type BWH 2 C  
BWH 2 D**

Connection block A.. to E.. (hydraulic power pack)



**Type BWH 2 F  
BWH 3 F**

Connection block A1/.. to A4/.. (hydraulic power pack)

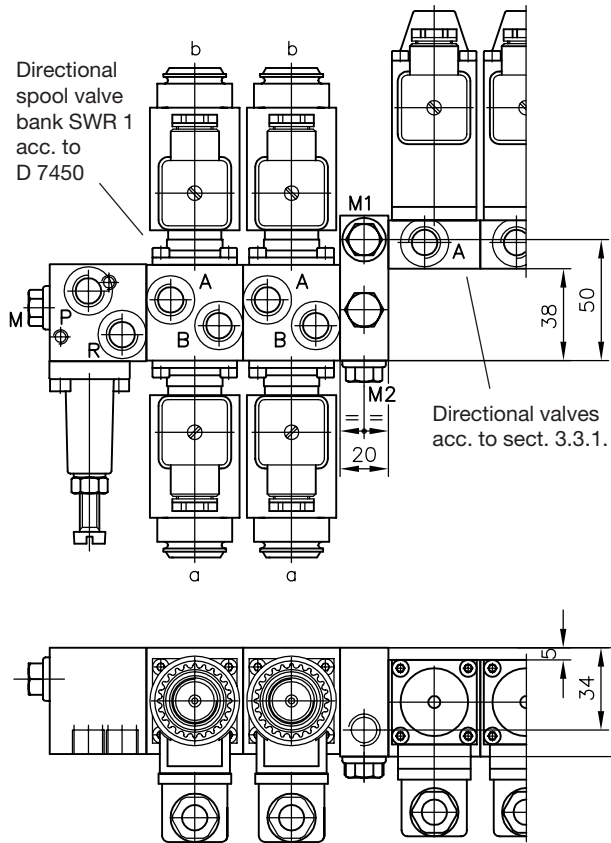


Type	a <sub>2</sub>	b <sub>3</sub>	c	e
BWH 2 C	30	15	23	9
BWH 3 D	26	30	25	5

Type	a	a <sub>1</sub>	b	b <sub>1</sub>	b <sub>2</sub>	h	h <sub>1</sub>	Ports ISO 228/1 (BSPP) M1, M2 and R
BWH 2 F	50	25	25	14	10	50	10	G 1/4
BWH 3 F	62	30	30	15	15	60	12	G 3/8

**Note:** Port R (G 1/4, BSPP) may be used as additional reflow port.  
Pressure ports M 1(2) e.g. for connecting a pressure gauge or a pressure switch

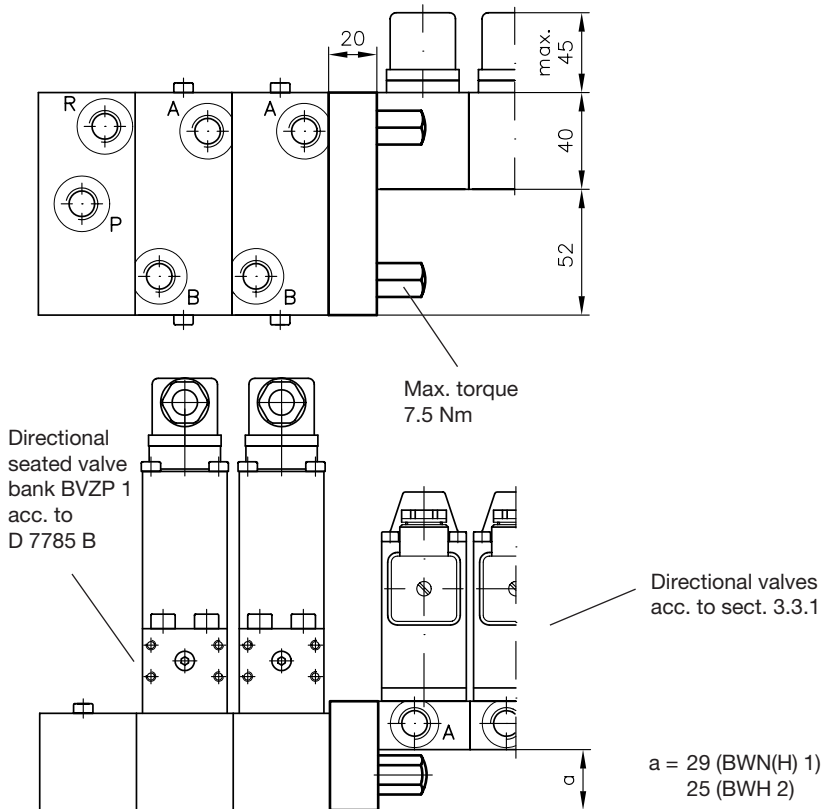
**Coding K**



**Note:** Pressure connection M1 and M2 (G 1/4, BSPP)  
e.g. pressure gauge or pressure switch

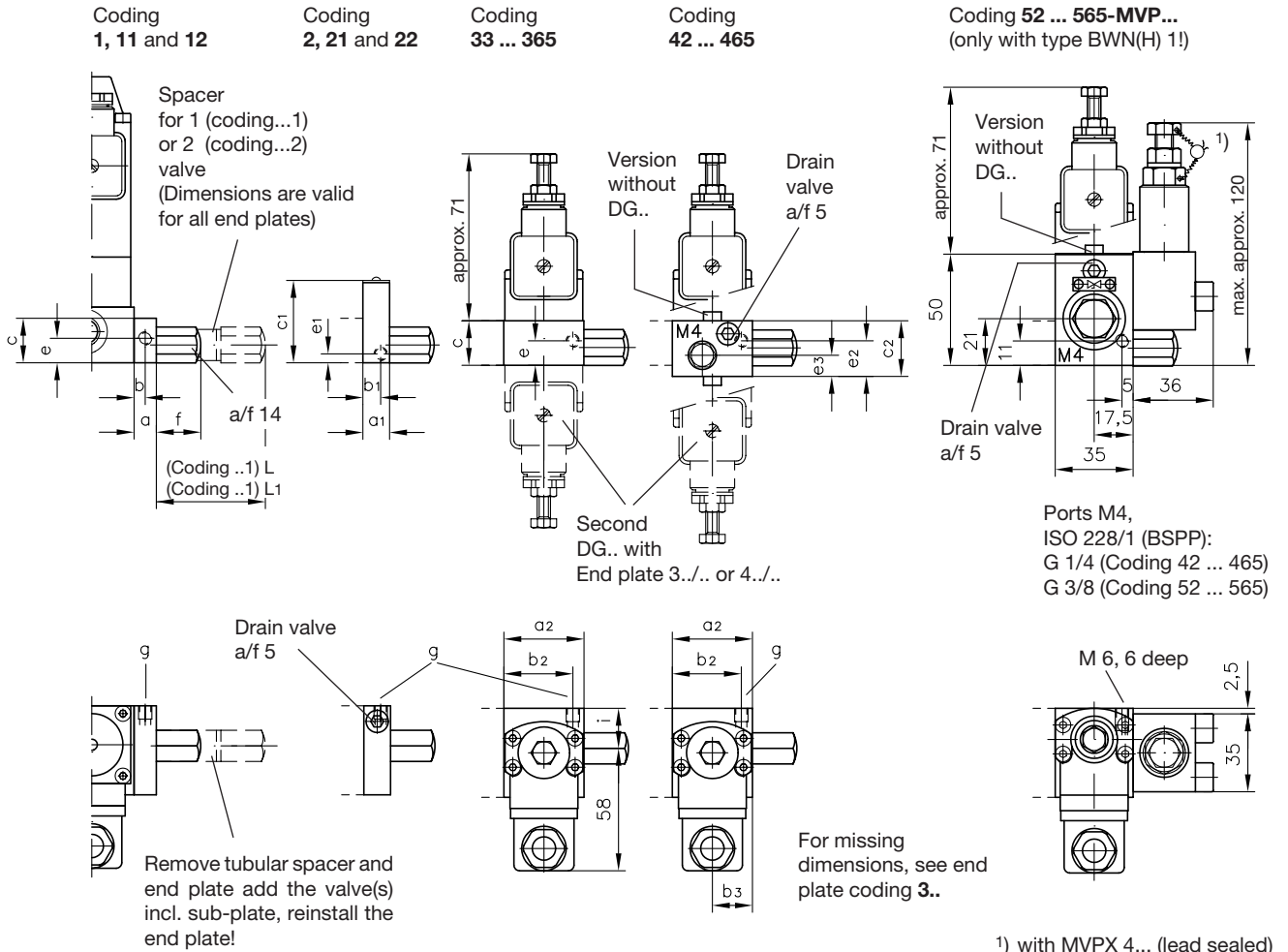
**Coding P**

(Illustration with type BWHN(H) 1)



### 3.2 End plates acc. to section 2.3

(Illustration with type BWN(H) 1 but applies to all sizes)

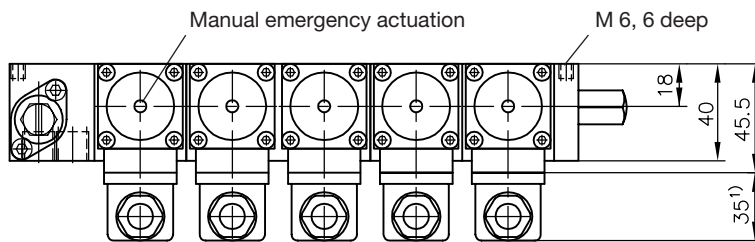
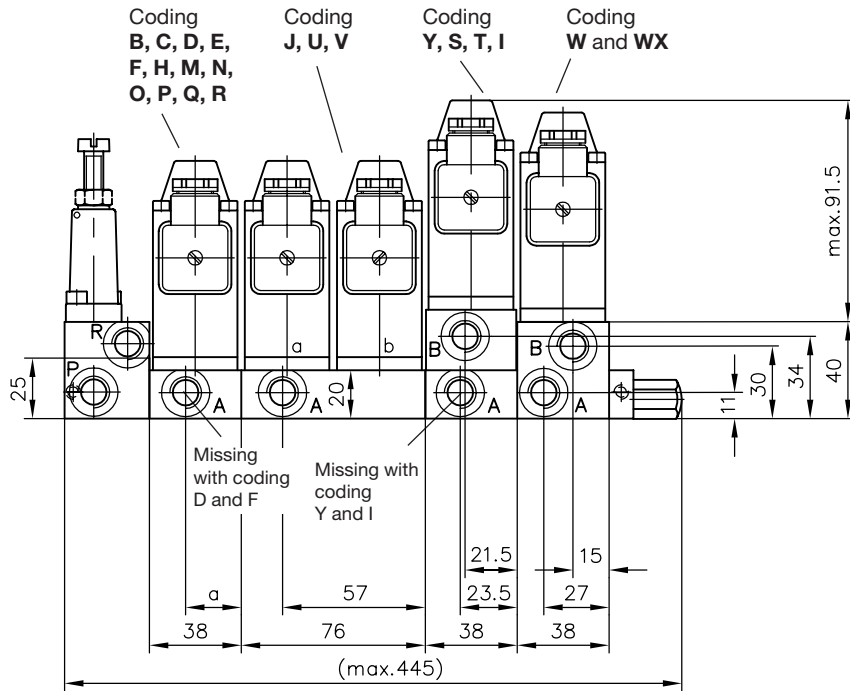


Suited for	L	L <sub>1</sub>	a	a <sub>1</sub>	a <sub>2</sub>	b	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	c	c <sub>1</sub>	c <sub>2</sub>	e	e <sub>1</sub>	e <sub>2</sub>	e <sub>3</sub>	f	i	g
BWN(H) 1	59	97	10	12	36	5	8	31	22.5	20	36	20	11	4	16	9.5	21	18	M 6, 6 deep
BWH 2	53	91	12	12	38	6	6	32	27	25	25	25	8.5	8.5	8.5	10	15	20.5	M 6, 6 deep
BWH 3	65	115	16	16	35	8	8	27	26	36	36	35	8	8	8	9	14	35	M 8, 8 deep

### 3.3 Directional valves

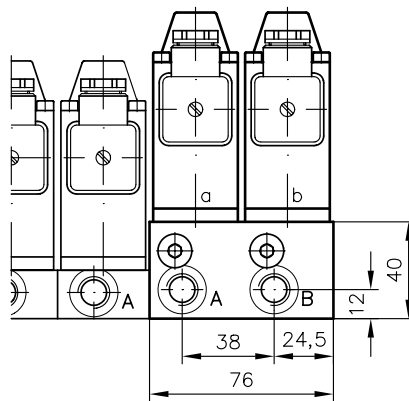
#### 3.3.1 Basic functions acc. to section 2.4

**Directional seated valves and directional spool valves for type BWN(H) 1**  
 (Version with return pressure stop is identical)



Valve sections

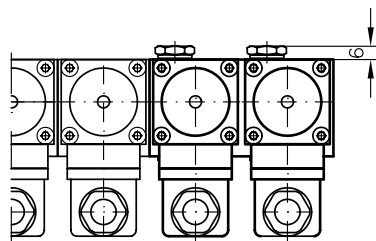
Coding K



Coding	a
D, F, H, M, N, R	23.5
B, C, Q, E	15
P and O	21.5

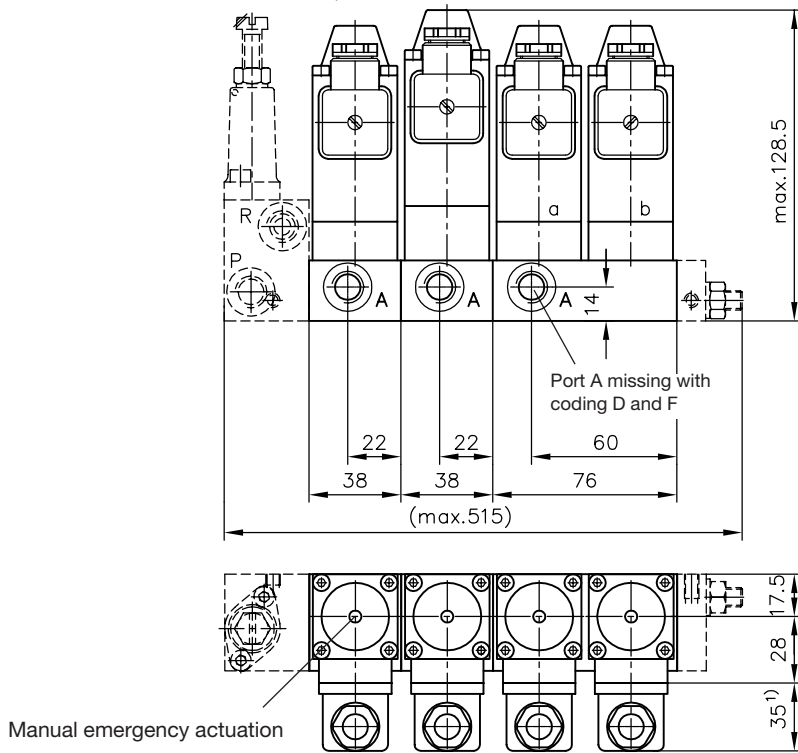
Ports ISO 228/1 (BSPP):  
 A, B, P and R = G 1/4

1) This dimension depends on the manufacturer and can be max. 40 mm acc. to DIN EN 175 301-803



**Directional seated valves for type BWH 2**  
(Version with return pressure stop is identical)

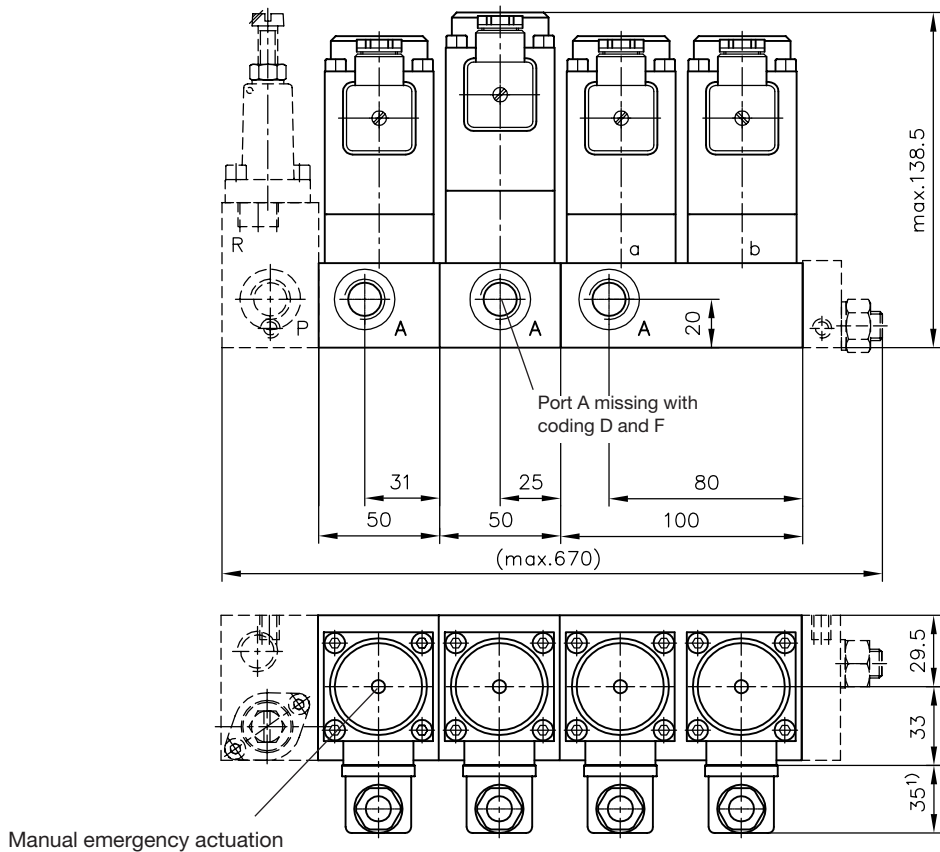
Coding    Coding    Coding  
**B, C, D,**    **H, N,**    **J, U**  
**E, F, O,**    **M, R**



Ports  
 ISO 228/1 (BSPP):  
 A, B, P and R = G 1/4

**Directional seated valves for type BWH 3**

Coding    Coding    Coding  
**B, C, D,**    **H, N,**    **J**  
**E, F, O,**    **M, R**  
**P, Q**



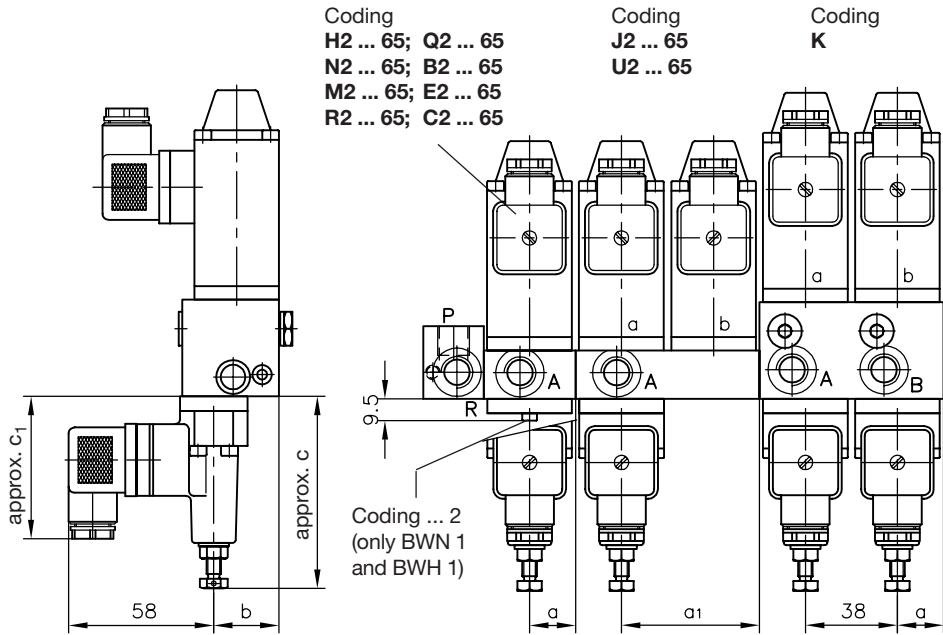
Ports  
 ISO 228/1 (BSPP):  
 A, B, P and R = G 3/8

1) This dimension depends on the manufacturer and can be max. 40 mm acc. to DIN EN 175 301-803



**3.3.2 Additional functions**

**Directional seated valves with additional pressure switches for type BWN 1 and BWH 1 and 2 acc. to section 2.4.3**  
 (Version with return pressure stop is identical)



	a	a <sub>1</sub>	b	c	c <sub>1</sub>
BWN(H) 1	19	57	27	77	62
BWH 2	19	57	20.5	71	56
BWH 3	25	75	35	71	56

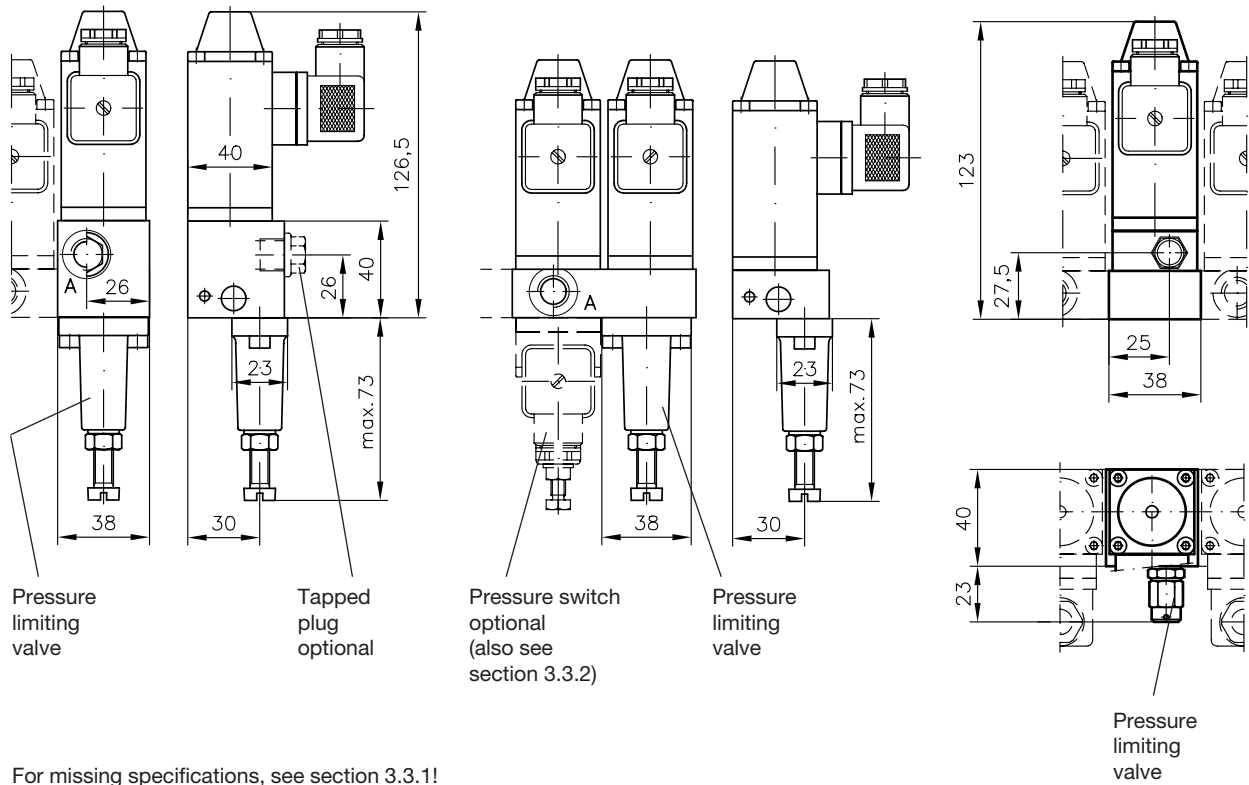
For missing dimensions,  
 see section 3.3.1!

**Directional seated valves with pressure limiting valve for type BWN 1 and BWH 1 acc. to section 2.4.3**

**Coding H(1)/... to R(1)/...**

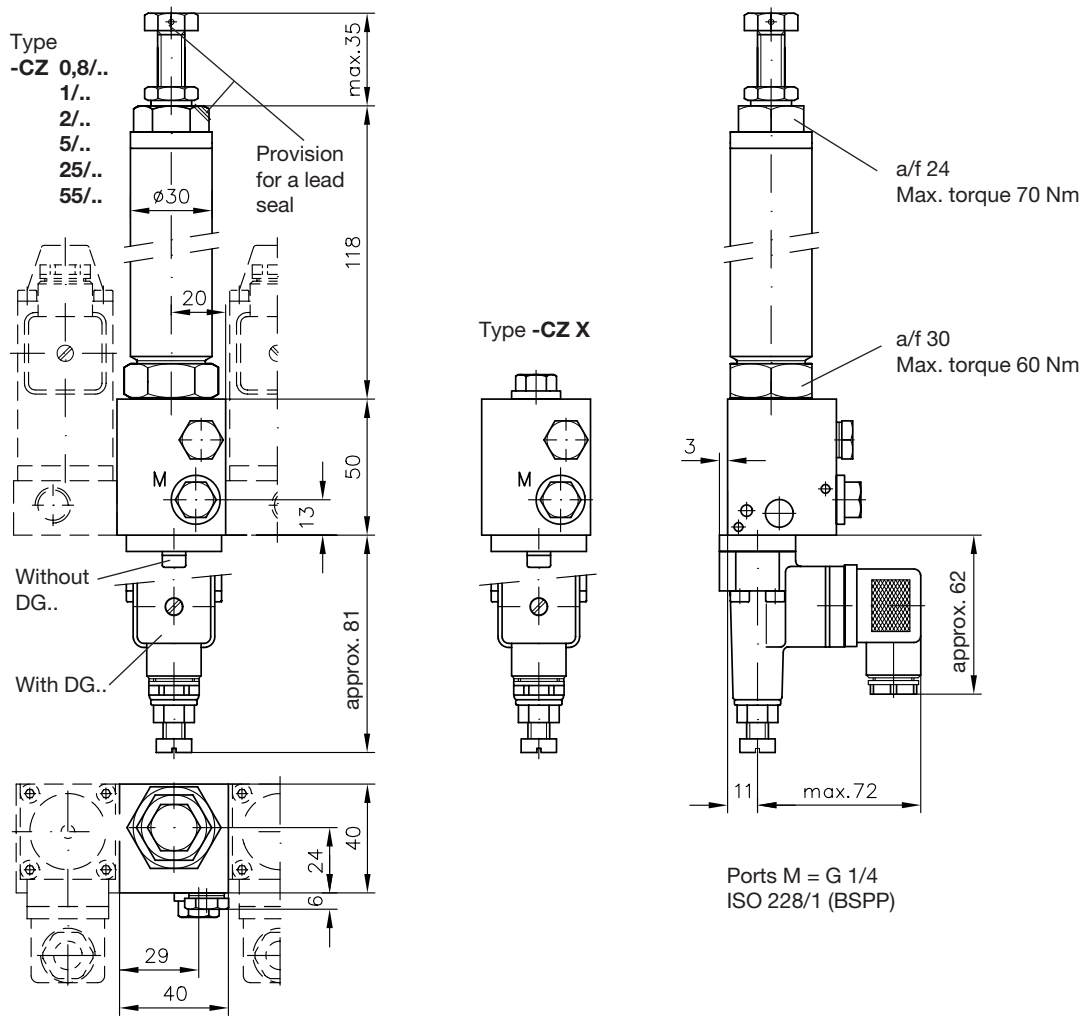
**Coding J(1)/..., U(1)/..., V(1)/...**

**Coding F/... and D/...**

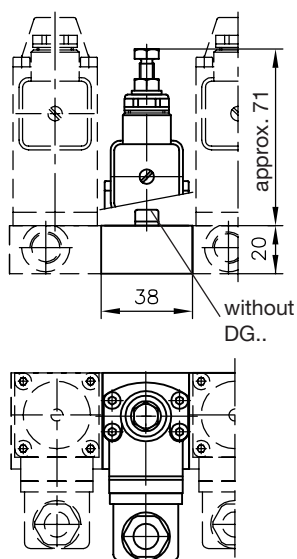


### 3.4 Additional sections acc. to section 2.5

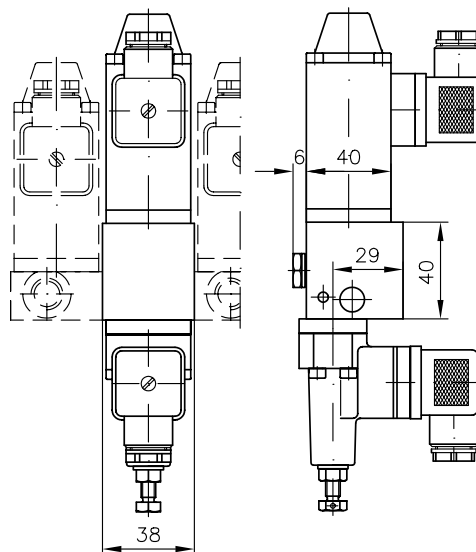
2-way pressure reducing valve type -CZ ...,  
for installation in valve banks BWN 1, BWH 1, and BWH 2 (acc. to section 2.5.1)



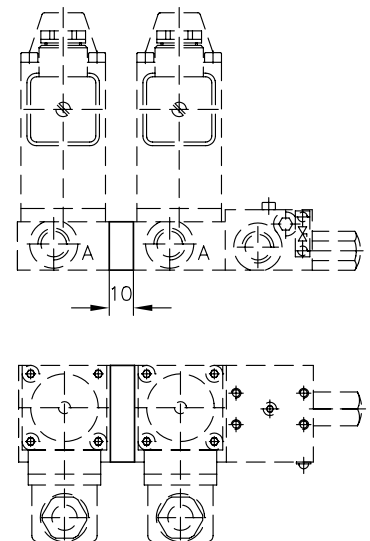
Indiv. sub-plate with pressure switch (acc. to sect. 2.5.2)



Directional seated valve coding H.XX with return pressure stop and pressure switch (acc. to sect. 2.5.3)



Separating plate for gallery P (acc. to section 2.5.4)

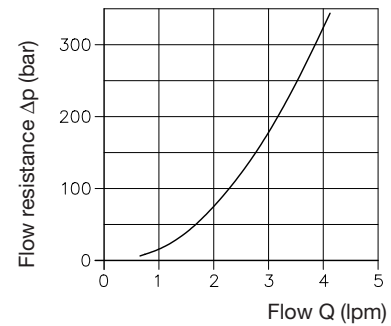
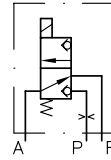


## 4. Additional elements

### 4.1 Orifice inserts (only type BWN 1 and BWH 1!)

When an orifice is required for functional reasons at the entries of valves B, P, I, C, O, Y, H, M, S and T, then it must be stated in uncoded text which valve (coding and position number starting from the connection block) should be fitted with which orifice. Currently available  $\varnothing 0.7$  (for retrofitting order No. 7470 040)

Example: BWN1A-5-FHHJ-1-1-G 24;  
Valve H, section 2 with orifice  $\varnothing 0.7$



### 4.2 Directional valve section

For retrofitting within directional valve banks e.g. instead of the clearance with end plates 11, 12, 21, 22 etc. (sect. 2.3). In case of further extension, a tension rod can be ordered according to the new number of valves.

Order example for valve section: **BWH2 - H - 1 - G 24**

Type code and size acc. to sect. 2.1, table 1

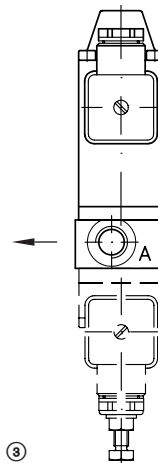
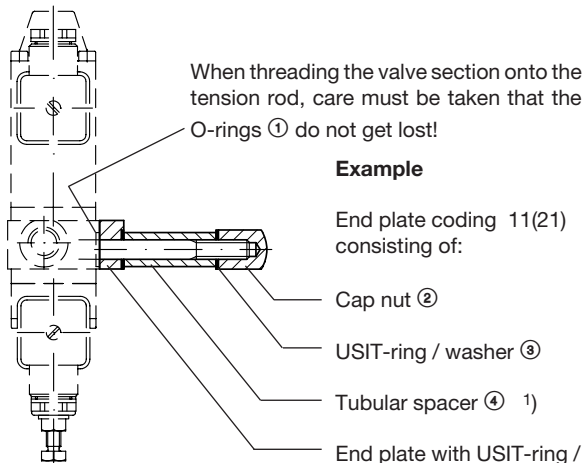
Symbol acc. to sect. 2.4 ++

Nom. voltage acc. to sect. 2.1, table 3

Port acc. to sect. 2.1, table 2

1 = G 1/4 (BWN(H) 1 and BWH 2)

2 = G 3/8 (BWH 3)



#### Valve section to be installed by the customer

Installation directions:

1. Remove cap nut with seals and end plate from the tension rod
2. Thread on valve section
3. Push on end plate with USIT-ring and tighten cap nut with 25 Nm.

One USIT-ring and the tubular spacer will no longer be needed.

	BWN(H) 1	BWH 2	BWH 3
① O-ring NBR 90 Sh	$\varnothing 5 \times 1.5$ and $\varnothing 11 \times 1.5$	$\varnothing 6.07 \times 1.78$	$\varnothing 10.82 \times 1.78$
② Cap nut	HAWE-Nr. 7250 015 Max. torque 20 Nm	ISO 4032-M8-8-A2K Max. torque 40 Nm	ISO 4032-M12-8-A2K Max. torque 80 Nm
③ USIT-ring washer	U8.7x16x1	ISO 7092-8.4-140HV-A2K	ISO 7092-13-140HV-A2K
④ Tubular spacer	HAWE-No. 7250 041	HAWE-No. 7250 041	HAWE-No. 7287 041

1) With end plate coding 12 (22, 332 etc.) two tubular spacers ④ with USIT-ring in between ③

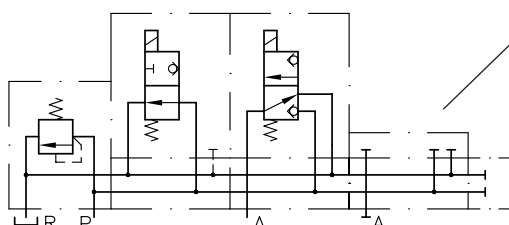
### 4.3 Blanking plate

An already assembled sub-plate with blanking plate can be used instead of a clearance (see sect. 2.3 end plates) for valves to be retrofitted. They can be fitted anywhere within the valve bank. An X is appended to the code letter (section 2.4.1 and 2.4.2) of the directional control valve to be retrofitted. The following are available: HX, MX, NX, RX, BX, CX, EX, QX, PX, OX, YX, IX, SX, TX and AX. A combination with pressure switches acc to sect. 2.4.3 is possible.

Example: BWN1A-1/200-FHHX-1-1-G 24

Not available for directional spool valves W and G. (Coding WX and GX do have a different meaning, see section 2.4.1).

#### Necessary parts:



BWN 1 and BWH 1	BWH 2	BWH 3
1 Blanking plate 7470 057	1 Blanking plate 7586 033 complete	1 Blanking plate 7587 037 complete
3 O-rings 6x1.5 NBR 90 Sh		
4 Screws ISO 4762-M4x16-8.8-A2K		
Height 10 mm	Height 10 mm	Height 12 mm

**4.4 3-way pressure reducing valve for BWN(H) 1 and BWH 2** (Production is running out)

Permissible inlet pressure 300 bar

Order example: BWH 2 A-2/100-HR **Z5** <sup>2)</sup> -HH-1-G 24

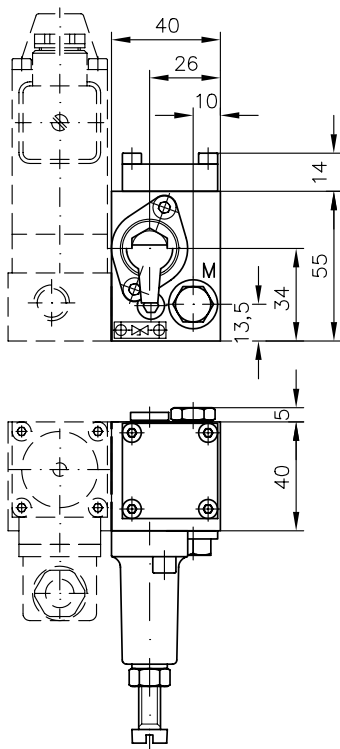
Pressure range (bar) adjustable from ... to <sup>1)</sup>	Standard version		With a 2/2-way seated valve upstream								Vers. Z11 to Z48 with add. pressure switch acc. to D 5440 <sup>3)</sup>
	Tool adjustable	Manually adjustable	Tool adjustable	Manually adjustable	Tool adjustable	Manually adjustable	Tool adjustable	Manually adjustable	Tool adjustable	Manually adjustable	
160 ... 250	<b>Z1</b>	<b>Z5</b>	<b>Z11</b>	<b>Z15</b>	<b>Z21</b>	<b>Z25</b>	<b>Z31</b>	<b>Z35</b>	<b>Z41</b>	<b>Z45</b>	<b>Z114 ... Z484</b> with DG 34 <b>Z115 ... Z485</b> with DG 35 <b>Z116 ... Z486</b> with DG 36 <b>Z1165 ... Z4865</b> with DG 365
60 ... 160	<b>Z2</b>	<b>Z6</b>	<b>Z12</b>	<b>Z16</b>	<b>Z22</b>	<b>Z26</b>	<b>Z32</b>	<b>Z36</b>	<b>Z42</b>	<b>Z46</b>	
30 ... 120	<b>Z3</b>	<b>Z7</b>	<b>Z13</b>	<b>Z17</b>	<b>Z23</b>	<b>Z27</b>	<b>Z33</b>	<b>Z37</b>	<b>Z43</b>	<b>Z47</b>	
10 ... 30	<b>Z4</b>	<b>Z8</b>	<b>Z14</b>	<b>Z18</b>	<b>Z24</b>	<b>Z28</b>	<b>Z34</b>	<b>Z38</b>	<b>Z44</b>	<b>Z48</b>	

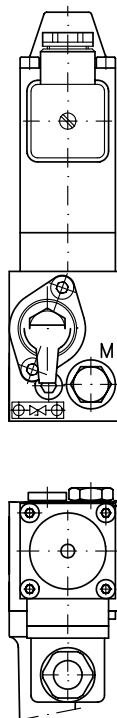
Symbols	Standard version		WN 1 D		WN 1 F		WH 2 D (WH 1 D)		WH 2 F (WH 1 F)		Directional valve acc. to D 7470 A/1
Tool adjustable  Manually adjustable 											

- 1) Set value for secondary pressure (pressure gauge reading) at flow Q = 0 lpm (consumer in end position). The pressure drops a little if pressurised oil flows to the consumer.
- 2) As single unit for own storage, replacement, etc. order code is:  
 BWN 1 and BWH 1: ADZ1-Z1 (to Z28; resp. Z114 to Z2865) - G12(24) or ...- WG 230  
 BWH 2: ADZ2-Z1 (to Z8; Z31 to Z48 resp. Z314 to Z4865) - G12(24) or ...- WG 230, see above
- 3) Only for type BWN(H) 1  
 For adjustment ranges see above. 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 the permanent on/off switching of the pump being controlled by the DG...

**Type Z1 to Z8**

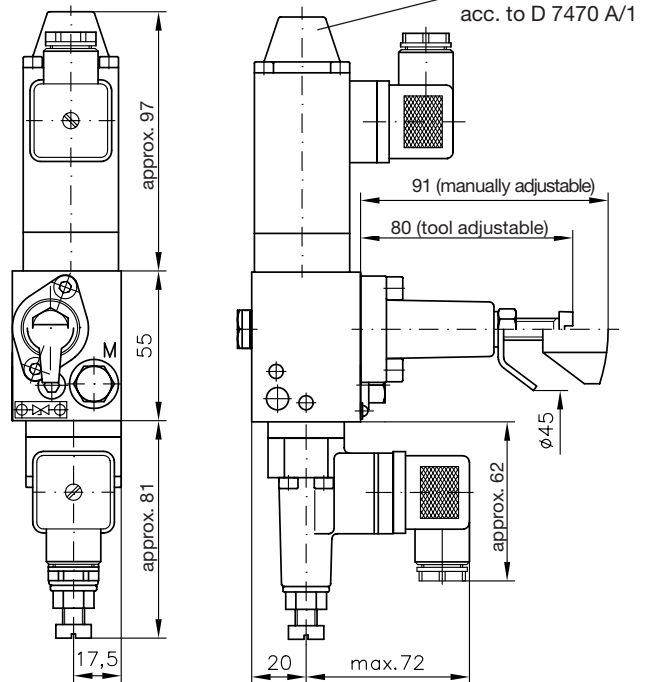


**Type Z11 to Z28**



Ports M = G 1/4  
ISO 228/1 (BSPP)

**Type Z114 to Z2865**



## 5. Appendix

### 5.1 Connection block with proportional-pressure limiting valve type AP

Proportional pressure limiting valves type PMVP 4 (acc. to D 7485/1) are utilized here, for control characteristic etc. see D 7485/1. The electric control requires a prop. amplifier e.g. EV1M2 acc. to D 7831/1 or EV1G1 acc. to D 7837.

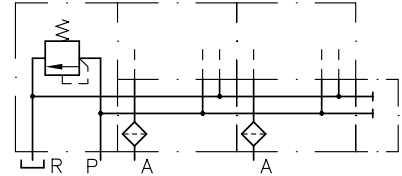
Available output voltage 12 V DC or 24 V DC, this voltage is usually identical to the solenoid voltage of the directional valves. Otherwise this has to be stated in the order coding.

The minimal pressure setting is 5 bar due to functional reasons (control of the piloting section). This min. figure may be raised via a set screw.

Order example: BWH 1 AP - 13 - 43/420 - HH - 1 - 1 - G24

### 5.2 Fitted screen filters as standard

To prevent sudden disturbance caused by coarse contaminations that may occasionally be carried along in the oil (such as torn off particles of tubing, packing, scale, swarf) directional seated valves are fitted with screen filter elements 0.25 mm mesh width in the ports P and A. The directional spool valves cannot be fitted in the housing with these filter elements because of the port design, but they are less sensitive to the contaminations mentioned above.

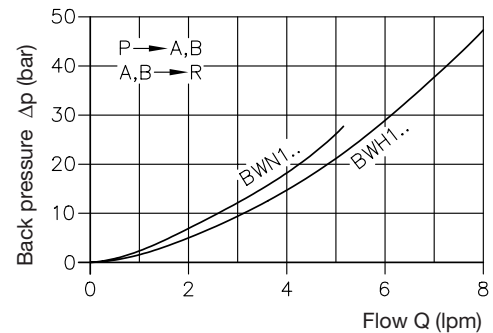


These screen filter elements should not be seen as a replacement for the usual hydraulic filters. In practice, however, they provide sufficient protection against malfunctions in small hydraulic systems. When such malfunctions should occur, the filter elements should be checked first. For the sake of simplicity, the filter elements are not explicitly shown in the diagrams.

### 5.3 Release ratios with spool valve (for type BWN 1 and BWH 1)

Max. flow	Approx. 5 lpm (BWN 1) Approx. 8 lpm (BWH 1)
Control pressure $p_{St}$	Min. pressure in the P duct (guideline) For releasing $p_{St} = a \cdot p_{A(B)} + 6$ (bar) For keeping open $p_{St} = \Delta p_{A(B) \rightarrow R} + \Delta p_R + 10$ (bar)
$a = \frac{1}{2.67}$	Release ratio
$p_{A(B)}$	Pressure at port A(B) in closed state
$\Delta p_{A(B) \rightarrow R}$	See $\Delta p$ -Q-curves
$\Delta p_R$	When flow resistance occurs from the valve to the tank

$\Delta p / Q$ -curves



Oil viscosity during measur. approx. 60 mm<sup>2</sup>/s

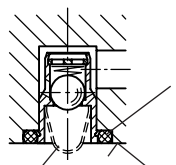
There is also a release ratio of 1:3.8 available. Indicate in uncoded text, if this is required.

Example: BWH1 A-5-HKR-1-1-G 24 valve K with release ratio 1:3.8

### 5.4 Installation instruction

#### 5.4.1 Check valve insert EK 01

Only for WN 1 type valves coding Q and N acc. to sect. 2.4.1



Screen filter (sect. 5.2) Installation side

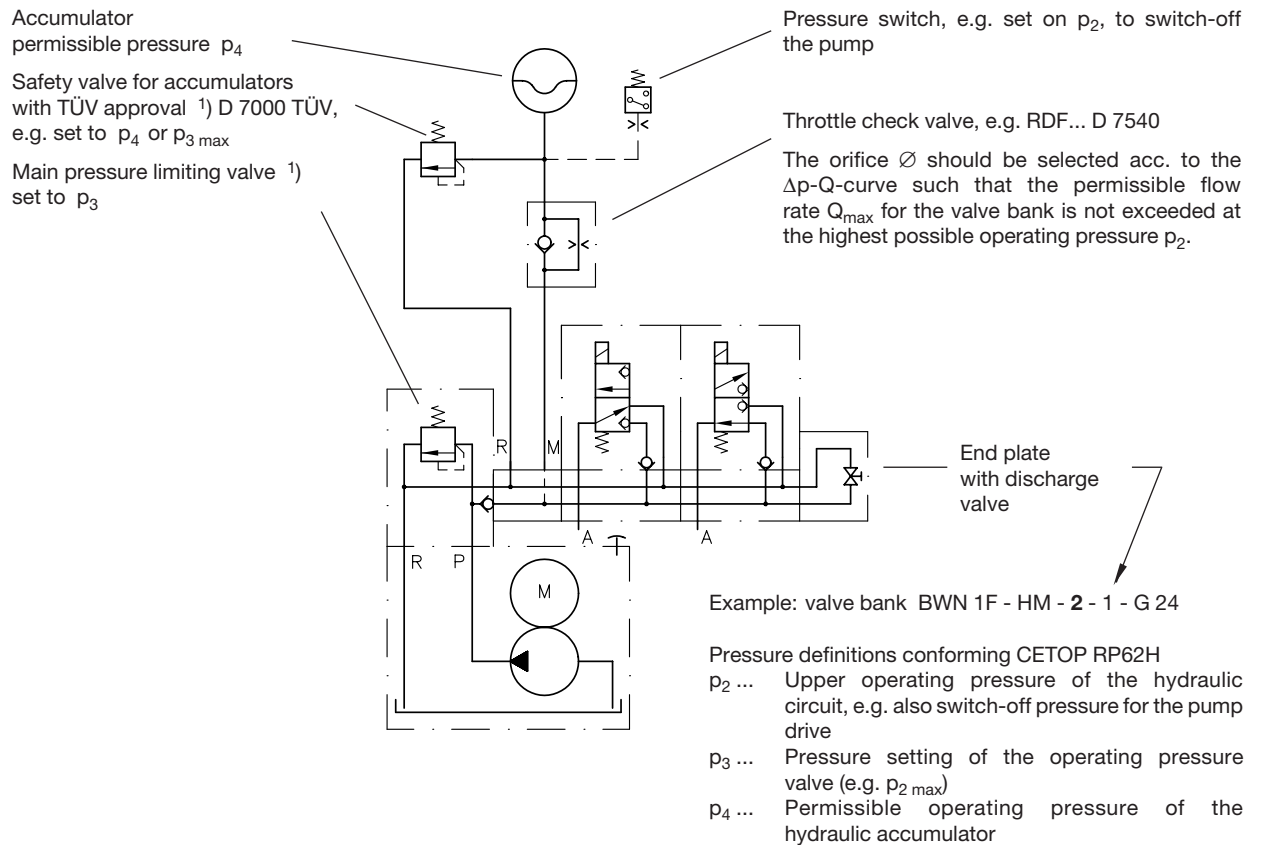
Due to the O-ring's elasticity, the check valve may move and protrude a few tenths of a millimetre before being bolted to the sub-plate. If the valve WN 1 is filled with oil (e.g. due to functional test on a test rig previously), tightening of the bolts may cause a compression of the trapped oil due to the check valve being forced in. The resulting pressure would exceed the one at which the solenoid is still able to actuate. While tightening the mounting screws, it is therefore advisable to press either the manual emergency actuation (D 7470 A/1, see sect. 4.1) or energise the solenoid via the valve. This problem cannot occur with WH 1 type valves due to the hydraulic relief.

#### 5.4.2 Solenoid heat built-up

Directional valve banks slightly reduce the heat dissipation to the surroundings because of the small distance between neighbouring valve solenoids. It is therefore advisable to locate at least one unactuated valve between valves actuated simultaneously or for longer periods. Otherwise neighbouring valves would hinder heat dissipation and heat each other up. This rule should be obeyed, if the duty cycle of the valves is above 60% ED.

If this is not possible it is recommended to use economy circuits acc. to D 7813, D 7832, D 7833.

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



<sup>1)</sup> The unit approved accumulator safety valve secures the hydraulic accumulator against unpermissible excess pressure. Supplied with fixed pressure setting and lead seal e.g. at the highest permissible accumulator pressure  $p_4$  or a pressure  $p_{3 \max}$  that is still permissible for the hydraulic system. The adjustable limit for the max. operating pressure  $p_2$  or  $p_{2 \max}$  intended for the hydraulic system is normally achieved by the operating 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).

## 5.6 Combination of directional valves of type BWN 1 with BWH 1

A combination of these two basic types is possible, but the permissible operation pressure for the respective basic type and flow pattern symbol have to be taken into account.

Order examples:

- One or several WH valves **within** a BWN valve bank  
BWN/**H**1A-5 - MR/**NQ**/HT -1-1-G 24
- One or several WH valves at the **end** of a BWN valve bank  
BWN/**H**1A-1/120 - MRHT/**NN** -1-1-WG 230
- One or several WN valves at the **end** of a BWH valve bank (it is then regarded as a valve bank type BWH).  
BWH/**N**1A-2/220 - NJ/**HH** -1-1-G 24
- One or several WN valves together with an upstream located -CZ.../... (sect. 2.5) at the **end** of a BWH valve bank  
BWH/**N**1A-1/300 - HR/**CZ 2/180 HM** -1-1-G 24.  
CZ.../... is then regarded as part of the WN part of the valve bank, therefore its coding is located after the slash.  
Observe the permissible inlet pressure, see section 2.5 !

## 6. Mass (weight) approx. in kg, individual elements

### Connection blocks acc. to section 2.2

Coding	A1/.. to A4/..	5	F	F1	C	D	K	P	AP...
BWN(H) 1	0.4	0.2	0.4	0.5	0.5	---	0.5	0.6	1.3
BWH 2	0.5	0.5	0.4	---	0.5	---	0.6	0.6	---
BWH 3	0.8	0.5	0.8	---	---	0.8	---	---	---

### End plates acc. to section 2.3

Coding	1 a. 2	11	12, 21 and 22	33 to 365	3../3..	42	43 to 465	4../3..	52	53 to 565	with pressure limiting valve 53.. - MVP(X)4E/...
BWN(H) 1	0.1	0.1	0.2	0.5	0.8	0.3	0.6	0.9	0.4	0.8	1.0 (1.3 with DG)
BWH 2	0.1	0.2	0.2	---	---	---	---	---	---	---	---
BWH 3	0.3	0.5	---	---	---	---	---	---	---	---	---

### Directional seated valves acc. to section 2.4.1, 2.4.2 and 2.4.3

Coding	acc. to section 2.4.1 a. 2.4.2. <b>Note:</b> B1, C1 etc. identical						acc. to section 2.4.3 (additional elements )				
	A	B, C, D, E, F, H, M, N, O, P, Q, R	J and U	Y and I	W and WX	K	with pressure switch with 1 DG   with 2 DG		with pressure limiting valve H(1)/..; M(1)/.. N(1)/..; R(1)/.. J/..; J1/.. U/..; U1/..		
BWN(H) 1	0.9	0.8	1.6	1.0	1.0	2.0	+ 0.3	+ 0.6	1.1	1.7 (2.0 with DG)	
BWH 2	1.0	0.9	1.8	---	---	---	+ 0.3	+ 0.6	---	---	
BWH 3	2.0	1.9	3.5	---	---	---	+ 0.3	+ 0.6	---	---	

### Pressure reducing valves acc. to section 2.5.1 and 4.4

Coding	- CZ X - LZ X	- CZ ... - LZ ...	Z1 to Z8	Z11 to Z48	Z114 to Z4865
BWN(H) 1	0.5 (0.7) <sup>1)</sup>	1.2 (1.4) <sup>1)</sup>	0.9	1.5	1.8
BWH 2	---	---	0.9	1.5	1.8

<sup>1)</sup> Figures in brackets  
= with DG

### Additional elements

Coding	Directional seated valve with pressure limiting valve (sect. 2.4.3)	Sub-plate with DG (sect. 2.5.2)	Directional seated valve with return pressure stop and DG (sect. 2.5.3) H6(7, 8)XX	Separation plate (sect. 2.5.4) X	Blanking plate (sect. 4.3)
BWN(H) 1	1.3	0.4	1.3	0.1	0.1

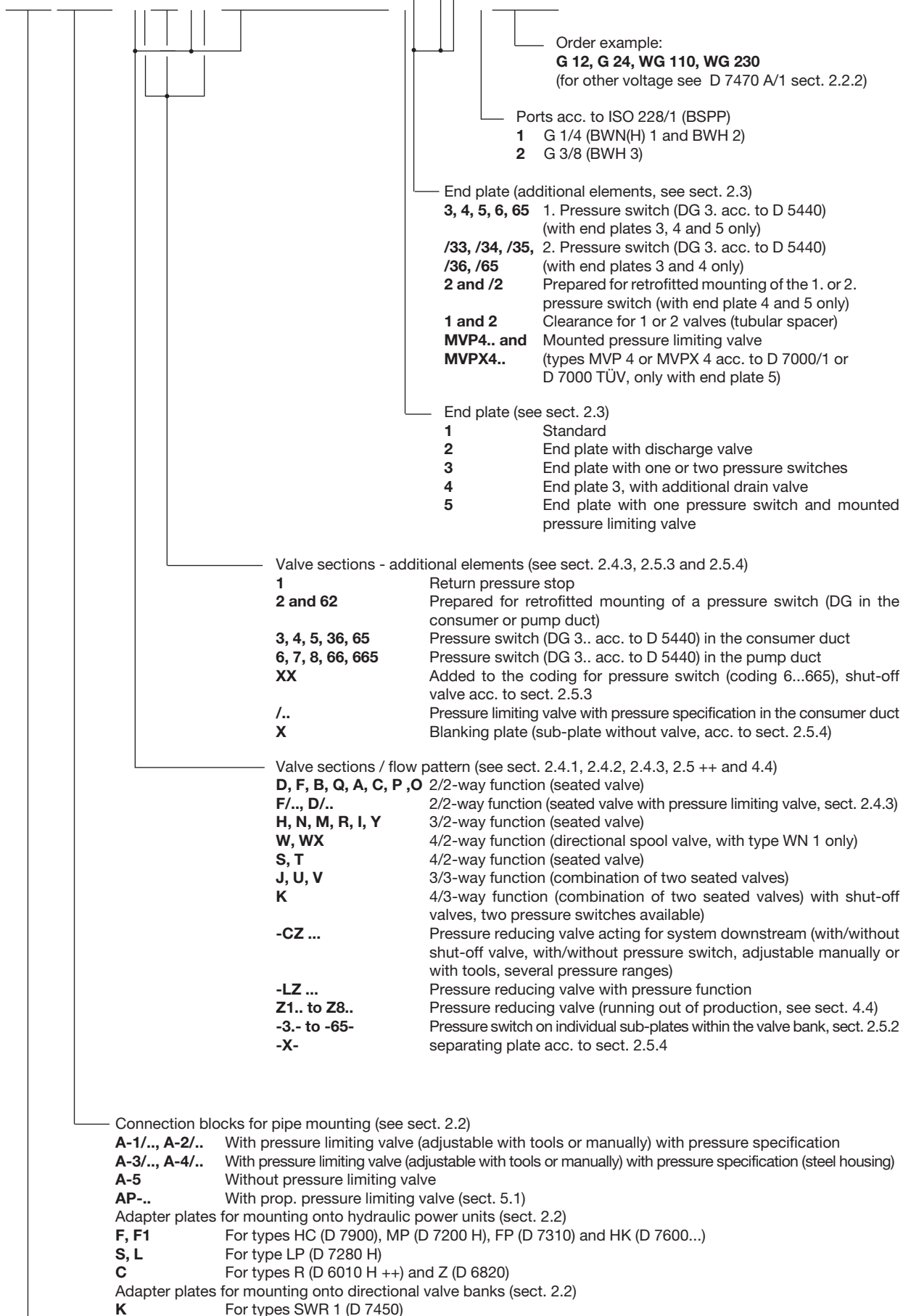


## 7. Type over view

Order example:

**BWN1 A-1/300 - H1/250 M3 - CZ1/180/5R/4 - WX - 33 / 652 - 1 - G 24**

**BWH2 F - J4/250 N3 HHRH - 1 - 1 - WG 230**



Basic type coding and size (see sect. 2.1 table 1)

**BWN 1, BWH 1, BWH 2, BWH 3** (size 1, 2 and 3)

Only size 1: Combination types available BWH/N 1 or BWN/H 1 (see sect. 5.6)