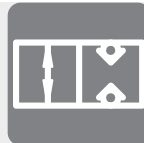


Directional seated valve type EM and EMP

Product documentation



Operating pressure p_{\max} : 450 bar
Flow rate Q_{\max} : 160 lpm



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

The directional seated valves type EM and EMP are screw-in valves. 2/2-way directional seated valves with direct or pilot-controlled electromagnetic actuation are available. The directional seated valve type EM is available as a directional. Type EMP is a proportionally switching directional seated valve. Appropriate connection blocks make possible direct pipe connection or manifold mounting. You can obtain additional components, e.g. a drain valve, bypass throttle valve, pressure switch or flow control valve.

Features and benefits:

- Zero leakage in blocked state
- Directly switching up to approx. 3 lpm and piloted up to 160 lpm
- Minimized flow resistance even at high flow rate
- Long lifetime due to hardened valve seats

Intended applications:

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

*Cartridge valve**Screw-in valve with individual connection block*

2 Available versions, main data

2.1 directional seated valves, directional valve

Symbol:



Order example:

EM 21 S	- AMP 24	- M	- AT
EM 32 V	- 3/4 F	- G 24	

Seal spec. Table 5 Seal spec.

Function lock Table 1a Mechanical function block of the valve

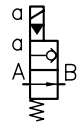
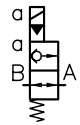
Actuation solenoid Table 4 Actuation solenoid

Single connection block Single connection block [Chapter 2.4, "Single connection blocks"](#)

Basic type und size Table 1 Basic type und size

Table 1 Basic type and size

Basic type and size	Note	Volumetric flow Q_p (lpm)	Pressure p_{max} (bar)	Volumetric flow direction	Symbol
EM 11 D EM 11 D 0,8 EM 11 D 1,2 EM 21 D	Non-piloted ▪ For piloting applications	1 2.5 5 3	450 150 60 400	A → B B → A = inadmissible	
EM 11 V EM 21 V EM 31 V EM 41 V	Piloted	20 40 80 160	400 400 400 350	A → B B → A = Free volumetric flow, solenoid must be deenergized	
EM 12 V EM 22 V EM 32 V EM 42 V	Piloted	20 40 80 160	400 400 400 350	Any	
EM 11 DS EM 11 DS 0,8 EM 21 DS	Non-piloted ▪ For piloting applications	1 2.5 3	450 150 400	A → B B → A = inadmissible	

Basic type and size	Note	Volumetric flow rate Q_p (lpm)	Pressure p_{max} (bar)	Volumetric flow direction	Circuit symbol
EM 11 S	pilot-controlled shifting <ul style="list-style-type: none"> with manual override, not displayed additionally Type ..ST with button for emergency 	20	400	A → B	
EM 11 ST		20	400	B → A = not permitted	
EM 21 S		40	400		
EM 21 ST		40	400		
EM 31 S		80	400		
EM 31 ST		80	400		
EM 41 S		160	350		
EM 12 S	actuation (see Chapter 4, "Dimensions")	20	400	as desired	
EM 12 ST		20	400		
EM 22 S		40	400		
EM 22 ST		40	400		
EM 32 S		80	400		
EM 42 S		160	350		



Note

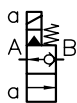
- Maximal permissible pressure only with basic blocks made of steel.
- If other materials have been used (e.g. cast iron, aluminium), pay attention to the potentially reduced strength of the thread.

Table 1a Function lock (e.g. for emergency- or initial operation)

Coding	Description
Without	No function lock (std.) but incl. manual emergency actuation
M	Winged nut (fixed laterally via lead seal) Available with type EM 11 DS, EM 21 DS, EM 1. S and EM 2. S!

2.2 Directional seated valve, soft-shift

Symbol:



Order example:

EMP 21 VG 10		- WG 230
EMP 31 SG	- 3/4	- G 24

Actuation solenoid Table 4 Actuation solenoid

Single connection blocks Table 6a Single connection blocks

Basic type and size Table 2 Basic type and size, soft-shift

Table 2 Basic type and size

Basic type and size	Note	Flow Q_p (lpm)	Pressure p_{max} (bar)	Flow direction	Symbol
EMP 21 VG EMP 21 VG 10 EMP 21 VG 15 EMP 21 VG 20 EMP 31 VG EMP 41 VG	Piloted <ul style="list-style-type: none"> Typ .VG 10(20) with customized throttling characteristic (see curves, Chapter 3, "Parameters") 	40 40 40 40 80 160	400 400 400 400 400 350	A → B B → A = Free flow, solenoid must be deenergized	
EMP 21 SG EMP 21 SG 10 EMP 21 SG 20 EMP 31 SG	Piloted <ul style="list-style-type: none"> With manual emergency actuation (not detailed) Typ .SG 10(20) with customized throttling characteristic, (see curves, Chapter 3, "Parameters") 	40 40 40 80	400 400 400 350	A → B B → A = inadmissible	

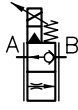


Note

- Maximal permissible pressure only with basic blocks made of steel.
- If other materials have been used (e.g. cast iron, aluminium), pay attention to the potentially reduced strength of the thread.

2.3 Proportional directional seated valve, proportional throttle

Symbol:



Order example:

EMP 21 S 20		- AMP 24	
EMP 31 V	- 1/4	- G 24	- M

Function lock Table 1a Function lock

Actuation solenoid Table 4 Actuation solenoid

Single connection blocks Table 6a Single connection blocks

Basic type and size Table 3 Basic type and size, proportional

Table 3 Basic type and size

Basic type and size	Note	Volumetric flow Q_p (lpm)	Pressure p_{max} (bar)	Volumetric flow direction	Symbol
EMP 21 V	Piloted	40	400	A → B	
EMP 21 V 10	<ul style="list-style-type: none"> Typ ..V 10(20,80) with customized throttling characteristic (see curves, Chapter 3, "Parameters") Type ..VH with stroke limitation 	40	400	B → A = Free volumetric flow, solenoid must be deenergized	
EMP 21 V 15		40	400		
EMP 21 V 20		40	400		
EMP 21 VH		40	400		
EMP 31 V		80	400		
EMP 31 V 70		70	400		
EMP 31 V 80		80	400		
EMP 31 V 100		100	400		
EMP 41 V		160	350		
EMP 21 S	Piloted	40	400	A → B	
EMP 21 S 10	<ul style="list-style-type: none"> With manual emergency actuation (not detailed) (see curves, Chapter 3, "Parameters") 	40	400	B → A = not permitted	
EMP 21 S 20		40	400		
EMP 31 S		80	400		

Note

- Maximal permissible pressure only with basic blocks made of steel.
- If other materials have been used (e.g. cast iron, aluminium), pay attention to the potentially reduced strength of the thread.

Note

A proportional amplifier is mandatory for this valve type. For recommended components, see [Chapter 5.4, "Maintenance information"](#)

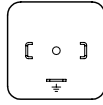
Table 4 Actuating solenoid

Coding	Electrical connection	Nominal voltage	Protection class (IEC 60529)	EM 1 EM 2 EM 3	EMP 2 EMP 3 EM 4	EMP 4
X 12	DIN EN 175 301-803 A (Coding G... with line connector, coding L... with LED plug) Coding WG with alternating rectifier in line connector	12 V DC	IP 65	●	●	●
X 24		24 V DC		●	●	●
X 48		48 V DC		●	●	
X 98		98 V DC		●	●	
X 205		205 V DC		●	●	
WG 110		110 V AC 50/60 Hz		●	●	
WG 230	Coding WG with alternating rectifier in line connector	230 V AC 50/60 Hz		●		
AMP 12	AMP Junior Timer	12 V DC	IP 65	●	●	●
AMP 24		24 V DC		●	●	●
AMP 48		48 V DC		●	●	●
DT 12	DEUTSCH (DT 04-2P)	12 V DC	IP 69 K	●	●	
DT 24		24 V DC		●	●	
K 12	KOSTAL (M27x1)	12 V DC	IP 67	●	●	
K 24		24 V DC		●	●	
S 12	SCHLEMMER (bayonet PA 6)	12 V DC	IP 67	●	●	
S 24		24 V DC		●	●	
M 24	M12x1	24 V DC	IP 67		●	
F 24	Free cable ends 600 mm	24 V DC	IP 69 K		●	
ITT 24	MIL-VG 95234	24 V DC	IP 67	●		
DTL 24	MIL-DTL-38999 series III	24 V DC	IP 67	●		

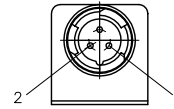
Electrical connection Actuation solenoid

Connection pattern

G .., X.., L .. (WG)



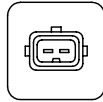
S ..



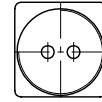
DT ..



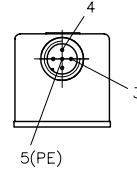
AMP ..



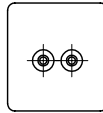
K ..



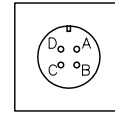
M ..



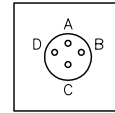
F ..



ITT ..



DTL ..



The specifications regarding the IP protection class apply for versions featuring a properly assembled male connector.

Table 5 Seal specification, for fluid exposed seals

Coding	Note
Without	Standard, fluid seals made of NBR or AU, e.g. suited for mineral oil and synth. Ester HEES
PYD	Fluid seals made of FKM
AT	Fluid seals made of EPDM, e.g. suited for glycol based brake fluid (DOT4)

i Note

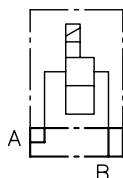
For the seal specification coding -PYD and -AT, the maximum operating pressure is limited to 250 bar.

2.4 Single connection blocks

Suited for direct pipe connection of manifold mounting

2.4.1 Single connection blocks with and without drain valve

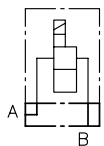
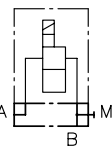
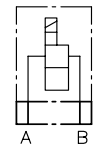
Symbol:



Order example:

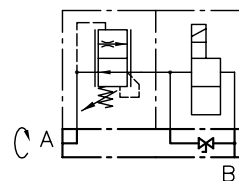
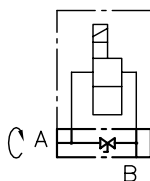
EMP 21 S	- 1/4	- G 24	
		Actuation solenoid	Table 4 Actuation solenoid
		Single connection blocks	Table 6 Single connection blocks
Basic type and size	Basic type and size acc. to table 1, 2, 3		

Table 6 Single connection blocks

Coding	Description	Symbol	Ports (BSPP) A, B	Basic type					
				EM 11 D EM 11 DS	EM 1. V EM 1. S	EM 21 D EM 21 DS	EM 2. V EM 2. S EMP 2. V EMP 2. S	EM 3. V EM 3. S EMP 3. V EMP 3. S	EM 4. V EM 4. S EMP 4. V
1/4	For pipe connection		G 1/4	•	•	•			
3/8			G 3/8		•		•		
1/2			G 1/2				•	•	
3/4			G 3/4					•	•
1			G 1						•
1 5/16-12 UN					1 5/16-12UN-2B				
1/4 A	For pipe connection with (accumulator) discharge valve		G 1/4		•				
3/8 A			G 3/8		•		•		
1/2 A			G 1/2				•	•	
3/4 A			G 3/4					•	•
1 A			G 1						•
3/8 N 0,8	For pipe connection with manual bypass valve		G 3/8				•		
3/8 N 1,5			G 3/8				•		
P	For manifold mounting		--			•		•	

2.4.2 Connection block with additional functions

Symbol:



Order example:

EM 21V	- 1/2 F	- K 12
EM 11S	- 3/8 F - SB15H	- G 24
EM 11V	- 1/4 D	- K 12
EM 11S	- 3/8 DG 35	- G 24
EM 21S	- 3/8 SJ 07 C-6	- AMP 24

Actuation solenoid Table 4 Actuation solenoid

Single connection blocks Table 7 Single connection blocks

Basic type and size Basic type and size acc. to table 1, 2, 3

Table 7 Single connection blocks

Coding	Description	Symbol	Ports (BSPP)		Basich type		
			A, F	B	EM 1. V EM 1. S	EM. 2. V EM. 2. S	EM. 3. V EM. 3. S
3/8 F	Swivel fitting with drain valve (accumulator drain valve)		G 3/8 A	G 3/8	●		
16 F			M16x1,5	G 3/8	●		
1/2 F			G 1/2 A	G 1/2		●	
3/4 F			G 3/4 A	G 3/4			●
3/8 F - SB 1 . H -..	Swivel fitting, drop-rate braking valve according to D 6920 and drain valve; for details, see Table 7a		G 3/8 A	G 3/8	●		
1/2 F - SB 2 . H -..			G 1/2 A	G 1/2		●	
Note $p_{max} = 315 \text{ bar}$							
1/4 D	With bypass throttle		G 1/4	G 1/4	●		
3/8 D			G 3/8	G 3/8		●	
3/8 DG ..	With pressure switch according to D 5440 ; for details, see Table 7b		G 3/8	G 3/8	●		
3/8 SJ 0. C..	With load-independent flow rate limitation in direction B → F with type SJ flow control valves according to D 7395 ; for details, see Table 7c		G 3/8	G 3/8		●	
Note $p_{max} = 315 \text{ bar}$							

1/2 F - SB 2 . H- ..

Desired flow setting Table 7a Coding for flow setting
 Flow setting Table 7a Coding for flow setting

Table 7a Coding for flow setting

Coding	Adjustment range (lpm)	
	SB 1.	SB 2.
1	2.5 ... 4	16 ... 21
2	4 ... 6.3	21 ... 28.5
5	6.3 ... 10	28 ... 37
7	10 ... 16	37 ... 50
9	16 ... 25	50 ... 57
90	25 ... 35	--

3/8 DG ..

Pressure range Table 7b Pressure range coding

Table 7b Pressure range coding

Coding	Adjustment range (bar)
33	200 ... 700
34	100 ... 400
35	20 ... 250
36	4 ... 12
64	4 ... 50
365	12 ... 170

3/8 SJ 0. . C- ..

Desired flow setting Table 7c Coding for flow setting
 Flow setting Table 7c Coding for flow setting

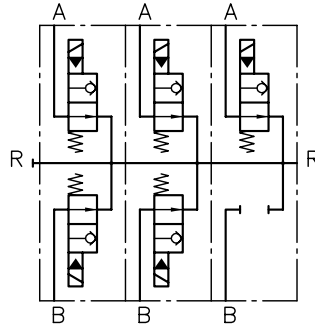
Table 7c Coding for flow setting

Coding	Adjustment range (lpm)
1	1.0 ... 1.6
3	1.6 ... 2.5
5	2.5 ... 4.0
7	4.0 ... 6.4
9	6.4 ... 10.0
90	10.0 ... 15.0

2.5 Valve combinations

2.5.1 Valve banks type BEM

Symbol:



Order example:

BEM 11 - SS/SS/S - 1/4 - G 12

Actuation solenoid Table 11 Actuation solenoid

Ports Table 10 Ports

Valve section Table 9 Valve section

Basic type and size Table 8 Basic type and size

Table 8 Basic type and size

Basic type	Flow rate Q_{\max} (lpm)	Pressure p_{\max} (bar)
BEM 11	20	400

Table 9 Valve section (max. 10 valve sections can be combined)

Coding	Description	Circuit symbol	
SS VV SV VS	Twin valve (first letter port A, second letter port B) S-N/O contact, type EM 11 S V-N/C contact, type EM 11 V	VV 	SS
S V	Single valve (B side sealed)	V 	S

Table 10 Threaded connection

	Port (BSPP)
A B R	G 1/4

Table 11 Actuating solenoid

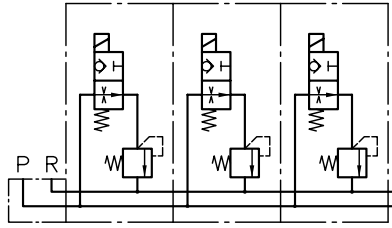
Coding	Electrical connection	Nominal voltage	Protection class (IEC 60529)
X 12	DIN EN 175 301-803 A	12 V DC	IP 65
X 24	(Coding G... with line connector, coding L... with LED plug)	24 V DC	


Note

Compared to the series valves (laterally flattened), solenoids are used (also see [Chapter 5, "Assembly, operation and maintenance recommendations"](#))

2.5.2 Valve bank type BEMD 21

Symbol:



Order example:

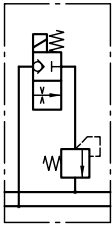
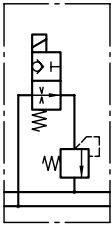
BEMD 21	- DS 80	/ DS 140	/ DS 180	- G 24
				Actuation solenoid Table 4 Actuation solenoid
				Valve section, Pressure setting (bar)
				Valve section, Pressure setting (bar)
				Valve section, Pressure setting (bar) Table 13 Valve section
				Basic type and size Table 12 Basic type and size

Table 12 Basic type and size

Basic type	volumetric flow Q_{max} (lpm)	Pressure p_{max} (bar)
BEMD 21	3	400

Table 13 Valve section (max. 10 valve sections can be combined)

Coding	Description	Symbol
D	NC-valve, type EM 21 D	D
DS	NO-valve, type EM 21 DS	DS

3 Parameters

3.1 General

General information

Description	2/2-Directional seated valve
Design	Conical seat design
Design	Cartridge valve
Material	Steel; zinc-nickel coated valve housing, hardened and ground functional inner parts
Torque	see Chapter 4, "Dimensions"
Installation position	Any
Ports	A, P - input (pump or primary side) B - consumer (secondary side) R - reflux, tank
volumetric flow direction	Depending on type see Chapter 2, "Available versions, main data"
Hydraulic fluid	Hydraulic oil: according to part 1 to 3; ISO VG 10 to 68 according to DIN 51519 Viscosity range: min. approx. 4, max. approx. 1500 mm ² /s Optimal operation range: approx. 10 to 300 mm ² /s Also suitable are biologically degradable pressure fluids types HEPG (Poly-alkylenglycol) and HEES (Synth. Ester) at service temperatures up to approx. +70°C. Not suitable for water-based fluids and native oils (HETG).
cleanliness level	ISO 4406 <hr/> 20/17/14...18/15/12
Temperature	Ambient: approx. -40 ... +80°C, Fluid: -25 ... +80°C, Note the viscosity range! Permissible temperature during start: -40°C (observe start-viscosity!), as long as the service temperature is at least 20K higher for the following operation. Biologically degradable pressure fluids: Observe manufacturer's specifications. By consideration of the compatibility with seal material not over +70°C.

i Note
Observe the limitation with regard to the permissible switch-on duration of the solenoid in [Chapter 3, "Parameters"](#).

Pressure and volumetric flow

Operating pressure	$p_{\max} = 450 \text{ bar}$ (for limitation, see Table 1, 2, 3) Chapter 2, "Available versions, main data" ; for type EM..V: $p_{\min} = 2 \text{ bar}$
Static overload nominal volume	$2x P_{\max}$
volumetric flow	In accordance with type and size (table 1, 2, 3)

Weight

Screw-in valves

Type

EM 1	= 0.3 kg
EM 2, EMP 2	= 0.35 kg
EM 3, EMP 3	= 0.4 kg
EM 4	= 0.6 kg
EMP 4	= 0.7 kg

Weight

Single connection blocks

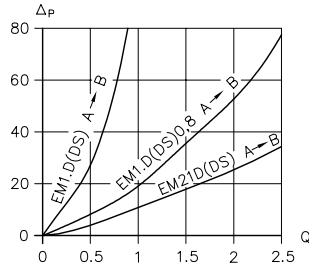
Type	
EM 11 D..	= 0.3 kg
EM 11 DS..	
EM 1. V(S)	= 0.3 kg
EM 21 D(DS)	= 0.45 kg
EM 2. V(S)	= 0.35 kg
EMP 2. V.(S.)	
EM 3. V(S)	= 0.45 kg
EMP 3. V.(S.)	
EM 4. V(S)	= 0.6 kg
EMP 4. V.(S.)	= 0.7 kg
EM 1. V(S)	= 0.3 kg
EM 2. V..(S..)	= 0.4 kg
EMP 2. V..(S..)	
EM 3. V..(S..)	= 0.5 kg
EMP 3. V..(S..)	
EM 4. V(S)	= 0.6 kg
EM 2. V..(S..)	= 0.4 kg
EMP 2. V..(S..)	
EM 21 D(DS) - P	= 0.3 kg
EM(P) 3. - P	= 0.6 kg
EM 1.. - 3/8 F	= 1.0 kg
EM 1.. - 3/8 F - SB1..	
EM 1.. - 16 F	
EM(P) 2.. - 1/2 F	= 1.3 kg
EM(P) 2.. - 1/2 F - SB2..	= 1.4 kg
EM(P) 3.. - 3/4 F	= 1.7 kg
EM 1.. - 1/4 D	= 0.7 kg
EM 2.. - 3/8 D	= 0.9 kg
EMP 2.. - 3/8 D	
EM 2.. - 3/8 - SJ 0..	= 0.9 kg
EMP 2.. - 3/8 - SJ 0..	
EM 1.. - 3/8 DG	= 0.9 kg

Oil viscosity approx. 60 mm²/s

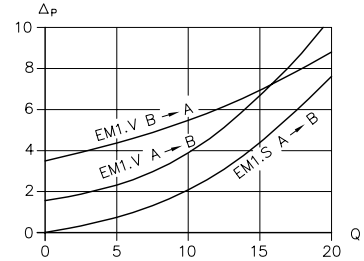
Δp -Q-Curves

A→B EM(P)...V energized solenoid

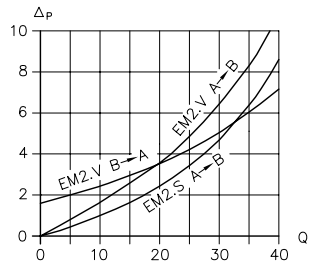
EM 11 D(S)..; EM 21 D(S); EM(P)...S solenoid, de-energised



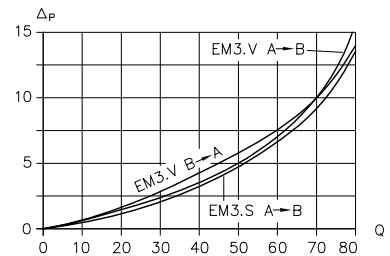
Q volumetric flow (lpm); Δp Back pressure (bar)



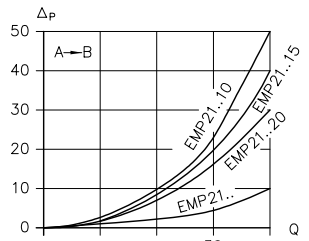
Q flow rate (lpm); Δp flow resistance (bar) ¹⁾



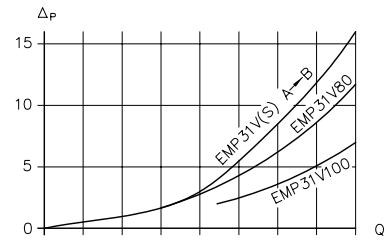
Q flow rate (lpm); Δp flow resistance (bar) ¹⁾



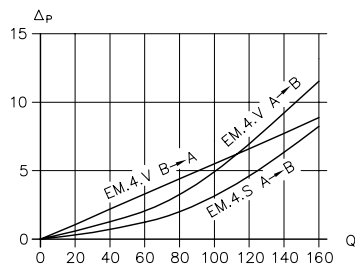
Q flow rate (lpm); Δp flow resistance (bar)



Q flow rate (lpm); Δp flow resistance (bar) ²⁾



Q flow rate (lpm); Δp flow resistance (bar) ²⁾

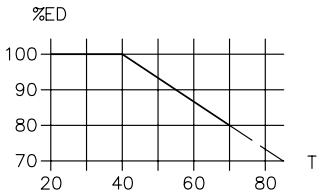


Q flow rate (lpm); Δp flow resistance (bar)

¹⁾ Only for EM...V: free flow from B→A only possible with de-energised solenoid

²⁾ Also applies for type EMP.. VG..(SG..) Flow directions that are not shown act in the same way as type EM.. with the same size

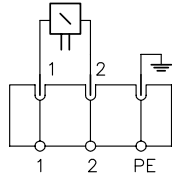
3.2 Electrical data (type EM.. and EMP..)

Nom. power P_N	12 V DC	24 V DC	98 V DC	205 V DC	
	EM 1.., EM 2.., EM 3..	21 W	21 W	21 W	21 W
EMP 2.., EMP 3.., EM 4..	32 W	32 W	32 W	32 W	
EMP 4..	30 W	30 W	--	--	
Cold current I_{20}	EM 1.., EM 2.., EM 3..	1.75 A	0.89 A	0.2 A	0.1 A
	EMP 2.., EMP 3.., EM 4..	2.67 A	1.33 A	0.3 A	0.15 A
EMP 4..	2.5 A	1.25 A	--	--	
Max. current $I_{lim.}$	EM 1.., EM 2.., EM 3..	1.23 A	0.62 A	--	--
	EMP 2.., EMP 3.., EM 4..	1.87 A	0.93 A	--	--
EMP 4..	1.75 A	0.88 A	--	--	
Switching time approx. ms	EM..S: in 150 out 50 EM..V: in 50 out 150 The switching times with version WG.. are 2 to 3 times and with type EMP.. VG.. and EMP.. SG.. 5 to 10 times longer For type EMP.. VG.. and EMP.. SG.. 5 ... 10 times larger				
Switchings / h	approx. 2000 (rather even distributed)				
Insulation material class	F Contact temperature approx. 85 ... 95°C (solenoid housing) with an ambient temperature of 20°C. In adhering to the reference values for %ED in operation, the permissible winding limit temperature of approx. 150°C according to insulation material class F is approximately reached as a steady-state temperature. The thermal load of the coil can be reduced by means of an economy circuit, for example (see Chapter 5.4, "Maintenance information").				
Relative duty cycle: 100% ED (Specification on the solenoid)	Reference value and restriction in the operation  T Ambient temperature (°C); %ED Duty cycle				
Protection class	Depending on the actuating solenoid, see Chapter 2, "Available versions, main data" table 4				
Electrical connection	Depending on actuation solenoid, Chapter 2, "Available versions, main data" table 4				

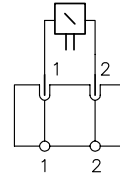
Circuit diagrams

DC voltage

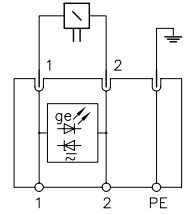
G .., X ..



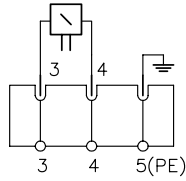
**DT .., K .., S ..,
AMP .., F ..**



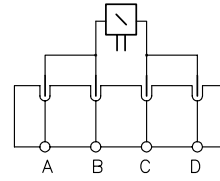
L ..



M ..

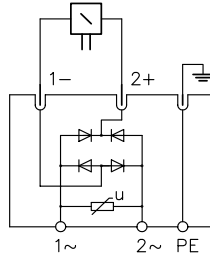


ITT .., DTL ..



AC voltage

WG 110, WG 230



For the required connection parts, see [Chapter 6.1, "Accessories, spare parts and separate components"](#)

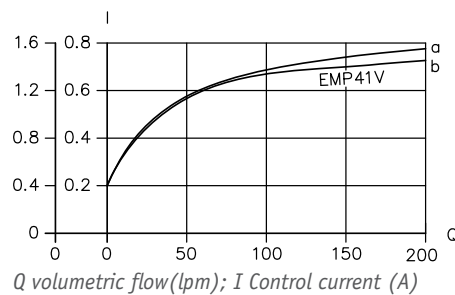
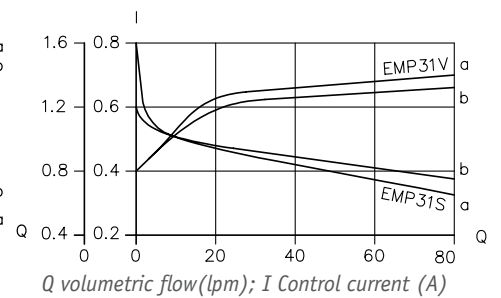
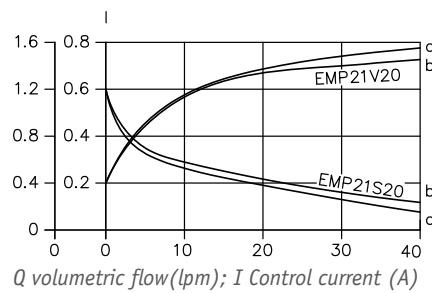
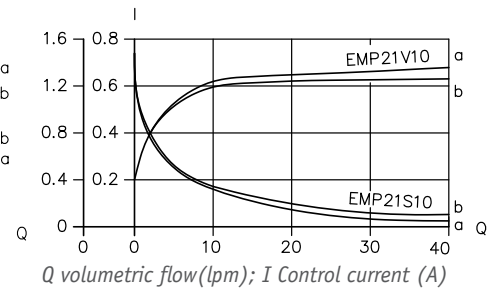
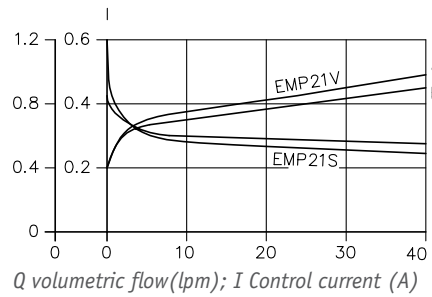
Cut-off energy

Guideline for max: approx. < 10 Ws + approx. 10% when measuring at U_N

Dither frequency for type EMP

50 to 150 Hz

I-Q-curves



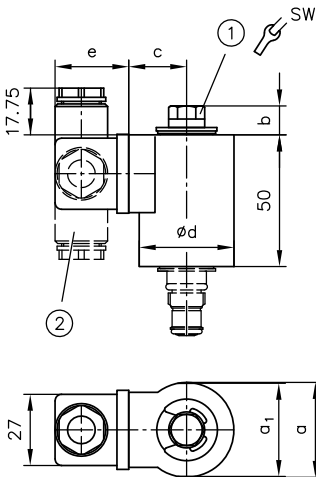
Curve a: Load pressure $p = 50$ bar
Curve b: load pressure $p = 200$ bar

4 Dimensions

All dimensions in mm, subject to change.

4.1 Valve and actuating solenoid

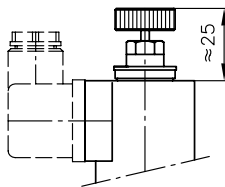
Coding G.., WG.., X.., L..



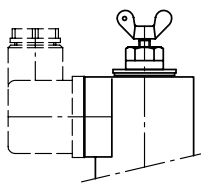
- 1 Manual override for EM(P)...S
- 2 Line connector can be mounted offset by 90° each

$$SW = a/f$$

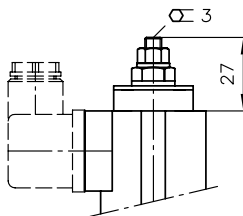
EM .. ST (button for emergency actuation)



EM .. S-M (wing nut, attached to side upon delivery)



EMP .. VH

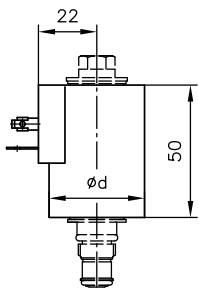


Type	a	a ₁	b	c	Ød	SW	Tightening torque (Nm)
EM 1..	36.5	--	12	22	36.5	12	30
EM 2..	36.5	--	12	22	36.5	12	30
EM 3..	36.5	--	12	22	36.5	12	60
EM 4..	--	37.5	15	25	38.5	14	90
EMP 2..	--	37.5	15	25	38.5	14	30
EMP 3..	--	37.5	15	25	38.5	14	60
EMP 4..	Ø37	--	18.3	28	Ø37	19	90

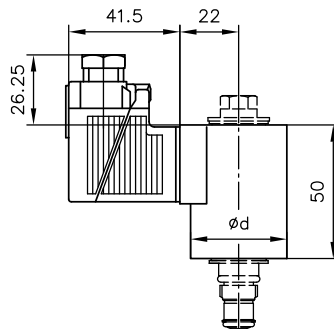
Version	e
G	28
WG	34.5
L	40

Actuation solenoid

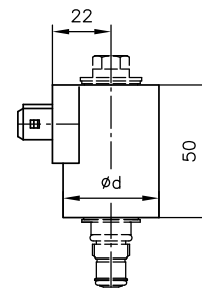
Coding X..



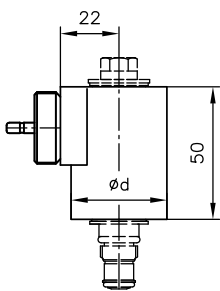
Coding L..



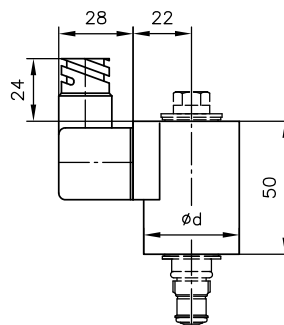
Coding AMP..



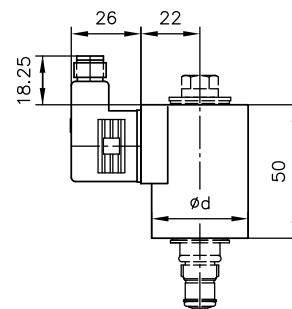
Coding K..



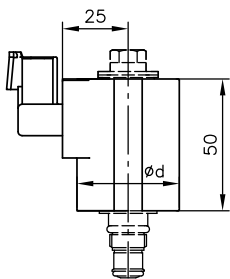
Coding S..



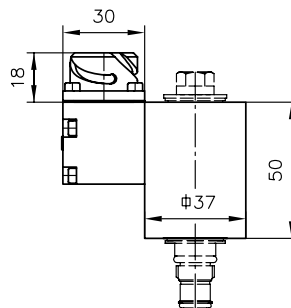
Coding M..



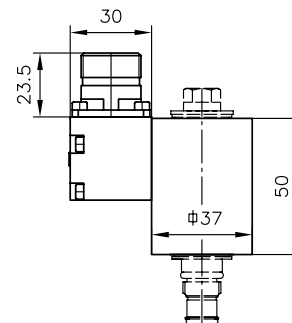
Coding DT..



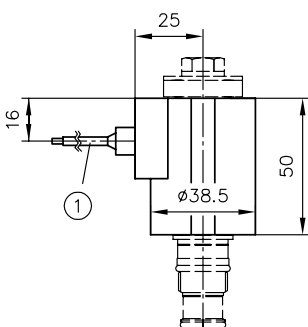
Coding ITT..



Coding DTL..



Coding F..



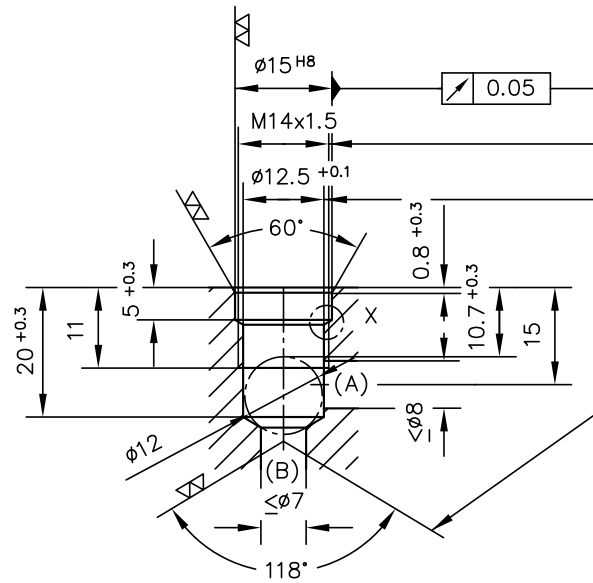
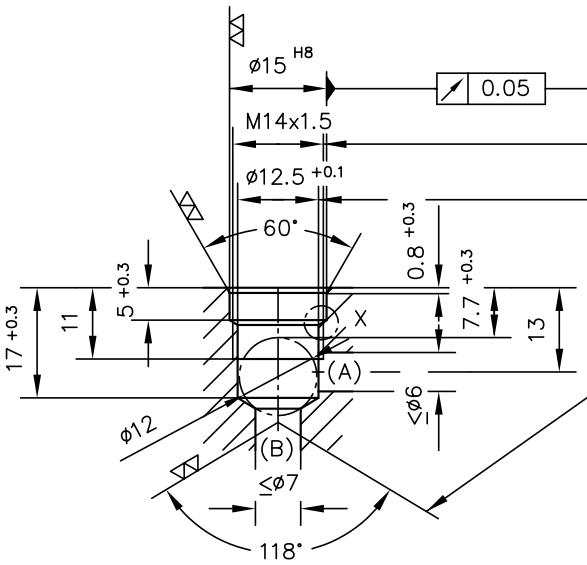
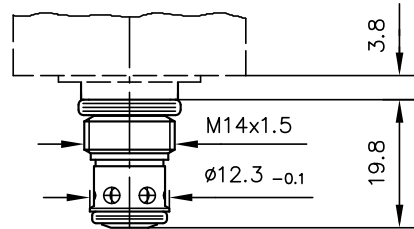
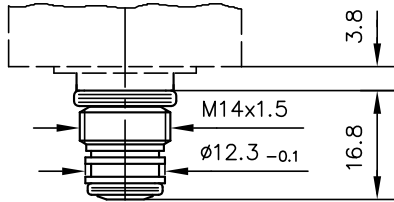
1 approx. 600 mm

Type	$\varnothing d$	$\varnothing d$ (DT)
EM 1..	36.5	36.5
EM 2..	36.5	36.5
EM 3..	36.5	36.5
EM 4..	38.5	39
EMP 2..	38.5	39
EMP 3..	38.5	39
EMP 4..	$\varnothing 37$	--

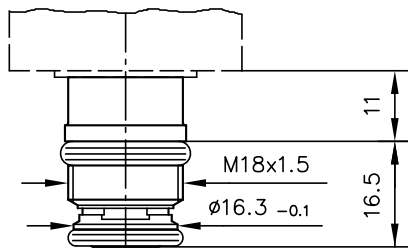
4.2 Screw-in valve

EM 11 D, EM 11 DS,
EM 11 D 0,8, EM 11 DS 0,8

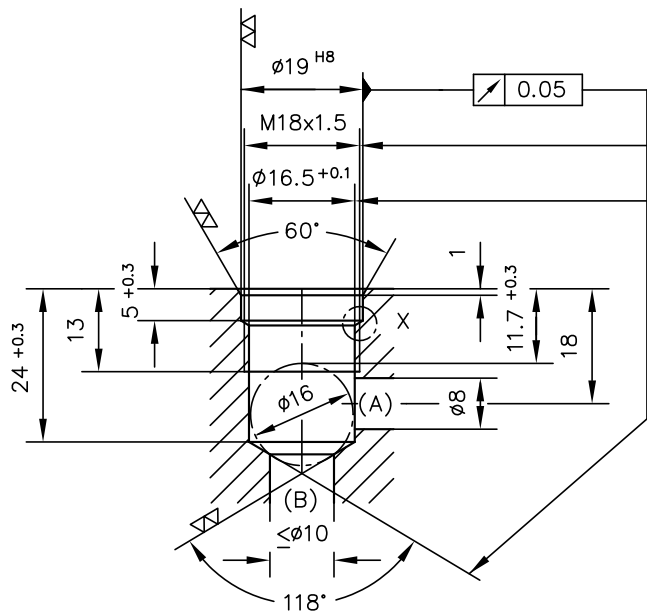
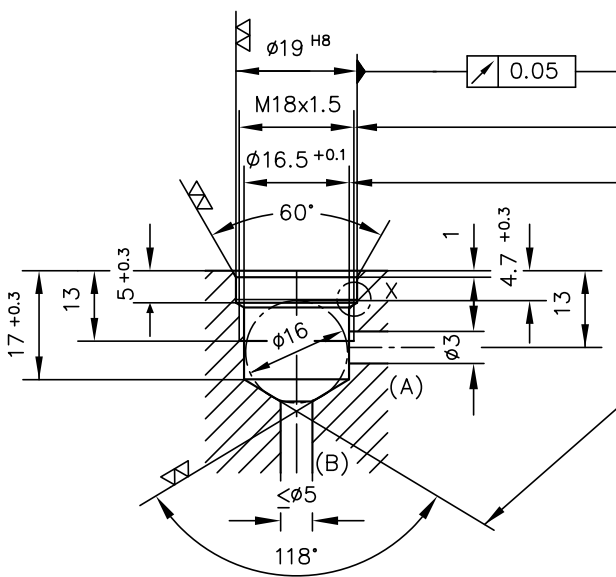
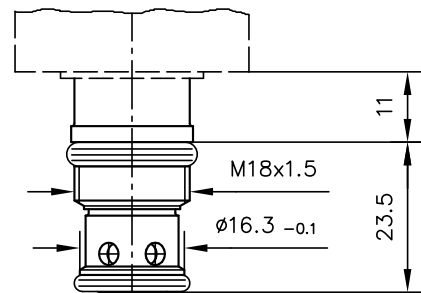
EM 1. V, EM 1. S



EM 21 D, EM 21 DS

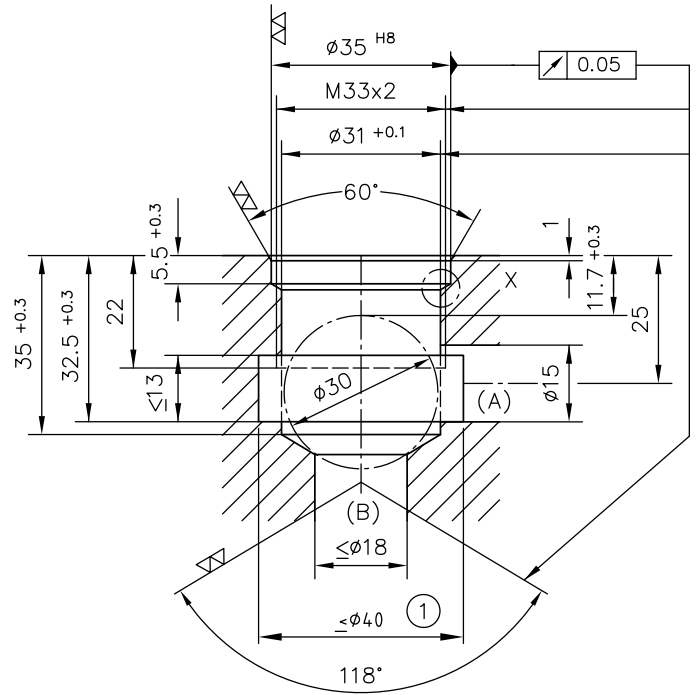
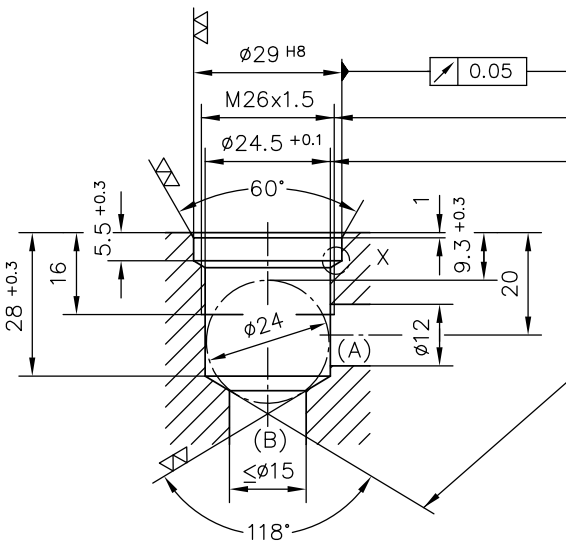
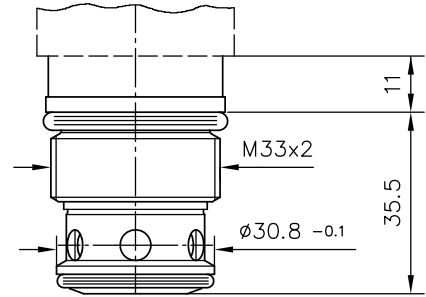
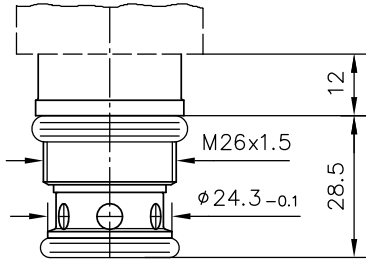


EM 2. V, EM 2. S,
EMP 21 VG, EMP 21 SG,
EMP 21 V., EMP 21 S..



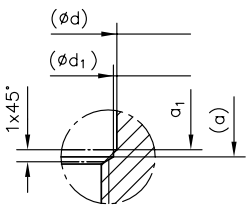
EM 3. V, EM 3. S,
EMP 31 VG, EMP 31 SG,
EMP 31 V., EMP 31 S..

EM 4. V, EM 4. S,
EMP 41 V..



- 1 Insertion optional:
Insertion to reduce the flow resistance, not necessary for functional-technical reasons

Detail X M2:1



Type	ϕd^{H8}	ϕd_1	$a^{+0.3}$	a_1
EM 1.	15	14.75	5	4.5
EM 2., EMP 2.	19	18.75	5	4.5
EM 3., EMP 3.	29	28.75	5.5	5
EM 4., EMP 4.	35	34.75	5.5	5

Note

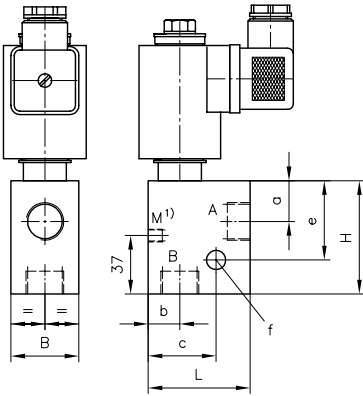
The 118° shoulder of the stepped bore is tolerated in its angular position to the centring bore ϕd^{H8} (reaming depth).

- This tolerance must be adhered to.
- See the information in [Chapter 5, "Assembly, operation and maintenance recommendations"](#).

4.3 Connection blocks

Coding

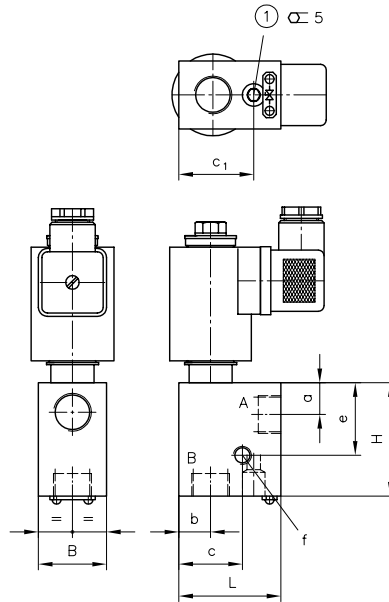
-1/4, -3/8, -1/2,
-3/4, -1, -1 5/16-12 UN



1) only coding - 1 5/16-12 UN

Coding

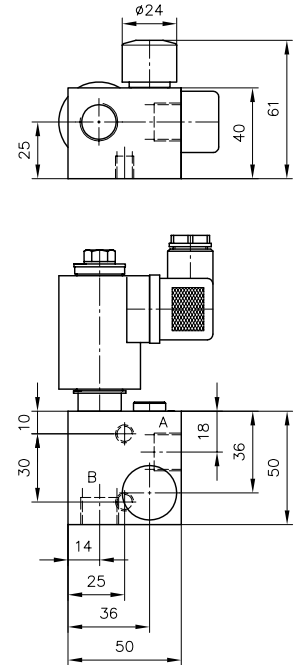
-1/4 A, -3/8 A, -1/2 A,
-3/4 A, -1 A



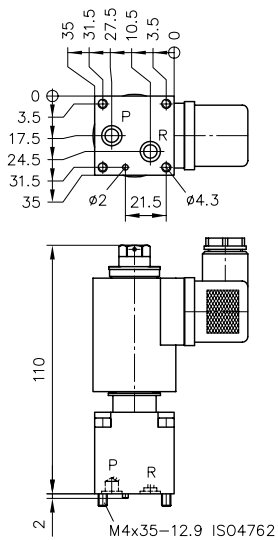
1 Drain screw

Coding

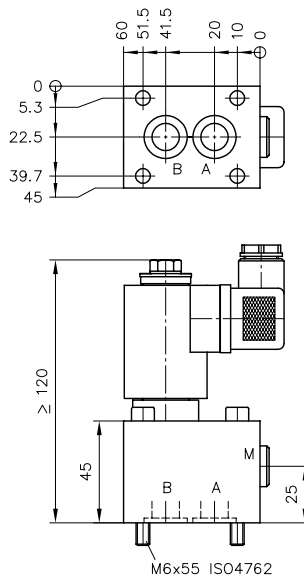
-3/8 N 0.8
-3/8 N 1.5



EM 21 D - P
EM 21 DS - P



EM 3. - P
EMP 3. - P



Basic type according to Chapter 2, "Available versions, main data"	Coding	Ports A, B (BSPP)	Main dimensions (mm)									Order No. Connection block without valve
			L	B	H	a	b	c	c ₁	e	f	
EM 11 D.. EM 11 DS..	- 1/4	G 1/4	35	20	40	14.5	10	25	--	30	∅6.5	7490 013
EM 1. V(S)	- 1/4	G 1/4	35	20	40	16	10	25	--	30	∅6.5	7490 010
	- 3/8	G 3/8	40	25	40	16	15	32	--	32	∅6.5	7490 011
EM 21 D(DS)	- 1/4	G 1/4	45	30	50	13	14	30	--	35	∅8.5	7902 310
EM 2. V(S) EMP 2. V(S)	- 3/8	G 3/8	45	30	50	18	14	30	--	35	∅8.5	7491 012
	- 1/2	G 1/2	50	30	50	18	14	32	--	35	∅8.5	7491 013
EM 3. V(S) EMP 3. V(S)	- 1/2	G 1/2	55	40	60	20	20	37	--	38	∅10.5	7590 011
	- 3/4	G 3/4	60	40	60	20	20	40	--	40	∅10.5	7590 012
EM 4. V(S) EMP 4. V(S)	- 3/4	G 3/4	65	40	70	25	22	50	--	55	∅12.5	7591 011
	- 1	G 1	70	50	70	25	22	55	--	55	∅12.5	7591 012
	- 1 5/16-12 UN	1 5/16-12 UN-2B (M: 7/16-20 UNF-2B)	81	51	85	25	28	63	--	60	M12, 12 deep	7591 018
EM 1. V(S)	- 1/4 A	G 1/4	40	20	45	13	10	35	27	25	∅6.3	7490 038
	- 3/8 A	G 3/8	45	25	45	13	15	40	33	27	∅6.3	7490 039
EM 2. V(S) EMP 2. V(S)	- 3/8 A	G 3/8	45	30	50	14	14	28	33	32	M8, 8 deep	7491 015
	- 1/2 A	G 1/2	50	30	50	14	14	31	36	32	M8, 8 deep	7491 016
EM 3. V(S) EMP 3. V(S)	- 1/2 A	G 1/2	56	40	60	20	20	34	42	36	M10, 10 deep	7590 015
	- 3/4 A	G 3/4	60	40	60	20	20	40	46	40	M10, 10 deep	7590 016
EM 4. V(S)	- 3/4 A	G 3/4	65	40	70	25	22	41	49	45	M12, 12 deep	7591 015
	- 1 A	G 1	70	50	70	25	22	47	52	50	M12, 12 deep	7591 016
EM 2. V(S) EMP 2. V(S)	- 3/8 N 0,8 - 3/8 N 1,5	G 3/8	50	40	50	18	14	25	--	--	M8, 10 deep	7902 150
EM 21 D(DS) - P EM 3. - P EMP 3. - P	P	--	--	--	--	--	--	--	--	--	--	7902 360 7903 140B



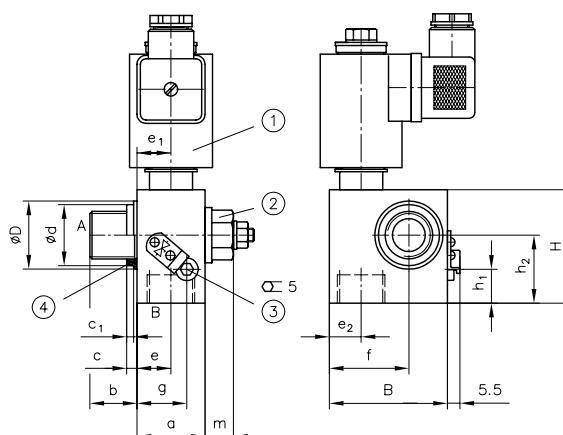
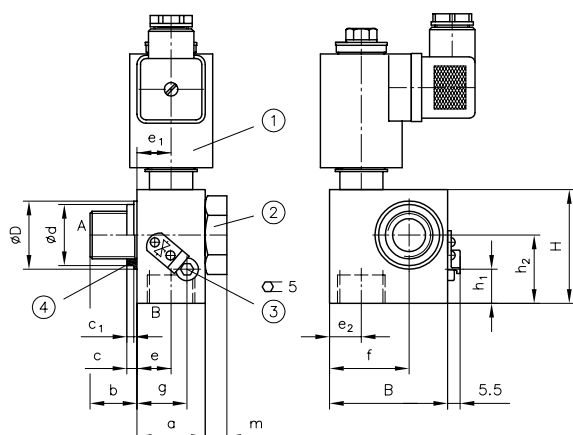
Note

Attachment options (dimension f):

∅.. -Through bore, thread specification M..; thread present on both sides (-3/8 N.. is an exception, only on rear).

EM 1. - .F
 EM 2. - .F
 EM 3. - .F
 EMP 2. - .F
 EMP 3. - .F

EM 1. - .F - SB 1. H
 EM 2. - .F - SB 2. H
 EMP 2. - .F - SB 2. H



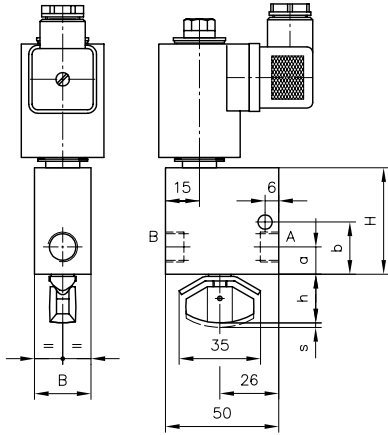
- 1 Each rotatable by 360°
- 2 SW (banjo bolt) Can be mounted on both sides with - 3/4 F
- 3 Drain screw
- 4 Seal ring

- 1 Each rotatable by 360°
- 2 SW (drop-rate braking valve screw-in cartridge according to [D 6920](#))
- 3 Drain valve
- 4 O-ring

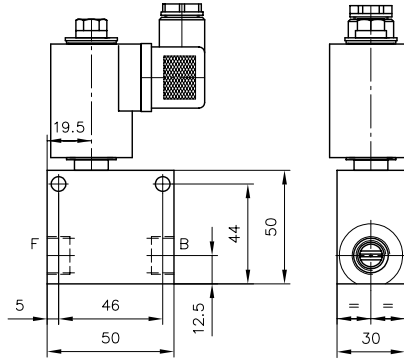
Type	Ports (BSPP)		Dimensions																
	A	B	B	H	∅D	a	b	c	c ₁	∅d	e	e ₁	e ₂	f	h ₁	h ₂	g	m	SW
EM 1. - 3/8 F	G 3/8 A	G 3/8	45	40	24	25	15	3	2.1	21.9	12.5	15.5	12	30	12.5	27	18	7.5	24
EM 1. - 3/8 F - SB1.	G 3/8 A	G 3/8	45	40	24	25	15	3	2.1	21.9	12.5	15.5	12	30	12.5	27	18	11	34
EM 1. - 16 F	M 16x1.5	G 3/8	45	40	24	25	15	3	2.1	21.9	12.5	15.5	12	30	12.5	27	18	7.5	24
EM 2. - 1/2 F EMP 2. - 1/2 F	G 1/2 A	G 1/2	52	50	30	30	20.7	4.5	2.6	26.9	15	15	14	35	15	30	22	9.5	30
EM 2. - 1/2 F - SB2. EMP 2. - 1/2 F - SB2.	G 1/2 A	G 1/2	52	50	30	30	20.7	4.5	2.6	26.9	15	15	14	35	15	30	22	12.5	30
EM 3. - 3/4 F EMP 3. - 3/4 F	G 3/4 A	G 3/4	70	60	--	40	19.5	5	--	36	20	20	20	50	18	40	20	10	36

SW = a/f

EM 1.. - 1/4 D
EM 2.. - 3/8 D
EMP 2.. - 3/8 D

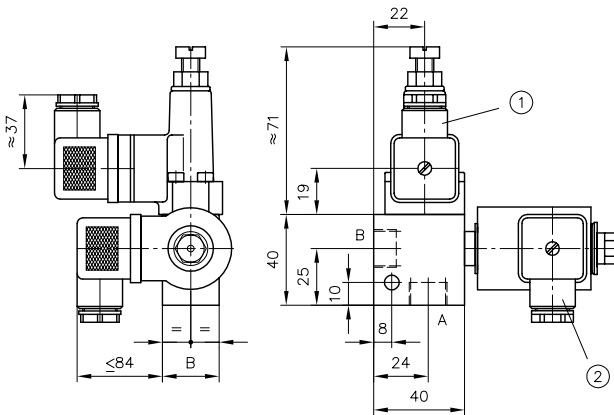


EM 2.. - 3/8 - SJ 0..
EMP 2.. - 3/8 - SJ 0..



Type	B	H	a	b	h	s
EM 1. - 1/4 D	25	47	12	23	21.5	2
EM 2. - 3/8 D EMP 2. - 3/8 D	55	62	13.5	34	27	3

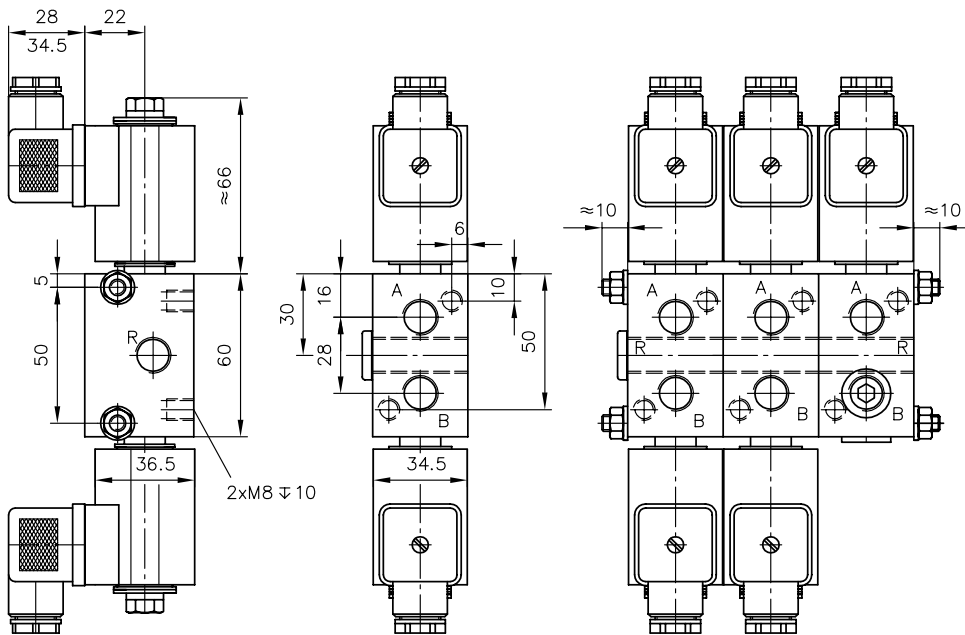
EM 1.. - 3/8 DG



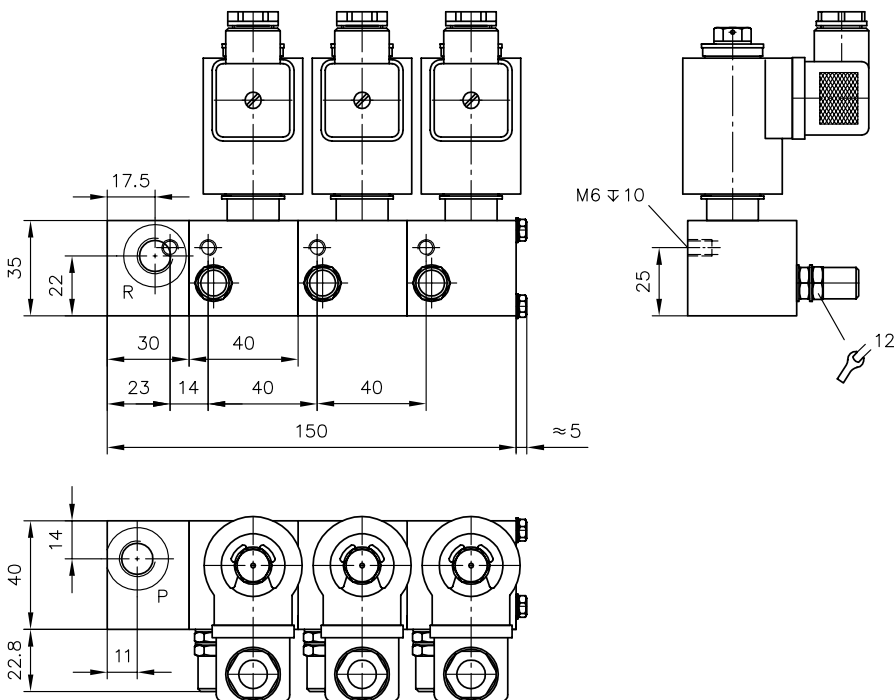
- 1 For missing information see [D 5440](#) (DG 3..)
- 2 Plug may be installed rotated by 4 x 90°

4.4 Valve combination

BEM 11



BEMD 21



5.1 Intended application

This valve is intended exclusively for hydraulic applications (fluid engineering). The valve meets high technical safety standards and regulations for fluid and electrical engineering.

The user must observe the safety measures and warnings in this documentation.

Essential requirements for the product to function correctly and safely:

- All information in this documentation must be observed. This applies in particular to all safety measures and warnings.
- The product must only be assembled and put into operation by qualified personnel.
- The product must only be operated within the specified technical parameters. The technical parameters are described in detail in this documentation.
- The operating and maintenance manual of the specific complete system must also always be observed.

If the product can no longer be operated safely:

Remove the product from operation and mark it accordingly. It is then not permitted to continue using or operating the product.

5.2 Assembly information

The product must only be installed in the complete system with standard connection components that comply with market requirements (screw fittings, hoses, pipes, etc.).

The hydraulic system must be shut down correctly prior to dismantling; this applies in particular to hydraulic systems with hydraulic accumulators.



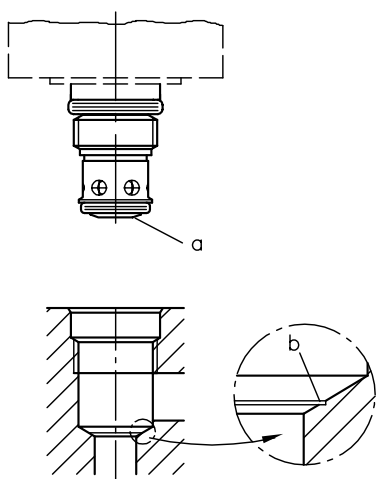
Danger

Risk to life caused by sudden movement of the hydraulic drives when dismantled incorrectly!

Risk of serious injury or death.

- Depressurise the hydraulic system.
- Perform safety measures in preparation for maintenance.

5.2.1 Notes for initial operation



In accordance with [Chapter 4, "Dimensions"](#), the 118° shoulder of the stepped bore is tolerated in its angular position to the centring bore $\varnothing d^{H8}$ (reaming depth). This enables a larger edge force on the facial area of the housing journal when the valve is tightened and it also prevents lateral distortion of function elements which might cause sticking. This enables a max. edge force on the facial area of the tapped journal when the valve is screwed in with the correct torque and it also prevents distortion of functional valve parts which might cause malfunction (sticking).

1. Screw in the valve and tighten steadily with the correct torque (see [Chapter 4, "Dimensions"](#)).
2. Remove the valve again and check whether the journal of the valve a has produced an annular impact b at the chamfer of the stepped bore.
3. When this impact is even everything is correct and the valve can be reinstalled as described above.
4. If the ring impression b is not closed or is significantly weaker on one side, screw the valve in again and secure with a tightening torque approx. 1.2x that stated in step 1. Then check as in step 2. This is normally sufficient for making the imprint more even.
5. Then screw the valve in again as in step 1 and secure. Otherwise, rework the bore.

5.2.2 Creating the mounting hole

See description in [Chapter 4, "Dimensions"](#).

5.3 Operating instructions

Product configuration and setting the pressure and flow rate

The statements and technical parameters in this documentation must be strictly observed.
The instructions for the complete technical system must also always be followed.

Note

- Read the documentation carefully before usage.
- The documentation must be accessible to the operating and maintenance staff at all times.
- Keep documentation up to date after every addition or update.



Caution

Risk of injury on overloading components due to incorrect pressure settings!

Risk of minor injury.

- Always monitor the pressure gauge when setting and changing the pressure.

Purity and filtering of the hydraulic fluid

Fine contamination can significantly impair the function of a hydraulic power pack. Contamination can cause irreparable damage.

Examples of fine contamination include:

- Metal chips
- Rubber particles from hoses and seals
- Dirt due to assembly and maintenance
- Mechanical debris
- Chemical ageing of the hydraulic fluid

Note

Fresh hydraulic fluid from the drum does not always have the highest degree of purity. Under some circumstances the fresh hydraulic fluid must be filtered before use.

Pay attention to the cleanliness level of the hydraulic fluid in order to maintain faultless operation.
(Also see cleanliness level in [Chapter 3, "Parameters"](#).)

5.4 Maintenance information

This product is largely maintenance-free.

Check that the product is securely fastened in the mounting hole at regular intervals, but at least once per year.

Conduct a visual inspection at regular intervals, but at least once per year, to check if the hydraulic connections are damaged. If external leakages are found, shut down and repair the system.

Clean the device surface of dust deposits and dirt at regular intervals, but at least once per year.

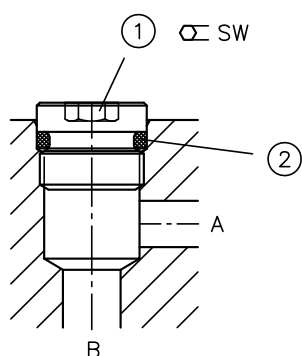
6 Other information

6.1 Accessories, spare parts and separate components

6.1.1 Tapped plugs

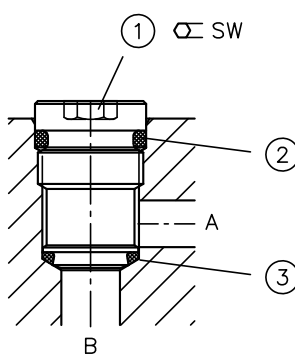
The mounting holes can be sealed with tapped plugs if necessary; for example, if the assembly of standardised basic bodies is to be carried out with or without screw-in valves as required.

Passage open



- 1 Tapped plug
 2 O-ring ①

Passage blocked



- 1 Locking tapped plug
 2 O-ring ①
 3 O-ring ②

Type	Tapped plug	Locking tapped plug	SW	Tightening torque (Nm)	O-ring ① P5001 94 Shore	O-ring ② HNBR 90 Sh
EM 1.. V(S)	7490 105 b	7490 105 a	6	30	10.3x2.4	7.65x1.78
EM 11 D(DS)	7490 105 b	7490 105 c	6	30	10.3x2.4	7.65x1.78
EM(P) 2.. V(S)	7491 105 b	7491 105 a	8	30	14.03x2.61	12.42x1.78
EM 21 D(DS)	7491 105 b	7902 315 a	8	30	14.03x2.61	12.42x1.78
EM(P) 3..	7590 105 b	7590 105 a	12	40	21x3.53	18.72x2.62
EM(P) 4..	7904 019	7904 018	14	60	28.17x3.53	25.07x2.62

SW = a/f

6.1.2 Sealing kits

Type	Order coding
EM 11(12)..	DS 7490-11
EM 21(22)..	DS 7490-21
EMP 21..	DS 7490-21P
EM 31(32)..	DS 7490-31
EMP 31..	DS 7490-31P
EM(P) 41(42)..	DS 7490-41

Seals for connection blocks with banjo bolt (acc. to [Chapter 2, "Available versions, main data"](#))

Order coding	For valve type
KDS 16 A 3 C	EM 1.. - F..
KDS 22 A 3 C	EM(P) 2.. - F..
7590 018	EM(P) 2.. - F..

6.1.3 Additional components

Coding Line connector	Order coding
G..	MSD 3-309
L..	SVS 3129020
L5K	L5K
L10K	L10K
WG..	MSD 4-209 P 10

These components have to be ordered separately!

Other line connectors

Economy circuit plugs	MSD 4 P 55 MSD 4 P 53 MSD 4 P 63 MSE 28026	24 V DC 230 V DC 115 V DC 24 V DC	According to D 7833 According to D 7813 According to D 7813 According to D 7832
Plugs with LED and protective circuitry	SVS 3129020	24 V DC	According to D 7163
Plugs with clamp diode	MSD 3-209 C 1	150 V DC	According to D 7163
Proportional amplifier for type EMP	EV 22 K 2 EV 1 M 3 EV 1 D	(Card) (Module) (Module)	According to D 7817/1 According to D 7831/2 According to D 7831 D

Connection parts for other solenoid designs

Coding Line connector	Description
K	Kastel, 03888005
S	Schlemmer, cone with bayonet 10 SL
AMP	AMP, AMP Junior 2-pole code number 1

Further information

Additional versions

- Directional seated valve type BVE: D 7921
- Directional seated valve type BVG 1 and BVP 1: D 7765
- Directional seated valve type G, WG and others: D 7300