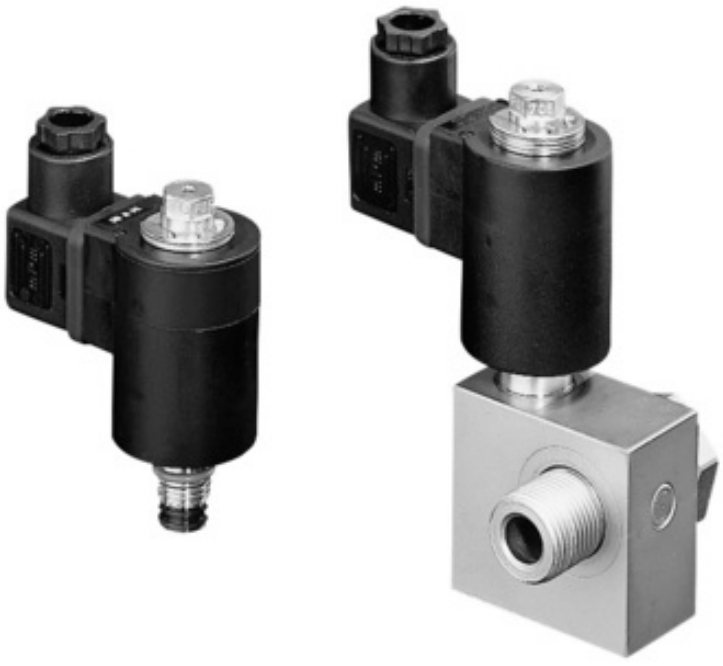
Directional seated valve type EM, EMP

Product documentation

Operating pressure p_{max}:	450 bar
Flow rate Q_{max}:	160 l/min



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1 Overview of directional seated valve type EM, EMP

Directional seated valves are a type of directional valve. Their function is to direct the flow of hydraulic medium in certain directions, therefore connecting the relevant connections, or shutting off the flow with zero leakage. By this means they control the movement of the actuators in a hydraulic system.

The directional seated valves type EM and EMP are screw-in valves. As cone valves they are tightly sealed, with zero leakage in the closed state. 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 valve; type EMP is available as a directional seated valve with either damped switching (soft-shift) or proportional throttling.

Appropriate connection blocks enable direct pipe connection or manifold mounting. They may contain additional components, e.g. a drain valve, bypass throttle valve, pressure switch or flow control valve.



Screw-in valve



Screw-in valve with single connection block

Features and advantages

- Zero leakage in closed switching position
- Directly switching up to approx. 3 l/min and with pilot-controlled switching up to 160 l/min
- Low flow resistance even at high flow rates
- Long service life thanks to hardened seats

Intended applications

- Cranes and lifting equipment
- Road vehicles
- Materials handling (industrial trucks etc.)
- Handling and mounting technology (industrial robots, etc.)

2 Available versions

2.1 Screw-in valve

Ordering examples

EM 21 S EM 32 V EMP 21 VG 10 EMP 31 SG EMP 21 S 20 EMP 31 V	 -3/4 F -3/4 -1/4	-AMP 24 -G 24 -WG 230 -G 24 -AMP 24 -G 24	 -M -M	 -AT

2.1.4 "Seal"

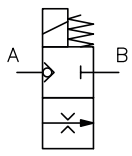
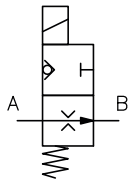
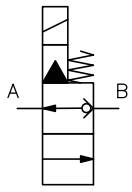
2.1.2 "Function block"

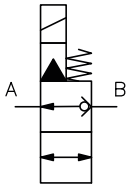
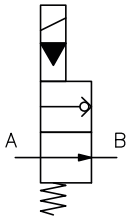
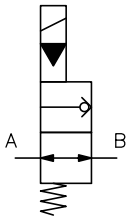
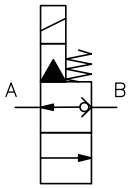
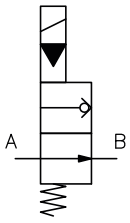
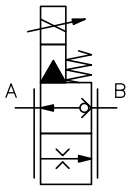
2.1.3 "Solenoid voltage and connector"

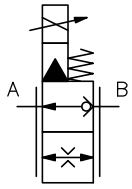
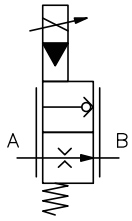
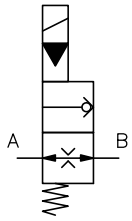
2.2 "Single connection blocks"

2.1.1 "Basic type and size"

2.1.1 Basic type and size

Type	Comment	Flow rate Q_N (l/min)	Pressure p_{max} (bar)	Flow direction	Circuit symbol
Directional seated valves, directional valve					
EM 11 D **EM 11 D 0.8** **EM 11 D 1.2** **EM 21 D**	direct switching ▪ for pilot purposes	1 2.5 5 3	450 150 60 400	Solenoid de-energised: ▪ A → B blocked ▪ B → A not permitted Solenoid energised: ▪ A → B ▪ B → A not permitted	
EM 11 DS **EM 11 DS 0.8** **EM 21 DS**	direct switching ▪ for pilot purposes	1 2.5 3	450 150 400	Solenoid de-energised: ▪ Flow direction A → B ▪ B → A not permitted Solenoid energised: ▪ A → B blocked ▪ B → A not permitted	
EM 11 V **EM 21 V** **EM 31 V** **EM 41 V**	pilot-controlled shifting	20 40 80 160	400 400 400 350	Solenoid de-energised: ▪ A → B blocked ▪ B → A free flow Solenoid energised: ▪ A → B ▪ B → A not permitted	

Type	Comment	Flow rate Q_N (l/min)	Pressure p_{max} (bar)	Flow direction	Circuit symbol
EM 12 V **EM 22 V** **EM 32 V** **EM 42 V**	pilot-controlled shifting	20 40 80 160	400 400 400 350	Solenoid de-energised: ▪ A → B blocked ▪ B → A free flow Solenoid energised: ▪ Any flow direction A → B, B → A	
EM 11 S **EM 11 ST** **EM 21 S** **EM 21 ST** **EM 31 S** **EM 31 ST** **EM 41 S** **EM 41 ST**	pilot-controlled shifting ▪ with manual override, not displayed additionally ▪ type ..ST with button for manual actuation (see Chapter 4, "Dimensions")	20 20 40 40 80 80 160 160	400 400 400 400 400 400 350 350	Solenoid de-energised: ▪ Flow direction A → B ▪ B → A = not permitted Solenoid energised: ▪ A → B blocked ▪ B → A not permitted	
EM 12 S **EM 12 ST** **EM 22 S** **EM 22 ST** **EM 32 S** **EM 32 ST** **EM 42 S** **EM 42 ST**		20 20 40 40 80 80 160 160	400 400 400 400 400 400 350 350	Solenoid de-energised: ▪ Any flow direction A → B, B → A Solenoid energised: ▪ A → B blocked ▪ B → A not permitted	
Directional seated valve, soft-shift					
EMP 21 VG **EMP 21 VG 10** **EMP 21 VG 15** **EMP 21 VG 20** **EMP 31 VG** **EMP 41 VG**	pilot-controlled shifting ▪ type ..VG 10(15, 20) with modified throttle characteristics (see Chapter 3.4, "Characteristic lines")	40 40 40 40 80 160	400 400 400 400 400 350	Solenoid de-energised: ▪ A → B blocked ▪ B → A free flow Solenoid energised: ▪ A → B ▪ B → A not permitted	
EMP 21 SG **EMP 21 SG 10** **EMP 21 SG 20** **EMP 31 SG**	pilot-controlled shifting ▪ with manual override, not displayed additionally ▪ type ..SG 10(20) with modified throttle characteristics (see Chapter 3.4, "Characteristic lines")	40 40 40 80	400 400 400 350	Solenoid de-energised: ▪ Flow direction A → B ▪ B → A not permitted Solenoid energised: ▪ A → B blocked ▪ B → A not permitted	
Proportional directional seated valve, proportional throttle					
EMP 21 V **EMP 21 V 10** **EMP 21 V 15** **EMP 21 V 20** **EMP 21 VH** **EMP 31 V** **EMP 31 V 80** **EMP 31 V 100** **EMP 31 VH** **EMP 31 VH 80** **EMP 31 VH 100** **EMP 41 V** **EMP 41 VH**	pilot-controlled shifting ▪ type ..V 10(15, 20, 80, 100) with modified throttle characteristics (see Chapter 3.4, "Characteristic lines") ▪ type ..VH with stroke limitation (see Chapter 4.1, "Valve and actuating solenoid"	40 40 40 40 40 80 80 100 80 80 100 160 160	400 400 400 400 400 400 400 400 400 400 400 350 350	Solenoid de-energised: ▪ A → B blocked ▪ B → A free flow Solenoid energised: ▪ A → B ▪ B → A not permitted	

Type	Comment	Flow rate Q_N (l/min)	Pressure p_{max} (bar)	Flow direction	Circuit symbol
EMP 22 V 20 **EMP 32 V 100**		40 100	400 400	Solenoid de-energised: ▪ A → B blocked ▪ B → A free flow Solenoid energised: ▪ Any flow direction A → B, B → A	
EMP 21 S **EMP 21 S 10** **EMP 21 S 20** **EMP 31 S**	pilot-controlled shifting ▪ with manual override, not displayed additionally (see Chapter 3.4, "Characteristic lines")	40 40 40 40 80	400 400 400 400 400	Solenoid de-energised: ▪ Flow direction A → B ▪ B → A not permitted Solenoid energised: ▪ A → B blocked ▪ B → A not permitted	
EMP 22 S 20		40	400	Solenoid de-energised: ▪ Any flow direction A → B, B → A Solenoid energised: ▪ A → B blocked ▪ B → A not permitted	

NOTICE

- Maximal permissible pressure only with basic blocks made of steel.
- If other materials have been used (e.g. cast iron, aluminium), take the possibly lower strength of the thread into account.

NOTICE

Directional seated valves with soft-shift (coding VG, SG) can only be actuated in the on/off positions. Cannot be used as a proportional throttle valve!

NOTICE

A proportional amplifier is required to actuate the proportional directional seated valves. For the recommended components see Chapter 5.4, "Maintenance information"

2.1.2 Function block

A means of mechanically blocking the function of the valve (e.g. for emergency or set-up mode)

Coding	Description
without coding	without, series, with manual override only type EM.. DS, EM.. S, EMP.. S
M	Wing nut (fitted at the side and sealed) Available for type EM 11 DS, EM 21 DS, EM 1. S and EM 2. S

2.1.3 Solenoid voltage and connector

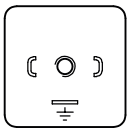
Coding	Electrical connection	Nominal voltage	Protection class (IEC 60529)	EM 1 EM 2 EM 3	EMP 2 EMP 3 EM 4	EMP 4
X 12, G 12 **X 24, G 24** **X 48, G 48** **X 98, G 98** **X 205, G 205** **L 12** **L 24** **WG 110** **WG 230**	EN 175 301-803 A ▪ **X:** without line connector ▪ **G:** with line connector MSD3-309 ▪ **L:** with LED connector ▪ **WG:** with alternating rectifier in line connector	12 V DC 24 V DC 48 V DC 98 V DC 205 V DC 12 V DC 24 V DC 110 V AC 50/60 Hz 230 V AC 50/60 Hz	IP 65	● ● ● ● ● ● ● ● ●	● ● ● ● ● ● ● ● ●	● ●
AMP 12 **AMP 24** **AMP 48**	AMP Junior Timer	12 V DC 24 V DC 48 V DC	IP 65	● ● ●	● ● ●	● ● ●
DT 12 **DT 24**	GERMAN (DT 04-2P)	12 V DC 24 V DC	IP 69	● ●	● ●	● ●
K 12 **K 24**	KOSTAL (M27x1)	12 V DC 24 V DC	IP 67	● ●	● ●	
S 12 **S 24**	SCHLEMMER (bayonet PA 6)	12 V DC 24 V DC	IP 67	● ●	● ●	
M 24	M12x1	24 V DC	IP 65	●	●	
F 24	Free cable ends 600 mm	24 V DC	IP 69		●	
ITT 24	MIL-VG 95234	24 V DC	IP 67	●		
DTL 24	MIL-DTL-38999 series III	24 V DC	IP 67	●		

INFORMATION

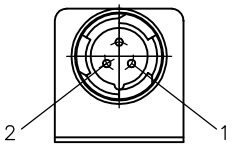
The specifications regarding the IP protection class apply for versions featuring a properly assembled male connector.

Connection pattern

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



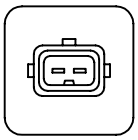
S ..



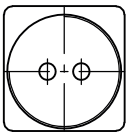
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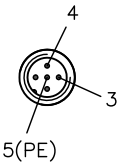
AMP ..



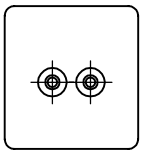
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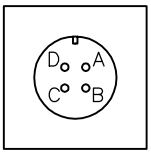
M ..



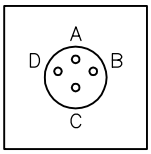
F ..



ITT ..



DTL ..



2.1.4 Seal

For seals that are in contact with the medium

Coding	Comment
without coding	Series, seals from NBR or AU, e.g. for mineral oil and HEES (synthetic ester)
PYD	FKM seals
AT	EPDM seals e.g. for glycol-based brake fluids (DOT4)

NOTICE
For the seal specification coding PYD and AT, the maximum operating pressure is limited to 200 bar.

2.2 Single connection blocks

For direct pipe connection / for manifold mounting

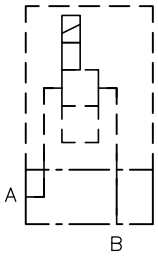
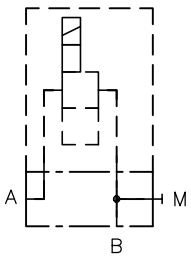
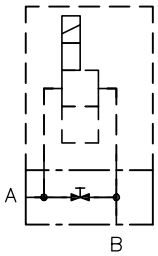
2.2.1 Single connection blocks without/with drain valve

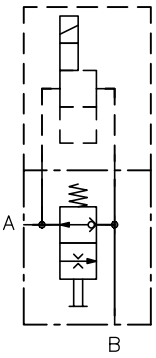
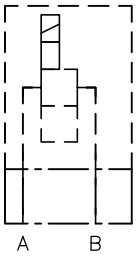
Ordering example

EMP 21 S **-1/4** -G 24

2.2.1 "Single connection blocks without/with drain valve"

Single connection block

Coding	Circuit symbol	Ports A, B	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
pipe connection								
-1/4		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						●
Pipe connection additionally with (accumulator) drain valve *								
	NOTICE * p_{max} at B = 200 bar							
-1/4 A		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						●

Coding	Circuit symbol	Ports A, B	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
Pipe connection with bypass valve that can be switched manually								
-3/8 N 0.8		G 3/8				●		
-3/8 N 1.5		G 3/8				●		
manifold mounting								
-P		--			●		●	

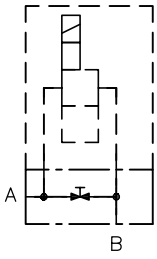
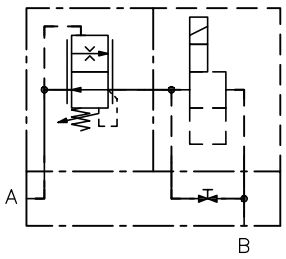
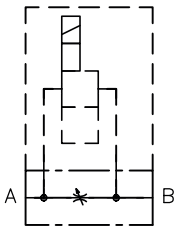
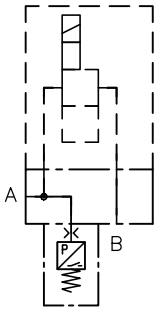
2.2.2 Single connection block with additional functions

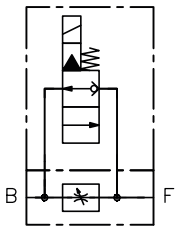
Ordering examples

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

2.2.2 "Single connection block with additional functions"

Single connection block

Coding	Description	Circuit symbol	Ports A, F	Ports 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	●		
-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, counterbalance valve according to D 6920 and drain valve, for details see "Coding for flow rate setting" **NOTICE** p_{max} = 315 bar		G 3/8 A	G 3/8	●		
-1/2 F - SB 2. -H -..			G 1/2 A	G 1/2		●	
-1/4 D	With bypass throttle valve		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 "Coding for pressure range"		G 3/8	G 3/8	●		

Coding	Description	Circuit symbol	Ports		EM 1. V EM 1. S	EM. 2. V EM. 2. S	EM. 3. V EM. 3. S
			A, F	B			
-3/8 SJ 0. C..	With load-independent flow rate limitation in direction B → F with flow control valves type SJ according to D 7395, for details see "Coding for flow rate setting" **NOTICE** p_{max} = 315 bar		G 3/8	G 3/8		●	

Coding for flow rate setting

1/2 F 3/8	- SB 2 - SJ 0	. .	H C	-.. -..

Desired flow rate setting

Flow rate setting

Coding	Adjustment range (l/min)		
	SB 1.	SB 2.	SJ 0.
1	2.5 ... 4	16 ... 21	1.0 ... 1.6
2	4 ... 6.3	21 ... 28.5	--
3	--	--	1.6 ... 2.5
5	6.3 ... 10	28 ... 37	2.5 ... 4.0
7	10 ... 16	37 ... 50	4.0 ... 6.4
9	16 ... 25	50 ... 57	6.4 ... 10.0
90	25 ... 35	--	10.0 ... 15.0

Coding for pressure range

3/8 DG	..

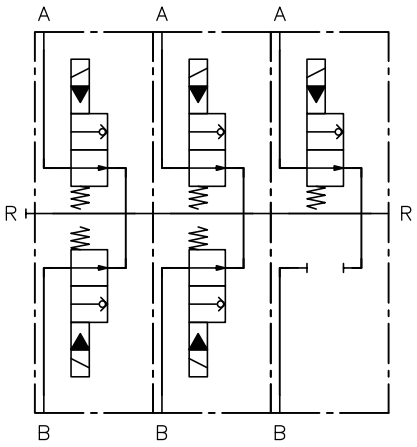
Pressure range

Coding	Adjustment range p_{max} (bar)
34	100 ... 400
35	20 ... 250
36	4 ... 12
64	4 ... 50
365	12 ... 170

2.3 Valve bank BEM

Circuit symbol

BEM 11



Ordering examples

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

- -G 12 → 2.1.3 "Solenoid voltage and connector"
- -1/4 → "Threaded connection"
- -SS/SS/S → "Valve section"
- BEM 11 → "Basic type and size"

NOTICE

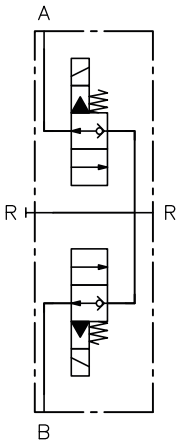
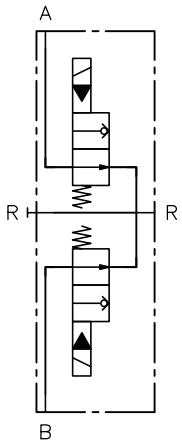
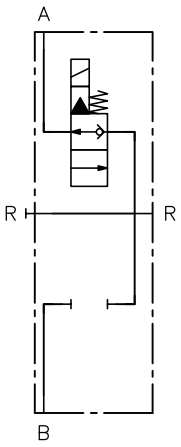
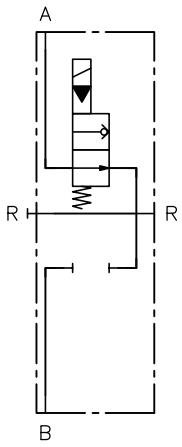
Compared to the series valves (laterally flattened), solenoids are used (see Chapter 5, "Installation, operation and maintenance information"), only excitation system with DIN connector available.

Basic type and size

Type	Flow rate Q_{max} (l/min)	Pressure p_{max} (bar)
BEM 11	20	400

Valve section

INFORMATION
A maximum of 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 

Threaded connection

Coding	Ports (ISO 228-1)
	A, B, R
-1/4	G 1/4

3 Parameters

3.1 General data

Designation	2/2-way directional seated valve
Design	Conical seat design
Model	Screw-in valve
Material	Steel; Valve housing zinc-nickel coated; Hardened and ground functional inner parts
Tightening torque	see Chapter 4, "Dimensions"
Installation position	As desired **NOTICE** Ensure the valve is sufficiently vented. Recommendation: when installing the solenoid, suspend it to provide self-venting. If this is not possible, ensure the hydraulic system is sufficiently vented. If there is a difference in height between the tank and block, a corresponding pre-load will be required.
Ports/connections	▪ **A, P** = input (pump or primary side) ▪ **B** = consumer (secondary side) ▪ **R** = reflux, tank
Flow direction	depending on type, see Chapter 2, "Available versions"
Hydraulic fluid	Hydraulic fluid, according to DIN 51524 Parts 1 to 3; ISO VG 10 to 68 according to DIN ISO 3448 Viscosity range: 4 - 1500 mm²/s Optimal operating range: approx. 10 - 300 mm²/s Also suitable for biologically degradable hydraulic fluids type HEPG (polyalkylene glycol) and HEES (synthetic ester) at operating temperatures up to approx. +70°C. Not suitable for water-based fluids and native oils (HETG).
Cleanliness level	**ISO 4406** 20/17/14...18/15/12
Temperatures	Environment: approx. -40 to +80 °C, hydraulic fluid: -25 to +80 °C, pay attention to the viscosity range. Start temperature: down to -40 °C is permissible (take account of the start viscosities!), as long as the steady-state temperature is at least 20 K higher during subsequent operation. Biologically degradable hydraulic fluids: note manufacturer specifications. With consideration for the seal compatibility, not above +70°C. **NOTICE** Observe the limitation with regard to the permissible duty cycle of the solenoid, see Chapter 3.5, "Electrical data"

3.2 Pressure and volumetric flow

Operating pressure	p_{max} = 450 bar (for limitation see Chapter 2.1.1, "Basic type and size") for type EM..V: p_{min} = 2 bar
Flow rate	see Chapter 2.1.1, "Basic type and size"

3.3 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

Single connection blocks

Type	
EM 11 D (DS)	
-1/4	= 0.2 kg
EM 1. V(S)	
-1/4	= 0.2 kg
-3/8	= 0.25 kg
-1/4 A	= 0.25 kg
-3/8 A	= 0.35 kg
-3/8 F	= 0.3 kg
-1/4 D	= 0.45 kg
-3/8 DG	= 0.55 kg
EM 21 D(DS)	
-1/4	= 0.5 kg
-P	= 0.3 kg
EM(P) 2. V(S)	
-3/8	= 0.45 kg
-1/2	= 0.45 kg
-3/8 A	= 0.45 kg
-1/2 A	= 0.45 kg
-3/8 N 0.8	= 0.7 kg
-3/8 N 1.5	= 0.7 kg
-1/2 F	= 0.5 kg
-3/8 D	= 0.55 kg
-3/8 SJ 0. C..	= 0.55 kg

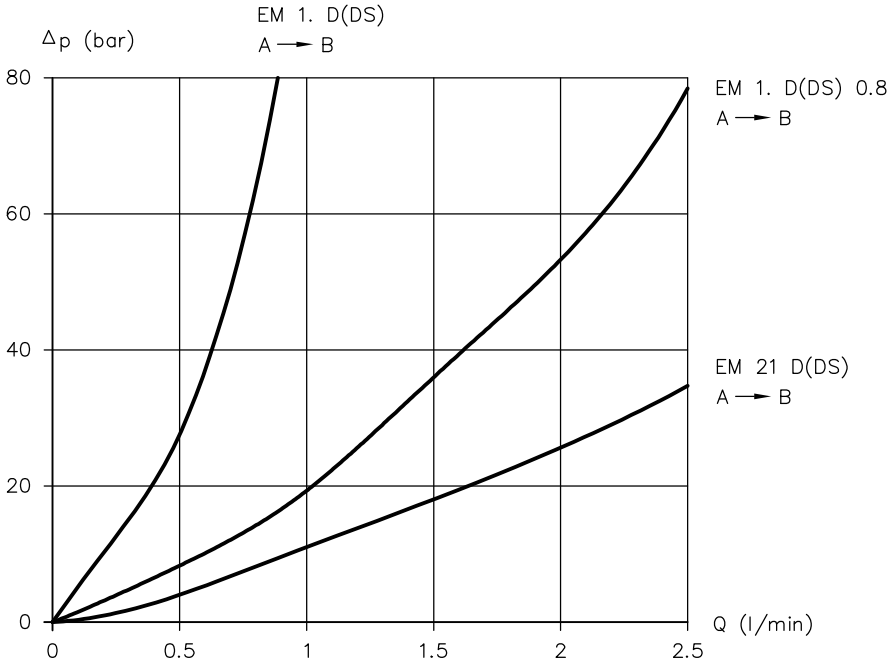
Type	
EM(P) 3. V(S)	
-1/2	= 1.4 kg
-3/4	= 0.8 kg
-1/2 A	= 0.85 kg
-3/4 A	= 0.85 kg
-P	= 0.75 kg
-3/4 F	= 1.0 kg
EM(P) 4. V(S)	
-3/4	= 1.0 kg
-1	= 1.3 kg
-1 5/16-12 UN	= 2.0 kg
-3/4 A	= 1.0 kg
-1 A	= 1.35 kg

3.4 Characteristic lines

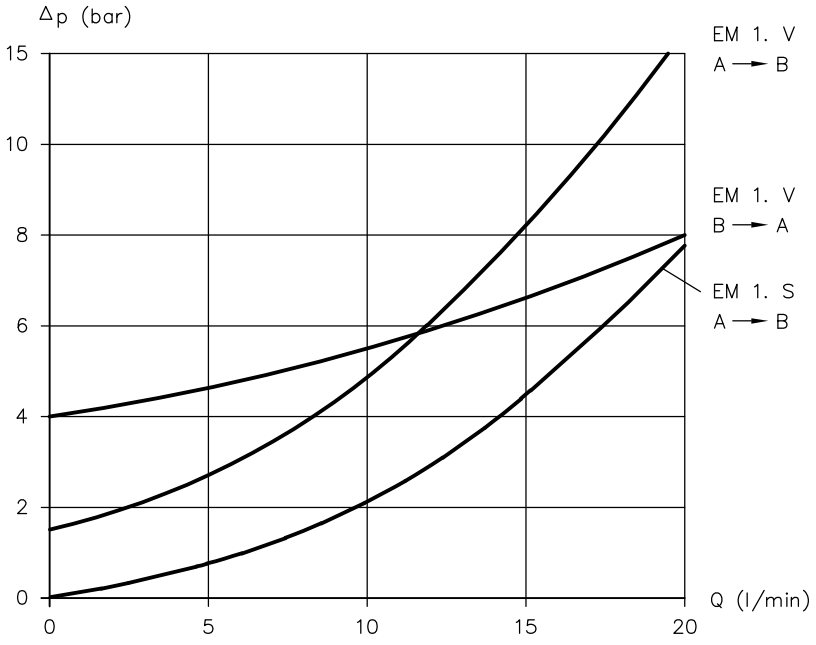
Viscosity of the hydraulic fluid approx. 60 mm²/s

Δp-Q-Characteristic lines

- A → B EM(P)...V solenoid excited
- EM 11 D(S)..; EM 21 D(S); EM(P)...S solenoid, de-energised



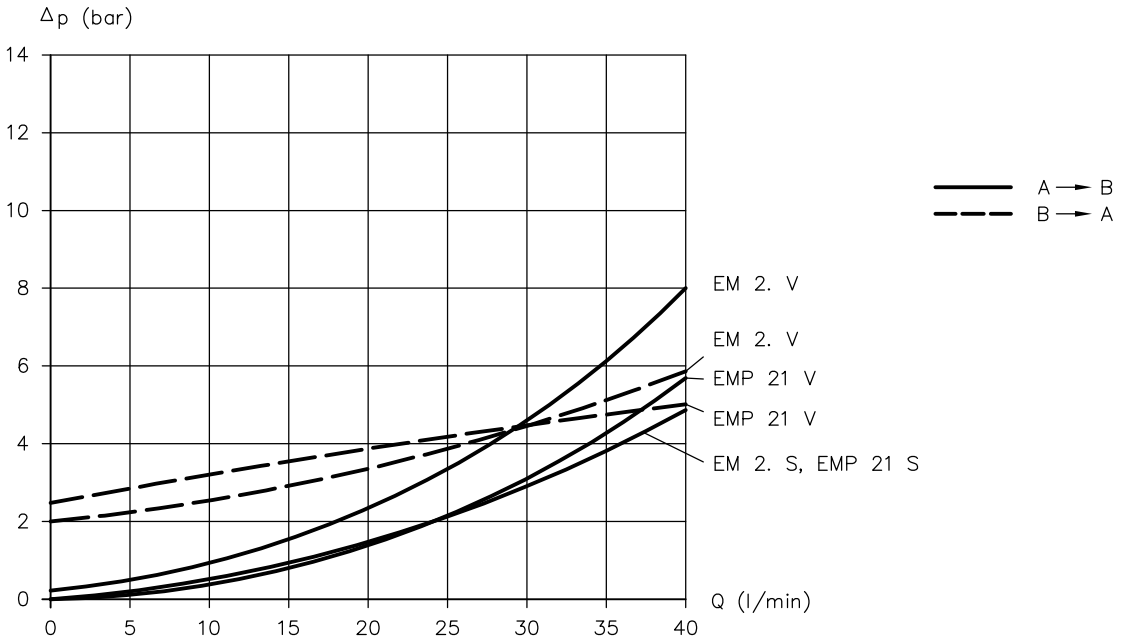
Q Flow rate (l/min); Δp Flow resistance (bar)



*Q Flow rate (l/min); Δp Flow resistance (bar) **

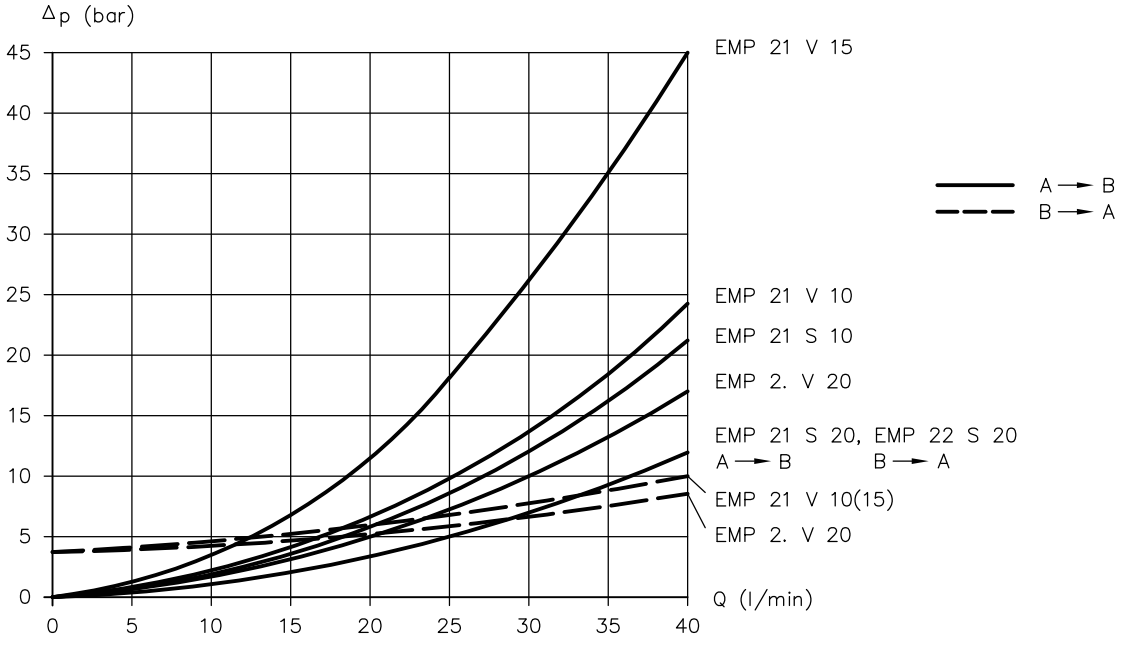
NOTICE
An insertion in the mounting hole to reduce flow resistance is not provided here, as the effect is too small!

EM 2., EMP 2.



*Q Flow rate (l/min); Δp Flow resistance (bar) **

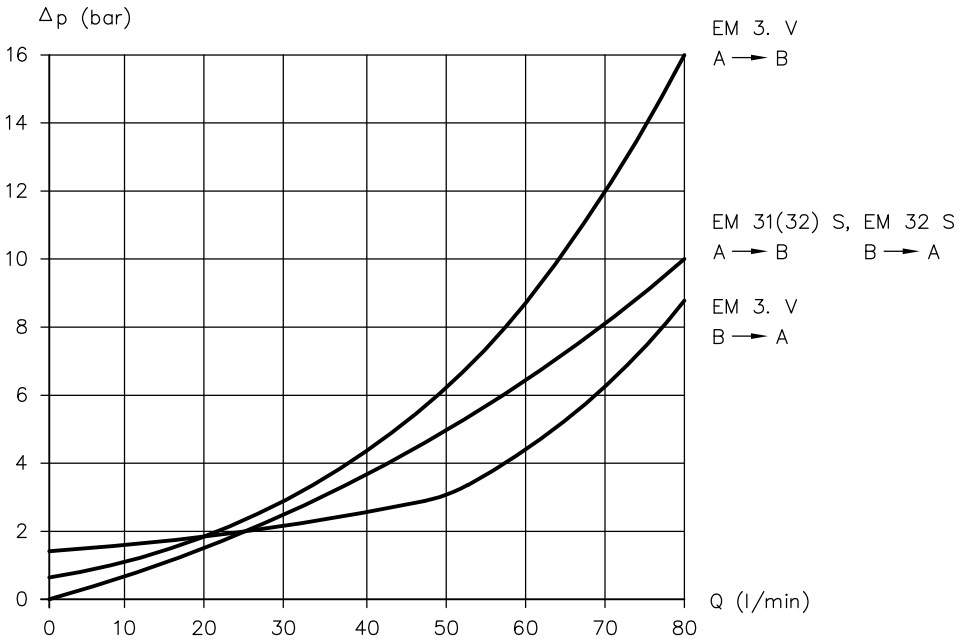
NOTICE
Flow resistance without insertion approx. twice as high!



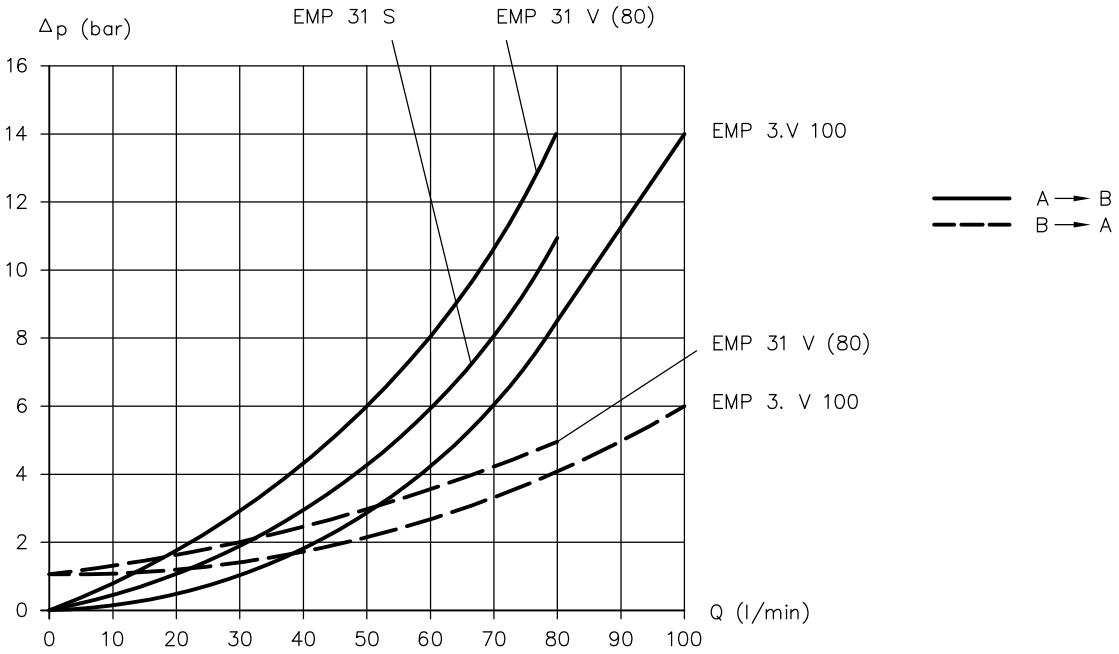
*Q Flow rate (l/min); Δp Flow resistance (bar) ***

NOTICE
Flow resistance without insertion approx. 30% higher!

EM 3., EMP 3.

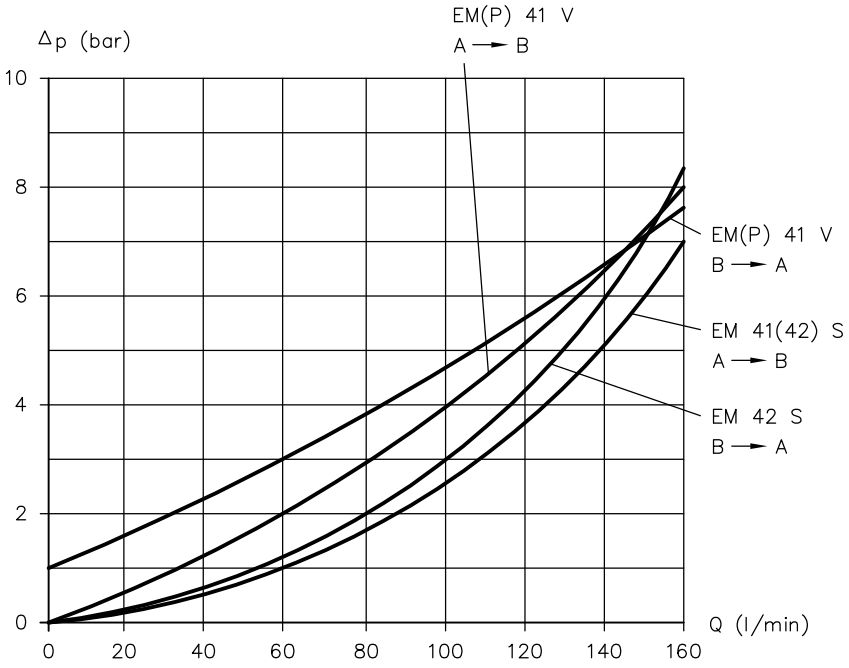


Q Flow rate (l/min); Δp Flow resistance (bar)



*Q Flow rate (l/min); Δp Flow resistance (bar) ***

NOTICE
Flow resistance without insertion approx. 25–50% higher!



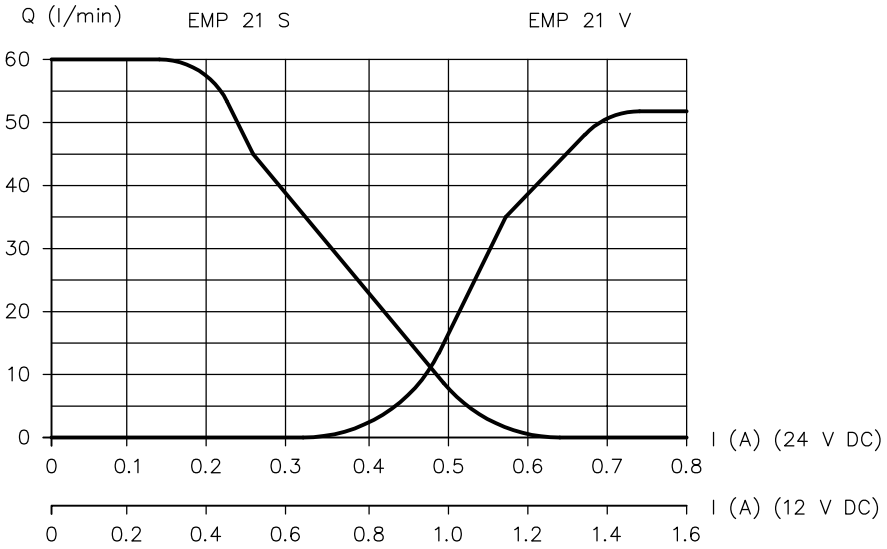
Q Flow rate (l/min); Δp Flow resistance (bar)

NOTICE
Flow resistance without insertion approx. 25–50% higher!

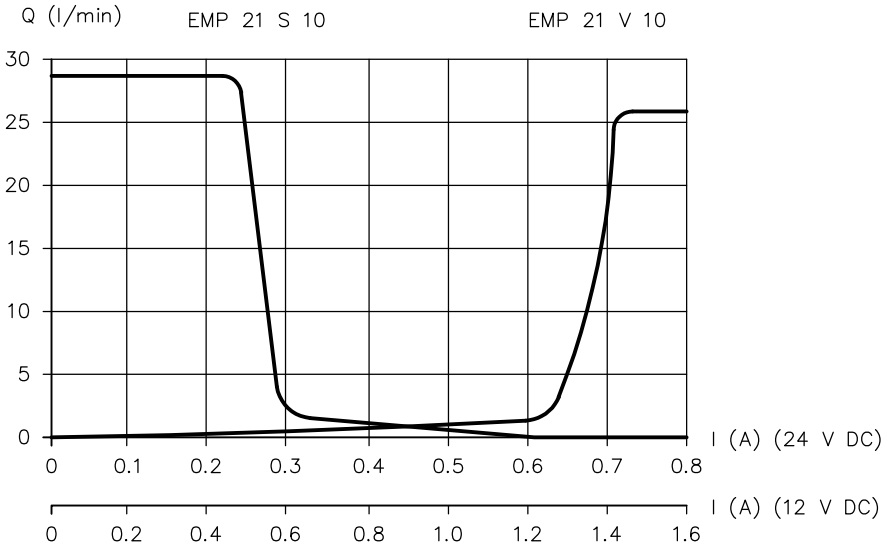
* Only for type EM...V: free flow from B → A only possible with de-energised solenoid

** Also applies to type EMP.. VG..(SG..): flow directions that are not shown act in the same way as type EM.. with the same size

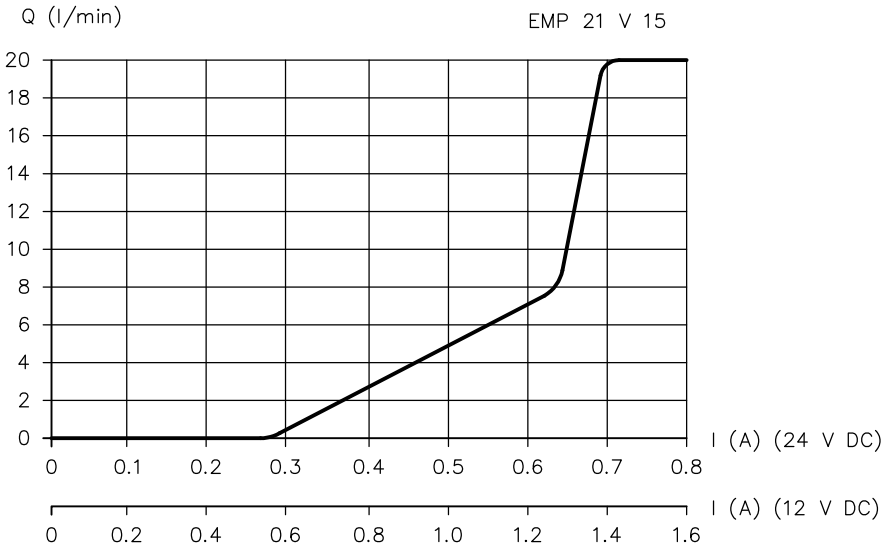
I-Q-Characteristic lines



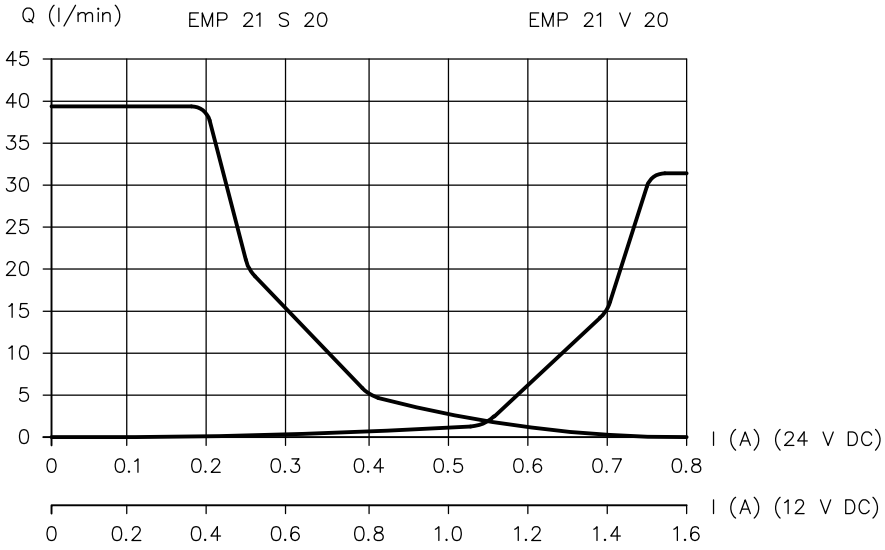
I Control current (A); Q Flow rate (l/min)



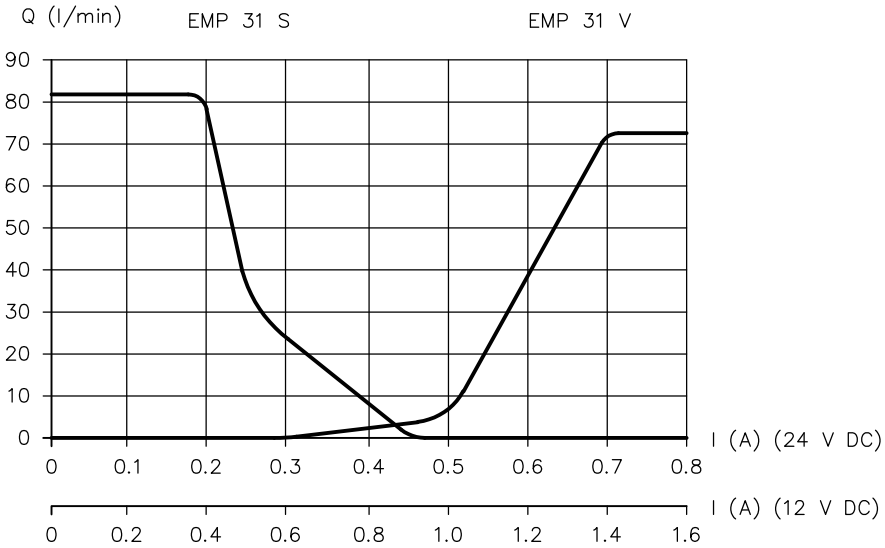
I Control current (A); Q Flow rate (l/min)



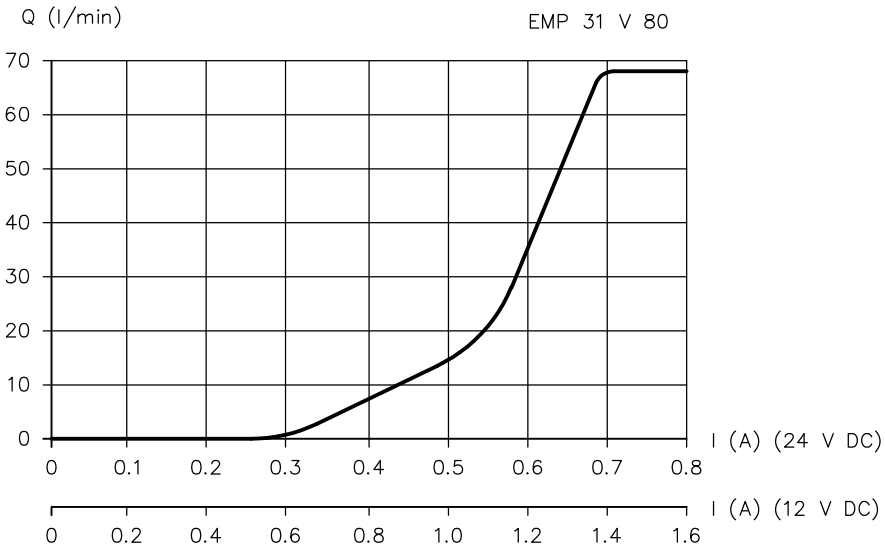
I Control current (A); Q Flow rate (l/min)



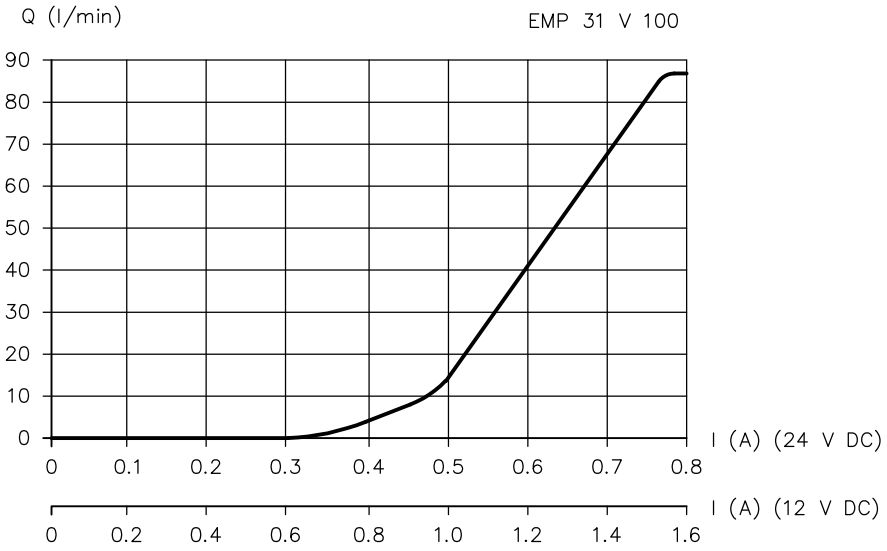
I Control current (A); Q Flow rate (l/min)



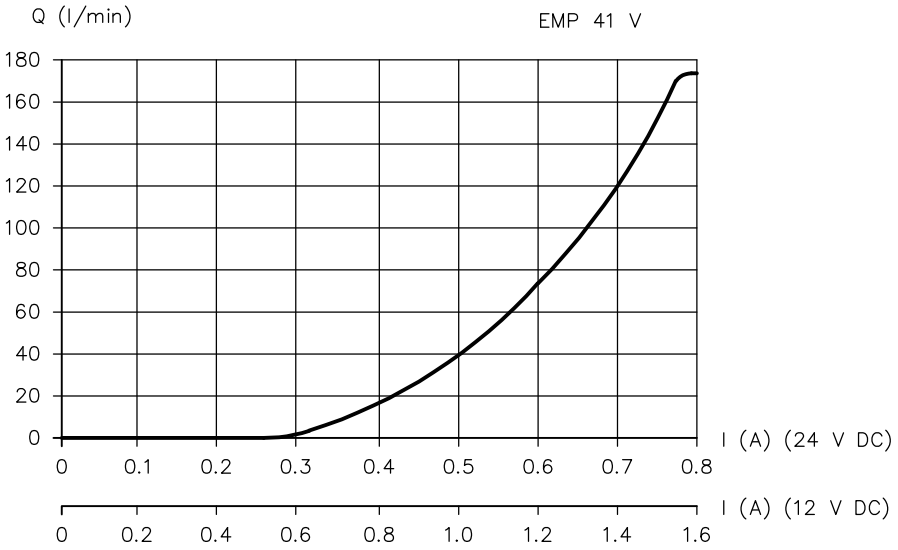
I Control current (A); Q Flow rate (l/min)



I Control current (A); Q Flow rate (l/min)



I Control current (A); Q Flow rate (l/min)



I Control current (A); Q Flow rate (l/min)

NOTICE

Curves measured at a flow resistance of Δp = 10 bar, hysteresis approx. 4%

As the flow resistance Δp increases, the characteristic line becomes steeper; with the same control current, the flow rate Q and Q_{max} increase.

3.5 Electrical data

Nominal power P_N		**12 V DC**	**24 V DC**	**48 V DC**	**98 V DC**	**205 V DC**
	EM 1.., EM 2.., EM 3..	21 W	21 W	21 W	21 W	21 W
	EMP 2.., EMP 3.., EM 4..	32 W	32 W	32 W	32 W	32 W
	EMP 4..	30 W	30 W	--	--	--
Current, cold I_{20}	EM 1.., EM 2.., EM 3..	1.75 A	0.89 A	0.44 A	0.2 A	0.1 A
	EMP 2.., EMP 3.., EM 4..	2.67 A	1.33 A	0.67 A	0.3 A	0.15 A
	EMP 4..	2.5 A	1.25 A	--	--	--
Limit current I_G	EMP 2.., EMP 3..	1.87 A	0.93 A	0.47 A	--	--
	EMP 4..	1.75 A	0.88 A	--	--	--

Switching times approx. (ms)

EM 11.21 D:	on/off approx. 20
EM 1.V, EM(P) 2.V, EM 3.V:	on approx. 30–80
EMP 3.V, EM(P) 4.V:	on approx. 70–200
EM 1.V, EM(P) 2.V, EM 3.V:	off approx. 40–120
EMP 3 V., EM(P) 4V.:	off approx. 70–220
EM 11.21 DS:	on/off approx. 20
EM 1.S, EM(P) 2.S, EM 3.S:	on approx. 40–120
EMP 3.S, EM(P) 4 S:	on approx. 70–220
EM 1.S, EM(P) 2.S, EM 3.S:	off approx. 30–80
EMP 3.S, EM(P) 4 S:	off approx. 70–200

- In the case of version WG.., approx. 2 to 3 times larger
- For type EMP.. VG.. and EMP.. SG.. 5 ... 10 times larger

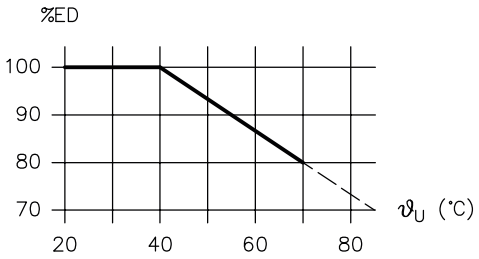
NOTICE
Switching times depend on the pressure level and flow rate; high values result in shorter switching times and vice versa.

Switching operations

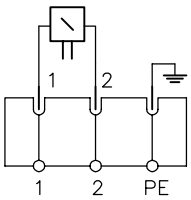
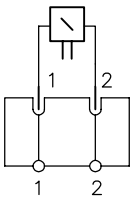
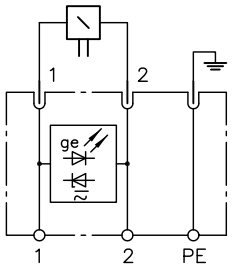
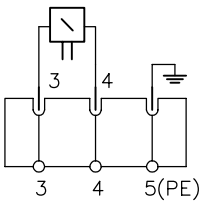
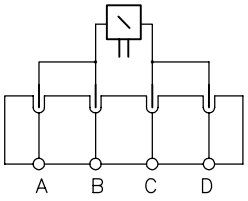
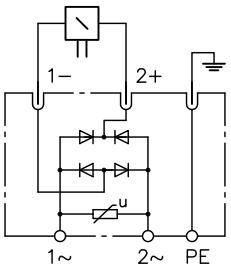
Approx. 2000/h, to be seen as approximately evenly distributed

Insulation material class

F
Contact temperature at 20° ambient temperature approx. 85 – 95°C (cladding).
In adhering to the reference values for % duty cycle 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.

Relative duty cycle 100% duty cycle (specified on solenoid)	Reference value and restriction in operation  *ϑU ambient temperature (°C); % duty cycle* **NOTICE** The thermal load of the coil can be reduced by means of an economy circuit, for example.
Protection class	Depending on the actuating solenoid, see Chapter 2.1.3, "Solenoid voltage and connector"
Electrical connection	Depending on the actuating solenoid see Chapter 2.1.3, "Solenoid voltage and connector"

For circuit diagrams

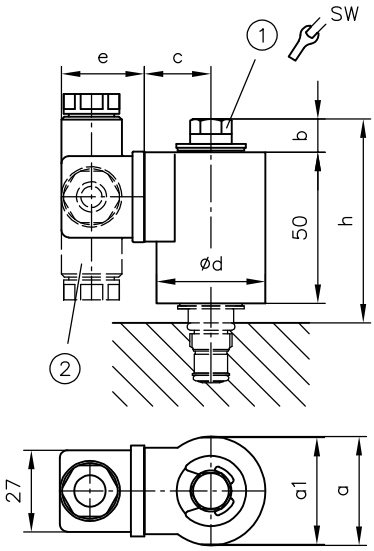
DC voltage	**G .., X ..**  **DT .., K .., S .., AMP .., F ..**  **L ..**  **M ..**  **ITT .., DTL ..** 
AC voltage	**WG 110, WG 230**  For the required connection parts, see Chapter 6.1, "Accessories, spare and individual parts"
Cut-off energy	Approx. < 10 Ws of maximum reference value + approx. 10% from measurements at nominal voltage U_N
Dither frequency for type EMP	50 ... 150 Hz

4 Dimensions

All dimensions in mm, subject to change.

4.1 Valve and actuating solenoid

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



SW = Width across flats

1 Manual override for EM(P) ... S

2 Line connector can be mounted offset by 90° each

Version	e
G	28
WG	34.5
L	40

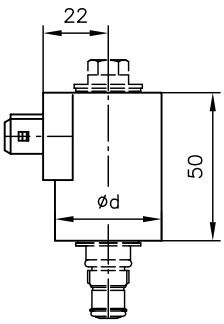
Type	a	a1	b	c	h	∅d	SW	Tightening torque (Nm)
EM 1..	36.5	--	12	22	69	36.5	12	30
EM 2..	36.5	--	12	22	75.5	36.5	12	30
EM 3..	36.5	--	14	22	73.6	36.5	12	60
EM 4..	--	37.5	18	25	76.9	38.5	14	90
EMP 2..	--	37.5	15	25	77.1	38.5	14	30
EMP 3..	--	37.5	18	25	77.9	38.5	14	60
EMP 4..	⌀37	--	22	28	80	⌀37	19	90

NOTICE

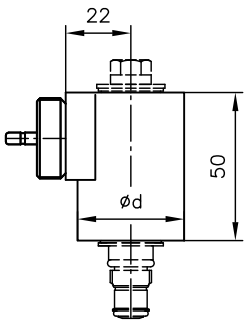
Maximum permissible operating pressures (see Chapter 2.1.1, "Basic type and size") and tightening torques only basic blocks made of steel. Other materials (e.g. cast iron, aluminium alloys) that differ significantly from steel in terms of strength and/or friction coefficients usually require modified values.

Actuating solenoid

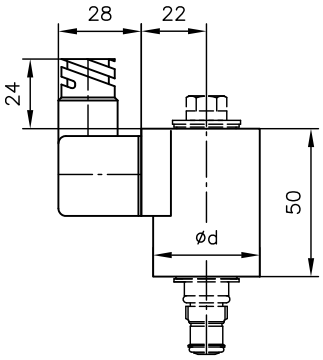
Coding **AMP..**



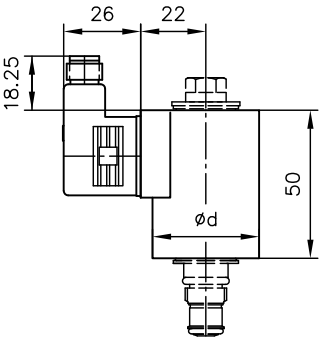
Coding **K..**



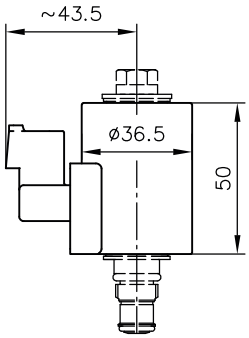
Coding **S..**



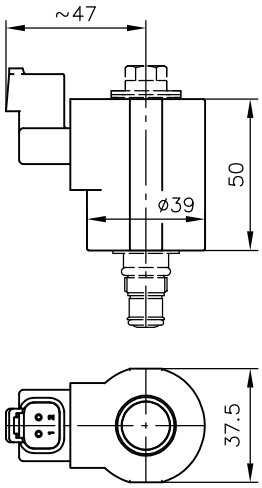
Coding **M..**



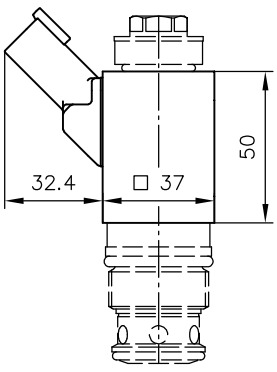
Coding **DT..**
EM 1.., EM 2.., EM 3..



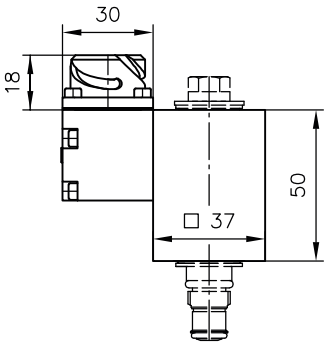
Coding **DT..**
EM 4.., EMP 2.., EMP 3..



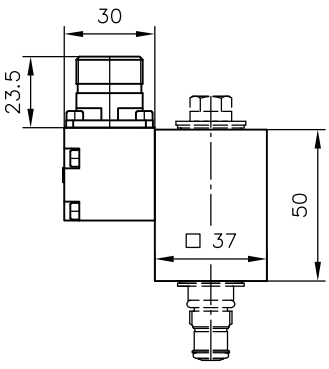
Coding **DT..**
EMP 4..



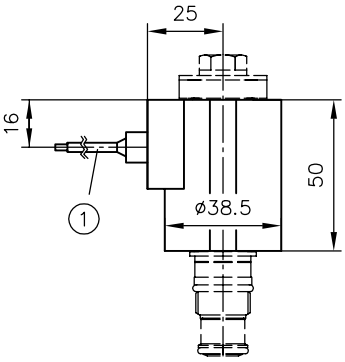
Coding **ITT..**



Coding **DTL..**



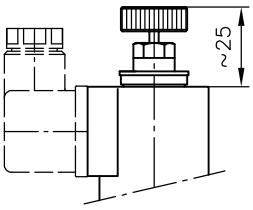
Coding **F..**



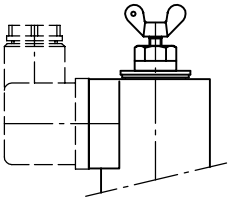
Type	∅d
EM 1..	36.5
EM 2..	36.5
EM 3..	36.5
EM 4..	38.5
EMP 2..	38.5
EMP 3..	38.5
EMP 4..	⌀37

1 Approx. 600 mm

EM .. ST (button for manual actuation)

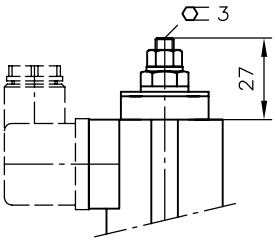


EM .. S-M (wing nut, attached to side upon delivery)



NOTICE
Max. tightening torque: 1 Nm, use when de-pressurised

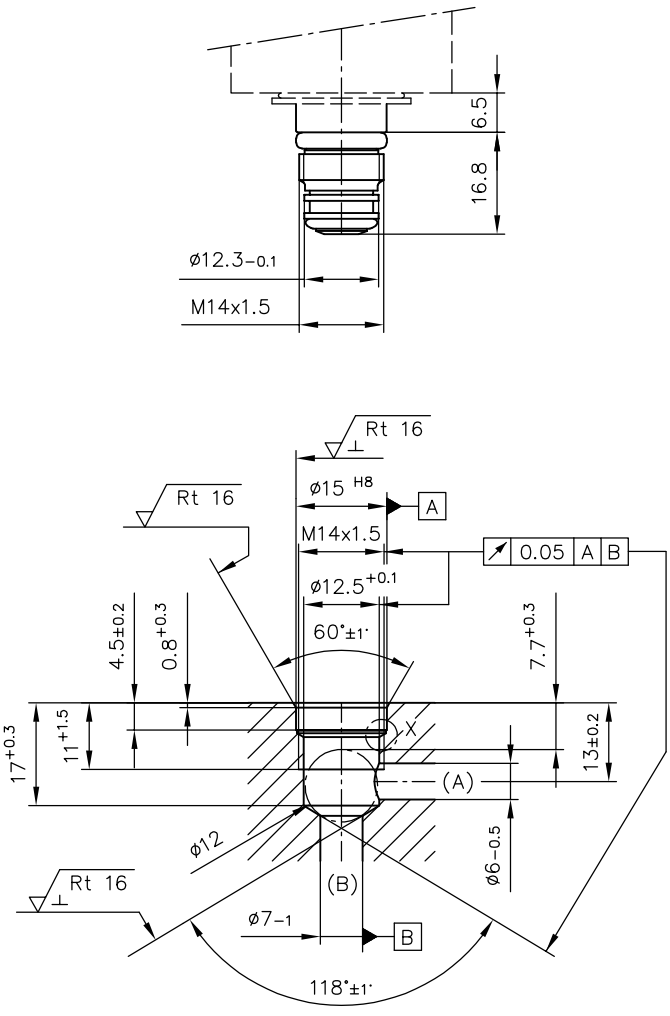
EMP .. VH (stroke limitation)



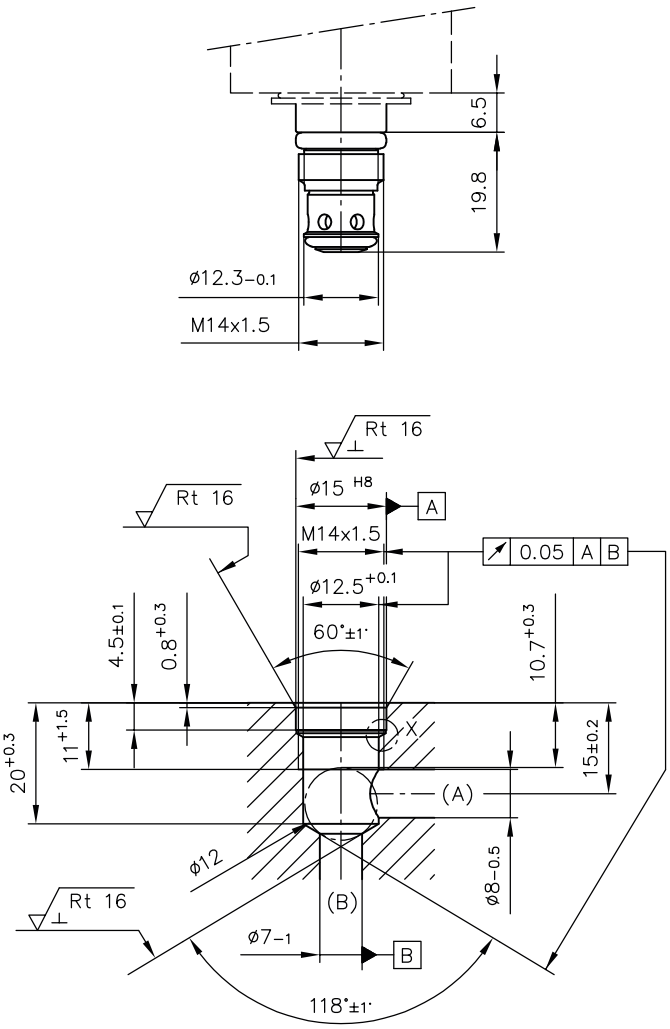
INFORMATION
The stroke limitation type VH is not set upon delivery, i.e. the threaded screw is completely unscrewed, meaning the flow is not limited. To limit the flow, undo the lock nut and screw in the threaded screw clockwise. Tightening torque of lock nut: 9.0 - 10.1 Nm

4.2 Bore holes

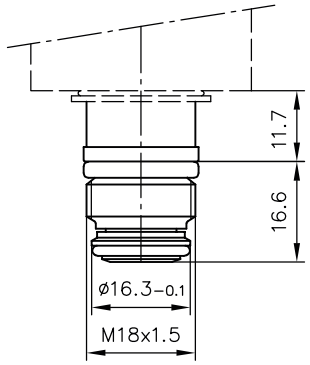
EM 11 D, EM 11 DS
EM 11 D 0.8, EM 11 DS 0.8

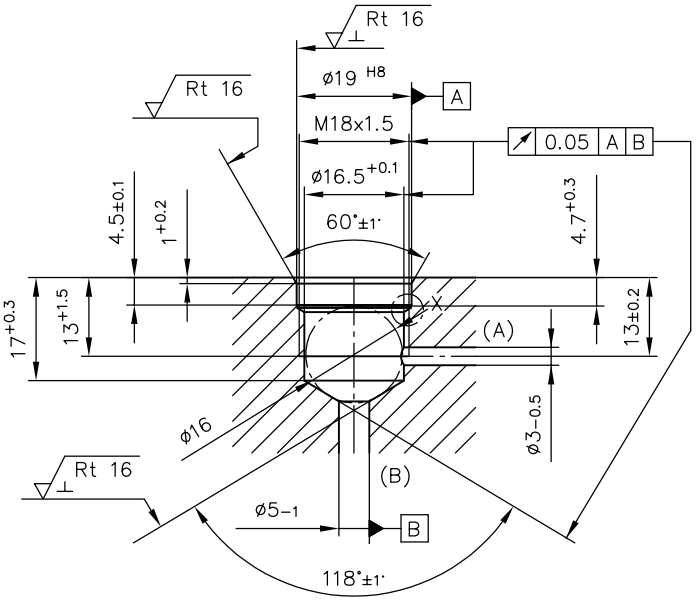


EM 1. V, EM 1. S

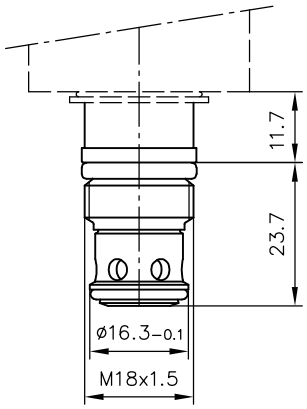


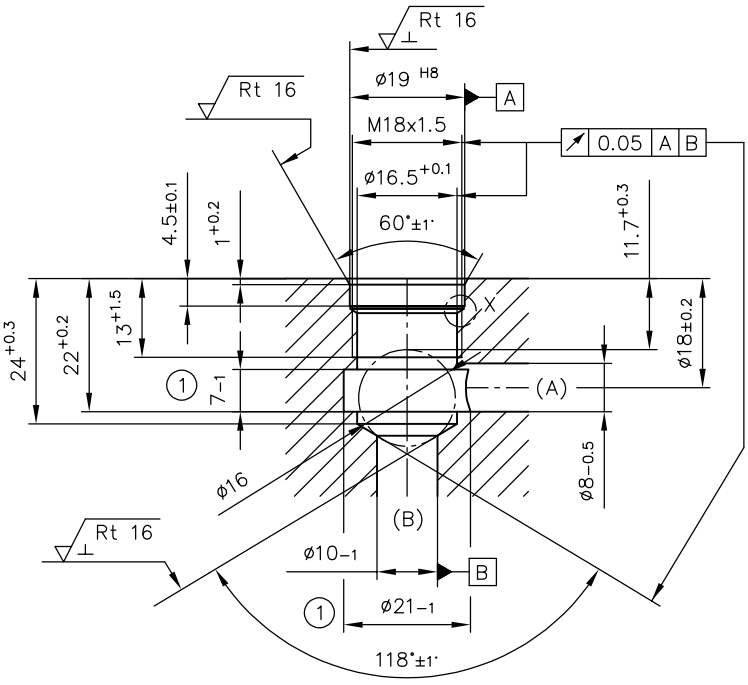
EM 21 D, EM 21 DS





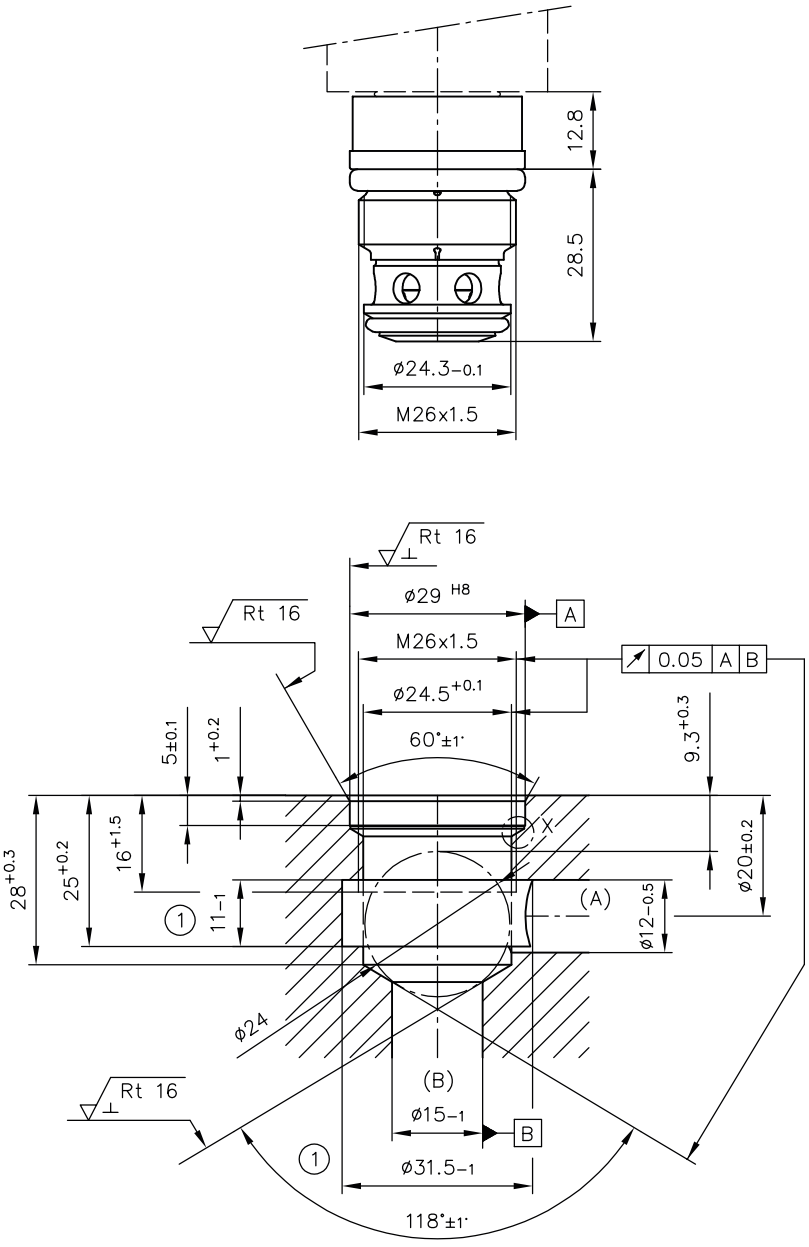
EM 2. V, EM 2. S
EMP 21 VG, EMP 21 SG
EMP 21 V.., EMP 21 S..



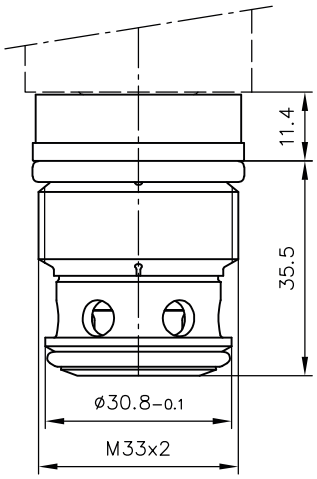


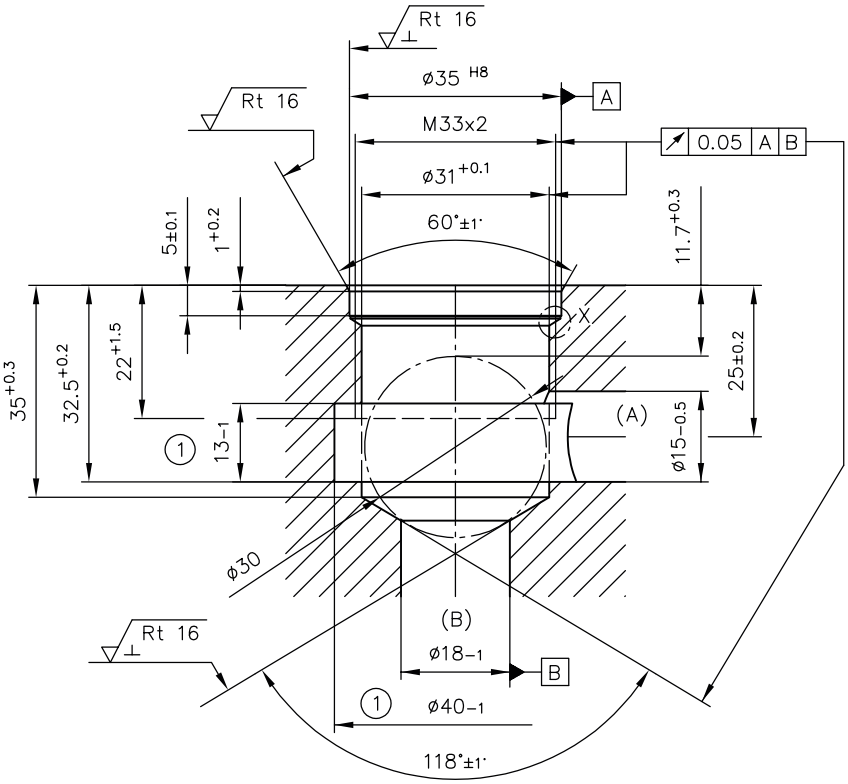
1 Insertion optional:
Insertion to reduce the flow resistance, not necessary for functional-technical reasons

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



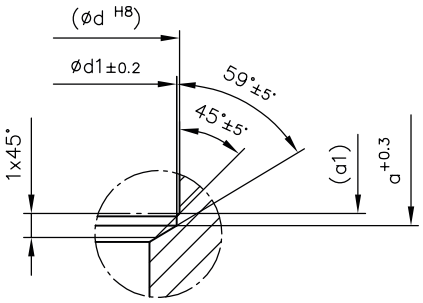
1 Insertion optional:
Insertion to reduce the flow resistance, not necessary for functional-technical reasons





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

Detail X



Type	∅d	∅d1	a	a1
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

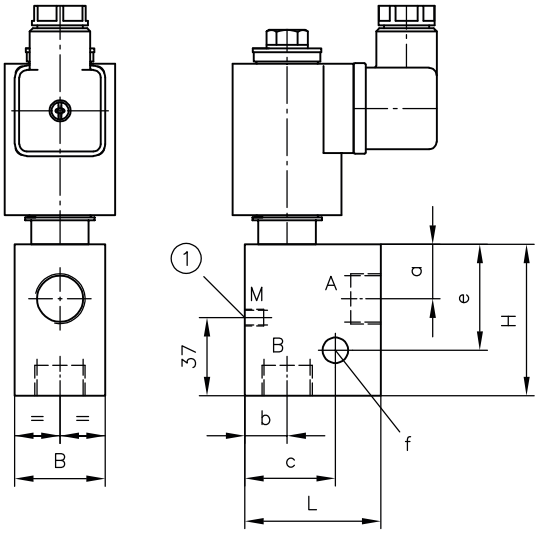
NOTICE

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

- This tolerance must be adhered to.
- See the information in Chapter 5, "Installation, operation and maintenance information".

4.3 Single connection block

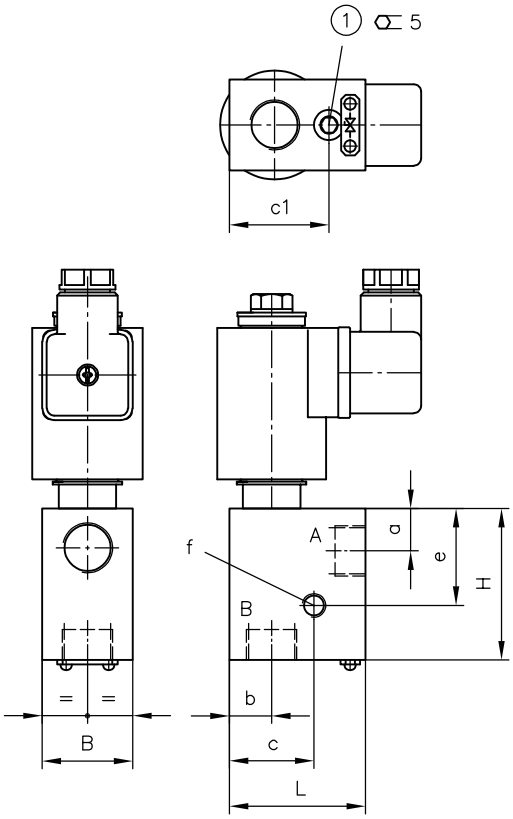
Coding **- 1/4, - 3/8, - 1/2, - 3/4, - 1, - 1 5/16-12 UN**



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

Type	Coding	Ports (ISO 228-1)	Principal dimensions (mm)								Order no. for connection block without valve
		A, B	L	B	H	a	b	c	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

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

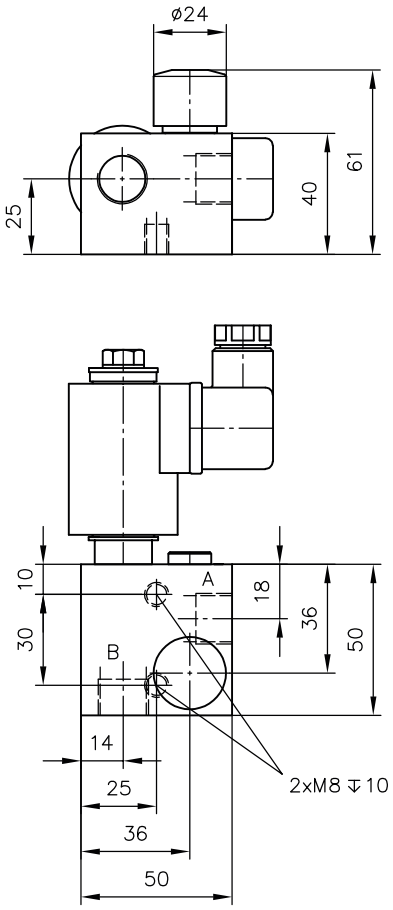


1 Drain valve

Type	Coding	Ports (ISO 228-1)	Principal dimensions (mm)									Order no. for connection block without valve
		A, B	L	B	H	a	b	c	c1	e	f	
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	15	14	27	33	30	M8, 8 deep	7491 015
	- 1/2 A	G 1/2	50	30	50	15	14	30	36	30	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	51.5	50	M12, 12 deep	7591 016

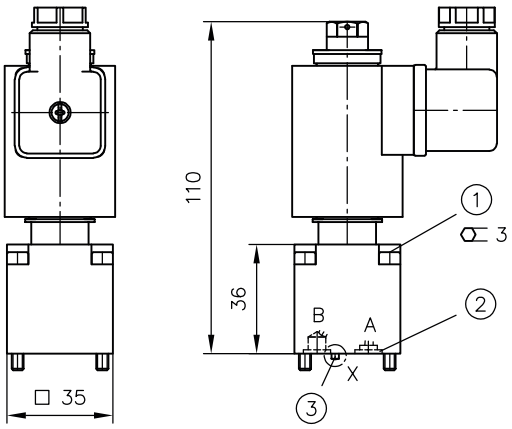
NOTICE
Attachment options (dimension f):
∅.. -Through bore, thread specification M.. Thread present on both sides (- 3/8 N.. is an exception, only on rear).

Coding **- 3/8 N 0.8, - 3/8 N 1.5**



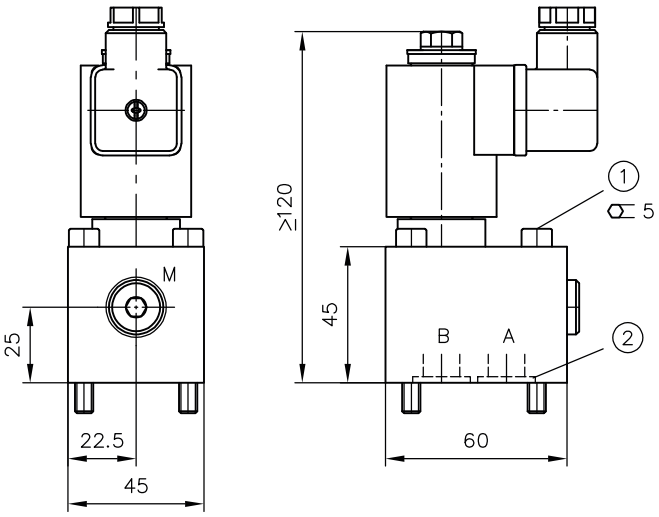
Type	Coding	Ports (ISO 228-1)	Order no. for connection block without valve
		A, B	
EM 2. V(S) EMP 2. V(S)	- 3/8 N 0.8 - 3/8 N 1.5	G 3/8	7902 150

EM 21 D - P
EM 21 DS - P



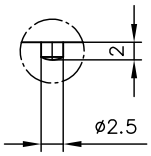
1 Cylinder screw M4x35-12.9 ISO 4762
2 O-ring 6x1.5 NBR 90 Sh
3 Mounting centring pin

EM 3. - P
EMP 3. - P



1 Cylinder screw M6x55 ISO 4762
2 O-ring 13.95x2.62 NBR 90 Sh

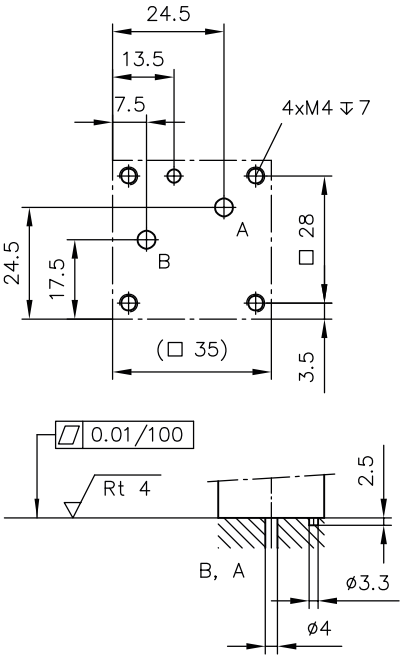
Detail X



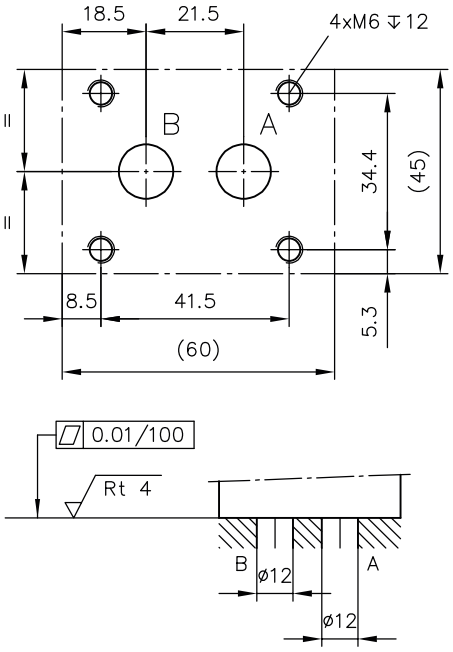
Type	Coding	Order no. for connection block without valve
EM 21 D(DS) EM 3. EMP 3.	- P	7902 360 7903 140 B

Hole pattern of the base plate

EM 21 D - P
EM 21 DS - P

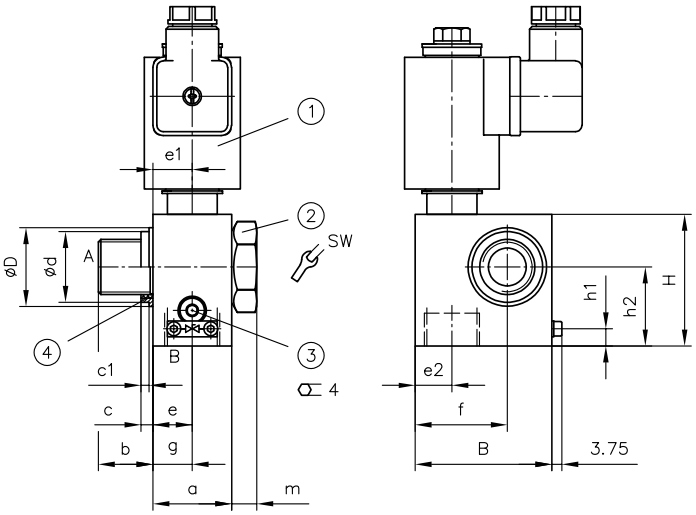


EM 3. - P
EMP 3. - P



4.3.1 Single connection block with additional function

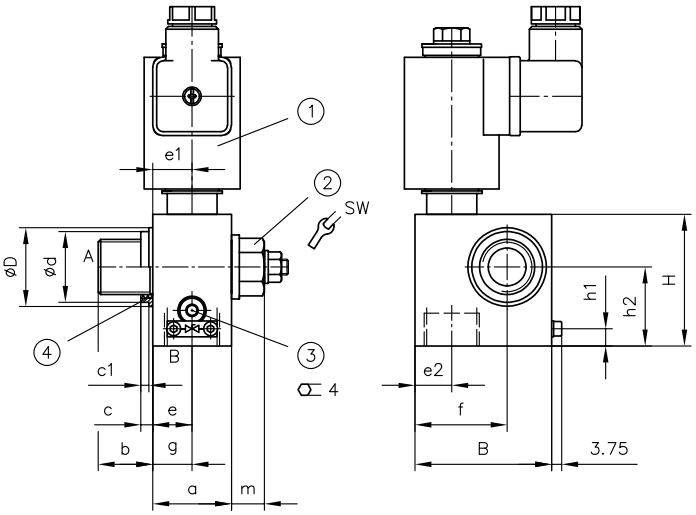
EM 1. - .F, EM 2. - .F, EM 3. - .F
EMP 2. - .F, EMP 3. - .F



SW = Width across flats

1 Each rotatable by 360°
2 Banjo bolt can be mounted on both sides for - 3/4 F
3 Drain valve
4 Sealing ring

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

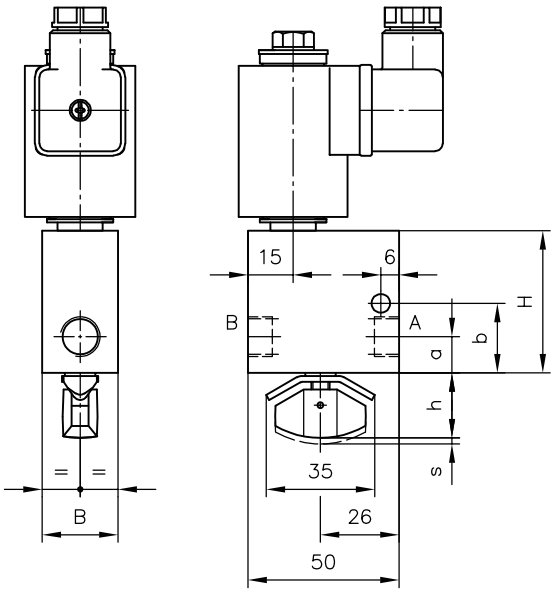


1 Each rotatable by 360°
2 Counterbalance valve screw-in cartridge according to D 6920
3 Drain valve
4 Sealing ring

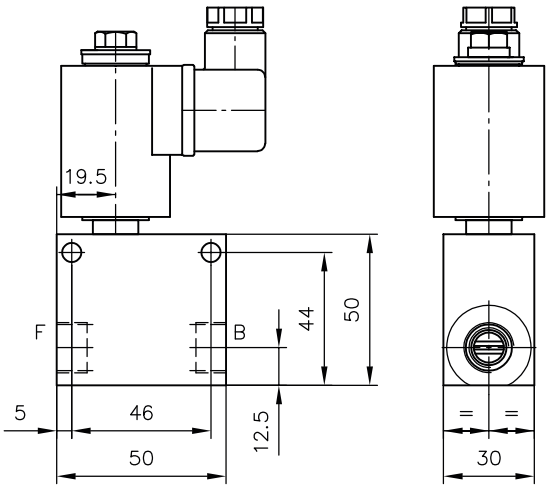
Type	B	H	∅D	a	b	c	c1	∅d	e	e1	e2	f	h1	h2	g	m	SW
EM 1. -3/8 F	45	40	24	25	15	3	2.1	21.9	12.5	15.5	12	30	12.5	27	18	7.5	24
EM 1. -3/8 F -SB1. H	45	40	24	25	15	3	2.1	21.9	12.5	15.5	12	30	12.5	27	18	11	17
EM 2. -1/2 F EMP 2. -1/2 F	52	50	30	30	20.7	4.5	2.6	26.9	15	15	14	35	13.5	30	15	9.5	30
EM 2. -1/2 F -SB2. H EMP 2. -1/2 F -SB2. H	52	50	30	30	20.7	4.5	2.6	26.9	15	15	14	35	13.5	30	15	12.5	19
EM 3. -3/4 F EMP 3. -3/4 F	70	60	--	40	19.5	5	--	36	20	20	20	50	18	40	20	10	36

Type	Ports (ISO 228-1)		Bore hole for banjo bolt
	A	B	
EM 1. -3/8 F EM 1. -3/8 F -SB1. H	G 3/8 A	G 3/8	ISO 1179-1 - G 3/8 - N In deviation from the standard: L2 min. = 13.5 mm
EM 2. -1/2 F EMP 2. -1/2 F EM 2. -1/2 F -SB2. H EMP 2. -1/2 F -SB2. H	G 1/2 A	G 1/2	ISO 1179-1 - G 1/2 - N In deviation from the standard: L2 min. = 15.5 mm
EM 3. -3/4 F EMP 3. -3/4 F	G 3/4 A	G 3/4	ISO 1179-1 - G 3/4 - N

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

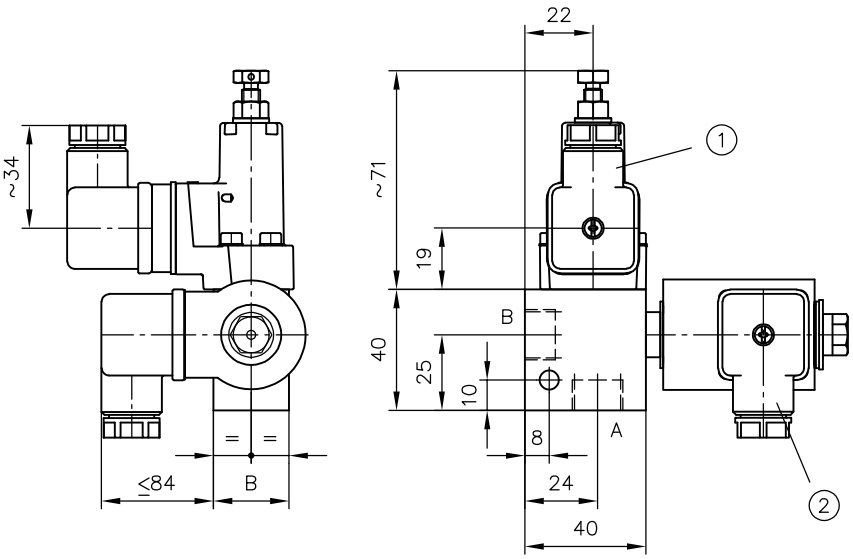


EM 2. - 3/8 - SJ 0.
EMP 2. - 3/8 - SJ 0.



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

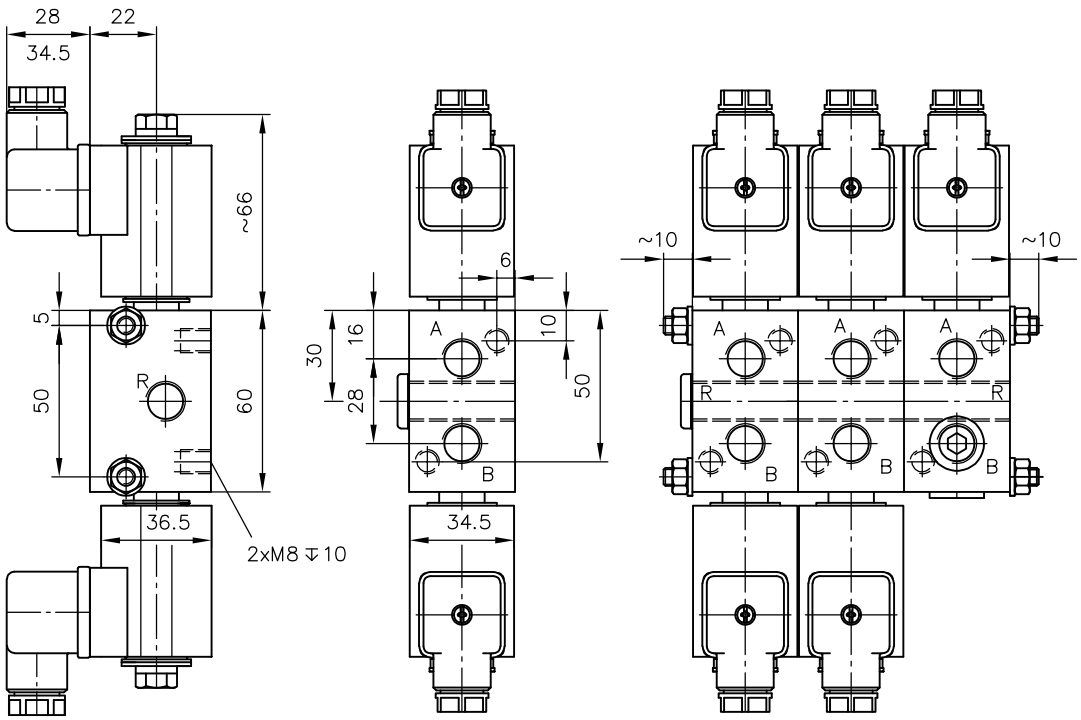
EM 1. - 3/8 DG



1 For missing information see D 5440 (DG 3..)
2 Connector can be mounted offset 4x 90°

4.4 Valve bank

BEM 11



5 Installation, operation and maintenance information

Observe the document B 5488 “General operating instructions for assembly, commissioning, and maintenance.”

5.1 Intended use

This product is intended exclusively for hydraulic applications (fluid technology).

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

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 specialist personnel.
- ► The product must only be operated within the specified technical parameters described in detail in this document.
- ► All components must be suitable for the operating conditions when using an assembly.
- ► The operating instructions for the components, assemblies and the specific complete system must also always be observed.

If the product can no longer be operated safely:

1. 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 and compliant connection components (screw fittings, hoses, pipes, fixtures etc.).

The product must be shut down correctly prior to disassembly (in particular in combination with hydraulic accumulators).

⚠ **DANGER**

Sudden movement of the hydraulic drives when disassembled incorrectly

Risk of serious injury or death

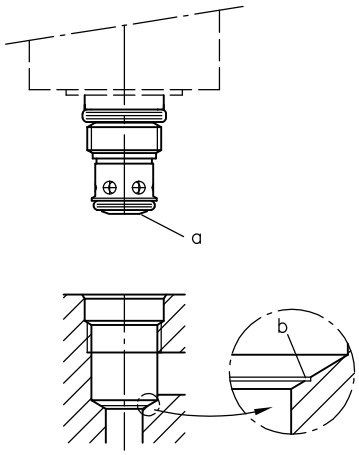
- ► Depressurise the hydraulic system.
- ► Perform safety measures in preparation for maintenance.

5.2.1 Notes on commissioning

In accordance with Chapter 4, "Dimensions", the 118° shoulder of the stepped bore is tolerated in its angular position to the centring bore ∅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.

The accuracy of the angular position can be checked when installing the EM valve and corrected if there are minor deviations.

1. Screw in the valve and quickly tighten it to the specified torque according to Chapter 4, "Dimensions".
2. Unscrew the valve again. The edge **a** running all around the head end of the valve housing must leave behind a uniform, ring-like impression **b** on the stepped bore.
3. If this is the case, screw in and secure the valve again as stated in step 1.
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 impression 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 Chapter 4, "Dimensions"

5.2.3 Setting the stroke limitation

see Chapter 4, "Dimensions"

5.3 Operating instructions

Observe product configuration and pressure/flow rate.

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

NOTICE

- 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

Overloading components due to incorrect pressure settings.

Risk of minor injury. Parts may burst or fly off, and uncontrolled leakage of hydraulic fluid.

- Pay attention to the maximum operating pressure of the pump, valves and fittings.
- 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 the product. Contamination can cause irreparable damage.

Examples of fine contamination include:

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

NOTICE

New hydraulic fluid from the manufacturer may not have the required purity.

Damage to the product is possible.

- ► Filter new hydraulic fluid to a high quality when filling.
- ► Do not mix hydraulic fluids. Always use hydraulic fluid that is from the same manufacturer, of the same type, and with the same viscosity properties.

For smooth operation, pay attention to the cleanliness level of the hydraulic fluid (cleanliness level see Chapter 3, "Parameters").

Additionally applicable document: D 5488/1 oil recommendations

5.4 Maintenance information

Check regularly (at least once a year) by visual inspection whether the hydraulic connections are damaged. If external leakages are found, shut down and repair the system.

Clean the surface of the device regularly (at least once a year) (dust deposits and dirt).

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

6 Other information

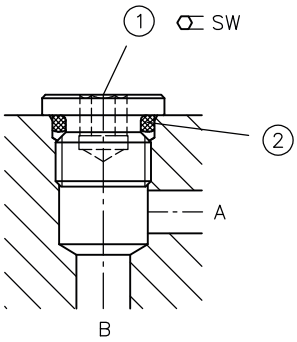
6.1 Accessories, spare and individual parts

To purchase spare parts, please see HAWE Hydraulik interactive contact map.

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.

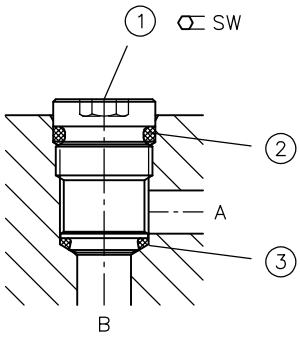
Passage open



SW = Width across flats

1 Tapped plug
2 O-ring P5001 94 Sh

Passage blocked



1 Locking tapped plug
2 O-ring P5001 94 Sh
3 O-ring NBR 90 Sh

Type	Tapped plug	Locking tapped plug	SW	Tightening torque (Nm)	O-ring	
					P5001 94 Sh	NBR 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

6.1.2 Seal 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

Sealing rings for connection blocks with swivel fitting (see Chapter 2, "Available versions")

6.1.3 Line connectors

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

Other line connectors

Economy circuits	MSD 4 ECO MSD 4 P 53 MSD 4 P 63	24 V DC 230 V DC 115 V DC	as per D 7833/1 as per D 7813 as per D 7813
LED circuit and protective circuit	SVS 3129020	24 V DC	as per D 7163
Clamp diode	MSD 3-209 C 1	150 V DC	as per D 7163
Proportional amplifier for type EMP	EV 22 K 5 EV 1 M 3 EV 1 D	(Card) (Module) (Module)	as per D 7817/2 as per D 7831/2 as per D 7831 D

References

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
- Directional seated valve type G with interchangeable solenoid: D 7300-12
- Directional seated valve type SVNE, SVSE: D 6354/1

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