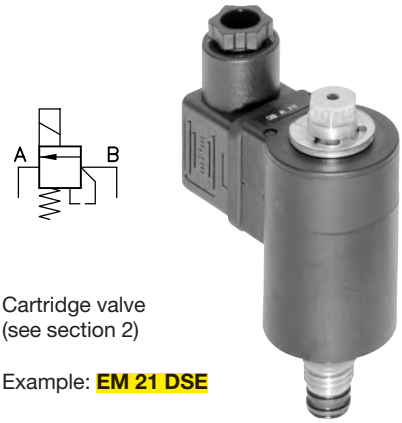
Prop. directional seated valve type EM 21 DE and EM 21 DSE

intended as pilot valve

Operation pressure p_{max} = 420 bar
Flow Q_{max} = 3.5 lpm

See also:
Directional seated valves type EM and EMP D 7490/1
Prop. pressure limiting valve type PMV and PMVP D 7485/1



Cartridge valve
(see section 2)

Example: **EM 21 DSE**

1. General

These 2/2-way directional cone seated valves show zero leakage while in blocked shifting position.
The following versions are available:

Basic version
- Directly actuated
  Application, as piloting or discharge valves for hydraulic consumers, e.g. idle circulation circuit for 2/2-way cartridge valves, 3-way flow control valves or piloted pressure limiting valves.

Basic flow pattern symbol
- Blocked in idle position, opening when energized (NO-characteristic)
- Open in idle position, blocking when energized (NC-characteristic)

Switching characteristics
- ON/OFF
- Proportional, prop. pressure limiting valve

Versions
- Cartridge valve
- Cartridge valve with indiv. connection block for direct pipe connection with various additional functions, e.g. drain valve, throttle valve or as manifold mounting valve

The actuation solenoid is a wet armature type, i.e. all moving parts of the valve and the solenoid are lubricated by the hydraulic fluid, the coil cavity is sealed to the outside at the armature tube by means of O-rings. Therefore the solenoid is highly protected against ambient influences e.g. corrosion. The valves are bled automatically during operation.
A tapered pin directly opens or closes the valvular passage with the directly actuated type.
The solenoid acts either on the tapered pin (directly actuated valves) or on the tapered piloting pin (piloted valves) thereby pulling with NC-valves or pushing with NO-valves and always acting against the spring return.
The valve is designed to be self-locking i.e. it is vibration save.
There are various passage cross sections available to enable a customized shifting characteristic (see curves in sect. 3.2).
Control of the prop. valve is via a proportional amplifier (see sect. 5.4).
The mounting hole is a simple stepped hole where the transition from one to the next diameter shows a chamfer of 118° (std. point angle of drills).

2. Available versions, main data

2.1 Directional seated valves

Order example: **EM 21 DSE - 1/4 - G 24 - M - AT**
EM 21 DE 1,4 - - G 12

Indiv. connection block, see sect. 2.2

Seal spec., see table 3

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

Note: Only available with type EM 21 DSE!

Coding	Description
(without)	No function lock (std.) but incl. manual emergency actuation
M	Winged nut (fixed laterally via lead seal)

Table 1: Basic type

Note: Max. permissible pressure only with manifolds made of steel. Observe the reduced strength of the thread for other materials e.g. cast iron, light alloy!

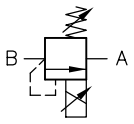
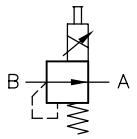
Basic type		Operating pressure p_{max} (bar)	Flow Q_{max} (lpm)	Symbol
EM 21 DE	**-**	400	3.5	
	1,2	250		
	1,4	200		
	1,6	150		
	2,0	100		
EM 21 DSE	**-**	420		
	1,0	340		
	1,2	300		
	1,4	250		
	1,6	200		
	2,2	150		

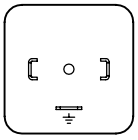
Table 2: Actuation solenoid

Note: ● The specified protection class is only valid when the plug is properly mounted.

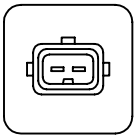
Electrical connection	Coding and nom. voltage					Protection class (IEC 60529)
	12V DC	24V DC	48V DC	110 V 50/60 HZ	230 V 50/60 Hz	
DIN EN 175 301-803 A with plug	**G 12**	**G 24**	**G 48**	**WG 110**	**WG 230**	IP 65
DIN EN 175 301-803 A without plug	**X 12**	**X 24**	**X 48**	**X 98**	**X 205**	(IP 65)
DIN EN 175 301-803 A with LED-plug	**L 12**	**L 24**	--	--	--	IP 65
Co. AMP Junior Timer	**AMP 12**	**AMP 24**	**AMP 48**	--	--	IP 65
Co. DEUTSCH (DT 04-2P)	**DT 12**	**DT 24**	--	--	--	IP 67
Co. KOSTAL	**K 12**	**K 24**	--	--	--	IP 67
Co. SCHLEMMER (quarter-turn PA 6)	**S 12**	**S 24**	--	--	--	IP 67
MIL-VG 95234	--	**ITT 24**	--	--	--	IP 67
MIL-DTL-38999 series III	--	**DTL 24**	--	--	--	IP 67

Connection pattern

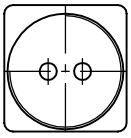
G.., X.., L..



AMP..

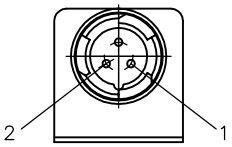


K..

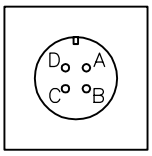


DT..

S..



ITT..



DTL..

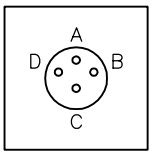


Table 3: Seal specification, for fluid exposed seals

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)

2.2 Indiv. connection blocks

Suited for direct pipe connection of manifold mounting

2.2.1 Indiv. connection blocks without and with drain valve

Order example: **EM 21 DSE - 1/4 - G 24**

Basic type acc. to table 1

Actuation solenoid, table 2

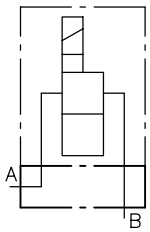
Table 4: Indiv. connection blocks

Coding	Description	Ports A, B (BSPP)
1/4	For pipe connection	G 1/4
P	For manifold mounting	--

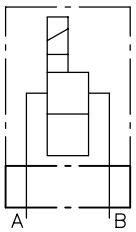
Symbols

Below symbols are only exemplary and have to be completed with the flow pattern symbols, see table 1

Coding
1/4



Coding
P

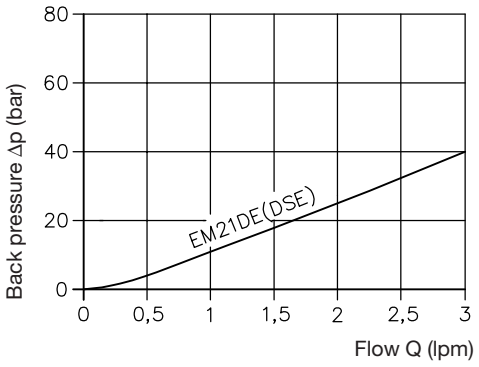


3. Technical data

3.1 General and hydraulic

Nomenclature and design:	2/2-way directional seated valve, solenoid actuated, seated ball type design
Installed position	Any
Operating pressure	p_{max} = 420 bar
Flow	Q_{max} = 3.5 lpm
Flow direction	B → A
Pressure fluid	Hydraulic oil conforming DIN 51514 part 1 to 3: ISO VG 10 to 68 conforming to DIN 51519. Viscosity limits: min. approx. 4, max. approx. 1500 mm²/s; opt. operation approx. 10... 300 mm²/s. Also suitable are biological degradable pressure fluids types HEPG (Polyalkylenglycole) and HEES (Synth. Ester) at service temperatures up to approx. +70°C.
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. Biological degradable pressure fluids: Note manufacturer's specifications. By consideration of the compatibility with seal material not over +70°C. **Attention:** Observe the restrictions regarding the permissible duty cycle in sect. 3.2
Mass (weight)	0.4 kg

Δp-Q curve
(valve completely open)



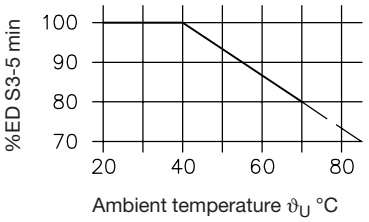
3.2 Electrical

Nom. voltage (solenoid) U_N	12V DC	24V DC	98V DC	205V DC
Supply voltage	12V DC	24V DC	98V DC 110V 50/60 Hz	205V DC 230V 50/60 Hz
Nom. power P_N	21 W	21 W	21 W	21 W
Nom. current I_N	1.2 A	0.63 A	0.21 A	0.11 A
Current, limit I_{lim}	1.2 A	0.6 A	-	-

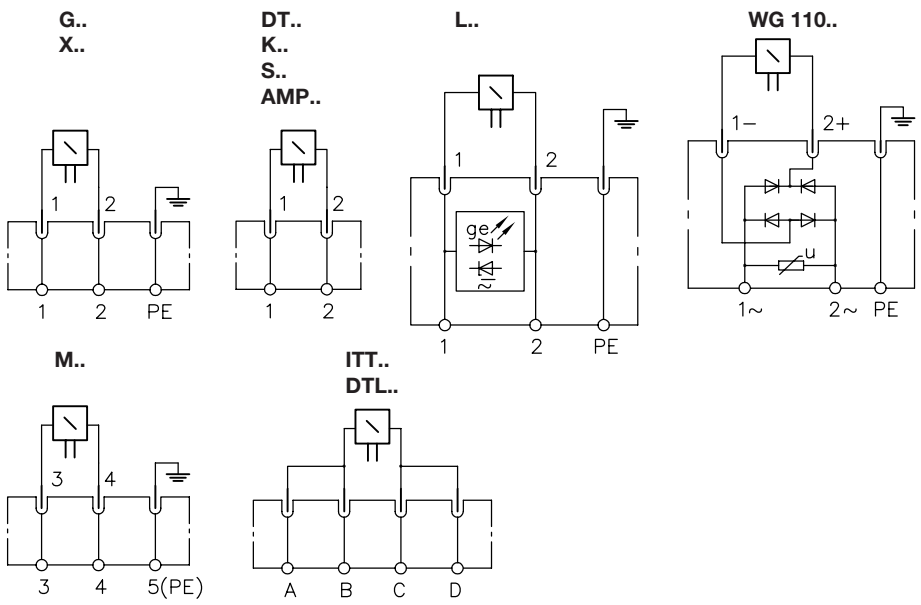
Switching times approx. ms	EM..DSE: On 150 Off 50 EM..DE: On 50 Off 150 The switching times with version WG.. are 2 to 3 times
Switching /h	approx. 2000, to be regarded as approx. evenly distributed
Insulation material class	F; Contact temperature approx. 85 ... 95°C (solenoid housing) with an ambient temperature of 20°C. Classification F permits a max. winding temperature of approx. 150°C; This won't be exceeded if the guideline figures for %ED are observed during operation. The thermal load of the coil may be reduced when an economy circuit is employed (see sect. 5.4).

Relative duty cycle: 100% ED
(Specification on the solenoid)

Reference value and restriction in the operation



Protection class	IP 65, depending on actuation solenoid, see table 2
Connector and connection	Depending on actuation solenoid, see table 2
Required connectors Coding K.. 03888005 Co. KOSTAL Coding S.. Taper with quarter-turn 10 SL Co. SCHLEMMER Coding AMP.. Co. AMP Junior 2-pole, Coding 1 Coding G.., X.., L.. DIN EN 175 301-803 A	DC-voltage **G..** **X..** **DT..** **K..** **S..** **AMP..** **L..** AC-voltage **WG 110..**



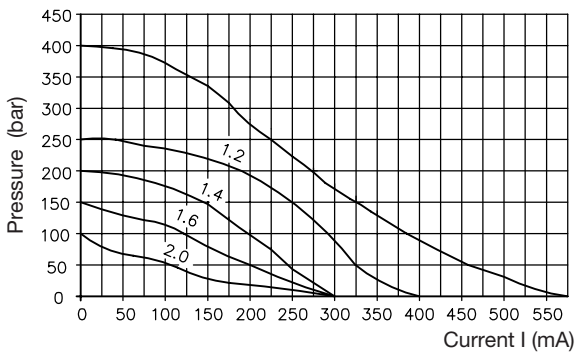
M..

ITT..
DTL..

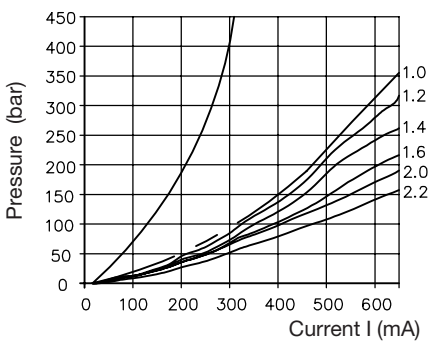
Cut-off energy	Guideline for max: approx. < 10 Ws + approx. 10% when measuring at U_N
Dither frequency	50 ...150 Hz

I-Q curve

Type EM 21 DE



Type EM 21 DSE



Attention: The valve is flow responsive, i.e. an adjusted current/pressure-relation will remain constant only if the flow doesn't change.

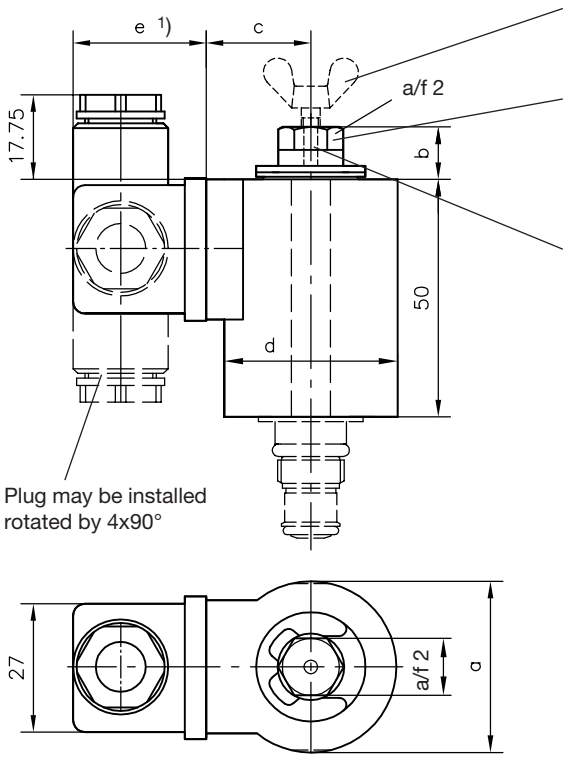
4. Unit dimensions

All dimensions in mm, subject to change without notice!

4.1 Valve and actuation solenoid

Valve and actuation solenoid
Coding G.., WG.., X.., L..

Type EM 21 DSE



Function lock coding **M**
Winged nut is laterally fixed at a/f 2, when delivered from HAWE

Manual emergency actuation

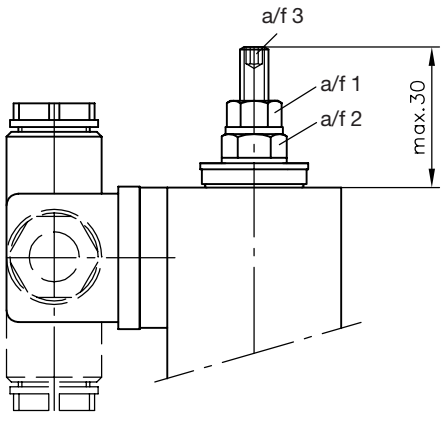
Actuation force
at pressure 100 bar
at A = approx. 70 N

Type	a/f 2	(Nm)
EM 2..	12	30

Type	EM 2		
a	36.5		
b	12		
c	22		
d	∅36.5		
Version	G	WG	L
e	29 1)	34 1)	40

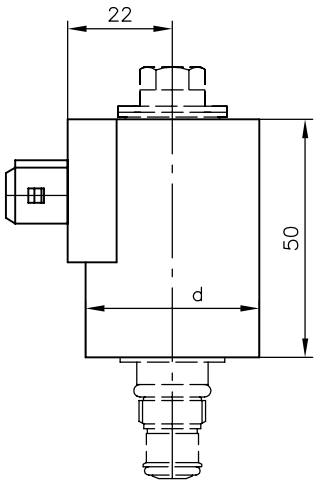
1) This dimension depends on the manufacturer (of the plug) and may be up to 40 mm acc. to DIN EN 175 301-803!

Type EM 21 DE

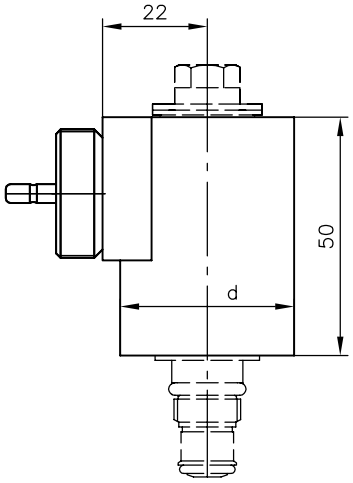


Type	a/f 1	(Nm)	a/f 2	(Nm)	a/f 3	(Nm)
EM 2..	10	8	12	30	3	8

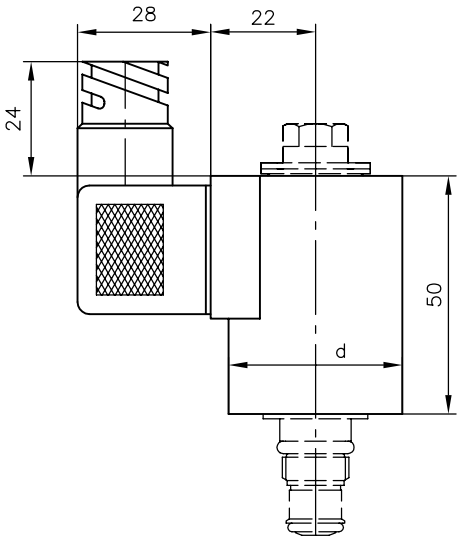
Actuation solenoid
Coding AMP..



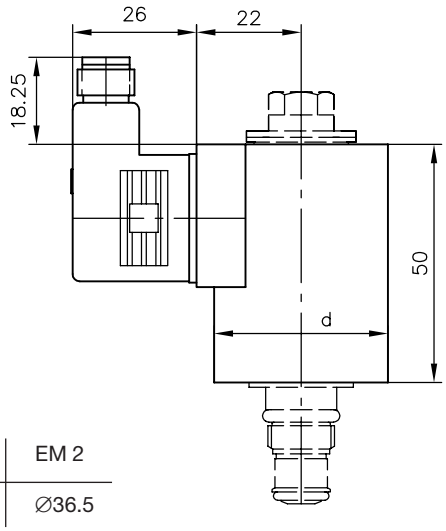
Coding K..



Coding S..

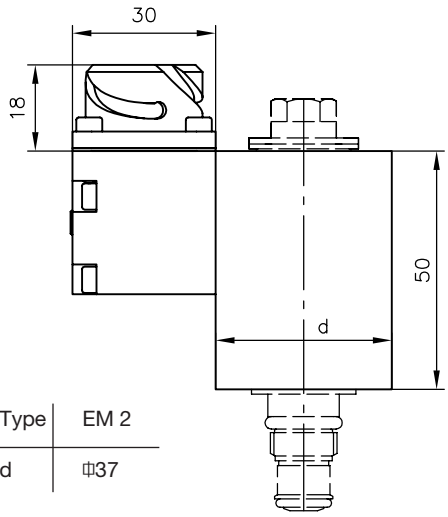


Coding M..



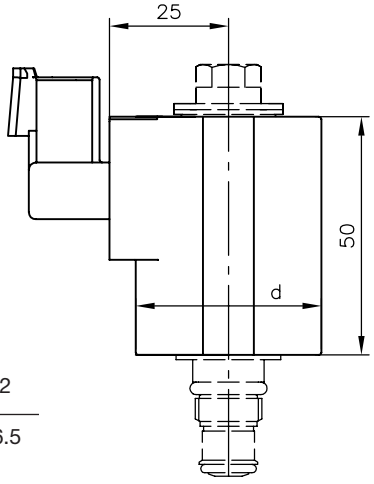
Type	EM 2
d	∅36.5

Coding ITT..
DTL..



Type	EM 2
d	⌽37

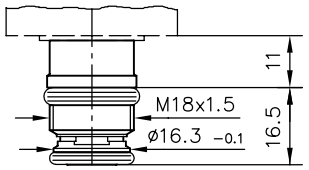
Coding DT..



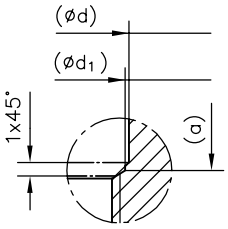
Type	EM 2
d	∅36.5

4.2 Screwed-in section of the valve

Type EM 21 DE and EM 21 DSE

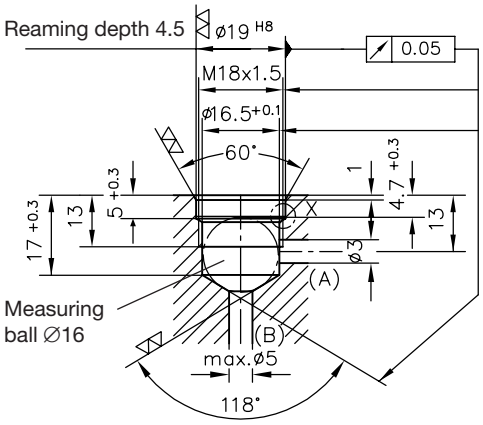


Detail at X M 2:1



Type	$\varnothing d^{H8}$	$\varnothing d_1$	$a^{+0.3}$
EM 2	19	18.75	5

Mounting hole:



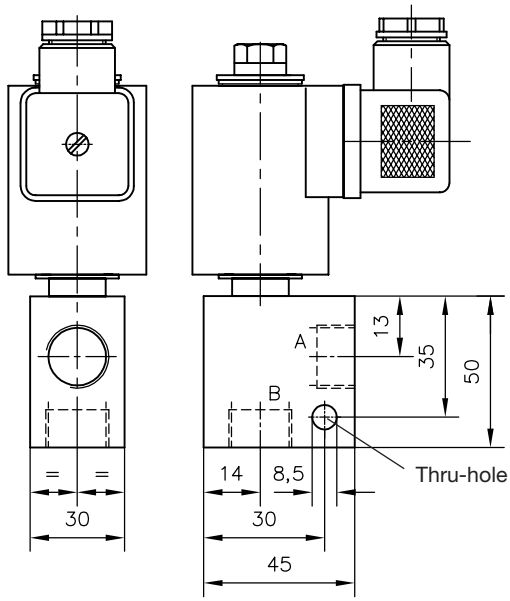
Attention:
The angularity of the 118° chamfer of the stepped bore are tolerated with reference to the reamed core diameter $\varnothing d^{H8}$ (reaming depth). The stated tolerance must be observed. Also see section 5.1!

4.3 Individual connection block

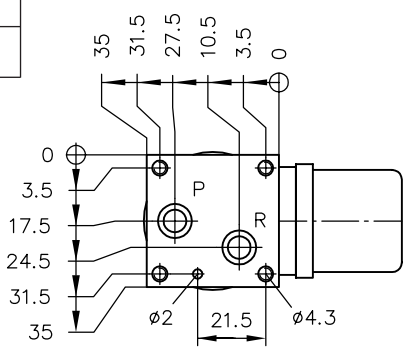
Enabling direct pipe connection via common fittings, male thread, shape B DIN 3852 page 2

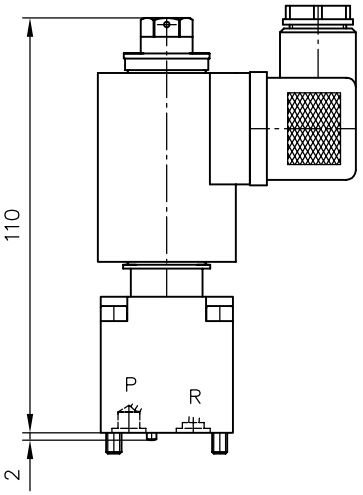
Coding	Ports A and B ISO 228/1 (BSPP)	Main dimensions (mm) L	B	H	a	b	c	e	f	Part No. Individual connection block without valve	Mass (weight) approx. (kg)
- 1/4	G 1/4	45	30	50	13	14	30	35	8.5	7902 310	0.45
- P	-									7902 360	0.3

Type EM 21 D.. - 1/4



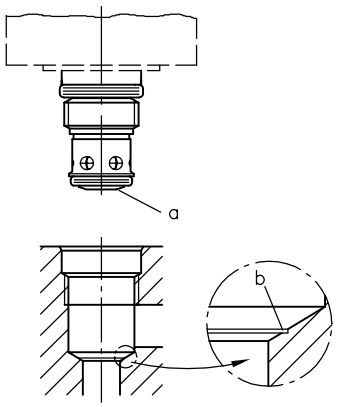
Type EM 21 D.. - P





5. Appendix

5.1 Notes for initial operation



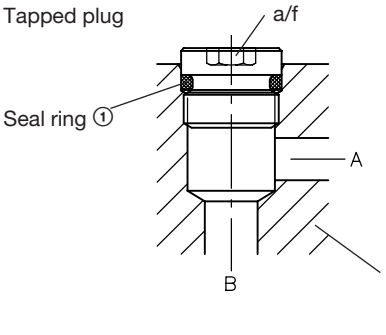
The angularity of the 118° chamfer of the stepped bore tolerance is in reference to the reamed core diameter $\varnothing d^{H8}$ (reaming depth). The stated tolerance must be observed. Also see section 4.2! This enables a max. edge force on the facial area of the tapped journal when the valve is screwed in with the correct torque and it also prevents distortion of functional valve parts which might cause malfunction (sticking).
The correct angular orientation may be checked when the valve is installed the first time and can be remachined in case of minor deviation.

1. Screw in the valve and tighten steadily with the correct torque (30 Nm)
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. When this impact is even everything is correct and the valve can be reinstalled as described above.
3. When the annular impact is not evenly distributed over its length or not complete the valve should be reinstalled but with up to 120 to 140% of the specified torque (30 Nm). Remove the valve and check the annular impact again whether it is correct now (see above); It will be so in most cases and the valve can be reinstalled with the specified torque (30 Nm).
   If it is still not correct after above procedure it will be necessary to remachine the bore.

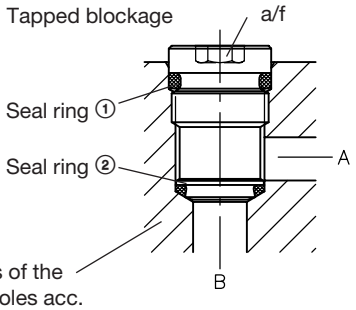
5.2 Tapped plugs

Mounting holes in the manifold may be blocked if required by tapped plugs e.g. if uniform manufactured manifolds should be equipped with or without cartridge valves depending on application.

Passage open



Passage blocked



Type	Tapped plug [1]	Tapped blockage [1]	a/f	Torque (Nm)	Seal ring ① AU 90 Sh	Seal ring ② HNBR 90 Sh
EM 21 D(DS)	7492 170	7902 315 a	8	30	14.03x2.61	12.42x1.78

[1] Complete with seal ring

5.3 Seal kit

Seal kit:

Type	Order No.
EM 21(22)..	DS 7490-21

5.4 Additional components

Plug/Coding	Order No.
G.. :	MSD 3-309
L.. :	SVS 3129020
L5K	L5K
L10K	L10K
WG.. :	MSD 4-209 P 10

These components have to be ordered separately!

Additional plugs available

Economy circuit plugs	MSD 4 P 55	24V DC	acc. to D 7833
	MSD 4 P 53	230V DC	acc. to D 7813
	MSD 4 P 63	115V DC	acc. to D 7813
Plugs with LED and protective circuitry	MSE 28026	24V DC	acc. to D 7832
	SVS 3129020	24V DC	acc. to D 7163
Plugs with clamp diode	MSD 3-209 C 1	150V DC	acc. to D 7163
Recommended prop. amplifier			
	EV 22 K 2-12/24	(card)	acc. to D 7817/1
	EV 1 G 1-12/24	(module with housing)	acc. to D 7837
	EV 1 M 2-12/24	(module)	acc. to D 7831/1
	EV 1 D	(module)	acc. to D 7831 D