

Proportional directional spool valve type PSVF, and SLF according to the Load-Sensing principle size 7 (manifold mounting)

1. General information

The directional spool valves types PSVF as well as the individual sections type SLF serve to control both, the direction of movement and the load-independent, stepless velocity of the hydraulic consumers. In this way several consumers may be moved simultaneously, independently from each other at different velocity and pressure ratings, as long as the sum of the partial flows needed for this is within the total delivery supplied by the pump.

The proportional spool valves of this pamphlet are designed as manifold mounting valves. They may be also combined as valve banks via the sub-plates available from HAWE.

They consist of three functional groups.

Basic data

Design

Prop. directional spool valve according to the Load-Sensing principle
Individual valves and valve banks (manifold mounting)

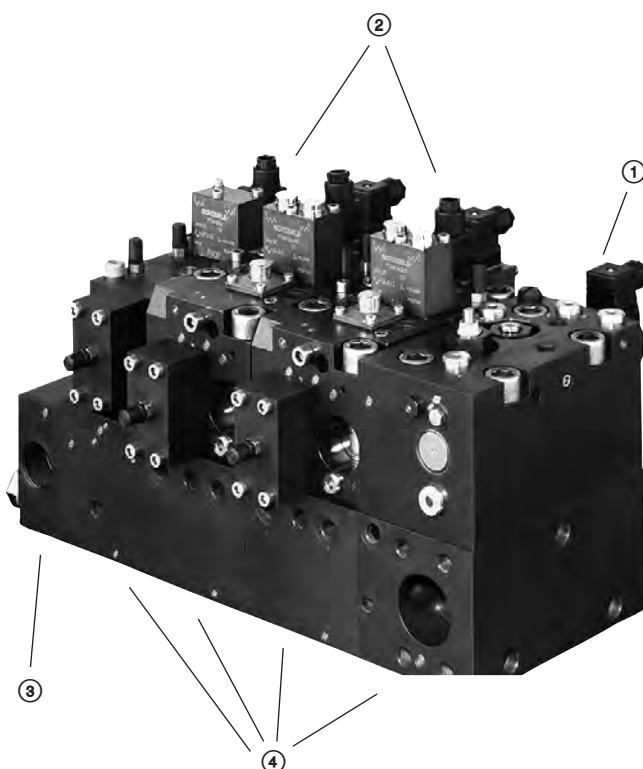
Versions

Operating pressure
Flow

p_{\max} 400 bar
 Q_{\max} 400 lpm

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Further technical information:

Size	Design	Pamphlet
2	Manifold mounting design	D 7700-2
2	Valve bank design (CAN onboard)	D 7700 CAN
3	Valve bank design	D 7700-3
5	Valve bank design	D 7700-5
3, 5	Manifold mounting design	D 7700-F

Mounting

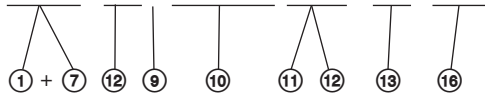
- ① Inlet section(control section)
- ② Valve bank design
- ③ End plate
- ④ Sub-plates

2. Type coding, overview

Order examples:

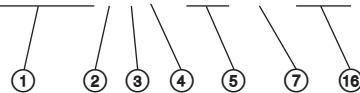
Valve section (for individual orders, without sub-plate)

SLF 7 - A 2 J 320/250 A 300/EA - G 24



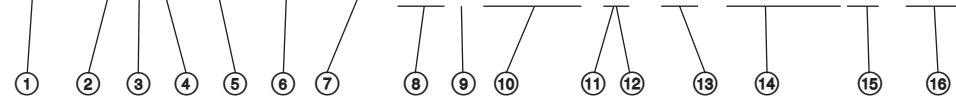
Inlet section with controller (for individual order, without sub-plate)

PSVF A B1 F / 400 - 7 - G 24



Valve bank

PSVF A S 1 F / 400 /7 SAE-7 - A2 J 320/250 /EA/ 6 SAE 6 SAE - E4 - G 24



- | | |
|--|--|
| <p>① Basic type coding for the valve bank or inlet section (see table 1 and 5 in sect. 3.1) as well as valve sections (see sect. 3.2)</p> <p>PSVF A Supply with pressurized oil by means of variable displacement pump (closed center) with a delivery flow controller, or as a second, separate unit if both valve banks are connected to a constant pressure system</p> <p>SLF Individual valve section, without sub-plate</p> <p>② Additional elements (see table 2 and 4 in sect. 3.1)</p> <p>(no coding) Basic version</p> <p>S, W Additional damping device in gallery LS (only with PSVF, standard with PSLF)</p> <p>B, B 4 ... B 7 Orifice in gallery LS (PSVF only)</p> <p>G Restrictor check valve (type PSLF)</p> <p>③ Control oil supply (see table 7, sect. 3.1.3)</p> <p>(no coding) Without pressure reducing valve in case of an external control oil supply (min. 20 bar up to max. 40 bar)</p> <p>1 With integrated pressure reducing valve for the internal supply of control oil (control pressure approx. 20 bar)</p> <p>2 With integrated pressure reducing valve for the internal supply of control oil (control pressure approx. 40 bar)</p> <p>④ Optional 2/2-way solenoid valve for arbitrary idle pump circulation (see table 8, sect. 3.1.3)</p> <p>(no coding) Without directional valve, but prepared for retrofitting</p> <p>F, Z, ZM De-energized open = Idle pump circulation when valve is de-energized</p> <p>D, V De-energized closed = Idle pump circulation when valve is energized</p> <p>F.. or D.. When a pressure is specified, with pressure limiting valve which can be activated as a second pressure stage (e.g. F 80)</p> <p>PA, PB, PD Prop. pressure limiting valve, with various pressure ranges</p> <p>⑤ Pressure limiting valve (main pressure limitation) in the inlet section (see table 9, sect. 3.1.3)</p> <p>(no coding) Without pressure limiting valve (type PSVF only)</p> <p>/ ... Pressure limiting valve factory set to ... bar</p> | <p>⑥ Sub-plate for the inlet section (see table 3, sect. 3.1)</p> <p>/7 Size 7, standard (tapped ports for P and R G 1 1/2 ISO 228/1 (BSPP))</p> <p>/7 SAE Size SAE (flange SAE 1 1/2" 6000 psi)</p> <p>⑦ Size (see table 1 and 5, sect. 3.1)</p> <p>7 Size 7</p> <p>⑧ Valve section - Basic function (see table 13, section 3.2.1)</p> <p>A 2 (standard) Spool valve with inflow controller for each consumer</p> <p>A 1 Spool valve without inflow controller, suitable for consumers, which are actuated individually and successively but not simultaneously (no additional functions possible)</p> <p>A 5 Inflow controller with enforced spring for higher flow</p> <p>AX Blanking plate</p> <p>⑨ Coding for the flow-pattern (see table 14, sect. 3.2.1 and 6 c)</p> <p>L, H, J, O</p> <p>⑩ Flow coding for port A and B (see table 15, sect. 3.2.1)</p> <p>.../... Coding for port A or B (independently selectable)</p> <p>120, 180, 250, 320</p> <p>⑪ LS-pressure limitation (deviating from the main pressure setting, lower pressure for the connected consumer) no shock valves (see table 16 and 18, section 3.2.1)</p> <p>(no coding) No LS-pressure limitation</p> <p>AB Prep. for retrofitting (standard)</p> <p>A..., B... Only for consumer port or B</p> <p>A...B... For consumer ports A and B</p> |
|--|--|

- ⑫ Functional cut-off (see table 17 and 18, sect. 3.2.1)
(no coding) No functional cut-off
F0 Prep. for retrofitting (standard)
F 1 Electrical cut-off, consumer port A
F 2 Electrical cut-off, consumer port B
F 3 Electrical cut-off, consumer port A and B
FP 1(2, 3) Like F1(2,3), however with electro-proportional pressure limitation
FPH 1(2, 3) Like FP1(2,3), however with additional push-button for manual emergency actuation
S 1 External hydraulic load signal pick-up from the control signal port U (consumer port A) and W (consumer port B)
- ⑬ Types of actuation (see table 19 and 20, sect. 3.2.1)
/E Electro-hydraulic actuation
/EA Electro-hydraulic and manual actuation
/E0A Like /EA, however without actuation solenoid (prepared for retrofitting)
/E0H Hydraulic actuation
/E0H UNF Like /E0H, however with connection 7/16-20 UNF-2B SAE-4 (SAE J 514)
/E0HA Hydraulic, solenoid and manual actuation
/E0HA UNF Like /E0HA, however with connection 7/16-20 UNF-2B SAE-4 (SAE J 514)
/HEA Hydraulic, solenoid and manual actuation
/HEA UNF Like /HEA, however with connection 7/16-20 UNF-2B SAE-4 (SAE J 514)
/... Suffix **1** without hand lever
WA, WA-EX Position sensor
U Lift monitoring (side indication)
- ⑭ Sub-plate for the individual valve section (see table 21, section 3.2.2)
/6 SAE Sub-plate size 7, ports A and B with flange SAE 1 1/4" (6000 psi)
/55 SAE Sub-plate size 7, prepared to accept valve sections size 5, ports A, B with flange SAE 1" (6000 psi)
- ⑮ End plates (see table 11, section 3.1.3)
E 1 With T-port for control oil return externally to the tank (basic type)
E 4 Like E 1, however with internal drain connection, max. pressure 10 bar!
- ⑯ Solenoid voltage and version (see table 10, sect. 3.1.3)
G 12.. 12V DC, connection conf. EN 175 301-803 A,
G 24.. 24V DC, connection conf. EN 175 301-803 A,
G 24 EX 24V DC, explosion-proof version
G 24 EX 70 24V DC, explosion-proof version (ambient temperature 70°C)
G 24 MSHA 24V DC, explosion-proof version (fire-damp protection (mining))
G 24 M2 FP 24V DC, explosion-proof version (fire-damp protection (mining))
G 12 IS 12V DC, explosion-proof version, fire-damp protection (mining), intrinsically safe
AMP 12 K 4 12V DC, connection via AMP Junior Timer
AMP 24 K 4 24V DC, connection via AMP Junior Timer
S 12.. 12V DC electr. connection via quarter turn plug
S 24.. 24V DC electr. connection via quarter turn plug
DT 12 12V DC electr. connection via plug
Co. DEUTSCH
DT 24 24V DC electr. connection via plug
Co. DEUTSCH

3. Available versions, main data
3.1 Inlet section (control section)

3.1.1 Inlet sections for variable displacement pump systems / constant pressure system or for a second and all other separately parallel connected directional spool valve banks type PSVF

Order examples:

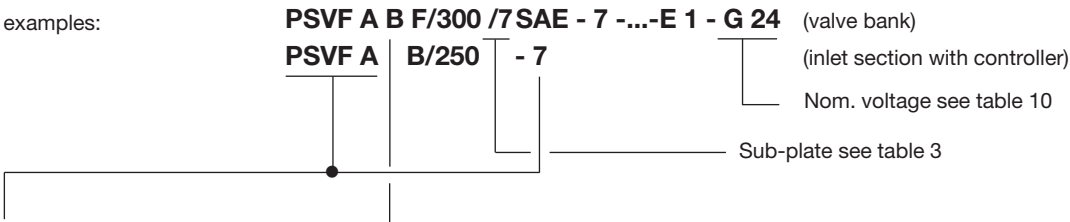


Table 4: Basic type and size

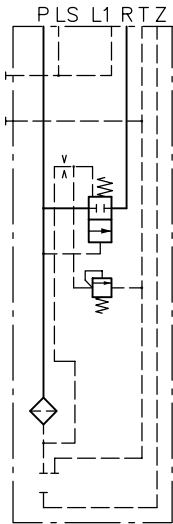
Coding and size	Description	Max. pump delivery flow (lpm)
PSVF A ...-7	Individual section	approx. 1000

Table 5: Code letter for features within the LS-signal duct for the damping of pump flow controllers (for notes and explanation, see sect. 6.1 a)
Additional features only suitable where variable displacement pumps are used (limitation of the control oil flow). Observe note at table 9!

Coding	Description
no coding	Standard , without additional element
S	With integrated combination of orifice, check valve, pre-load valve (pre-load pressure approx. 25 bar) like standard element of type PSLF
W	Like S, but with increased throttle effect
B	With orifice Ø 0.8 mm within LS-duct (limiting the control oil flow)
B 4, B 5, B 6, B 7	With orifice Ø 0.4 mm, 0.5 mm, 0.6 mm or 0.7 mm within LS-duct

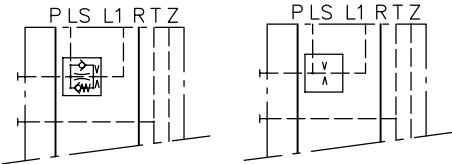
Symbols

Basic type (see table 4)



PSVF A...-7

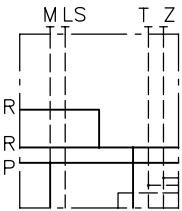
Additional elements (see table 5)



PSVF AS...-7

PSVF AB...-7

Sub-plates (see table 3)



PSVF A...-7 SAE-7

Table 3: Coding of the sub-plate for the inlet sections

Coding	Ports ISO 228/1 (BSPP) or SAE 514 J P and R	LS, M, T and Z
/7 SAE	SAE 1 1/2" (6000 psi, P) (3000 psi, R)	G 1/4

3.1.2 Additional elements for the inlet sections

Order examples: PSVF A. **1 F** /380 / 7SAE - 7 -...- E1 - G 24
 PSVF A. **1 F120 /350** - 7 - G 24

Table 8

Table 7: Coding for control oil supply
 (for symbol, see sect. 3.1.1)

Coding	Description
no coding	Without pressure reducing valve for actuation coding A, C or P acc. to sect. 3.2, table 18 or in the case of external control oil supply (20-40 bar) for other actuations
1	With integrated pressure reducing valve for internal control oil supply for actuations coding H(HA, HEA, F, FA, FEA).. and E(EA).. or as pick-up for other control valves (max. permissible control oil flow approx. 2 lpm)
2	Control pressure: Coding 1: approx. 20 bar (+ return pressure at R) Coding 2: approx. 40 bar (+ return pressure at R)

Table 8: Arbitrary idle pump circulation of all consumers by means of 2/2-way solenoid valve type WN 1 acc. to D 7470 A/1

Coding	Description
no coding	If not required
F	With WN 1 F, idle pump circulation if valve is deenergized (emergency stop)
D	With WN 1 D, idle pump circulation if valve is energized
F... or D...	With pressure limiting valve, which can be activated as a second pressure stage (specify pressure in bar) (pre-set pressure, tool adjustable from 50 to 400 bar). Example: type PSVF A1 F100/350/7-7.. deenergized p_{\max} 100 bar energized p_{\max} 350 bar

Table 9: Tool adjustable pressure limiting valve for the main pressure.
 Adjustable from 50 up to 400 bar, after loosening the lock-nut (for symbol, see sect. 3.1.1)

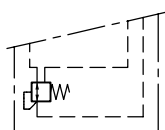
Coding	Description
no coding	Version without pressure limiting valve (only type PSVF)
/...	With pressure limiting valve at PSVF (pressure specification in bar)

Note: To limit the control oil flow, when using the idle pump circulation with type PSV an additional element coding S, W or B 4, B 5, B 6 acc. to table 4 is required.

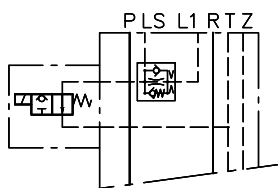
Attention: Observe note in sect. 6.1 a!

Coding	Description
PA, PB, PD	Prop. pressure limiting valve enabling variable adjustment of the system pressure; Pressure range: PA 100...320 bar, PB 15...250 bar, PD 18...400 bar
Z	Prop. pressure limiting valve type EM 21 DSE, open when deenergized
ZM	Like Z, but with lead sealed wing screw for emergency operation
V	Prop. pressure limiting valve type EM 21 DE, closed when deenergized
X...	Additional LS pressure limitation (50...400 bar) Not suited to compensate pressure peaks on the consumer side.

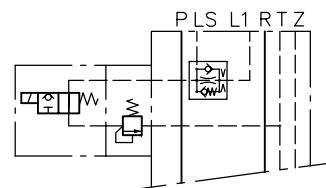
Symbols



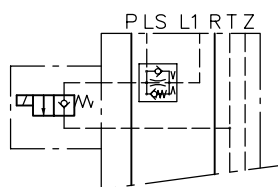
PSVF A 1(2)/...-7



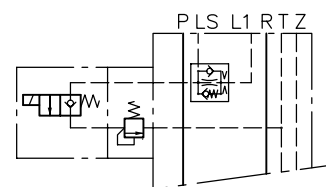
PSVF A..F, Z, ZM



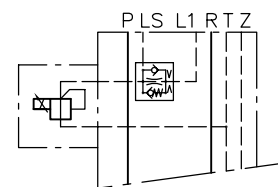
PSVF A..F...



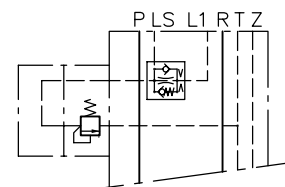
PSVF A..D, V5



PSVF A..D...



PSVF..PA (PB,PD)



PSVF A..X...

Table 10: Solenoid voltage and version

Coding	Beschreibung
	<p>Electr. connection conf. EN 175 301-803 A, via plug (MSD 3-309)</p> <p>Suffix: Applies only to the solenoid actuation coding E, EA, HEA, FEA (table 20) and the functional cut-off (coding F, FP, table 17), see also sect. 4.3</p> <p>Actuation solenoid 3-pin (standard)</p> <p>Manual emergency actuation (standard with functional cut-off F., FP., see table 17)</p> <p>Manual emergency actuation with pushbutton (standard with functional cut-off FPH., FP., see table 17)</p> <p>4-pin actuation solenoid (only 24V DC)</p>
	Electr. connection conf. EN 175 301-803 C, via plug (MSD 6-209), 4-pin actuation solenoid
	Electr. connection conf. EN 175 301-803 A, without plug. For options, see coding G...
	<p>Electr. connection via quarter turn type plug (Bayonet PA 6 ®, Co. SCHLEMMER D-85586 Poing, suited for taper with bayonet 10 SL), 3-pin actuation solenoid</p> <p>Suffix:</p> <p>Manual emergency actuation (standard with functional cut-off FP., table 17)</p>
	Vertical connection via plug AMP Junior Timer, solenoid features 4 terminals
	Lateral connection via plug AMP Junior Timer, solenoid features 4 terminals and manual emergency actuation
	Connection via plug Co. DEUTSCH DT 04-4P, suited for socket DT 06-4S
G 24 EX G 24 EX-10 m EX TEX EX4 TEX4	<p>For use in areas with explosion hazardous atmosphere. Suited for category 2 and 3, zone 1, 21, 2, 22.</p> <p>Protection class EEx m II 120° (T4), with cable length 3 m (no coding) or 10 m</p> <p>3-pin actuation solenoid</p> <p>3-pin actuation solenoid with manual emergency actuation</p> <p>4-pin actuation solenoid</p> <p>4-pin actuation solenoid with manual emergency actuation</p>
G 24 TEX 70 G 24 TEX 70-10 m	Like G 24 EX .. , but for ambient temperature < 70°C
G 12 IS G 12 IS-10 m	For use in mines and its on-surface systems, which can be endangered by fire damp and/or combustible dust. Protection class I M2 Ex d ib I (fire-damp protection, intrinsic safe), with cable length 5 m (no coding) or 10 m
G 24 MSHA G 24 MSHA-10 m	For use in mines and its on-surface systems, where a ATEX (EU), IEC, MSHA (USA) or MA (China) approval is mandatory. Protection class I M2 Ex d I (fire-damp protection, intrinsic safe), with cable length 5 m (no coding) or 10 m
G 24 M2 FP G 24 M2 FP-10 m	For use in mines and its on-surface systems, where a IEC or ANZE (Australia) approval is mandatory. Protection class I M2 Ex d I (fire-damp protection, intrinsic safe), with cable length 5 m (no coding) or 10 m
Note:	<ul style="list-style-type: none"> ● Solenoids of explosion-proof design are only available for actuation E, EA or HE (A) (table 20). ● Coding G 24 C4 (X 24 C4) is only available for solenoids of the electrical actuation (table 20) emergency actuation. ● Coding AMP 24... not available for idle circulation valves coding D, F, PA, PB, PD (table 8), functional cut-off coding F., FP. (table 17) ● Coding S.: Not available for functional cut-off coding F. (table 17) and position comparator coding U (table 20)

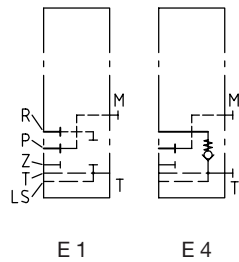
3.1.3 End plates of valve bank

Order example: PSLF A1 F100/380/7 - 7 - ... - **E1** - G 24

Table 11: End plates

End plate		Description
With T-port at the inlet section for control oil return externally to the tank (basic type)	Like E 1, however with internal drain connection	Order coding of an end plate as separate part (example): SLF 7 - E 1 (State the size: 7 !)
E 1	E 4	Standard end plate
Note: ● The internal control oil return gallery is to be used only in systems where the return pressure is below 10 bar.		

Symbols



3.2 Valve sections

3.2.1 Directional spool valve (individual valve)

Order examples: (valve bank) PSVF A1 F/320/7SAE - **7 - A2 L 320/250 F1 /EA /6SAE** - E1 - G 24
(individual section) SLF **7 - A2 H 180/180 A250 /EA** - G 24

Size

Note: Size specification is absolutely necessary! The valve spools are subsequently interchangeable, e.g. if a different flow rating than initially planned becomes necessary (see sect. 6.3.4)

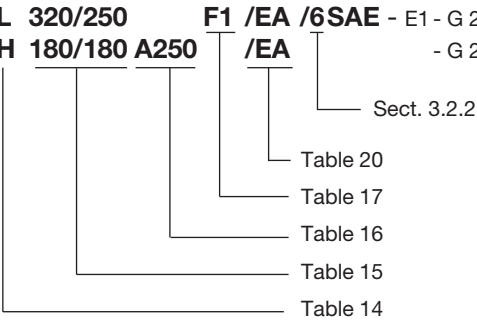


Table 13: Spool valve, basic version

Coding	Description	
A 2	Standard , with inflow controller, for simultaneous load compensated moving of several consumers (standard type)	
AX	Blanking plate	Symbol
Note: Beside the listed versions also valve sections size 5 (SLF 5...) acc. to D 7700-F can be mounted on sub-plates listed in table 21.		

Table 14: Symbols

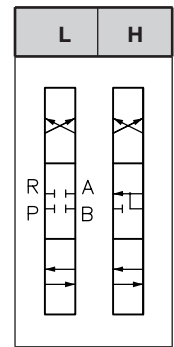


Table 15: Max. flow P → A(B) acc. to the coding

Valve spool coding acc. to table 12		Flow coding Q _{A, B} (lpm) at consumer port A and B				
Coding	Size	120	180	250	320	400
A 2	7	120	180	250	320	400

The flow rate for the consumer ports A and B can be individually selected, e.g. 250/180, 250/400. This provides optimal adaptation to the respective consumer while exploiting the full functional spool lift. In addition there is the possibility of mechanical stroke limitation.

Table 16: LS-pressure limiting valves, only available with spool valves featuring an inflow controller, coding A 2 (acc. to table 13!). These are no shock valves!

Coding	Description
AB	Without pressure limitation
A...	Pressure limitation at A with pressure specification
B...	Pressure limitation at B with pressure specification
A...B...	Pressure limitation at A and B with pressure specification

Pressure limitation $p_{\min} = 50 \text{ bar}$; $p_{\max} = 400 \text{ bar}$
 Example: SLF 7-A2 H320/320 **A250 B200**/EA

Table 18: Combination possibilities for additional functions

Pressure limitation	Functional cut-off	
	F0	F1, F2, F3, S1 FP1, FP2, FP3 FPH1, FPH2, FPH3
AB	•	•
A or B A and B	•	•

Table 17: Functional cut-off or prop. pressure limitation (only available with spool valves with inflow controller coding A 2 acc. to table 13!)

Coding	Description
F0.	Without functional cut-off
F1, F2	Electric functional cut-off at A or B
F3	Electric functional cut-off at A and B
FP1, FP2, FP3 FPH1, FPH2, FPH3	Prop. pressure limitation for A or B resp. A and B, version FPH. with additional emergency actuation (no tools needed)
S1	Load signal ports U and W (G 1/8 (BSPP)) for external piping; tapped ports at valve section

- There remains a residual pressure when the LS gallery is relieved. When the return line is depressurized the residual pressure will be: $p_{\text{relieved}} = \Delta p_{\text{block}} + \Delta p_{\text{controller}}$ ($\Delta p_{\text{controller}}$ = control pressure of the inflow controller acc. to table 13)

Coding F., FP. : $\Delta p_{\text{block}} = 10 \text{ bar}$
 Coding S 1 : $\Delta p_{\text{block}} = 5 \text{ bar}$
 $\Delta p_{\text{controller}} = 12 \text{ bar}$

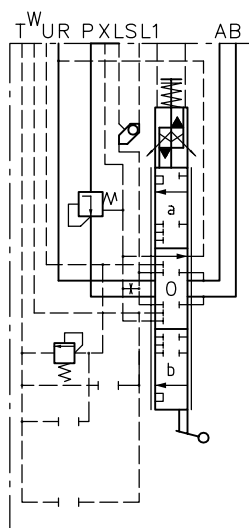
- Coding F., FP.. not available with solenoids G 24 TEX 70 and G 12 IS

**Basic version
(individual section
acc. to table 13)**

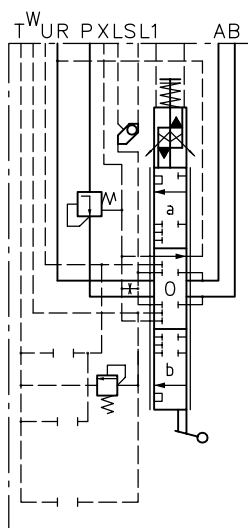
With respect to flow configuration and actuation, these symbols are neutral and must be supplemented by the corresponding flow pattern symbols illustrated in table 14, see also example in sect. 6.2

Example:
SLF 7-A2 H 320/250 A 250 B 310 F3/EA-G 24

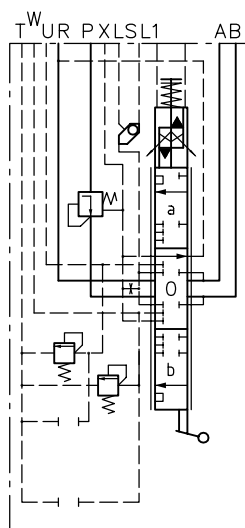
Additional function:
LS-pressure limitation
acc. to table 16 for
spool valves with inflow
controller (no shock
valve!)



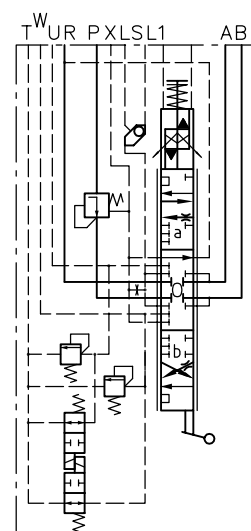
..A... F0



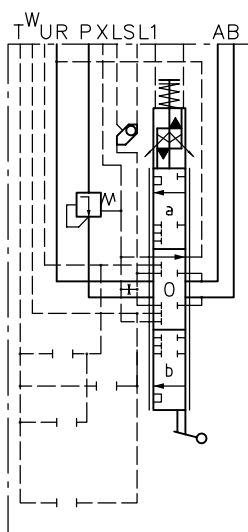
..B... F0



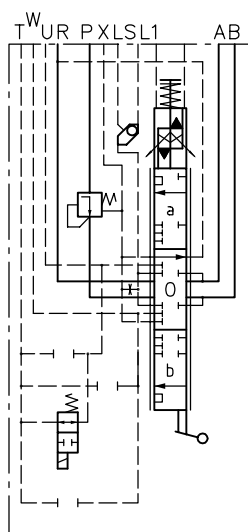
..A...B... F0



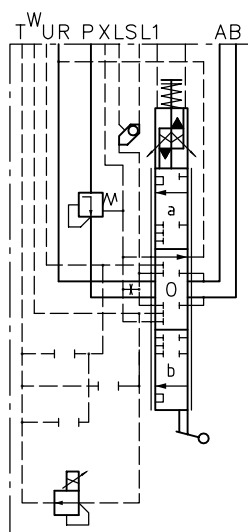
Functional cut-off,
acc. to table 17, for
spool valves with
inflow controller



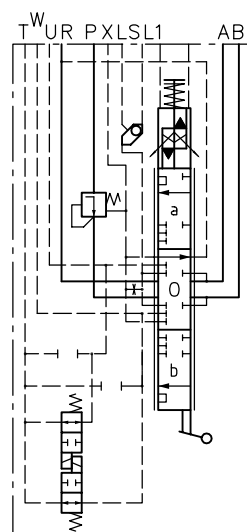
ABF0



ABF0



ABFP2



ABF3

Combination possibilities:
(see table 18)

ABS 1	ABF0	AB..F(FP, FPH)1	AB..F(FP, FPH)2	AB..F(FP, FPH)3
A..S 1	A..F0	A..F(FP, FPH)1	A..F(FP, FPH)2	A..F(FP, FPH)3
B..S 1	B..F0	B..F(FP, FPH)1	B..F(FP, FPH)2	B..F(FP, FPH)3
A..B..S 1	A..B..F0	A..B..F(FP, FPH)1	A..B..F(FP, FPH)2	A..B..F(FP, FPH)3

Table 19: Types of actuation (for further explanations, see sect. 4.3)

Nomenclature	Manual actuation	Electro-hydraulic actuation		Hydraulic actuation		
	Spring return	electro-hydraulic	Combination with manual actuation	hydraulic	Combination with manual actuation	Combination with solenoid and manual actuation
Coding	E0A	E	EA	E0H E0H UNF	E0HA E0HA UNF	HEA HEA UNF (HE, HE UNF)
Symbol						
Manipulated variables	Actuation angle min. approx. 5° max. approx. 30°	Control current ratio I/I_N min. approx. 0.2 max. approx. 1		Control pressure min. approx. 5 bar max. approx. 18 bar max. perm. 40 bar		

- Note:**
- Approximate values for start of flow at A or B (= min) up to max. consumer flow according to the flow coding table 15, see curves sect. 4.2.
 - With actuations HE(A) observe also notes and circuit examples in sect. 6.1 i !
 - Type E0... prepared for retrofitting of a solenoid actuation
 - Type AR, ER, and EAR with detent in end position, stroke limitation not possible
 - Type EM and EAM: Version with pressure gauge ports at the actuation heads
 - Type A 8: Actuation torque like with EA. Type E 9, E 9 A: Actuation torque like with H, HA

Table 20: Additional features for actuations

Type of actuation / coding	Suffix	Description	Example	Symbols
E0A, EA, HA, PA	1	Manual actuation without hand lever. For dimensions see sect. 5.1.3.	EA 1	1
E0A, EA, H, HA	WA WA-EX WA-M2 FP	Integrated position sensor (Hall-sensor) with analogous signal output (lift monitoring) Coding WA-EX, version for explosion hazardous areas Coding WA-M2 FP, intrinsic safe version (mining)	EA WA, E0A 1 WA	WA U
E0A, EA, HA, HEA, FA, FEH	U	Integrated spool monitoring for side indication (Comparator, triggered signal: on/off)	EA U	

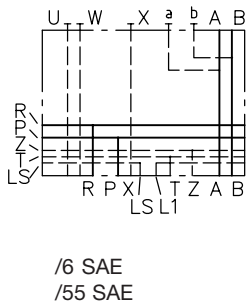
3.2.2 Sub-plates

Order example: PSVF A2 F/320/7 SAE-3-A2 L 250/180 A300 F1/EA /6 SAE - E1 - G 24
PSVF A2/300/7-5-A2 H 320/250/EA /55 SAE - E4 - G 24

Table 21: Sub-plates

Coding	Port size for A and B ISO 228/1 (BSPP)	Size	Description
/6 SAE	SAE 1 1/4" (6000 psi)	7	Sub-plate with SAE-flange
/55 SAE	SAE 1" (6000 psi)	7	Sub-plate with SAE-flange for valve section size 5 acc. to D 7700-F

Symbol



4. Characteristic data

4.1 General and hydraulic

Type coding

Design

Mounting

	Size 5
Indiv. section	4 x M10
Valve bank	M10

See dimensional drawings in sect. 5 ++

Installation position

Any

Ports

P = Pressure inlet (pump)
 R = Return
 A, B = Consumer ports
 U, W, X = Load-signal outlet at the indiv. spool valve section
 LS = Load-signal outlet e.g. connection of pump metering valve at PSVF.
Attention: No pressure input!
 M = Pressure gauge connection (pump side)
 Z = Pilot pressure connection (20...40 bar inlet, 20 or 40 bar outlet)
 T = Control oil return port
 Y = Load-signal inlet port (end plate E 2 and E 5)

Port size

P, R, A, B = Acc. to dimensional drawings (see sect. 5.1.10)
 M, LS, Z, T, Y = G 1/4 conform. ISO 228/1 (BSPP) (see sect. 5.1.10)
 U, W, X = Acc. to dimensional drawings (see sect. 5.1.10)

Surface coating

Indiv. valve section and sub-plates: All surfaces corrosion-inhibiting, gas nitrided (Solenoid at actuation E... and additional functions F1...F3, FP1...FP3, FPH1...FPH3 inc galvanized and olive-green anodized)

Mass (weight) approx. (kg)

Size		7
Inlet section	PSLF, PSVF	12.0
Valve section	SLF with actuation E0C, E0A, E, FE0, HE0, EOP EA, E0PA FE0A, HE0A FEA, HEA	12.6 ¹⁾ 13.0 ¹⁾ 12.6 ¹⁾ 13.0 ¹⁾
Sub-plates	/6 SAE, /55 SAE	12.0
End plates	E 1, E 4	3.0

Pressure fluid

Hydraulic fluid (DIN 51524 table 1 to 3); ISO VG 10 to 68 (DIN 51519)
 Viscosity range: min. 4; max. 1500 mm²/sec; Optimal operation range: 10...500 mm²/sec
 Also suitable are biodegradable pressure fluids of the type HEPG (Polyalkylenglycol) and HEES (synth. Ester) at operation temperatures up to +70°C. HETG (e.g. rape seed oil) or water based fluids e.g. HFA or HFC must not be used!

Temperature

Ambient: approx. -40 ... +80°C; Fluid: -25 ... +80°C, pay attention to the viscosity range!
 Start temperature down to -40°C are allowable (Pay attention to the viscosity range during start!), as long as the operation temperature during consequent running is at least 20K (Kelvin) higher.
 Biodegradable pressure fluids: Pay attention to manufacturer's information. With regard to the compatibility with sealing materials do not exceed +70°C.
Observe restrictions for versions with ex-proof solenoid!

Rec. contamination class

ISO 4406 20/18/15

Operating pressure

$p_{max} = 400$ bar; Ports P, P1, A, B, LS, M, Y
 The max. pressure achievable at the consumer side of the spool valves is lowered by the amount equivalent to the internal control pressure drop at the 3-way flow regulator of the PSLF (see curves) or at the pump flow regulator (PSVF).
 Return port R(R1) ≤ 50 bar; port T pressure less with separate pipe (e.g. 8x1) to the tank. It is recommended to employ end plate E 1, E 2, E 3, etc. with an additional leakage port, in case higher return pressure is anticipated. Port Z approx. 20 or 40 bar (acc. to coding, see table 7) (outlet); ≤ 40 bar (inlet)

Control circuit

For control pressure, see Q-I-characteristics. The internal control oil circuit is sufficiently protected against malfunctions caused by contamination by means of a disk filter.

Flow

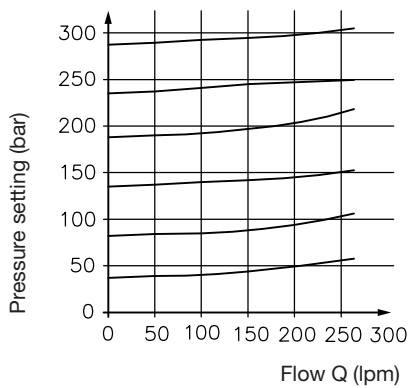
Acc. to the specifications in table 14, in sect. 3.2.1

¹⁾ + 0.4 kg at version with functional cut-off(coding F., FP., FPH.. acc. to table 16)

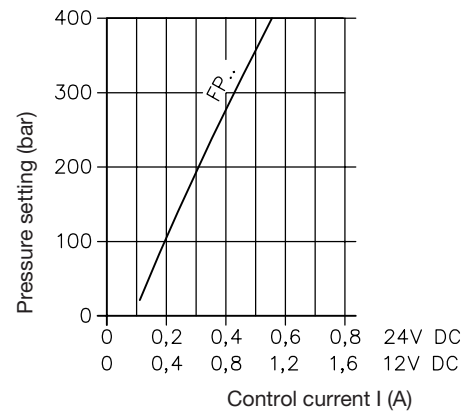
4.2 Curves

Main pressure limiting valve in the inlet section

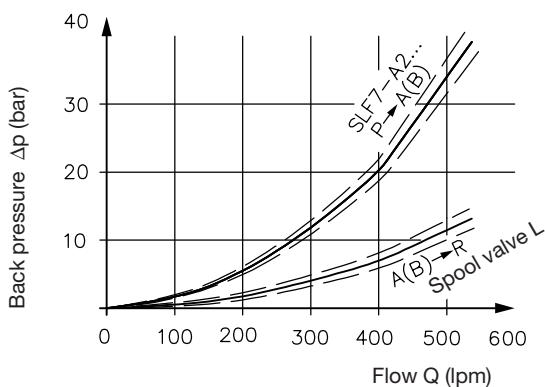
PSL(V)F A../.- 7



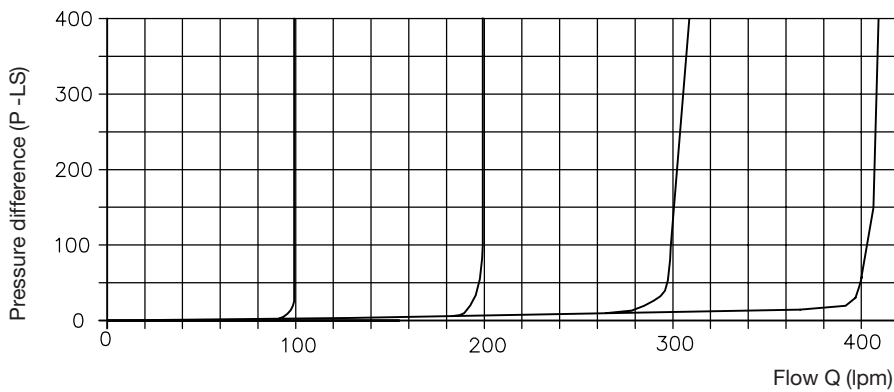
Prop. pressure limitation
Coding FP(H)1, FP(H)2, FP(H)3
acc. to table 16, sect. 3.2.1



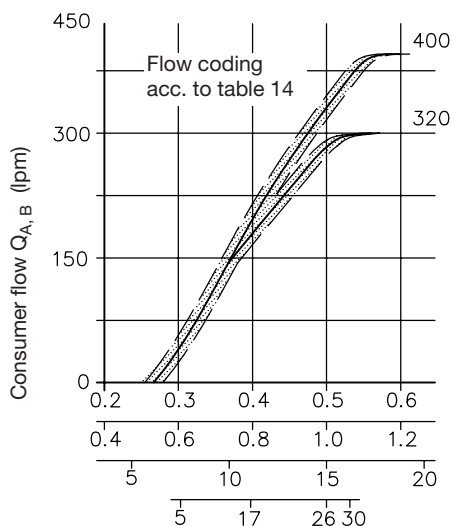
Size 7



2-way inflow controller



Consumer flow curves (guide line, example is valve section with inflow controller type SLF. - A2 ../..)



Oil viscosity during measurement
approx. 60 mm²/sec

- Control current I (A)
- ← 24V DC
- Control current I (A)
- ← 12V DC
- ← Control pressure (bar) hydr. actuation H, F
- ← Angle at hand lever (°) manual actuation A, C

4.3 Actuators

For other data, such as codings, symbols etc., see table 18 sect. 3.2

Actuation E0A

	Actuating moment (Nm)	
	Idle position	End position
Version E0HA, HEA	approx. 5.0	approx. 16.5
Version EA, E0A	approx. 3.0	approx. 12.0

Actuation
E, EA, HEA

Prop.-Solenoid, manufactured and tested acc. to VDE 0580
Twin solenoids are of wet armature design. The hydraulic fluid provides lubrication and protection against corrosion.

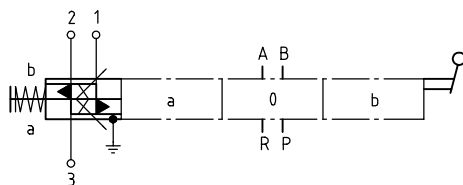
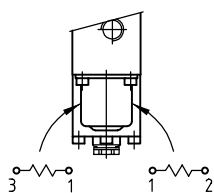
Additional notes:

See also Sk 7814, as well as for additional components sect. 6.1 j!

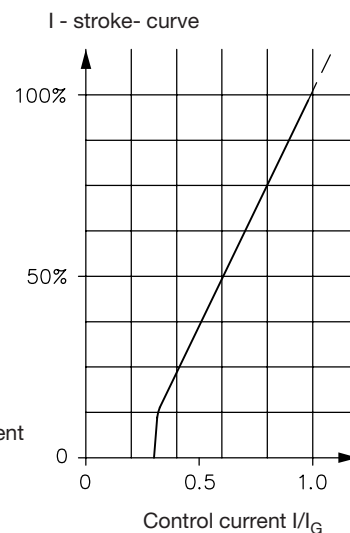
Specifications apply to all solenoid versions if not stated otherwise.

Nom. voltage U_N	24V DC	12V DC
Coil resistance R_{20}	26.6 Ω	6.3 Ω
Current, cold I_{20}	0.9 A	1.9 A
Lim. current I_G (I_{lim})	0.63 A	1.26 A
Cut-off energy W_A	≤ 0.3 Ws	≤ 0.3 Ws
Rel. duty cycle (reference temp. $\vartheta_{11} = 50^\circ\text{C}$)	S 1	S 1
Required dither frequency	40...70 Hz (best 55 Hz)	
Dither amplitude A_D ¹⁾	$20\% \leq A_D \leq 35\%$	

$$1) A_D (\%) = \frac{I_{\text{peak-peak}}}{I_G} \cdot 100$$

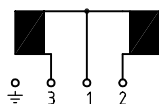


Oil viscosity during measurement
approx. 60 mm²/s



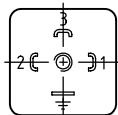
Electrical connection

3-pin
Coil a (1) Coil b (2)



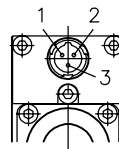
Circuitry

for coding -G 12, -G 24
-X 12, -X 24
EN 175 301-803 A
3-pin
IP 65 (IEC 60529)



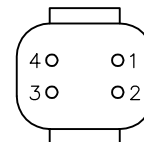
Circuitry

for coding -S 12
-S 24
3-pin
IP 67 (IEC 60529)

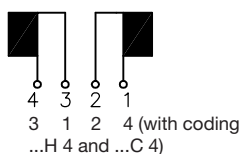


Circuitry

for coding -DT 12
-DT 24
4-pin
IP 67 (IEC 60529)

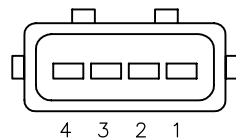


4-pin
Coil a (1) Coil b (2)



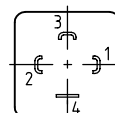
Circuitry

for coding -AMP 12 K 4
-AMP 24 K 4
AMP Junior Timer,
4-pin
IP 65 (IEC 60529)



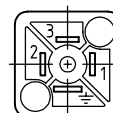
Circuitry

for coding -G 24 H 4,
4-pin
IP 65 (IEC 60529)



Circuitry

for coding -G 24 C 4,
4-pin
EN 175 301-803 C
IP 65 (IEC 60529)



The IP-specification only applies when the plug is mounted as specified.

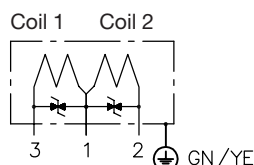
Explosion-proof version of actuation E, EA, HE(A)
Voltage specification **G 24 EX, G 24 TEX**

Attention:

Additionally observe operating manuals
B 01/2002 and B ATEX

Protect against direct sun light !

Not available in combination with other solenoids at the connection block (table 3a and 8), ancillary blocks (table 19), intermediate plates (table 22), end plates (table 11) and functional cut-off F.. (table 17).



Letter of conformity ATEX
Ex-proof level

Duty cycle

Protection class

Nom. voltage U_N

Coil resistance R_{20}

Current, cold I_{20}

Lim. current I_G

Max. residual ripple of the

Conditions of use:

Ambient temperature

Max. fluid temperature

Fuse

Surface coating

Electrical design and testing

Electrical connection

Cable length

For connection scheme. see "Actuation E, EA" (standard version)

TÜV-A 02ATEX 0007 X

⊕ II 2 G Ex mb II 120°C (T4)

⊕ II 2 D Ex mbD 21 T120°C

S 1, one coil energized per solenoid housing

IP 67 (IEC 60529)

24V DC

26.6 Ω

0.88 A

0.63 A

15% supply voltage

-35 ... +40°C

+70°C

$I_F < 1.8$ A each solenoid must be safe guarded against overload and short-cut by fuse conforming

IEC 60127 medium

Housing zinc galvanized

Coil and connection cavity are molded

conforming EN 60079-0, VDE 0170/0171 T1 and T9

4 x 0.5 mm²

3 m or 10 m (cable ÖLFLEX-440P ® Co. LAPP, D-70565 Stuttgart)

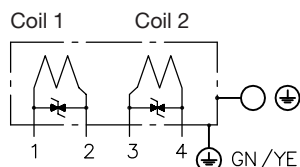
Explosion-proof version of actuation E, EA, HE(A)
Voltage specification **G 24 EX 4, G 24 TEX 4**

Attention:

Additionally observe operating manuals
B 01/2002 and B ATEX

Protect against direct sun light !

Not in to combination with functional cut-off F(FP).. (table 17) or all other solenoids mounted on connection blocks (table 3 a, 8), ancillary blocks (table 19), intermediate plates (table 22) and end plates (table 11)



Letter of conformity ATEX
Ex-proof level

Duty cycle

Protection class

Nom. voltage U_N

Coil resistance R_{20}

Current, cold I_{20}

Lim. current I_G

Max. residual ripple of the

Conditions of use:

Max. ambient temperature

Max. fluid temperature

Fuse

Surface coating

Electrical design and testing

Electrical connection

Cable length

For connection scheme. see "Actuation E, EA" (standard version)

TÜV-A 02 ATEX 0007 X

⊕ II 2 G Ex mb II 120°C (T4)

⊕ II 2 D Ex mbD 21 T120°C

S 1, one coil energized per solenoid housing

IP 67 (IEC 60529)

24V DC

26.6 Ω

0.88 A

0.63 A

15% supply voltage

-35 ... +40°C

+70°C

$I_F < 1.8$ A each solenoid must be safe guarded against overload and short-cut by fuse conforming

IEC 60127 medium

Housing zinc galvanized

Coil and connection cavity are molded

conforming EN 60079-0, VDE 0170/0171 T1 and T9

4 x 0.5 mm²

3 m or 10 m (cable ÖLFLEX-440P ® Co. LAPP, D-70565 Stuttgart)

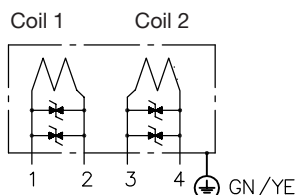
Explosion-proof version of actuation E, EA, HE(A)
Voltage specification **G 24 TEX 70**

Attention:

Additionally observe operating manuals
B 09/2006 und B ATEX

Protect against direct sun light !

Not in to combination with functional cut-off F(FP).. (table 17) or all other solenoids mounted on connection blocks (table 3 a, 8), ancillary blocks (table 19), intermediate plates (table 22) and end plates (table 11)



Letter of conformity IEC

Letter of conformity ATEX

Ex-proof level

Duty cycle

Protection class

Nom. voltage U_N

Coil resistance R_{20}

Lim. current I_G

Max. residual ripple of the

Conditions of use:

Max. ambient temperature

Max. fluid temperature

Fuse

Surface coating

Electrical design and testing

Electrical connection

Cable length

For connection scheme. see "Actuation E, EA" (standard version)

IEC Ex IBE 09.0005 X

IBExU07 ATEX 1089 X

⊕ II 2 G Ex d IIB T4

⊕ II 2 D Ex tD A21 T135°C

S 1, one coil energized per solenoid housing

IP 67 (IEC 60529)

24V DC

80 Ω

0.24 A

15% supply voltage

-20 ... +70°C

+70°C

$I_F < 0.5$ A each solenoid must be safe guarded against overload and short-cut by fuse conforming

IEC 60127 medium

Housing zinc galvanized

Coil and connection cavity are molded

conforming, EN 60079-0, VDE 0170/0171 T1 and T9

4+1 x 0.5 mm²

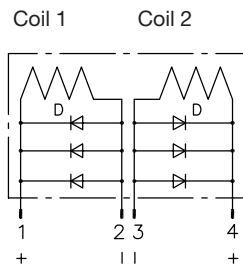
3 m or 10 m (cable ÖLFLEX-440P ® Co. LAPP, D-70565 Stuttgart)

Explosion-proof version of actuation E, EA
(intrinsic safe, flame proof)
Voltage specification **G 12 IS**

Attention:

Additionally observe operating manuals
B 04/2005 and B ATEX

Not in to combination with functional cut-off
F(FP).. (table 17) or all other solenoids mounted on
connection blocks (table 3 a, 8), ancillary blocks
(table 19), intermediate plates (table 22) and end
plates (table 11)



Attention: Observe polarity!

Letter of conformity IEC
Letter of conformity ATEX
Ex-proof level

Duty cycle (ED)
Protection class
Nom. voltage U_N
 I_l
Lim. current I_G
Power, cold R_{20}
Conditions of use:
max. ambient temperature
max. fluid temperature
Surface coating

Electrical design and testing

Electrical connection
Cable length

IEC Ex IBE 09.0006 X
IBExU05ATEX 1116 X
Ⓢ I M1 Ex d ia I
Ⓢ I M2 Ex d ib I
S 1, one coil energized per solenoid housing
IP 67 (IEC 60529)
12V DC
1.7 A
0.4 A
22 Ω
-20 ... +40°C
+70°C
Housing galvanically zinc coated
Coil and connection cavity are moulded
conforming EN 60079-0 (general requests),
EN 60079-25 (intrinsic safe "i"),
EN 60079-1 (pressure resistant encapsulation "d")
4 x 0.5 mm²
3 m or 10 m (cable ÖLFLEX-EB ® Co. LAPP,
D-70565 Stuttgart) Coded leads: 1-4, insulation
color: fair blue)

The complete circuit has to be designed and get approved acc. to EN 60079-25.

Note: Due to the utilized clamp diodes at the pulsed prop. amplifier PWM it is not possible to measure the coil current during operation. Readings will usually be too low and are additionally dependent on the supply voltage and the coil resistance.

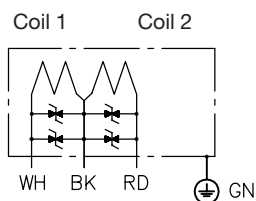
Explosion-proof version of actuation E, EA
(flame proof)
Voltage specification **G 24 MSHA**

Attention:

Additionally observe operating manuals
B 05/2006 and B ATEX

Not available in combination with other
solenoids at the connection block (table 3a
and 8), ancillary blocks (table 19), intermedi-
ate plates (table 22), end plates (table 11) and
functional cut-off F(FP) .. (table 17).

Exception: A combination with functional
cut-off FP.. (table 17) together
with intermediate plate 7709 090
is available.



MSHA-approval (USA)
MA-approval (China)
Letter of conformity IEC
Letter of conformity ATEX
Ex-proof level
Duty cycle
Protection class
Nom. voltage U_N
Coil resistance R_{20}
Lim. current I_G
Current, cold I_{20}
Conditions of use:
Max. ambient temperature
Max. fluid temperature
Fuse

Surface coating

Electrical design and testing

Electrical connection
Cable length
Leads

18-NXA 05 0003-0
J2007101
IEC Ex IBE 09.0004 X
IBEx U05 ATEX 1115 X
Ⓢ I M2 Ex d I
S 1, one coil energized per solenoid housing
IP 67 (IEC 60529)
24V DC
26.6 Ω
0.63 A
0.9 A
-20 ... +40°C
+70°C
I = max. 3x I_G , each solenoid must be safe
guarded against overload and short-cut by fuse
conforming IEC 60127-2 UL 248
Housing zinc galvanized
Coil and connection cavity are molded
conforming EN 60079-0 (general requests),
EN 60079-1 (pressure resistant encapsulation "d")
4 x 18 AWG (approx. 0.8 mm²)
3 m or 10 m
BK, WH, RD, GN; Item-No. 40003, General Cable

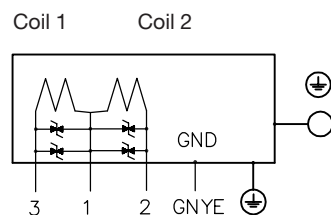
Explosion-proof version of actuation E, EA, HE(A)
(flame proof)
Voltage specification **G 24 M2 FP**

Letter of conformity ATEX
Letter of conformity ANZEx
Electrical connection

For additional information

IBEx U05 ATEX 1115 X
ANZEx 10.3019X
4 x 0.75 mm², shielded connection line.

see coding G 24 MSHA

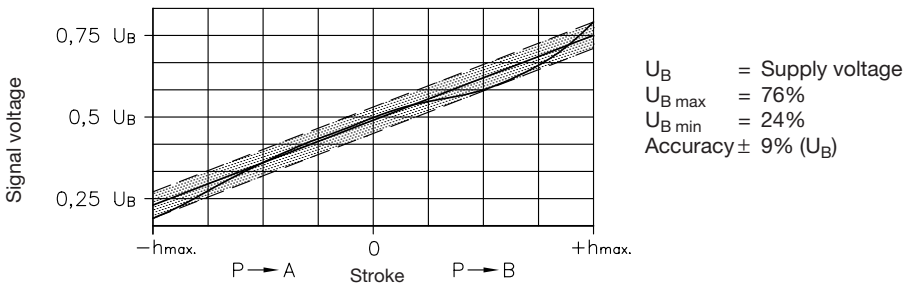


Actuation E0H, E0HA, HEA, E0F, E0FA, FEA

Control pressure approx. 5 bar (start of movement)
approx. 18 bar (max. movement) max. perm. pressure 40 bar
The remote control pipes to the control ports 1 and 2 must be externally piped.
Supply is via proportional pressure reducing valve e.g. type FB2/18 etc. or KFB2/18
(both acc. to D 6600)

Actuation suffix WA, WA-EX

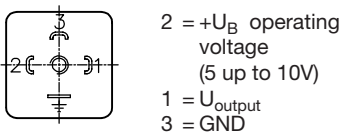
Position sensor supervision of the valve spool stroke via a Hall-sensor



Circuitry

The DC supply voltage must be stabilized and smoothened.
Attention: The transducer will be permanently damaged, when exposed to a strong magnetic field !

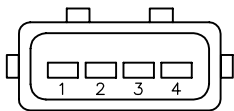
Coding G...



Actuation suffix WA
Electrical connection acc. to coding, see table 10

Actuation suffix WA-EX
ATEX-Certificate of conformity IBEx U09 ATEX 1001X
Ex-proof level Ⓔ II 2 G Ex d IIB T4
Ⓔ II 2 D Ex td A21 IP 6x T 135°C
Ⓔ I M2 Ex d I
Ambient temperature -30 ... +40°C

Coding AMP...



Electrical connection 3 m or 10 m (cable ÖLFLEX-440 ® with shielding and YE/GN ground (protectne conductor) Co. LAPP, D-70565 Stuttgart)
Attention: Operating manual B ATEX and B 10/2008 have to be additionally observed!

Coding S...



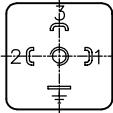
Actuation suffix WA-M2 FP IECEx IBE 11.0004X
Ex-proof level see WA-EX
Ambient temperature -30 ... +40°C
Electrical connection 3 m or 10 m

Actuation suffix U

Comparator
(lift monitoring / side indication)

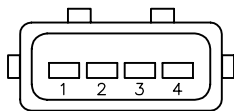
Circuitry

Coding G...



Pin	Signal	Description	
1	OUT _A	PNP-transistor conducting to plus)	Open-Collector: I _{max} = 10 mA short-circuit proof
2	OUT _B	PNP-transistor conducting to plus)	
3	+U _B	10 ... 32V DC	Residual ripple ≤ 10%
4/GND	GND	0V DC	

Coding AMP...



Electrical connection acc. to coding, see table 10

Signal table			
Ident. No.	Spool movement	OUT _A	OUT _B
1	Idle position middle	ON	ON
2	P → B	OFF	ON
3	P → A	ON	OFF

4.4 Functional cut-off, prop. pressure limitation

Functional cut-off

On/Off solenoid with manual emergency actuation

Nom. voltage U_N	24V DC	12V DC
Coil resistance R_{20}	34.8 Ω	8.7 Ω
Current, cold I_{20}	0.69 A	1.38 A
Current, warm I_{70}	0.48 A	0.97 A
Cut-off energy W_A	≤ 0.3 Ws	≤ 0.3 Ws
Rel. duty cycle ¹⁾	S 1	S 1

(reference temp. $\vartheta_{11} = 50^\circ\text{C}$)

Electrical connection

Protection type (assembled)

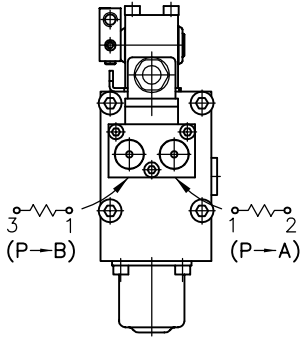
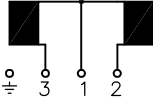
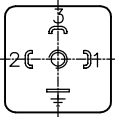
Circuitry

EN 175 301-803 A

IP 65 (IEC 60529)

Coil a

Coil b



¹⁾ **Note:** The duty cycle refers to one coil only of each twin solenoid. The perm. duty cycle is only 50%, when both coils are energized simultaneously

Prop. pressure limitation

Prop. solenoid, with manual emergency actuation. For connection pattern, see functional cut-off. For electrical data, see actuation E, EA.

4.5 Other solenoid valves

Electrical data	- Connection blocks coding Z, ZM, V		- Connection blocks coding F, D - End plates coding E 3, E 6		- Connection blocks coding PA, PB, PD	
Additional documentation	D 7490/1 E (type EM)		D 7470 A/1 (type WN 1, WH 1)			
Nom. voltage U_N	24V DC	12V DC	24V DC	12V DC	24V DC	12V DC
Nom. power P_N	21 W	21 W	24.4 W	24.4 W	21 W	21 W
Nom. current I_N	0.63 A	1.2 A	1 A	2 A	0.63 A	1.26 A

Electr. connection

Circuitry with coding -G 12, -G 24
-X 12, -X 24

EN 175 301-803 A

IP 65 (IEC 60529)

Circuitry with coding -S 24

Plug Co. SCHLEMMER

Type SL-10

IP 67 (IEC 60529)

Circuitry with coding -AMP 24 K 4

AMP Junior Timer

2-pin

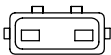
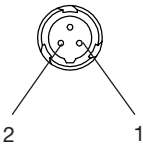
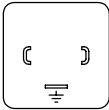
IP 65 (IEC 60529)

Circuitry with coding PA, PB, PD

-G 12, -G 24
-X 12, -X 24

Slim design industrial standard contact clearance 11 mm

IP 65 (IEC 60529)

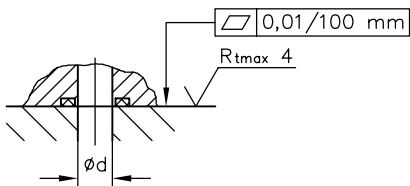
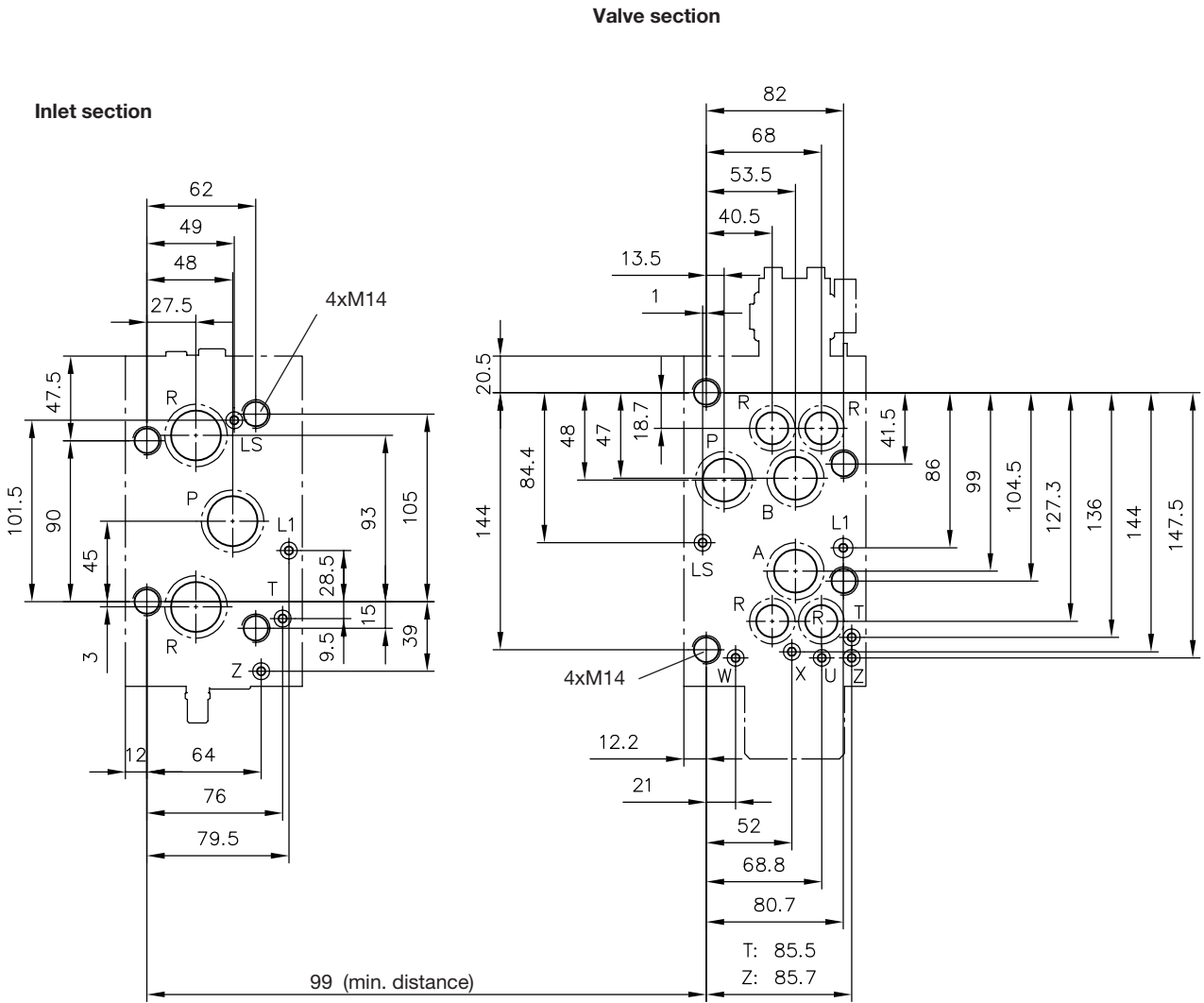


5. Dimensions

5.1 Size 7

5.1.1 Hole pattern of the sub-plate

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



Inlet section:

Ports	Ød	O-ring ¹⁾ PUR 90 Sh
P	20	29.82x2.62
F(R)	20	29.82x2.62
M, LS, L1, Z	4.7	6.07x1.78

Valve section:

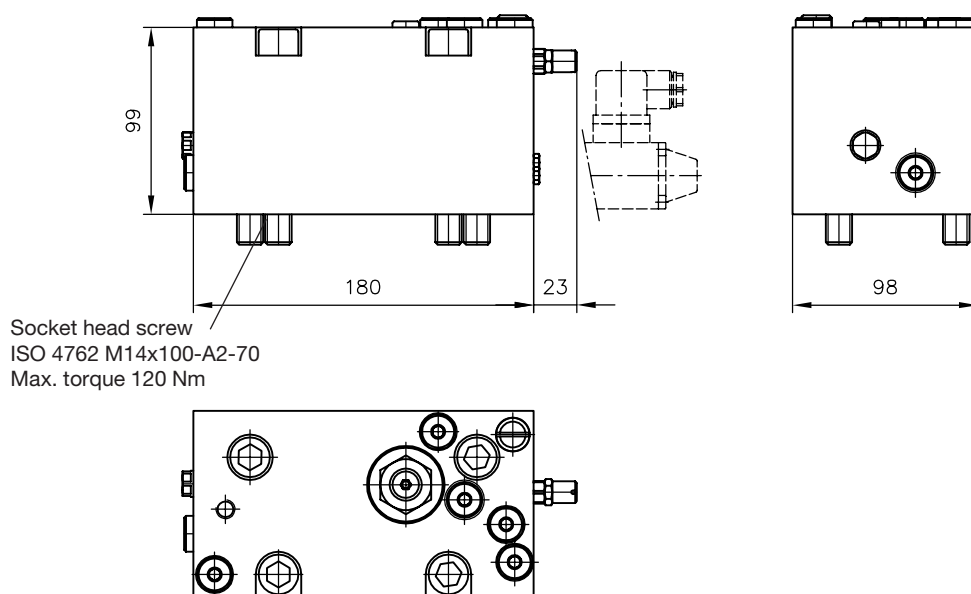
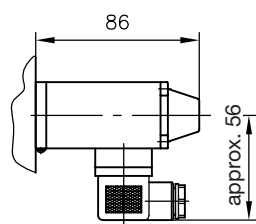
Ports	Ød	O-ring ¹⁾ PUR 90 Sh
P, A, B	24	26.64x2.62
R	18	20.29x2.62
LS, T, U, W, X, Z	4.7	6.07x1.78
L1	4.7	7.65x1.78

¹⁾ These O-rings are also available as complete seal kits, see also sect. 6.3.2
Inlet section: DS 7700-F 71

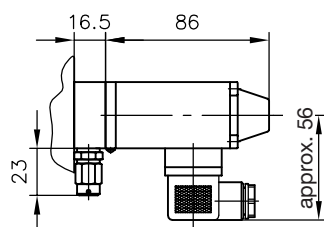
Valve section: DS 7700-F 72

5.1.2 Inlet section

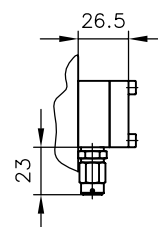
Type PSVF A.../.../...-7

Type PSV..F(D)
PSV..F(D)/...

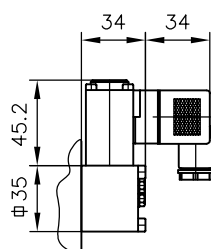
Type PSV..F(D).../...



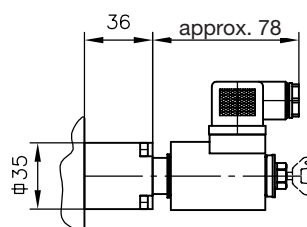
Type PSV...X...



Type PSV..PA(PB, PD)/...



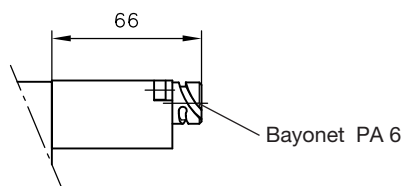
Type PSV..Z(V).../...



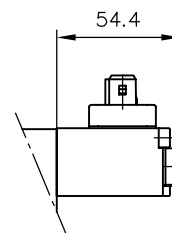
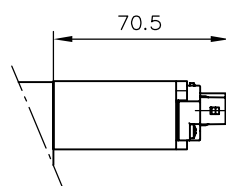


Additional solenoid versions

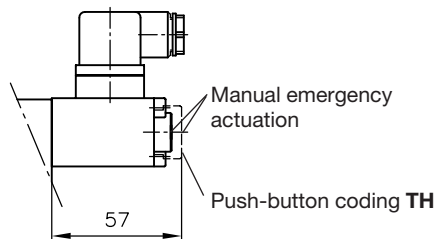
Coding
-S 12
-S 24
-S 12 T
-S 24 T



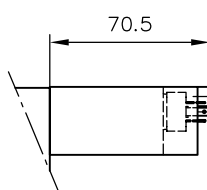
Coding
-AMP 12 K 4
-AMP 24 K 4



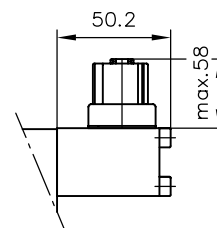
Coding
-G(X) 12 T
-G(X) 24 T



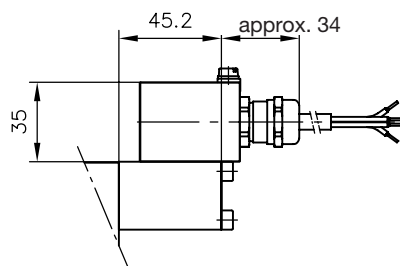
Coding
-G(X) 24 C 4



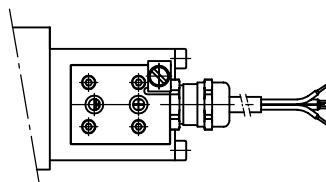
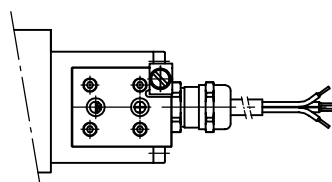
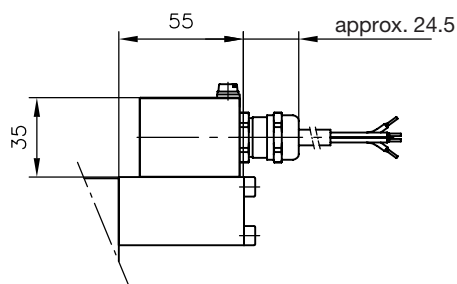
Coding
-DT 12
-DT 24



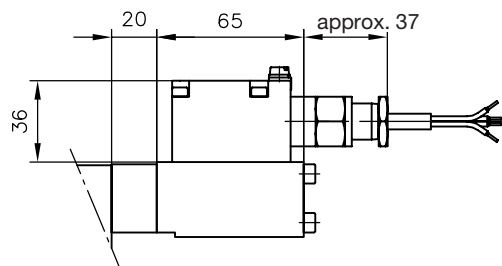
Coding
-G 24 EX
-G 24 EX 4



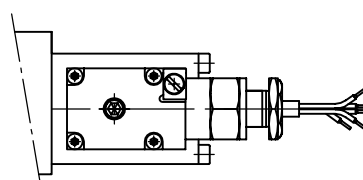
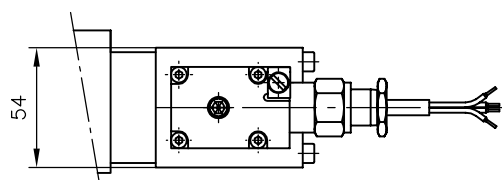
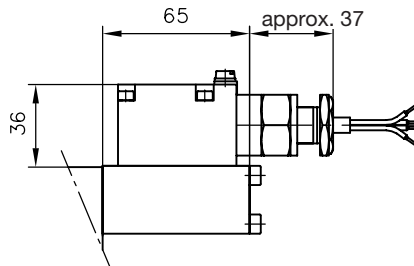
Coding
-G 24 TEX
-G 24 TEX 4



Coding
-G 12 IS
-G 24 MSHA
-G 24 M2 FP

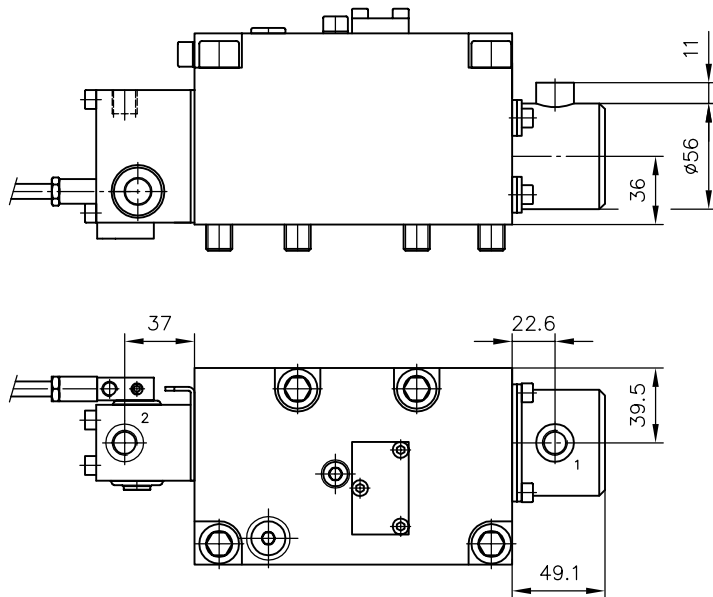


Coding
-G 24 TEX 70

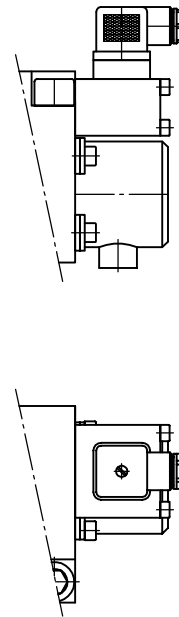


5.1.5 Individual valves with hydraulic actuation type E0HA, E0H, HEA, HE

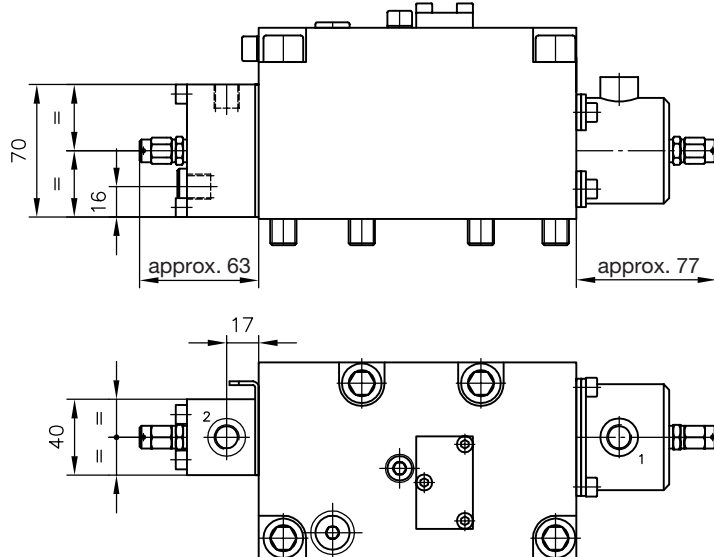
Type E0HA



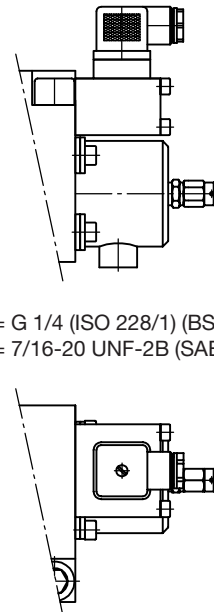
Type HEA



Type E0H

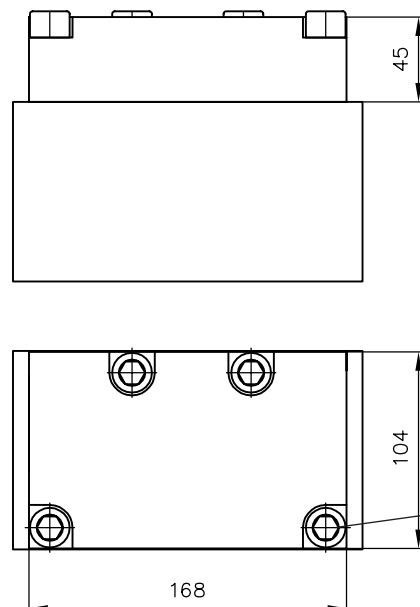


Type HE



Ports
1 and 2 = G 1/4 (ISO 228/1) (BSPP)
1 and 2 = 7/16-20 UNF-2B (SAE-4)

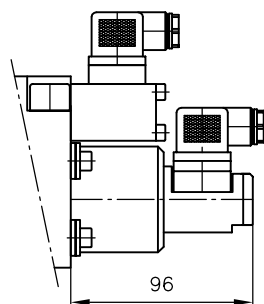
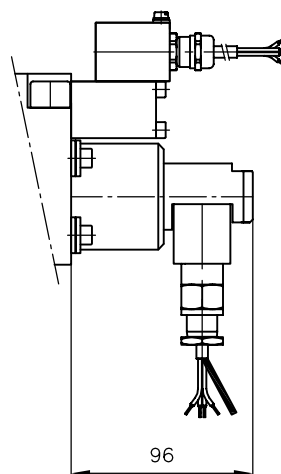
5.1.6 Blanking plate type AX



Socket head screw
ISO 4762 M14x50-A2-70
Max. torque 120 Nm

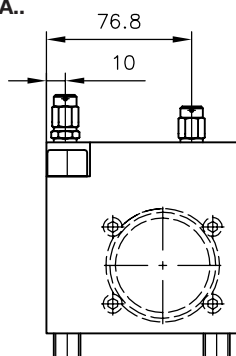
5.1.7 Lift monitoring

Type ... WA, U

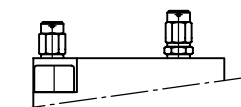
Type WA-EX
WA-M2 FP

5.1.8 Valve sections with LS-pressure limitation, functional cut-off and prop. pressure limitation

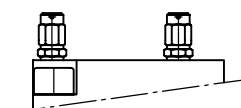
Type A..



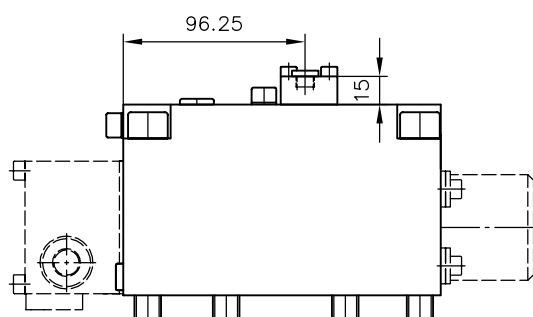
Type B..



Type A..B..



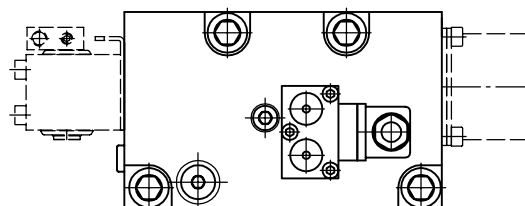
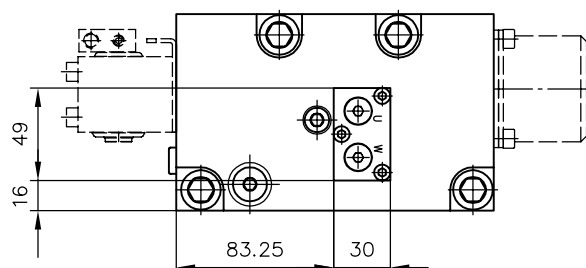
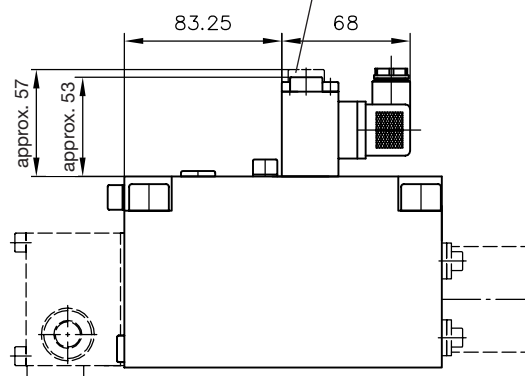
Type S1 to A..B..S1



Type A..B.. F1 to A..B.. F3

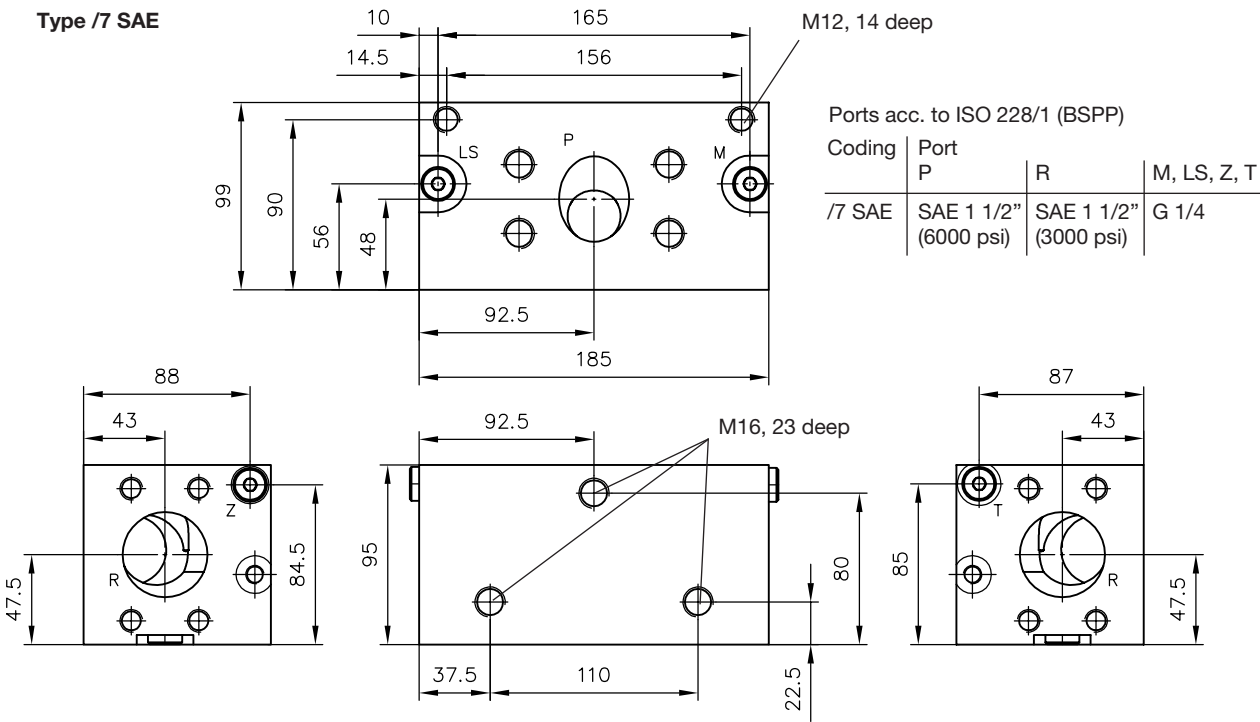
A..B.. FP1 to A..B.. FP3

A..B.. FPH1 to A..B.. FPH 3

Pushbutton
(manual emergency
actuation) with type FPH..

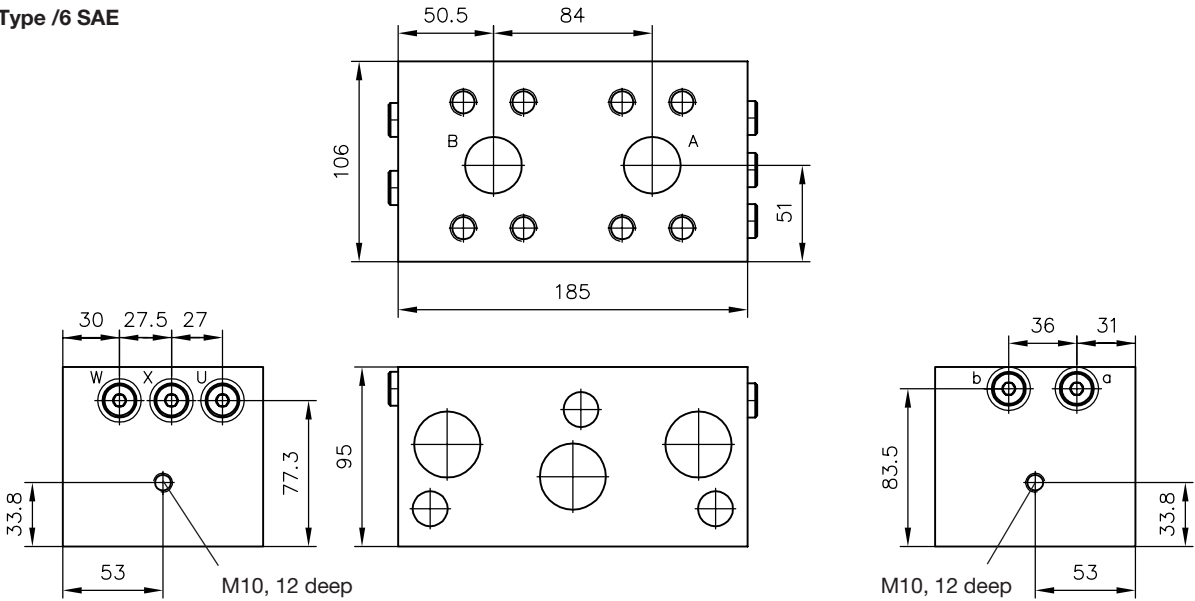
5.1.9 Sub-plate
For inlet section

Type /7 SAE

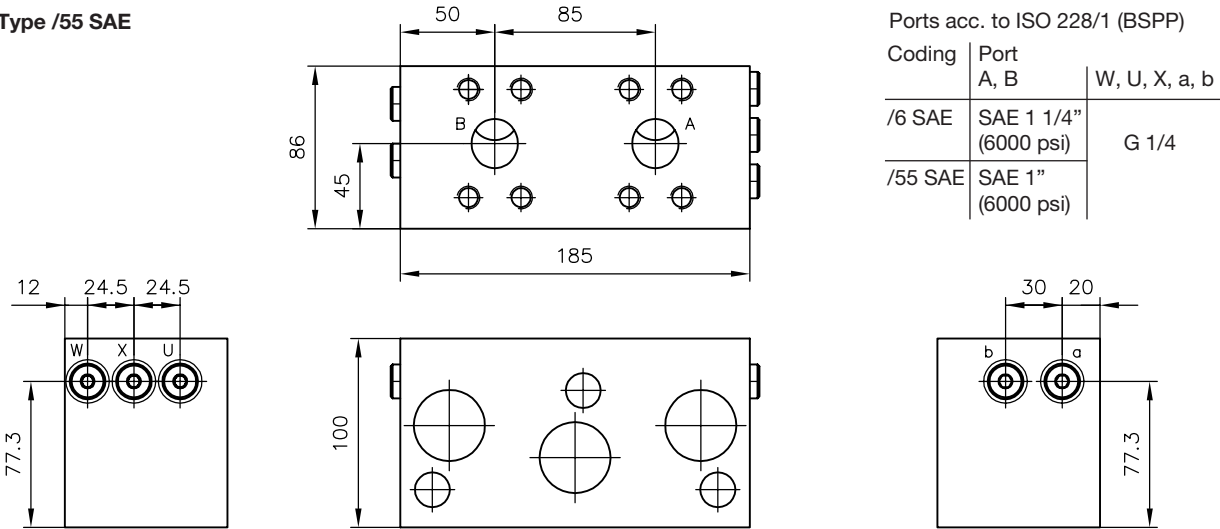


For valve sections

Type /6 SAE

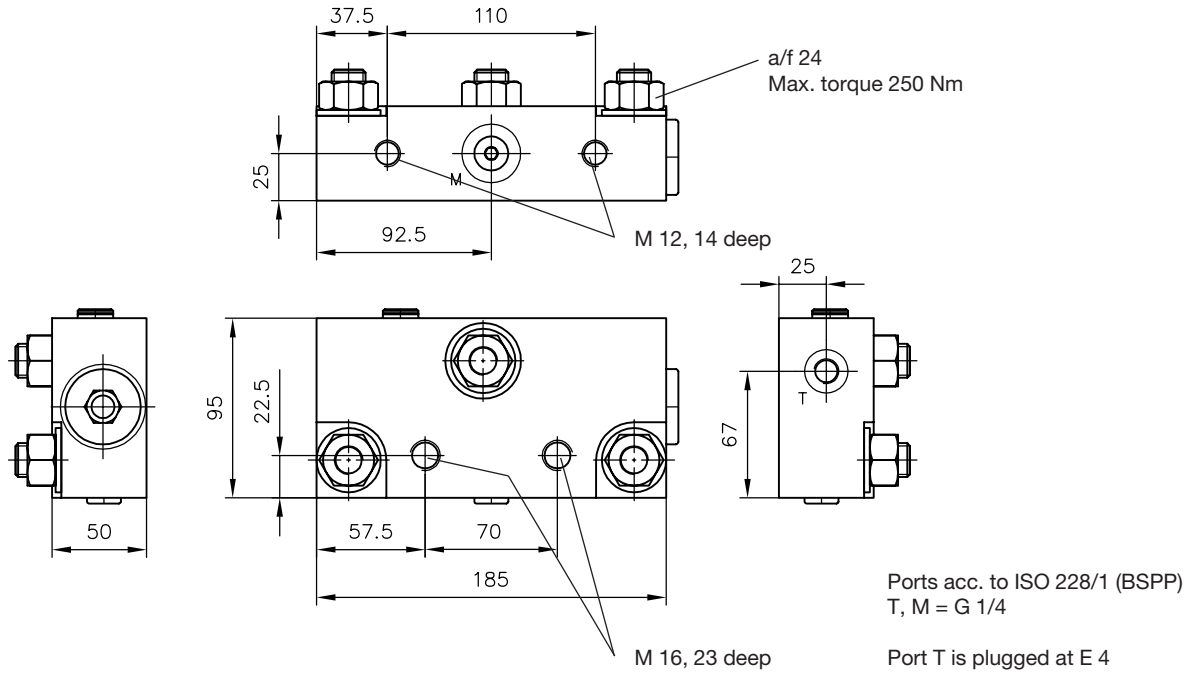


Type /55 SAE



End plates of the valve bank

Type E 1, E 4



6. Appendix

6.1 Notes for selection and lay-out

a) Connection block

There are, apart from the standard versions acc. to sect. 3.1.1 and 3.1.2. additional damping variations for the LS-signal type PSVF (coding S or B) duct listed in tables 2 or 4. These are required, if strong (load-) oscillations are externally induced on the control circuit. A general rule concerning the use of one or other variation can however not given.

Coding G

This version lacks the sequence valve at the damping element which is apparent at the standard version to enable quick depressurization down to the pre-load pressure during idle position of the valve spool. Main application is with consumers prone to low frequent oscillations - drawback is the delayed depressurization down to the pre-load pressure during idle position of the valve spool (pro-longed run-down).

Coding Z, ZM, V and PA, PB, PD (see table 8)

When using these valves for an emergency stop function, it has to be taken into account that there will be a certain min. residual pressure during pushing load while a valve spool is elevated!

Dampening screw acc. to table 2 and 5 Coding	Residual pressure at load induced pressure of	
	250 bar	350 bar
S, G, W, B	125	150
B 4	60	70
B 5	75	80
B 6	85	95
B 7	100	120

Viscosity $\leq 60 \text{ mm}^2/\text{s}$

b) Spool valve sections

Coding A 2 (example SLF 7-H 2 O 320/250)

The standard version of the spool valve comes with load compensation. Due to the control pressure of the inflow controller, it regulates a constant flow related only to the spool elevation, making its delivery independent of other consumers or system pressure $Q \approx \sqrt{\Delta p_{\text{controller}}} \cdot A_{\text{valve spool}}$

d) Variations for special operation conditions or -requirements

Operation at potentially explosive areas

electro-hydraulic actuation (type E or EA) version G 24 EX..., see sect. 3.1.3 table 10 and sect. 4.3

Monitoring of the spool elevation (safety- / switching function)

With contact- or proximity switch for monitoring the idle position of the valve spool (suffix to the types A, C, EA, HA, HEA, PA acc. to sect. 3.2.1 tables 20 and 21 and sect. 4.3)

Maritime ambient climate

The aggressive sea atmosphere requires sufficient corrosion protection of all moving part of the actuators with hand lever. The actuation shaft in the hand lever housing is therefore made of stainless steel as standard. All other parts are either corrosion inhibiting gas nitrided or made of stainless steel.

e) Use of variable displacement pumps

With Load-sensing controls in alliance with variable displacement pumps, the LS-signal duct for the pump pressure-flow controller (Load-Sensing metering valve) is relieved, to minimize circulation losses during idle position (no consumer flow). This limiting takes place via the proportional spool valves. Without this decompression the pump would have to work during no-lift position with all the remaining flow against the pressure set at the safety valve of the pressure regulator.

As there exist spool valves without this limiting possibility, some brands of pressure-flow controllers have a internal bypass orifice or throttle between LS-signal entrance and decompressed leakage outlet.

In case of the prop. spool valves type PSVF this is not necessary and can even cause malfunctions due to lost control oil. The control oil flow is for functional reasons consciously limited (approx. 2 lpm) (slow-motion of the consumer).

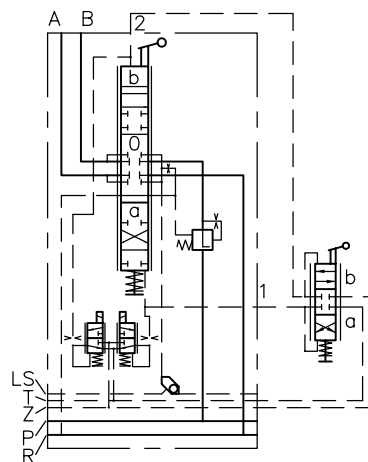
Note: Care must therefore be taken, to ensure that a possible bypass orifice in the pressure-flow regulator is plugged!

i) Indications of actuation HEA

The following notes to the connection of the valve bank have to be observed to ensure a flawless function of the electric and hydraulic actuation.

Combination with hydraulic control devices similar (circuitry acc. to example 1)

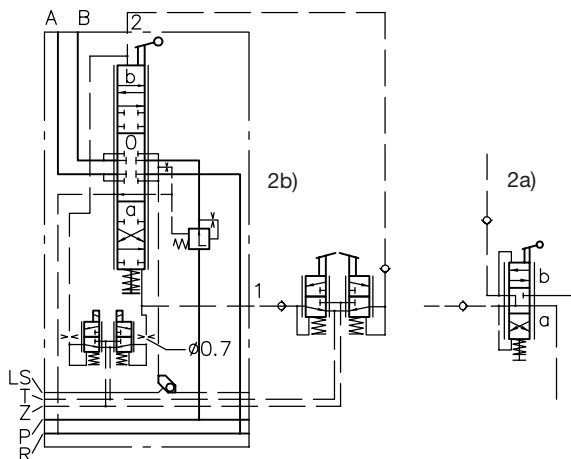
Example 1



Combination with common hydraulic joy-sticks or hydraulic control devices type FB and KFB acc. to D 6600 and D 6600-01 (circuitry acc. to example 2)

The pressure reducing valves integrated in the joysticks open the consumer line to the tank during idle position. The control oil flow would escape via this bypass when a valve is simultaneously solenoid actuated. Therefore it is a must to provide check valves for the control lines at this kind of circuitry. The same applies to hydraulic actuations. The used throttles however limit the bypass leakage. The control oil supply must be dimensioned so that this leakage can be compensated (> 1.1 lpm per actuated valve section plus the internal leakage of the hydraulic joy-stick).

Example 2



j) Optional components

For electro-hydraulic actuations

1. Plugs MSD 3-309 Standard, belongs to the scope of delivery
SVS 296107 Plug with LED's for functional cut-off acc. to sect. 3.2 table 17 (for more details, see D 7163)
2. Electric amplifier EV 22 K2-12(24) acc. to D 7817/1 One board can control two directional valves.
3. Electric amplifier EV 1 M2 acc. to D 7831/1
EV 1 D acc. to D 7831 D
A remote control potentiometer with direction switches is required additionally (see detailed information in D 7831/1 sect. 5.2).
4. Logic valve control type PLVC acc. to D 7845 ++
5. Joystick type EJ 1, EJ 2 and EJ 3 acc. to D 7844
6. Radio controls are accepted, if they fulfill the requirements of SK 7814.
(Approved brands:
Co. HBC-ELEKTRONIK in D-74564 Crailsheim,
Co. HETRONIK Steuer-Systeme in D-84085 Langquaid,
Co. NBB-Nachrichtentechnik in D-75248 Ölbrenn-Dürren,
Co. SCANRECO Industrieelektronik AB, Box 19144,
S-5227 Södertälje)

Other valves

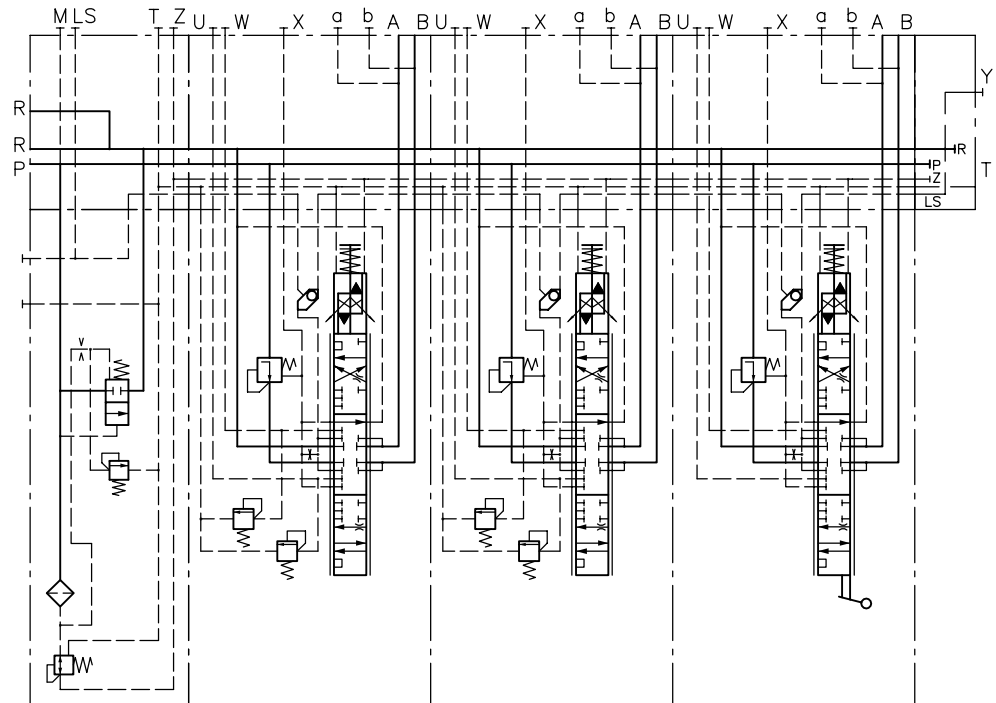
Proportional spool valve type PSLF (PSVF)
Size 5 (manifold mounting) acc. to D 7700-F
Proportional pressure reducing valve type PMZ acc. to D 7625
Hydraulic joy-stick type KFB01 acc. to D 6600-01

6.2 Example circuit

Control system with PSVF, and variable displacement pump

Flow pattern symbol
acc. to the order
example

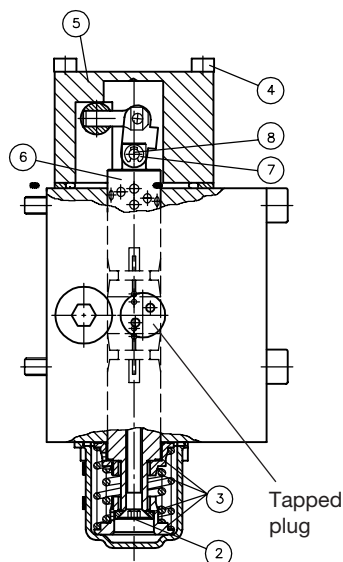
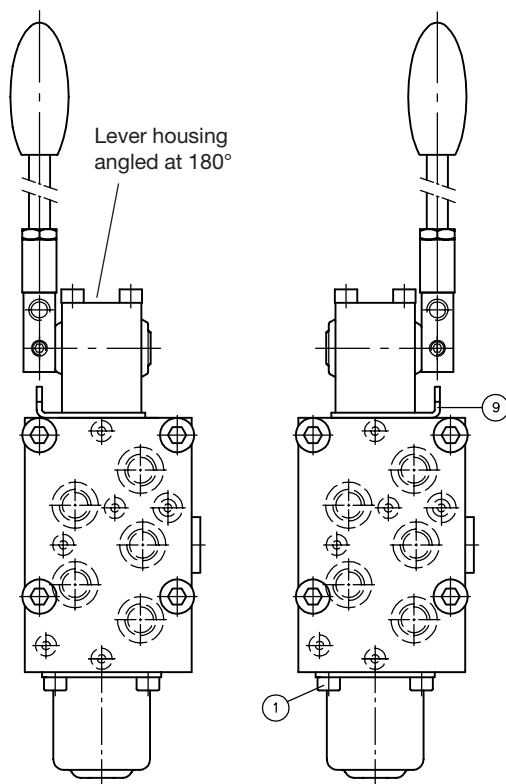
PSVF A1/380/7 SAE - 7 - A2 L 400/320 A200 B200 /E /7
- A2 H 320/320 A280 B130 /E /7
- A2 H 250/180 /EA/7
- E1 - G 24



6.3 Notes regarding assembly, installation and conversion

6.3.1 Notes on changing the spool

The valve spools are not mated to one spool housing. Therefore valve spools can be changed at any time to adapt to changing consumer consumption. The following routine is to be followed particularly:



Advice on changing the valve spool

1. Slacken screws ① (M6x8 ISO 4762), remove spring cover
2. Remove screw ② M8x40 DIN 7991
3. Remove spring assembly including spring cap ③
4. Slacken screws ④ (M6x60 ISO 4762)
5. Lift lever housing including spool out of spool housing, drawing ⑤ ⑥
6. Remove circlip DIN 6799 3.2 and remove bolt ⑦ ⑧
7. Assemble with (new) spool in reverse sequence

Indications for angling the lever housing by 180° (inversion of the shifting mode)

As set out in 1. - 7. above, however instead of a new valve spool the existing one has to be disconnected, angled at 180° and remounted (see above mentioned note). The intermediate plate ⑨ together with the lever housing, have to be angled at 180°.

All lever housings of the valve bank have to be rotated!

6.3.2 Seal kits

	Size 7
Inlet section (control section)	DS 7700-F 71
Valve section	DS 7700-F 72
Sub-plate	DS 7700-F 74