2.1 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.

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<td>Manifold mounting design</td>
<td>D 7700-2</td>
</tr>
<tr>
<td>2</td>
<td>Valve bank design (CAN onboard)</td>
<td>D 7700 CAN</td>
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<tr>
<td>3</td>
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<td>5</td>
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</tr>
<tr>
<td>3, 5</td>
<td>Manifold mounting design</td>
<td>D 7700-F</td>
</tr>
</tbody>
</table>

Mounting

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

D 7700-7F
Prop.-directionnel spool valve type PSVF and SLF

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Hawe Hydraulik
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August 2011-04
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
```

---

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)

   **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

   **SLF** Individual valve section, without sub-plate

2. Additional elements (see table 2 and 4 in sect. 3.1) (no coding)

   - **S, W** Additional damping device in gallery LS (only with PSVF, standard with PSLF)
   - **B, B 4 ... B 7** Orifice in gallery LS (PSVF only)
   - **G** Restrictor check valve (type PSLF)

3. Control oil supply (see table 7, sect. 3.1.3) (no coding)

   - **1** Without pressure reducing valve in case of an external control oil supply (min. 20 bar up to max. 40 bar)
   - **2** With integrated pressure reducing valve for the internal supply of control oil (control pressure approx. 20 bar)

4. Optional 2/2-way solenoid valve for arbitrary idle pump circulation (see table 8, sect. 3.1.3) (no coding)

   - **F, Z, ZM** De-energized open = Idle pump circulation when valve is de-energized
   - **D, V** De-energized closed = Idle pump circulation when valve is energized
   - **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)
   - **PA, PB, PD** Prop. pressure limiting valve, with various pressure ranges

5. Pressure limiting valve (main pressure limitation) in the inlet section (see table 9, sect. 3.1.3) (no coding)

   - **/ ...** Pressure limiting valve factory set to … bar

6. Sub-plate for the inlet section (see table 3, sect. 3.1)

   - **/7** Size 7, standard (tapped ports for P and R G 1 1/2 ISO 228/1 (BSPP))
   - **/7 SAE** Size SAE (flange SAE 1 1/2" 6000 psi)

7. Size (see table 1 and 5, sect. 3.1)

   - **7** Size 7

8. Valve section - Basic function (see table 13, section 3.2.1)

   - **A 2** (standard) Spool valve with inflow controller for each consumer
   - **A 1** Spool valve without inflow controller, suitable for consumers, which are actuated individually and successively but not simultaneously (no additional functions possible)
   - **A 5** Inflow controller with enforced spring for higher flow
   - **AX** Blanking plate

9. Coding for the flow-pattern (see table 14, sect. 3.2.1 and 6 c)

   - **L, H, J, O**

10. Flow coding for port A and B (see table 15, sect. 3.2.1)

    - **.../...** Coding for port A or B (independently selectable)
    - **120, 180, 250, 320**

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) (no coding)

    - **AB** Prep. for retrofitting (standard)
    - **A..., B...** Only for consumer port or B
    - **A..., B...** For consumer ports A and B
Functional cut-off (see table 17 and 18, sect. 3.2.1)

(No coding)

F0  No functional cut-off

F1  Electrical cut-off, consumer port A

F2  Electrical cut-off, consumer port B

F3  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

S1  External hydraulic load signal pick-up from the control signal port U (consumer port A) and W (consumer port B)

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)

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)

End plates (see table 11, section 3.1.3)

E1  With T-port for control oil return externally to the tank (basic type)

E4  Like E1, however with internal drain connection, max. pressure 10 bar!

Solenoid voltage and version (see table 10, sect. 3.1.3)

G12.. 12V DC, connection conf. EN 175 301-803 A

G24.. 24V DC, connection conf. EN 175 301-803 A

G24 EX 24V DC, explosion-proof version

G24 EX 70 24V DC, explosion-proof version (ambient temperature 70°C)

G24 MSHA 24V DC, explosion-proof version (fire-damp protection (mining))

G24 M2 FP 24V DC, explosion-proof version (fire-damp protection (mining))

G12 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

S12.. 12V DC electr. connection via quarter turn plug

S24.. 24V DC electr. connection via quarter turn plug

DT12 12V DC electr. connection via plug Co. DEUTSCH

DT24 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:

PSVF A B F/300 /7 SAE - 7 -...- E 1 - G 24 (valve bank)

PSVF A B/250 - 7 (inlet section with controller)

Nom. voltage see table 10

Sub-plate see table 3

<table>
<thead>
<tr>
<th>Coding and size</th>
<th>Description</th>
<th>Max. pump delivery flow (lpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSVF A ../..-7</td>
<td>Individual section</td>
<td>approx. 1000</td>
</tr>
</tbody>
</table>

### Table 4: Basic type and size

<table>
<thead>
<tr>
<th>Coding and size</th>
<th>Description</th>
<th>Max. pump delivery flow (lpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSVF A ../..-7</td>
<td>Individual section</td>
<td>approx. 1000</td>
</tr>
</tbody>
</table>

### 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!

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

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

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/7 SAE</td>
<td>SAE 1 1/2” (6000 psi, P) (3000 psi, R)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/7 SAE</td>
<td>G 1/4</td>
</tr>
</tbody>
</table>
3.1.2 Additional elements for the inlet sections

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

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

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>no coding</td>
<td>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</td>
</tr>
<tr>
<td>1</td>
<td>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)</td>
</tr>
<tr>
<td>2</td>
<td>Control pressure: Coding 1: approx. 20 bar (+ return pressure at R) Coding 2: approx. 40 bar (+ return pressure at R)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>no coding</td>
<td>If not required</td>
</tr>
<tr>
<td>F</td>
<td>With WN 1 F, idle pump circulation if valve is deenergized (emergency stop)</td>
</tr>
<tr>
<td>D</td>
<td>With WN 1 D, idle pump circulation if valve is energized</td>
</tr>
<tr>
<td>F... or D...</td>
<td>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 $p_{\text{max}}$ 100 bar energized $p_{\text{max}}$ 350 bar</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>no coding</td>
<td>Version without pressure limiting valve (only type PSVF)</td>
</tr>
<tr>
<td>/...</td>
<td>With pressure limiting valve at PSVF (pressure specification in bar)</td>
</tr>
</tbody>
</table>

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!

Symbols

- PSVF A 1(2)/...-7
- PSVF A..F, Z, ZM
- PSVF A..F...
- PSVF A.D...
- PSVF A.D, V5
- PSVF..PA (PB,PD)
- PSVF A.X...
Table 10: Solenoid voltage and version

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description</th>
</tr>
</thead>
</table>
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  
Actuation solenoid 3-pin (standard)  
Manual emergency actuation (standard with functional cut-off F., FP., see table 17)  
Manual emergency actuation with pushbutton (standard with functional cut-off FP., FP., see table 17)  
4-pin actuation solenoid (only 24V DC) |
| without T       |                                                                                                                                             |
| TH              |                                                                                                                                             |
| H 4             |                                                                                                                                             |
| G 24 C 4        | Electr. connection conf. EN 175 301-803 C, via plug (MSD 6-209), 4-pin actuation solenoid                                                                 |
| X 12 .  X 24 .  | Electr. connection conf. EN 175 301-803 A, without plug. For options, see coding G...                                                                 |
| S 12 .  S 24 T  | 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  
Suffix: Manual emergency actuation (standard with functional cut-off FP., see table 17) |
| without T       |                                                                                                                                             |
| AMP 12 K 4      | Vertical connection via plug AMP Junior Timer, solenoid features 4 terminals                                                                 |
| AMP 24 K 4      | Lateral connection via plug AMP Junior Timer, solenoid features 4 terminals and manual emergency actuation                                    |
| DT 12 DT 24     | Connection via plug Co. DEUTSCH DT 04-4P, suited for socket DT 06-4S                                                                       |
| G 24 EX         | For use in areas with explosion hazardous atmosphere. Suited for category 2 and 3, zone 1, 21, 2, 22.  
Protection class EEEx mII 120° (T4), with cable length 3 m (no coding) or 10 m  
3-pin actuation solenoid  
3-pin actuation solenoid with manual emergency actuation  
4-pin actuation solenoid  
4-pin actuation solenoid with manual emergency actuation |
| G 24 EX-10 m    |                                                                                                                                             |
| EX              |                                                                                                                                             |
| TEX             |                                                                                                                                             |
| EX4             |                                                                                                                                             |
| TEX4            |                                                                                                                                             |
| G 24 TEX 70     | Like G 24 EX . . , but for ambient temperature < 70°C                                                                                     |
| G 24 TEX 70-10 m|                                                                                                                                             |
| G 12 IS         | 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 I (fire-damp protection, intrinsic safe), with cable length 5 m (no coding) or 10 m |
| G 12 IS-10 m    |                                                                                                                                             |
| G 24 MSHA       | 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 MSHA-10 m  |                                                                                                                                             |
| G 24 M2 FP      | 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 |
| G 24 M2 FP-10 m |                                                                                                                                             |

Note:  
- 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

<table>
<thead>
<tr>
<th>End plate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>With T-port at the inlet section for control oil return externally to the tank (basic type)</td>
<td>Like E 1, however with internal drain connection</td>
</tr>
<tr>
<td>Order coding of an end plate as separate part (example): SLF 7 - E 1 (State the size: 7 !)</td>
<td></td>
</tr>
<tr>
<td>E 1</td>
<td>E 4</td>
</tr>
</tbody>
</table>

**Note:** The internal control oil return gallery is to be used only in systems where the return pressure is below 10 bar.

### 3.2 Valve sections

#### 3.2.1 Directional spool valve (individual valve)

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

**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

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 2</td>
<td>Standard, with inflow controller, for simultaneous load compensated moving of several consumers (standard type)</td>
</tr>
<tr>
<td>AX</td>
<td>Blanking plate</td>
</tr>
</tbody>
</table>

**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 $P \rightarrow A(B)$ acc. to the coding

<table>
<thead>
<tr>
<th>Coding</th>
<th>Size</th>
<th>Flow coding $Q_{A,B}$ (lpm) at consumer port A and B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
<td>120 180 250 320 400</td>
</tr>
</tbody>
</table>

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!

<table>
<thead>
<tr>
<th>Coding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>Without pressure limitation</td>
</tr>
<tr>
<td>A...</td>
<td>Pressure limitation at A with pressure specification</td>
</tr>
<tr>
<td>B...</td>
<td>Pressure limitation at B with pressure specification</td>
</tr>
<tr>
<td>A...B...</td>
<td>Pressure limitation at A and B with pressure specification</td>
</tr>
</tbody>
</table>

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

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

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

Table 18: Combination possibilities for additional functions

<table>
<thead>
<tr>
<th>Pressure limitation</th>
<th>Functional cut-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>F1, F2, F3, S1 FP1, FP2, FP3 FPH1, FPH2, FPH3</td>
</tr>
<tr>
<td>AB</td>
<td></td>
</tr>
<tr>
<td>A or B</td>
<td></td>
</tr>
<tr>
<td>A and B</td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

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

Combination possibilities:
(see table 18)

Example:
SLF 7-A2 H 320/250 A 250 B 310 F3/EA-G 24
### Table 19: Types of actuation (for further explanations, see sect. 4.3)

<table>
<thead>
<tr>
<th>Nomenclature</th>
<th>Manual actuation</th>
<th>Electro-hydraulic actuation</th>
<th>Hydraulic actuation</th>
<th>Combination with manual actuation</th>
<th>Combination with solenoid and manual actuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coding</td>
<td>E0A</td>
<td>E</td>
<td>EA</td>
<td>E0H UNF</td>
<td>HEA UNF</td>
</tr>
<tr>
<td>Symbol</td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Manipulated variables</td>
<td>Actuation angle min. approx. 5° max. approx. 30°</td>
<td>Control current ratio I/IN min. approx. 0.2 max. approx. 1</td>
<td>Control pressure min. approx. 5 bar max. approx. 18 bar max. perm. 40 bar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 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 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

<table>
<thead>
<tr>
<th>Type of actuation / coding</th>
<th>Suffix</th>
<th>Description</th>
<th>Example</th>
<th>Symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>E0A, EA, HA, PA</td>
<td>1</td>
<td>Manual actuation without hand lever. For dimensions see sect. 5.1.3</td>
<td>EA 1</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>E0A, EA, H, HA</td>
<td>WA</td>
<td>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)</td>
<td>EA WA, E0A 1 WA</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Integrated spool monitoring for side indication (Comparator, triggered signal: on/off)</td>
<td>EA U</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Coding</th>
<th>Port size for A and B ISO 228/1 (BSPP)</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/6 SAE</td>
<td>SAE 1 1/4&quot; (6000 psi)</td>
<td>7</td>
<td>Sub-plate with SAE-flange for valve section size 5 acc. to D 7700-F</td>
</tr>
<tr>
<td>/55 SAE</td>
<td>SAE 1&quot; (6000 psi)</td>
<td>7</td>
<td>Sub-plate with SAE-flange</td>
</tr>
</tbody>
</table>

Symbol

```
U W X Y A B

R P X T Z A B
```

/6 SAE
/55 SAE
4. Characteristic data

4.1 General and hydraulic

Type coding

Design

Mounting

<table>
<thead>
<tr>
<th></th>
<th>Size 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indiv. section</td>
<td>4 x M14</td>
</tr>
<tr>
<td>Valve bank</td>
<td>M10</td>
</tr>
</tbody>
</table>

Installation position

Any

Ports

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Pressure inlet (pump)</td>
</tr>
<tr>
<td>R</td>
<td>Return</td>
</tr>
<tr>
<td>A, B</td>
<td>Consumer ports</td>
</tr>
<tr>
<td>U, W, X</td>
<td>Load-signal outlet at the indiv. spool valve section</td>
</tr>
<tr>
<td>LS</td>
<td>Load-signal outlet e.g. connection of pump metering valve at PSVF.</td>
</tr>
</tbody>
</table>

Attention: No pressure input!

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Pressure gauge connection (pump side)</td>
</tr>
<tr>
<td>Z</td>
<td>Pilot pressure connection (20...40 bar inlet, 20 or 40 bar outlet)</td>
</tr>
<tr>
<td>T</td>
<td>Control oil return port</td>
</tr>
<tr>
<td>Y</td>
<td>Load-signal inlet port (end plate E 2 and E 5)</td>
</tr>
</tbody>
</table>

Port size

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P, R, A, B</td>
<td>Acc. to dimensional drawings (see sect. 5.1.10)</td>
</tr>
<tr>
<td>M, LS, Z, T, Y</td>
<td>G 1/4 conform. ISO 228/1 (BSPP) (see sect. 5.1.10)</td>
</tr>
<tr>
<td>U, W, X</td>
<td>Acc. to dimensional drawings (see sect. 5.1.10)</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Size</th>
<th>Approx. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>12.0</td>
</tr>
</tbody>
</table>

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 (Polyalkylen glycol) 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

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

Oil viscosity during measurement
approx. 60 mm²/sec

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

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

<table>
<thead>
<tr>
<th>Actuation</th>
<th>Actuating moment (Nm)</th>
<th>End position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version E0HA, HEA</td>
<td>approx. 5.0</td>
<td>approx. 16.5</td>
</tr>
<tr>
<td>Version EA, E0A</td>
<td>approx. 3.0</td>
<td>approx. 12.0</td>
</tr>
</tbody>
</table>

#### Additional notes:

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

Specifications apply to all solenoid versions if not stated otherwise.

- **Nom. voltage** $U_N$
  - 24V DC
  - 12V DC

- **Coil resistance** $R_0$
  - 26.6 Ω
  - 6.3 Ω

- **Current, cold** $I_{20}$
  - 0.9 A
  - 1.9 A

- **Lim. current** $I_{lim}$
  - 0.63 A
  - 1.26 A

- **Cut-off energy** $W_A$
  - ≤ 0.3 Ws
  - ≤ 0.3 Ws

- **Rel. duty cycle** $S_1$
  - S 1

- **Reference temp. $\theta_1 = 50^\circ C$**

- **Required dither frequency**
  - 40...70 Hz (best 55 Hz)

- **Dither amplitude $A_D$**
  - 20% ≤ $A_D$ ≤ 50%

#### Control current I

- **I - stroke- curve**
  - ![Curves](image)

- **Oil viscosity during measurement**
  - approx. 60 mm²/s

#### Electrical connection

- **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 69 K (IEC 60529)

- **Circuitry for coding**
  - -AMP 12 K 4
  - -AMP 24 K 4
  - AMP Junior Timer,
  - 4-pin
  - IP 67 (IEC 60529)

- **Circuitry for coding**
  - -G 24 H 4
  - -G 24 C 4
  - EN 175 301-803 C
  - 4-pin
  - 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).

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).

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).
**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 E0H, E0HA, HEA, E0F, E0FA, FEA**

- **Letter of conformity IEC** IEC Ex IBE 09.0006 X
- **Letter of conformity ATEX** IBExU05ATEX 1116 X

**Explosion-proof version of actuation E, EA (intrinsic save, flame proof)**

**Voltage specification G 24 MSHA**

**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 3a, 8), auxiliary blocks (table 19), intermediate plates (table 22) and end plates (table 11)

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

**Coil a (1)  Coil b (2)**

**Surface coating**
- Housing galvanically zinc coated
- Coil and connection cavity are moulded

**Electrical design and testing**
- Conforming EN 60079-0 (general requests),
- EN 60079-25 (intrinsic save “i”),
- EN 60079-1 (pressure resistant encapsulation “d”)**

**Electrical connection**
- 4 x 0.5 mm²

**Cable length**
- 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 (intrinsic save, flame proof)**

**Voltage specification G 24 M2 FP**

**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), auxiliary blocks (table 19), intermediate plates (table 22) 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.

**Coil a (1)  Coil b (2)**

**Surface coating**
- Housing zinc galvanized
- Coil and connection cavity are moulded

**Electrical design and testing**
- Conforming EN 60079-0 (general requests),
- EN 60079-25 (intrinsic save “i”),
- EN 60079-1 (pressure resistant encapsulation “d”)**

**Electrical connection**
- 4 x 0.75 mm², shielded connection line.

For additional information see coding G 24 MSHA
### Actuation suffix WA, WA-EX

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

![Graph showing signal voltage vs. stroke](image)

- $U_b$ = Supply voltage
- $U_{b \text{ max}}$ = 76%
- $U_{b \text{ min}}$ = 24%
- Accuracy ± 9% ($U_b$)

#### 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

#### Coding AMP...

- 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
- Electrical connection 3 m or 10 m (cable ÖLFLEX-440 ® with shielding and YE/GN ground (protect conductor) Co. LAPP, D-70565 Stuttgart)

**Attention:** Operating manual B ATEX and B 10/2008 have to be additionally observed!

#### Coding S...

### Actuation suffix U

**Comparator (lift monitoring / side indication)**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OUT$_A$</td>
<td>PNP-transistor conducting to plus)</td>
</tr>
<tr>
<td>2</td>
<td>OUT$_B$</td>
<td>PNP-transistor conducting to plus)</td>
</tr>
<tr>
<td>3</td>
<td>$+U_b$</td>
<td>10 ... 32V DC</td>
</tr>
<tr>
<td>4/GND</td>
<td>GND</td>
<td>0V DC</td>
</tr>
</tbody>
</table>

- Open-Collector: $I_{\text{max}} = 10$ mA short-circuit proof
- Residual ripple ≤ 10%

**Electrical connection acc. to coding, see table 10**

### Signal table

<table>
<thead>
<tr>
<th>Ident. No.</th>
<th>Spool movement</th>
<th>OUT$_A$</th>
<th>OUT$_B$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Idle position middle</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>2</td>
<td>$P \rightarrow B$</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>3</td>
<td>$P \rightarrow A$</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>
## 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 $\Omega$
  - 8.7 $\Omega$
- **Current, cold** $I_{20}$
  - 0.69 A
  - 1.38 A
- **Current, warm** $I_{70}$
  - 0.48 A
  - 0.97 A
- **Cut-off energy** $W_A$
  - $\leq 0.3$ Ws
- **Rel. duty cycle** 1) $S_1$
  - (reference temp. $\phi_{11} = 50^\circ C$)
- **Electrical connection**
  - EN 175 301-803 A
- **Protection type (assembled)**
  - IP 65 (IEC 60529)
- **Circuitry**
  - Coil a
  - Coil b

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

### 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.

## 4.5 Other solenoid valves

### Electrical data
- **Nom. voltage** $U_N$
  - 24V DC
  - 12V DC
- **Nom. power** $P_N$
  - 21 W
  - 24.4 W
- **Nom. current** $I_N$
  - 0.63 A
  - 1 A

### Additional documentation
- D 7490/1 E (type EM)
- D 7470 A/1 (type WN 1, WH 1)

### Circuitry
- **with coding** -G 12, -G 24
- **Plug Co. SCHLEMMER**
- **Type SL-10**
- **IP 65 (IEC 60529)**

- **with coding** -S 24
- **Type SL-10**
- **IP 67 (IEC 60529)**

- **with coding** -AMP 24 K 4
- **AMP Junior Timer**
- **2-pin**
- **IP 65 (IEC 60529)**

- **with coding** -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: P, A, B, M, LS, L1, Z
- #d: 20
- O-ring (1) PUR 90 Sh: 29.82x2.62

Valve section:

- #d: 20, 18
- O-ring (1) PUR 90 Sh: 26.64x2.62, 20.29x2.62

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

Socket head screw
ISO 4762 M14x100-A2-70
Max. torque 120 Nm

Type PSVF A.../.../...
5.1.3 Individual valve with manual actuation type E0A

Type E0A

Socket head screw
ISO 4762 M14x100-A2-70
Max. torque 120 Nm

5.1.4 Individual valves with actuation type E, EA
Additional solenoid versions

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

Bayonet PA 6

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

Manual emergency actuation

Push-button coding TH

- **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

AMP 12 K 4
AMP 24 K 4

DT 12
DT 24

AMP 24 H 4 T

AMP 12 K 4
AMP 24 K 4

DT 12
DT 24

AMP 24 H 4 T

AMP 12 K 4
AMP 24 K 4

- **Coding**
  - G 24 TEX
  - G 24 TEX 70

Approx. 34
Approx. 37
Approx. 37
Approx. 37
Approx. 24.5
Approx. 54.4
5.1.5 Individual valves with hydraulic actuation type E0HA, E0H, HEA, HE

Type E0HA

Type HEA

Type HE

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

approx. 77

approx. 63

approx. 77

approx. 63

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

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

Type S1 to A..B..S1

Type WA-EX
WA-M2 FP

Pushbutton (manual emergency actuation) with type FPH..
5.1.9 Sub-plate
For inlet section

Type /7 SAE

Ports acc. to ISO 228/1 (BSPP)

<table>
<thead>
<tr>
<th>Coding</th>
<th>Port</th>
<th>R</th>
<th>M, LS, Z, T</th>
</tr>
</thead>
<tbody>
<tr>
<td>/7 SAE</td>
<td>P</td>
<td></td>
<td>SAE 1 1/2&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(6000 psi)</td>
</tr>
</tbody>
</table>

M18, 24 deep

M12, 23 deep

For valve sections

Type /6 SAE

Ports acc. to ISO 228/1 (BSPP)

<table>
<thead>
<tr>
<th>Coding</th>
<th>Port</th>
<th>W, U, X, a, b</th>
</tr>
</thead>
<tbody>
<tr>
<td>/6 SAE</td>
<td>A, B</td>
<td></td>
</tr>
</tbody>
</table>

M14, 23 deep

M10, 12 deep

Type /55 SAE

Ports acc. to ISO 228/1 (BSPP)

<table>
<thead>
<tr>
<th>Coding</th>
<th>Port</th>
<th>W, U, X, a, b</th>
</tr>
</thead>
<tbody>
<tr>
<td>/55 SAE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M12, 23 deep
End plates of the valve bank

Type E 1, E 4

- M 14, 16 deep
- Max. torque 250 Nm
- Ports acc. to ISO 228/1 (BSPP)
  - T, M = G 1/4
  - Port T is plugged at E 4

- M 16, 23 deep
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!

<table>
<thead>
<tr>
<th>Dampening screw acc. to table 2 and 5</th>
<th>Residual pressure at load induced pressure of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coding</td>
<td>250 bar</td>
</tr>
<tr>
<td>S, G, W, B</td>
<td>125</td>
</tr>
<tr>
<td>B 4</td>
<td>60</td>
</tr>
<tr>
<td>B 5</td>
<td>75</td>
</tr>
<tr>
<td>B 6</td>
<td>85</td>
</tr>
<tr>
<td>B 7</td>
<td>100</td>
</tr>
</tbody>
</table>

Viscosity ≤ 60 mm²/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 = \sqrt{A_{\text{controller}} \cdot A_{\text{valve spool}}}

Viscosity ≤ 60 mm²/s

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 an 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

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 ÖlbRoman-Dürrn,
   Co. SCANRECO Industrielektronik 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 \( M6x8 \text{ ISO 4762} \), remove spring cover
2. Remove screw \( M8x40 \text{ DIN 7991} \)
3. Remove spring assembly including spring cap
4. Slacken screws \( M6x60 \text{ ISO 4762} \)
5. Lift lever housing including spool out of spool housing, drawing
6. Remove circlip DIN 6799 3.2 and remove bolt
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 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

<table>
<thead>
<tr>
<th>Inlet section (control section)</th>
<th>Size 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve section</td>
<td>DS 7700-F 71</td>
</tr>
<tr>
<td>Sub-plate</td>
<td>DS 7700-F 72</td>
</tr>
</tbody>
</table>

Tapped plug