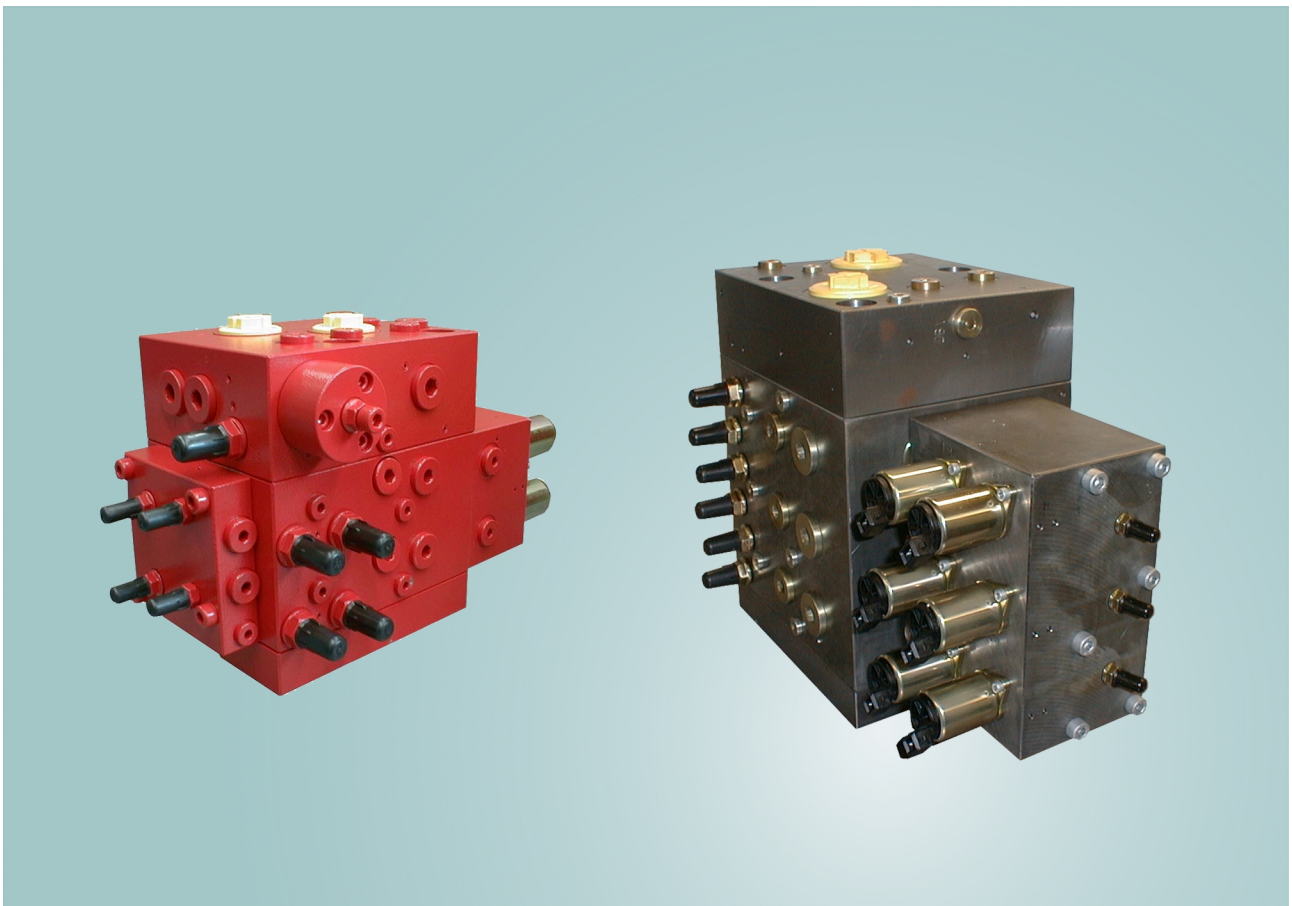


## Safety for Hydraulics

User information for proportional valves in sandwich design, series LV



motion and progress

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## 1. Functional description

Bucher Hydraulics sectional proportional valves control the rate of oil flow to the actuator. Each proportional directional valve section is equipped with its own individual compensator, which ensures that the flow rate is independent of the load (the Load Sensing principle).

The whole valve consists of an inlet module, 2 to 8 actuator sections and an end module. With this flexible building-block system, the user is assured of a valve assembly that is ideally matched to the application. This is achieved by having:

- several variants of the inlet module
- intermediate sections with individual compensator and individually adjustable actuator pressure relief settings
- various types of actuation.

## 2. Safety instructions

- Use the valves for their intended purpose only.
- The valves must only be adjusted by suitably qualified personnel.
- The hydraulic system must be depressurized before work can be performed on the machine.
- The unit may only be opened with the manufacturer's authorisation.
- Ensure that the pump provides an adequate flow for the supply of all actuators during parallel operation of several actuators. If this is not observed, the actuator with the highest load pressure may inadvertently change its direction of motion.
- There is always a risk that a sliding spool can stick - this is often caused

by contamination of the pressure fluid. A risk assessment with regard to the safety of the machine/system must be performed during the design of the hydraulic control system and appropriate safety measures, which may be defined in categories as per EN 954, must be implemented.

## 3. Installation instructions

- Never lift the valve by its solenoids, displacement transducers or similar delicate parts.
- Screw-in pipe fittings: do not exceed the maximum tightening torque for screw-in pipe fittings; see Table 3.1
- Secure the valve at three points only (3-point mounting) to prevent deformation of the body (see mounting holes 'B' in Fig. 3.1 and Table 3.2).
- It is **strictly forbidden** to loosen the tie rods ('Z' in Fig. 3.1) that are holding the individual valve sections together and to misuse the tie rods for the purpose of mounting the complete assembly. Tightening torques - see Table 3.3
- Pipes must be properly bent before installation so that they do not have to be forced into position.
- Installation position and attitude: ensure good opportunities for air bleeding and good access for service.

**3.1 Table:** Tightening torques ( $\mu_{tot} = 0.125$ ) for screw-in pipe fittings. See manufacturer's specifications, but not higher than:  
Specifications for: series S, form E, with soft seal

Thread	Tightening torque (Nm)
G1/8	18
G1/4	55
G3/8	80
G1/2	115
G3/4	180
G1	310
G1 1/4	450
G1 1/2	540

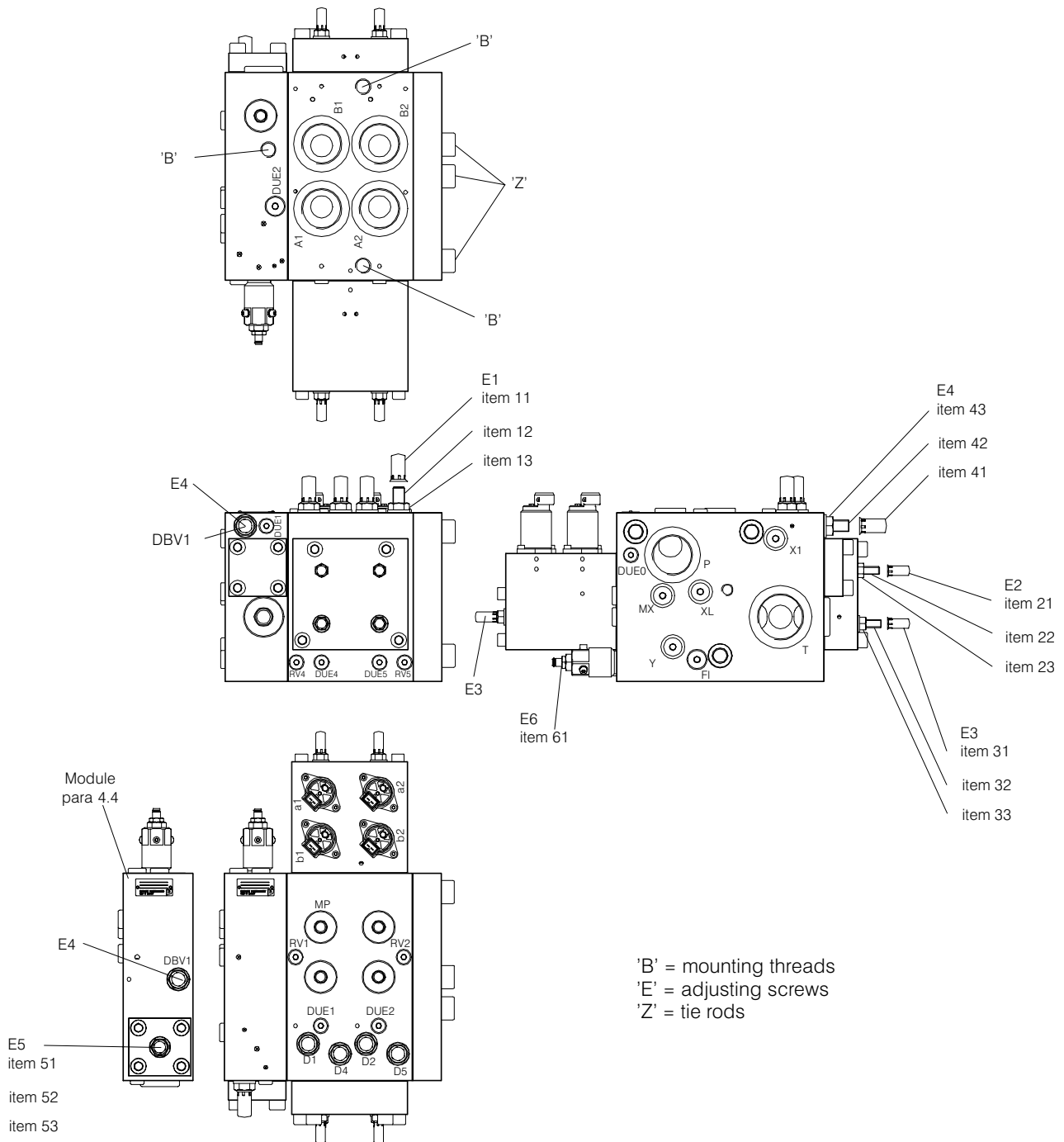
**3.2 Table:** Tightening torques for the mounting bolts, DIN 912-12.9  
Mounting points 'B' (see Fig. 3.1)

LV	Thread	Wrench size	Tightening torque (Nm)
16	M12	12	94
22	M16	14	232

**3.3 Table:** Tightening torques for tie rods, DIN 912-10.9 (see 'Z' in Fig. 3.1)

LV	Thread	Wrench size	Tightening torque (Nm)
16	M12	12	78
22	M16	14	193

**Fig. 3.1:** View of a proportional valve (example here: LV22, 2-section, inlet module L with electro-hydraulic control E20)



## 4. Adjustment instructions

### 4.1 General precautions

Valves are normally factory-set to the pressures and flows specified on the customer's order.

Subsequent adjustments should be made only in exceptional circumstances and by suitably qualified personnel only!



Caution: The adjusting devices do not have any mechanical stops at the ends of their adjustment ranges!

Changes to the pressures or flows must be made in small steps, with extreme care and in accordance with the

adjustment procedures (sect. 4.2...4.5).

Untested adjustments and non-observance of the adjustment instructions can lead to failure of the maximum pressure relief function.

### 4.2 Setting the maximum primary pressure relief and the secondary pressure relief



Note: The pressure relief settings may only be changed when a pressure measuring device is connected to the test points 'MP' (maximum pressure relief) or 'XL' (actuator pressure relief). See Fig. 3.1

4.2.1 Table: Overview of the differing, adjustable pressure relief functions

Function	Marking	Installation position	Permissible adjustment range	Note
inlet module:				
maximum pressure relief (with types L, M, U, V only)	DBV1	inlet module, see Fig. 3.1, item E4	≤ 350 bar	
actuator section:				
actuator pressure relief				
for ports A1, A2, A3	D1, D2, D3	intermediate section, see Fig. 3.1, item E1	≤ 420 bar	
for ports B1, B2, B3	D4, D5, D6	intermediate section, see Fig. 3.1, item E1	≤ 420 bar	When setting pressures: $p_B \leq p_A$

#### 4.2.1 Setting the maximum pressure relief valve DBV1 on the inlet module

- Only possible with inlet modules L, M, U and V.
- Adjust pressure only when a directional valve is actuated but actuator cannot move.
- Installation position: see item E4, Fig. 3.1.
- Connect pressure measuring device at test point 'MP' (see Fig. 3.1).
- Identify the pressure relief valve(s) of the actuator section that is to be operated (e.g. pressure relief valve 'D1' if port A1 is activated or pressure relief valves 'D1' and 'D4' if port B1 is activated) and set their spring preload(s) to maximum as follows:
  - Loosen the lock nut (item 13, Fig. 3.1)
  - Carefully turn the adjusting screw (item 12, Fig. 3.1) clockwise with a hexagon socket wrench until a mechanical end-stop can be felt. **Do not use great force!**
  - Turn the adjusting screw back by half a turn counterclockwise
  - Hold the adjusting screw with the wrench and tighten the lock nut



Caution: After the pressure relief valve 'DBV1' in the inlet module has been set, the spring force in the pressure relief valves of the modular plate must be reduced again - see sect. 4.2.2.

- Start the pump and operate the actuator section.
- Set the pressure relief valve 'DBV1' on the inlet module - see 'Procedure' below.

#### Procedure:

- Remove the protective cap (item 41, Fig. 3.1).
- Insert the hexagon socket wrench (DIN 911 pattern) into the adjusting screw (item 42, Fig. 3.1).
- Hold the adjusting screw in its original position, then loosen the lock nut (item 43, Fig. 3.1).
- While turning the adjusting screw, check the pressure gauge:
  - to increase maximum pressure: turn adjusting screw clockwise

- to reduce maximum pressure: turn adjusting screw counterclockwise
- approx. rate of change:  $\frac{1}{4}$  turn  $\approx$  60 bar
- For standard valves the maximum permissible pressure relief setting is 350 bar.
- When adjustment is finished, hold the adjusting screw (item 42, Fig. 3.1) with the hexagon socket wrench and tighten the lock nut (item 43, Fig. 3.1). See Table 4.2.2 for the correct tightening torque.
- Replace the protective cap.
- Check the pressure setting.

#### 4.2.2 Setting the secondary pressure relief D1...D6 (modular plates)

- Adjust pressure only when directional valve is actuated but actuator cannot move.
- Item E1, Fig. 3.1
- Connect pressure measuring device at test point 'XL'.
- Start the pump and operate the actuator section.
- Adjust the pressure relief valves in the actuator section, for example pressure relief valve 'D1' for port A1 or pressure relief valve 'D4' for port B1. If both ports have to be adjusted, start with 'D1' ('D2', 'D3') first (repeat this procedure for all actuator modules).



Note: The setting of pressure relief valve 'D4' ('D5', 'D6') must be less than or equal to the setting of pressure relief valve 'D1' ('D2', 'D3').

##### Procedure:

- Remove the protective cap (item 11, Fig. 3.1).
- Insert the hexagon socket wrench (DIN 911 pattern) into the adjusting screw (item 12, Fig. 3.1).
- Hold the adjusting screw in its original position, then loosen the lock nut (item 13, Fig. 3.1).

- While turning the adjusting screw, check the pressure gauge:
  - to increase secondary pressure: turn adjusting screw clockwise
  - to reduce secondary pressure: turn adjusting screw counterclockwise
  - approx. rate of change:  $\frac{1}{4}$  turn  $\approx$  60 bar
- For standard valves the maximum permissible pressure relief setting is 420 bar.
- When adjustment is finished, hold the adjusting screw (item 12, Fig. 3.1) with the hexagon socket wrench and tighten the lock nut (item 13, Fig. 3.1). See Table 4.2.2 for the correct tightening torque.
- Replace the protective cap.
- Check the pressure setting.

4.2.2 Table: Tightening torques and wrench sizes for adjusting pressure relief valves (Sect. 4.2)

Thread	Wrench size items 12, 42	Wrench size items 13, 43	Tightening torque (Nm) items 13, 43
M12	6	19	65

### 4.3 Setting the maximum flow

- Tip for the adjustment of LS pumps: after adjusting the pressure compensator in the actuator section it can be useful to readjust the pump controller as well.
- The maximum flows for each actuator section have to be adjusted separately.
- If the flows for both actuator ports of one section are to be altered in the same manner (e.g. both to be increased), please continue from section 4.3.1.
- If the flow is to be altered for only one direction of actuator movement, please continue from section 4.3.2.

#### 4.3.1 Setting the maximum flow by adjusting the pressure compensator in the actuator sections (item E2, Fig. 3.1)

##### Procedure:

- **Depressurize the system!** (stop the pump).
- Remove the protective cap (item 21, Fig. 3.1).
- Loosen the lock nut (item 23, Fig. 3.1)
- Insert the hexagon socket wrench (DIN 911 pattern) into the adjusting screw (item 22, Fig. 3.1).
- Turn the adjusting screw counterclockwise until a hard end-stop is felt.
- Turn the adjusting screw counterclockwise by the number of turns given in Table 4.3.1 (with this adjustment, the maximum possible speed will be reached).



Caution: Turning the screw back by less than the value given in the table can lead to failure of the primary pressure relief function and to the loss of the secondary pressure relief and flow control functions.

- To check the speed, start the pump and operate the actuator section.
- If speed is too high, turn the adjusting screw (item 22, Fig. 3.1) counterclockwise (reducing the spring force) until the required actuator speed (flow rate) is reached.

- Hold the adjusting screw (item 22, Fig. 3.1) with the hexagon socket wrench and tighten the lock nut (item 23, Fig. 3.1). See Table 4.3.2 for the correct tightening torque.
- Replace the protective cap (item 21, Fig. 3.1).
- Check speed in both directions.



Note: If this procedure does not produce any change, please contact the valve manufacturer.

4.3.1 Table: Setting the pressure compensator in the actuator sections

Minimum numbers of turns back from the end-stop(= maximum spring force)	
LV16	LV22
5	6

4.3.2 Table: Tightening torques and wrench sizes for adjusting the pressure compensators and the stroke of the directional valve spools (Sect. 4.3.2)

Thread	Wrench size items 22, 32	Wrench size items 23, 33	Tightening torque (Nm) items 23, 33
M8	4	13	20

#### 4.3.2 Reducing the maximum flow via the main spool stroke



Caution: Untested adjustment of the adjusting screw by several clockwise turns can lead to malfunction of the fail-safe position; i.e. the spool of the directional valve may not be able to return to its neutral position!

Adjustment is done by means of the adjusting screw in the main spool cover; see item E3, Fig.3.1.

##### Procedure:

- Check that there is sufficient pump flow.

- Ensure that the directional valve spool is reaching its maximum stroke:
  - hydraulic actuation: control pressure difference  $\geq 19$  bar (control pressure - tank pressure)
  - electrical actuation: control current (24V)  $\geq 700$  mA
- Do not actuate the valve.
- Remove the protective cap (item 31) from the side to be adjusted (actuator A/B).
- Loosen the lock nut (item 33) (wrench size - see Table 4.3.2).
- Turn the adjusting screw (item 32) clockwise.



Note: At maximum stroke, the control edges of the main spool are customised for individual applications. Limitation of the stroke will cause a degradation of the valve's previously good resolution.

- Tighten the lock nut (item 33). See Table 4.3.1 for the correct tightening torque.
- Actuate valve and check the change in actuator speed.
- If actuator speed is OK, replace the protective cap.



Note: If this procedure does not produce any change, the setting of the pressure compensator (Sect. 4.3.1) can be altered.

## 4.4 Adjusting inlet modules U and V

Tip for the adjustment of inlet modules, types U and V:

After adjusting the pressure compensator in the actuator section (Sect. 4.3.1) it can be useful to readjust the pressure compensator in the U- or V-module as well (adjusting screw - see item E5 in Fig. 3.1). When adjusting the U or V module, use a setting that is as close as possible to - but not less than - the value given in Table 4.4.1.



Caution: Turning the screw back by less than the given value can lead to failure of the primary pressure relief function and to the loss of the unloaded re-circulation function.

##### Procedure:

- **Depressurize the system!** (stop the pump).
- Remove the protective cap (item 51, Fig. 3.1).
- Loosen the lock nut (item 53, Fig. 3.1)
- Insert the hexagon socket wrench (DIN 911 pattern) into the adjusting screw (item 52, Fig. 3.1).
- Turn the adjusting screw clockwise until a hard end-stop is felt.

- Turn the adjusting screw counter-clockwise by the number of turns given in Table 4.4.1 (= maximum spring force on the pressure compensator).
- When adjustment is finished, hold the adjusting screw (item 52, Fig. 3.1) with the hexagon socket wrench and tighten lock nut (item 53, Fig. 3.1). See Table 4.4.2 for the correct tightening torque.
- Replace the protective cap.
- To check the function, start the pump and operate the actuator.

4.4.1 Table: Setting the pressure compensator in inlet modules U, V (Sect.4.4)

Minimum numbers of turns back from the end-stop(= maximum spring force)

LV16	LV22
Contact the manufacturer	3.5

4.4.2 Table: Tightening torques and wrench sizes for adjusting the pressure compensator (Sect. 4.4)

LV	Thread	Wrench size item 52	Wrench size item 53	Tightening torque (Nm) item 53
16	M8	4	13	20
22	M10	5	17	40

#### 4.5 Adjusting the pressure reducing function for the pilot valve suppl

- Only possible with inlet modules types A, F, L and U.
  - Pressure reducing cartridge - see Fig. 3.1, item E6. Marked as 'DM' on the valve block.
  - Standard setting: 30 bar; permissible adjustment range: 25...35 bar.
- Procedure:**
- Connect pressure measuring device at test point 'MX'.
  - Operate the actuator.
  - Check the pressure gauge and, if necessary, adjust the pressure.
  - Tighten lock nut (item 61 in Fig. 3.1) to 6 Nm

### 5. Notes on storage

The maximum permissible storage period in enclosed, dry areas is six months. Longer storage periods (up to 3 years) may be achieved by taking appropriate preservation measures.

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