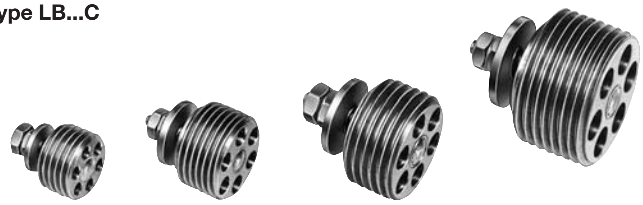
Line rupture protection valves type LB

Pressure p_{max} = 500 bar
Flow rate $Q_{A\ max}$ = 4 ... 160 lpm

Screw-in versions

Type LB...C



In-line versions

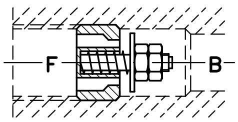
Type LB...G

Type LB...F

1. General

Line rupture protection valves prevent an uncontrollable, accelerated movement of a loaded hydraulic actuator (drop) when the hydraulic back-pressure is lost as a result of rupture in the pressurized line or pipe connection. The line rupture protection valve must be screwed directly into or onto the pressurized oil inlet port of the hydraulic actuator to be safeguareded.
The type LB is a plate valve whose valve disc is raised off the valve seat by spring action in the neutral state, thereby maintaining an open flow-through cross section of variable width. The flow-through resistance and the back-pressure action at the valve disc in the flow-through direction B → F (operation or actuating direction) generate a force which during normal operation does not exceed the spring counterforce: the valve remains open. If the flow-through increases after rupture due to the driving load, the flow forces will exceed the spring force and the valve will close immediately.
Line rupture protection valves are available in two models which, in case of rupture, i.e. when the valve plate is closed, differ as follows:

Schematic cross-sectional view



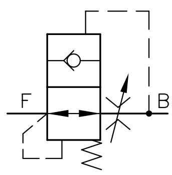
1.1 Valve for complete load holding

The valve plate fits very closely onto the ring-shaped seat. Any leakage that may occur through the screw thread has no appreciable effect. In order to keep this to a minimum, see note in section 5. The load stays in the stroke position reached at the moment of breakdown. The disruption can be eliminated immediately, or after supporting (underpining) the load, according to the safety risk. The valve is then reopened by feeding pressure oil into the actuator.

Symbols

simplified

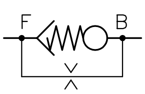
detailed



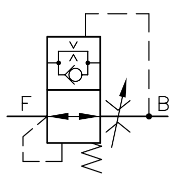
1.2 Valve for gradual load lowering

The valve plate contains an orifice hole with a fixed diameter (see table 3 in sect. 2). An oil flow, previously estimated in accordance with the Δp-Q-characteristics, can move through this orifice hole form B to F irrespective of the magnitude of the load, thereby gradually lowering the load to the ground. The disruption can be eliminated thereafter.

simplified



detailed



2.5

2. Available versions, main data

Order examples:

LB 2 C - 40
LB 3 F 0.8 - 63
LB 3 C 1.0 7/8-14 UNF - 50

Table 3: Optional orifice

Suited for	Coding for orifice diameter (≙ ∅) only available for valves acc. to section 1.2					
	0,5	**0,8**	**1,0**	**1,2**	**1,5**	**2**
LB 1	•	•	•	•		
LB 2	•	•	•	•	•	
LB 3	•	•	•	•	•	•
LB 4		•	•	•	•	•

Table 2: Design version

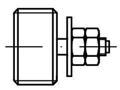
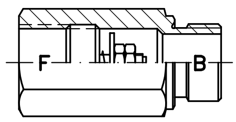
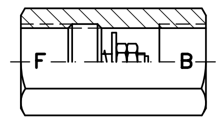
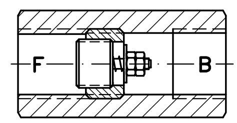
Design version		Coding and illustration			
Screw-in version		**C**			
In-line version	Standard	**F**		**G**	
	With tapped reducer	Screw-in valve size 1 to 3 installed via a tapped reducer (table 1) in the next higher dimension housing (G or F) size 2 to 4. Application example: Adaptation to the port size of other hydraulic devices being utilized e.g. **LB 3/2 G-..**			

Table 1: Basic type, size and response flow

Version	Port size [1)] DIN ISO 228/1 (BSPP)	Basic type and size	Suffix for UNF thread [2)]	Response flow coding Q_A (lpm) [3)]											
				-4	**-6.3**	**-10**	**-16**	**-25**	**-40**	**-50**	**-63**	**-80**	**-100**	**-125**	**-160**
Serie	G 1/4 (A)	**LB 1..**		•	•	•	•	•							
	G 3/8 (A)	**LB 2..**			•	•	•	•	•	•					
	G 1/2 (A)	**LB 3..**					•	•	•	•	•	•			
	G 3/4 (A)	**LB 4..**						•	•	•	•	•	•	•	•
Version with UNF thread conf. SAE J 514	3/4-16 UNF	**LB 2..**	**3/4-16 UNF**		•	•	•	•	•	•					
	7/8-14 UNF	**LB 3..**	**7/8-14 UNF**				•	•	•	•	•	•			
	1 1/16-12 UN	**LB 4..**	**1 1/16-12 UN**					•	•	•	•	•	•	•	•
With metric fine thread DIN 13T6 (only available for design version C !)	M 14x1.5	**LB 14..**		•	•	•	•	•							
	M 16x1.5	**LB 26..**			•	•	•	•	•	•					
	M 18x1.5	**LB 28..**			•	•	•	•	•	•					
	M 20x1.5	**LB 30..**					•	•	•	•	•	•			
	M 22x1.5	**LB 32..**					•	•	•	•	•	•			
	M 27x2	**LB 47..**						•	•	•	•	•	•	•	•
With tapped reducer	G 3/8 (A)	**LB 2/1..**		•	•	•	•	•							
	G 1/2 (A)	**LB 3/2..**			•	•	•	•	•	•					
	G 3/4 (A)	**LB 4/3..**					•	•	•	•	•	•			

1) G...A for tapped journal, G... for tapped port (see also note in section 5!)

2) All sizes of version C, available only size 3 of version F also

3) Other response flows (intermediate values) should be set by the customer acc. to section 4. The same applies to corrections if required (adaptation to local conditions). Q_{max} will be set by HAWE, when a response flow specification is missing.

3. Additional parameter

3.1 General and hydraulic

Installation position and direction: Any; B connected to the one consumer side, that should be safeguarded against rupture.

Pressure p_{max}: 500 bar

Mass (weight) approx. g:

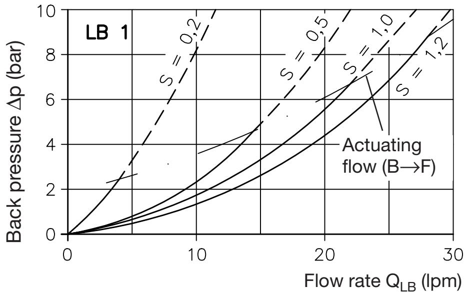
Basic type coding	LB 1	LB 2	LB 3	LB 4
Screw-in version	6	12	21	45
In-line version G, F	70	100	170	390

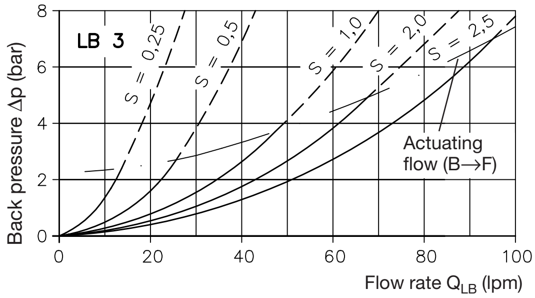
Pressure fluid: Hydraulic oil conforming DIN 51524 part 1 to 3: ISO VG 10 to 68 conforming DIN 51519.
Viscosity limits: min. approx. 4, max. approx. 1500 mm^2/s;
opt. operation approx. 10 ... 500 mm^2/s.
Also suitable for biological degradable pressure fluids types HEPG (Polyalkylenglycol) and HEES (Synth. Ester) at service temperatures up to approx. +70 °C.

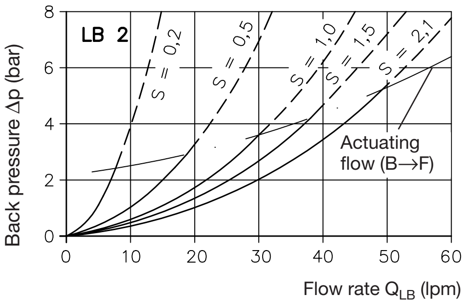
Temperature: Ambient: approx. -40 ... +80 °C
Fluid: -25 ... +80°C, Note the viscosity range !
Permissible temperature during start: -40°C (Note start-viscosity!), as long as the service temperature is at least 20K higher for the following operation.
Biological degradable pressure fluids: Note manufacturer's specifications. By consideration of the compatibility with seal material not over +70 °C.

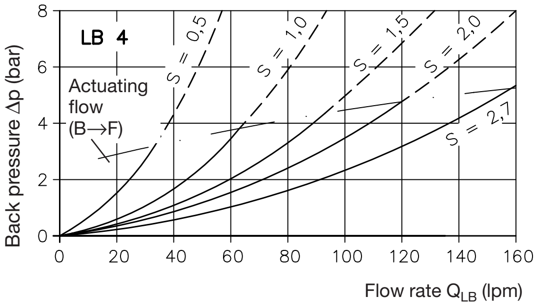
Δp-Q-curves
Oil viscosity during tests approx. 60 mm^2/s: Δp-Q-characteristics for both directions of flow (B → F or F → B) dependent on the set length S. In the direction B → F, the valve closes at the point of intersection of the Δp-Q-charcteristics for a given S and the dot-dash line. Intermediate values must be interpolated. The curves apply to valves according to sect. 1.1 ($Q_A = Q_{LB}$). In case of valves with an orifice (sect. 1.2), the actual actuating flow is increased by the proportion flowing through the orifice hole (see the example below), although the influence is minimal ($Q_A = Q_{LB} + Q_{BI}$).

Applying to all LB versions



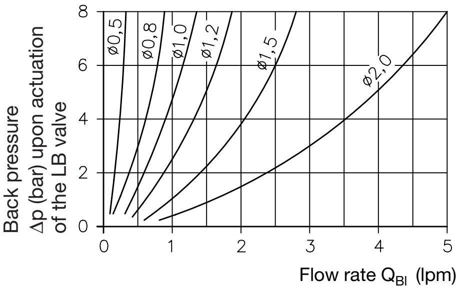




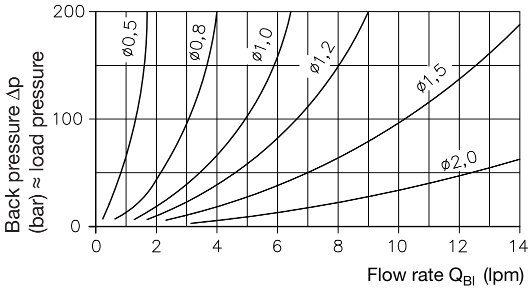


Additional for valves with optional orifice (B → F)

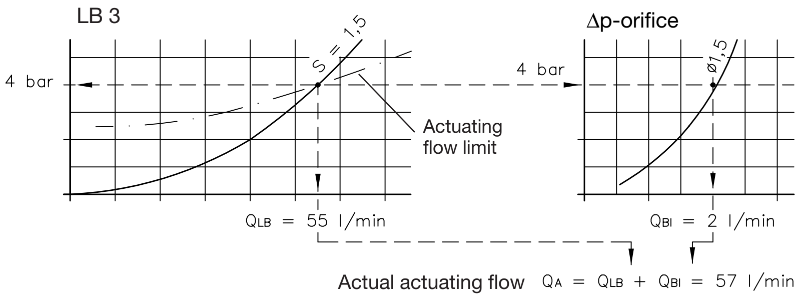
Orifice characteristics (approximate values) for determining the actual actuating flow



Orifice characteristics for determining the load lowering speed upon actuating



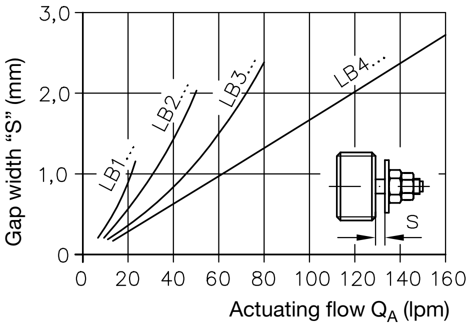
Example: LB 3C 1.5;
set at S = 1.5 mm ≙
Q_{LB} = 55 lpm
(see also sect. 4)



The influence of the orifice is normally minimal

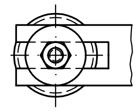
3.2 Valve setting

With viscosities above approx. 500 mm²/s, the operating point will gradually change towards lower flow rate values; when the actuating flow is small (small width of gap S), the difference may be greater than with larger ones. When necessary, the setting can be corrected, if the viscosities are not in any case kept < approx. 500 mm²/s through the choice of appropriate oils (oil should be changed when operating outdoors in winter) or by other means (such as pre-heating).



Oil viscosity during measurem. 60 mm²/s

Loosen the nuts, select two identical feeler gauges or a caliper gauge, thighten the nuts by hand until they are snug, remove the gauges and carefully tighten the locknut.



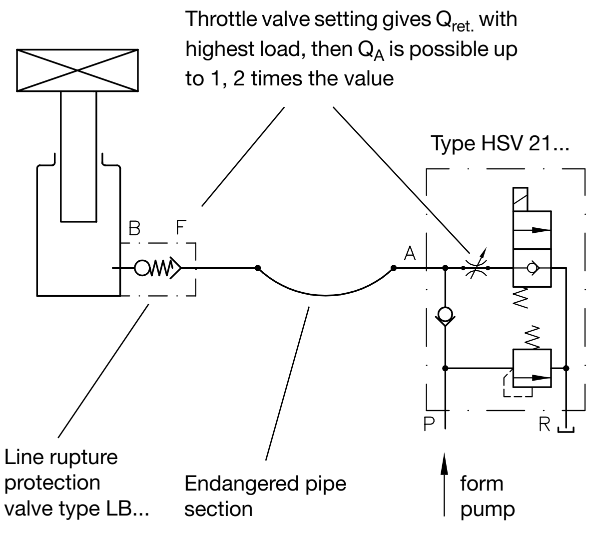
4. Recommended values for actuating flow from section 3.2

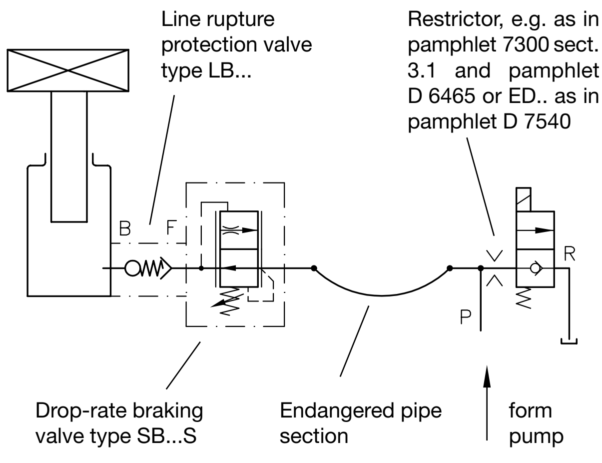
The determining factor in setting the value Q_A for the actuating flow is the return flow $Q_{ret.}$ from the consumer during undisturbed operation in direction B → F. In practice, a ratio $Q_A : Q_{ret.} \geqq 1.5$ for hand-operated directional control valves, or ≈ 2 for solenoid-operated or other, quick-action directional valves, is found to be a useful recommended value.
With large-volume hydraulic cylinders and/or high load burdens it may occasionally be found that with actuating flow ratios selected on the basis of these recommended values there is an undesired closing of the line rupture protection valve during test running of the normal functions of the equipment. This is caused by the decompression surge from the consumer when the directional control valve is actuated. If it is not possible to adjust the switching time of the directional control valve, the decompression surge should be suppressed by means of a restrictor on the discharge side. The restrictor should be selected on the basis of its Δp-Q-characteristic curve such that with the largest load burden to be expected for the equipment the flow rate is **smaller** than the actuating flow for the line rupture protection valve, but the **same** as (example on the left in section 4.1) or **greater** than (example on the right in section 4.1) the return flow $Q_{ret.}$. It should be noted that this restrictor is not to be fitted in the pipe section monitored by the line rupture protection valve, but in an unendangered section (e.g. in the return pipe). Where there are very big load differences (e.g. between maximum possible load and empty weight), there may be a reduction in the lifting/lowering speed with lesser loads, depending on the Δp-Q-characteristic curve of the restrictor.

4.1 Examples of use

Line rupture protection valve in the lifting device with lift/lower valve as described in pamphlet 7032

Line rupture protection valve in lifting device with solenoid-operated directional control valve (e.g. as in pamphlet 7300) for lowering, and drop-rate braking valve (as in pamphlet 6920). This combination is possible because of the actuating delay of the flow valve; during this time the line rupture protection valve is effective should any fault occur.



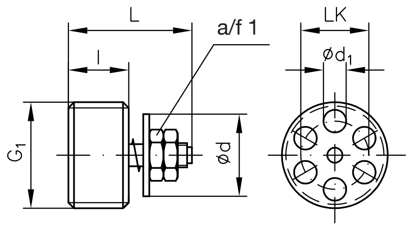


The drop-rate brake determines the return $Q_{ret.}$ (= Q_{SB})

5. Dimensions of units

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

Screw-in version type LB..C

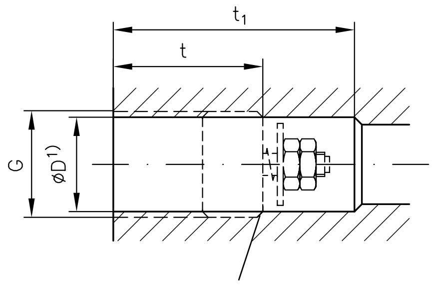


Appropriate assembly tools must be self-manufactured in accordance with the master gauge for holes

Torque:

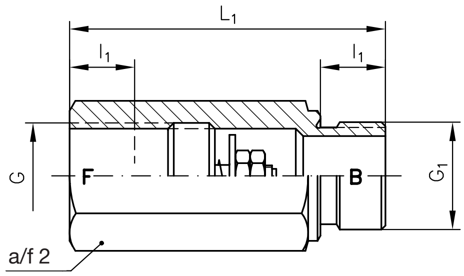
Type	LB 1	LB 2	LB 3	LB 4
Nm (approx.)	8	12	18	23

Tapped mounting hole 1)

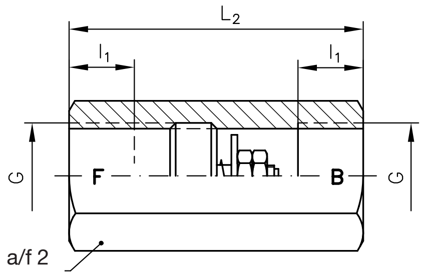


End of thread to have start shape E
(1 1/2 - 2-turn start, start taper ≈ 23°, see also FETTE -Grinding book, for example)

In-line version
Type LB..F



Type LB..G



Type	Connect. thread DIN ISO 228/1 (BSPP)		LB.. C									LB.. F			LB.. G		
	G	G1	L	l	d	(a/f)1	LK	d1	t	t1	D 1)	L1	l1	(a/f)2	L2	l1	(a/f)2
LB 1..	G 1/4	G 1/4 A	17.5	8.1	9.5	5.5	8.5	2.4	22	33	$11.5^{+0.1}$	50	12	19	48	12	19
LB 14 C	M 14 x 1.5		17.5	8.1	9.5	5.5	8.5	2.4	22	33	$12.5^{+0.1}$	--	--	--	--	--	--
LB 2..	G 3/8	G 3/8 A	21	10.6	12.5	5.5	11	3.5	26	37	$15.0^{+0.1}$	58	12	22	52	12	22
LB 26 C	M 16 x 1.5										$14.4^{+0.1}$						
LB 28 C	M 18 x 1.5		21	10.6	12.5	5.5	11	3.5	26	37	$16.4^{+0.1}$	--	--	--	--	--	--
LB 2..	3/4-16 UNF 2)										$17.5^{+0.1}$						
LB 3..	G 1/2	G 1/2 A	25	12.1	15	7	13	4.5	30	45	$18.7^{+0.1}$	65	14	27	60	14	27
LB 30 C	M 20 x 1.5										$18.4^{+0.1}$						
LB 32 C	M 22 x 1.5		25	12.1	15	7	13	4.5	30	45	$20.4^{+0.1}$	--	--	--	--	--	--
LB 3..	7/8-14 UNF 2)										$20.4^{+0.1}$	102	19.3	30			
LB 4..	G 3/4	G 3/4 A	30.5	17.1	17.5	7	16	6	38	54	$24.2^{+0.1}$	78	16	36	72	16	36
LB 47 C	M 27 x 2		30.5	17.1	17.5	7	16	6	38	54	$24.9^{+0.1}$	--	--	--	--	--	--
LB 4..	1 1/16-12 UNF 2)										$25.0^{+0.1}$						

1) A core drill ∅ (acc. to diameter D in the table below) should be selected to minimize the thread leakage

2) Version with UNF thread conforming SAE J 514, only available as design version C (all sizes) and F (size 3)!