BIOFIAL S.A.
hydraulic cylinders - elevator systems

Maintenance and service manual for elevator control valve

EV 100 blain

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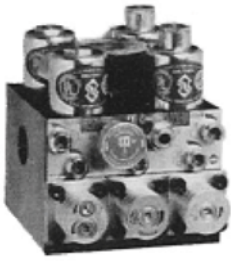
Elevator control valve EV 100 Blain

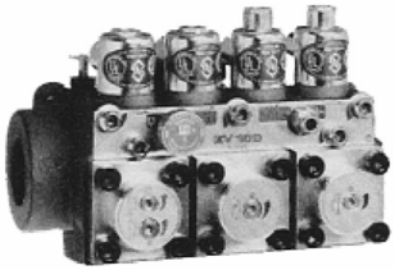
The Blain EV 100 program includes the widest range of options offered to the elevator industry for high performance passenger service. Easy to install, EV 100's are smooth, reliable and precise in operation throughout extreme load and temperature variations.

Description: Available port sizes are 3/4", 1 ½", 2" and 2 ½" pipe threads, depending on flow. EV 100's start on less than minimum load and can be used for across the line or wye-delta starting. According to customers' information, valves are factory adjusted ready for operation and very simple to readjust if so desired. The patented up leveling system combined with compensated pilot control ensure stability of elevator operation and accuracy of stopping independent of wide temperature variations.

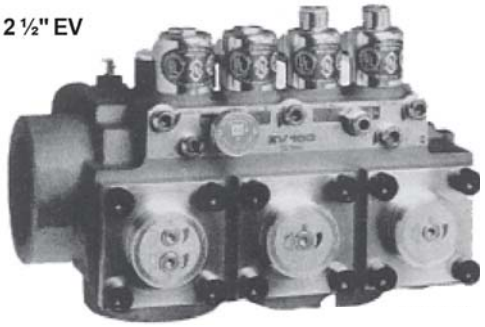
¾" EV



1 ½" EV



2 ½" EV

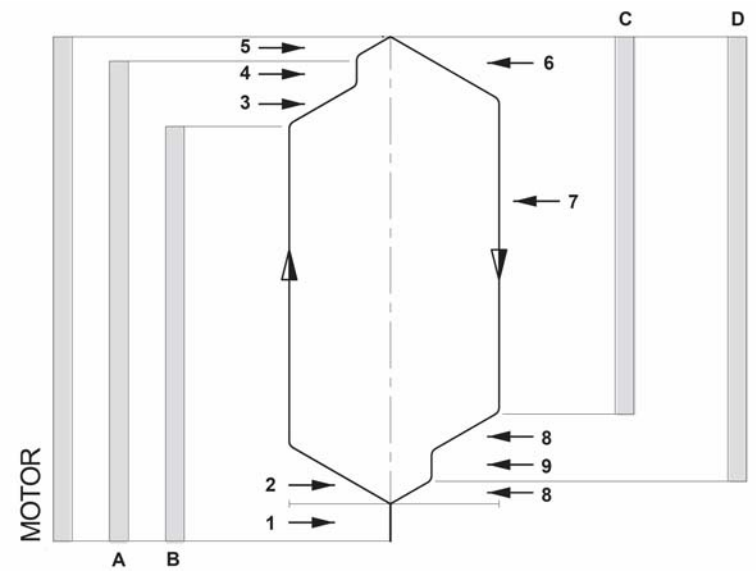


Technical Data	¾" EV	1 ½" & 2" EV	2 ½" EV
Flow Range: l/min	10-125 (2-33 USgpm)	30-800 (8-208 USgpm)	500-1530 (130-400 USgpm)
Pressure Range:	5-100 bar (74-1500 psi)	3-100 bar (44-1500 psi)	3-68 bar (44-1000 psi)
Press. Range UL/CSA:	5-100 bar (74-1500 psi)	3-70 bar (44-1030 psi)	3-47 bar (44-690 psi)
Burst Pressure Z:	575 bar (8450 psi)	505 bar (7420 psi)	265 bar (3890 psi)
Pressure Drop P–Z:	6 (88 psi) at 125 lpm	4 (58 psi) at 800 lpm	4 (58 psi) at 1530 lpm
Weight:	kg 5 (11 lbs)	10 (22 lbs)	14 (31 lbs)
Oil Viscosity:	25-60 mm²/sec. at 40°C (15-35 cSt. at 120°F).		
Max. Oil Temperature:	70°C (158°F)		
Solenoids AC:	24 V/1.8 A, 42 V/1.0 A, 110 V/0.43 A, 230 V/0.18 A, 50/60 Hz.		
Solenoids DC:	12 V/2.0 A, 24 V/1.1 A, 42 V/0.5 A, 48 V/0.6 A, 80 V/0.3 A, 110 V/0.25 A, 196 V/0.14 A.		
Insulation Class, AC and DC:	IP 68		

EV 100 valves include the following features essential to efficient installation and trouble-free service:

- Simple Responsive Adjustment
- Self Cleaning Pilot Line Filters
- Temperature and Pressure Compensation
- Self-Cleaning Main Line Filter (Z-T)
- Solenoid Connecting Cables
- Built-in Turbulence Suppressors
- Pressure Gauge and Shut Off Cock
- 70 HRc Rockwell Hardened Bore Surfaces
- Self-Closing Manual Lowering
- 100% Continuous Duty Solenoids

EV 100 has one full speed and one leveling speed per direction, the maximum suggested speed is 1 m/sec. All up and down functions are smooth and adjustable. In the following diagram it is shown the speed variation, the electrical sequence and the available adjustments.



Adjustment and Service of valve EV 100 BLAIN

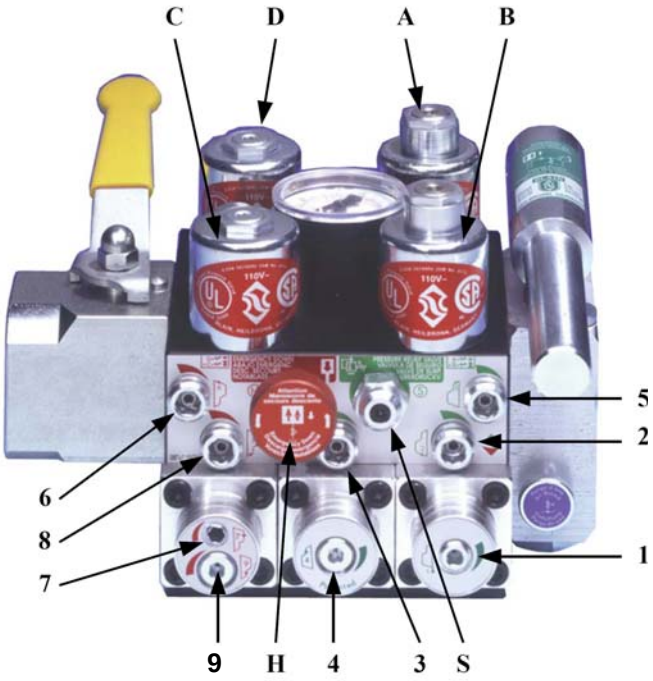
Adjustments

Flow control valve **EV 100** provides many adjustments in order to accomplish the accurate control of the elevators movement. It has 9 adjustments, which controls the speeds and the accelerations during the up and the down travel. On the right diagram are shown the phases of the movement with the corresponding adjustments. On the photos bellow we can see the position of the adjustments on the valve body.

More specific the adjustments are:

Adjustment 1 – by pass: It defines the time that the pump works while the cabin stands still so the first and the motor accelerate without load. Screwing this time is reduced.

Adjustment 2 – upward acceleration: It defines the acceleration time to the nominal speed. Screwing the acceleration becomes smoother (acceleration time increase's).

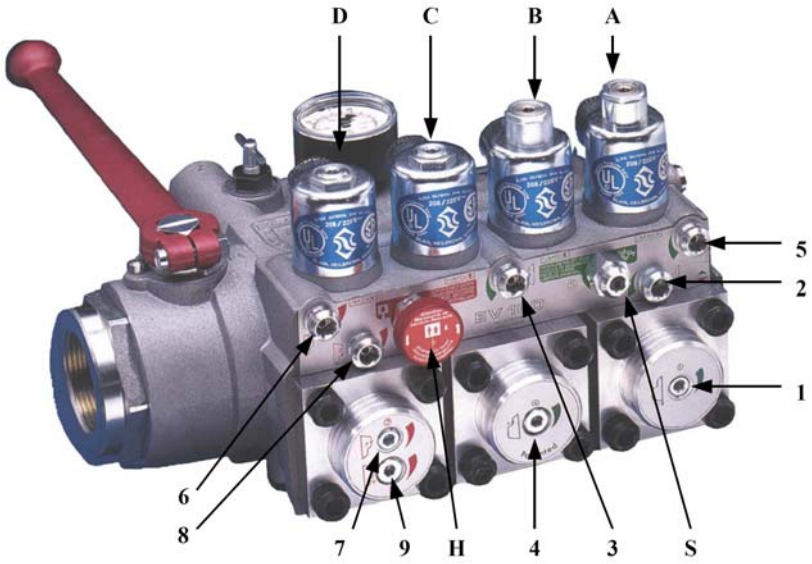


Adjustment 3 – upward deceleration: It defines the deceleration time from nominal to the leveling speed. Screwing the deceleration becomes smoother (deceleration time increase's)

Adjustment 4 – upward leveling speed: It defines the upward leveling speed (low up speed). Screwing leveling speed becomes lower.

Adjustment 5 – up stop: It defines the time that cabin stops from the leveling speed. Screwing the stop becomes smoother (time increases).

Adjustment 6 – downward acceleration: It defines the acceleration time to the downward speed. Screwing the acceleration becomes smoother (acceleration time increase's).



Adjustment 7 – downward speed: It defines the cabin's downward speed. Screwing the speed is reduced.

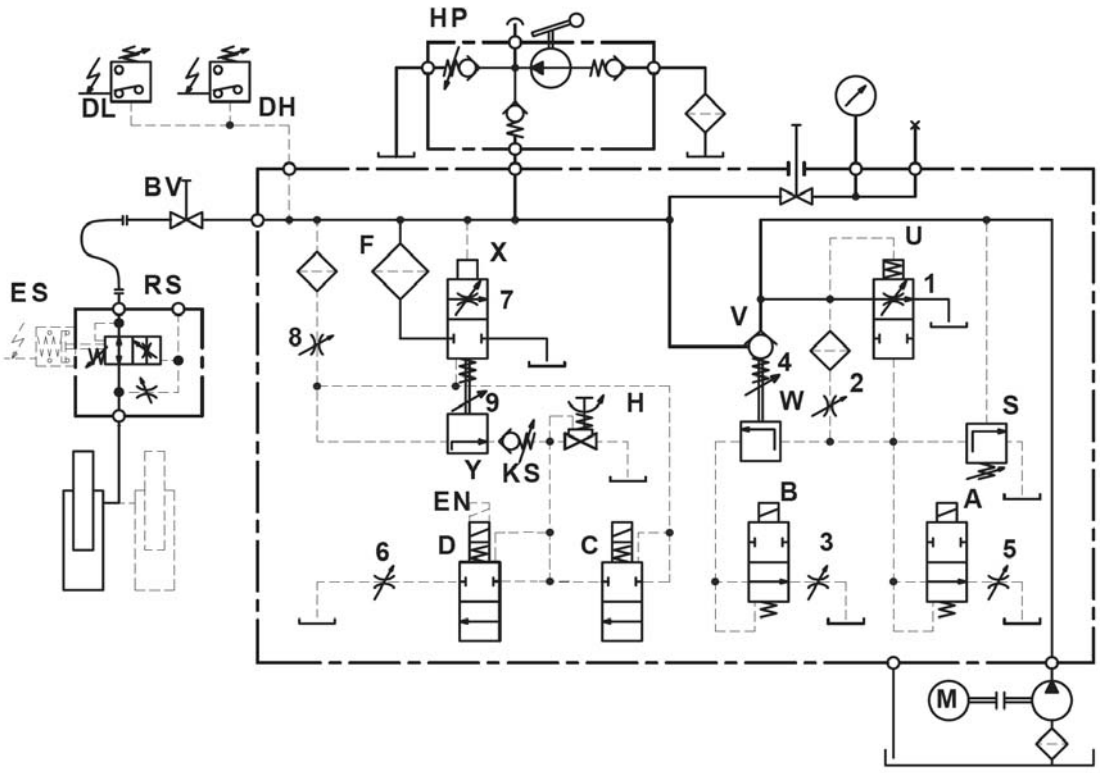
Adjustment 8 – downward deceleration: It defines cabin's deceleration time from the downward speed to the leveling speed

and the final stopping. Screwing the deceleration becomes smoother.

Adjustment 9 – downward leveling speed: It defines the downward leveling speed. Screwing the speed is reduced.

Adjustment S – relief pressure: It defines the maximum working pressure in the valve. Screwing the relief pressure increases.

In the following diagram it is shown the hydraulic circuit of EV 100:



During adjustment of the EV 100 valve, instead of making a full floor to floor travel to check operation, much time can be saved by removing the securing nuts of the coil and switching to deceleration or to acceleration by lifting or replacing the appropriate coil by hand, allowing several adjustment corrections during one car travel between floors.

Caution: Once removed from the solenoid tube, the energized coil will begin to overheat after about 20 secs. If necessary, to slow the rate of heating, place an 8 or 10 mm socket key or similar steel rod as core thru the coil. Do not lay an energized coil to one side otherwise it may overheat unnoticed. If the coil becomes too hot to hold, it must be replaced, back over the solenoid tube and any further adjustment carried out with the elevator making normal floor to floor runs.

Car not visible from Machine-room

If the car cannot be seen during adjustment of the valve, the acceleration and deceleration times can be heard from the change of the turbulent noise within the valve as the speed of the car changes. With no load in the car, the duration of the speed changes should be about 2,5 seconds. This applies to adjustments 2, 3, 6 and 8.

Up Travel (empty car)

Pre-settings

Adjustment No. **1**, level with flange face.	5 mm Socket key
Adjustment No. **2**, all the way 'in' then 2 turns 'out'.	3 mm Socket key
Adjustment No. **3**, all the way 'in' then 4 turns 'out'.	3 mm Socket key
Adjustment No. **4**, level with flange face.	5 mm Socket key
Adjustment No. **5**, all the way 'in' then 4 turns 'out'.	3 mm Socket key
Adjustment No. **S**, all the way 'in' then 2 turns 'out'.	3 mm Socket key

1. Pilot Pressure Setting: Disconnect coil **A.** Energize Motor (pump). If the car does not move, turn No. **1** 'in' until the car begins to move, turn No. **1** 'out' until the car stops, then back out again ½ turn. The car remains standing still. DO NOT UP-LEVEL WITH THIS ADJUSTMENT! Between full and empty car, leveling speed differences would be extreme.

2. Up Acceleration: Reconnect coil **A.** Start Motor and energize coil **A** and B (normal 'up' call). Observe the up acceleration. If it is too quick, turn No. **2** 'in' ¼ turn. If it is too long, turn No. **2** 'out' ¼ turn. Repeat until acceleration is satisfactory. Acceleration time should be about 2,5 secs.

4. Up Leveling: Disconnect coil **B.** Energize Motor and coil **A** (normal 'up-level' call). With adjustment No. **4** level with the face of the flange the car will up level. If the leveling speed is too fast, turn No. **4** 'in' until the speed is as required. If the speed is too slow, turn No. **4** 'out'. Recommended speed: 6 cm/sec.

3. Up Deceleration: With coil B still disconnected. Energize motor and coil **A** (normal 'up-level' call). The car will travel upwards at leveling speed. Turn No. 3 'in' until the car starts to up level faster, then turn No. 3 'out' until the original leveling speed is observed. Reconnect coil B and place a normal up call. Observe the deceleration of the car. If it is too long, turn No. 3 'out' ¼ turn; if it is too short, turn No. 3 'in' ¼ turn. Repeat until deceleration is satisfactory. Deceleration time should be about 2,5 sec.

5. Up Soft Stop: Disconnect coil **A.** Energize Motor. The car should not move. Turn No. **5** 'in' until the car starts upwards then turn No. **5** 'out' until the car stops. Reconnect coil **A.** Energize Pump-Motor and **A.** The car will travel upwards at leveling speed. Lift **A** coil by hand briefly and observe the stopping of the car. If the stop is too hard, turn No. **5** 'in' ¼ turn. If the stop is too soft, turn No. **5** 'out', % turn. Repeat until the stop is satisfactory.

S Pressure Relief Valve: Turn **S** screw 'out' until about 2 mm of the screw head is showing. Close the ball valve in the cylinder line and open the manual lowering H to lower valve pressure down to zero. Place an up call, energizing motor and coils **A** and B. The relief pressure will show on the pressure gauge. To increase the relief valve setting, turn **S** 'in'. To decrease the relief valve setting, turn **S** 'out', then open the manual lowering for ½ second with the pump still running to release locked-in pressure, before observing the pressure gauge reading.

Down Travel (empty car)

Pre-settings

Adjustment No. **6,** all the way 'in' then 4 turns 'out'.	3 mm Socket key
Adjustment No. **7,** 3 mm under the flange face.	5 mm Socket key
Adjustment No. **8,** all the way 'in' then 2 turns 'out'.	3 mm Socket key
Adjustment No. **9,** level with flange face.	5 mm Socket key

8. Down Deceleration: Place down call (coils **C** and **D** energized). As the car approaches full speed, remove coil **D** by hand briefly from the solenoid and observe the deceleration of the car. If the deceleration is too long, turn No. **8** 'out' ¼ turn; if it is too short, turn No. **8** 'in' ¼ turn. Repeat until deceleration is satisfactory. Deceleration time should be about 2,5 sec.

6. Down Acceleration: Turn No. **6** all the way 'in'. Place down call (coils **C** and **D** energized). The car will not move. Turn No. **6** 'out' slowly until the car accelerates downwards. If the acceleration is too long, turn No. **6** 'out' ¼ turn. If it is too short, turn No. **6** 'in' ¼ turn. Acceleration time should be about 2,5 sec.

7. Down Full Speed: Place down call (coils **C** and **D** energized). Observe full down speed. Turn No. **7** 'in' for slower, 'out' for faster speed.

9. Down Leveling Speed: Disconnect coil **C.** Place down call **(D** energized). Observe down leveling speed. Turn No. **9** 'in' for slower, 'out' for a fast down leveling speed. Recommended speed: 6 cm/sec.

H Emergency Lowering: The manually operated emergency down speed and the **D** coil operated down leveling speed are the same.

Down Stop: When solenoid **D** is de-energized with solenoid **C** remaining de-energized, the car will stop according to the setting of adjustment 8 and no further adjustment will be required.

KS Slack Rope Valve: The KS is adjusted with a 3 mm Socket Key by turning the screw **K** 'in' for higher pressure and 'out' for lower pressure. With **K** turned all the way 'in', then half a turn back out, the unloaded car should descend when the **D** solenoid alone is energized. Should the car not descend, **K** must be backed off until the car just begins to descend, then backed off a further half turn to ensure that with cold oil, the car can be lowered as required.

Troubleshooting: Up Travel

***** For checking the operation of the solenoids, remove the top nuts. By lifting the solenoids a few millimeters, the magnetic pull of the solenoid can be felt. For testing, the operation of the elevator car can also be controlled by lifting and replacing the coil.

Valves are fully adjusted and tested in the factory. Check electrical operation before changing valve setting.

Problem	Possible cause	Recommended
No up-start (Elevator remains at floor)	1. Test: Turn adjustment 5 all the way in. If the elevator now starts upwards the problem is at solenoid A.	
	2. Solenoid A not energized or voltage too low	Lift coil to check magnetic pull (see ***** above)
	3. Solenoid A tube not screwed down tight	Tighten Solenoid A tube.
	4. Solenoid valve A - dirt or damage between needle AN and seat AS	Clean or change needle and seat.
	5. Adjustment 2 not far enough open.	Turn out adjustment 2.
	6. Adjustment 1 too far back (open). Not enough pilot pressure.	Turn in adjustment 1 with the pump running.
	7. Relief valve is set too low.	Set relief valve higher.
	8. Adjustment 8 turned in too far (car sits on the buffer).	Turn out adjustment 8.
	9. Bypass flow guide is too large.	Insert smaller bypass flow guide (see flow guide charts at EV catalogue).
	10. Pump running in the wrong direction.	Install the pump correct.
	11. The pump connection flange is leaking excessively.	Seal the pump connection.
	12. The pump is undersize or worn.	Select bigger pump or replace pump.
	13. Test: If by turning adjustment 1 with the pump running the pressure does not rise above 5 bar, even with a smaller bypass valve inserted, the problem should be sought at the pump	
Up-Start, but no Full Speed	14. Test: Turn adjustment 3 all the way in. If the elevator now travels upwards at full speed the problem is at solenoid B.	
	15. Solenoid B not energised or voltage too low.	Lift coil to check magnetic pull (see ***** above)
	16. Solenoid B tube not screwed down tight.	Tighten Solenoid B tube.
	17. Solenoid valve B - dirt or damage between needle AN and seat AS.	Clean or change needle and seat,
	18. The pump connection flange is leaking excessively	Seal the pump connection.

Problem	Possible cause	Recommended
Up-Start, but no Full Speed	19. The pump is undersize or worn.	Select bigger pump or replace pump.
	20. Test: If by turning adjustment 1, the pressure does not rise above 5 bar, even with a smaller bypass valve inserted, the problem should be sought at the pump	
Up-Start too hard	21. Adjustment 1 turned in too far.	Turn out adjustment 1.
	22. Adjustment 2 turned out too far.	Turn in adjustment 2.
	23. 0-Ring UO on Bypass Valve U is leaking.	Change 0-Ring see EV Spare Parts List.
	24. Star to Delta motor switch period is too long.	0.2-0.3 sec. is sufficient.
	25. Excessive friction on the guide rails or in the cylinder head.	Cannot be eliminated thru valve adjustment.
No deceleration into leveling speed	26. Solenoid B does not de-energize.	Lift coil to check magnetic pull (see ***** above). Slow down switch possibly set to high (late).
	27. Adjustment 3 turned in too far.	Turn out adjustment 3.
	28. 0-Ring UO on Bypass Valve U is leaking.	Change 0-Ring, see EV Spare Parts List.
Deceleration into leveling speed but overtravel of floor level	29. Solenoid **A** is de-energized too late	Lift coil to check magnetic pull (see ***** above)
	30. Adjustment **5** turned in too far	Turn out adjustment **5**.
	31. Adjustment **1** turned in too far	Turn out adjustment **1**.
	32. Up leveling speed too slow	Turn in adjustment **4** to about 12 t/min leveling speed.
Elevator stops before reaching the floor (no leveling)	33. Solenoid A and B reversed..	Lift coil to check magnetic pull (see ***** above)
	34. Up leveling speed too slow.	Turn out adjustment 4.
	35. Middle 0-Ring FO of flange 4F is leaking.	Change O-Ring, see EV Spare Parts List.
	36. Relief valve is set too low.	Set relief valve higher.
Down Leak Releveling	37. For possible down leakage points, see 'EV Parts List', page 5.	Replace one seal point and test before proceeding to the next point of possible leakage, if still necessary.
	38. Releveling may also occur as hot oil cools down and contracts.	Install an oil cooler

Troubleshooting: Down Travel

***** For checking the operation of the solenoids, remove the top nuts. By lifting the solenoids a few millimeters, the magnetic pull of the solenoid can be felt. For testing, the operation of the elevator car can also be controlled by lifting and replacing the coil.

Valves are fully adjusted and tested in the factory. Check electrical operation before changing valve setting.

Problem	Possible cause	Recommended
No Down Start	39. Solenoid **D** not energized or voltage too low.	Lift coil to check magnetic pull (see ***** above)
	40. Adjustment **6** turned in too far.	Turn out adjustment **6**.
	41. Adjustment **8** turned out too far.	Turn in adjustment **8** cautiously. **Attention:** Danger of traveling through
	42. O-Ring **UO** on Down Valve **X** is leaking.	Change O-Ring, see EV Spare Parts List.
No full speed	43. Solenoid **C** not energized or voltage too low.	Lift coil to check magnetic pull (see ***** above)
	44. Adjustment **7** turned in too far.	Turn out adjustment **7.**
	45. Down Valve flow guide too small.	Check insert size (see flow guide charts page 12)
No down leveling. Elevator stops before floor level	46. Solenoid **C** and **D** reversed.	Lift coil to check magnetic pull (see ***** above)
	47. Solenoid **D** not energized or voltage too low.	Lift coil to check magnetic pull (see ***** above)
	48. Adjustment **9** turned in too far.	Turn out adjustment **9** to about 10 ft/min. leveling speed.
	49. Spring **9F** in adjustment **9** broken.	Replace adjustment **9** complete.
	50. Adjustment **KS** turned in too far.	Turn out adjustment **KS** as mentioned before**.**
No down leveling. Elevator travels thru floor level	51. Adjustment **8** turned in too far.	Turn out adjustment **8** about ½ turn.
	52. Adjustment **9** turned out too far.	Turn in adjustment **9** to about 10 ft/min. leveling speed.
	53. Solenoid valve **C** dirt or damage between needle **DN** and seat **DS**.	Clean or change needle and seat.
	54. Inner O-Ring **FO** on flange **7F** is leaking.	Change O-Ring, see EV Spare Parts List.
Elevator sinks quickly	55. Solenoid **D** tube not screwed down tight.	Tighten Solenoid **D** tube.
	56. Adjustment **8** turned in too far.	Turn out adjustment **8** about ½ turn.

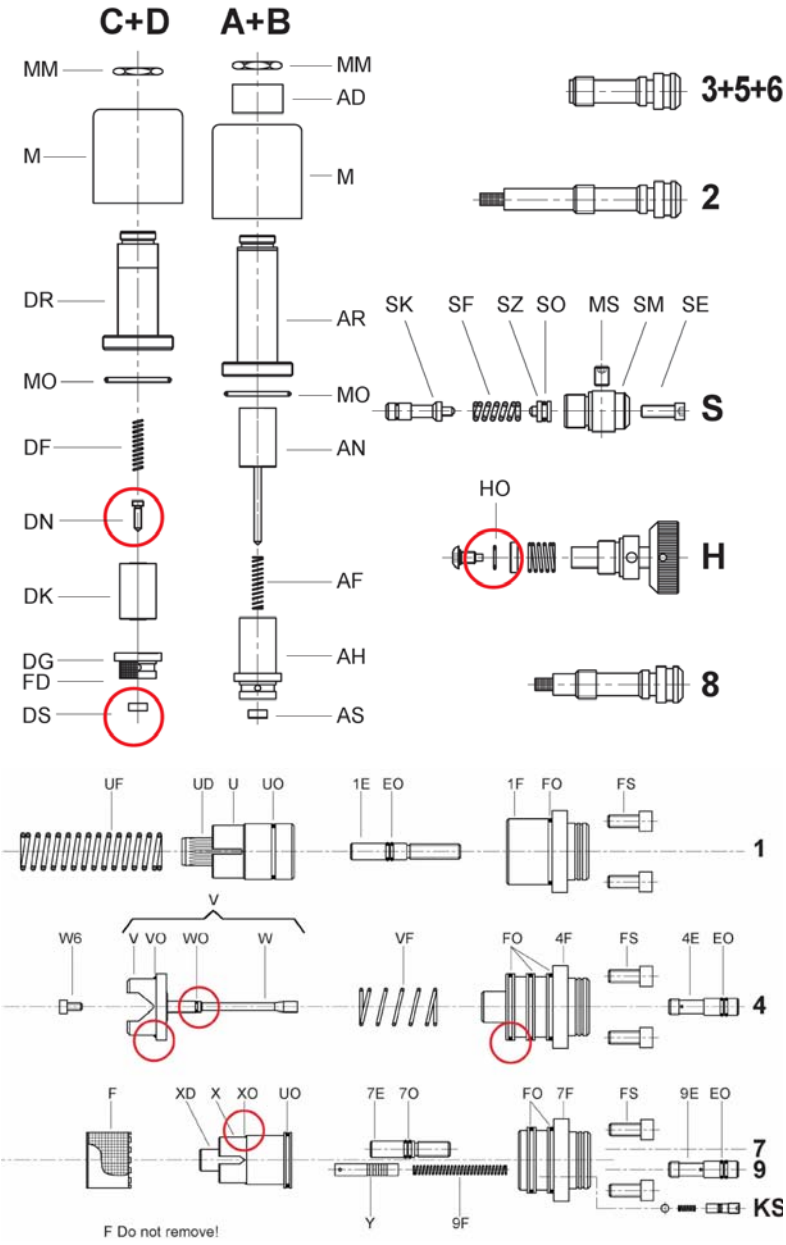
Problem	Possible cause	Recommended
Elevator sinks slowly due to inner leakage	57. Solenoid valve **D** - dirt or damage between needle **DN** and seat **DS**.	Clean or change needle and seat.
	58. O-Ring **XO** of Down Valve **X** is leaking.	Change O-Ring, see EV Spare Parts List. When Down Valve is compensated, replace Down Valve.
	59. O-Ring **VO** of Check Valve **V** is leaking.	
	60. O-Ring **WO** of Leveling Valve **W** is leaking.	Change O-Ring, see EV Spare Parts list.
	61. Inner O-Ring **FO** on flange **4F** is leaking.	Change Check Valve, see EV Spare Parts List.
	62. O-Ring **HO** of Manual Lowering **H** is leaking.	Replace Manual Lowering.
	63. Hand-pump leaking.	Remove suction tube and observe if hand-pump leaks. Replace complete hand-pump.
	64. Adjustment **8M** turned in too far.	Turn out adjustment **8**.
	65. Manual Lowering is leaking.	Replace Manual Lowering.
	66. Contraction of oil during cooling especially from above 35°C.	Install an oil cooler
Manual Lowering Valve not working	67. Check 50,39,40	
	68. Static pressure to low	
	69. Solenoid **D** (12V) not energized or voltage too low.	Lift coil to check magnetic pull (see ***** above). Check battery and replace

EV 100 Spare part list

In case of down leakage replace the parts and test with the following order DS & DN, XO, VO, WO, FO and HO

No		Item
1	FS	Lock Screw - Flange
	FO	O-Ring - Flange
	1F	Flange - By Pass
	EO	O-Ring –Adjustment
	1E	Adjustment - By Pass
	UO	O-Ring - By Pass Valve
	U	By Pass Valve
	UD	Noise Suppressor
	UF	Spring - By Pass
2	2	Adjustment - Up Acceleration
3	3	Adjustment - Up Deceleration
4	EO	O-Ring –Adjustment
	4E	Adjustment - Up Leveling
	4F	Flange - Check Valve
	FO	O-Ring - Flange
	VF	Spring - Check Valve
	W	Up-Leveling Valve
	WO	O-Ring - Up Leveling Valve
	VO	Seal - Check Valve
	V	Check valve
	W6	Screw - Check Valve
5	3	Adjustment - Up Stop
6	3	Adjustment - Down Acceleration
7	7F	Flange - Down Valve
	FO	O-Ring - Flange
	7O	O-Ring -Adjustment
	7E	Adjustment - Down Valve
	UO	O-Ring - Down Valve
	XO	Seal - Down Valve
	X	Down valve
	XD	Noise Suppressor
	F	Main Filter
8	8	Adjustment - Down Deceleration
9	EO	0-Ring -Adjustment
	9E	Adjustment - Down Leveling
	9F	Spring - Down Valve
	Y	Down Leveling Valve
H	H	Manual Lowering - Self Closing
	HO	Seal -Manual Lowering
S	SE	Adjustment - Screw
	SM	Hexagonal
	MS	Grub Screw
	SO	0-Ring - Nipple
	SZ	Nipple
	SF	Spring
	SK	Piston
A+B	MM	Nut - Solenoid
	AD	Collar - Solenoid
	M .	Coil -Solenoid (indicate voltage)
	AR	Tube - Solenoid 'Up'
	MO	O-Ring - Solenoid
	AN	Needle - 'Up'
	AF	Spring -Solenoid 'Up'
	AH	Seat Housing - 'Up'
	AS	S eat - Solenoid Up
C+D	MM	Nut - Solenoid
	M	Coil -Solenoid (indicate voltage)
	DR	Tube - Solenoid 'Down'
	MO	O-Ring - Solenoid
	DF	Spring - Solenoid 'Down'
	DN	Needle - 'Down
	DK	Core - Solenoid
	DG	Seat Housing with Screen-'Down'
	FD	Filter Solenoid
	DS	Seat - Solenoid 'Down'
Some parts occur more than once in different positions of the valve.		

O-Ring-Size			
EV	**¾"**	**1"**	**1 ½"**
FO	26x2P	47x2.5P	58x3P *
EO	9x2P	9x2P	9x2P
UO	26x2V	39.34x2.62V	58x3V
WO	5.28x1.78V	5.28x1.78V	5.28x1.78V
VO	23x2,5V	42x3V	6Ox3V**
70	5.28x1.78P	9x2P	9x2P
XO	13x2V	3Ox3V	47x3V
HO	5.28~1.78V	5.28~1.78V	5.28~1.78V
SO	5.28x1.78P	5.28x1.78P	5.28x1.78P
MO	26x2P	26x2P	26x2P



Adjustment of rupture valve R10 – Blain

The rupture valve should shut off the oil's flow when the lowering speed of the elevator becomes 0,3 m/sec higher than the nominal.

To find the cut off flow:

$Q_c = (v + 0,3) * Q / v$

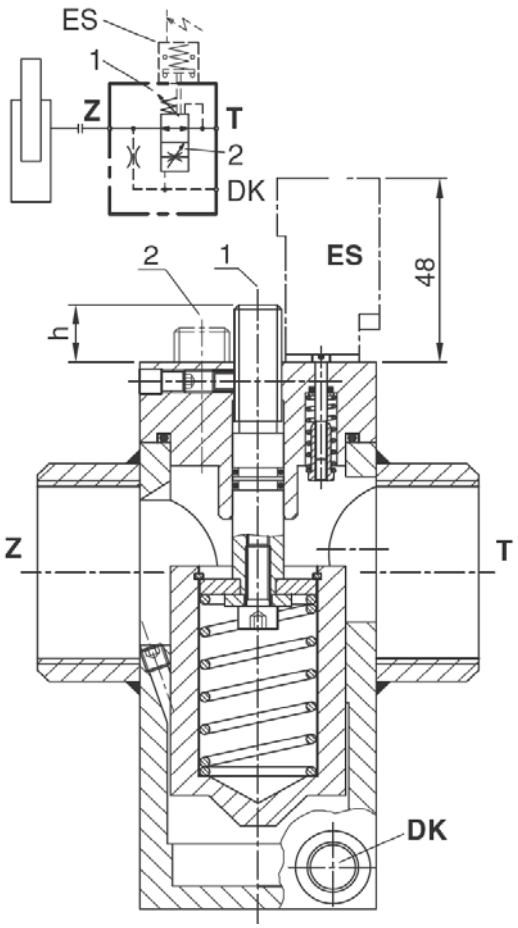
V the elevator's speed

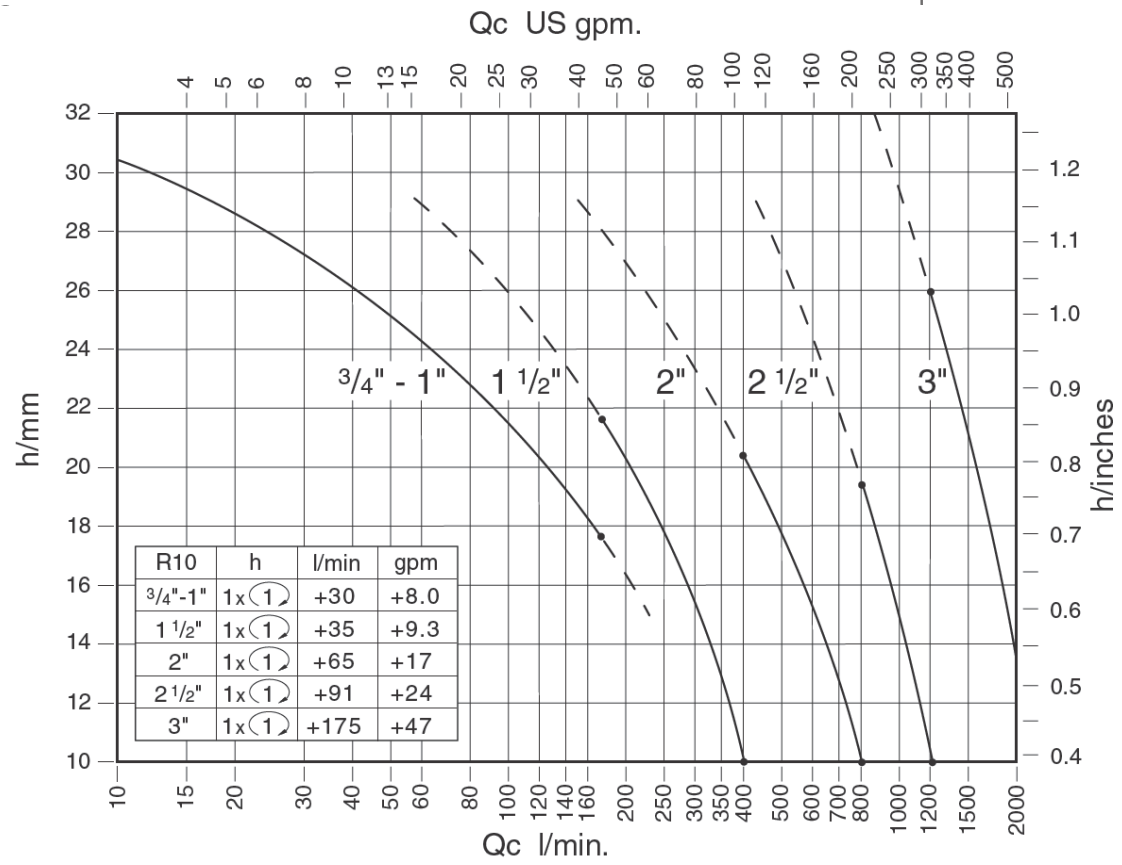
Q the nominal speed of the pump

Example : v = 0,64 m/sec Q = 100 l/min

$Q_c = (0,64 + 0,3) * 100 / 0,64 = 146$ l/min

To adjust the rupture valve we use the following diagram, for the example above the **h** must be set on 19 mm





R10	h	l/min	gpm
3/4"-1"	1x(1)	+30	+8.0
1 1/2"	1x(1)	+35	+9.3
2"	1x(1)	+65	+17
2 1/2"	1x(1)	+91	+24
3"	1x(1)	+175	+47