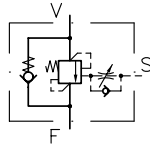


Over-center valves type LHK with hydraulic release

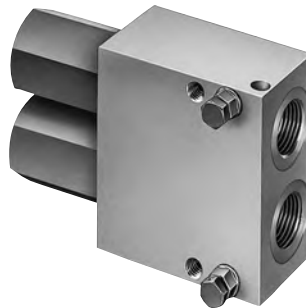
Operation pressure p_{\max} = 400 bar
Flow Q_{\max} = 100 lpm



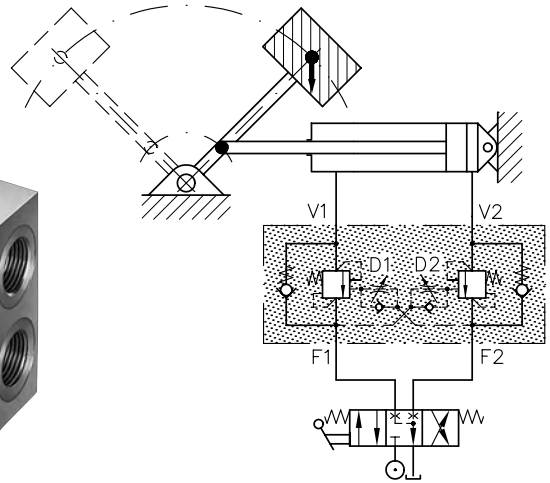
Symbol



Example:
Type LHK 33 G - 11 - 230
for single-sided load direction,
see section 2.1



Example:
Type LHK 33 G - 21 - 320/320
for alternating load directions (like example circuitry),
see section 2.2



1. General

The units included in the pressure valve group in accordance with DIN ISO 1219-1 prevent double-acting consumers (hydraulic cylinders, hydraulic motors) with an attached, pulling or pushing load from moving uncontrollably at high speeds (acceleration), when moving in the load direction that corresponds to the oil inflow (pump) (stalling, oil column torn free).

Example: Any type of lifting and swiveling equipment with change of direction (swiveling over dead point). Cable winch and swing gear motors.

As a side-effect of this, when the directional control valves or directional spool valves are in the neutral position, there is protection against undesired or unauthorized movements of a hydraulic cylinder's piston in the load direction if the directional spool valve controllers are contaminated with leaked oil in the stop position. See section 5.4 for details.

Example: Lifting and push-out cylinders, rotating piston rods and steering racks/pinion swivel cylinder.

Use also possible as relievable servo valves (pressure back valves) for special applications.

Example: For feed cylinders in machine tools, for stamping cylinders in fixtures, in hydraulic synchronizers if the synchronism or parallel working of two hydraulic cylinders is maintained with two equal part delivery currents of the pump etc., also see section 5.3.

See D 7381 for details of other synchronized control operations using flow dividers type TQ.

The over center valves type LHK are intended for all kind of turning, swiveling or rotating devices etc. which are sufficiently stiff and therefore show only a low tendency for oscillations.

For application that heavily tend to low frequent oscillations, especially when used together with prop. control type PSL / PSV acc. to D 7700 ++, type LHDV acc. to D 7770 or type LHT acc. to D 7918 should be used.

The outlet side (return side) of the hydraulic consumer, referred to the load and movement direction, is preloaded with the load holding valve. Depending on requirements, the pressure setting can be selected approx. 15 ... 25% higher than the highest possible load pressure. When hydraulic cylinders are in the resting state, the good sealing properties ensure that leaking oil from the consumer side cannot travel to a directional spool valve. The good sealing properties also make sure that the load cannot overcome the pre-load pressure or back press, of the valve.

If the hydraulic consumer is set in the „lower load“ direction via the directional control valve, the load cannot set the consumer in motion itself due to the back pressure on the load holding valve (see previous paragraph). Rather, the pump must „push“ on the consumer inflow side. The pressure required for this acts on the unlocking piston in the load holding valve via a control line. The force of the piston is directed against the spring pre-load. This reduces the pressure setting to load pressure. The valve is brought into a throttle operating position (unlocked) and movement of the consumer begins. The pressure on the pump side for moving the load depends on the difference between the set pressure value in the over-center valves and the current load pressure. It also depends on the area ratio in the hydraulic consumer and on the unlocking ratio in the over-center valves. It is only a fraction of the set pressure.

When the consumer is triggered, the valve quickly opens the outlet side so that no pressure intensification can occur and then goes over damped into the load-dependent throttle position. Starting jumps on consumers and associated pitching of the components moved by them are thereby largely suppressed just as they start or quickly die out. This starting behavior is achieved by way of threaded throttles with bypass check valves in the internal control channels. The effectiveness of the threaded throttles can be changes within a certain range and adapted to local requirements.

For additional notes regarding function and application see sect. 5.1

2. Available versions, main data

2.1 Valves for single-sided load direction V → F

For notes regarding the use of the different versions, see sect. 5

For comparison of old and new type coding, see sect. 5.5

Order example:

LHK 22 G - 11H - 180
LHK 33 G - 15C - 250/220
LHK 44 F - 14W - 200

Table 1:

Pressure setting shock valve p_2 (bar) ^{2), 4)}

Pressure setting over-center valve p_1 (bar) ^{1), 4)}

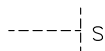
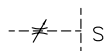
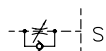
Basic type, size	Dampening characteristic	Symbol and connection mode	Relief ratio	Flow approx. (lpm)	Pressure range p_1 (bar) ¹⁾	Port thread ISO 228/1 (BSPP) F/V, R, A, B ³⁾	Dimensional drawings		
LHK 21	G	-14	Pipe connection	1 : 4.6	15	50...200	G 1/4	7	
		-14 T						6	
		-14 T-3/8						6	
LHK 22	G F U	-11	Pipe connection	1 : 4.6	20	50...200 201...400	G 3/8	1	
		-11 H	V - banjo bold connection					2	
		-11 H16	V - manifold mounting					M 16x1.5 / G 3/8	2
		-11 K -11 P						G 3/8	4
LHK 227	G F	-11 K	V - manifold mounting	1 : 7			G 3/8	5	
LHK 30	G F	-11 PV -11 C PV	Manifold mounting, external pressure adjustment	1 : 4.4	60	60...130 131...320 321...360	--	3	
LHK 32	G F U	-11	Pipe connection	1 : 4.4	40	60...130 131...320	G 3/8	1	
LHK 33	G F U	-11 -11 C	Pipe connection	1 : 4.4	60	60...130 131...320 321...360	G 1/2	1	
		-11 H	V - banjo bold connection					2	
		-11 K -11 P	V - manifold mounting					4	
		-14 -14 W	Pipe connection					7	
		-15 ²⁾ -15 C ²⁾	Pipe connection					9	
		-17 OMR -17 OMT -17 OMV	V - manifold mounting					10/11	
LHK 333	G F U	-11 K	V - manifold mounting	1 : 3				4	
LHK 337		-11	Pipe connection	1 : 7				1	
		-11 K -11 P	V - manifold mounting					4	
LHK 40	G F	-11 PV -11 C PV	Manifold mounting, external pressure adjustment	1 : 4.4	100		--	3	
LHK 43	G F	-14	Pipe connection	1 : 4.4	80		G 3/4 / G 1/2	7	
LHK 44	G F U	-11 -11 C	Pipe connection	1 : 4.4	100	0...159 160...350	G 3/4	1	
		-11 P	V - manifold mounting					4	
		-14 -14 W	Pipe connection					7	
		-14 W M1C	V - manifold mounting					8	
		-15 ²⁾ -15 C ²⁾	Pipe connection					9	

Dampening characteristic

G = Dampened via throttle/check valve combination (adjustable throttle screw)

F = Simple dampening via adjustable throttle screw

U = no dampening



1) Various pressure ranges (pressure springs) according to the specified pressure.

2) Pressure setting for shock valve $p_{2 \max} \leq 340$ bar (Pressure range: 150 ... 250 bar and 251 ... 340 bar)

3) Port thread M, S, X, Z see dimensional drawings section 4 ++

4) Set to 80% of p_{\max} of the respective pressure range, when not specified in the order

2.3 Over-center valve cartridges

The over-center valve cartridges are available individually for customer furnished base bodies featuring ducts V and S. Therefore function test and pressure setting have to be carried out after assembly on site. For notes regarding the adjustment, see „Pressure adjustment“ in sect. 3 and sect. 4.3. A specification of the intended load pressure is necessary for a pre-selection of the pressure spring.

The restrictor check valve type FG2 (acc. to D 7275) is used best for damping the control piston (port A = control piston side, port B = control inflow).

Order example:

LHK 21 - 180

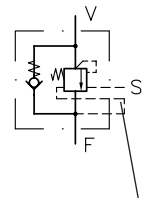
LHK 30 V - 260

LHK 447 - 120

Table 3:

A specification of the intended load pressure p_1 (bar)³⁾ is necessary for a pre-selection of the pressure spring.

Basic type, size	Relief ratio	Flow approx. (lpm)	Pressure range (bar) ^{1), 3)} p_1	Port thread (BSPP)	Utilized symbol	Dimensional drawings	
LHK 20 V	1 : 4.6	15	50...200	2) --	---	17	
LHK 21				G 1/4	14.	14	
LHK 22		20	50...200 201...400	G 3/8	11., 21	14	
LHK 227	1 : 7				11.	14	
LHK 30 V	1 : 4.4	60	60...130 131...320 321...360	2) --	11 PV, 11 CPV	18	
LHK 32		40	60...130 131...320	G 3/8	11	15	
LHK 33		60	60...130 131...320 321...360	G 1/2	11., 14., 15., 17., 21., 25.	15	
LHK 33 S					11 SK	20	
LHK 33 SL					21 SL	15	
LHK 337		1 : 7				11., 21, 25	15
LHK 40 V		1 : 4.4	100	60...130 131...350	2) --	11 PV, 11 CPV	19
LHK 44	G 3/4				11., 14., 15., 21.,	16	
LHK 447					21	16	



Connection hole Y see dimensional drawings sect. 4.3

1) Various pressure ranges (pressure springs) according to the specified pressure.

2) All ports are in the manifold. The pressure is adjustable after loosening the lock nut.

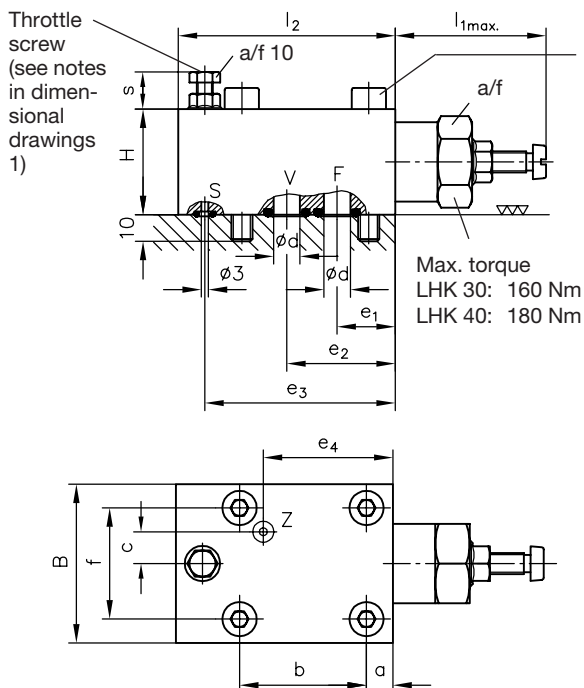
3) Set to 80% of p_{max} of the respective pressure range, when not specified in the order

3. Further data

Designation	Over-center valve, with hydraulic relief, with bypass check valve	
Design	Pressure valve part (load holding valve):	Ball or cone seated valve
	Bypass check valve:	Plate seated valve
Mounting	Depending on type, see dimensional drawings in sect. 4	
Installation position	Any	
Connections	F, F1, F2; V, V1, V2; A, B and R = Main connections, depending on type S, X and M = Control and measuring connections, depending on type All connections can be loaded with full operating pressure.	
Flow direction	Operating direction (load holding function) V → F, V1 → F1, V2 → F2 flow F → V, F1 → V1, F2 → V2	
Unblocking ratio	See Table 1, 2 and 3; section 2.1 to 2.3 The relief pressure is 0.23 x (set pressure - load pressure) for 1 : 4.4 0.22 x (set pressure - load pressure) for 1 : 4.6 0.14 x (set pressure - load pressure) for 1 : 7	

The area ratio for hydraulic cylinders is included in the calculation.

Dimensional drawings 3: **Type LHK ... - 11 PV**
LHK ... - 11 CPV



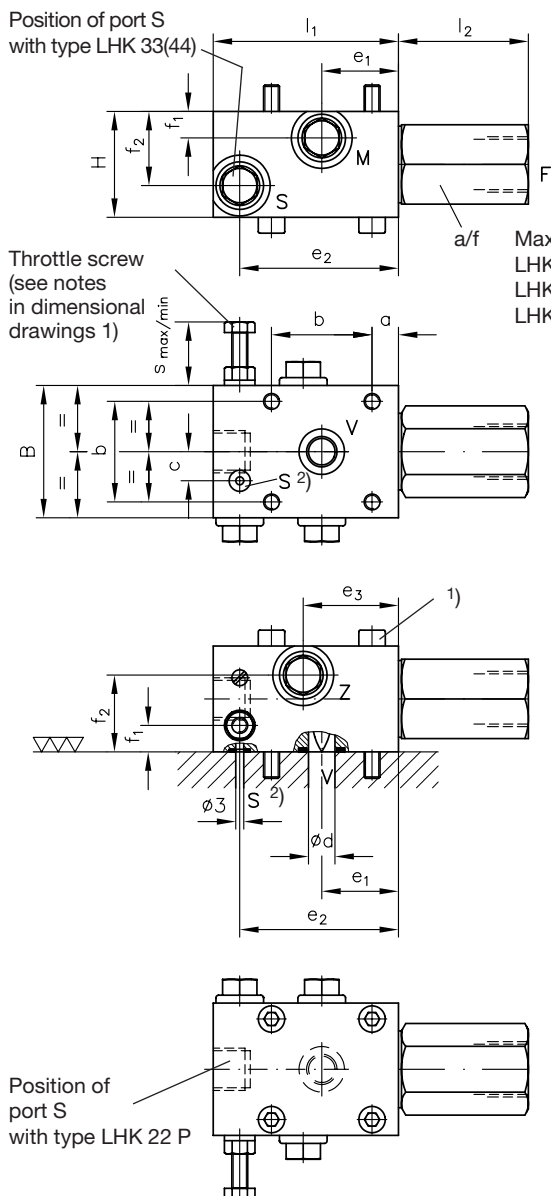
Socket-head screws
LHK 33: M 8x50 DIN 912-8.8
LHK 44: M 8x60 DIN 912-8.8

Type	O-rings NBR 90 Shore at ports		B	H	l ₁	l ₂
	F and V	S and Z				
LHK 30 -11 (C)PV	12.37 x 2.62	4.47 x 1.78	60	40	57	82
LHK 40 -11 (C)PV	17.12 x 2.62	4.47 x 1.78	62	50	85	80

Type	a	b	c	Ød	e ₁	e ₂	e ₃
LHK 30 -11 PV	10	48	--	10	22	41	72
LHK 30 -11 CPV	10	48	12	10	22	41	72
LHK 40 -11 PV	17	50	--	14	28.5	52.5	74
LKK 40 -11 CPV	17	50	15	14	28.5	52.5	74

Type	e ₄	f	a/f	s		Mass (weight) approx. kg
				min	max	
LHK 30 -11 PV	--	42	30	14	24	1.5
LHK 30 -11 CPV	49	42	30	14	24	1.5
LHK 40 -11 PV	--	48	36	12	24	1.8
LKK 40 -11 CPV	60	48	36	12	24	1.8

Dimensional drawings 4: **Type LHK ... - 11 P**
Type LHK ... - 11 K



- 1) Socket-head screws
LHK 22: M 6x35 DIN 912-8.8 thread depth 8 mm
LHK 33: M 6x50 DIN 912-8.8 thread depth 11 mm
LHK 44: M 8x60 DIN 912-8.8 thread depth 14 mm
- 2) Port S on flange side only with type LHK 33 (333, 337) .. - 11 K

Attention:
The hexagonal spring housing must be countered while installing the pipe fitting!

Ports G... = (BSPP)

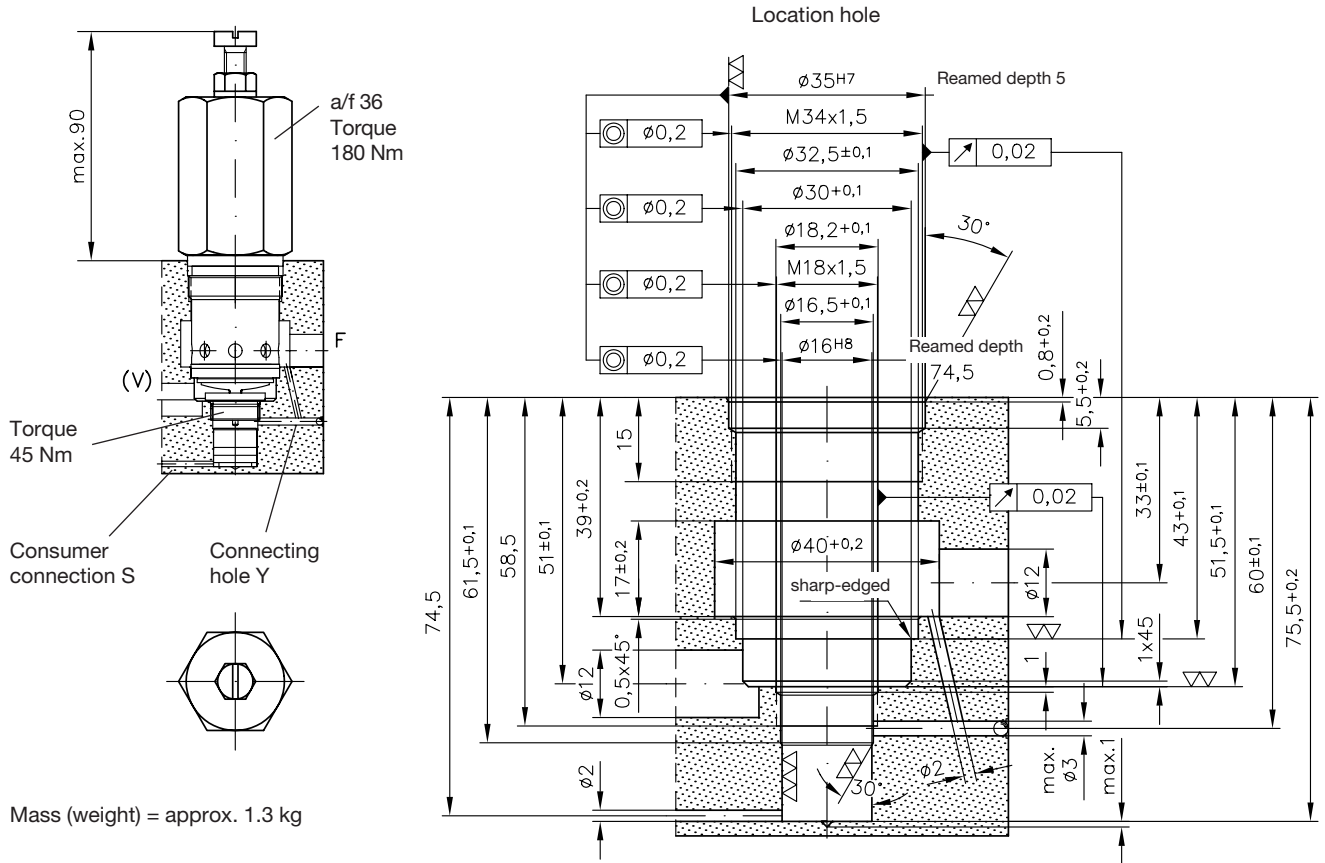
Type	Ports			O-rings NBR 90 Shore at ports	
	F	S	M, Z	F and V	S and Z
LHK 22	G 3/8	G 3/8	--	10.77 x 2.62	--
LHK 33 (333, 337)	G 1/2	G 1/4	G 1/4	12.37 x 2.62	4.47 x 1.78
LHK 44	G 3/4	--	--	15.55 x 2.62	4.47 x 1.78

Type	B	H	l ₁	l ₂	a	b	c	Ød	e ₁	e ₂	e ₃
LHK 22	40	28	70	40	9.5	28	--	8	23.5	--	--
LHK 33 (333, 337)	50	40	70	49	10	38	11	10	29	60	36
LHK 44	60	48	90	60	18	28	0	14	33	54.5	--

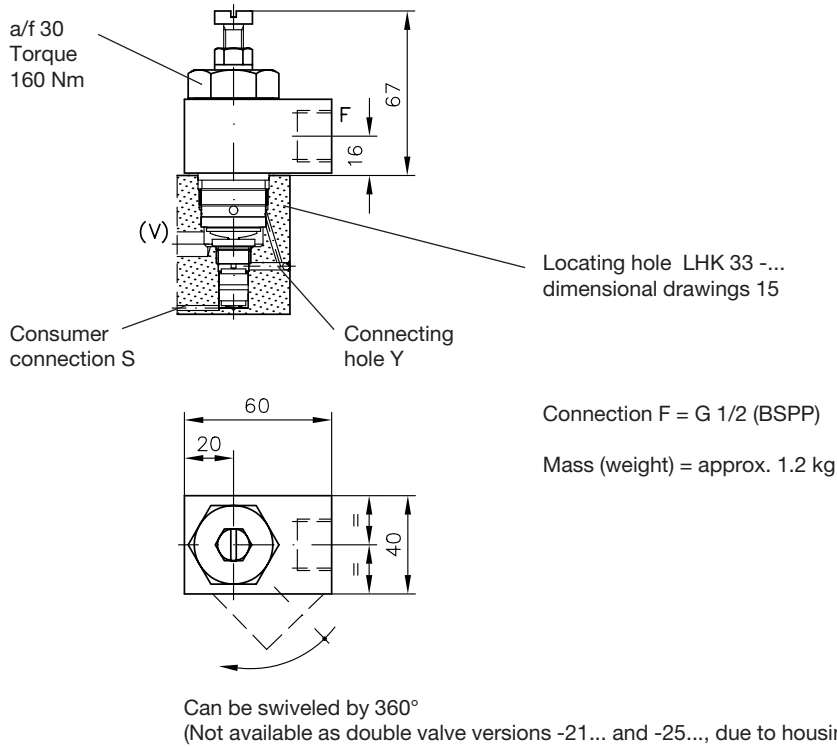
Type	f ₁	f ₂	a/f	s		Mass (weight) approx. kg
				min	max	
LHK 22	14	--	22	8	15	0.6
LHK 33 (333, 337)	10	28	30	14	24	1.0
LHK 44	12	--	36	12	24	2.0

Position of port S with type LHK 22 P

Dimensional drawings 19: **Type LHK 40 V ...**



Dimensional drawings 20: **Type LHK 33 S ...**



5.5 Old and new type coding

Some changes were necessary for the unification of the type coding. The table below lists all these changes.

Old	Previous SK-drawing	New (like in sect. 2.1)
LHK 22 K-11-...	Sk 7660 GP/3	LHK 22 G -11 K-...
LHK 30 GVP-11-...	Sk 7100 GVP-11	LHK 30 G -11 PV -...
LHK 30 FVP-11-...	Sk 7100 GVP-11	LHK 30 F -11 PV -...
LHK 30 GVP-11C-...	Sk 7100 GVP-11C	LHK 30 G -11C PV -...
LHK 30 FVP-11C-...	Sk 7100 GVP-11C	LHK 30 F -11C PV -...
LHK 33 OMR-17-...	Sk 7547 OMR	LHK 33 G -17 OMR
LHK 33 OMT-17-...	Sk 7547 OMT	LHK 33 G -17 OMT
LHK 33 OMV-17-...	Sk 7547 OMV	LHK 33 G -17 OMV
LHK 33 K-10..- G(F)	Sk 7100 K	LHK 333 G(F) - 11 K -...
LHK 33 K-11..- G(F)	Sk 7100 K	LHK 33 G(F) - 11 K -...
LHK 33 K-12..- G(F)	Sk 7100 K	LHK 337 G(F) - 11 K -...
LHK 33 P-11-...	Sk 7100 P-11	LHK 33 G -11P -...
LHK 33 PF-11-...	Sk 7100 P-11	LHK 33 F -11P -...
LHK 33 P-12-...	Sk 7100 P-11	LHK 337 G -11P -...
LHK 33 PF-12-...	Sk 7100 P-11	LHK 337 F -11P -...
LHK 40 GVP-11-...	Sk 7101 GVP-11	LHK 40 G -11PV -...
LHK 40 FVP-11-...	Sk 7101 GVP-11	LHK 40 F -11PV -...
LHK 40 GVP-11C-...	Sk 7101 GVP-11C	LHK 40 G -11C PV -...
LHK 40 FVP-11C-...	Sk 7101 GVP-11C	LHK 40 F -11C PV -...
LHK 44 G M1C-14W-...	Sk 7101 M1C-14W/1	LHK 44 G - 14W M1C -...
LHK 44 P-11-...	Sk 7101 P-11	LHK 44 G -11 P -...