Compact hydraulic power pack type HK 4, HKF 4

Product documentation

Continuous operation with constant load (S1), Short period operation (S2), Periodic intermittent operation (S3), Continuous periodic operation (S6)

Operating pressure p_{max}:	700 bar
Displacement volume $V_{g\ max}$:	17.0 cm^3/rev
Usable volume V_{use}:	11.1 l

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1 Overview of compact hydraulic power pack type HK 4, HKF 4

Compact hydraulic power packs are a type of hydraulic power pack. They are characterised by a highly compact design, since the motor shaft of the electric motor also acts as the pump shaft. Compact hydraulic power packs are used to supply hydraulic oil in hydraulic systems.

The ready-for-connection compact hydraulic power packs type HK and HKF contain an oil immersed motor. The stator is securely attached to the housing (tank). The compact hydraulic power pack is suitable for hydraulic systems with operating mode S1, S2, S3 or S6. A fan, which effectively dissipates the heat from the hydraulic system, is mounted on the housing. In the case of type HKF, the fan is powered by a separate motor independently of the pump motor. In the case of type HK, the fan is securely attached to the motor shaft. An external cooler is not generally required. The types HK and HKF are operated with a 3-phase motor and installed in an upright housing. Single-circuit, dual-circuit or triple-circuit systems can be selected. A radial piston pump, an external gear pump or an internal gear pump can be used as a hydraulic pump. The compact hydraulic power packs type HK and HKF are suitable for use as a highly compact control system, since connection blocks and valve banks can be directly mounted.

Compact hydraulic power pack type HK 4

Features and advantages

- Environmentally friendly thanks to low oil filling volume; low cost of disposal and low hydraulic fluid costs
- Long service life and high reliability

Intended applications

- Clamping systems and tool loaders in lathes
- Test bench construction
- Material testing machines
- Renewable energy plants
- Welding machines and robots

2 Available versions

2.1 Motor and container

Ordering examples

HK 43 **HKF 44**	**9**	**D** **DT**	**/1** **/1**	**P1**	**M**	**-H 0,7** **-Z 11,3**	-AB 1 K B 350 -C6	**-3x400/230 V 50 Hz** **-3x400/230 V 50 Hz**	**G 1/4 x 300**

2.1.6 "Oil drain hose"

3.6 "Motor data"

2.2 "Pump"

2.1.3 "Additional options"

2.1.5 "Electrical connection"

2.1.4 "Position of terminal box"

2.1.3 "Additional options"

2.1.2 "Tank size"

2.1.1 "Basic type and motor power"

2.1.1 Basic type and motor power

Type	Comment	Nominal power (kW)	Rated speed (min-1)	Frequency (Hz)
HK 43 **HK 43 V**	With integrated fan Type HK 4..V is a version with cast stator (see the notes Chapter 6.1.5, "Selecting the compact hydraulic power pack")	1.5 1.8	1395 1674	50 60
HK 44 **HK 44 V**		2.2 2.6	1405 1700	50 60
HK 48 **HK 48 V**		3.0 3.6	1420 1704	50 60
HKF 43 **HKF 43 V**	With separately driven fan for temperature-critical applications with approx. 25% higher cooling (see Chapter 6.1.7, "Determining the steady-state temperature") Type HK 4..V is a version with cast stator (see the notes Chapter 6.1.5, "Selecting the compact hydraulic power pack")	1.5 1.8	1395 1674	50 60
HKF 44 **HKF 44 V**		2.2 2.6	1405 1700	50 60
HKF 48 **HKF 48 V**		3.0 3.6	1420 1704	50 60
HKF 43...U **HKF 44...U** **HKF 48...U**	Version with frequency converter, see D 7600-4 FU	1.5 2.2 3.0	1395 1405 1420	-- -- --

NOTICE
The actual power consumption depends on the load and can be up to 1.8 x nominal power.

2.1.2 Tank size

Coding	Type	Fill volume V_{fill} (l)	Usable volume V_{usable} (l)
2	HKF 48	15.4	11.1
5	HK 43 HK 44	6.8	2.5
	HK(F) 48	6.6	1.8
9	HK 43 HK 44	10	5.7
	HK(F) 48	9	5.5

2.1.3 Additional options

Ordering examples

HKF 449	**AWW60**	/1	P1		-Z16	-3x400/230 V 50 Hz
HKF 482	**LD-DT55T65**	/5	P11		-H8,6	-3x400/230 V 50 Hz
HK 449	**LDTR**	/3	P11E	**M A**	-H6,0	-3x400/230 V 50 Hz

Further options

Additional options

Options for indicating and switching the level and temperature

Coding	Comment
without coding	Without additional equipment
S	Level switch (N/O contact)
S-T	Level/temperature switch (1 x N/O contact, 1 x N/C contact), separate
D	Level switch (N/C contact)
D-D	2 x level switch, separate (2 x N/C contact); two switching points (not in the case of tank size 5) ▪ 1. switching point 2 litres lower than usable volume (only in the case of type HK 4..9, HKF 4..9 and HKF 482)
DT	Level/temperature switch, in series (2 x N/C contact)
D-T	Level/temperature switch, separate (2 x N/C contact)
D-DT..T..	2 x level switch (2 x N/C contact) and 2 x temperature switch, separate (2 x N/C contact) ▪ Switching points 50°C, 60°C, 80°C (not in the case of tank size 5, interference suppressor coding E is not possible) **NOTICE** Additional option only possible in the case of HARTING connector with M12x1 connector (2x).
DT..T..	1 x level switch (N/C contact) and 2 x temperature switch, separate (2 x N/C contact) ▪ Switching points 50°C, 60°C, 80°C (interference suppressor coding E is not possible) **NOTICE** Additional option only possible in the case of HARTING connector with M12x1 connector (2x).
A	Level switch (N/C contact) with cubic plug, connected outside the terminal box.

Coding	Comment
T	Temperature switch (switching point 80°C)
T60, T55, T65	Temperature switch (switching points 55°C, 60°C, 65°C)
T55T65	2 x temperature switch, two switching points (55°C, 65°C)
W **W60**	Temperature switch (switching point 80°C or 60°C) with cubic plug, separate electric connection (also available in the combination AW, AW 60, WW 60, AWW 60), only in combination with alternative terminal box assignment according to Chapter 2.1.4, "Position of terminal box" coding /5 ... /8
L	Additional drain port on second connection base G 3/4, see Chapter 3.5.1, "" and Chapter 6.1.10, "Additional leakage oil return port" ▪ Only single- and dual-circuit pumps, coding H, Z, HH, HZ, ZZ according to Chapter 2.2, "Pump".
R	Fan cover for additional protection against coarse dirt

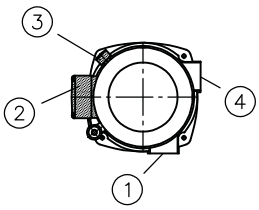
Further options

Coding	Comment
M	with G 1 1/4 filling reduction
A	Additional drain plug G 1/4 in pump base, only for pump combination H, HH, HH-H, Z (size 1 to Z 11.3)
MW	with filling coupling MD-012-2-WR021-19-1

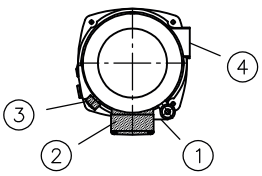
2.1.4 Position of terminal box

Coding	Comment		
/1	Series		**INFORMATION** ▪ Terminal box: pump motor and fan motor are wired together as standard. ▪ HARTING connector: pump motor and fan motor are wired separately in the factory. Can be adjusted by the customer (pump motor and fan motor wired together).
/2	90°	rotated anti-clockwise	
/3	180°		
/4	270°		
Alternative assignment for type HKF with terminal box:			
/5	Series		for type HKF without HARTING connector (external fan and motor are connected separately)
/6	90°	rotated anti-clockwise	
/7	180°		
/8	270°		

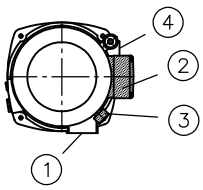
Coding **/1, /5**



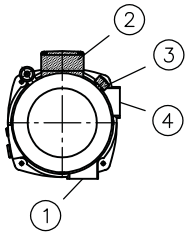
Coding **/2, /6**



Coding **/3, /7**



Coding **/4, /8**



1 Main connection base
2 Terminal box
3 Air filter
4 Second connection base

NOTICE

The 4 terminal box positions cover the entire finned tube top, including the oil level gauge, air filter, etc. (see also dimension diagram Chapter 4.2, "Basic pump").

2.1.5 Electrical connection

Coding	Comment
without coding	Series (terminal box)
P1 **P2** **P5** **P6**	Connector with male insert HAN 10 E (from HARTING) instead of terminal box Position of HARTING connector: ▪ **1:** Connector on left ▪ **2:** Connector at bottom, rotated 90° ▪ **5:** Connector on left, male insert rotated by 180° ▪ **6:** Connector at bottom, rotated 90°, male insert rotated by 180°
P11 **P21** **P51** **P61**	Connector with male insert HAN 10 E (from HARTING) with 4-pin M12x1 connector instead of terminal box Position of HARTING connector: ▪ **11:** Connector on left with 4-pin M12x1 connector ▪ **21:** Connector at bottom with 4-pin M12x1 connector ▪ **51:** Connector on left with 4-pin M12x1 connector, male insert rotated by 180° ▪ **61:** Connector at bottom with 4-pin M12x1 connector, male insert rotated by 180°
E	Electrical connection with additional suppressor module at the terminal box or HARTING connector, see Chapter 3.5, "Electrical data" ▪ HK 4..5(9): with 1 suppressor module ▪ HKF 4..5(9): with 2 suppressor modules

INFORMATION

For version with HARTING connector: the pump motor and fan motor are connected (together or separately) at the customer's HARTING socket.

2.1.6 Oil drain hose

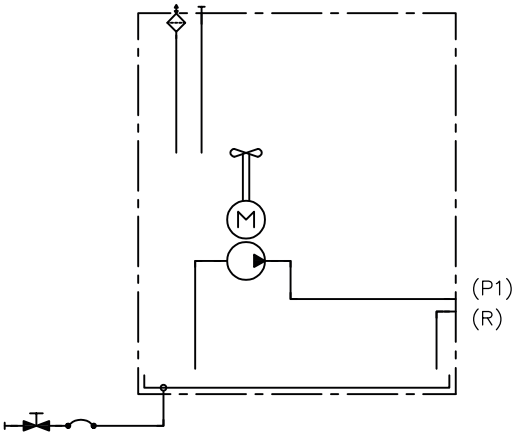
Coding	Description
without coding	Tapped plug G 1/4, additionally: drain G 3/4, see Chapter 4.2, "Basic pump"
G 1/4 x 300	Oil drain hose approximately 300 mm with ball valve
G 1/4 x 500	Oil drain hose approximately 500 mm with ball valve
G 1/4 W x 300	Oil drain hose approximately 300 mm with bracket and ball valve
G 1/4 W x 500	Oil drain hose approximately 500 mm with bracket and ball valve

2.2 Pump

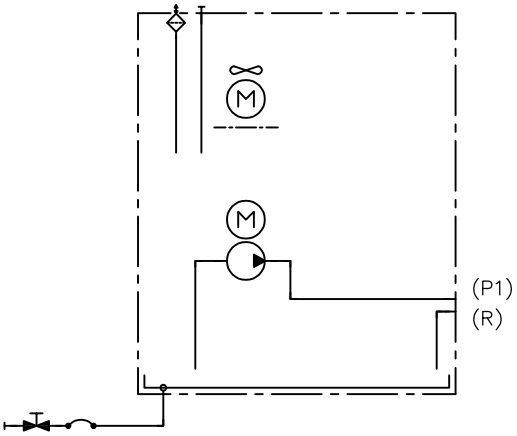
2.2.1 Single-circuit pumps

Circuit symbol

HK



HKF



Ordering examples

HKF 482 DT/1	**-Z 24**	-A1/150	-3x400/230 V 50 Hz
HK 445/1	**-H 7,2**	-C5	-3x400/230 V 50 Hz

Single-circuit pump with a 3-phase motor

Single-circuit pump (radial piston pump) with a 3-phase motor

INFORMATION

Re the following points see Chapter 3.6, "Motor data":

- The flow rate Q_{max} relates to the rated speed and varies depending on the load.
- Notes on pressures p_{max} (see Chapter 3.6, "Motor data").
- The permitted pressures p_{max} apply to a version with a 3x400 V 50 Hz/460 V 60 Hz or 3x230 V 50 Hz/265 V 60 Hz motor
- Be aware of different motor power ratings and resulting permissible maximum pressures $p_{max} = (pV_g)_{max} / V_g$. at other nominal voltages and power frequencies $(pV_g)_{max}$.

Radial piston pump H

Type	Delivery flow coding		H 0.9	H 1.25	H 1.4	H 1.5	H 1.8	H 2.08
	Piston diameter (mm)		6	7	6	8	6	7
	Number of pump elements		3	3	5	3	6	5
	Displacement volume V_g (cm^3/rev)		0.64	0.88	1.07	1.15	1.29	1.46
HK 43	Permissible pressure p_{max} (bar)		700	700	700	700	700	620
HKF 43	Continuous operation S1 p_1 (bar)		680	500	410	390	340	300
	Flow rate Q_{max} (l/min)	50 Hz	0.9	1.23	1.5	1.6	1.8	2.04
		60 Hz	1.07	1.47	1.79	1.93	2.16	2.44
HK 44	Permissible pressure p_{max} (bar)		700	700	700	700	700	700
HKF 44	Continuous operation S1 p_1 (bar)		700	700	700	700	690	610
	Flow rate Q_{max} (l/min)	50 Hz	0.9	1.24	1.5	1.62	1.81	2.05
		60 Hz	1.09	1.5	1.82	1.96	2.19	2.48
HK 48	Permissible pressure p_{max} (bar)		700	700	700	700	700	700
HKF 48	Continuous operation S1 p_1 (bar)		700	700	700	700	700	700
	Flow rate Q_{max} (l/min)	50 Hz	0.91	1.25	1.52	1.63	1.83	2.07
		60 Hz	1.09	1.5	1.82	1.96	2.2	2.49

Radial piston pump H

Type	Delivery flow coding		H 2.45	H 2.5	H 2.6	H 3.2	H 3.6	H 4.2
	Piston diameter (mm)		7	10	8	8	12	10
	Number of pump elements		6	3	5	6	3	5
	Displacement volume V_g (cm³/rev)		1.75	1.79	1.91	2.29	2.58	2.98
HK 43	Permissible pressure p_{max} (bar)		510	500	470	390	350	300
HKF 43	Continuous operation S1 p_1 (bar)		250	250	230	190	170	150
	Flow rate Q_{max} (l/min)	50 Hz	2.44	2.5	2.66	3.2	3.6	4.16
		60 Hz	2.93	3.0	3.2	3.83	4.32	4.99
HK 44	Permissible pressure p_{max} (bar)		700	560	650	550	390	420
HKF 44	Continuous operation S1 p_1 (bar)		510	500	470	390	350	300
	Flow rate Q_{max} (l/min)	50 Hz	2.46	2.51	2.68	3.22	3.62	4.2
		60 Hz	2.98	3.04	3.25	3.89	4.39	5.07
HK 48	Permissible pressure p_{max} (bar)		700	560	700	700	390	560
HKF 48	Continuous operation S1 p_1 (bar)		670	560	620	520	390	400
	Flow rate Q_{max} (l/min)	50 Hz	2.49	2.54	2.71	3.25	3.66	4.23
		60 Hz	2.98	3.05	3.25	3.9	4.4	5.08

Radial piston pump H

Type	Delivery flow coding		H 4.3	H 5.0	H 5.1	H 5.6	H 6.0	H 6.5
	Piston diameter (mm)		13	10	14	15	12	16
	Number of pump elements		3	6	3	3	5	3
	Displacement volume V_g (cm³/rev)		3.03	3.58	3.51	4.03	4.30	4.58
HK 43	Permissible pressure p_{max} (bar)		300	250	260	220	210	200
HKF 43	Continuous operation S1 p_1 (bar)		150	120	130	110	100	100
	Flow rate Q_{max} (l/min)	50 Hz	4.23	4.99	4.9	5.62	6.0	6.39
		60 Hz	5.07	5.99	5.88	6.75	7.2	7.67
HK 44	Permissible pressure p_{max} (bar)		330	350	290	250	290	220
HKF 44	Continuous operation S1 p_1 (bar)		300	250	260	220	210	200
	Flow rate Q_{max} (l/min)	50 Hz	4.26	5.03	4.93	5.66	6.04	6.43
		60 Hz	5.15	6.09	5.97	6.85	7.31	7.79
HK 48	Permissible pressure p_{max} (bar)		330	560	290	250	390	220
HKF 48	Continuous operation S1 p_1 (bar)		330	330	290	250	280	220
	Flow rate Q_{max} (l/min)	50 Hz	4.3	5.08	4.98	5.72	6.11	6.5
		60 Hz	5.16	6.1	5.98	6.87	7.33	7.8

Radial piston pump H

Type	Delivery flow coding		H 7.0	H 7.2	H 8.3	H 8.6	H 9.5	H 9.9
	Piston diameter (mm)		13	12	14	13	15	14
	Number of pump elements		5	6	5	6	5	6
	Displacement volume V_g (cm³/rev)		5.04	5.16	5.8	6.0	6.7	7.0
HK 43	Permissible pressure p_{max} (bar)		180	170	150	150	130	130
HKF 43	Continuous operation S1 p_1 (bar)		90	90	80	70	70	60
	Flow rate Q_{max} (l/min)	50 Hz	7.03	7.2	8.09	8.37	9.35	9.77
		60 Hz	8.44	8.64	9.71	10.04	11.22	11.72
HK 44	Permissible pressure p_{max} (bar)		250	240	210	210	190	180
HKF 44	Continuous operation S1 p_1 (bar)		180	170	150	150	130	130
	Flow rate Q_{max} (l/min)	50 Hz	7.08	7.25	8.15	8.43	9.41	9.84
		60 Hz	8.57	8.77	9.86	10.2	11.39	11.9
HK 48	Permissible pressure p_{max} (bar)		330	390	290	330	250	290
HKF 48	Continuous operation S1 p_1 (bar)		230	230	200	200	180	170
	Flow rate Q_{max} (l/min)	50 Hz	7.16	7.33	8.24	8.52	9.51	9.94
		60 Hz	8.59	8.79	9.88	10.22	11.42	11.93

Radial piston pump H

Type	Delivery flow coding		H 10.9	H 11.5	H 13.1
	Piston diameter (mm)		16	15	16
	Number of pump elements		5	6	6
	Displacement volume V_g (cm³/rev)		7.64	8.06	9.17
HK 43	Permissible pressure p_{max} (bar)		120	110	100
HKF 43	Continuous operation S1 p_1 (bar)		60	50	50
	Flow rate Q_{max} (l/min)	50 Hz	10.66	11.24	12.79
		60 Hz	12.79	13.49	15.35
HK 44	Permissible pressure p_{max} (bar)		160	160	140
HKF 44	Continuous operation S1 p_1 (bar)		120	110	100
	Flow rate Q_{max} (l/min)	50 Hz	10.73	11.32	12.88
		60 Hz	12.99	13.7	15.59
HK 48	Permissible pressure p_{max} (bar)		220	250	220
HKF 48	Continuous operation S1 p_1 (bar)		150	150	130
	Flow rate Q_{max} (l/min)	50 Hz	10.85	11.45	13.02
		60 Hz	13.02	13.73	15.63

Single-circuit pump (gear pump) with a 3-phase motor

INFORMATION

For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Gear pump Z

Type	Delivery flow coding		Z 2	Z 2.7	Z 3.5	Z 4.5	Z 5.2	Z 6.5
	Displacement volume V_g (cm³/rev)		1.6	2.15	2.65	3.35	4.25	4.5
	Size		1	1	1	1	1	2
HK 43	Permissible pressure p_{max} (bar)		170	170	170	170	170	170
HKF 43	Continuous operation S1 p_1 (bar)		170	170	170	140	110	100
	Flow rate Q_{max} (l/min)	50 Hz	2.2	3.0	3.7	4.7	5.9	6.3
		60 Hz	2.7	3.6	4.4	5.6	7.1	7.5
HK 44	Permissible pressure p_{max} (bar)		170	170	170	170	170	170
HKF 44	Continuous operation S1 p_1 (bar)		170	170	170	170	170	170
	Flow rate Q_{max} (l/min)	50 Hz	2.2	3.0	3.7	4.7	6.0	6.3
		60 Hz	2.7	3.7	4.5	5.7	7.2	7.7
HK 48	Permissible pressure p_{max} (bar)		170	170	170	170	170	170
HKF 48	Continuous operation S1 p_1 (bar)		170	170	170	170	170	170
	Flow rate Q_{max} (l/min)	50 Hz	2.3	3.1	3.8	4.8	6.0	6.4
		60 Hz	2.7	3.7	4.5	5.7	7.2	7.7

Gear pump Z

Type	Delivery flow coding		Z 6.9	Z 8.8	Z 9	Z 9.8	Z 11.3	Z 12.3
	Displacement volume V_g (cm³/rev)		5.35	6.65	6.0	7.1	8.5	8.5
	Size		1	1	2	1	1	2
HK 43	Permissible pressure p_{max} (bar)		170	150	150	140	110	110
HKF 43	Continuous operation S1 p_1 (bar)		90	70	70	70	60	50
	Flow rate Q_{max} (l/min)	50 Hz	7.5	9.3	8.4	9.9	11.9	11.9
		60 Hz	9.0	11.1	10.0	11.9	14.2	14.2
HK 44	Permissible pressure p_{max} (bar)		170	170	170	170	160	150
HKF 44	Continuous operation S1 p_1 (bar)		170	140	150	140	110	110
	Flow rate Q_{max} (l/min)	50 Hz	7.5	9.3	8.4	10.0	11.9	11.9
		60 Hz	9.1	11.3	10.2	12.1	14.5	14.5
HK 48	Permissible pressure p_{max} (bar)		170	170	170	170	170	170
HKF 48	Continuous operation S1 p_1 (bar)		170	170	170	170	150	140
	Flow rate Q_{max} (l/min)	50 Hz	7.6	9.4	8.5	10.1	12.1	12.1
		60 Hz	9.1	11.3	10.2	12.1	14.5	14.5

Gear pump Z

Type	Delivery flow coding		Z 14.4	Z 16	Z 21	Z 24
	Displacement volume V_g (cm³/rev)		10.65	11.0	14.5	17.0
	Size		1	2	2	2
HK 43	Permissible pressure p_{max} (bar)		90	80	60	50
HKF 43	Continuous operation S1 p_1 (bar)		40	40	30	30
	Flow rate Q_{max} (l/min)	50 Hz	14.9	15.3	20.2	23.7
		60 Hz	17.8	18.4	24.3	28.5
HK 44	Permissible pressure p_{max} (bar)		130	110	90	70
HKF 44	Continuous operation S1 p_1 (bar)		90	80	60	50
	Flow rate Q_{max} (l/min)	50 Hz	15.0	15.5	20.4	23.9
		60 Hz	18.1	18.7	24.7	28.98
HK 48	Permissible pressure p_{max} (bar)		170	170	170	150
HKF 48	Continuous operation S1 p_1 (bar)		120	110	80	70
	Flow rate Q_{max} (l/min)	50 Hz	15.1	15.6	20.6	24.1
		60 Hz	18.1	18.7	24.7	29.0

Single-circuit pump (internal gear pump) with a 3-phase motor (only type HKF)

INFORMATION

For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Internal gear pump IZ

Type	Delivery flow coding		IZ 7.5	IZ 9.1	IZ 11.9	IZ 16.2	IZ 19.2	IZ 22.9
	Displacement volume V_g (cm^3/rev)		5.4	6.4	7.9	10.9	13.3	15.8
	Size		2	2	2	2	2	2
HK 44	Permissible pressure p_{max} (bar)		230	200	160	110	90	80
HKF 44	Continuous operation S1 p_1 (bar)		170	140	110	80	70	60
	Flow rate Q_{max} (l/min)	50 Hz	7.6	9.0	11.1	15.3	18.7	22.2
		60 Hz	9.2	10.9	13.4	18.5	22.6	26.9
HK 48	Permissible pressure p_{max} (bar)		250	250	250	240	200	160
HKF 48	Continuous operation S1 p_1 (bar)		220	180	150	110	90	70
	Flow rate Q_{max} (l/min)	50 Hz	7.7	9.1	11.2	15.5	18.9	22.4
		60 Hz	9.2	10.9	13.5	18.6	22.7	26.9

2.2.2 Dual-circuit pump with shared connection base

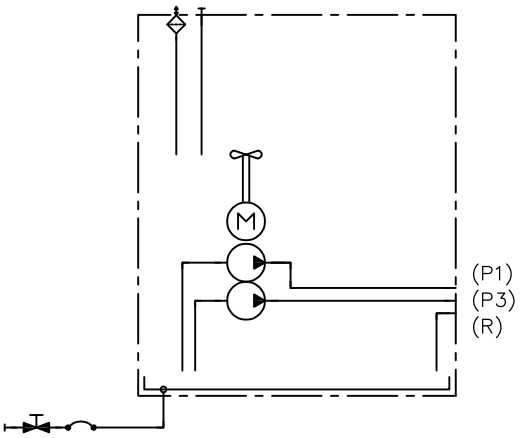
a) Radial piston pump version - radial piston pump HH and radial piston pump - gear pump HZ

INFORMATION

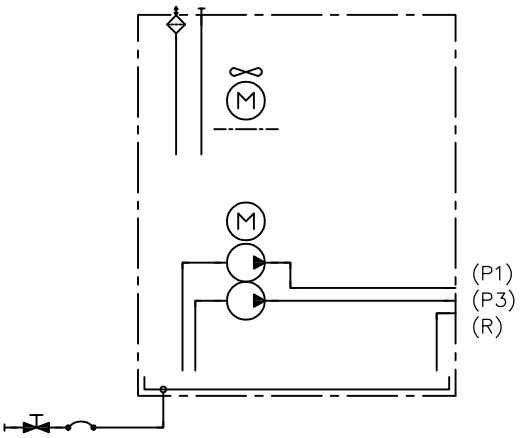
For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Circuit symbol

HK



HKF



Ordering examples

HK	44	ST/1	**-H**	**H**	**3,6**	**/ 6,5**	-SS -AB 1 C 250	-3x400/230 V 50 Hz
HK	449	DT/1 P	**-H**	**Z**	**1,5**	**/ 8,8**	-AN21F2C50 - C315	-3x400/230 V 50 Hz

Pressure connection P3 2.2.2.2 "Pressure connection P3"

Pressure connection P1 2.2.2.1 "Pressure connection P1"

Pressure connection P3 2.2.2.2 "Pressure connection P3"

Pressure connection P1 2.2.2.1 "Pressure connection P1"

Combination options

Coding	P1	P3	Examples
HH	3 pump elements	3 pump elements	HH 0.9/0.9
HZ	3 pump elements	Gear pump size 1	HZ 1.25/11.3
	3 pump elements	Gear pump size 2	HZ 0.9/16
	5 pump elements	Gear pump size 1	HZ 2.08/9.8
	5 pump elements	Gear pump size 2	HZ 1.4/8.8
	6 pump elements	Gear pump size 1	HZ 1.8/6.9
	6 pump elements	Gear pump size 2	HZ 5.0/21

2.2.2.1 Pressure connection P1

INFORMATION

Re the following points see Chapter 3.6, "Motor data":

- The flow rate Q_{max} relates to the rated speed and varies depending on the load.
- Notes on pressures p_{max} (see Chapter 3.6, "Motor data").

Radial piston pump H

Delivery flow coding	H 0.9	H 1.25	H 1.4	H 1.5	H 1.8	H 2.08	H 2.45	H 2.5	H 2.6
Displacement volume V_g (cm³/rev)	0.64	0.88	1.07	1.15	1.29	1.46	1.75	1.79	1.91
Piston diameter (mm)	6	7	6	8	6	7	7	10	8
Number of pump elements	3	3	5	3	6	5	6	3	5

Delivery flow coding	H 3.2	H 3.6	H 4.2	H 4.3	H 5.0	H 5.1	H 5.6	H 6.0	H 6.5
Displacement volume V_g (cm³/rev)	2.29	2.58	2.98	3.03	3.58	3.51	4.03	4.30	4.58
Piston diameter (mm)	8	12	10	13	10	14	15	12	16
Number of pump elements	6	3	5	3	6	3	3	5	3

Delivery flow coding	H 7.0	H 7.2	H 8.3	H 8.6	H 9.5	H 9.9	H 10.9	H 11.5	H 13.1
Displacement volume V_g (cm³/rev)	5.04	5.16	5.85	6.05	6.72	7.02	7.64	8.06	9.17
Piston diameter (mm)	13	12	14	13	15	14	16	15	16
Number of pump elements	5	6	5	6	5	6	5	6	6

2.2.2.2 Pressure connection P3

INFORMATION

Re the following points see Chapter 3.6, "Motor data":

- The flow rate Q_{max} relates to the rated speed and varies depending on the load.
- Notes on pressures p_{max} (see Chapter 3.6, "Motor data").

Radial piston pump H

Delivery flow coding	H 0.9	H 1.25	H 1.5	H 2.5	H 3.6	H 4.3	H 5.1	H 5.6	H 6.5
Displacement volume V_g (cm³/rev)	0.64	0.88	1.15	1.79	2.58	3.03	3.51	4.03	4.58
Piston diameter (mm)	6	7	8	10	12	13	14	15	16
Number of pump elements	3	3	3	3	3	3	3	3	3

Gear pump Z

INFORMATION

For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Delivery flow coding	Z 2	Z 2.7	Z 3.5	Z 4.5	Z 5.2	Z 6.5	Z 6.9	Z 8.8	Z 9
Displacement volume V_g (cm³/rev)	1.6	2.15	2.65	3.35	4.25	4.5	5.35	6.65	6.0
Size	1	1	1	1	1	2	1	1	2

Delivery flow coding	Z 9.8	Z 11.3	Z 12.3	Z 14.4	Z 16	Z 21
Displacement volume V_g (cm³/rev)	7.1	8.5	8.5	10.65	11.0	14.5
Size	1	1	2	1	2	2

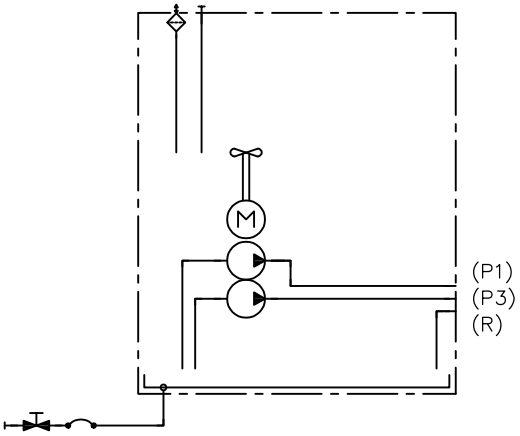
b) Version of gear pump – gear pump ZZ

INFORMATION

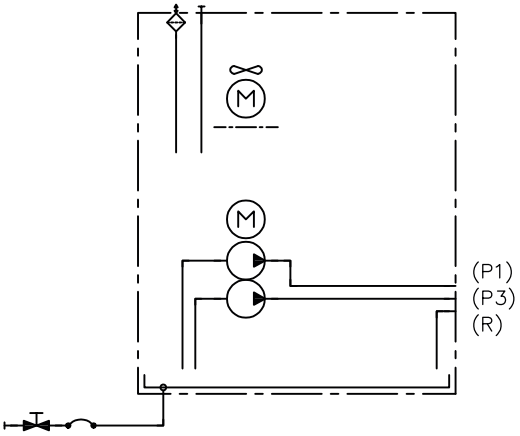
For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Circuit symbol

HK



HKF



Ordering example

HK	489	DT/1 M	-Z	Z	2,7	/ 9,8	-SS -UF 1-AB 1 E 120	-3x400/230 V 50 Hz

Pressure connection P3 2.2.2.3 "Pressure connection P1 and P3"

Pressure connection P1 2.2.2.3 "Pressure connection P1 and P3"

Pressure connection P3 2.2.2.3 "Pressure connection P1 and P3"

Pressure connection P1 2.2.2.3 "Pressure connection P1 and P3"

Available combinations:

ZZ 2.7/5.2	ZZ 3.5/5.2	ZZ 5.2/11.3
ZZ 2.7/8.8	ZZ 4.5/4.5	ZZ 6.9/11.3
ZZ 2.7/9.8	ZZ 4.5/9.8	ZZ 8.8/8.8
ZZ 2.7/11.3	ZZ 4.5/11.3	ZZ 11.3/11.3

2.2.2.3 Pressure connection P1 and P3

INFORMATION

Re the following points see Chapter 3.6, "Motor data":

- The flow rate Q_{max} relates to the rated speed and varies depending on the load.
- Notes on pressures p_{max} (see Chapter 3.6, "Motor data").
- The permitted pressures p_{max} apply to a version with a 3x400 V 50 Hz/460 V 60 Hz or 3x230 V 50 Hz/265 V 60 Hz motor
- Be aware of different motor power ratings and resulting permissible maximum pressures $p_{max} = (pV_g)_{max} / V_g$. at other nominal voltages and power frequencies $(pV_g)_{max}$.

INFORMATION

For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Gear pump Z

Delivery flow coding	Z 2.7	Z 3.5	Z 4.5	Z 5.2	Z 6.9	Z 8.8	Z 9.8	Z 11.3
Displacement volume V_g (cm^3/rev)	2.15	2.65	3.35	4.25	5.35	6.65	7.1	8.5
Size	1	1	1	1	1	1	1	1

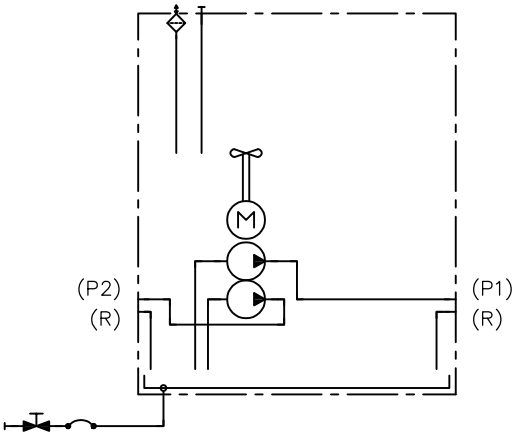
2.2.3 Dual-circuit pumps with separate connection pedestals

INFORMATION

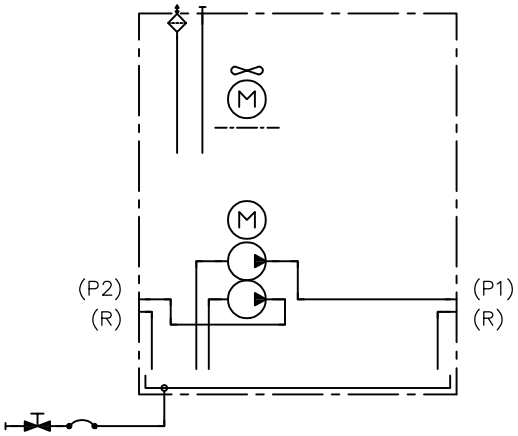
For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Circuit symbol

HK



HKF



Ordering examples

HKF	449	DT/1	**-Z 4,5**	**-Z 4,5**	-AL 21 D 10 - E/70/90 -AL 21 D 10 - E/90/100	-3x400/230 V 50 Hz
HK	43	DT/1M	**-H 0,9**	**-H 1,5**	-AB 1 K E 150	-3x400/230 V 50 Hz
HKF	449	DT	**-H 0,9**	**-Z 16**	-AB 1 K E 160 -AL 21 F3 VM - E/85/100 - 7/70	-3x400/230 V 50 Hz

Pressure connection P2 2.2.3.2 "Pressure connection P2"

Pressure connection P1 2.2.3.1 "Pressure connection P1"

Combination options

Coding	P1	P3	Examples
H - H	3 pump elements	3 pump elements	H 0.9 - H 0.9
H - Z	3 pump elements	Gear pump size 1	H 1.25 - Z 11.3
	3 pump elements	Gear pump size 2	H 0.9 - Z 16
	5 pump elements	Gear pump size 1	H 2.08 - Z 9.8
	5 pump elements	Gear pump size 2	H 1.4 - Z 8.8
	6 pump elements	Gear pump size 1	H 1.8 - Z 6.9
	6 pump elements	Gear pump size 2	H 3.2 - Z 21
Z - Z	Gear pump size 1	Gear pump size 1	Z 4.5 - Z 4.5

2.2.3.1 Pressure connection P1

NOTICE

Re the following points see Chapter 3.6, "Motor data":

- The flow rate Q_{max} relates to the rated speed and varies depending on the load.
- Notes on pressures p_{max} (see Chapter 3.6, "Motor data").
- The permitted pressures p_{max} apply to a version with a 3x400 V 50 Hz/460 V 60 Hz or 3x230 V 50 Hz/265 V 60 Hz motor
- Be aware of different motor power ratings and resulting permissible maximum pressures $p_{max} = (pV_g)_{max} / V_g$. at other nominal voltages and power frequencies $(pV_g)_{max}$.

Radial piston pump H

Delivery flow coding	H 0.9	H 1.25	H 1.4	H 1.5	H 1.8	H 2.08	H 2.45	H 2.5	H 2.6
Displacement volume V_g (cm³/rev)	0.64	0.88	1.07	1.15	1.29	1.46	1.75	1.79	1.91
Piston diameter (mm)	6	7	6	8	6	7	7	10	8
Number of pump elements	3	3	5	3	6	5	6	3	5

Delivery flow coding	H 3.2	H 3.6	H 4.2	H 4.3	H 5.0	H 5.1	H 5.6	H 6.0	H 6.5
Displacement volume V_g (cm³/rev)	2.29	2.58	2.98	3.03	3.58	3.51	4.03	4.30	4.58
Piston diameter (mm)	8	12	10	13	10	14	15	12	16
Number of pump elements	6	3	5	3	6	3	3	5	3

Delivery flow coding	H 7.0	H 7.2	H 8.3	H 8.6	H 9.5	H 9.9	H 10.9	H 11.5	H 13.1
Displacement volume V_g (cm³/rev)	5.04	5.16	5.85	6.05	6.72	7.02	7.64	8.06	9.17
Piston diameter (mm)	13	12	14	13	15	14	16	15	16
Number of pump elements	5	6	5	6	5	6	5	6	6

Gear pump Z

INFORMATION

For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Delivery flow coding	Z 2.7	Z 4.5	Z 5.2	Z 8.8	Z 11.3
Displacement volume V_g (cm³/rev)	2.15	3.35	4.25	6.65	8.5
Size	1	1	1	1	1

Available combinations:

Z 2.7 - Z 5.2	Z 4.5 - Z 4.5	Z 8.8 - Z 8.8	Z 11.3 - Z 11.3

2.2.3.2 Pressure connection P2

NOTICE

Re the following points see Chapter 3.6, "Motor data":

- The flow rate Q_{max} relates to the rated speed and varies depending on the load.
- Notes on pressures p_{max} (see Chapter 3.6, "Motor data").
- The permitted pressures p_{max} apply to a version with a 3x400 V 50 Hz/460 V 60 Hz or 3x230 V 50 Hz/265 V 60 Hz motor
- Be aware of different motor power ratings and resulting permissible maximum pressures $p_{max} = (pV_g)_{max} / V_g$. at other nominal voltages and power frequencies $(pV_g)_{max}$.

Radial piston pump H

Delivery flow coding	H 0.9	H 1.25	H 1.5	H 2.5	H 3.6	H 4.3	H 5.1	H 6.5
Displacement volume V_g (cm^3/rev)	0.64	0.88	1.15	1.79	2.58	3.03	3.51	4.58
Piston diameter (mm)	6	7	8	10	12	13	14	16
Number of pump elements	3	3	3	3	3	3	3	3

Gear pump Z

INFORMATION

For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Delivery flow coding	Z 2	Z 2.7	Z 3.5	Z 4.5	Z 5.2	Z 6.5	Z 6.9	Z 8.8	Z 9
Displacement volume V_g (cm^3/rev)	1.6	2.15	2.65	3.35	4.25	4.5	5.35	6.65	6.0
Size	1	1	1	1	1	2	1	1	2

Delivery flow coding	Z 9.8	Z 11.3	Z 12.3	Z 14.4	Z 16	Z 21	Z 24
Displacement volume V_g (cm^3/rev)	7.1	8.5	8.5	10.65	11.0	14.5	17.0
Size	1	1	2	1	2	2	2

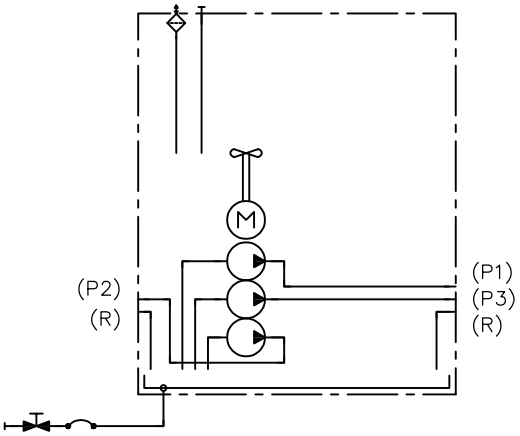
2.2.4 Three-circuit pumps

INFORMATION

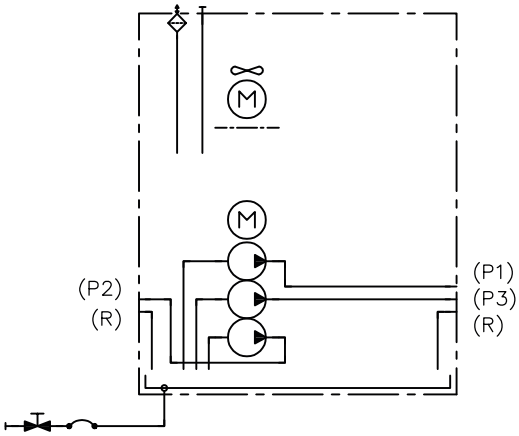
For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Circuit symbol

HK



HKF



Ordering examples

HK	43	ST/1	**-H**	**H**	**1,6**	**/ 1,6**	**-H 1,6**	-C30 -UF 1-AB 1 E 120 -UF 1-AB 1 B 450	-3x400/230 V 50 Hz
HK	449	DT/1	**-H**	**H**	**3,3**	**/ 0,83**	**-Z 9,8**	-SS -AB 1 E 120 - G 24 -UF 1 AB 1 E 100	-3x400/230 V 50 Hz
HKF	489	DT/1	**-H**	**H**	**0,9**	**/ 0,9**	**-Z 8,8**	-U4 - AP1 F3-P4-42/290 - G 24 -AL 21 R F3 D/160/180 - 23	-3x400/230 V 50 Hz

Pressure connection P2 2.2.4.2 "Pressure connection P2"

Pressure connection P3 2.2.4.1 "Pressure connection P1 and P3"

Pressure connection P1 2.2.4.1 "Pressure connection P1 and P3"

Pressure connection P3 2.2.4.1 "Pressure connection P1 and P3"

Pressure connection P1 2.2.4.1 "Pressure connection P1 and P3"

Combination options

Coding	P1	P3	P2	Examples
HH - H	2 pump elements	2 pump elements	2 pump elements	HH 1.6/1.6 - H 2.8
HH - Z	2 pump elements	2 pump elements	Gear pump size 1	HH 1.6/1.6 - Z 8.8
	3 pump elements	3 pump elements	Gear pump size 1	HH 4.3/4.3 - Z 11.3
	3 pump elements	3 pump elements	Gear pump size 2	HH 6.5/3.6 - Z 16

2.2.4.1 Pressure connection P1 and P3

NOTICE

Re the following points see Chapter 3.6, "Motor data":

- The flow rate Q_{max} relates to the rated speed and varies depending on the load.
- Notes on pressures p_{max} (see Chapter 3.6, "Motor data").
- The permitted pressures p_{max} apply to a version with a 3x400 V 50 Hz/460 V 60 Hz or 3x230 V 50 Hz/265 V 60 Hz motor
- Be aware of different motor power ratings and resulting permissible maximum pressures $p_{max} = (pV_g)_{max} / V_g$. at other nominal voltages and power frequencies $(pV_g)_{max}$.

Radial piston pump H

Delivery flow coding	H 0.6	H 0.83	H 0.9	H 1.0	H 1.25	H 1.5	H 1.6	H 2.4	H 2.5
Displacement volume V_g (cm³/rev)	0.43	0.58	0.64	0.76	0.88	1.15	1.19	1.72	1.79
Piston diameter (mm)	6	7	6	8	7	8	10	12	10
Number of pump elements	2	2	3	2	3	3	2	2	3

Delivery flow coding	H 2.8	H 3.3	H 3.6	H 3.8	H 4.3	H 5.0	H 5.1	H 5.6	H 6.5
Displacement volume V_g (cm³/rev)	2.02	2.34	2.58	2.69	3.03	3.06	3.51	4.03	4.58
Piston diameter (mm)	13	14	12	15	13	16	14	15	16
Number of pump elements	2	2	3	2	3	2	3	3	3

2.2.4.2 Pressure connection P2

NOTICE

Re the following points see Chapter 3.6, "Motor data":

- The flow rate Q_{max} relates to the rated speed and varies depending on the load.
- Notes on pressures p_{max} (see Chapter 3.6, "Motor data").
- The permitted pressures p_{max} apply to a version with a 3x400 V 50 Hz/460 V 60 Hz or 3x230 V 50 Hz/265 V 60 Hz motor
- Be aware of different motor power ratings and resulting permissible maximum pressures $p_{max} = (pV_g)_{max} / V_g$. at other nominal voltages and power frequencies $(pV_g)_{max}$.

Radial piston pump H

Delivery flow coding	H 0.9	H 1.25	H 1.5	H 2.5	H 3.6	H 4.3	H 5.1	H 5.6	H 6.5
Displacement volume V_g (cm³/rev)	0.64	0.88	1.15	1.79	2.58	3.03	3.51	4.03	4.58
Piston diameter (mm)	6	7	8	10	12	13	14	15	16
Number of pump elements	3	3	3	3	3	3	3	3	3

Gear pump Z

INFORMATION

For this pump version, the maximum hydraulic work value $(pV_g)_{max}$ is 10% lower.

Delivery flow coding	Z 2	Z 2.7	Z 3.5	Z 4.5	Z 5.2	Z 6.9	Z 8.8	Z 9.8	Z 11.3
Displacement volume V_g (cm³/rev)	1.6	2.15	2.65	3.35	4.25	5.35	6.65	7.1	8.5
Size	1	1	1	1	1	1	1	1	1

Delivery flow coding	Z 12.3	Z 14.4	Z 16
Displacement volume V_g (cm³/rev)	8.5	10.65	11.0
Size	2	1	2

3 Parameters

3.1 General data

Conformity	▪ Declaration of incorporation according to Machinery Directive 2006/42/EC ▪ Declaration of conformity according to Low-Voltage Directive 2014/35/EU ▪ UKCA declaration of conformity according to Electrical Equipment (Safety) Regulations 2016 No. 1101 ▪ UL conformity of the stators - UL reference E 116360 ▪ UL conformity of the external fans - UL reference E 93656
Version / Model	Hydraulic power pack with built-in electric motor (3-phase version) and single-circuit pump, dual-circuit pump (high pressure and low pressure) or triple-circuit pump (3x high pressure or 2x high pressure and low pressure)
Pump version	Valve-controlled radial piston pump, external gear pump or internal gear pump
Operating mode	▪ Continuous operation with constant load (S1) ▪ Short period operation (S2) ▪ Periodic intermittent operation (S3) ▪ Continuous periodic operation (S6)
Installation position	vertical
Material	▪ Housing: Aluminium ▪ Terminal box: injection-moulded plastic ▪ Fan hood and sealing plate/cover: sheet steel
Attachment	see Chapter 4.1, "Mounting hole pattern"
Hydraulic connection	Via bolted-on connection blocks, see Chapter 6.1.13, "Connection blocks"
Hydraulic fluid	Hydraulic fluid, according to DIN 51 524 Parts 1 to 3; ISO VG 10 to 68 according to DIN ISO 3448 Viscosity range: 4 - 800 mm²/s Optimal operating range: approx. 10 - 500 mm²/s Also suitable for biologically degradable hydraulic fluids type HEPG (polyalkylene glycol) and HEES (synthetic ester) at operating temperatures up to approx. +70°C.
Cleanliness level	**ISO 4406** 21/18/15...19/17/13
Temperatures	Environment: approx. -25 to +60 °C, hydraulic fluid: -25 ... +80°C, ensure the correct viscosity range. Start temperature: down to -25°C is permissible (take account of the start viscosities!), as long as the steady-state temperature is at least 20 K higher during subsequent operation. Biologically degradable hydraulic fluids: note manufacturer specifications. With consideration for the seal compatibility, not above +70°C.
Rotation direction	▪ Radial piston pump – any ▪ Gear pump – anticlockwise ▪ Internal gear pump – anticlockwise ▪ Type HKF – anticlockwise (For 3-phase version: if there is no flow rate, swap over two of the three main conductors)

Speed range (min ... max)	Radial piston pump H:	200 ... 3500 min^{-1}
	Gear pump Z:	
	Z 1.1 ... Z 6.9	650 ... 3500 min^{-1}
	Z 8.8, Z 9.8, Z 11.3, Z 14.4	650 ... 3000 min^{-1}
	Z 6.5, Z 9, Z 12.3 ... Z 24	650 ... 3500 min^{-1}
	Internal gear pump IZ:	
	IZ 7.5 ... IZ 22.9	200 ... 3600 min^{-1}

3.2 Pressure and volumetric flow

Pressure

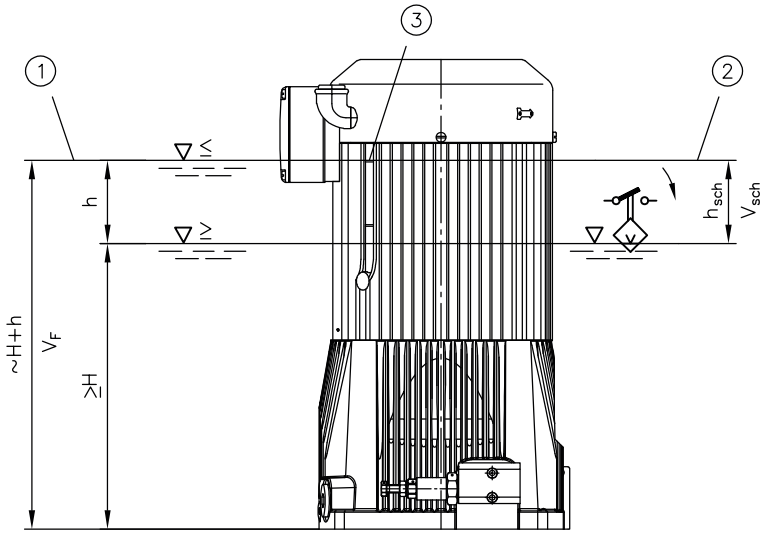
- Pressure side (port P): depends on version and flow rate, see Chapter 2.2, "Pump"
- Suction side (container interior): ambient air pressure. Not suitable for charging.

Start against pressure

The version with 3-phase motor can start against the pressure p_{max}.

Filling and extraction volumes

Fill volume and usable volume see Chapter 2.1.2, "Tank size"



1 Do not exceed the max. fill heights (see marking) as the remaining space is used for expansion purposes when the oil heats up.

2 On the version with a level switch, contact is made if the oil level height has dropped from the max. value by h_{Sch} and the volume V_{Sch} has been extracted.

3 Ring mark

	HKF 482	HK 435 HK 445 HK(F) 485	HK 439 HK 449 HK(F) 489
Oil level min. H (mm)	270	270	270
Extraction height h (mm)	75	94	214
Lowering of oil level h_{Sch} (mm)	75	94	214
Volume extracted V_{Sch} (l)	11.1	2.5	5.7

Dimensions and volumes are approximate values

3.3 Weight

Compact hydraulic power pack

(without oil filling)

Type	H HH H - H HH - H	Z IZ	H - Z HH - Z	ZZ Z - Z
HK 4.5, HKF 4.5	29.8 kg	26.3 kg	27.6 kg	29.3 kg
HK 4.9, HKF 4.9	34.4 kg	30.9 kg	33.9 kg	32.2 kg
HK 482, HKF 482	39.2 kg	36.1 kg	40.1 kg	37.3 kg

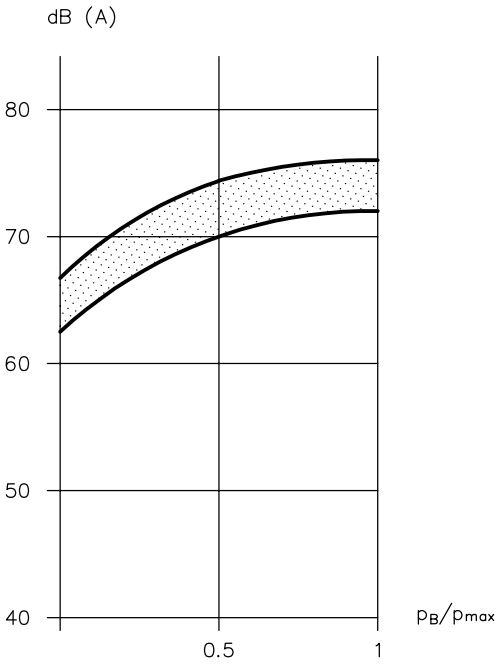
For details of the weight of the connection blocks and valve banks required, please see the associated publications, see Chapter 6.1.13, "Connection blocks" and Chapter 6.1.14, "Directional valve banks"

3.4 Characteristic lines

3.4.1 Running noise

Viscosity of the hydraulic fluid approx. 60 mm²/s

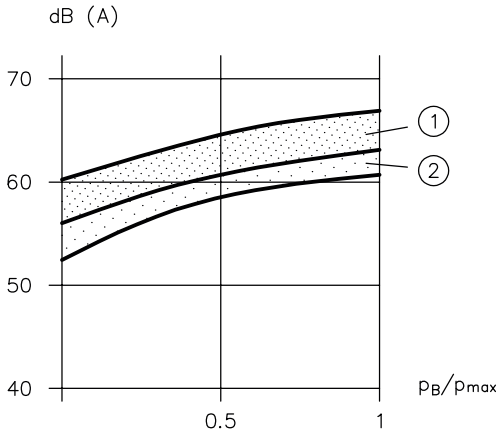
Radial piston pump



pB/pmax pressure ratio; dB noise level (A)

$\frac{p_B}{p_{max}}$ *pressure ratio*

Gear pump



pB/pmax pressure ratio; dB noise level (A)

1 Gear pump
2 internal gear pump

Measuring conditions:

Workroom, noise level approx. 50 dB(A); measuring point 1 m above ground; 1 m object distance, pump attached with 4 damping elements ∅40x30 (65 Shore, damping element brand No. 20291/V).

Measurement devices:

Precision noise level measurement device IEC 651 class I

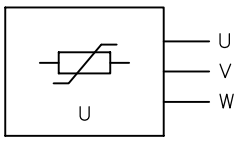
NOTICE

Pumps with smaller flow rates usually tend toward the lower limit, pumps with larger flow rates tend toward the upper limit. The noise level of dual-circuit pumps, based on the total flow rate, is approximately in the same range as that of a radial piston single-circuit pump of the same size.

3.5 Electrical data

The drive motor forms an enclosed, non-separable unit with the tank and pump.

Data applies to radial piston pumps and gear pumps.

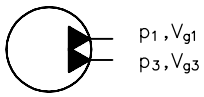
Connection	Version with HARTING connector: housing with female insert HARTING HAN 10 E or comparable, cable cross-section 1.5 mm² Version with terminal box: cable fitting M20x1.5 – must be provided by the customer
Protection class	▪ IP 54 according to IEC 60529 for variant with its own fan ▪ IP 44 according to IEC 60529 for variant with an external fan **INFORMATION** Protect the breather filter from moisture penetration.
Protection class	VDE 0100 Protection class 1
Insulation	**Designed in accordance with EN 60 664-1** ▪ For 4-wire AC voltage systems L1-L2-L3-PE (3-phase systems) **with** an earthed neutral point up to 500 V AC nominal phase voltage phase-phase ▪ For 3-wire AC voltage systems L1-L2-L3 (3-phase systems) **without** an earthed neutral point up to a nominal phase voltage of 300 V AC phase-phase ▪ For a single-phase and earthed 2-wire alternating current system L-N (alternating current or mains) up to a nominal voltage of 300 V AC.
Interference suppressor	Type RC 3 R
Coding E	▪ Operating voltage: 3x 575 V AC ▪ Frequency: 10 ... 400 Hz ▪ max. motor power: 4.0 kW 

3.6 Motor data

INFORMATION

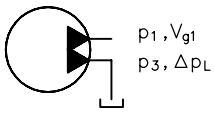
- The current consumption of the motor is dependent on the load. The nominal values only apply for one operating point. In modes S2 and S3 the motor may be used at up to about 1.8 times its nominal power. The heat development which is increased here is cooled in the no-load phases or during downtimes.
- The flow and pump flow rate can be estimated on the basis of the average and maximum hydraulic work values $(pV_g)_m$ and $(pV_g)_{max}$.
- The relevant load case is responsible for current consumption in dual-circuit pumps. The hydraulic work of the individual circuits is to be determined and added.

All connections pressurised:



Dual-circuit pumps $(pV_g)_{calc.} = p_1 V_{g1} + p_3 V_{g3}$

One connection pressurised, the other one delivering in circulation mode:



Dual-circuit pumps $(pV_g)_{calc.} = p_1 V_{g1} + \Delta p_L V_{g3}$

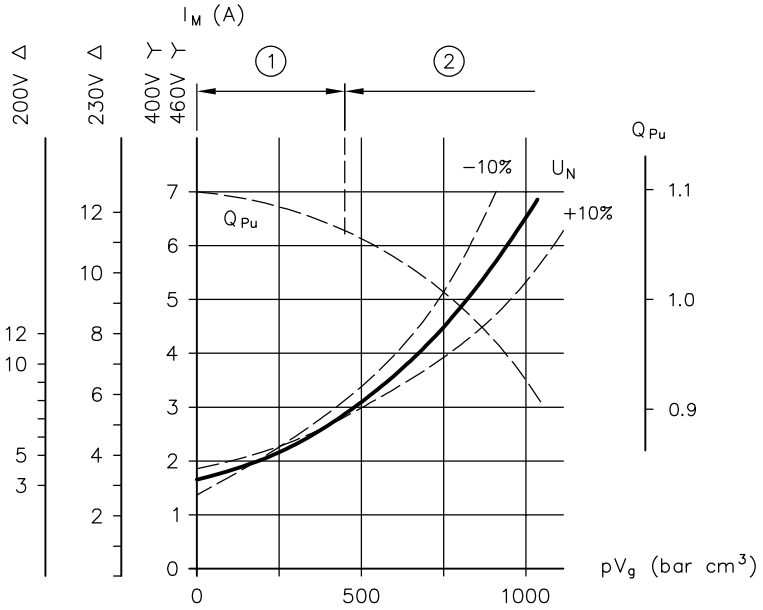
- Voltage tolerances: ± 10% (IEC 38), at 3x460/265 V 60 Hz ± 5%
  It can be operated at undervoltage; see Chapter 6.1.5, "Selecting the compact hydraulic power pack"!
- For pump version **Z**, **HH**, **HZ**, **H - H**, **H - Z**, **HH - Z**, **ZZ** or **Z - Z**, the max. hydraulic work value $(pV_g)_{max}$ is 10% lower.

Type	Nominal voltage and power frequency U_N (V), f (Hz)	Nominal power P_N (kW)	Rated speed n_N (min^{-1})	Nominal current I_N (A)	Starting current ratio I_A / I_N	Power factor cos φ	max. hydraulic work vlue $(pV_g)_{max}$ (bar cm³/rev)
HK 43 HKF 43	3x400/230 V 50 Hz	1.5	1395	3.1/5.4	4.2	0.91	900
	3x460/265 V 60 Hz	1.8	1674	2.8/5.2	4	0.9	900
	3x500 V 50 Hz	1.5	1395	2.5	3.8	0.91	900
	3x600 V 60 Hz	1.8	1670	2.5	3.8	0.91	900
HK 44 HKF 44	3x400/230 V 50 Hz	2.2	1405	4.8/8.3	5.4	0.85	1250
	3x460/265 V 60 Hz	2.6	1700	4.8/8.3	5	0.85	1250
	3x500 V 50 Hz	2.2	1405	3.9	4.8	0.85	1250
	3x600 V 60 Hz	2.6	1686	3.9	4.8	0.85	1250
	3x380 V 60 Hz	2.6	1710	4.9	5	0.84	1250
	3x200 V 50 Hz	2.2	1420	10.7	5.4	0.78	990
	3x220 V 60 Hz	2.6	1705	9.4	5.4	0.85	990
HK 48 HKF 48	3x400/230 V 50 Hz	3	1420	6.3/11.0	6.3	0.83	2600
	3x460/265 V 60 Hz	3.6	1704	6.3/11.0	6.3	0.83	2600
	3x500 V 50 Hz	3	1420	5	6	0.83	2600
	3x600 V 60 Hz	3.6	1704	5	6	0.83	2600
	3x200 V 50 Hz	3	1420	12	6.5	0.83	2000
	3x220 V 60 Hz	3.6	1700	12.5	6.5	0.89	2000

3.6.1 Current consumption characteristic lines

Current consumption

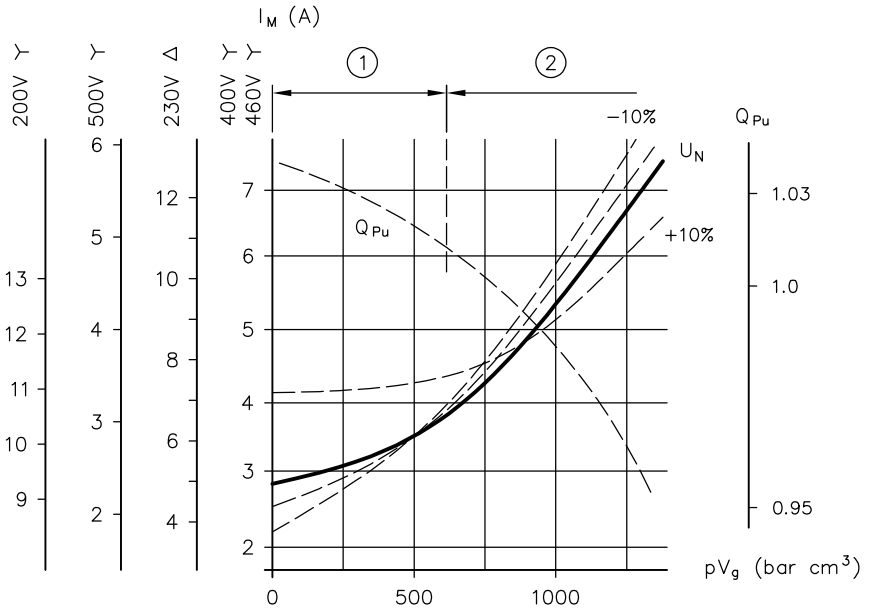
HK 43, HKF 43



pV_g hydraulic work value (bar cm³); I_M motor current (A); Q_{Pu} flow rate progression (trend) 1.0

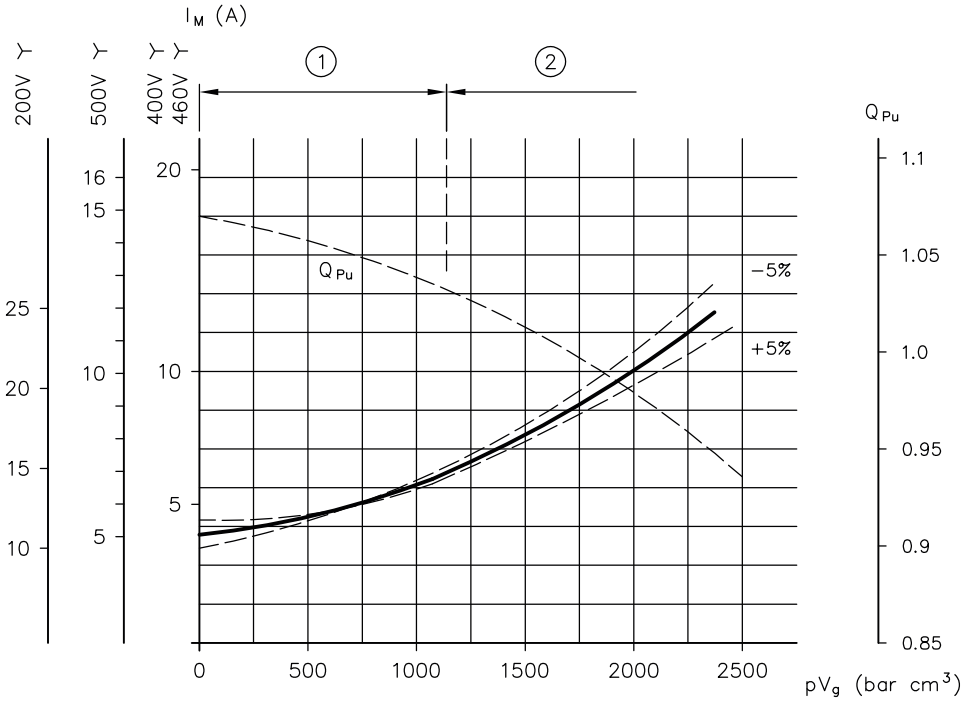
1 Area S1
2 Area S6

HK 44, HKF 44



pV_g hydraulic work value (bar cm³); I_M motor current (A); Q_{Pu} flow rate progression (trend) 1.0

1 Area S1
2 Area S6



pV_g hydraulic work value (bar cm³); I_M motor current (A); Q_{Pu} flow rate progression (trend) 1.0

1 Area S1
2 Area S6

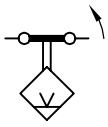
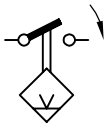
NOTICE

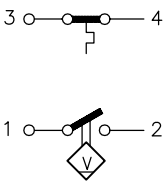
The set value is based on the respective motor/pump combination and the respective load/load cycle.

However, it is permitted to be max. 16 A. The limit is based on the rated current of 16 A for the electrical connection and applies to both the terminal board and the HARTING male insert HAN 10.

3.7 Additional options

3.7.1 Level switch

Coding	**A, D, S**
Max. switching capacity	AC/DC: 10 VA **NOTICE** The specified max. switching capacity must not be exceeded by the combination of switching voltage and switching current.
Max. current	AC/DC: 0.5 A
Max. voltage	AC/DC: 36 V
Electrical connection	see Chapter 4.3.2, "Electrical connections"
Circuit symbol	Coding **A, D** (N/C contact)  Coding **S** (N/O contact) 

Coding	**D-D**
Max. switching capacity	AC/DC: 3 VA
Max. current	AC/DC: 0.25 A
Max. voltage	AC/DC: 42 V
Electrical connection	see Chapter 4.3.2, "Electrical connections"
Circuit symbol	

A protective circuit is to be implemented in the case of an inductive load!

3.7.2 Temperature switch

Technical data:

- Bimetallic-element switch

Coding	**T, T60, T55, T65, T55T65, W, W60**
Signal indication	▪ 80°C ± 5K (coding T, W) ▪ 60°C ± 5K (coding T60, W60) ▪ 55°C or 65°C (coding T55, T65)
Max. switching capacity	AC/DC: 10 VA
Max. current at 24 V (cos φ = 1)	0.5 A
Max. voltage	AC/DC: 36 V
Electrical connection	see Chapter 4.3.2, "Electrical connections"
Switching hysteresis	30 K ± 15 K
Circuit symbol	N/C contact

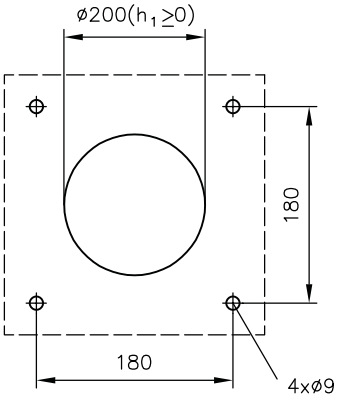
3.7.3 External fan

Coding	**HKF**
Temperature range	-25°C to +80 °C
Electrical connection	In terminal box or HARTING connector (see Chapter 4.3.2, "Electrical connections")
Motor data	U_N / P_N (W) / Rotation speed (min^{-1}) / Protection class
	3x400/230 V 50 Hz ⅄△ / 120 / 2700 / IP 44
	3x460/265 V 60 Hz ⅄△ / 170 / 3120 / IP 44

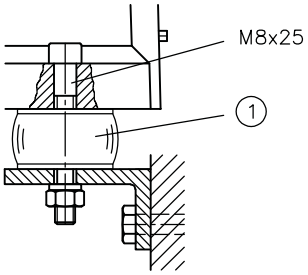
4 Dimensions

All dimensions in mm, subject to change.

4.1 Mounting hole pattern



Recommended fastening with damping element



1 Damping element ∅40x30 /M8

NOTICE

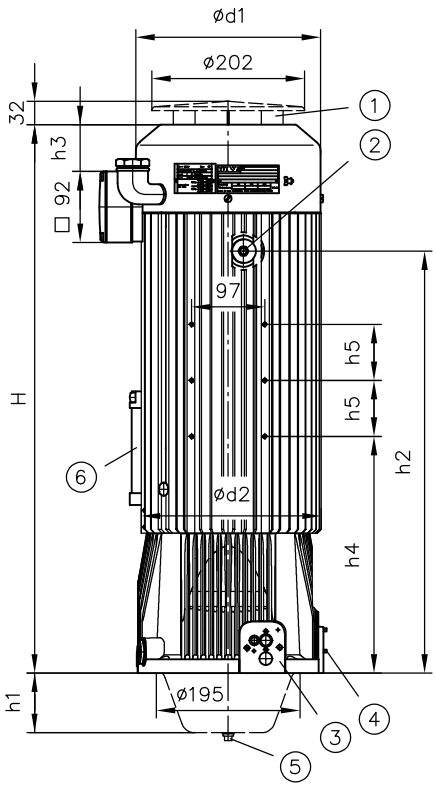
Hydraulic power pack attachment

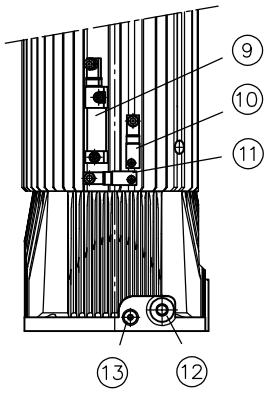
Subject vibration isolators to compressive stresses only.

INFORMATION

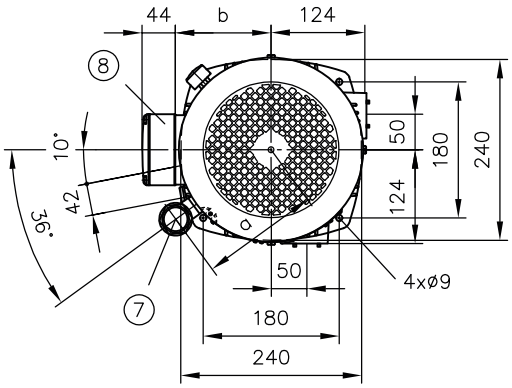
The version of the hydraulic power pack and associated valve mounting determine which is the correct damping element to select.

4.2 Basic pump





1 Fan cover, coding R
2 Drain port G 3/4, as standard
3 Main connection base
4 Second connection base
5 Drain screw G 1/4
6 Level switch, coding D, D-D, S
7 Oil filler G 1 1/4 series
8 Terminal box
9 Level switch, coding A
10 Temperature switch coding W60
11 Temperature switch, coding W
12 Connection for auxiliary tank G 3/4
13 Oil drain G 1/4



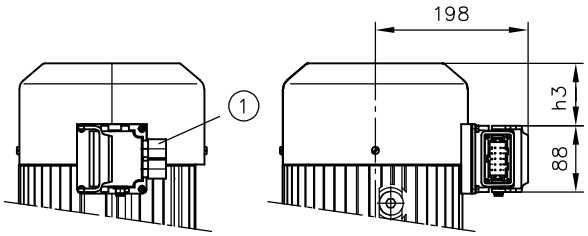
Pump version	h1
H, H-H, HH-H Z (size 1: Z 2 ... Z 11.3)	--
Z (Z 14.4 / size 2: 6.5 ... Z 16) IZ, ZZ, Z-Z HZ (Z 2.0 to 11.3)	79
Z (Z 21, Z 24) HZ (Z 6.5 to Z 24) H-Z HH-Z	103

Type	H	h2	h3	h4	h5	∅d1	∅d2	a	b
HK 4	460	--	50	--	--	219	174	135	114
HK 4.5	483	328	50	--	--	245	198	148	123
HK 4.9	603	448	50	337	74	245	198	148	123
HKF 4.2	833	648	80	337	74	245	198	148	123
HKF 4.5	513	328	80	--	--	245	198	148	123
HKF 4.9	633	448	80	337	74	245	198	148	123

4.2.1 Additional options

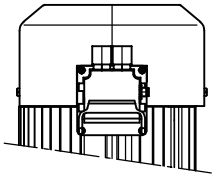
HARTING plug

Coding **P1**



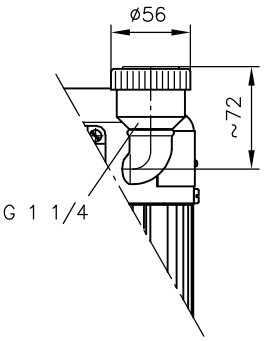
1 Suppressor coding **P1E**

Coding **P2**

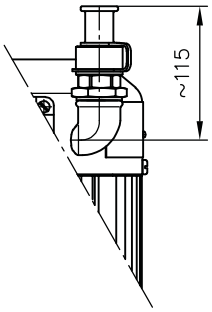


Filler reduction

Filler reduction fitting
Coding **M**



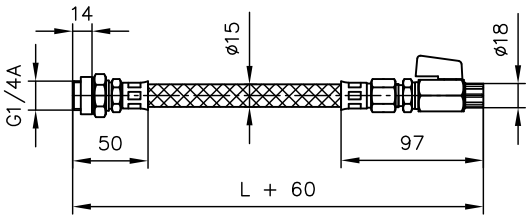
Filling coupling
Coding **MW**



Oil drain hose

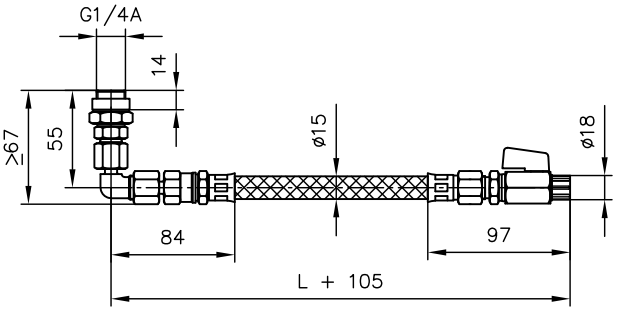
Coding **G 1/4 x 300**
G 1/4 x 500

L = 300 mm / 500 mm with ball valve



Coding **G 1/4 W x 300**
G 1/4 W x 500

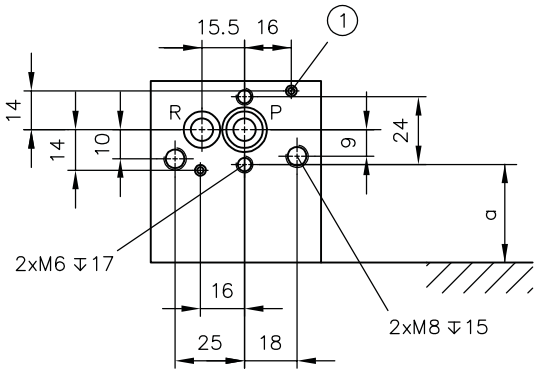
L = 300 mm / 500 mm with ball valve and bracket



4.3 Connections

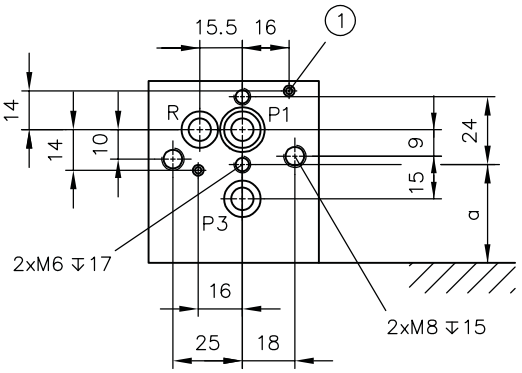
4.3.1 Hydraulic connections

Dual-circuit pump with separate connection base (second connection base)
Three-circuit pump (second connection pedestal)



1 Centring pin

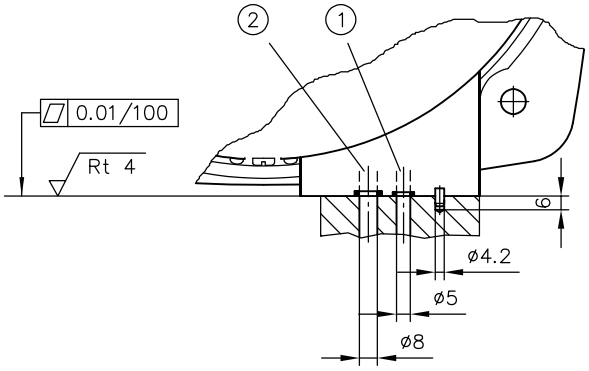
Single-circuit pump (main connection pedestal)
Dual-circuit pump with shared connection base (main connection base)
Three-circuit pump (main connection pedestal)



1 Centring pin

Type	a
HK 4, HKF 4 second connection pedestal	25
HK 4, HKF 4 main connection pedestal	31

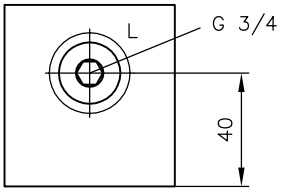
Hole for self-made connection block



1 Sealing of connections:
P1/P2/P3 = O-ring 8x2 NBR 90 Sh
2 Sealing of connections:
R = O-Ring 10x2 NBR 90 Sh

Drain port (second connection base)

Coding **L**

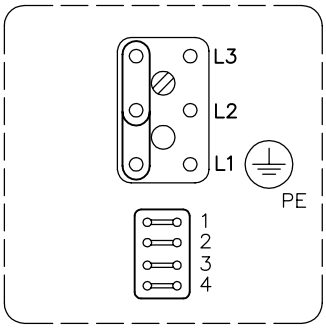


4.3.2 Electrical connections

Terminal box

HK

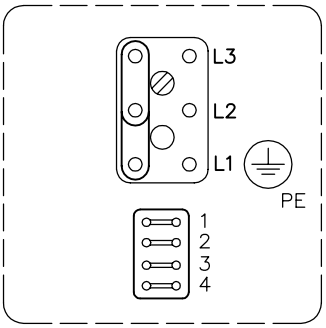
3-phase motor star pattern ⅄



HKF

3-phase motor star pattern ⅄

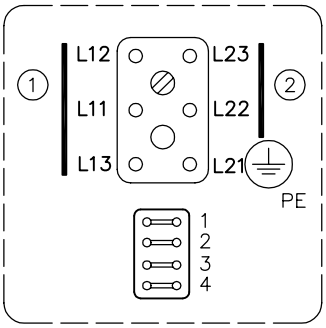
Coding /1, /2, /3, /4
(see Chapter 2.1.4, "Position of terminal box")



HKF

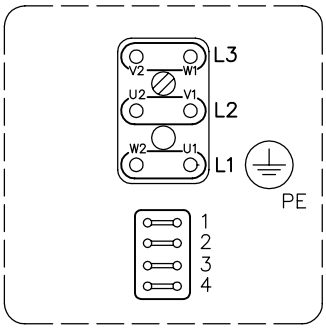
Star or delta circuit factory-set

Coding /5, /6, /7, /8
(see Chapter 2.1.4, "Position of terminal box")

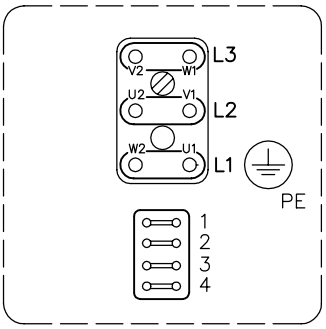


1 Fan
2 Pump

3-phase motor delta circuit △



3-phase motor delta circuit △

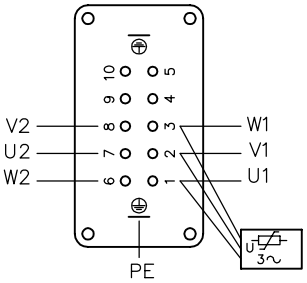


HARTING connector HAN 10 E

Coding **P1, P2, P5, P6, P11, P21, P51, P61**

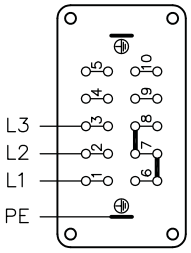
HK

Male insert (on the pump side)

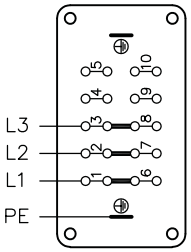


Socket (on the customer side)
Bridges are to be installed by the customer

Star pattern ⋎

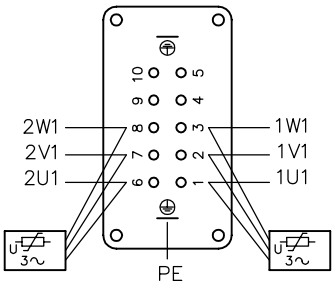


Delta circuit △



HKF

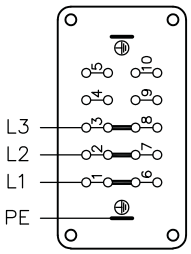
Male insert (on the pump side)



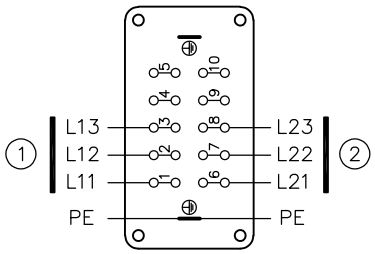
Socket (on the customer side)
Star or delta circuit factory-set

Terminal box
Coding /1, /2, /3, /4 (see Chapter 2.1.4, "Position of terminal box")

Motor and fan together



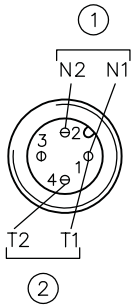
Motor and fan separately

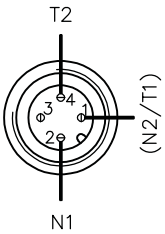


1 Pump
2 Fan

HARTING connector with M12x1 connector

Coding **DT**

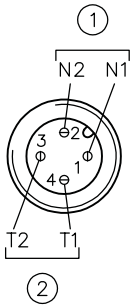


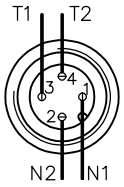


1 Level switch (NC contact)
2 Temperature switch (N/C contact)

customer-side connection (socket)

Coding **D-T**

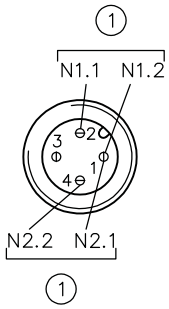


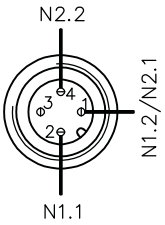


1 Level switch (NC contact)
2 Temperature switch (N/C contact)

customer-side connection (socket)

Coding **D-D**

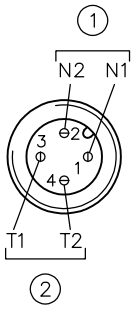


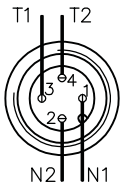


1 Level switch (NC contact)

customer-side connection (socket)

Coding **S-T**

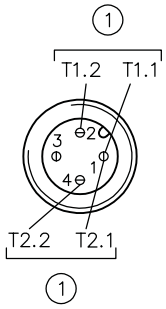


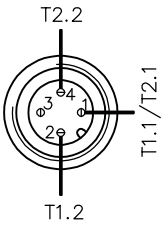


1 Level switch (N/O contact)
2 Temperature switch (N/C contact)

customer-side connection (socket)

Coding **T..T..**

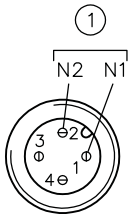


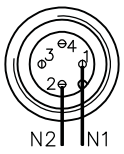


1 Temperature switch (N/C contact)

customer-side connection (socket)

Coding **D**, coding **S**





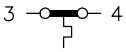
1 Level switch (NC contact)

customer-side connection (socket)

Terminal connections for version with terminal box

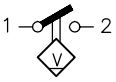
Temperature switch

Coding **T, T60**

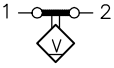


Level switch

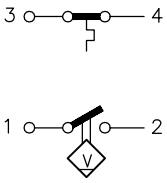
Coding **S**
(N/O contact)



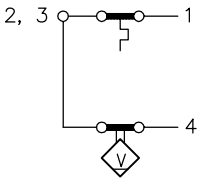
Coding **D**
(N/C contact)



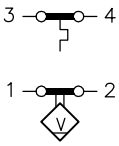
Coding **S-T**



Coding **DT**



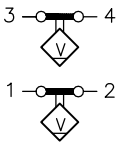
Coding **D-T**



Coding **D-D**

1. Switching point

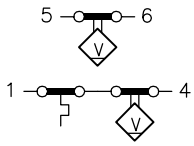
2. Switching point



Coding **D-DT**

1. Switching point

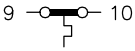
2. Switching point



Terminal connections for version with HARTING connector

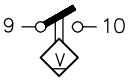
Temperature switch

Coding **T, T60**

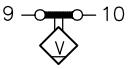


Level switch

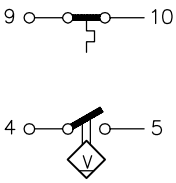
Coding **S**
(N/O contact)



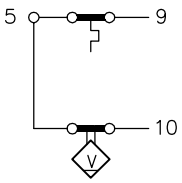
Coding **D**
(N/C contact)



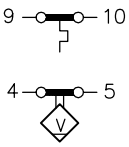
Coding **S-T**



Coding **DT**



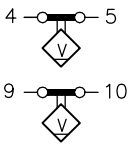
Coding **D-T**



Coding **D-D**

1. Switching point

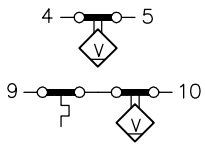
2. Switching point



Coding **D-DT**

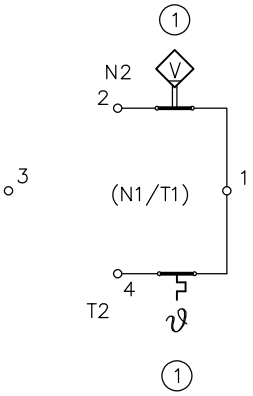
1. Switching point

2. Switching point



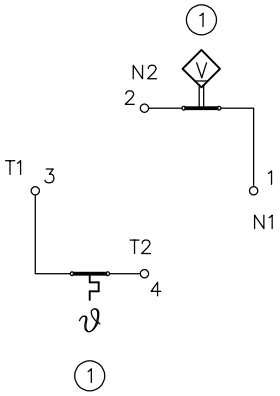
Terminal connections for version with HARTING connector with M12x1 connector

Coding **DT**



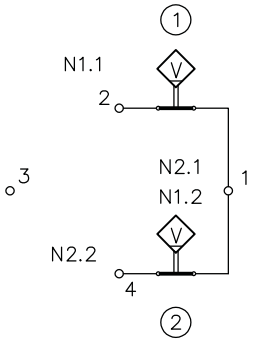
1 N/C contact

Coding **D-T**



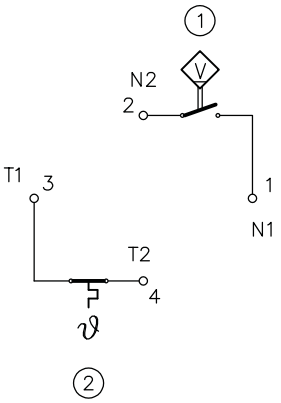
1 N/C contact

Coding **D-D**



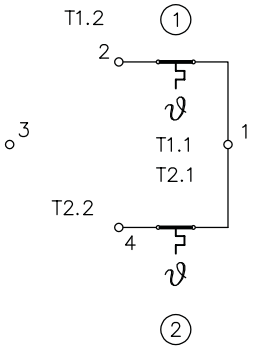
1 N/C contact switch-off
2 N/C contact pre-warning

Coding **S-T**



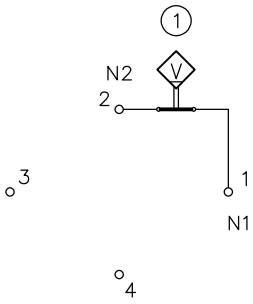
1 N/O contact
2 N/C contact

Coding **T..T..**



1 N/C contact switch-off
2 N/C contact pre-warning

Coding **D**

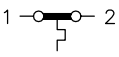


1 N/C contact

Additional options

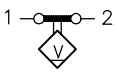
Temperature switch
(separate connection)

Coding **W, W60**



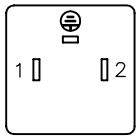
Level switch
(separate connection)

Coding **A**



Male connector

EN 175 301-803 C
(8 mm)



5 Installation, operation and maintenance information

NOTICE

Reference to other document

Assembly instructions for compact hydraulic power pack type HK and HKF: B 7600

Available for this product: assembly instructions with notes on

- intended use,
- operating and maintenance,
- Assembly information

6 Other information

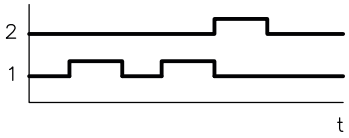
6.1 Planning information

INFORMATION

The procedure for the selection and design of compact hydraulic power packs with a valve attachment is described below. In order to find the ideal solution, several iterative steps generally have to be carried out.

6.1.1 Drawing up function diagram

The required or desired (hydraulically activated) functions form the basis for the function diagram.



6.1.2 Determining pressures and flow rates

1. Dimension and select actuators based on the reaction forces that occur
2. Calculate flow rates based on the desired velocity profiles

NOTICE

Observe the reset times of spring-loaded clamping cylinders when dimensioning pipelines or hose lines as well as the valves

In the case of time-linked clamping devices, the release of spring-loaded clamping cylinders may have a greater influence over the time interval than clamping. The return stroke times are determined exclusively by the forces of the reset springs. They drive the cylinder pistons ahead, against the flow resistance from directional valves and pipelines.

3. Calculate necessary operating pressures
4. Determine maximum necessary pump flow rate Q (l/min)
5. Determine system operating pressure p_{max} (bar)

Q - flow rate

p - pressure

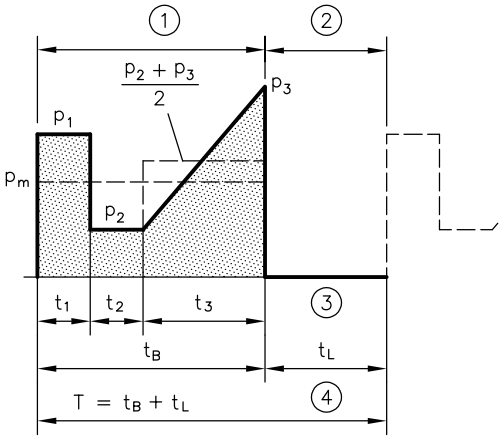
A - Area

v - Velocity

F - Force

$$Q\left(l/\min\right) = 0,06 \cdot A\left(mm^2\right) \cdot v\left(\frac{m}{s}\right)$$

$$p\left(bar\right) = \frac{10 \cdot F(N)}{A(mm^2)}$$



1 Loaded period tB
2 No-load period tL
3 No load
4 One working cycle

6.1.3 Creating a hydraulic circuit diagram

Selection criteria

- Single circuit system
- Accumulator charging mode
- Dual-circuit systems with two separately operating hydraulics circuits
- Dual-circuit systems with a shared hydraulics circuit (for instance, in presses or hydraulic tools as high-pressure systems / low-pressure systems, in handling systems with velocity control for rapid feed/creep)
- Use of an accumulator to provide short-term support for the pump flow rate

6.1.4 Drawing up a time/load diagram on the basis of a function diagram

Deriving the mode for the compact hydraulic power pack

- ► Calculation of the relative duty cycle %ED
- ► S1 – Continuous operation (only suitable to a limited extent for compact hydraulic power packs)
- ► S2 – Short period operation
- ► S3 – Periodic intermittent operation
- ► S6 – Continuous operation with intermittent load

6.1.5 Selecting the compact hydraulic power pack

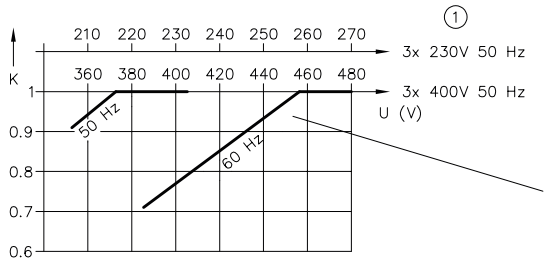
1. Select basic type based on power supply
   - 3-phase power
2. Select motor
   - Voltage tolerances: ± 10% (IEC 60038), at 3x460/265 V 60 Hz ± 5%
   - A 400 V 50 Hz 3-phase motor can be used without restrictions in 460 V 60 Hz supply networks.
   - It can be operated at undervoltage. Bear in mind that this will involve performance restrictions.

     $p_{max\ red} = p_{max} * k$

     p_{max} (bar) – max. operating pressure in accordance with the selection tables

     $p_{max\ red}$ (bar) – reduced max. available operating pressure

     * k – correction factor from the diagram



U supply voltage (V); K correction factor

1 Motor design

> **INFORMATION**
> Pump flow rate 1.2 x greater than with 50 Hz operation.

3. Select electrical connection
   - Terminal box
   - HARTING plug
4. Select pump type (radial piston pump, gear pump, internal gear pump, pump combination)
5. Select the key figure for the pump flow rate, taking into account the maximum permissible pressure
6. Determine basic type based on motor size
7. Estimate noise level on the basis of parameters

6.1.6 Calculating the hydraulic work value

1. Calculate mean pressure
2. Calculate mean hydraulic work value (average pressure x flow rate)
3. Calculate maximum hydraulic work value (max. operating pressure x flow rate)

Calculation

p_m (bar) = calculated average pressure per cycle during the load time

$t_B = t_1 + t_2 + t_3 + \ldots$

$$p_m = \frac{1}{t_B}\left(p_1 \cdot t_1 + p_2 \cdot t_2 + \frac{p_2 + p_3}{2} \cdot t_3 + \ldots\right)$$

$p_m V_g$ = average hydraulic work value

V_g = geometric displacement volume

$(pV_g)_{max}$ (bar cm³) = p_{max} * V_g

6.1.7 Determining the steady-state temperature

INFORMATION
Observe the maximum permissible temperature of the hydraulic fluid of 80°C!

Calculation

$\vartheta_{Oil\ B} = \Delta\vartheta_B + \vartheta_U$

$\vartheta_{Oil\ B}$ (°C)	Steady-state temperature of the hydraulic fluid
$\Delta\vartheta_B$ (K)	Steady-state temperature (estimation from the characteristic lines to determine the excess temperature)
ϑ_U (K)	Ambient temperature at the place of installation

For an approximate check of the steady-state temperature of the hydraulic fluid, the two most important data are generally sufficient:

- average hydraulic work of the pump $(pV_g)_m$ and
- relative load duration per working cycle (% duty cycle).

Other influencing factors are

- Pressure run during the load phase (average pressure)
- Time share of the no-load phase
- Additional throttle losses over and above normal flow resistances (approx. 30%) from valves and lines are only to be taken into account if they take effect over a longer share of time within a working cycle (load phase). For instance, this includes work against the pressure-limiting valve (loss = 100%)

$$\text{Relative duty cycle } \%ED = \frac{t_B}{t_B + t_L} \cdot 100$$

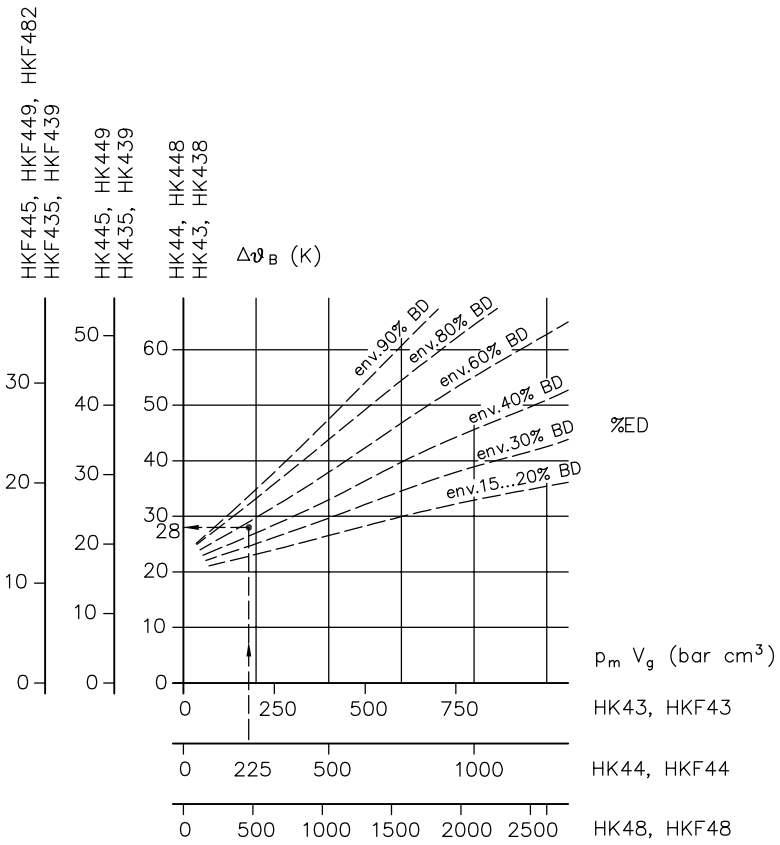
t_B Load time

t_L No-load time

INFORMATION
Lower steady-state excess temperatures with larger tank.

6.1.8 Characteristic lines for determining the temperature

HK, HKF



p_m V_g average hydraulic work value (bar cm³); $\Delta\vartheta_B$ expected steady-state temperatures (K); %ED relative duty cycle

Calculation

$$\text{Relative duty cycle } \%ED = \frac{t_B}{t_B + t_L} \cdot 100$$

6.1.9 Determining the maximum current consumption

Determine current consumption from the electrical data

► see Chapter 3.5, "Electrical data"

Set motor protection circuit

1. Set motor protection circuit to approximately 0.85 to 0.9 times the motor current (I_M).
   - ✓ When operating normally, the motor protection circuit will not trip prematurely.
   - ✓ When the pressure-limiting valve triggers, the period until shutdown does not become long enough for the hydraulic fluid's temperature to exceed its permissible maximum.
2. Run a test run to check the motor protection circuit's settings.

INFORMATION

Additional safety precautions against malfunctions are the temperature switches, level switches and pressure switches. These are optionally available for the hydraulic power pack.

6.1.10 Additional leakage oil return port

For larger, hot operating leakage oil return flows, for example chucks on lathes. The leakage oil return flow is guided so that its entrained heat loss is dissipated by the fan cooling.

6.1.11 Setting the pump after-run

If the compact hydraulic power pack is wired directly to the hydraulic cylinder, e.g. in the circuit for clamping devices (B-type connection blocks), and if a pressure switch causes it to cut out once the set pressure has been reached, a certain increase in pressure still takes place as a result of the after-run action of the pump motor.

The level of this additional rise in pressure is dependent on the pressure setting, on the consumer volume and on the pump flow rate.

If you wish to prevent these pressure rises, the setting for the pressure-limiting valve has to be adjusted in line with the switch-off point on the pressure switch. As a result, the subsequent delivery from the pump is discharged via the pressure-limiting valve.

The adjustment of the after-run should be carried out as follows:

1. Open the pressure-limiting valve fully.
2. Set the pressure switch to the highest value (by turning the adjusting screw clockwise as far as it will go).
3. Switch on the pump (with a consumer and pressure gauge connected) and turn up the pressure-limiting valve until the pressure gauge shows the required end operating pressure.
4. Turn the pressure switch in the opposite direction until the pump is switched off at the pressure value set.
   see Chapter 3, "Parameters"
5. Lock the pressure-limiting valve and the pressure switches.

The rise in pressure due to the after-run can also be avoided by using an accumulator or additional volume in the load line.

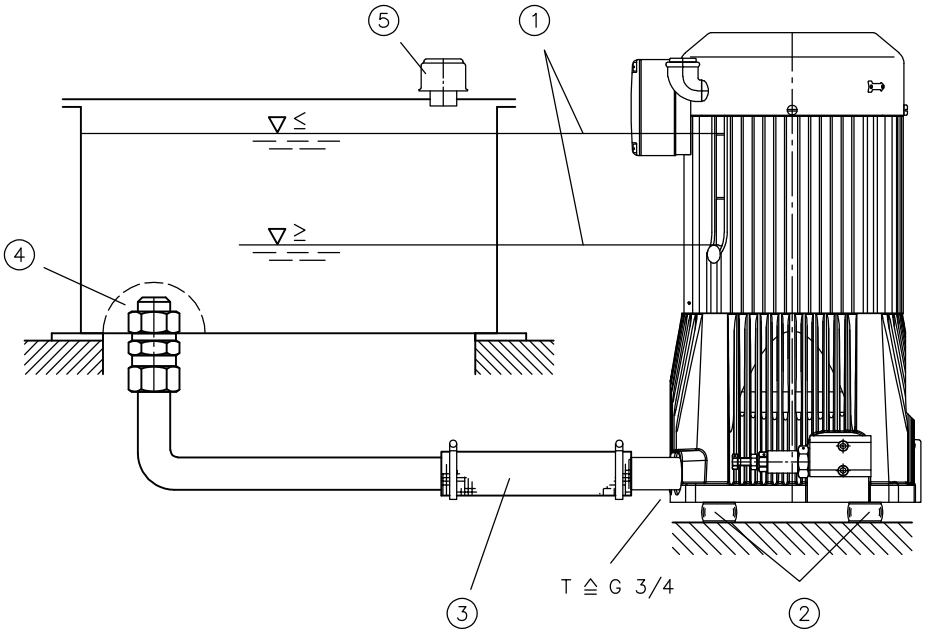
If the hydraulic power pack is used to full capacity, i.e. the pressure setting is close to the maximum permissible pressure, then practically no after-run occurs because the pump comes to a standstill almost immediately after being switched off.
see Chapter 2, "Available versions"

6.1.12 Additional reservoir

If necessary, an additional reservoir can be connected to port T to increase the usable volume. This reservoir must be supplied by the customer. It is only used to compensate for volume changes. The return line from the consumer circuit must always be fed into connection R of the HK pump!

The connection line must be dimensioned sufficiently. Connection, for example, with pipe screw connections light series for pipe 22x1.5 with hose connector for noise and vibration decoupling or with bare hose line.

NOTICE
Only suitable up to pump flow rates of approx. 12 l/min.



1 Same max. filling and removal height
2 Rubber-metal attachment
3 Hose connector
4 Strainer
5 Air filter

6.1.13 Connection blocks

A connection block is necessary to make a compact hydraulic power pack ready for a hydraulic connection.

INFORMATION

When selecting one, take note of the specifications for the connection blocks and mounted directional valves.

When setting the pressure-limiting valve on the connection block, take note of the pump's and valve mounting's maximum permitted pressure.

Type	Description	Publication
AB, AL A..D..	For single-circuit pumps with a pressure-limiting valve and the possibility of direct mounting of directional valve banks **Optional:** ▪ Pressure filter or return line filter ▪ Idle circulation valve ▪ Accumulator charging valve ▪ Proportional pressure-limiting valve	D 6905 AB SK 6905 AD
AB..X	For single-circuit pumps with a component-approved pressure-limiting valve and the possibility of direct mounting of directional valve banks (for use in accumulator systems) **Optional:** ▪ Pressure filter or return line filter ▪ Idle circulation valve	D 6905 AB SK 6905 AD TÜV
AN, AL, NA, C30, SS, VV	For dual-circuit pumps with a pressure-limiting valve and the partial possibility of direct mounting of directional valve banks **Optional:** ▪ Pressure filter or return line filter ▪ Accumulator charging valve ▪ Two-stage valve ▪ Idle circulation valve	D 6905 A/2
B	For single-circuit pumps for the activation of single-acting cylinders with a pressure-limiting valve and drain valve **Optional:** ▪ Throttle valve	D 6905 B
C	For single-circuit pumps with connections P and R for direct piping	D 6905 C

6.1.14 Directional valve banks

INFORMATION

The direct mounting of valve banks with directional valves on connection blocks enables a compact hydraulic unit to be assembled without the need for additional piping.

This applies to all types except type **C**.

Type	Description	p_{max} (bar)	Publication
VB	Valve bank (directional seated valve)	700	D 7302
BWN, BWH	Valve bank (directional seated valve)	450	D 7470 B/1
SWR, SWS	Valve bank (directional spool valve)	315	D 7951
BA	Valve bank for the combination of different directional valves with connection pattern NG 6 in accordance with DIN 24 340-A6	400	D 7788
BVH	Valve bank (directional seated valve)	400	D 7788 BV
NBVP	Directional seated valve	400	D 7765 N
ROLV	Directional seated valve	400	D 8144
NSWP	Directional spool valve	315	D 7451 N
NSMD	Clamping module (Directional spool valve with a pressure reducing valve and acknowledge function)	120	D 7787
NZP	Intermediate plates with connection pattern NG 6 in accordance with DIN 24 340-A6	400	D 7788 Z
POL, PRL, PIL	Proportional directional spool valve	350	D 6394
PIH	Proportional directional spool valve	350	D 6418
SWPM	Directional valve	320	D 6420/1

References

Compact hydraulic power packs

- Compact hydraulic power pack type KA and KAW size 2: D 8010
- Compact hydraulic power packs type KA size 4: D 8010-4
- Compact hydraulic power pack type INKA 1: D 8132-1
- Compact hydraulic power pack type MPN and MPNW: D 7207
- Compact hydraulic power pack type HK 3: D 7600-3
- Compact hydraulic power pack type HKL and HKLW: D 7600-3L
- Compact hydraulic power pack type HK 4: D 7600-4
- Compact hydraulic power pack type NPC: D 7940
- Mini hydraulic power pack type H 300, 350: D 6344
- Mini hydraulic power pack type H 400, 410, 440: D 6345
- Mini hydraulic power pack type HR 050: D 6014
- Micro hydraulic power pack type HR 080: D 6342
- Mini hydraulic power pack type HR 120: D 6343
- Servo hydraulic power pack type HS 120: D 6347
- Mini hydraulic power pack type A: D 6025

Connection blocks

- Connection blocks for single-circuit pumps types AB, AL: D 6905 AB
- Connection blocks type B for hydraulic power packs: D 6905 B
- Connection blocks type C: D 6905 C
- Connection blocks for dual-circuit pumps types AN, AL, NA: D 6905 A/2

Valves and valve banks

- Valve bank (directional seated valve) type VB: D 7302
- Valve bank (directional seated valve) type BWN and BWH: D 7470 B/1
- Directional spool valve type SWPN: D 7451 AT
- Directional spool valve bank type SWS: D 7951
- Valve bank (nominal size 6) type BA: D 7788
- Valve bank (directional seated valve) type BVH: D 7788 BV
- Directional seated valve type NBVP 16: D 7765 N
- Directional seated valve type ROLV: D 8144
- Directional spool valve type NSWP 2: D 7451 N
- Clamping module type NSMD: D 7787
- Intermediate plate type NZP: D 7788 Z

Attached components

- Fitting type X 84: D 7077
- Diaphragm accumulator type AC: D 7969
- Miniature accumulator type AC: D 7571

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