

# Compact hydraulic power packs type KA and KAW

for short-term and intermittent service

for 3~ and 1~phase power supply, as single or dual circuit pumps



Flow  $Q_{\max}$  = 19.9 lpm (1450 rpm)  
Operating pressure  $p_{\max}$  = 700 bar

Additional information:

Compact hydraulic power packs type KA 4 D 8010-4  
type HC D 7900  
type HCG D 7900 G  
type NPC D 7940  
type MPN D 7207  
type HK D 7600 ++

## 1. Design and general information

### 1.1 Basic design

The compact hydraulic power pack type KA serves to supply pressurized fluid for intermittently or short-term operated hydraulic circuits.

The basic hydraulic power pack consists:

- the tank (available in different sizes)
- the drive motor (available for different voltages and power requirements)
- the radial piston or gear pump directly driven by the motor shaft

The compact style obtained with this design represents an essential advantage opposite conventional units. Complete turn-key solutions can be easily arranged via a wide range of connection blocks (see D 6905 ++) and directly mountable valve banks (see photo).

There is a wide field of applications for these compact power packs within tool machines, jig assemblies and general mechanical engineering.

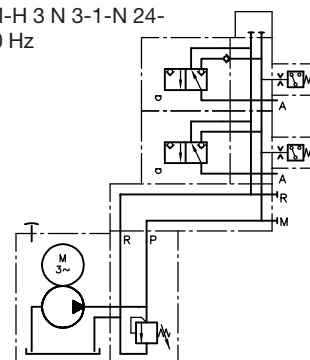
The power pack is suited for operation modes S2 (short time service) and S3 (intermittent service). The load can be up to 1.8 of the nom. power rating during these operation modes.



- ① Tank with pressed in stator
- ② Fluid filling / breather
- ③ Terminal box or alternatively: Version with plug Co. HARTING
- ④ Connection pedestal with one (single circuit pump) or two pressure ports (dual circuit pump) and one return port. Prepared for the mounting of connection blocks for ongoing pressure and reflow pipes or with directly mounted directional valve banks (see D 6905 ++).

#### Order example

KA 24 ST/H 0,66  
- A 2/650  
- VB 11 FM-H 3 N 3-1-N 24-  
3x400 V 50 Hz



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## 2. Available versions, type coding

### 2.1 Motor and tank section










Order examples:

**KA 24 1 S KS****E/H1,81 - A 1/280 - 3x400V 50 Hz****KA 28 22 L1 KTF****P/HZ 0,59/8,8-...- 3x400V 50 Hz/24V DC - G 1/2 x 300**Electrical port  
(table 1e)Pump version  
sect. 2.2Motor voltage of the  
aux. blower  
(table 1d and site 16)Fluid drain hose  
(table 1f)Options  
(table 1d)Motor voltage  
(table 9)**Table 1a:** Basic type and drive powerTank size  
table 1c

	Coding	For more detailed information about motor data and available voltage, see sect. 3.3 in table 9		
			Power (kW)	Speed (min <sup>-1</sup> )
<b>Note:</b> A actual power consumption is load dependent and can be up to 1.8 x nominal power.  <sup>1)</sup> only available with tank coding 1, 11, 2, 21, 22, and 3 acc. to table 1b	Basic type	<b>KA 21</b>	3~phase motor 0.55 0.66	2790 (50 Hz) 3350 (60 Hz)
		<b>KA 22</b>	3~phase motor 1.1 1.32	2790 (50 Hz) 3350 (60 Hz)
		<b>KA 23</b>	3~phase motor 0.37 0.44	1360 (50 Hz) 1650 (60 Hz)
		<b>KA 24</b>	3~phase motor 0.75 0.9	1360 (50 Hz) 1650 (60 Hz)
		<b>KA 26 <sup>1)</sup></b>	3~phase motor 1.4 1.68	2790 (50 Hz) 3340 (60 Hz)
		<b>KA 28 <sup>1)</sup></b>	3~phase motor 1.0 1.2	1370 (50 Hz) 1660 (60 Hz)
		<b>KAW 21</b>	1~phase motor 0.37	2770 (50 Hz) 3340 (60 Hz)
		<b>KAW 22</b>	1~phase motor 0.75	2810 (50 Hz) 3400 (60 Hz)
		<b>KAW 23</b>	1~phase motor 0.25	1380 (50 Hz) 1650 (60 Hz)
		<b>KAW 24</b>	1~phase motor 0.50	1390 (50 Hz) 1680 (60 Hz)
		<b>KAW 26 <sup>1)</sup></b>	1~phase motor 1.10	2770 (50 Hz) 3340 (60 Hz)
		<b>KAW 28 <sup>1)</sup></b>	1~phase motor 0.7	1370 (50 Hz) 1650 (60 Hz)









**Table 1b:** Tank size

① Connection pedestal, valve assembly, terminal box, options

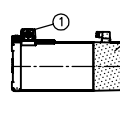
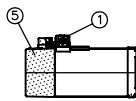
	Coding	Combination	Filling volume $V_{\text{fill}}$ (l)	Usable filling volume vertically $V_{\text{usable}}$ (l)	Usable filling volume horizontal $V_{\text{usable}}$ (l)
Tank size	no coding		3.9	1.85	1.5
	<b>1</b>		5.0	2.7	2.0
	<b>01</b>		5.0	1.85	2.0
	<b>11</b>		6.1	2.95	2.5
	<b>2</b>		7.5	5.45	3.15
	<b>02</b>		7.5	-	3.15
	<b>21</b>		8.6	5.45	3.65
	<b>22</b>		11.1	-	4.8
	<b>3</b>		11.1	8.95	4.8

**Table 1c:** Installation position

① Connection pedestal, valve assembly, terminal box, ② Filler neck with breather filter, ③ Fluid level gauge

vertically				horizontal			
S	S14	S25	S36	L	L1	L4	L14
Standard 	Top and bottom end cover off-set by 90° 	Top and bottom end cover off-set by 180° 	Top and bottom end cover off-set by 270° 	Standard 	Connection pedestal off-set by 90° 	Type plate and fluid level gauge ③ "rear side" 	Combination L1 plus L4 
<b>Note:</b> <ul style="list-style-type: none"> <li>- The horizontal version can be also installed vertically.</li> <li>- The vertical version utilizing a radial piston pump (coding H, HH and HZ acc. to sect. 2.2) must not be installed horizontally</li> <li>- Regarding ① : For details about the connection block and valve assembly, see sect. 5.1</li> </ul>							

**Table 1d:** Options

	Coding	Note	vertically	horizontal
Options	no coding	without optional equipments	●	●
	<b>K</b>	Fluid level gauge / Fluid level gauge	●	●
	<b>KS</b>	Fluid level gauge with float switch (NO-contact)	●	-
	<b>KD</b>	Fluid level gauge with float switch (NC-contact)	●	-
	<b>S</b>	Float switch (NO-contact)	-	●
	<b>D</b>	Float switch (NC-contact)	-	●
	<b>T</b>	Temperature switch (switch point 80°C), standard with type KAW	●	●
	<b>T60</b>	Temperature switch (switch point 60°C), only with type KA	●	●
	<b>G</b>	Silica gel filter (instead of std. breather filter see sect. 5.1k), can not be retrofitted,	●	-
	<b>F</b>	not available for versions with auxiliary blower coding F, F1 Auxiliary blower ⑤ (see sect. 5.1g) for available motor voltage and other motor data, see sect. 3.3, table 9a. Can be retrofitted. 	●	●
	<b>F1</b>	Auxiliary blower ⑤ like coding F, but on the opposite side 	-	●

**Table 1e:** Electrical connection

	Coding	Note
Means of electrical connection	no coding	Standard (Terminal box)
	<b>P</b>	Plug Co. HARTING
	<b>P, PM1</b>	with additional connector M12x1 on right or left side for temperature and/or float
	<b>E, PE</b>	Electrical connection with additional interference suppression in the terminal box or at the plug Co. HARTING. For alternatives, see sect. 3.3, only with type KA

**Table 1f:** Fluid drain hose

Coding	Description
no coding	Tapped plug G 1/4"
<b>Fluid drain hose G 1/4" x 300</b>	Fluid drain hose approx. 300 mm with ball cock
<b>Fluid drain hose G 1/4" x 500</b>	Fluid drain hose approx. 500 mm with ball cock
<b>Fluid drain hose G 1/4" W x 300</b>	Fluid drain hose approx. 300 mm with elbow and ball cock
<b>Fluid drain hose G 1/4" W x 500</b>	Fluid drain hose approx. 500 mm with elbow and ball cock

\* BSPP

## 2.2 Pump section

### 2.2.1 Single circuit pumps

Order example 1: KA 242 DT/1 - **H6,7** - A1/180 3 x 400V 50Hz

Order example 2: KAW 26/1P1 - **Z4,5** - AL11E/120 3 x 400/230V 50Hz

**Table 2a:** Single circuit pumps with 3~phase motor  
Radial piston pump **H** or gear pump **Z**

**Note:**

The delivery flow rating  $Q_{pu}$  is a guide line figure, based on nom. rev. rating that will be slightly reduced dep. on load (see curves in sect. 3.3). For notes regarding pressure  $p_{max}$  and  $p_1$  (see sect. 3.3, table 9).

The max. perm. hydraulic work  $(pV_g)_{max}$  for version **Z** with gear pump has to be reduced by 10%.

**The perm. pressure  $p_{max}$  correspond to motors 3~400/230V 50 Hz.**

For other voltage:  $p_{max} = (pV_g)_{max}/V_g$ . For  $(pV_g)_{max}$  (see page 13, table 9)

<b>H</b>	Coding for radial piston pump						
	Piston diameter (mm)	4	5	4	6	7	5
	Number of pump elements	3	3	6	3	3	6
	Delivery flow coding	<b>0,33</b>	<b>0,47</b>	<b>0,59</b>	<b>0,66</b>	<b>0,91</b>	<b>0,93</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.23	0.35	0.45	0.51	0.69	0.71
<b>KA 21</b>	Perm. pressure $p_{max}$ (bar)	700	465	360	320	235	230
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.63	0.99	1.26	1.42	1.93	1.97
	60 Hz	0.76	1.18	1.52	1.70	2.32	2.37
<b>KA 22</b>	Perm. pressure $p_{max}$ (bar)	700	700	700	700	700	700
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.63	0.99	1.26	1.42	1.93	1.97
	60 Hz	0.76	1.18	1.52	1.70	2.32	2.37
<b>KA 23</b>	Perm. pressure $p_{max}$ (bar)	700	620	485	430	315	310
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.31	0.48	0.62	0.69	0.94	0.96
	60 Hz	0.37	0.58	0.75	0.84	1.14	1.17
<b>KA 24</b>	Perm. pressure $p_{max}$ (bar)	700	700	700	700	700	700
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.31	0.48	0.62	0.69	0.94	0.96
	60 Hz	0.37	0.58	0.75	0.84	1.14	1.17
<b>KA 26</b>	Perm. pressure $p_{max}$ (bar)	700	700	700	700	700	700
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.63	0.99	1.26	1.42	1.93	1.97
	60 Hz	0.76	1.18	1.52	1.70	2.32	2.37
<b>KA 28</b>	Perm. pressure $p_{max}$ (bar)	700	700	700	700	700	700
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.31	0.48	0.62	0.69	0.94	0.96
	60 Hz	0.37	0.58	0.75	0.84	1.14	1.17

<b>H</b>	Coding for radial piston pump						
	Piston diameter (mm)	8	6	9	7	8	9
	Number of pump elements	3	6	3	6	6	6
	Delivery flow coding	<b>1,18</b>	<b>1,33</b>	<b>1,51</b>	<b>1,81</b>	<b>2,36</b>	<b>2,99</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.91	1.02	1.15	1.39	1.81	2.29
<b>KA 21</b>	Perm. pressure $p_{max}$ (bar)	180	160	140	115	90	70
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.52	2.84	3.19	3.87	5.05	6.39
	60 Hz	3.03	3.41	3.84	4.64	6.06	7.67
<b>KA 22</b>	Perm. pressure $p_{max}$ (bar)	570	510	450	370	285	225
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.52	2.84	3.19	3.87	5.05	6.39
	60 Hz	3.03	3.41	3.84	4.64	6.06	7.67
<b>KA 23</b>	Perm. pressure $p_{max}$ (bar)	240	215	190	155	120	95
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.23	1.38	1.56	1.88	2.46	3.11
	60 Hz	1.49	1.68	1.89	2.29	2.99	3.78
<b>KA 24</b>	Perm. pressure $p_{max}$ (bar)	650	580	510	425	325	255
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.23	1.38	1.56	1.88	2.46	3.11
	60 Hz	1.49	1.68	1.89	2.29	2.99	3.78
<b>KA 26</b>	Perm. pressure $p_{max}$ (bar)	540	570	510	420	320	255
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.52	2.84	3.19	3.87	5.05	6.39
	60 Hz	3.03	3.41	3.84	4.64	6.06	7.67
<b>KA 28</b>	Perm. pressure $p_{max}$ (bar)	700	670	550	490	375	295
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.23	1.38	1.56	1.88	2.46	3.11
	60 Hz	1.49	1.68	1.89	2.29	2.99	3.78

Continuation of table 2a:

**Note:**

- Version with pump elements type PE acc. to D 5600
- Only available as vertical version (see table 1c)

H	Coding for radial piston pump						
	Piston diameter (mm)	10	12	13	14	10	15
	Number of pump elements	3	3	3	3	6	3
	Delivery flow coding	<b>1,84</b>	<b>2,66</b>	<b>3,12</b>	<b>3,61</b>	<b>3,69</b>	<b>4,14</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	1.41	2.04	2.39	2.77	2.83	3.18
<b>KA 21</b>	Perm. pressure $p_{max}$ (bar)	115	80	65	55	55	50
	Delivery $Q_{pu}$ (lpm) 50 Hz	3.90	5.65	6.62	7.67	7.84	8.81
	60 Hz	4.69	6.79	7.96	9.22	9.42	10.59
<b>KA 22</b>	Perm. pressure $p_{max}$ (bar)	365	250	215	185	180	160
	Delivery $Q_{pu}$ (lpm) 50 Hz	3.90	5.65	6.62	7.67	7.84	8.81
	60 Hz	4.69	6.79	7.96	9.22	9.42	10.59
<b>KA 23</b>	Perm. pressure $p_{max}$ (bar)	155	105	90	75	75	65
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.91	2.76	3.23	3.74	3.83	4.30
	60 Hz	2.31	3.34	3.91	4.54	4.63	5.21
<b>KA 24</b>	Perm. pressure $p_{max}$ (bar)	415	285	245	210	205	185
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.91	2.76	3.23	3.74	3.83	4.30
	60 Hz	2.31	3.34	3.91	4.54	4.63	5.21
<b>KA 26</b>	Perm. pressure $p_{max}$ (bar)	410	285	240	210	205	180
	Delivery $Q_{pu}$ (lpm) 50 Hz	3.90	5.65	6.62	7.67	7.84	8.81
	60 Hz	4.69	6.79	7.96	9.22	9.42	10.59
<b>KA 28</b>	Perm. pressure $p_{max}$ (bar)	485	335	285	245	240	215
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.91	2.76	3.23	3.74	3.83	4.30
	60 Hz	2.31	3.34	3.91	4.54	4.63	5.21

H	Coding for radial piston pump						
	Piston diameter (mm)	16	12	13	14	15	16
	Number of pump elements	3	6	6	6	6	6
	Delivery flow coding	<b>4,72</b>	<b>5,31</b>	<b>6,24</b>	<b>7,23</b>	<b>8,29</b>	<b>9,45</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	3.62	4.07	4.78	5.54	6.36	7.24
<b>KA 21</b>	Perm. pressure $p_{max}$ (bar)	45					
	Delivery $Q_{pu}$ (lpm) 50 Hz	10.02					
	60 Hz	12.05					
<b>KA 22</b>	Perm. pressure $p_{max}$ (bar)	140					
	Delivery $Q_{pu}$ (lpm) 50 Hz	10.02					
	60 Hz	12.05					
<b>KA 23</b>	Perm. pressure $p_{max}$ (bar)	60	50	45	35	30	30
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.89	5.50	6.46	7.49	8.60	9.79
	60 Hz	5.93	6.66	7.83	9.07	10.41	11.85
<b>KA 24</b>	Perm. pressure $p_{max}$ (bar)	160	140	120	105	90	80
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.89	5.50	6.46	7.49	8.60	9.79
	60 Hz	5.93	6.66	7.83	9.07	10.41	11.85
<b>KA 26</b>	Perm. pressure $p_{max}$ (bar)	160					
	Delivery $Q_{pu}$ (lpm) 50 Hz	10.02					
	60 Hz	12.05					
<b>KA 28</b>	Perm. pressure $p_{max}$ (bar)	185	165	140	120	105	90
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.89	5.50	6.46	7.49	8.60	9.79
	60 Hz	5.93	6.66	7.83	9.07	10.41	11.85

Continuation of table 2a:

Z	Coding for gear	Size 1					
	Delivery flow coding	<b>Z 1,1</b>	<b>Z 1,7</b>	<b>Z 2,0</b>	<b>Z 2,7</b>	<b>Z 3,5</b>	<b>Z 4,5</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.8	1.1	1.4	1.9	2.4	3.1
<b>KA 21</b>	Perm. pressure $p_{max}$ (bar)	170	130	100	75	60	
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.23	3.07	3.91	5.30	6.70	
	60 Hz	2.68	3.69	4.69	6.37	8.04	
<b>KA 22</b>	Perm. pressure $p_{max}$ (bar)	170	170	170	170	170	150
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.23	3.07	3.91	5.30	6.70	8.65
	60 Hz	2.68	3.69	4.69	6.37	8.04	10.39
<b>KA 23</b>	Perm. pressure $p_{max}$ (bar)	170	170	140	100	80	60
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.09	1.50	1.90	2.58	3.26	4.22
	60 Hz	1.32	1.82	2.31	3.14	3.96	5.12
<b>KA 24</b>	Perm. pressure $p_{max}$ (bar)	170	170	170	170	170	170
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.09	1.50	1.90	2.58	3.26	4.22
	60 Hz	1.32	1.82	2.31	3.14	3.96	5.12
<b>KA 26</b>	Perm. pressure $p_{max}$ (bar)	170	170	170	170	170	170
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.23	3.07	3.91	5.30	6.70	8.65
	60 Hz	2.68	3.69	4.69	6.37	8.04	10.39
<b>KA 28</b>	Perm. pressure $p_{max}$ (bar)	170	170	170	170	170	170
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.09	1.50	1.90	2.58	3.26	4.22
	60 Hz	1.32	1.82	2.31	3.14	3.96	5.12

Z	Coding for gear	Size 1					
	Delivery flow coding	<b>Z 5,2</b>	<b>Z 6,4</b>	<b>Z 6,9</b>	<b>Z 8,8</b>	<b>Z 9,8</b>	<b>Z 11,3</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	3.6	4.4	4.8	6.1	7.0	7.9
<b>KA 21</b>	Perm. pressure $p_{max}$ (bar)						
	Delivery $Q_{pu}$ (lpm) 50 Hz						
	60 Hz						
<b>KA 22</b>	Perm. pressure $p_{max}$ (bar)	130	105	95	75	65	55
	Delivery $Q_{pu}$ (lpm) 50 Hz	10.04	12.28	13.39	17.02	19.53	22.04
	60 Hz	12.06	14.74	16.08	20.44	23.45	26.47
<b>KA 23</b>	Perm. pressure $p_{max}$ (bar)	50					
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.90					
	60 Hz	5.94					
<b>KA 24</b>	Perm. pressure $p_{max}$ (bar)	145	120	110	85	75	65
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.90	5.98	6.53	8.30	9.52	10.74
	60 Hz	5.94	7.26	7.92	10.07	11.55	13.04
<b>KA 26</b>	Perm. pressure $p_{max}$ (bar)	145	120	110	85	75	65
	Delivery $Q_{pu}$ (lpm) 50 Hz	10.04	12.28	13.39	17.02	19.53	22.04
	60 Hz	12.06	14.74	16.08	20.44	23.45	26.47
<b>KA 28</b>	Perm. pressure $p_{max}$ (bar)	170	140	125	100	85	75
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.90	5.98	6.53	8.30	9.52	10.74
	60 Hz	5.94	7.26	7.92	10.07	11.55	13.04

**Table 2b:** Single circuit pumps with 1~phase motor  
Radial piston pump **H** or gear pump **Z**

**Note:**

The delivery flow rating  $Q_{pu}$  is a guide line figure, based on nom. rev. rating that will be slightly reduced dep. on load (see curves in sect. 3.3). For notes regarding pressure  $p_{max}$  and  $p_1$  (see sect. 3.3, table 9).

**The perm. pressure  $p_{max}$  correspond to motors 1 x 230V 50 Hz**

For other voltage:  $p_{max} = (pV_{g,max}/V_g)$ . For  $(pV_{g,max})$  see page 16, table 9

The max. perm. hydraulic work  $(pV_{g,max})$  for version **Z** with gear pump has to be reduced by 10%.

A capacitor is mandatory for the version with 1~phase motor, which is not scope of delivery. For recommendations and notes regarding selection, see sect. 3.3 and. 5.1i.

These power packs won't start-up against pressure!

<b>H</b>	Coding for radial piston pump						
	Piston diameter (mm)	4	5	4	6	7	5
	Number of pump elements	3	3	6	3	3	6
	Delivery flow coding	<b>0,33</b>	<b>0,47</b>	<b>0,59</b>	<b>0,66</b>	<b>0,91</b>	<b>0,93</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.23	0.35	0.45	0.51	0.69	0.71
<b>KAW 21</b>	Perm. pressure $p_{max}$ (bar)	440	280	221	195	140	140
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.63	0.99	1.26	1.42	1.93	1.97
	60 Hz	0.76	1.18	1.52	1.70	2.32	2.37
<b>KAW 22</b>	Perm. pressure $p_{max}$ (bar)	700	650	505	450	330	325
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.63	0.99	1.26	1.42	1.93	1.97
	60 Hz	0.76	1.18	1.52	1.70	2.32	2.37
<b>KAW 23</b>	Perm. pressure $p_{max}$ (bar)	640	410	320	285	205	205
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.31	0.48	0.62	0.69	0.94	0.96
	60 Hz	0.37	0.58	0.75	0.84	1.14	1.17
<b>KAW 24</b>	Perm. pressure $p_{max}$ (bar)	700	700	700	685	505	495
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.31	0.48	0.62	0.69	0.94	0.96
	60 Hz	0.37	0.58	0.75	0.84	1.14	1.17
<b>KAW 26</b>	Perm. pressure $p_{max}$ (bar)	700	700	605	540	395	385
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.63	0.99	1.26	1.42	1.93	1.97
	60 Hz	0.76	1.18	1.52	1.70	2.32	2.37
<b>KAW 28</b>	Perm. pressure $p_{max}$ (bar)	700	700	700	700	575	565
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.31	0.48	0.62	0.69	0.94	0.96
	60 Hz	0.37	0.58	0.75	0.84	1.14	1.17

<b>H</b>	Coding for radial piston pump						
	Piston diameter (mm)	8	6	9	7	8	9
	Number of pump elements	3	6	3	6	6	6
	Delivery flow coding	<b>1,18</b>	<b>1,33</b>	<b>1,51</b>	<b>1,81</b>	<b>2,36</b>	<b>2,99</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.91	1.02	1.15	1.39	1.81	2.29
<b>KAW 21</b>	Perm. pressure $p_{max}$ (bar)	110	95	85	70	55	40
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.52	2.84	3.19	3.87	5.05	6.39
	60 Hz	3.03	3.41	3.84	4.64	6.06	7.67
<b>KAW 22</b>	Perm. pressure $p_{max}$ (bar)	250	225	200	165	120	100
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.52	2.84	3.19	3.87	5.05	6.39
	60 Hz	3.03	3.41	3.84	4.64	6.06	7.67
<b>KAW 23</b>	Perm. pressure $p_{max}$ (bar)	160	140	125	105	80	60
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.23	1.38	1.56	1.88	2.46	3.11
	60 Hz	1.49	1.68	1.89	2.29	2.99	3.78
<b>KAW 24</b>	Perm. pressure $p_{max}$ (bar)	385	340	305	250	190	150
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.23	1.38	1.56	1.88	2.46	3.11
	60 Hz	1.49	1.68	1.89	2.29	2.99	3.78
<b>KAW 26</b>	Perm. pressure $p_{max}$ (bar)	300	270	240	195	150	120
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.52	2.84	3.19	3.87	5.05	6.39
	60 Hz	3.03	3.41	3.84	4.64	6.06	7.67
<b>KAW 28</b>	Perm. pressure $p_{max}$ (bar)	440	390	345	285	220	175
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.23	1.38	1.56	1.88	2.46	3.11
	60 Hz	1.49	1.68	1.89	2.29	2.99	3.78



Continuation of table 2b:

**Note:**

- Version with pump elements type PE acc. to D 5600
- Only available as vertical version (see table 1c)

H	Coding for radial piston pump						
	Piston diameter (mm)	10	12	13	14	10	15
	Number of pump elements	3	3	3	3	6	3
	Delivery flow coding	<b>1,84</b>	<b>2,66</b>	<b>3,12</b>	<b>3,61</b>	<b>3,69</b>	<b>4,14</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	1.41	2.04	2.39	2.77	2.83	3.18
<b>KAW 21</b>	Perm. pressure $p_{max}$ (bar)	70	45	40	35	35	30
	Delivery $Q_{pu}$ (lpm) 50 Hz	3.86	5.59	6.55	7.59	7.75	8.71
	60 Hz	4.66	6.74	7.90	9.15	9.35	10.51
<b>KAW 22</b>	Perm. pressure $p_{max}$ (bar)	160	110	95	80	80	70
	Delivery $Q_{pu}$ (lpm) 50 Hz	3.86	5.59	6.55	7.59	7.75	8.71
	60 Hz	4.66	6.74	7.90	9.15	9.35	10.51
<b>KAW 23</b>	Perm. pressure $p_{max}$ (bar)	100	70	60	50	50	45
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.90	2.75	3.22	3.73	3.81	4.29
	60 Hz	2.27	3.28	3.84	4.46	4.55	5.12
<b>KAW 24</b>	Perm. pressure $p_{max}$ (bar)	245	170	145	125	120	100
	Delivery $Q_{pu}$ (lpm) 50 Hz	0.00	2.75	3.22	3.73	3.81	4.29
	60 Hz	2.27	3.28	3.84	4.46	4.55	5.12
<b>KAW 26</b>	Perm. pressure $p_{max}$ (bar)	195	130	115	95	95	85
	Delivery $Q_{pu}$ (lpm) 50 Hz	3.86	5.59	6.55	7.59	7.75	8.71
	60 Hz	4.6	6.74	7.90	9.15	9.35	10.51
<b>KAW 28</b>	Perm. pressure $p_{max}$ (bar)	280	195	165	140	140	125
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.90	2.75	3.22	3.73	3.81	4.29
	60 Hz	2.27	3.28	3.84	4.46	4.55	5.12

H	Coding for radial piston pump						
	Piston diameter (mm)	16	12	13	14	15	16
	Number of pump elements	3	6	6	6	6	6
	Delivery flow coding	<b>4,72</b>	<b>5,31</b>	<b>6,24</b>	<b>7,23</b>	<b>8,29</b>	<b>9,45</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	3,2	4.07	4.78	5.54	6.36	7.24
<b>KAW 21</b>	Perm. pressure $p_{max}$ (bar)	25					
	Delivery $Q_{pu}$ (lpm) 50 Hz	9.92					
	60 Hz	11.96					
<b>KAW 22</b>	Perm. pressure $p_{max}$ (bar)	60					
	Delivery $Q_{pu}$ (lpm) 50 Hz	9.92					
	60 Hz	11.96					
<b>KAW 23</b>	Perm. pressure $p_{max}$ (bar)	40	35	30	25	20	20
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.88	5.49	6.44	7.47	8.57	9.76
	60 Hz	5.82	6.55	7.69	8.91	10.23	11.65
<b>KAW 24</b>	Perm. pressure $p_{max}$ (bar)	95	85	70	60	55	45
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.88	5.49	6.44	7.47	8.57	9.76
	60 Hz	5.82	6.55	7.69	8.91	10.23	11.65
<b>KAW 26</b>	Perm. pressure $p_{max}$ (bar)	75					
	Delivery $Q_{pu}$ (lpm) 50 Hz	9.92					
	60 Hz	11.96					
<b>KAW 28</b>	Perm. pressure $p_{max}$ (bar)	110	95	80	70	60	55
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.88	5.49	6.44	7.47	8.57	9.76
	60 Hz	5.82	6.55	7.69	8.91	10.23	11.65



Continuation of table 2b:

Z	Coding for gear	Size 1					
		Z 1,1	Z 1,7	Z 2,0	Z 2,7	Z 3,5	Z 4,5
	Delivery flow coding						
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.8	1.1	1,4	1.9	2.4	3.1
KAW 21	Perm. pressure $p_{max}$ (bar)	110	80	60			
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.23	3.07	3.91			
	60 Hz	2.68	3.69	4.69			
KAW 22	Perm. pressure $p_{max}$ (bar)	170	170	145	105	85	65
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.23	3.07	3.91	5.30	6.70	8.65
	60 Hz	2.68	3.69	4.69	6.37	8.04	10.39
KAW 23	Perm. pressure $p_{max}$ (bar)	160	115	90	65	50	
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.09	1.50	1.90	2.58	3.26	
	60 Hz	1.32	1.82	2.31	3.14	3.96	
KAW 24	Perm. pressure $p_{max}$ (bar)	170	170	170	165	130	100
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.09	1.50	1.90	2.58	3.26	4.22
	60 Hz	1.32	1.82	2.31	3.14	3.96	5.12
KAW 26	Perm. pressure $p_{max}$ (bar)	170	170	170	130	100	80
	Delivery $Q_{pu}$ (lpm) 50 Hz	2.23	3.07	3.91	5.30	6.70	8.65
	60 Hz	2.68	3.69	4.69	6.37	8.04	10.39
KAW 28	Perm. pressure $p_{max}$ (bar)	170	170	170	170	150	115
	Delivery $Q_{pu}$ (lpm) 50 Hz	1.09	1.50	1.90	2.58	3.26	4.22
	60 Hz	1.32	1.82	2.31	3.14	3.96	5.12

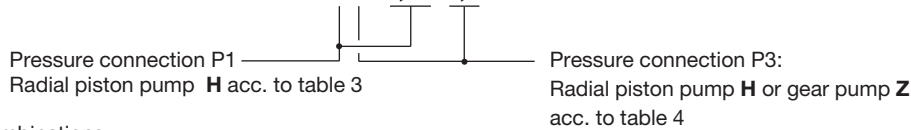
Z	Coding for gear	Size 1					
		Z 5,2	Z 6,4	Z 6,9	Z 8,8	Z 9,8	Z 11,3
	Delivery flow coding						
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	3.6	4.4	4.8	6.1	7.0	7.9
KAW 21	Perm. pressure $p_{max}$ (bar)						
	Delivery $Q_{pu}$ (lpm) 50 Hz						
	60 Hz						
KAW 22	Perm. pressure $p_{max}$ (bar)	55					
	Delivery $Q_{pu}$ (lpm) 50 Hz	10.04					
	60 Hz	12.06					
KAW 23	Perm. pressure $p_{max}$ (bar)						
	Delivery $Q_{pu}$ (lpm) 50 Hz						
	60 Hz						
KAW 24	Perm. pressure $p_{max}$ (bar)	85	70	65	50		
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.90	5.98	6.53	8.30		
	60 Hz	5.94	7.26	7.92	10.07		
KAW 26	Perm. pressure $p_{max}$ (bar)	65	55	50			
	Delivery $Q_{pu}$ (lpm) 50 Hz	10.04	12.28	13.39			
	60 Hz	12.06	14.74	16.08			
KAW 28	Perm. pressure $p_{max}$ (bar)	100	80	75	50	50	
	Delivery $Q_{pu}$ (lpm) 50 Hz	4.90	5.98	6.53	8.30	9.52	
	60 Hz	5.94	7.26	7.92	10.07	11.55	

## 2.2.2 Dual circuit pump with joint connection pedestal

### a) Version radial piston pump -- radial piston pump HH and radial piston pump -- gear pump coding HZ

Order example 1: KAW 24 1 S KS E / **H H 0,34 / 2,0** - NA31 - ... 1 + 230V 50 Hz

Order example 2: KA 24 11 S KS E / **H Z 0,34 / 6,9** - NA31 - ... 3 + 400V 50 Hz



Available combinations

Coding	P1	P3	Example
<b>HH</b>	3 pump elements	3 pump elements	HH 0,66/1,18
	2 pump elements	4 pump elements	HH 0,34/0,86
	6 pump elements	6 pump elements	HH 0,93/0,93
	3 pump elements	9 pump elements	HH 0,47/2,01
<b>HZ</b>	3 pump elements	Gear pump size 1	HZ 0,33/9,8
	6 pump elements	Gear pump size 1	HZ 0,59/8,8

**Table 3:** Pressure connection P1

**Note:** The delivery flow rating  $Q_{pu}$  is a guide line figure, based on nom. rev. rating that will be slightly reduced dep. on load (see sect. 3.3). For notes regarding pressure  $p_{max}$  and  $p_1$  (see sect. 3.3, table 9).

The max. perm. hydraulic work  $(pV_g)_{max}$  for version **HH** and **HZ** with gear pump has to be reduced by 10%.

<b>H</b>	Coding for radial piston pump						
	Piston diameter (mm)	4	5	6	7	8	9
	Number of pump elements	3	3	3	3	3	3
	Delivery flow coding	<b>0,33</b>	<b>0,47</b>	<b>0,66</b>	<b>0,91</b>	<b>1,18</b>	<b>1,51</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.23	0.35	0.51	0.69	0.91	1.15
	Piston diameter (mm)	4	5	6	7	8	9
	Number of pump elements	2	2	2	2	2	2
	Delivery flow coding	<b>0,21</b>	<b>0,34</b>	<b>0,48</b>	<b>0,62</b>	<b>0,78</b>	<b>0,99</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.15	0.24	0.34	0.46	0.60	0.76
	Piston diameter (mm)	4	5	6	7	8	9
	Number of pump elements	6	6	6	6	6	6
	Delivery flow coding	<b>0,59</b>	<b>0,93</b>	<b>1,33</b>	<b>1,81</b>	<b>2,36</b>	<b>2,99</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.45	0.71	1.02	1.39	1.81	2.29

**Table 4:** Pressure connection P3

radial piston pump **H** or gear pump coding **Z** for available combinations, see above

**Note:** The delivery flow rating  $Q_{pu}$  is a guide line figure, based on nom. rev. rating that will be slightly reduced dep. on load (see sect. 3.3). For notes regarding pressure  $p_{max}$  and  $p_1$  (see sect. 3.3, table 9).

<b>H</b>	Coding for radial piston pump						
	Piston diameter (mm)	4	5	6	7	8	9
	Number of pump elements	3	3	3	3	3	3
	Delivery flow coding	<b>0,33</b>	<b>0,47</b>	<b>0,66</b>	<b>0,91</b>	<b>1,18</b>	<b>1,51</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.23	0.35	0.51	0.69	0.91	1.15
	Piston diameter (mm)	4	5	6	7	8	9
	Number of pump elements	4	4	4	4	4	4
	Delivery flow coding	<b>0,38</b>	<b>0,58</b>	<b>0,86</b>	<b>1,21</b>	<b>1,59</b>	<b>2,00</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.30	0.47	0.68	0.92	1.21	1.53
	Piston diameter (mm)	4	5	6	7	8	9
	Number of pump elements	6	6	6	6	6	6
	Delivery flow coding	<b>0,59</b>	<b>0,93</b>	<b>1,33</b>	<b>1,81</b>	<b>2,36</b>	<b>2,99</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.45	0.71	1.02	1.39	1.81	2.29
	Piston diameter (mm)	4	5	6	7	8	9
	Number of pump elements	9	9	9	9	9	9
	Delivery flow coding	<b>0,85</b>	<b>1,38</b>	<b>2,01</b>	<b>2,71</b>	<b>3,54</b>	<b>4,49</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.68	1.06	1.53	2.08	2.71	3.44

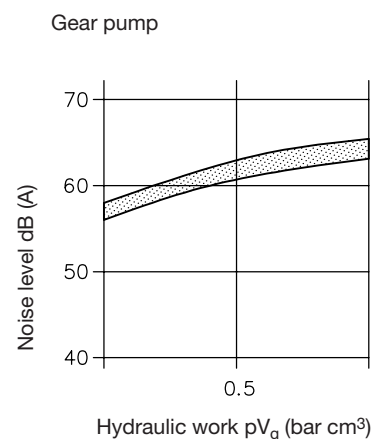
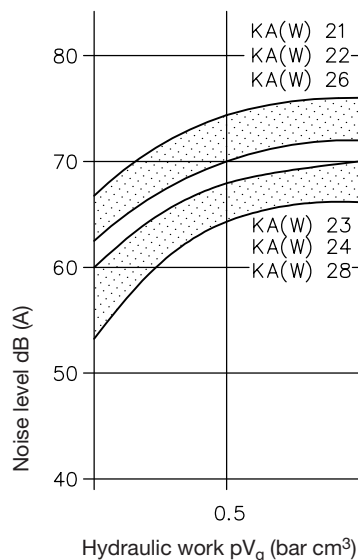
<b>Z</b>	Coding for gear						
	Delivery flow coding	<b>1,1</b>	<b>1,7</b>	<b>2,0</b>	<b>2,7</b>	<b>3,5</b>	<b>4,5</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	0.8	1.1	1.4	1.9	2.4	3.1
	Delivery flow coding	<b>5,2</b>	<b>6,4</b>	<b>6,9</b>	<b>8,8</b>	<b>9,8</b>	<b>11,3</b>
	Geom. displace $V_g$ (cm <sup>3</sup> /rev)	3.6	4.4	4.8	6.1	7.0	7.9

**Note:** Pump versions coding **HZ** are only available for tank size codings

### 3. Additional parameters

#### 3.1 General

Nomenclature	Constant delivery pump					
Design	Valve controlled radial piston pump or gear pump					
Direction of rotation	Radial piston pump - any Gear pump - counterclockwise (Direction of rotation can only be detected by checking the delivery flow - the connection of 2 of the 3 leads have to be changed at 3-phase versions, when there is no flow)					
Speed range	Radial piston pump H: 200 ... 3500 rpm Gear pump Z 1,1 ... Z 6,9: 700 ... 4000 rpm Z 8,8 ... Z 11,3: 500 ... 1800 rpm					
Installed position	Vertically (KA...S) or horizontally (KA...L) Observe notes regarding horizontal version, see sect. 4.2					
Mounting	Tapped holed M8, see dimensional drawings					
Mass (weight) (without fluid)		H (3 cyl.)	H (6 cyl.)	Z	HZ	For Mass (weight) of the required connection blocks, see the respective pamphlets (listing in sect. 5.1l and 5.1m)
	KA 21, 23	10.9	11.5	12.7	13.2	
	KA 22, 24	13.2	13.6	15.0	15.5	
	KA 26, 28	14.7	15.1	16.5	17.0	
	Tank size 01, 1	+0.7 kg				
	Tank size 02, 2	+2.2 kg				
	Tank size 11	+1.4 kg				
	Tank size 21	+2.9 kg				
	Tank size 22, 3	+4.4 kg				
	Auxilliary blower	+1.8 kg				
Hydraulic connection	via directly mounted connection blocks, see table in sect. 5.1l Basic pump: For connection hole pattern, see sect. 4					
Silica gel filter	Filtering surface 26.6 cm <sup>2</sup> Content 136 g Absorbance capacity 29.6 ml Filtration 3 µm Temperature range -30°C ... +90°C <b>Note:</b> For maintenance rules, see sect. 5.3!					
Running noise	Radial piston pump					



3.2 Hydraulic

Pressure	Delivery side (outlet ports P) depending on pump design and delivery flow, see sect. 2.2 Suction side (inside the tank): ambient pressure. Not suitable for charging.
Starting against pressure	Versions with 3~phase motor will start-up against pressure $p_{max}$ ! Whereas versions with 1~phase motor will start-up only against slight pressure!
Pressure fluid	Hydraulic oil conforming DIN 51 524 part 1 to 3; ISO VG 10 to 68 conforming DIN 51 519 Opt. operation range: Radial piston pump H: 10 ... 500 mm <sup>2</sup> /s Gear pump Z: 20 ... 100 mm <sup>2</sup> /s Viscosity range: min. approx. 4; max. approx. 800 mm <sup>2</sup> /s Also suitable are biologically degradable pressure fluids type HEES (synth. Ester) at service temperatures up to approx. +70°C. Electrically hazardous: Any fluid types containing water must not be used (short-cut).
Temperature	Ambient: approx. -40 ... +80°C; Fluid: -25 ... +80°C. Note the viscosity range! Permissible temperature during start: -40°C (observe start-viscosity!), as long as the service temperature is at least 20K higher for the following operation. Biologically degradable pressure fluids: Observe manufacturer's specifications. By consideration of the compatibility with seal material not over +70°C.
Filling and usable volume	See tank size in sect. 2.1, table 1b

3.3 Electrical

The following data apply to radial piston and to gear pumps The drive motor is part of the pump and can not be removed, see description in sect. 1.

Connection	Versions with plug Co. HARTING: cable 1.5 mm <sup>2</sup> Versions with integrated terminal box: Blade type plugs 6.3 Co. AMP Cable gland M20x1.5 or connector. M12x1 (option PM) are not scope of delivery.
Protection class	IP 65 acc. to IEC 60529 <b>Note:</b> The breather filter has to be protected from migrating moisture.
Safety class	DIN VDE 0100 safety class 1
Insulation	Lay-out conf. EN 60 664-1 ● up to 500V AC nom. phase voltage (wire-wire) for 4-wire AC-mains L1-L2-L3-PE (3~phase mains) <b>with</b> earthed star connection point. ● up to 300V AC nom. phase voltage (wire-wire) for 3-wire AC-mains L1-L2-L3 (3~phase mains) <b>without</b> earthed star connection point. ● for 1~phase mains with 2 conductors L-N up to 300 V AC nom. voltage.
Suppressor	Type RC3R
Coding E, PE	Oper. voltage 3x 575V AC Frequency 10 ... 400 Hz Max. power 4.0 kW

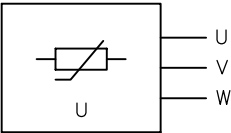


Table 9: Motor data

Type	Nom. voltage and mains frequency $U_N$ (V), f (Hz)	Nominal power $P_N$ (kW)	Nom. speed $n_N$ (rpm)	Nom. current $I_N$ (A)	Start current ratio $I_A / I_N$	Power factor $\cos \varphi$	Rec. operating capacitor $C_B$ (μF)	max. hydraulic work ( $pV_g$ ) <sub>max</sub> (bar cm <sup>3</sup> )
KA 21	3x400/230V 50 Hz YΔ	0.55	2790	1.25/2.2	4.8	0.84		165
	3x460/265V 60 Hz YΔ	0.66	3350	1.3/2.25	5.4	0.88		165
	3x690V 50 Hz Y	0.55	2790	0.73	4.8	0.84		165
KA 22	3x400/230V 50 Hz YΔ	1.1	2790	2.7/4.7	5.4	0.83		520
	3x460/265V 60 Hz YΔ	1.32	3400	2.6/4.5	7.1	0.80		520
	3x690V 50 Hz Y	1.1	2790	1.55	6.3	0.83		490
	3x200V 50 Hz/60 Hz	1.1	2820/3380	5.5/4.9	5.4/6.2	0.74/0.88		490/350
KA 23	3x400/230 V 50 Hz YΔ	0.37	1360	1.0/1.75	4.3	0.80		220
	3x460/265 V 60 Hz YΔ	0.44	1650	1.0/1.75	4.4	0.81		220
	3x690V 50 Hz Y	0.75	1330	1.3	3.0	0.75		385
	3x575V 60 Hz Y S3	0.75	1670	1.4	3.8	0.75		360
	3x200V 50 Hz/60 Hz S3	0.37	1410/1690	2.3/2.0	4.8	0.67		290/210
KA 24	3x400/230V 50 Hz YΔ	0.75	1360	2.2/3.8	4.3	0.74		590
	3x460/265V 60 Hz YΔ	0.9	1650	2.1/3.6	5.4	0.74		590
	3x200V 50 Hz/60 Hz	0.75	1390/1680	4.5/3.9	4.8	0.67		610/460
KA 26	3x400/230 V 50 Hz YΔ	1.4	2750	3.0/5.2	5.1	0.89		585
	3x460/265 V 60 Hz YΔ	1.68	3340	3.0/5.2	5.0	0.90		585
	3x500V 50 Hz Y	1.4	2820	2.35	6.0	0.85		590
	3x575V 60 Hz Y	1.4	3450	2.0	7.1	0.86		590
	3x380V 60 Hz Y	1.4	3450	3.05	7.1	0.86		630
	3x200V 50 Hz/60 Hz Y	1.4	2840/3450	6.4/5.3	6.2/7.1	0.79/0.86		630
KA 28	3x400/230V 50 Hz YΔ	1.0	1370	2,55/4,4	4.8	0.76		685
	3x460/265V 60 Hz YΔ	1.2	1660	2,5/4,35	5.0	0.78		685
	3x200V 50 Hz/60 Hz	1.1	1390/1690	6.3/5.5	5.1	0.67/0.76		785/665
KAW 21	1x230V 50 Hz ⊥	0.37	2770	2.5	3.7	0.97	24	100
	1x110V 60 Hz ⊥	0.37	3340	5.5	3.0	0.96	50	70
KAW 22	1x230V 50 Hz ⊥	0.75	2810	4.75	4.4	0.94	32	230
	1x110V 60 Hz ⊥	0.75	3400	12.0	3.5	0.90	120	175
KAW 23	1x230V 50 Hz ⊥	0.25	1380	1.9	3.0	0.91	18	145
	1x110V 60 Hz ⊥	0.25	1650	4.4	3.2	0.96	50	100
KAW 24	1x230V 50 Hz ⊥	0.5	1390	4.1	2.9	0.95	32	350
	1x110V 60 Hz ⊥	0.5	1680	9.0	3.3	0.98	65	210
	1x220V 60 Hz ⊥	0.5	1680	3.9	2.9	0.98	25	275
KAW 26	1x230V 50 Hz ⊥	1.1	2770	7.2	4.8	0.98	32	275
	1x110V 60 Hz ⊥	1.1	3340	15.0	4.0	0.99	100	235
	1x220V 60 Hz ⊥	1.1	3340	7.2	4.0	0.99	25	275
	1x115V 50 Hz ⊥	1.1	2750	15.0	4.0	0.96	120	260
KAW 28	1x230V 50 Hz ⊥	0.7	1370	5.1	3.0	0.94	36	400
	1x110V 60 Hz ⊥	0.7	1650	10.5	3.0	0.98	100	315

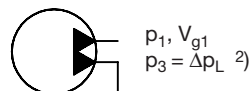
**Note:**

- The current consumption of the motor depends strongly on its load. The nominal figures apply strictly to one operating point only. Up to 1.8 of the nominal power of the motor can be exploited during load / no load operation (= operation mode S2 and S3). The increased heat built-up under these conditions gets intensively radiated during the idle or stand-still periods.
- The respective current consumption can be estimated via the middled and max. figures for the hydraulic work ( $pV_g$ )<sub>m</sub> and ( $pV_g$ )<sub>max</sub>.
- The respective load is determining for the current consumption of dual circuit pumps. The hydraulic work of the individual circuits have to be determined and added up.

All pressure outlets pressurized:

Dual circuit pumps  $(p \cdot V_g)_{\text{calc.}} = p_1 V_{g1} + p_3 V_{g3}$ 

One pressure outlet is pressurized, the other one in idle circulation mode:

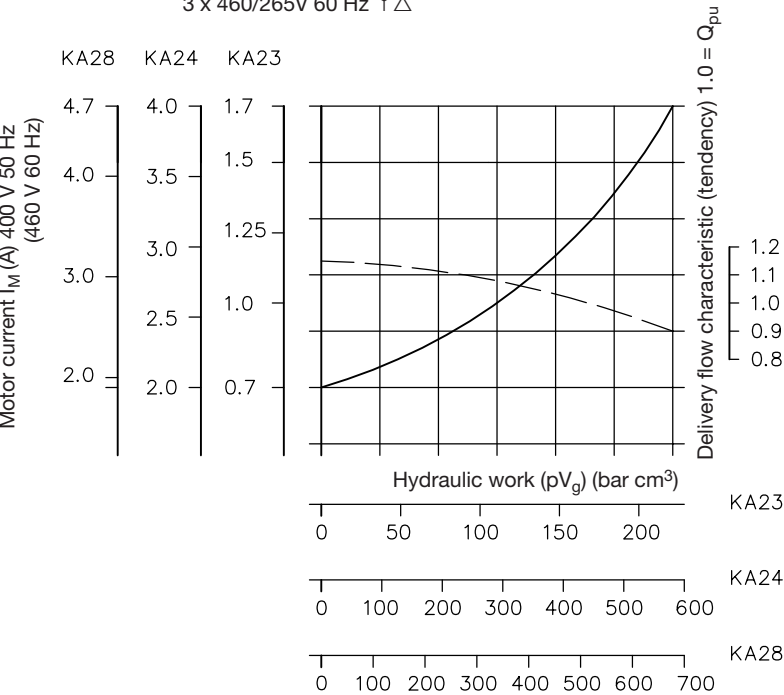
Dual circuit pumps  $(p \cdot V_g)_{\text{calc.}} = p_1 V_{g1} + \Delta p_L V_{g3}$ 

- Versions with 1~phase motors. The actual current consumption also depends on the size of the operating capacitor. The operating capacitor is not scope of delivery. For selection, see sect. 5.1 e
- Tension tolerances: ±10% (IEC 38), at 3 x 460/265V 60 Hz ±5%  
It is possible to use the power pack with reduced voltage, but this will cause a reduced performance, see sect. 5.1e !  
The max. perm. hydraulic work ( $pV_g$ )<sub>max</sub> for version **Z**, **HH**, and **HZ** with gear pump has to be reduced by 10%.

Current consumption

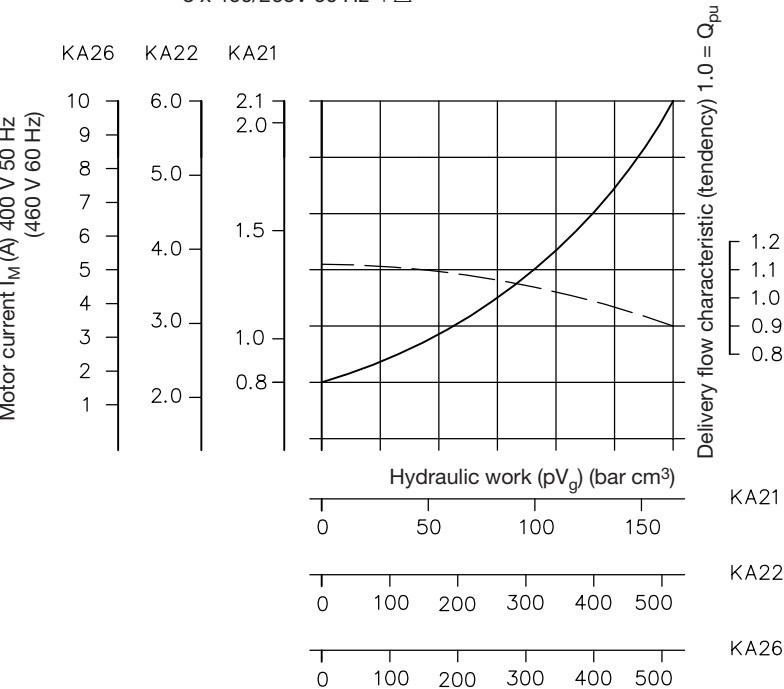
KA 23  
KA 24  
KA 28

Oper. voltage     3 x 400/230V 50 Hz  $\text{Y}\Delta$   
                         3 x 460/265V 60 Hz  $\text{Y}\Delta$



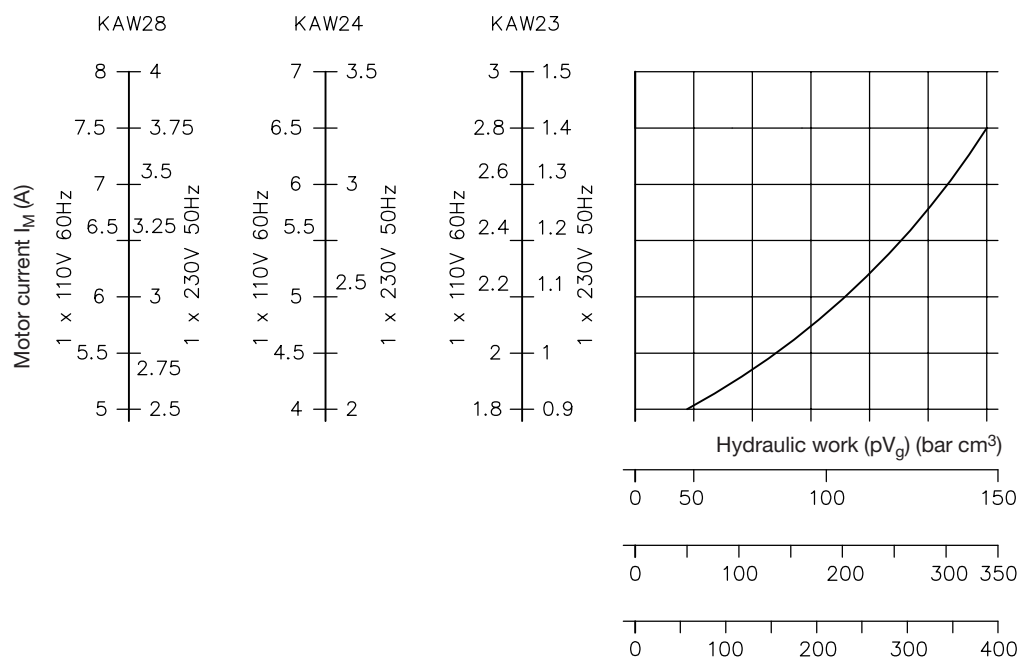
KA 21  
KA 22  
KA 26

Oper. voltage     3 x 400/230V 50 Hz  $\text{Y}\Delta$   
                         3 x 460/265V 60 Hz  $\text{Y}\Delta$

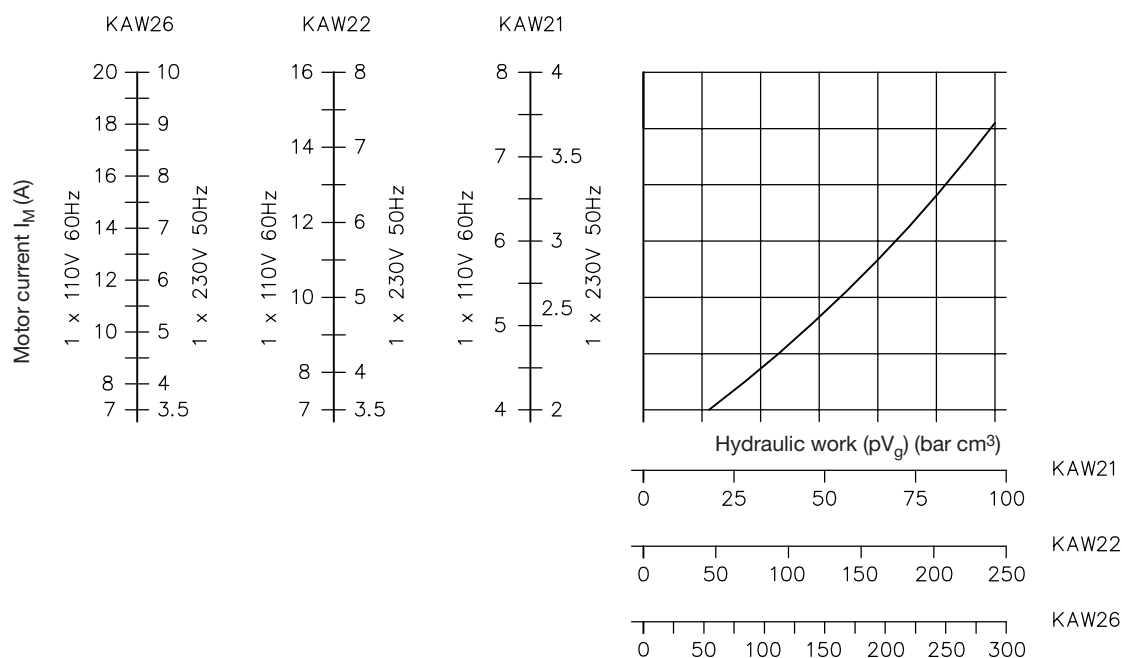


**KAW 23****KAW 24****KAW 28**

Oper. voltage 1 x 230V 50 Hz  
1 x 110V 60 Hz

**KAW 21****KAW 22****KAW 26**

Oper. voltage 1 x 230V 50 Hz  
1 x 110V 60 Hz





**Aux. blower**  
Coding **F, F1**

Motor data				
$U_N$	$P_N(W)$	Revolutions (rpm)	Protection class	
1x230V 50/60 Hz $\perp$	45	2800/ 3250	IP 44	
1x110V 60 Hz $\perp$	38	3250	IP 44	
24V DC	12	3050	IP 20	

Temperature range -30°C ... +50°C  
Electrical connection Plug conf. DIN EN 175 301-803 A

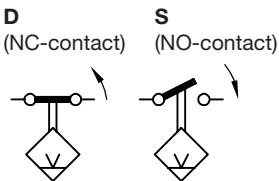
**Temperature switch**  
Coding **T**

Technical data:  
Bimetallic switch  
winding protective switch KAW  
separately mounted KA  
Temperature switch  
Trigger point 80°C  $\pm$  5K (Coding T)  
60°C  $\pm$  5K (Coding T60)  
Max. voltage 250 V 50/60 Hz  
Nom. current (cos  $\varphi$  ~0,6) 1.6 A  
Max. current at 24 V (cos  $\varphi$  = 1) 1.5 A  
Electrical connection Terminal box / plug Co. HARTING



**Float switch**  
Coding **D, S** (horizontal)

Technical data:  
Max. switched power DC/AC 60 W/ 60 VA  
Max. current DC/AC 0.8 A (cos  $\varphi$  =1)  
Max. voltage 230 V 50/60 Hz



Coding **KD, KS** (vertically)

Max. switched power DC/AC 10 W  
Max. current DC/AC 1 A  
Max. voltage 150 V 50/60 Hz  
200V DC

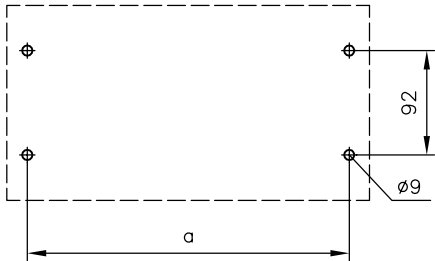
A protective circuitry has to be employed at inductive loads!

**4. Dimensions**

All dimensions in mm, subject to change without notice!

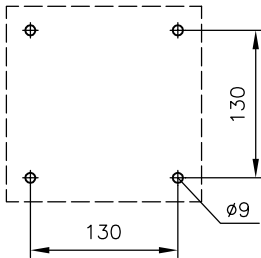
**4.1 Mounting hole pattern**

Horizontal version coding **L**

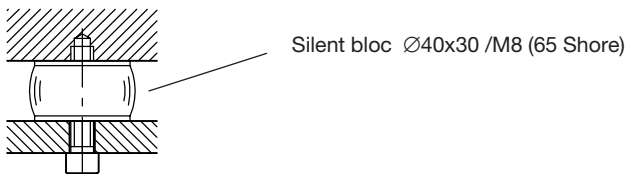


Coding	
Tank size	a
-	284
01, 1	336
11	388
02, 2	484
22, 3	684

Vertical version coding **S**



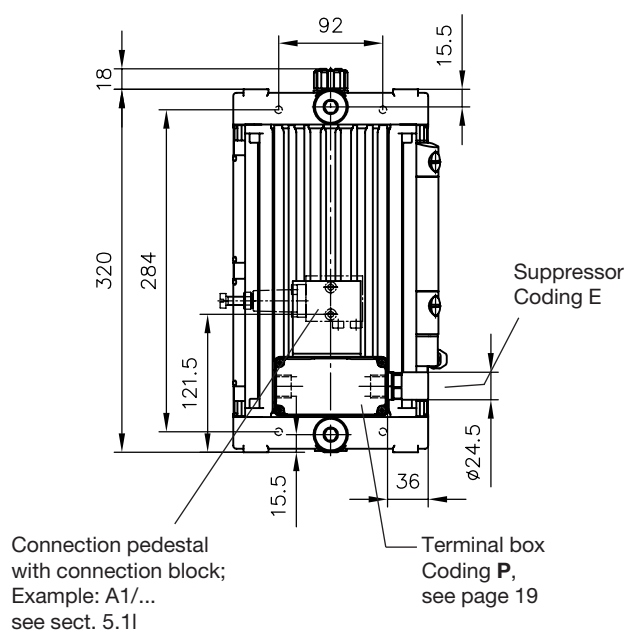
Recommended mounting



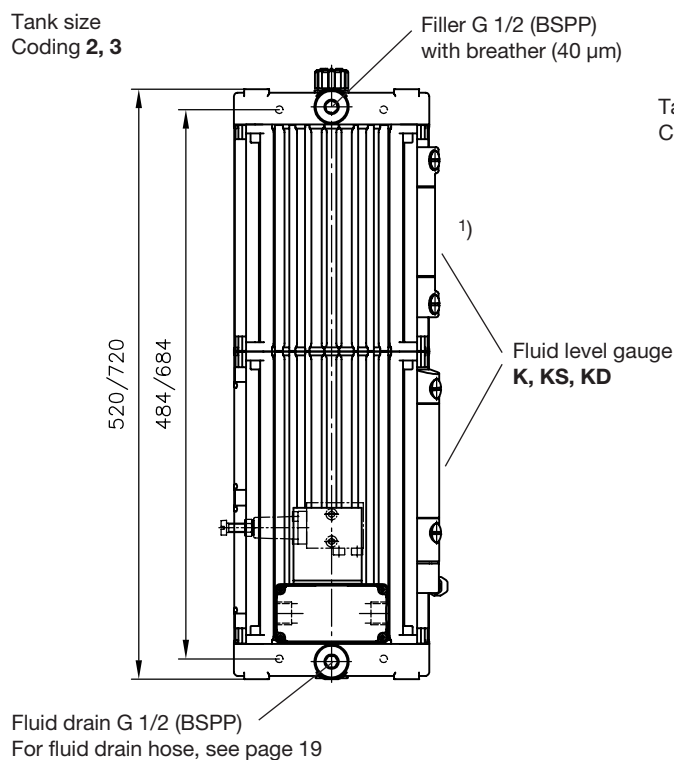
## 4.2 Basic pump

### Vertical version

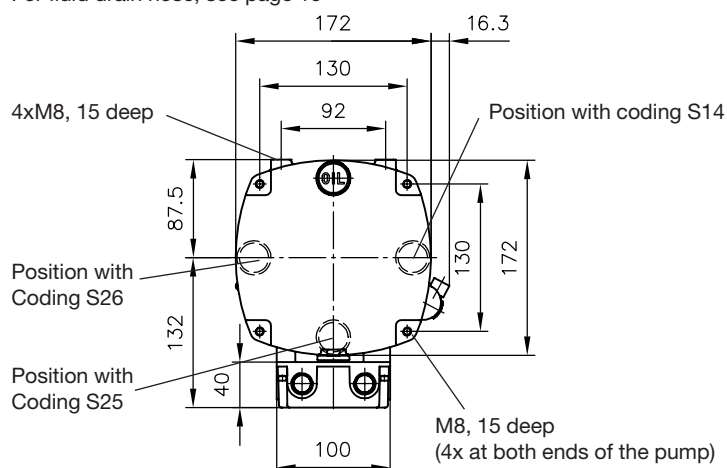
Tank size without coding



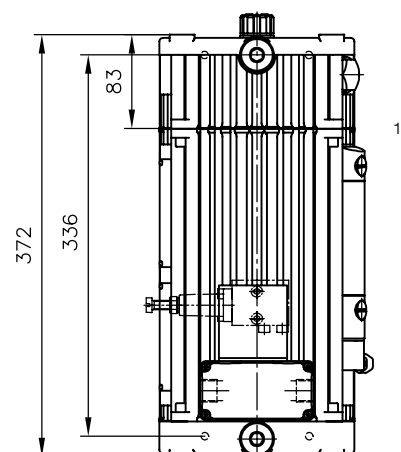
Tank size  
Coding 2, 3



Fluid drain G 1/2 (BSPP)  
For fluid drain hose, see page 19



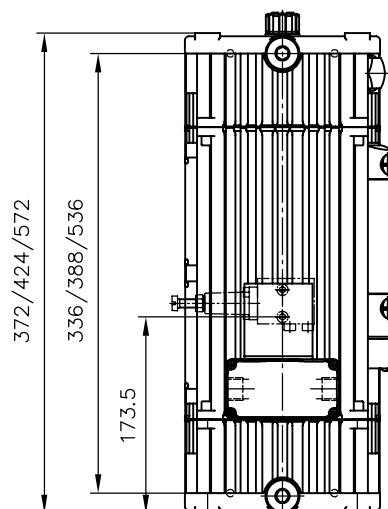
Tank size Coding 1



1) There is an additional fluid gauge in the tank extension with tank size coding 1, 2, 11, 21, 3 and optional fluid gauge coding K, KS, KD.

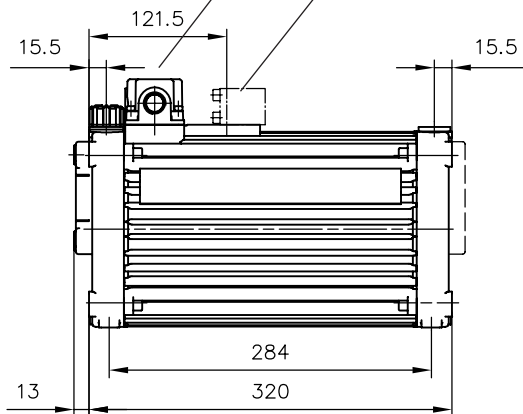
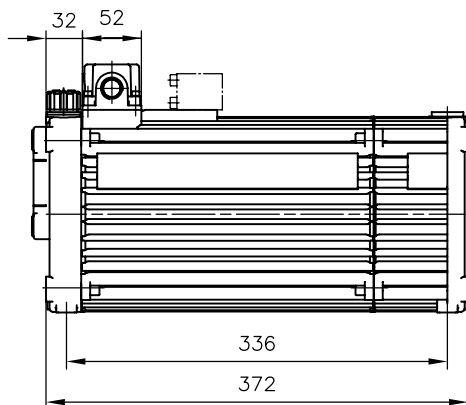
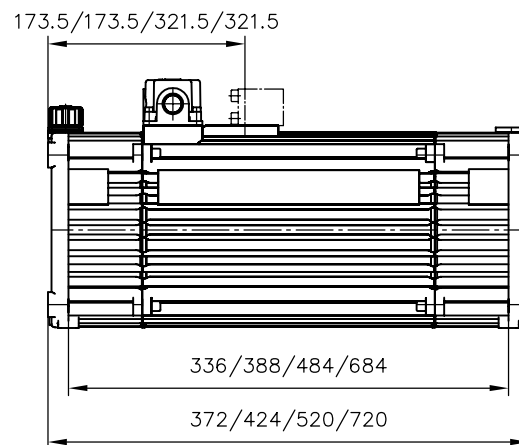
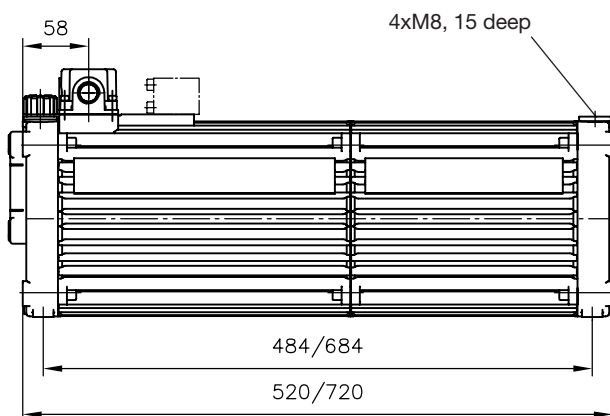
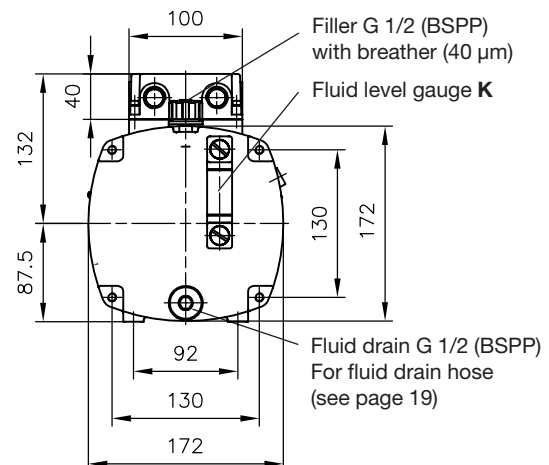
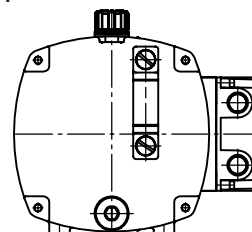
Whereas tank size 3 features the fluid gauge only in the tank extension.

Tank size  
Coding 01, 11, 21



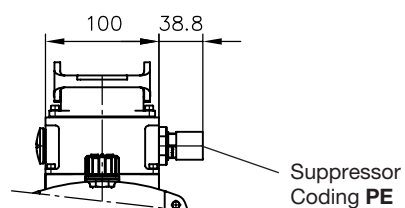
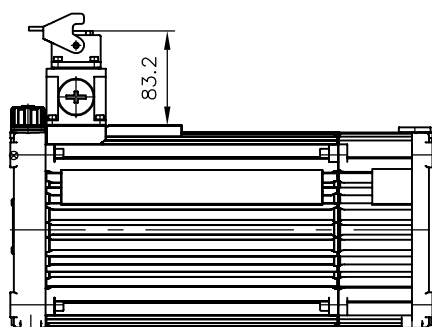
**Horizontal version**

Tank size without coding

Terminal box  
(coding P see page 19)Example:  
Connection block A1/...Tank size  
Coding 1Tank size  
Coding 01, 11, 02, 22Tank size  
Coding 2, 3**Note:** In case a version intended for horizontal use is installed vertically the breather has to be positioned on top and the pump at the bottom.Position with  
Coding L1, L14

**Options**

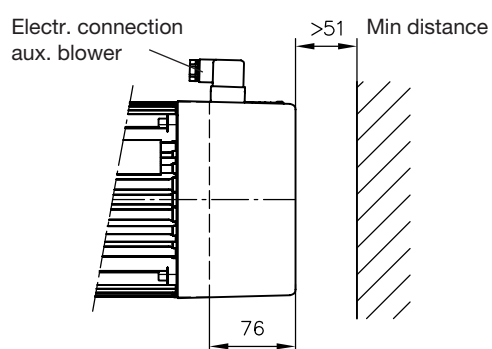
Terminal box  
Coding **P**



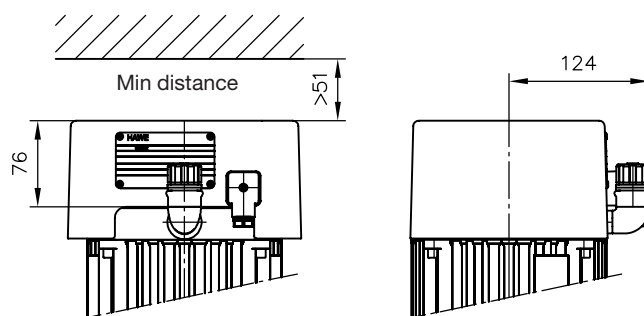
Aux. blower

Coding **F, F1**

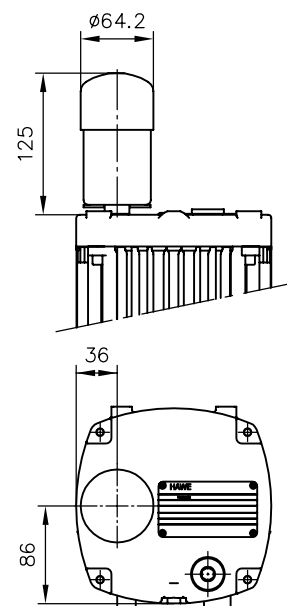
Horizontal version



Vertical version

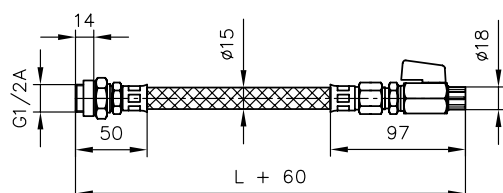


Silica gel filter  
Coding **G**

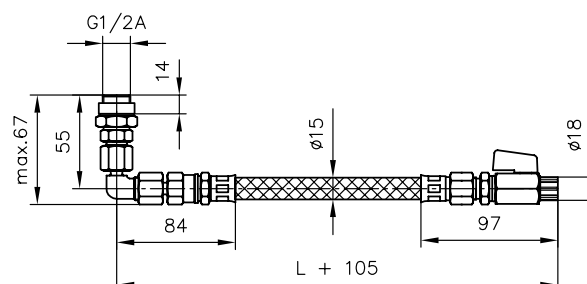


Fluid drain hose

Coding **G 1/2 x 300**  
**G 1/2 x 500**



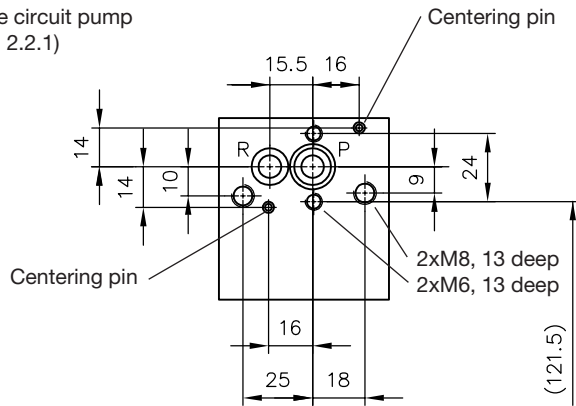
Coding **G 1/2 W x 300**  
**G 1/2 W x 500**



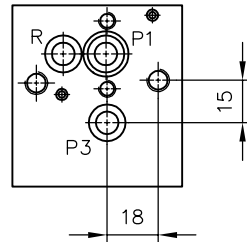
### 4.3 Electrical and hydraulic connections

#### Hydraulic

Single circuit pump  
(sect. 2.2.1)

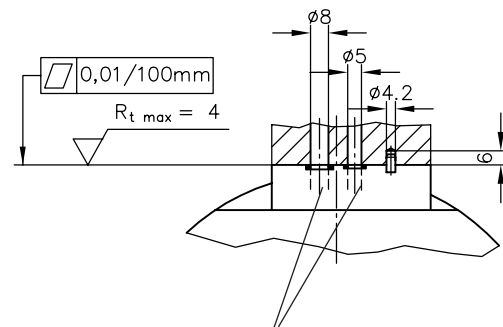


Dual circuit pump  
with joint connection  
pedestal  
(sect. 2.2.2)



For missing dimensions,  
see above !

#### Hole dimensions for customer furnished connection block



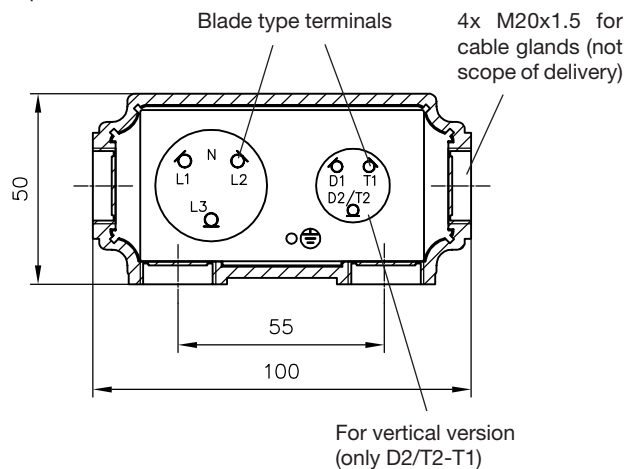
Port sealing:

P, P1, P3, R = 8x2 NBR 90 Sh

#### Electrical

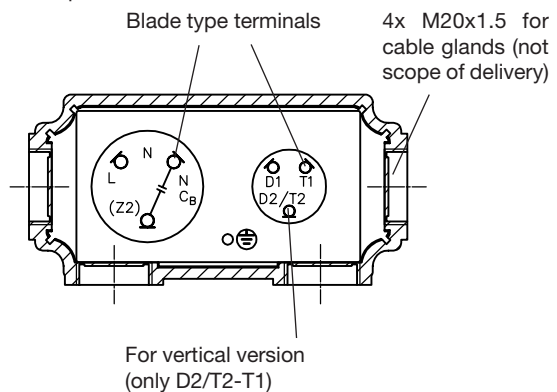
##### Terminal box

3~phase motor



For vertical version  
(only D2/T2-T1)

1~phase motor

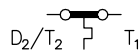


For vertical version  
(only D2/T2-T1)

C<sub>B</sub> - operating capacitor  
(not scope of delivery)

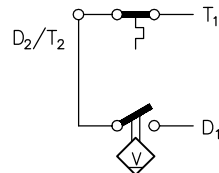
#### Temperature switch

Coding **T**  
(terminal box)

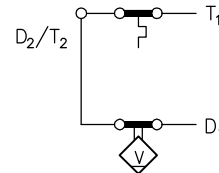


**Float switch** (horizontal version)

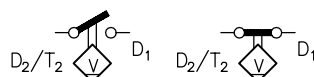
Coding **ST**  
(terminal box)



Coding **DT**  
(terminal box)

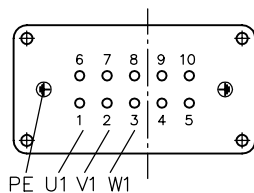


Coding **S, D**



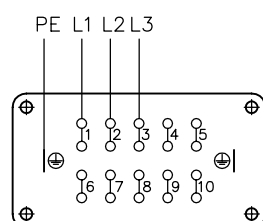
**Coding P**  
Plug Co. HARTING HAN 10 E

3~phase motor

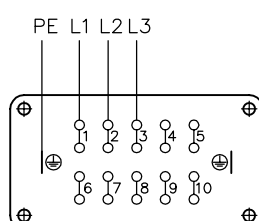


Electr. connection feed-in side (plug)

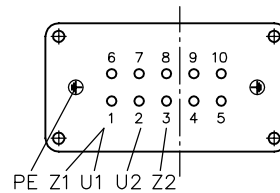
3~phase motor  $\nabla$



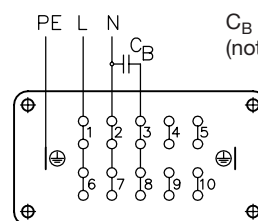
3~phase motor  $\Delta$



1~phase motor



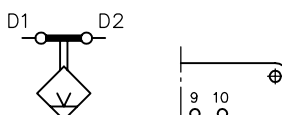
1~phase motor



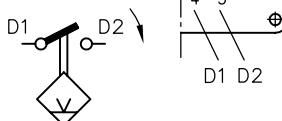
$C_B$  - operating capacitor  
(not scope of delivery)

**Coding D, S**

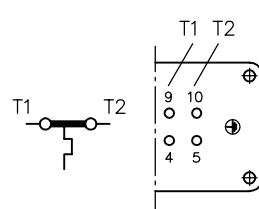
**D** (NC-contact)



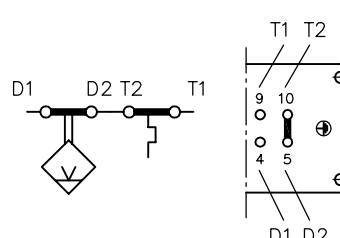
**S** (NO-contact)



**Coding T**



**Coding DT, ST**

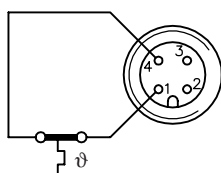


**Coding PM**

Plug Co. HARTING HAN 10 E (see above)  
Additional connection M12x1

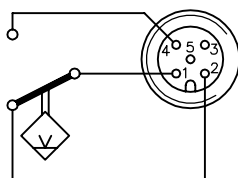
**Coding T**

One temperature switch:



**Coding S**

For vertical version with fluid level gauge and float switch:



**Float switch** (vertical version)

**Coding KS, KD**



Plug conf.  
DIN EN 175 301-803 A  
(8 mm)

**KS** (NO-contact)

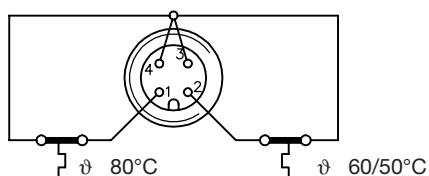


**KD** (NC-contact)



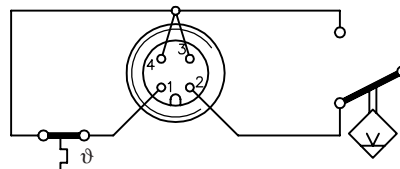
**Coding TT60**

Two temperatur switches:



**Coding ST**

For horizontal version with one temperature switch and one float switch:

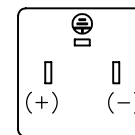
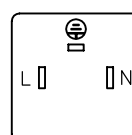


**Aux. blower**

**Coding F, F1**

1x230 V 50/60 Hz  
1x110 V 60 Hz

24V DC



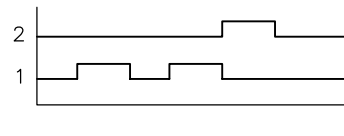
## 5. Appendix

### 5.1 Notes regarding selection

The following shows how to select a suitable hydraulic power pack with directly mounted valves. Usually an optimum solution is found when the following iteration steps have been passed.

#### a) Creation of a function diagram

The necessary or desired functions (hydraulically actuated) are the base for the function diagram.



#### b) Specification of pressure and flow

- Dimensioning and selection of the hydraulic consumers according to the required forces
- Calculation of the individual flows depending on the desired speed profiles

##### Note:

Take into account the necessary time for return for spring loaded clamping cylinders!

The return time of spring loaded clamping cylinders at time sensitive clamping applications, can often be even more long, than the time for clamping. In these cases, the strengths of the return spring exclusively determines the return times here. They force the piston back to its idle position opposed by the back pressure caused by valves and pipes. This has to be taken into account when dimensioning hoses, tubes and valves.

- Calculation of the individual necessary operation pressures
- Calculation of the max. necessary (pump) delivery flow – Q (lpm)
- Calculation of the max. necessary operating (system) pressure –  $p_{\max}$  (bar)

Q - flow

p - pressure

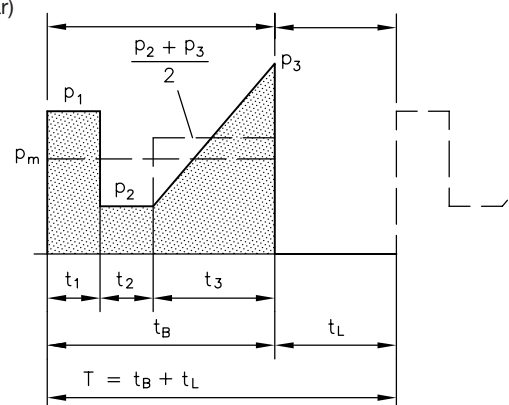
A - area

v - speed

F - force

$$Q \text{ (l/min)} = 0.06 \cdot A \text{ (mm}^2\text{)} \cdot v \left( \frac{\text{m}}{\text{s}} \right)$$

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



#### c) Creation of the hydraulic circuit diagram

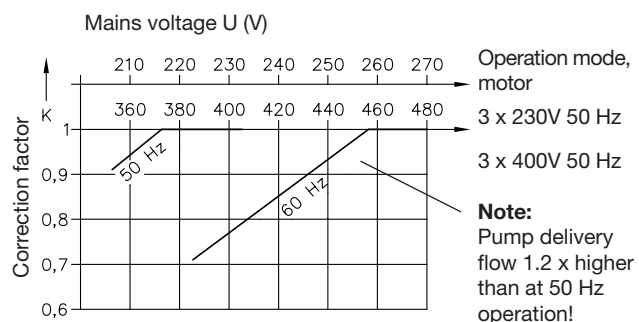
- Criteria:
  - Single circuit system
  - Accumulator charging operation
  - Dual circuit system with independently operated hydraulic circuits
  - Dual circuit system with one joint hydraulic circuit (e.g. press brakes or hydraulic tools with high-/low pressure or handling systems with rapid traverse and creeping)
  - Utilization of a hydraulic accumulator for brief support of the pump delivery

#### d) Creation of a time/load-diagram based on the function diagram

- The operation mode of the hydraulic power pack is selected according to this time/load-diagram
  - Calculation of the relative duty cycle %ED
  - S1 – permanent operation (not suited for compact power packs)
  - S2 – Short time operation
  - S3 – ON/OFF service
  - S6 – Permanent operation with intermittent load (only suited when combined with auxiliary blower coding F)

#### e) Selection of a hydraulic power pack

- Selection of the basic type based on the power supply
  - 3~phase mains type KA
  - 1~phase mains type KAW
- Motor selection
  - Voltage tolerances:  $\pm 10\%$  (IEC 38), at 3 x 460/265V 60 Hz  $\pm 5\%$
  - A 3~phase motor for 400 V 50 Hz can be used also at mains 460 V 60 Hz without any restrictions. 1~phase motors can be used only at mains where the nom. voltage and frequency specifications are apparent.
  - Operation with reduced voltage is possible, but there will be performance restrictions
  - $p_{\max \text{ red}} = p_{\max} \cdot k$
  - $p_{\max}$  (bar) – max. operating pressure according to the selection tables
  - $p_{\max \text{ red}}$  (bar) – reduced max. operating pressure
  - k – correction factor (diagram)



- Selection of the pump layout (radial piston pump, gear pump, pump combination)
- Selection of the pump delivery coding taking into account the respective perm. operating pressure of the design and selection of basic type and motor size
- Assessing the noise level acc. to the diagrams in sect. 3.1



### f) Calculation of the hydraulic work

- Calculation of the middled pressure
- Calculation of the middled hydraulic work (middled oper. pressure x delivery flow)
- Calculation of the max. hydraulic work (max. oper. pressure x delivery flow)

$p_m$  (bar) = calculated, middled pressure per cycle during while load is applied  $t_B = t_1 + t_2 + t_3 + \dots$

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

$p_m V_g$  = Middled hydraulic work of the pump

$V_g$  = geom. displacement acc, to tables in sect. 2.2

$$p V_{g \max} (\text{bar cm}^3) = p_{\max} \cdot V_g$$

### g) Determining the heat built-up

**Attention:** Observe the max. perm. fluid temperature of 80°C!

The persistent service temperature is reached after approximately one hour of operating time.

Influence-factors:

- Pressure distribution during the load duration (middled pressure)
- share of the idle period
- additional throttle losses, when exceeding usual figures (approx. 30%) of back pressure for pipes and valves. These influences only have to be taken into account if they are effective for a longer period within the operating cycle (load duration). This may be e.g. working against the pressure limiting valve (loss 100%)

The two most essential parameter, middled hydraulic work of the pump ( $p_m V_g$ ) and load duration per operating cycle (%ED) are usually sufficient for a rough re-check of the expected persistent fluid service temperature.

- The persistent over temperature will be 15% lower with tanks coding 02, 2, 22, 3.

- Auxiliary blower

The persistent over-temperature may be reduced by 50% when utilizing an auxiliary blower (coding F or F1).

The actual persistent over-temperature depends on the operation mode of the blower:

- only running while pump is running
- prolonged running (controlled either via time or temperature)
- permanently running

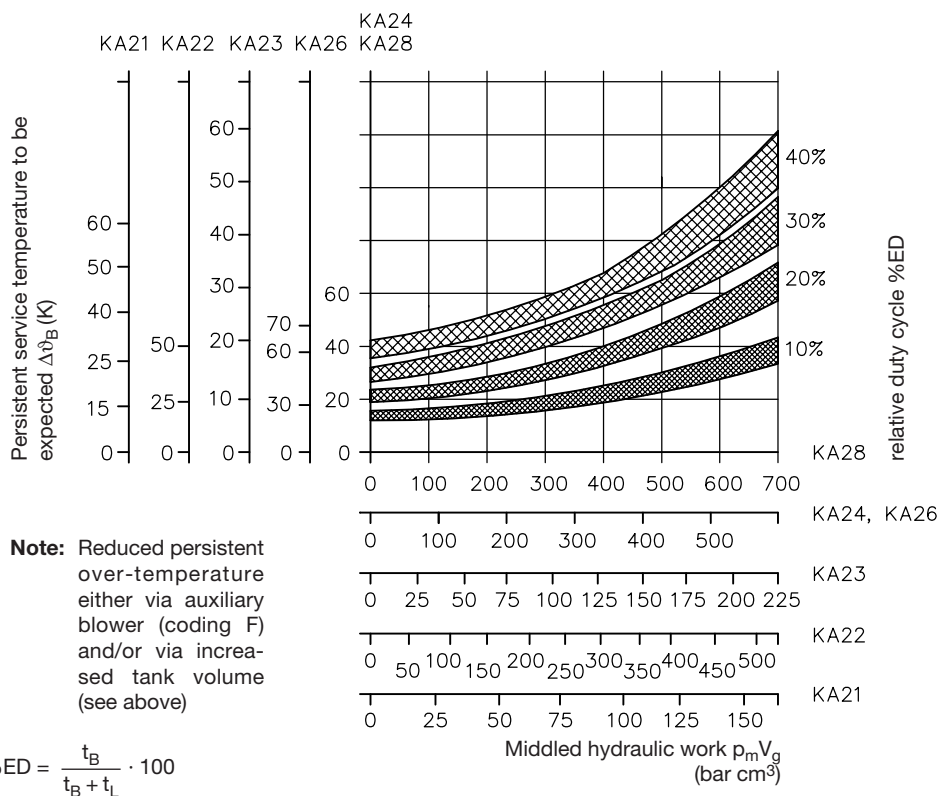
$$\vartheta_{\text{oil B}} = \Delta\vartheta_B + \vartheta_U$$

$\vartheta_B$  (°C) - Excess temperature after applied load, diagram

$\vartheta_U$  (K) - Ambient temperature in the installation area

$\vartheta_{\text{oil B}}$  (°C) - Persistent service temperature of the oil filling

**Attention:** Observe the max. fluid temperature of 80°C!



**h) Determining the max. current consumption**

see curves in sect. 3.3

For setting of the motor protective switch, see sect. 5.2 c

**i) Selection of the proper operation capacitor with type KAW**

A capacitor is mandatory for the version with 1~phase motor. The recommendations in sect. 3.3 table 9 ensure that the max. pressure rating specified are achieved.

The electric loss can be minimized by utilizing a smaller capacitor (- 30%) as long as only 75% of the specified max. hydraulic work ( $pV_g$ ) is employed

**Note:** The capacitor is not scope of delivery.

Selection of the capacitor

Motor voltage	Reference voltage
1 x 230V 50 Hz	400 V DB
1 x 220V 60 Hz	
1 x 110V 60 Hz	230 V DB
1 x 115V 50 Hz	

**j) Run-down**

A certain pressure rise will occur due to pump motor run-down, if the pump is directly connected to a hydraulic cylinder via a pipe, such as e.g. in the typical connection pattern for clamping equipment (connection block B...) and if the power unit is switched off by a pressure switch as soon as a pre-selected pressure is achieved. The extent of this additional pressure rise depends on the pre-selected pressure, the volume of the connected consumers and the pump delivery rate. If such pressure rises are undesired, it will be necessary to reset the pressure limiting valve to match the shut-off point of the pressure switch. The result will be that all excess delivery of the pump during run-down will be conducted to the tank via the pressure limiting valve.

Procedure for matching is as follows:

1. Fully open the pressure limiting valve.
2. Adjusting the pressure switch on highest value (turning the adjustment screw clockwise up to the stop).
3. Start the pump (pressure gauge and all consumers connected) and turn up the pressure limiting valve until the pressure gauge shows the desired final operation pressure.
4. Turn back the pressure switch until the pump is switched off at the preset pressure (see sect. 3.)
5. Lock pressure switch and pressure limiting valve in position.

The effect of excessive run-down pressure may also be minimized by utilizing an accumulator or providing additional volume in the consumer line.

If the compact hydraulic power pack is running under full load, i.e. the preset pressure is close to the maximum permissible pressure as listed in sect. 2.1 and 2.2, then effectively no run-down will occur, as the pump will stop almost immediately after shut-off.

**k) Silica gel filter**

The use of a silica gel filter is recommended, when water is migrating into the system via the tank breather because of high moisture and/or temperature changes (condensing water) - Danger of short-cut!

**Note:** Observe maintenance notes in sect. 5.3!

### l) Selection of a connection block

A connection block is mandatory for the hydraulic connection of the hydraulic power pack.

Type	Description	Pamphlet
<b>A, AL, AM, AK, AS, AV, AP</b>	For single circuit pumps with pressure limiting valve and the possibility for direct mounting of directional valve banks Optional: - pressure resistant filter or return filter - idle circulation valve - accumulator charging valve - prop. pressure limiting valve	D 6905 A/1
<b>AN, AL, NA, C30, SS, VV</b>	For dual circuit pumps with pressure limiting valve and where directional valve banks can be directly mounted in some cases Optional: - accumulator charging valve - two stage valve - idle circulation valve	D 6905 A/1
<b>AX</b>	For single circuit pumps with pressure limiting valve (type approved) and the possibility for direct mounting of directional valve banks for use at accumulator charged systems Optional: - pressure resistant filter or return filter - idle circulation valve	D 6905 TÜV
<b>B</b>	For single circuit pumps for actuating single acting cylinders with pressure limiting valve and drain valve Optional: - throttle valve	D 6905 B
<b>C</b>	For single circuit pumps with ports P and R for direct piping	D 6905 C

### m) Selection of the directional valve banks

The direct mounting of directional valves to the connection blocks type A enables creation of compact hydraulic units without additional piping.

Type	Description	Pamphlet
<b>VB</b>	Directional seated valves up to 700 bar	D 7302
<b>BWN, BWH</b>	Directional seated valves up to 450 bar	D 7470 B/1
<b>BVZP</b>	Directional seated valves up to 450 bar	D 7785 B
<b>SWR, SWS</b>	Directional spool valves up to 315 bar	D 7451, D 7951
<b>BA</b>	Valve bank for the combination of different directional valves with connection hole pattern NG 6 acc. to DIN 24 340-A6	D 7788
<b>BVH</b>	Valve bank with directional seated valves up to 400 bar	D 7788 BV
<b>NBVP</b>	Directional seated valves	D 7765 N
<b>NSWP</b>	Directional spool valves	D 7451 N
<b>NSMD</b>	Clamping modules (Directional spool valve with pressure reducing valve and feedback signal)	D 7787
<b>NZP</b>	Intermediate plate with connection hole pattern Ng 6 acc. to DIN 24 340-A6	D 7788 Z

## 5.2 Assembly and installation notes

**Attention:** The compact hydraulic power pack has to be installed and connected by a qualified technician, who is familiar with and works according to the generally accepted engineering standards and the latest legal regulations and standards.

The following guidelines and standards have to be taken into account:


- VDI 3027 "Initial operation and maintenance of hydraulic systems"
- DIN 24346 "Hydraulic systems"
- ISO 4413 "Hydraulic fluid power -- General rules relating to systems"
- D 5488/1 Pressure fluids - notes for selection
- B 5488 General operating manual for the assembly, initial operation and maintenance of hydraulic components and systems

### a) Identification

see type plate or selection table in section 2

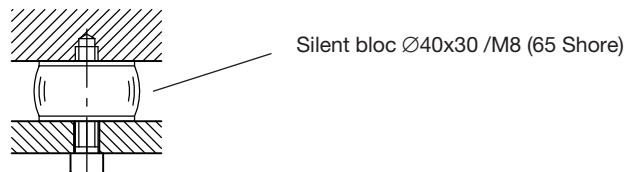
### b) Installation and mounting

#### ● Installation

 The hydraulic power pack incl. the solenoids of the directional valves can become hot during operation → Risk of injury!  
Care has to be taken that fresh air can be drawn in and the warm air can escape.

Modifications of any kind (mechanical, welding or soldering works) must not be performed.

- Installation position dep. on version, see sect. 2.1, table 1c
- For dimensions, see sect. 4.2
- For mounting hole pattern, see sect. 4.1
- Recommended mounting



- Mass (weight) for the basic power pack without valve assembly and fluid

	H (3 cyl.)	H (6 cyl.)	Z	HZ
KA 21, 23	10.9	11.5	12.7	13.2
KA 22, 24	13.2	13.6	15.0	15.5
KA 26, 28	14.7	15.1	16.5	17.0

Tank size 01, 1	+0.7 kg
Tank size 02, 2	+2.2 kg
Tank size 11	+1.4 kg
Tank size 21	+2.9 kg
Tank size 22, 3	+4.4 kg
Auxilliary blower	+1.8 kg

### c) Electrical connection and setting of the protective motor switch

- For connection of the electric motor, see sect. 4.3
- For connection of the float and fluid level switch, see sect. 4.3

**Note:** The temperature switch will trigger at a fluid temperature of approx. 95°C.

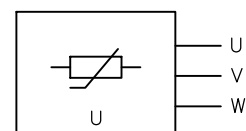
**Note:** The signal has to be delayed sufficiently (time lag relay) if the lay-out of the system features an operation cycle where the pump is emptied below the min. level and replenished by the reflow from the consumer within one cycle.

- Adjustment of the protective motor switch
  - In most cases it is sufficient, to set the response current to approx. 0.7 of  $I_M$  (see curves in sect. 3.3). This makes sure that on one hand the bimetallic switch does not trigger too early during normal operation but on the other hand the oil temperature doesn't rise too high due to a prolonged response time after the pressure limiting valve is in action.
  - Test the setting of the motor protective switch during a test run. Temperature switches, float switches and pressure switches are further safety measures against malfunctions.

### d) Notes to ensure EMC (Electromagnetic compatibility)

No impermissible spikes are emitted (EN 60034-1 sect. 19) when hydraulic power packs (inductive motor acc. to EN 60034-1 sect. 12.1.2.1) are connected to a system (e.g. power supply acc. to EN 60034-1 sect. 6). Tests regarding the conformity with EN 60034-1 sect. 12.1.2.1 and/or VDE 0530-1 are not required. Electro-magnetic fields may be generated during switching the motor ON/OFF. This effect can be minimized by means of a filter e.g. type 23140, 3x400V AC 4kW 50-60 Hz (Co. MURR-ELEKRONIK, D-71570 Oppenweiler)

There is an optional suppressor (Coding E or PE, see sect. 2.1, table 1e) available for type KA, which can be directly mounted either at the terminal box or at the plug Co. HARTING



**e) Putting into operation**

- Check, whether the compact hydraulic power pack is professionally connected.
  - Electrically: Power supply, controls
  - Hydraulically: Piping, hoses, cylinders, motors
  - Mechanically: Fastening at the machine, the frame, and the rack
- A protective motor switch should be employed to safeguard the electric motor.  
For current setting, see sect. 5.2 c
- The pressure fluid to top-up the power pack should have passed the system filter or be fed via a filter unit always. Only mineral oils conforming DIN 51524 part 1 to 3, type HL or HLP, with a viscosity of ISO VG 10 to 68 acc. to DIN 51519 are suited for use with this power pack. The water content must not exceed 0.1% (Danger of short-cut!)  
Also suitable are biologically degradable pressure fluids type HEES (synth. Ester) at service temperatures up to approx. +70°C. Electrically hazardous: Any fluid types containing water must not be used (short-cut) i.e. fluids type HEPG and HETG are not suitable! The compact hydraulic power pack has to be topped-up to the max. marking of the fluid level gauge/dip-stick.
- Filling and usable volume

Coding	Filling volume $V_{\text{filling}}$ (l)	Usable filling volume vertically $V_{\text{usable}}$ (l)	Usable filling volume horizontal $V_{\text{usable}}$ (l)
--	3.9	1.85	1.5
<b>1</b>	5.0	2.7	2.0
<b>01</b>	5.0	2.7	2.0
<b>11</b>	6.1	3.55	2.5
<b>2</b>	7.5	5.45	3.15
<b>02</b>	7.5	-	3.15
<b>21</b>	8.6	5.45	3.65
<b>22</b>	11.1	-	4.8
<b>3</b>	11.1	8.95	4.8

- Direction of rotation
  - Radial piston pump - any
  - Gear pump - counterclockwise
  - (Direction of rotation can only be detected by checking the delivery flow - the connection of 2 of the 3 leads have to be changed at 3-phase versions, when there is no flow)
- Initial operation and bleeding  
The pump cylinders will be bled automatically if the pump is switched on and off several times while the connected directional valves are switched into a switching position where idle circulation is provided, if possible with your circuitry (see circuit diagram). Another way is to install a pipe fitting with a short piece of pipe and prolonged by a translucent tube. The other end of the tube should be put into the filler neck (breather removed), held firmly and sealed with a non-fluffing cloth. Now switch on the pump and let it run until no more bubbles are visible. Next after the pump cylinders are bled any air dragged into the system should be removed by opening the bleeder screws at the consumers (if provided) until no more bubble are detected or by operating all functions of the circuitry without load until all cylinders, motors, etc. move steadily and without any hesitation.
- Pressure limitation and pressure reducing valves  
Do not make any changes of the pressure setting without simultaneously checking the pressure with a pressure gauge!
- Directional valves  
Solenoid valves apparent are to be connected to the controls according to the hydraulic wiring diagram and functional diagram.
- Accumulator charged systems  
Accumulators have to be filled with appropriate equipment according to the pressure specifications of the hydraulic wiring diagram. The respective operating manuals have to be taken into account.

### 5.3 Servicing

The hydraulic power packs type MP and the valves being directly mounted onto the hydraulic power pack are almost maintenance free. Only the fluid level should be checked regularly depending on operation conditions.

The fluid should be replaced every year as a general rule, but more frequently if tests show aging or contamination, filters (pressure or return) have to be replaced accordingly.

Silica gel filters, when apparent, have to be checked visually for a colour change every 6 month



Silica gel filter grain

blue = Ok

red = Replacement is indicated

- Used silica gel filter have to be disposed as hazardous waste!

**Attention:** Prior to maintenance and repair works the system has to be:

- depressurized (hydraulic side). This applies especially to systems with hydraulic accumulators
- cut-off or deenergized

Repairs and spare parts

Repairs (replacing service items) are possible by competent craftsmen. The motor can't be repaired or replaced by the customer. Therefore if the motor is defect, the complete pump should be returned to our facilities for an overhaul. There are spare parts lists available, pls. state your pump type acc. to the type plate either on the pump or on the cover plate.

### 5.4 Declaration of conformity

CE Letter of conformity acc. to EC directive 2006/95/EC

„Electrical equipment designed for use within certain voltage limits“

The compact power packs are manufactured in conformity with EN 60 034 (IEC 34 – VDE 0530) and VDE 0110.

Notes conforming EC directive machinery safety 2006/42/EC, appendix II, section 1 B:

The partly completed machinery are produced conforming the harmonized standards EN 982 and DIN 24 346. The setting in operation is forbidden until it is verified that the machine where the partly completed machinery is utilized fulfils the requirements in safety of Machinery Directive incl. appendix.