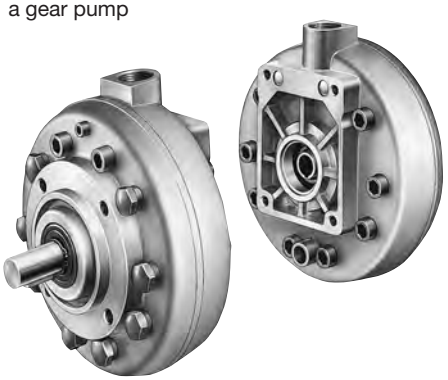
Dual stage pumps type RZ

High pressure pump	Pressure $p_{max\ HP}$	= 700 bar
	Delivery flow $Q_{max\ HP}$	= 91.2 lpm (1450 rpm)
	Geo. displacement $V_{geo\ HP}$	= 64.2 cm³/rev
Low pressure pump	Pressure $p_{max\ LP}$	= 200 bar
	Delivery flow $Q_{max\ LP}$	= 135 lpm (1450 rpm)
	Geo. displacement $V_{geo\ LP}$	= 89.6 cm³/rev

See also:
Hydraulic power packs type RZ D 6910 H

High pressure pump prepared for retrofitting of a gear pump



1. General

1.1 Design

Dual stage pumps type RZ consist of a high pressure section, i.e. a radial piston pump acc. to D 6010, and a directly mounted, play compensated gear pump forming the low pressure section. The housing of the high pressure pump provides a flange where the low pressure pump can be directly mounted. The drive shaft is designed as a thru-shaft to drive the second pump.

1.2 Application

High / Low pressure pump combination

- Dual stage pumps
  Use for press controls where rapid traverse and working speed is required. The low pressure flow is usually fed into a common line via a pressure actuated idle circulation valve which switches over as soon as the pre-set pressure is exceeded i.e. automatic by-pass.

- Dual circuit pumps
  These pumps are used for dual circuits where two individual circuits are fed simultaneously but pressure independent. Possible delivery flows and pressure depend on the combination. The two delivery flows are controlled via directional valves enabling idle circulation at one switching position.

1.3 Pump installation

- Installation outside of the tank
  The pumps are mounted to the electric motor (design IM B 35) via bell-housing and flex-coupling outside the tank. Best installation is beneath or below the tank with the suction line steadily declining. This ensures that the pump is automatically bled and helps suction, even when the fluid level is at minimum (see also sect. 5). There is a wide range of bell-housings and flex-couplings available, see D 6010 Z for order codings.

- Installation in the tank
  The most common installation is with the electric motor (design IM B 5 or IM V1) vertically on the cover plate and bell-housing, flex-coupling, and pump inside the tank.
  The order codings of the utilized bell-housings, flex-couplings are listed in D 6010 H. The respective suction parts are listed in D 6010 Z. These can be combined with pipe elbows conforming DIN 2950, shape D 4 or A 4.

2. Available versions, main data

The pressure specified in the tables below represent the maximum recommended values with which the respective high-pressure or low-pressure sections (p_{HPmax} or p_{LPmax}) can be loaded, with respect to the design of the units (pump cylinder or gear pump). The permissible pressure for a specific application have to be limited at a lower level in accordance with the power distribution.
See also sect. 4 „Power demand“!

2.1 High pressure pump prepared for retrofitting of a gear pump

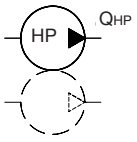
For main data see also D 6010.
The high-pressure pump (HP stage) is individually available. Gear pumps of any desired make can be used for fitting as a low-pressure stage (LP stage) as long as their flange area and shaft dimensions are compatible to the design illustrated for coding ../1 to ../3. The HP stage can rotate in any direction, i.e. gear pumps rotating either clockwise or counter-clockwise can be fitted. The utilized gear pump will determine the rotation direction of the pump combination. The pumps in sect. 2.2 are intended for counter-clockwise rotation. The low pressure pump for version .. /4 has to be furnished by the customer.

Order examples:

RZ 3,6 /2
RZ 1,4 A /3

Suffix **A** for up to 3 bar on the suction side; see sect. 2.3 „Pressure“

Symbol, when the low pressure pump is customer furnished



Basic type and delivery flow coding (High pressure section)

Basic type	Number of the pump cylinders	Delivery flow coding (guide line value Q_{HP} in lpm at 1450 rmp). The figure in the second line represents the geometric displacement in cm^3/rev.												Gear pump [3]
RZ		Piston diameter (mm)												
		4	5	6	7	8	9	10	12	13	14	15	16	
		Max. permissible operating pressure $p_{HP\,max}$ (bar) [1]												
Design		700	550	700 (450) [2]	600 (350) [2]	500 (300) [2]	250	450	350	300	250	200	160	Size
7631	2	**0,18** (0,13)	**0,28** (0,20)	**0,43** (0,28)	**0,56** (0,38)	**0,73** (0,50)	**0,92** (0,64)							**/1**
	3	**0,27** (0,19)	**0,42** (0,29)	**0,64** (0,42)	**0,81** (0,58)	**1,1** (0,75)	**1,35** (0,95							
	5	**0,46** (0,31)	**0,7** (0,49)	**1,08** (0,71)	**1,39** (0,96)	**1,77** (1,26)	**2,27** (1,59)							
6910	1			**0,3** (0,21)	**0,41** (0,29)	**0,5** (0,38)		**0,8** (0,60)	**1,2** (0,86)	**1,45** (1,01)	**1,7** (1,17)	**1,9** (1,34)	**2,2** (1,53)	**/2**
	2			**0,6** (0,43)	**0,83** (0,58)	**1,0** (0,76)		**1,6** (1,19)	**2,4** (1,72)	**2,8** (2,02)	**3,3** (2,34)	**3,8** (2,69)	**4,4** (3,06)	
	3			**0,9** (0,64)	**1,25** (0,88)	**1,5** (1,15)		**2,5** (1,79)	**3,6** (2,58)	**4,3** (3,03)	**5,1** (3,51)	**5,6** (4,03)	**6,5** (4,58)	
6911	3			**0,9** (0,64)	**1,25** (0,88)	**1,5** (1,15)		**2,5** (1,79)	**3,6** (2,58)	**4,3** (3,0)	**5,1** (3,5)	**5,6** (4,0)	**6,5** (4,58)	**/3** [4] or **/4** [5]
	5			**1,4** (1,07)	**2,08** (1,46)	**2,6** (1,91)		**4,2** (2,98)	**6,0** (4,30)	**7,0** (5,04)	**8,3** (5,85)	**9,5** (6,72)	**10,9** (7,64)	
	7			**2,1** (1,50)	**2,9** (2,05)	**3,7** (2,67)		**5,8** (4,18)	**8,4** (6,02)	**9,8** (7,06)	**11,8** (8,19)	**13,3** (9,40)	**15,3** (10,70)	**/2**
6912	10			**2,7** (2,15)	**4,15** (2,95)	**5,3** (3,82)		**8,2** (5,97)	**12,0** (8,60)	**14,2** (10,09)	**16,8** (11,70)	**19,3** (13,43)	**21,7** (15,28)	or
	14			**4,0** (3,01)	**5,85** (4,09)	**7,4** (5,35)		**11,6** (8,36)	**17,0** (12,03)	**20,0** (14,12)	**23,5** (16,38)	**26,5** (18,80)	**30,4** (21,39)	**/3** [4] or
6914	20			**6,1** (4,30)	**8,35** (5,85)	**11,0** (7,64)		**17,4** (11,94)	**25,0** (17,19)	**30,0** (20,18)	**35,0** (23,40)	**38,0** (26,86)	**43,4** (30,56)	**/4** [5]
	28			**8,0** (6,02)	**11,65** (8,19)	**15,0** (10,70)		**23,0** (16,71)	**34,0** (24,07)	**40,0** (28,24)	**47,0** (32,76)	**53,0** (37,60)	**60,8** (42,79)	
6916	42			**12,7** (9,03)	**17,45** (12,38)	**22,0** (16,04)		**34,5** (25,07)	**51,0** (36,10)	**60,0** (42,37)	**70,0** (49,14)	**80,0** (56,41)	**91,2** (64,18)	

[1] The operating pressure should be restricted for applications with continuous operation where the subsequent load cycles are all at the upper end of the pressure range (>75%) e.g. accumulator charging etc.
It is advisable for an economic service life of the bearings to restrict the operating pressure of the respective pump element diameter to about 75% of its original specification. Another pump with smaller but more pump elements should be selected, if this is not possible.

[2] Figures in brackets apply to design 7631

[3] For hole pattern of flange area and general dimensions, see sect. 6.2

[4] Attention: There is a offset of 10° when a LP-pump with hole pattern of size /3 is combined with design 6916 (see also page 11) !

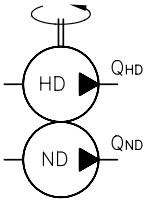
[5] Only a LP-pump can be retrofitted where the dimensions are compatible to size /4 illustrated in sect. 6.2 !

2.2 Pump combinations direct from HAWE

The HP-pumps acc. to sect. 2.1 RZ.... /1 to RZ... /3 are combined with gear pumps. Combinations with gear pumps of other brands have to be customer furnished (sect. 2.1).

Order example: **RZ 8,3/3 - 59**

Symbol



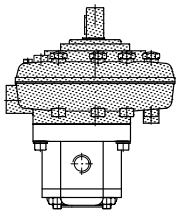
[1]) The actual permissible pressure p_{LP} may be lower, depending on the application. Observe the max. drive power rating of the shaft, see sect. 4. It is advisable for an economic bearing service life to restrict the middled operating pressure of subsequent load cycles (e.g. accumulator charging) down to 50 to 60% of p_1.

Coding high pressure section from sect. 2.1	Delivery flow coding (guide line value Q_{HP} in lpm at 1450 rpm) second figure represents the geometric displacement in cm^3/rev.		Permissible pressure $p_{LP\ max}$ [1]) in (bar) when mounted to a HP-pump of the specified design (see also sect. 2.1)			
			7631	6910	6911 6912	6914 6916
RZ 0,18/1- to RZ 2,27/1-	**2,0**	(1,4)	180			
	2,7	(1,9)	180			
	3,5	(2,4)	180			
	4,5	(3,1)	170			
	5,2	(3,6)	150			
	6,9	(4,8)	110			
	8,8	(6,1)	90			
	9,8	(7)	80			
	11,3	(7,9)	70			
RZ 0,3/2- to RZ 91,2/2-	**9,0**	(6,0)		200	200	200
	12,3	(8,5)		130	200	200
	16	(11)		100	200	200
	21	(14,5)		80	180	180
	24	(17)		70	150	180
	28	(19,5)		60	130	160
	37	(26)		45	100	140
RZ 0,9/3- to RZ 91,2/3-	**45**	(30,2)			120	210
	59	(41,8)			90	180
	75	(50,4)			70	160
	87	(61)			60	150
	110	(72)			50	120
	135	(87,8)			40	90

2.3 Additional parameter

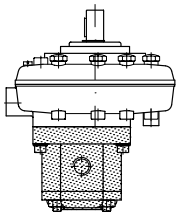
Nomenclature	Dual stage pump, two constant delivery flows
Design	Combination of valve controlled radial piston pump and directly mounted, play compensated gear pump
Fastening	At the facial side of the HP-pump via 4 tapped holes, see sect. 6 ++.
Drive and direction of rotation	Only via flex-coupling, e.g. acc. to sect. 2.3 in D 6010 Z; A rotation direction is not specified for HP-pumps without gear pump, but combinations of HP- and LP-pump (acc, to sect. 2.2) must rotate counter clockwise when facing the drive shaft
Drive speed	Nom. speed rating 1450 rpm; perm. range 500 ... 2000 rpm
Unit dimensions	see dimensional drawings 6.1 (HP-pumps) and 6.2 (LP-pumps)
Installed position	Lateral or vertical, observe notes in sect. 6.2 !
Pressure	Pressure outlet: Perm pressure ratings acc. to sect. 2.1 and 2.2 Suction side: The fluid should enter the pump with ambient pressure, see also notes for installation in sect. 5.1 and 5.2 Perm. pressure HP-pump only $p_{suction}$ = 1 bar (2 bar abs.) $p_{suction}$ = 3 bar (version RZ..**A**/..); For details see D 6010, sect. 5.2
Hydraulic fluid:	Hydraulic oil acc. to DIN 51524 table 1 to 3; ISO VG 10 to 68 acc. to DIN 51 519) Viscosity range: min. approx. 4; max. approx. 1500 mm^2/sec (design 6910 ..6916) min. approx. 4; max. approx. 800 mm^2/sec (design 7631) Optimum service: approx. 10 … 500 mm^2/sec Also suitable are biologically degradable pressure fluids type HEPG (Polyalkylenglykol) and HEES (synth. Ester) at operation temperatures up to approx. +70°C.
Temperature:	Ambient: approx. -40...+80°C; Fluid: -25...+80°C, pay attention to the viscosity range! Start temperature down to -40°C are allowable (Pay attention to the viscosity range during start!), as long as the operation temperature during subsequent running is at least 20K (Kelvin) higher. Biological degradable pressure fluids: Pay attention to manufacturer's information. With regard to the compatibility with sealing materials do not exceed +70°C.

3. Mass (weight) approx. (kg)



High pressure stage

Design	7631	6910		6911		6912		6914		6916
	Coding acc. to section 2.1									
Suited for low pressure stage	0.18 to 2.27	0.3 to 4.4	0.9 to 6.5	1.4 to 10.9	2.1 to 15.3	2.7 to 21.7	4.0 to 30.4	6.1 to 43.4	8.0 to 60.8	12.7 to 91.2
Size /1	3.1	--	--	--	--	--	--	--	--	--
Size /2	--	2.5	3.1	5.1	5.9	8.8	10.1	20.8	23.5	38.7
Size /3 (/4)	--	--	--	5.5	6.3	9.2	10.5	21.2	23.9	39.1



Low pressure stage

Size	/1		/2			/3			
Coding acc. to sect. 2.2	2.0 to 6.9	8.8 to 11.3	9 to 16	21 to 28	37	45 and 59	75 and 87	110	135
approx. (kg)	1.0	1.2	2.3	2.8	3.1	5.5	7.3	7.8	8.4

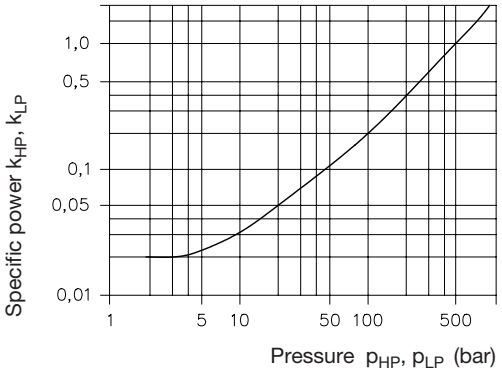
Attention: The individual weights of HP- and LP-pump have to be added with pump combinations acc. to sect. 2.2

4. Power demand

The required power depends on the type of application. It is important that the total power requirement does not exceed the permissible power rating for the shaft ($P_{requ.} \leqq P_{max}$), when calculating the necessary drive power $P_{requ.}$ for the pump combination at the respective load.

HP-pump	7631	6910	6911	6912	6914	6916
max. power rating P_{max} (kW)	1.5	3	11	11	22	30

The specific power k_{HP}, k_{LP} is limited by the pressure ratings $p_{HP\,max}$ (see sect. 2.1) and $p_{LP\,max}$ (see sect. 2.2)

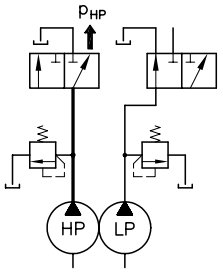


There are two typical operation cases, which depending on the type of machine control, may occur during a work cycle. The highest value resulting for $P_{requ.}$ determines the drive motor size.

1. Case:
One of the two pumps is in idle circulation mode, whereas the other one acts against the consumer pressure

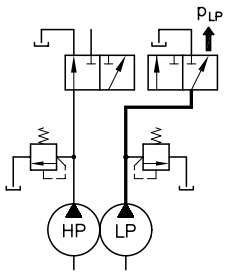
Case 1a:
HP against consumer pressure p_{HP}
LP idle circulation pressure

$P_{requ.} = k_{HP} \cdot Q_{HP} + 0.02 \cdot Q_{LP}$



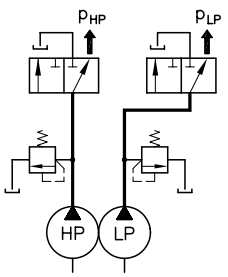
Case 1b:
HP idle circulation pressure
LP against consumer pressure p_{LP}

$P_{requ.} = 0.02\ Q_{HP} + k_{LP} \cdot Q_{LP}$



2. Case:
Both pumps act against the consumer pressure p_{HP} and p_{LP}

$P_{requ.} = k_{HP} \cdot Q_{HP} + k_{LP} \cdot Q_{LP}$



Example:

In the case of press controls in accordance with the circuit diagrams in D 7150 (switch unit type CR) or D 7161 (two-stage valves types NE 70 and 80), case 2 is typical for rapid traverse with $p_{HP} = p_{LP}$. Case 1a is typical for the LP stage circulating without pressure for the following work operation.

Calculated:
RZ 8,3/3-45 with p_{LP} = 20 bar and p_{HP} = 240 bar

Solution:
Rapid traverse (case 2): $p_{LP} = p_{HP}$ = 20 bar, results in $k_{LP} = k_{HP}$ = 0.052
$p_{requ.\,LP} = 0.052 \cdot 8.3 + 0.052 \cdot 45.0$ = 2.77 kW

Working operation (case 1a): p_{HP} = 240 bar, $p_{LP} \approx 0$ bar, results in
k_{HP} = 0.5
$P_{requ.\,HP} = 0.5 \cdot 8.3 + 0.02 \cdot 45.0$ = 5.05 kW

Selected drive motor 5.5 kW.

This can be optimized by suitable converting the given arithmetical formula for case 1 or case 2. If, for example, you wish to maintain the calculated power value of 2.77 kW for rapid traverse and select a 3 kW motor, Q_{HP} must be reduced.

$$Q_{HP} = \frac{P_{requ.} - 0.02\ Q_{LP}}{k_{HP}} = \frac{3 - 0.02 \cdot 45.0}{0.5} = 4.2 \text{ lpm}$$

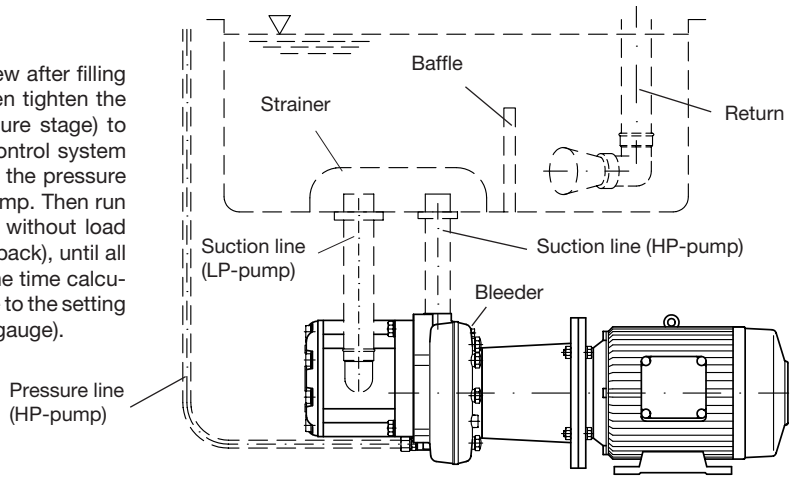
You will now select a RZ 4,3/3-45 or RZ 4,2/3-45 .

5. Bleeding and initial operation

When starting up the pump for the first time and whenever changing the oil in the system, bleeding is necessary. This prevents intake problems or air being fed to the consumers.

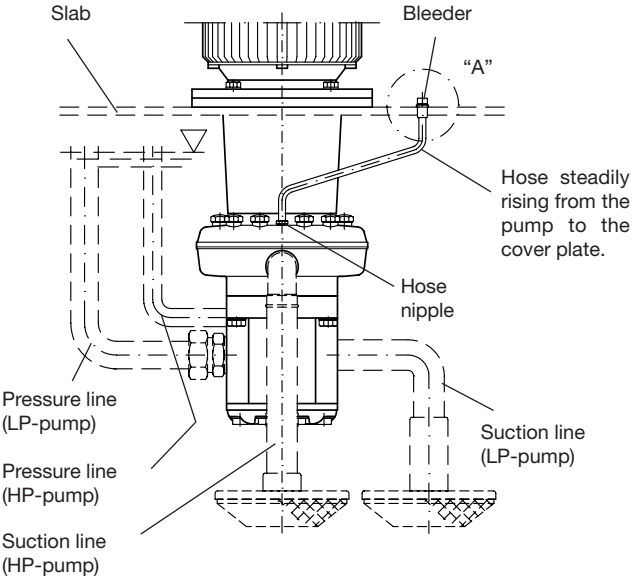
5.1 Pumps installed outside the oil tank

Slacken (but do not remove) the bleeder screw after filling the oil tank and wait until oil comes out. Then tighten the bleeder and allow pump (HP- and LP-pressure stage) to run briefly without pressure (assuming the control system provides this possibility). Otherwise set back the pressure limiting valve to zero pressure and run the pump. Then run the hydraulic system through several cycles without load (possibly with the pressure-limiting valve set back), until all functions take place freely and smoothly in the time calculated. Finally, return the pressure-limiting valve to the setting for operation (always checked by a pressure gauge).



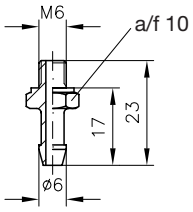
5.2 Pump installed in the tank

A bleeder line must be routed to the cover plate, like with the power packs available from HAWE (see D 6010 H), when the tank is customer furnished. The bleeder screw at the pump is replaced by a hose nipple an additional hose nipple (screw or peened type) is positioned at the bottom side of the cover plate. Both nipple are interconnected with a hose. The nipple in the cover plate is blocked with a screw (M6) from top.
This screw is removed when the tank is filled enabling any trapped air in the pump to escape. Wait some minutes and reinstall the screw. Subsequent initial operation is like in sect. 5.1.

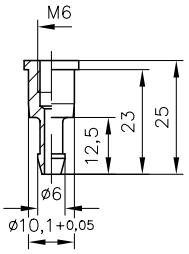


Available components for bleeding

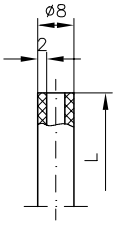
1. Screw-type hose nipple
   Order No. 6020 070



Peen type hose nipple
Order No. 6020 307

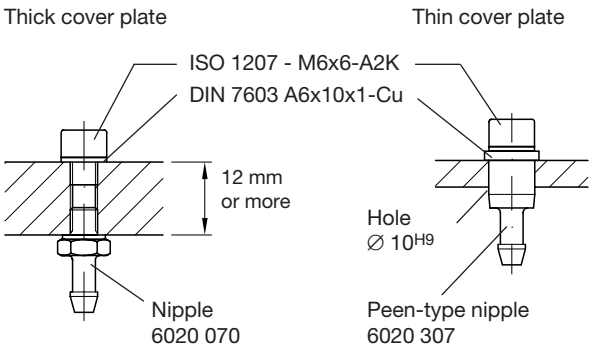


2. Hose (NBR)



Order No.	L
6020 077a	220
6020 077b	260
6020 077c	310
6020 077d	420
6020 077e	600

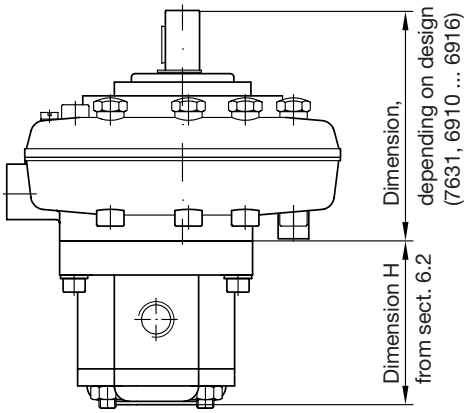
Detail "A"



6. Unit dimensions

All dimensions in mm, subject to change without notice!

The dimensional drawings below show the high and low pressure pumps in individual illustrations. The total length is determined by adding the respective individual dimensions.s



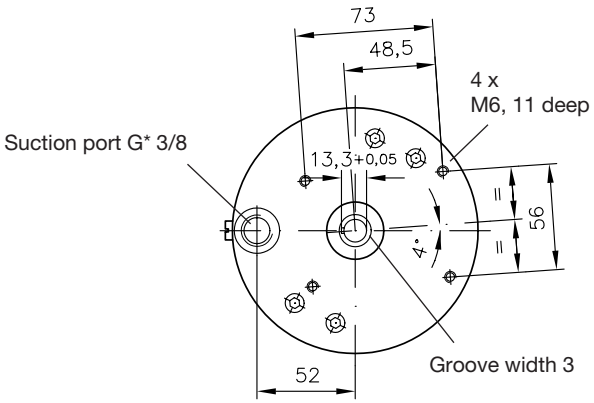
6.1 High pressure stage

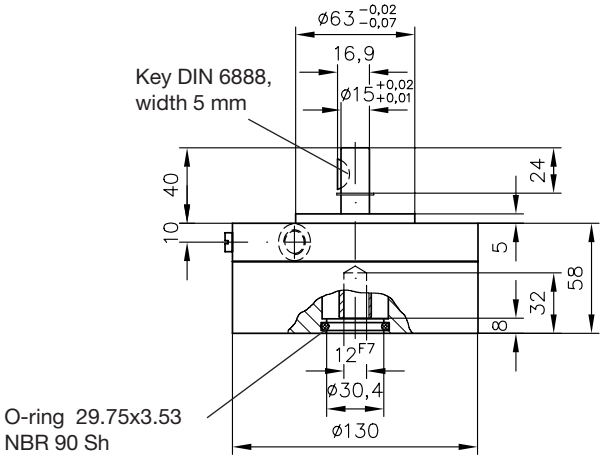
Design 7631 acc. to sect. 2.1

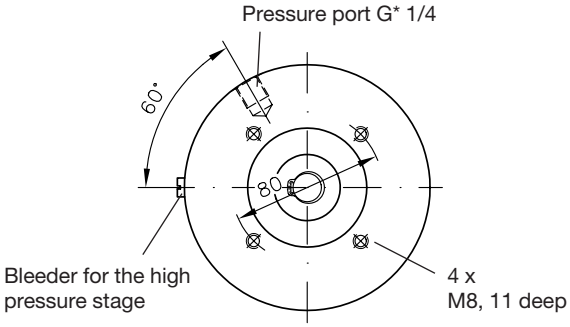
Suited for low pressure pump size /1

2-, 3-, and 5-cylinder pump

Type RZ 0,18/1 ... 2,27/1







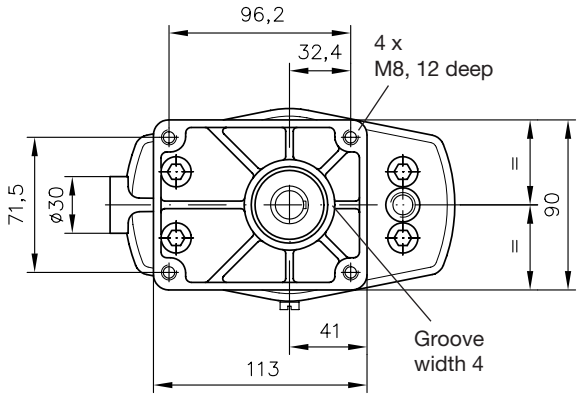
*G = (BSPP)

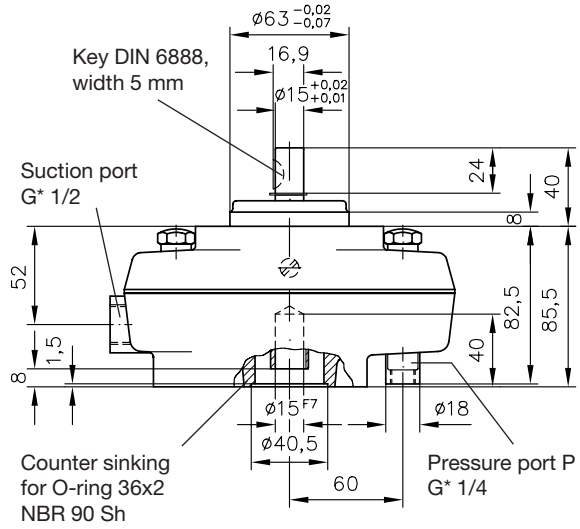
Design 6910

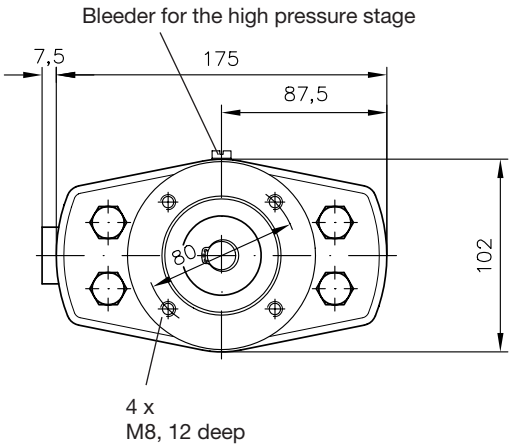
Suited for low pressure pump size /2

1- and 2-cylinder pump

Type RZ 0,3/2 ... 4,4/2

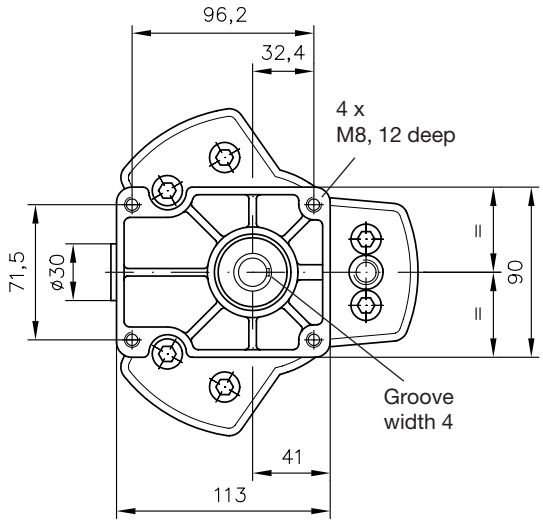


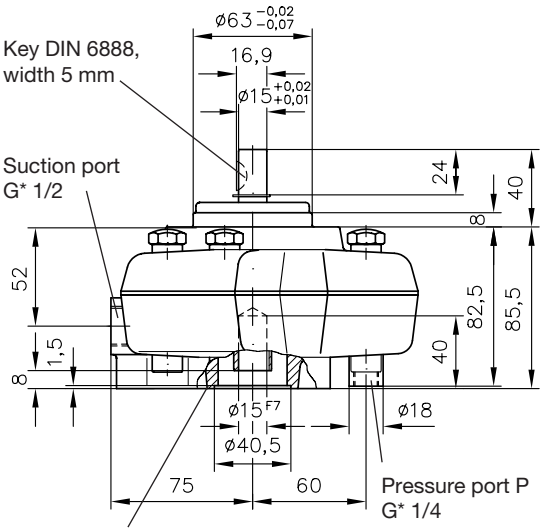


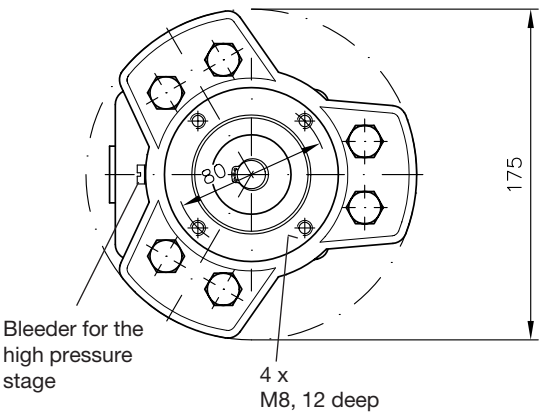


3-cylinder pump

Type RZ 0,9/2 ... 6,5/2



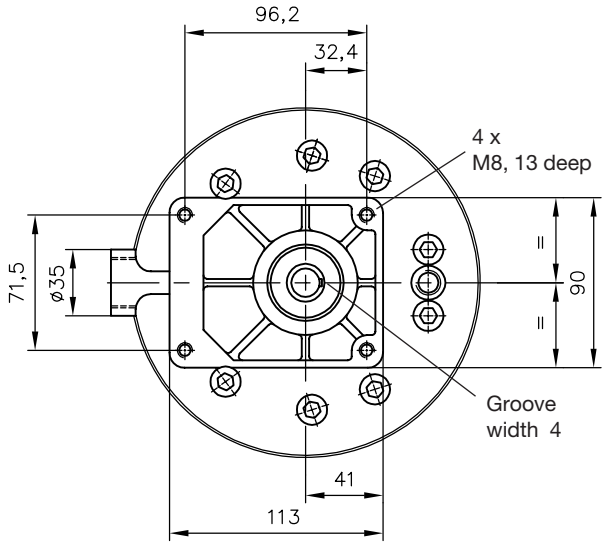




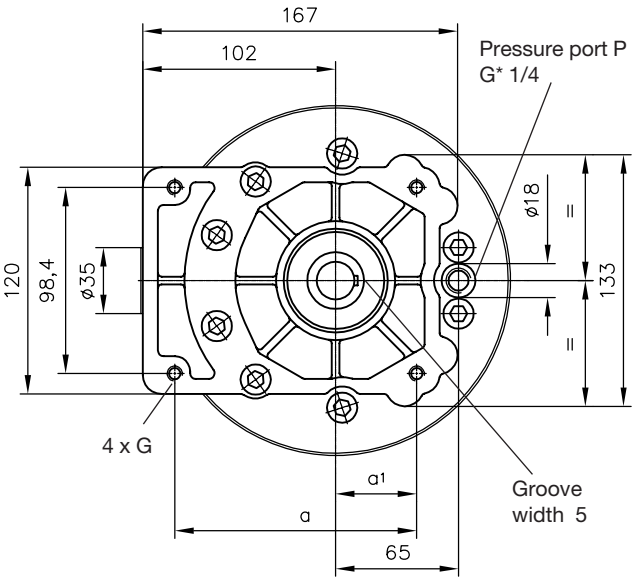
*G = (BSPP)

Design 6911, single radial pump Type RZ 0,9/3 (/4) ... 6,5/3 (/4)
Type RZ 1,4/2 (/3, /4) ... 15,3/2 (/3, /4)

Suited for low pressure pump size /2

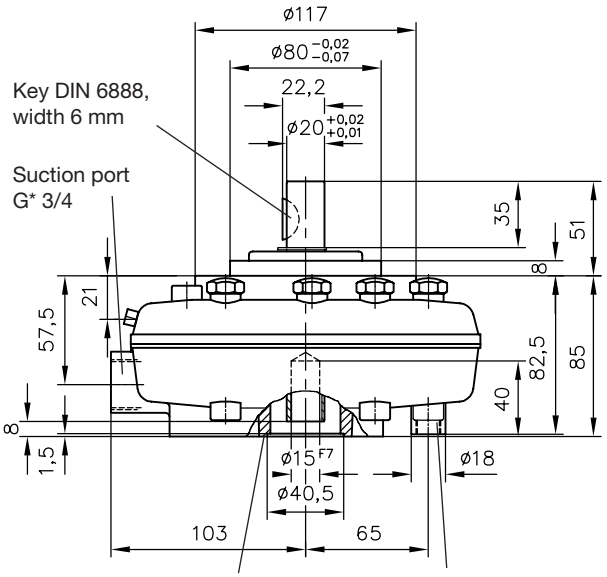


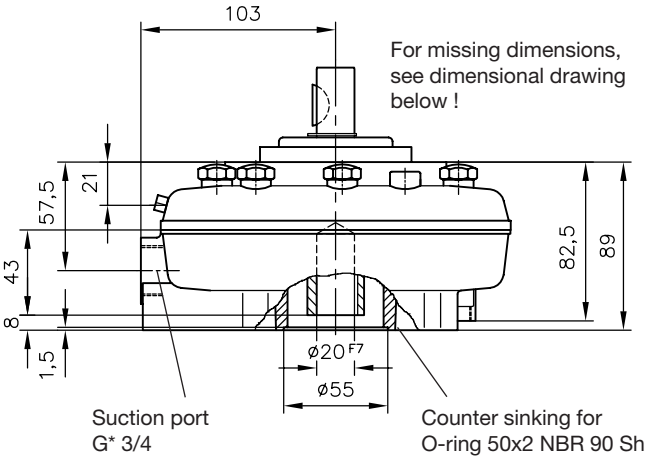
Suited for low pressure pump size /3 and /4 [1)]

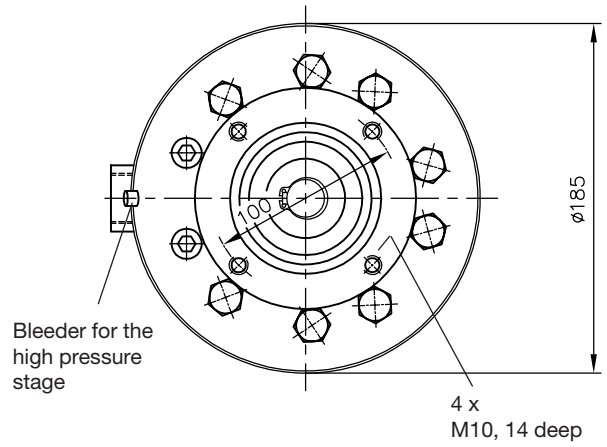


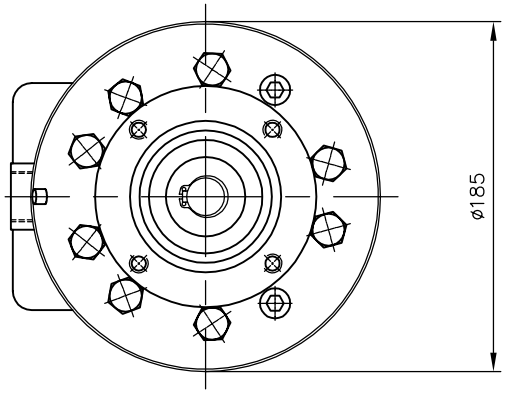
Suited for low pressure pump	a	a1	G
Size /3	128	42.9	M8, 15 deep
Size /4 [1)]	137	45	M10, 16 deep

[1)] /4 only for mounting of a suited, customer furnished gear pump (sect 2.1)





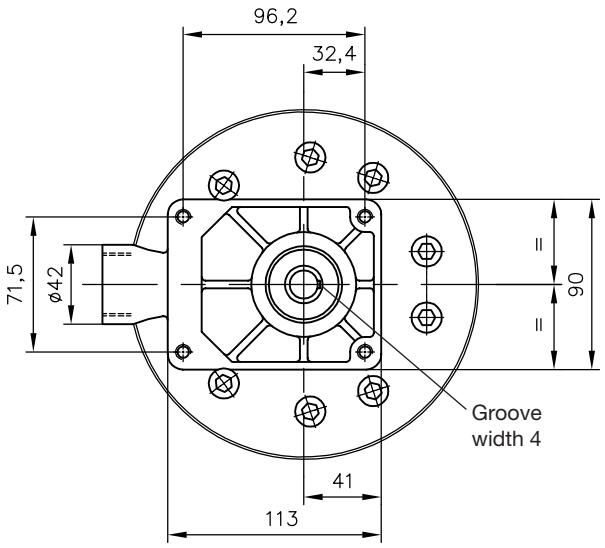




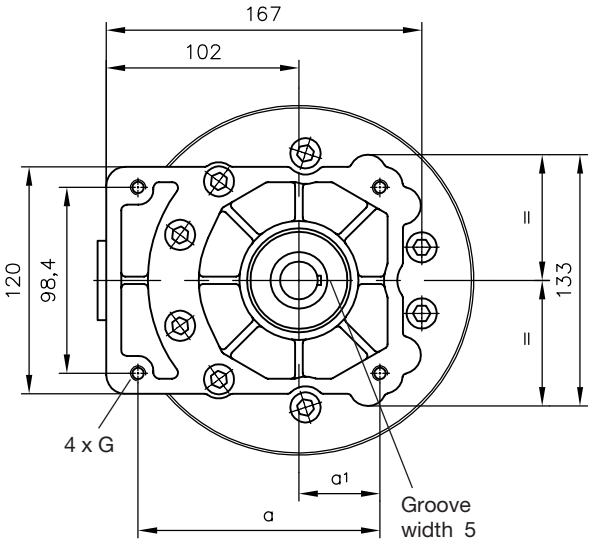
*G = (BSPP)

Design 6912, double radial pump Type RZ 2,7/2 (/3, /4) ... 30,4/2 (/3, /4)

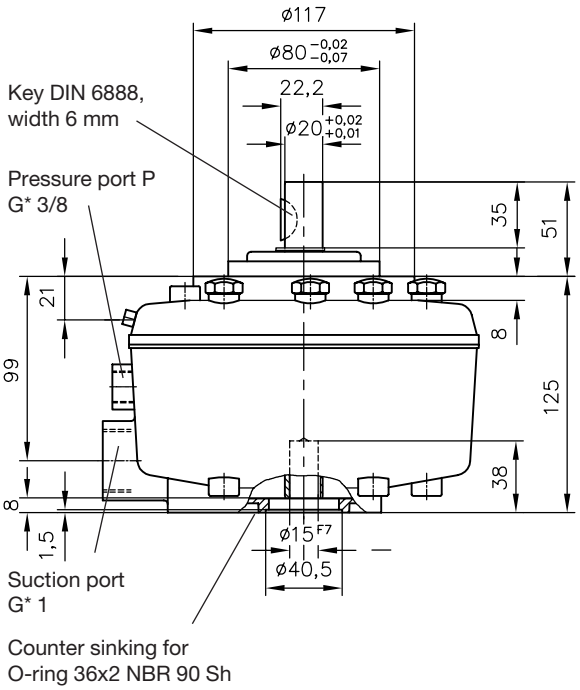
Suited for low pressure pump size /2

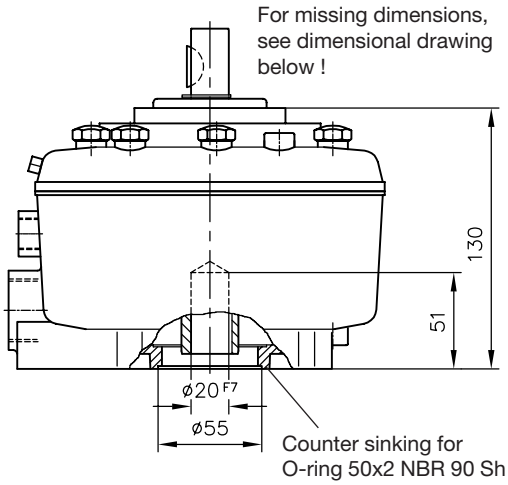


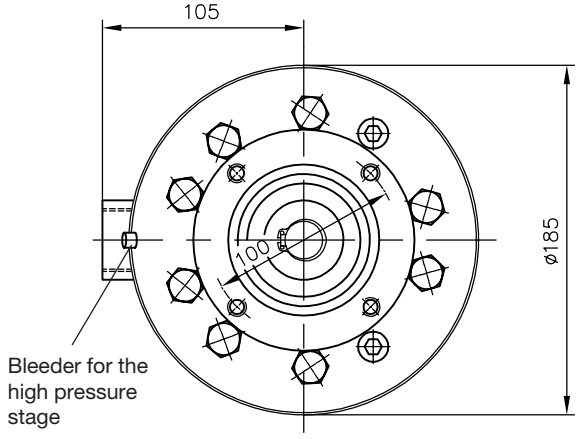
Suited for low pressure pump size /3 and /4 [1])

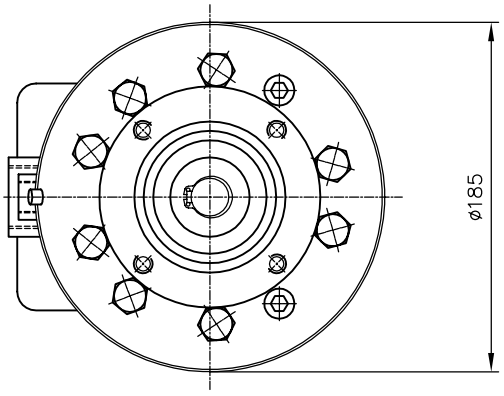


Suited for low pressure pump	a	a1	G
Size /3	128	42.9	M8, 15 deep
Size /4 [1])	137	45	M10, 16 deep









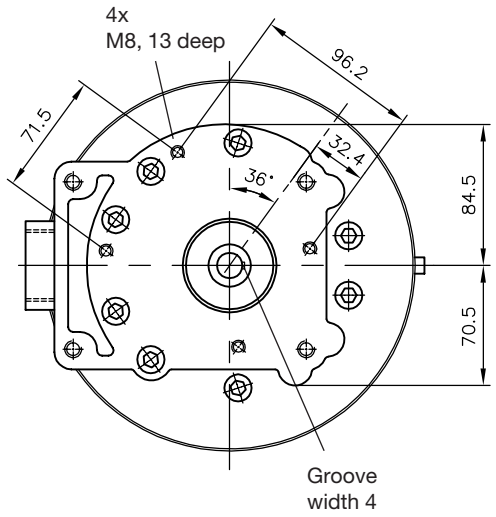
*G = (BSPP)

[1]) /4 only for mounting of a suited, customer furnished gear pump (sect 2.1)

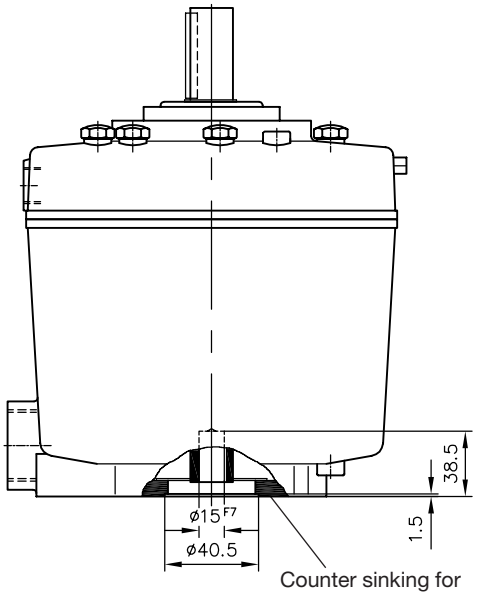
Design 6914, four radial pump Type RZ 6,1/2 (/3, /4) ... 60,8/2 (/3, /4)

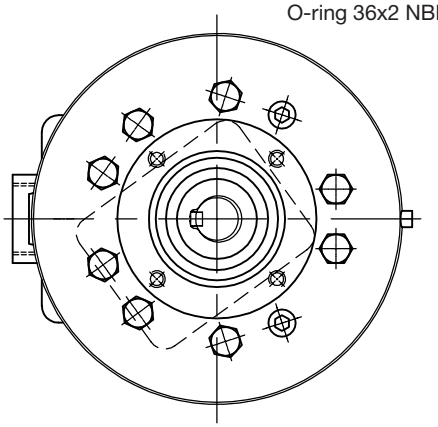
Suited for low pressure pump size /2

Attention: The low pressure mounted off-set by 36° !



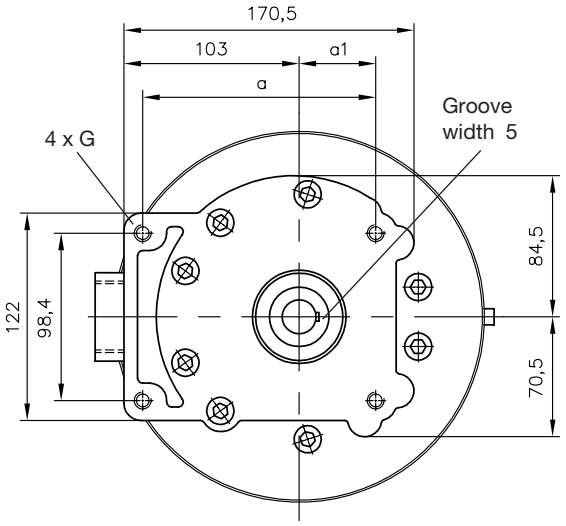
For missing dimensions, see dimensional drawing below !



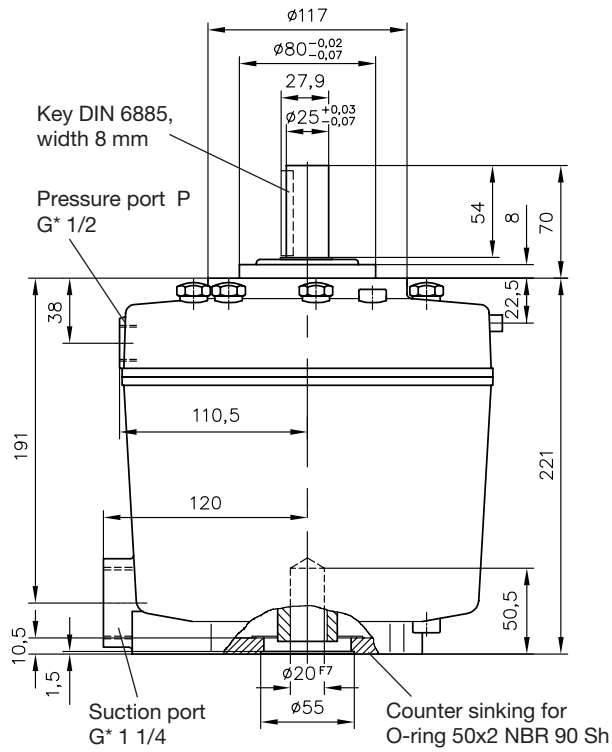


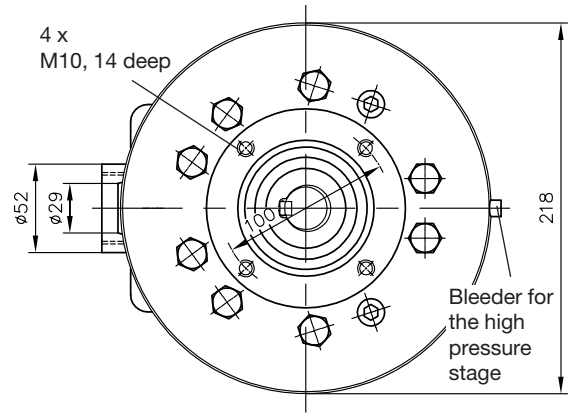
*G = (BSPP)

Suited for low pressure pump size /3 and /4 [1]



Suited for low pressure pump	a	a1	G
Size /3	128	42.9	M8, 15 deep
Size /4 [1]	137	45	M10, 15 deep



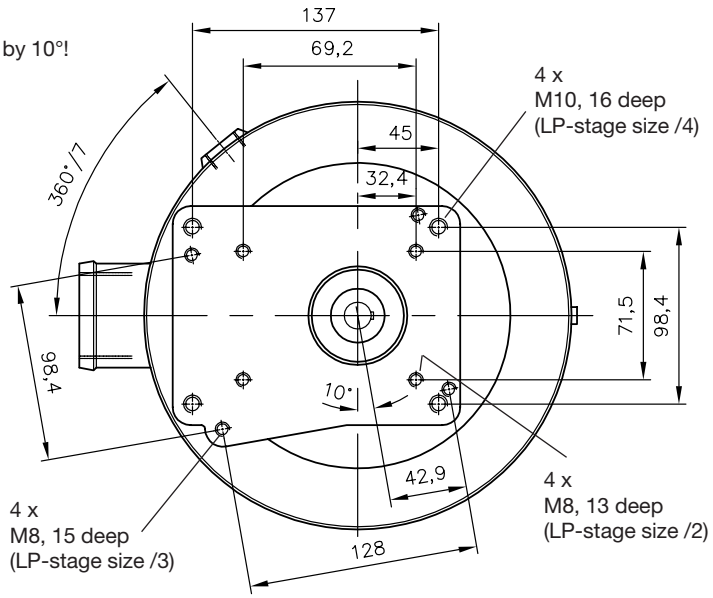


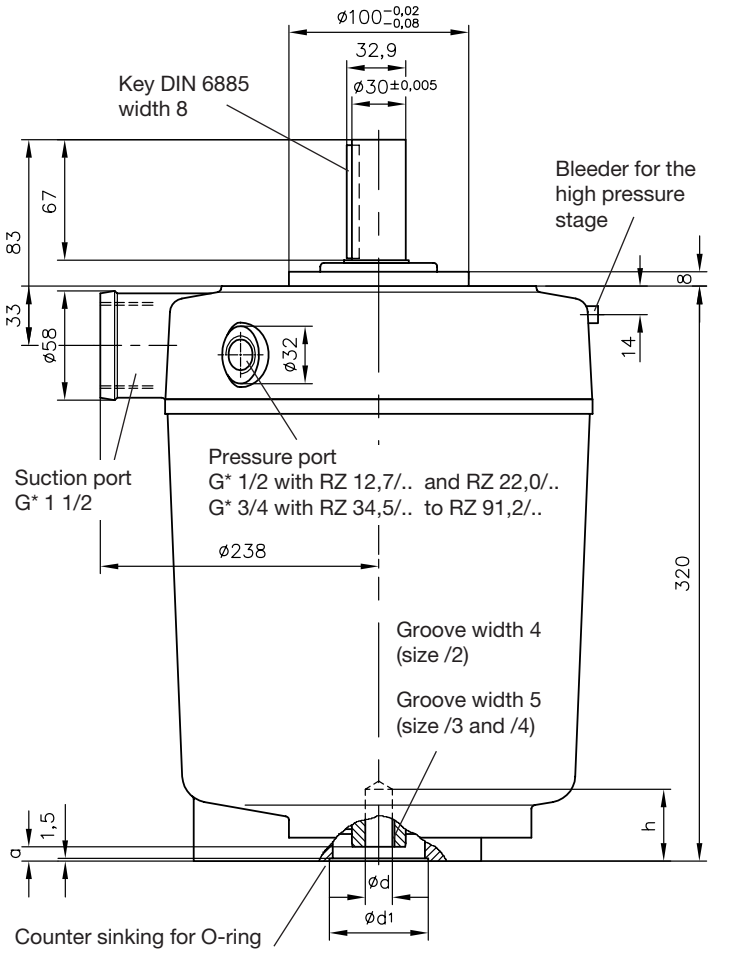
[1] /4 only for mounting of a suited, customer furnished gear pump (sect 2.1)

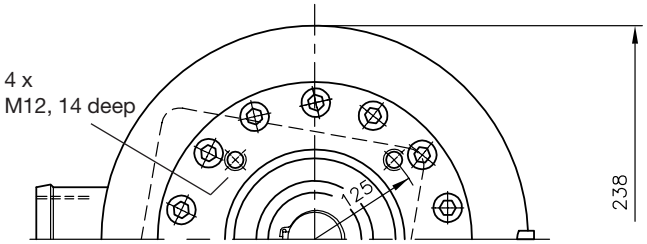
Design 6916, six radial pump Type RZ 12,7/2 (/3, /4) ... 91,2/2 (/3, /4)

Suited for low pressure pump size /2, /3 and /4 [1])

Attention: The low pressure pumpe size /3 is mounted off-set by 10°!







Suited for low pressure pump	a	d	d_1	h
Size /2	8	15^{F7}	40.5	40
Size /3 Size /4 [1])	11	20^{F7}	55	50.5

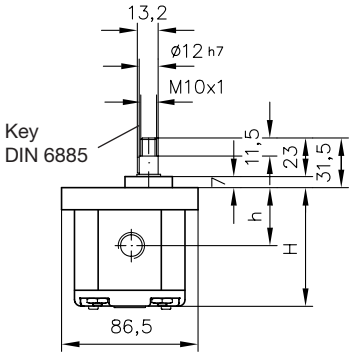
[1]) /4 only for mounting of a suited, customer furnished gear pump (sect. 2.1)

*G = (BSPP)

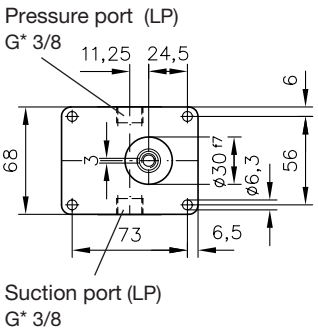
6.2 Low pressure stage

The HP-pumps acc. to sect. 6.1 are combined with gear pumps. Combinations with gear pumps of other makes have to be customer furnished (sect. 2.1), as long as their flange area and shaft dimensions are compatible (see below).

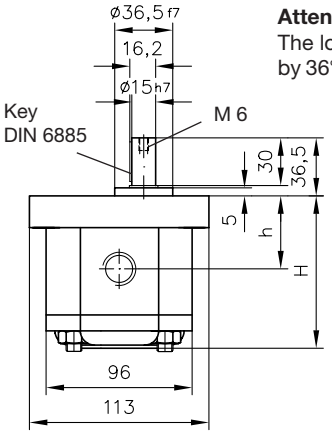
Low pressure stage /1
Suited high pressure stage design 7631;
For dimensional drawing see, page 6



Coding	H	h
2,0 2,7 3,5 4,5	70	33.3
5,2 6,9	77	36.7
8,8 9,8 11,3	86	42

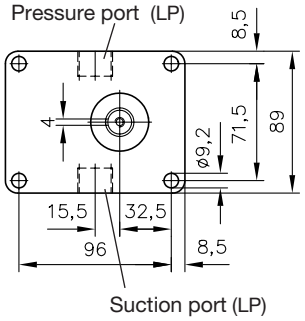


Low pressure stage /2
Suited high pressure stage design 6910, 6911, 6912, 6914 and 6916;
For dimensional drawing see, page 7 to 11



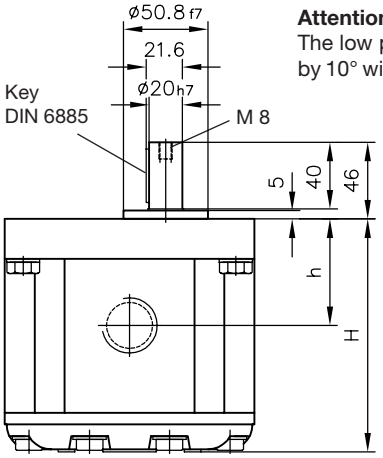
Attention:
The low pressure pump is mounted offset by 36° with design 6914, see also page 10.

Coding	H	h
9 12,3 16	96	46
21 24 28	120	58
37	132	64.3



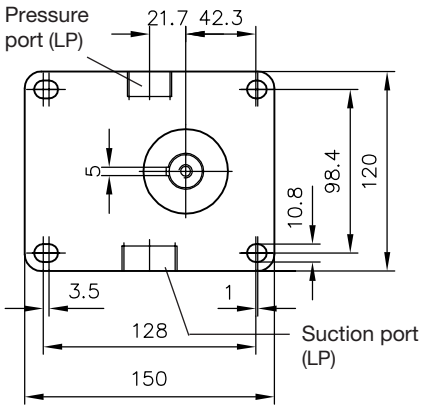
Coding	Pressure port LP *	Suction port LP *
9 12,3 16	G 1/2	G 1/2 G 1/2 G 3/4
21 24 28	G 1/2	G 3/4
37	G 3/4	G 1

Low pressure stage /3
Suited high pressure stage design 6911, 6912, 6914 and 6916;
For dimensional drawing see, page 8 to 11



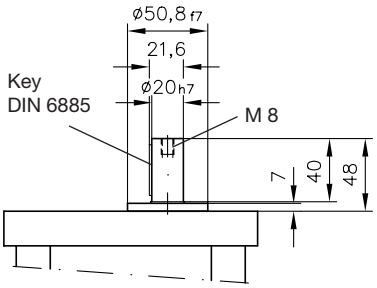
Attention:
The low pressure pump is mounted offset by 10° with design 6916, see also page 11.

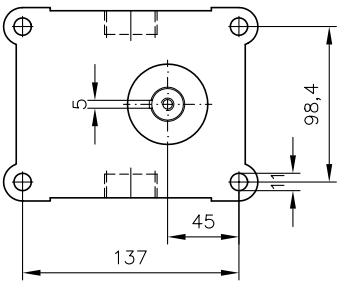
Coding	H	h
45	137	67.5
59	145	71.5
75	151	74.5
87	159	78
110	167	82
135	178	87.5



Coding	Pressure port LP *	Suction port LP *
45 59	G 3/4	G 3/4
75		G 1
87 110 135	G 1	G 1 1/4

Low pressure stage /4
Is not available from HAWE.
Suited pump for retrofitting is type RZ../4 acc. to sect. 2.1





*G = (BSPP)