

Gear pump type Z

Product documentation



Operating pressure p_{\max} :	260 bar
Displacement volume $V_{g \max}$:	87.5 cm ³ /rev
Flow rate Q_{\max} :	127 lpm (n = 1,450 rpm)



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Table of Contents

1	Overview gear pump type Z.....	4
2	Available versions.....	5
2.1	Basic type and size.....	5
3	Parameters.....	7
3.1	General data.....	7
3.2	Pressure and volumetric flow.....	9
3.3	Running noise.....	9
3.4	Weight.....	10
3.5	Characteristic lines.....	11
4	Dimensions.....	13
5	Installation, operation and maintenance information.....	16
5.1	Intended use.....	16
5.2	Assembly information.....	16
5.3	Operating instructions.....	16
5.4	Maintenance information.....	17
6	Other information.....	18
6.1	Peak pressure, intermittent pressure.....	18
6.2	Oil level.....	18
6.3	Drive.....	19

1 Overview gear pump type Z

Gear pumps are a type of hydraulic pump. They are used to supply hydraulic oil to hydraulic consumers in oil-hydraulic systems.

The external gear pump type Z is a constant pump with a closed pump housing. It is available as a separate hydraulic pump.

To set up a dual-stage pump type RZ (D 6910, D 6910 H) the type Z described here can also be combined with a radial piston pump type R (D 6010).

Features and advantages

- Low noise
- Self-priming
- Low pulsation
- Good price-performance ratio

Intended applications

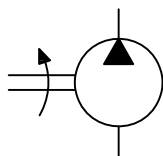
- Industrial hydraulics
- Mobile hydraulics
- Process engineering
- Vehicle construction



Gear pump type Z

2 Available versions

Circuit symbol



Ordering example

Z 21

2.1 "Basic type and size"

2.1 Basic type and size

Type	Geometric displacement volume V_g (cm ³ /rev)	Delivery flow ¹⁾ Q (lpm)	Pressure ²⁾ p_{max} (bar)	Drive power ³⁾ (standard motor)	
				min (kW)	max (kW)
Size 1					
Z 2.0	1,6	2,3	260	0,25	1,1
Z 2.7	2,15	3,1	260	0,25	1,5
Z 3.5	2,65	3,8	260	0,25	2,2
Z 4.5	3,35	4,9	260	0,25	3
Z 5.2	4,25	6,2	250	0,25	3
Z 6.9	5,35	7,8	250	0,37	3
Z 8.8	6,65	9,6	230	0,37	3
Z 9.8	7,1	10,3	180	0,37	3
Z 11.3	8,5	12,3	180	0,55	3
Z 14.4	10,65	15,4	140	0,55	3
Size 2					
Z 6.5	4,5	6,5	240	0,25	3
Z 9.0	6,0	8,7	240	0,37	4
Z 12.3	8,5	12,3	230	0,55	5,5
Z 16	11,0	16,0	230	0,75	7,5
Z 21	14,5	21,0	230	0,75	9
Z 24	17,0	24,7	230	1,1	11
Z 28	19,5	28,3	200	1,1	11
Z 37	26,0	37,7	180	1,5	11
Size 3					
Z 45	30,1	43,6	210	2,2	18,5
Z 59	41,6	60,3	180	2,2	22
Z 75	50,2	72,8	180	3	30
Z 87	61,0	88,5	150	4	30
Z 110	71,8	104,1	140	4	30
Z 135	87,5	126,9	110	5,5	30

1) at $n = 1,450$ rpm

2) Pressure p_{max} corresponds to permitted continuous pressure p_1

3) see Chapter 3.5, "Characteristic lines", power required min (kW) at 20 bar pressure

i INFORMATION

For description of peak pressure p3 and intermittent pressure p2 see [Chapter 6.1](#)

Pressure specified here is continuous pressure p1.

Permitted peak pressure p3 is

- for size 1 approx. 1.1 x continuous pressure p1
- for size 2 approx. 1.2 x continuous pressure p1
- for size 3 approx. 1.3 x continuous pressure p1

! NOTICE

Observe the gear pumps' max. shaft speed, see [Chapter 3.1](#)

3 Parameters

3.1 General data

Designation	Constant pump																												
Design	Gear pump, single pump																												
Model	Hydraulic pump																												
Attachment	Front side see Chapter 4, "Dimensions"																												
Drive	<p>Electric drive</p> <ul style="list-style-type: none"> ▪ for motor pumps: model IM B 35 see Chapter 6.3, "Drive" ▪ for hydraulic power packs (cover plate or tank versions): model IM B 5, IM V 1 see Chapter 6.3, "Drive" <p>Power consumption: see Chapter 2.1, "Basic type and size" and Chapter 3.2, "Pressure and volumetric flow"</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>i INFORMATION Accessories such as couplings etc. must be provided by customer.</p> </div>																												
Tightening torque	see Chapter 4, "Dimensions"																												
Max. shaft speed for Z pump	<ul style="list-style-type: none"> ▪ Size 1: 16 Nm ▪ Size 2: 65 Nm ▪ Size 3: 190 Nm 																												
Installation position	Any																												
Duty cycle	100%																												
Line connection	Pipe thread ISO 228-1, see Chapter 4, "Dimensions"																												
Rotation direction	left-hand thread with view onto pump shaft (anti-clockwise)																												
Speed range (min ... max)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3">Size 1</td> </tr> <tr> <td>Z 2.0; Z 2.7; Z 3.5; Z 4.5; Z 5.2; Z 6.9</td> <td style="text-align: right;">650 – 4,000 rpm</td> <td></td> </tr> <tr> <td>Z 8.8; Z 9.8; Z 11.3; Z 14.4</td> <td style="text-align: right;">650 – 3,500 rpm</td> <td></td> </tr> <tr> <td colspan="3">Size 2</td> </tr> <tr> <td>Z 6.5; Z 9.0; Z 12.3; Z 16; Z 21; Z 24</td> <td style="text-align: right;">700 – 3,500 rpm</td> <td></td> </tr> <tr> <td>Z 28; Z 37</td> <td style="text-align: right;">700 – 3,000 rpm</td> <td></td> </tr> <tr> <td colspan="3">Size 3</td> </tr> <tr> <td>Z 45; Z 59; Z 75</td> <td style="text-align: right;">700 – 3,000 rpm</td> <td></td> </tr> <tr> <td>Z 87; Z 110; Z 135</td> <td style="text-align: right;">600 – 2,500 rpm</td> <td></td> </tr> </table>		Size 1			Z 2.0; Z 2.7; Z 3.5; Z 4.5; Z 5.2; Z 6.9	650 – 4,000 rpm		Z 8.8; Z 9.8; Z 11.3; Z 14.4	650 – 3,500 rpm		Size 2			Z 6.5; Z 9.0; Z 12.3; Z 16; Z 21; Z 24	700 – 3,500 rpm		Z 28; Z 37	700 – 3,000 rpm		Size 3			Z 45; Z 59; Z 75	700 – 3,000 rpm		Z 87; Z 110; Z 135	600 – 2,500 rpm	
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Z 87; Z 110; Z 135	600 – 2,500 rpm																												

<p>Hydraulic fluid</p>	<p>Hydraulic fluid, according to DIN 51 524 Parts 2 to 3; ISO VG 10 to 68 according to DIN ISO 3448 Viscosity range:</p> <ul style="list-style-type: none"> ▪ Size 1: 12 – 750 mm²/s optimal operation: 12 – 100 mm²/s ▪ Size 2, size 3: 10 – 500 mm²/s, 10 – 1,400 mm²/s (permitted for cold start) optimal operation: 12 – 90 mm²/s <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> <p>! NOTICE</p> <ul style="list-style-type: none"> ▪ At viscosities of 500 mm²/s and greater, we recommend unpressurised start. ▪ Viscosities above 500 mm²/s and below 10 mm²/s lead to loss of efficiency and reduced service life. </div> <p>Also suitable for biologically degradable hydraulic fluids type HEES (synthetic ester) at operating temperatures up to approx. +70°C.</p>
<p>Cleanliness level</p>	<p>ISO 4406</p> <hr style="width: 20%; margin-left: 0;"/> <p>20/18/15...19/17/14</p> <p>Recommended filter fineness $\beta_{10 \text{ to } 25} \geq 75$</p> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> <p>! NOTICE</p> <p>Lower values apply at pressures</p> <ul style="list-style-type: none"> ▪ > 210 bar (size 1) ▪ > 150 bar (size 2, size 3) </div>
<p>Temperatures</p>	<p>Environment: approx. -40 to +80°C, Hydraulic fluid:</p> <ul style="list-style-type: none"> ▪ Size 1: -25 to +80°C ▪ Size 2: -20 to +80°C ▪ Size 3: -20 to +80°C, <p>Note the viscosity range. Start temperature: down to -40 °C is permissible (take account of the start viscosities!), as long as the steady-state temperature is at least 20 K higher during subsequent operation. Biologically degradable hydraulic fluids: note manufacturer specifications. With consideration for the seal compatibility, not above +70°C.</p>

3.2 Pressure and volumetric flow

Operating pressure

- Pressure side (outlet): see Chapter 2.1, "Basic type and size"
- Suction side: -0.3 bar to +0.5 bar (approx. 0.7 bar abs. to approx. 1.5 bar abs.)

Delivery flow

$$Q_{Pu} = V_g n \cdot \eta_{vol} \cdot 10^{-3} \text{ l/min}$$

V_g output volume in cm³/rev (see Chapter 2.1, "Basic type and size")

n speed in rpm

η_{vol} ≈ 0.90 to 0.97 volumetric efficiency

i INFORMATION

Efficiency depends significantly on

- operating pressure
- speed
- viscosity

3.3 Running noise

Reference values

Size		1	2	3
dB(A)	unpressurised	55 to 63	60 to 66	63 to 70
	0.5 p _{max}	66 to 72	72 to 74	73 to 76
	p _{max}	70 to 75	73 to 76	75 to 78

! NOTICE

Actual values depend on operating pressure and speed.

3.4 Weight

Size 1	Type	
	Z 2.0; Z 2.7	= 0.9 kg
	Z 3.5; Z 4.5; Z 5.2	= 1.0 kg
	Z 6.9; Z 8.8	= 1.1 kg
	Z 9.8; Z 11.3	= 1.2 kg
	Z 14.4	= 1.3 kg

Size 2	Type	
	Z 6.5	= 2.3 kg
	Z 9.0	= 2.4 kg
	Z 12.3	= 2.5 kg
	Z 16	= 2.6 kg
	Z 21	= 2.8 kg
	Z 24	= 2.9 kg
	Z 28	= 3.1 kg
	Z 37	= 3.4 kg

Size 3	Type	
	Z 45	= 6.1 kg
	Z 59	= 6.5 kg
	Z 75	= 6.8 kg
	Z 87	= 7.2 kg
	Z 110	= 7.7 kg
	Z 135	= 8.2 kg

3.5 Characteristic lines

Power consumption

$$P_{kW} = \frac{p_{bar} \cdot Q_{l/min}}{600 \eta_T}$$

P_{kW} = required drive power at the pump shaft in kW

p_{bar} = pressure in bar that the pump is countering

Q_{lpm} = delivery flow in lpm, at 1,450 rpm (see Chapter 2.1, "Basic type and size")

p_{kW} = for other speeds

$$Q = \frac{V_g \cdot n \cdot \eta_T}{1000}$$

η_T = total efficiency, roughly 0.80 to 0.85

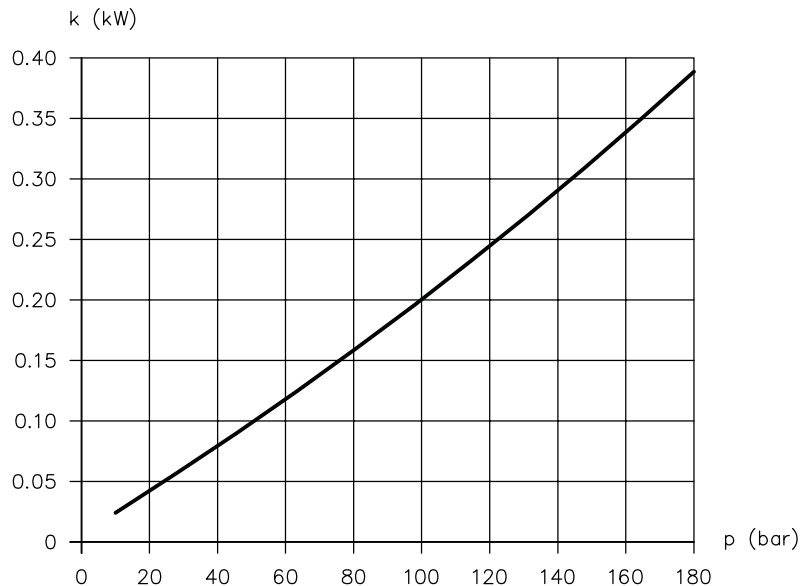
Power value

$$P_{erf kW} = k_{kW} \cdot Q_{l/min}$$

p_{kW} = required drive power at the pump shaft in kW

k_{kW} = k in kW for 1 lpm, actually required drive power

Q_{lpm} = delivery flow in lpm, at 1,450 rpm (see Chapter 2.1, "Basic type and size")



p operating pressure (bar); k power value (kW) for 1 lpm

Torque

$$M = \frac{p \cdot Vg}{62,83 \cdot \eta_{mech}}$$

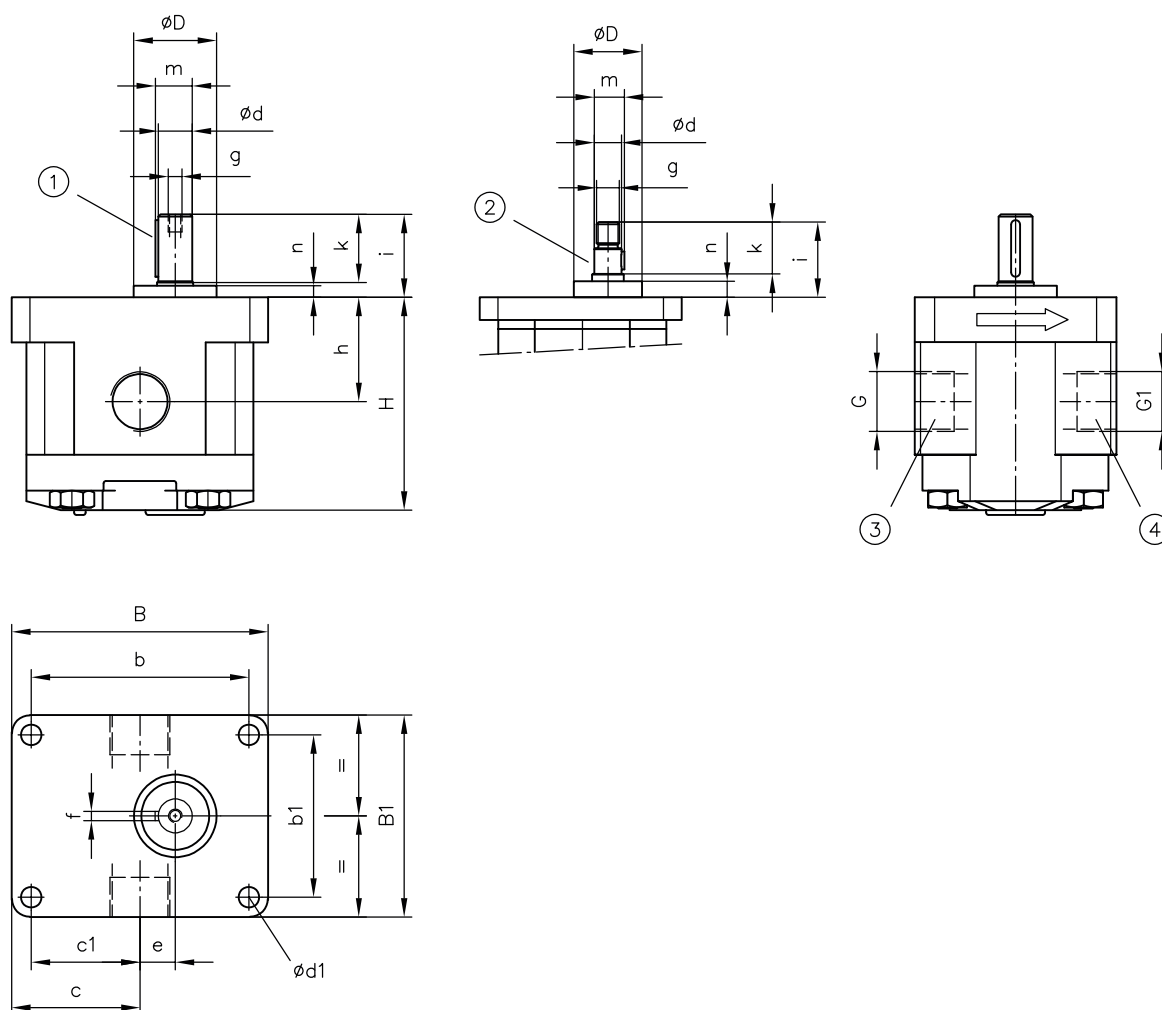
η_{mech} = total efficiency, roughly 0.85 to 0.90

! NOTICE

Max. shaft speed for Z pump, see [Chapter 3.1](#)

4 Dimensions

All dimensions in mm, subject to change.



- 1 Drive shaft for sizes 2 and 3
- 2 Drive shaft for size 1
- 3 Pressure port
- 4 Suction port

NOTICE
Rotation direction, see Chapter 3.1

Size 1

Type	B	B1	b	b1	c	c1	ØD	Ød	Ød1 ¹⁾	e
Z 2.0										
Z 2.7										
Z 3.5										
Z 4.5										
Z 5.2	89	72	73	56	45,2	37,2	30 f8	12 ^{-0.01/} _{-0.02}	7	11,3
Z 6.9										
Z 8.8										
Z 9.8										
Z 11.3										
Z 14.4										

1) for M6 bolt: torque 9+1 Nm

Type	f	G ²⁾	G1 ³⁾	g	H	h	i	k	m	n
Z 2.0					67,3	32,4				
Z 2.7					68,9	33,2				
Z 3.5					72	34				
Z 4.5					72,5	35				
Z 5.2	3 ^{-0.035/} _{-0.055}	G 3/8x12.5	G 3/8x12.5	M10x1x11.5	75,1	36,4	31,5	22,9	13,2	5,4
Z 6.9					78,5	38				
Z 8.8					82,5	40				
Z 9.8					84,3	40,7				
Z 11.3					88	42,8				
Z 14.4					94,5	46				

2) G = pressure port

G 3/8: torque 25+1 Nm

3) G 1= suction port

G 3/8: torque 15+1 Nm

Size 2

Type	B	B1	b	b1	c	c1	ØD	Ød	Ød1 ¹⁾	e
Z 6.5										
Z 9										
Z 12.3										
Z 16	113	89	96	71,5	56,5	48	36.5 f8	15 h7	9,5	15,5
Z 21										
Z 24										
Z 28										
Z 37										

1) for M8 bolt: torque 20+5 Nm

Type	f	G ²⁾	G1 ³⁾	g	H	h	i	k	m	n
Z 6.5		G 1/2x16	G 1/2x16		93,5	44,6				
Z 9		G 1/2x16	G 1/2x16		96,2	45,9				
Z 12.3		G 1/2x16	G 1/2x16		100,7	48,2				
Z 16	4 h9	G 1/2x16	G 3/4x19	M6x16	105,2	50,4	36,5	30	16.2 -0.1	5
Z 21		G 1/2x16	G 3/4x19		111,6	53,6				
Z 24		G 1/2x16	G 3/4x19		116,1	55,9				
Z 28		G 1/2x16	G 3/4x19		120,6	58,1				
Z 37		G 3/4x19	G 1x19		133	64,3				

2) G = pressure port

G 1/2: torque 50+2.5 Nm

G 3/4: torque 90+5 Nm

3) G 1= suction port

G 1/2: torque 20+1 Nm

G 3/4: torque 30+2.5 Nm

G 1: torque 50+2.5 Nm

Size 3

Type	B	B1	b	b1	c	c1	ØD	Ød	Ød1 ¹⁾	e
Z 45	150	120	129	98,4	75	64	50.8 f8	20 h7	10,8	22,05
Z 59										
Z 75										
Z 87										
Z 110										
Z 135										

1) for M10 bolt: torque 48+2 Nm

Type	f	G ²⁾	G1 ³⁾	g	H	h	i	k	m	n
Z 45	5 h9	G 3/4x20	G 3/4x20	M8x18	137,6	67,5	46	40	21.6 -0.2	5
Z 59										
Z 75										
Z 87										
Z 110										
Z 135										

2) G = pressure port

G 3/4: torque 90+5 Nm

G 1: torque 130+10 Nm

3) G 1= suction port

G 3/4: torque 30+2.5 Nm

G 1: torque 50+2.5 Nm

G 1 1/4: torque 60+5 Nm

Observe the document B 5488 "General operating instructions for assembly, commissioning, and maintenance."

5.1 Intended use

This product is intended exclusively for hydraulic applications (fluid technology).

The user must observe the safety measures and warnings in this document.

Essential requirements for the product to function correctly and safely:

- ▶ All information in this documentation must be observed. This applies in particular to all safety measures and warnings.
- ▶ The product must only be assembled and put into operation by specialist personnel.
- ▶ The product must only be operated within the specified technical parameters described in detail in this document.
- ▶ All components must be suitable for the operating conditions when using an assembly.
- ▶ The operating instructions for the components, assemblies and the specific complete system must also always be observed.

If the product can no longer be operated safely:

1. Remove the product from operation and mark it accordingly.
 - ✓ It is then not permitted to continue using or operating the product.

5.2 Assembly information

The product must only be installed in the complete system with standard and compliant connection components (screw fittings, hoses, pipes, fixtures etc.).

The product must be shut down correctly prior to disassembly (in particular in combination with hydraulic accumulators).

DANGER

Sudden movement of the hydraulic drives when disassembled incorrectly

Risk of serious injury or death

- ▶ Depressurise the hydraulic system.
- ▶ Perform safety measures in preparation for maintenance.

5.3 Operating instructions

Observe product configuration and pressure/flow rate.

The statements and technical parameters in this document must be strictly observed.

The instructions for the complete technical system must also always be followed.

NOTICE

- ▶ Read the documentation carefully before usage.
- ▶ The documentation must be accessible to the operating and maintenance staff at all times.
- ▶ Keep documentation up to date after every addition or update.

CAUTION

Overloading components due to incorrect pressure settings.

Risk of minor injury.

- Pay attention to the maximum operating pressure of the pump, valves and fittings.
- Always monitor the pressure gauge when setting and changing the pressure.

Purity and filtering of the hydraulic fluid

Fine contamination can significantly impair the function of the product. Contamination can cause irreparable damage.

Examples of fine contamination include:

- Swarf
- Rubber particles from hoses and seals
- Dirt due to assembly and maintenance
- Mechanical debris
- Chemical ageing of the hydraulic fluid

! NOTICE

New hydraulic fluid from the manufacturer may not have the required purity.

Damage to the product is possible.

- ▶ Filter new hydraulic fluid to a high quality when filling.
- ▶ Do not mix hydraulic fluids. Always use hydraulic fluid that is from the same manufacturer, of the same type, and with the same viscosity properties.

For smooth operation, pay attention to the cleanliness level of the hydraulic fluid (cleanliness level see [Chapter 3, "Parameters"](#)).

Additionally applicable document: [D 5488/1](#) Oil recommendations

5.4 Maintenance information

Check regularly (at least once a year) by visual inspection whether the hydraulic connections are damaged. If external leakages are found, shut down and repair the system.

Clean the surface of the device regularly (at least once a year) (dust deposits and dirt).

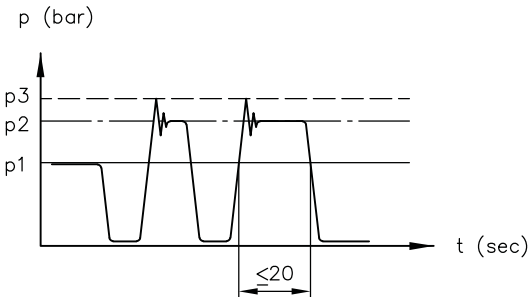
Check hydraulic fluid level regularly.

Change hydraulic fluid (once a year). Change any pressure and return line filters.

See also [B 5488](#).

6 Other information

6.1 Peak pressure, intermittent pressure



Legend:

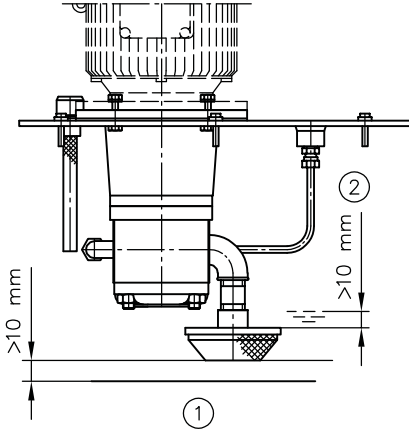
- p_1 = permitted continuous pressure
- p_2 = intermittent pressure (max. 20 ms, max. operating pressure, with safety measure e.g. by pressure-limiting valve)
- p_3 = permitted peak pressure (max. 50 ms)

6.2 Oil level

For gear pump in tank:

- Minimum clearance between suction head's lower edge and tank floor should be 10 mm in order to prevent aspiration of contamination.
- When commissioning, the oil tank should be well filled but not filled to the brim.

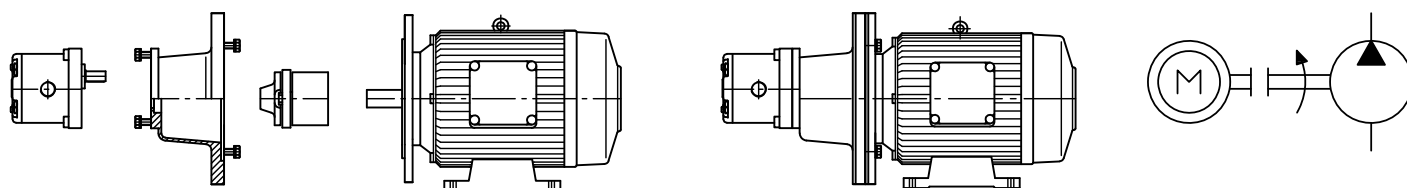
Once the operating temperature has been reached, there still needs to be sufficient space underneath the cover plate (note oil volume's thermal expansion).



- 1 Tank floor
- 2 min. oil level

6.3 Drive

Model IM B 35 for motor pumps



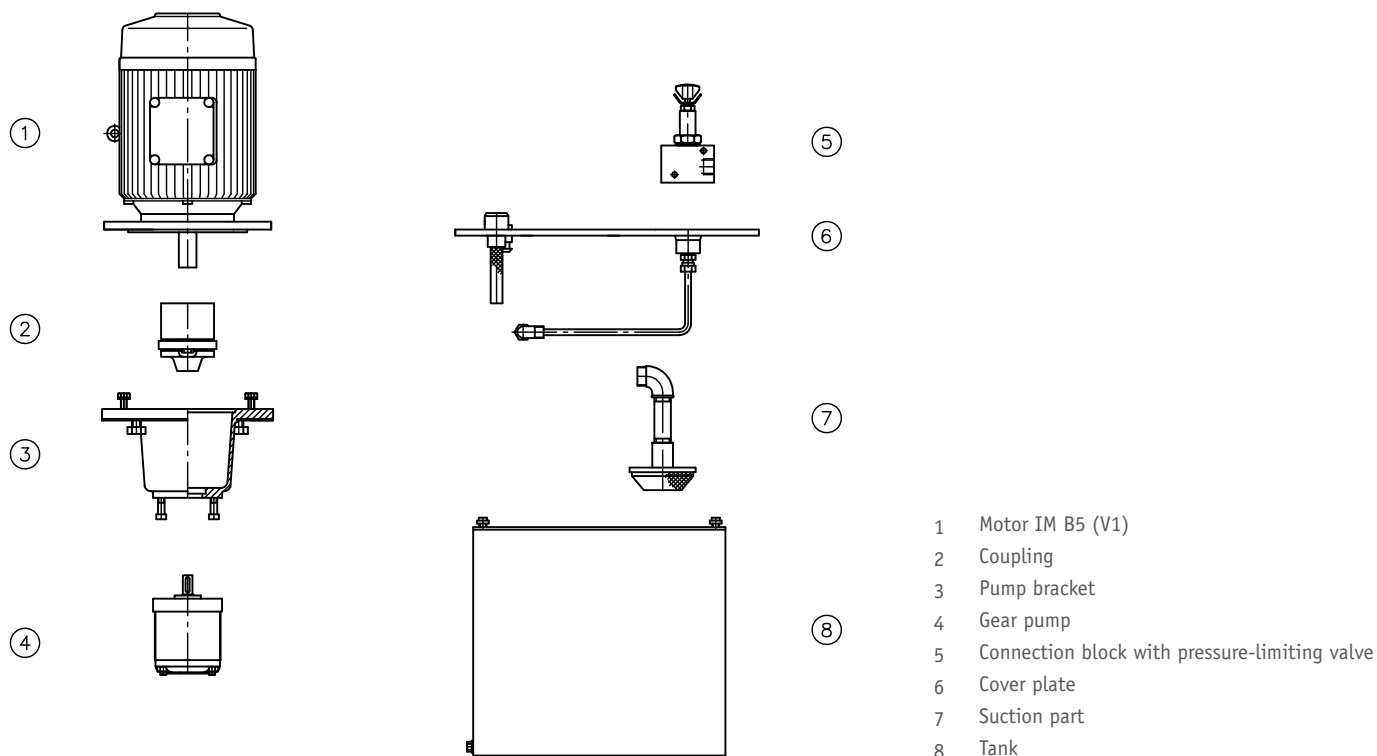
- ④ Gear pump
- ③ Flange
- ② Coupling
- ① Motor IM B35

! NOTICE

Motor, coupling and flange must be provided by customer, see Chapter 3.1 "Drive".

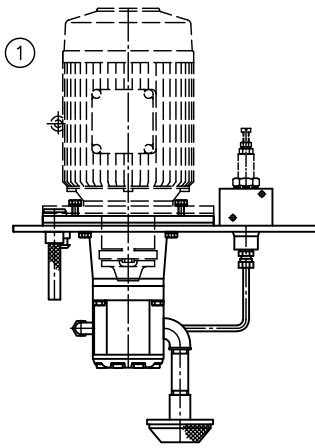
Model IM B 5, IM V 1 for hydraulic power packs (cover plate version or tank version)

Tank installation



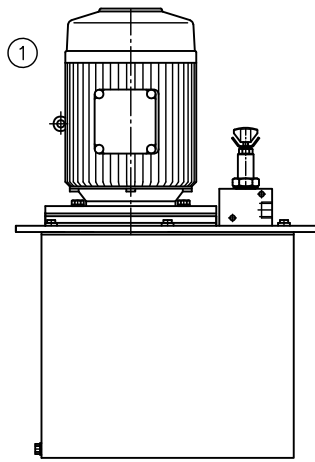
- ① Motor IM B 5 (V1)
- ② Coupling
- ③ Pump bracket
- ④ Gear pump
- ⑤ Connection block with pressure-limiting valve
- ⑥ Cover plate
- ⑦ Suction part
- ⑧ Tank

Cover plate version

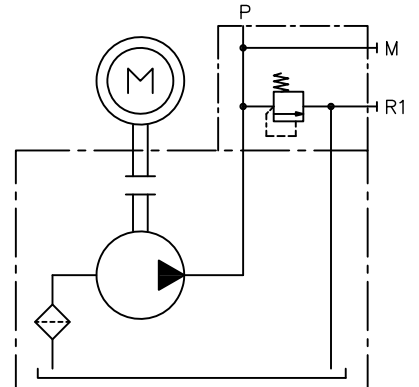


1 ready-for-installation without or with motor

Tank version



1 ready-for-connection without or with motor



! NOTICE

Additional parts need to be provided by the customer, see Chapter 3.1 "Drive".

References

Compact hydraulic power pack

- Compact hydraulic power pack type INKA 1: D 8132-1
- Compact hydraulic power pack type KA and KAW size 2: D 8010
- Compact hydraulic power packs type KA size 4: D 8010-4
- Compact hydraulic power pack type MPN and MPNW: D 7207
- Compact hydraulic power pack type HK 2: D 7600-2
- Compact hydraulic power pack type HK 3: D 7600-3
- Compact hydraulic power pack type HKL and HKLW: D 7600-3L
- Compact hydraulic power pack type HK 4: D 7600-4
- Compact hydraulic power pack type NPC: D 7940
- Compact hydraulic power pack type HR according to D 6014, D 6342 and D 6343
- Compact hydraulic power pack type HS according to D 6347
- Compact hydraulic power pack type A according to D 6025 and D 6034
- Compact hydraulic power pack type H according to D 6344 and D 6345

Hydraulic power pack

- Hydraulic power pack type FXU: D 6020
- Hydraulic power pack type R and RG: D 6010 DB
- Motor pump and hydraulic power pack type R and RG: D 6010 H
- Hydraulic power pack type RZ: D 6910 H

Radial piston pumps

- Radial piston pump type R and RG: D 6010
- Radial piston pump type R and RG with several pressure connections: D 6010 D
- Radial piston pump type R and RG with one main pressure connection and one or two ancillary pressure connections: D 6010 S
- Dual-stage pump type RZ: D 6910

