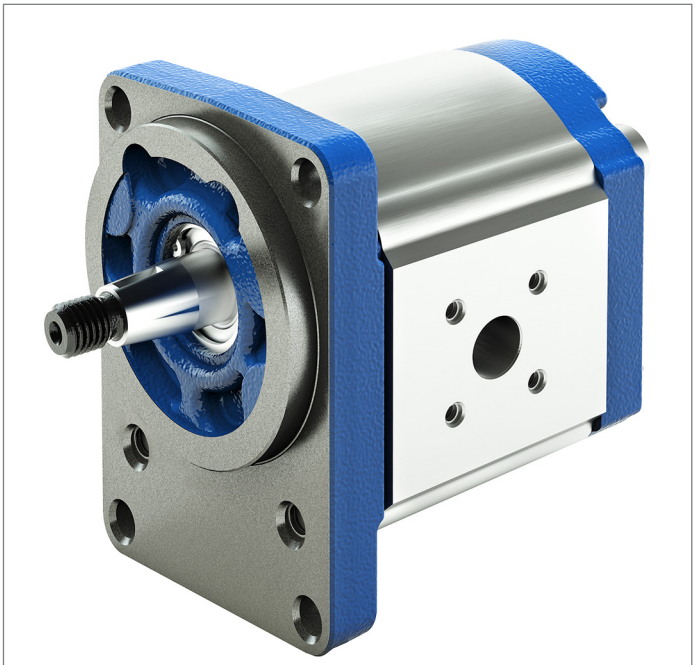
RE 10095/2024-05-02
Replaces: 2021-11-24

rexroth
A Bosch Company

External gear pump SILENCE AZPS



Note: Product photo deviates from delivery condition

- Platform F
- Fixed displacement
- Nominal size 4 to 28
- Continuous pressure up to 250 bar
- Intermittent pressure up to 280 bar

Features

- Optimized pressure pulsation, reduces noise emissions and oscillations in the system
- Consistent high quality based on large-volume production
- Long service life
- Slide bearings for high loading
- Drive shafts conforming to ISO or SAE and customer-specific solutions
- Port connections: Connection flanges or screw-in threads
- Combinations of several pumps possible

Contents

Product description

General information

It is the central task of external gear pumps to convert mechanical energy (torque and speed) into hydraulic energy (flow and pressure). To reduce heat losses, Rexroth's external gear units offer very high efficiencies. They are realized by pressure-dependent gap sealing and highly precise production technology.
Rexroth external gear pumps are built in four frame sizes: Platform B, F, N and G. Within each platform different sizes can be realized by different gear widths. The pumps are available in the versions Standard, High Performance, SILENCE und SILENCE PLUS. Further configuration variants are given by different flanges, ports, shafts, valve arrangements and multiple pump combinations.
Moreover, in the low-noise SILENCE pumps, the dual-flank principle helps to reduce flow pulsation by up to 75 %.

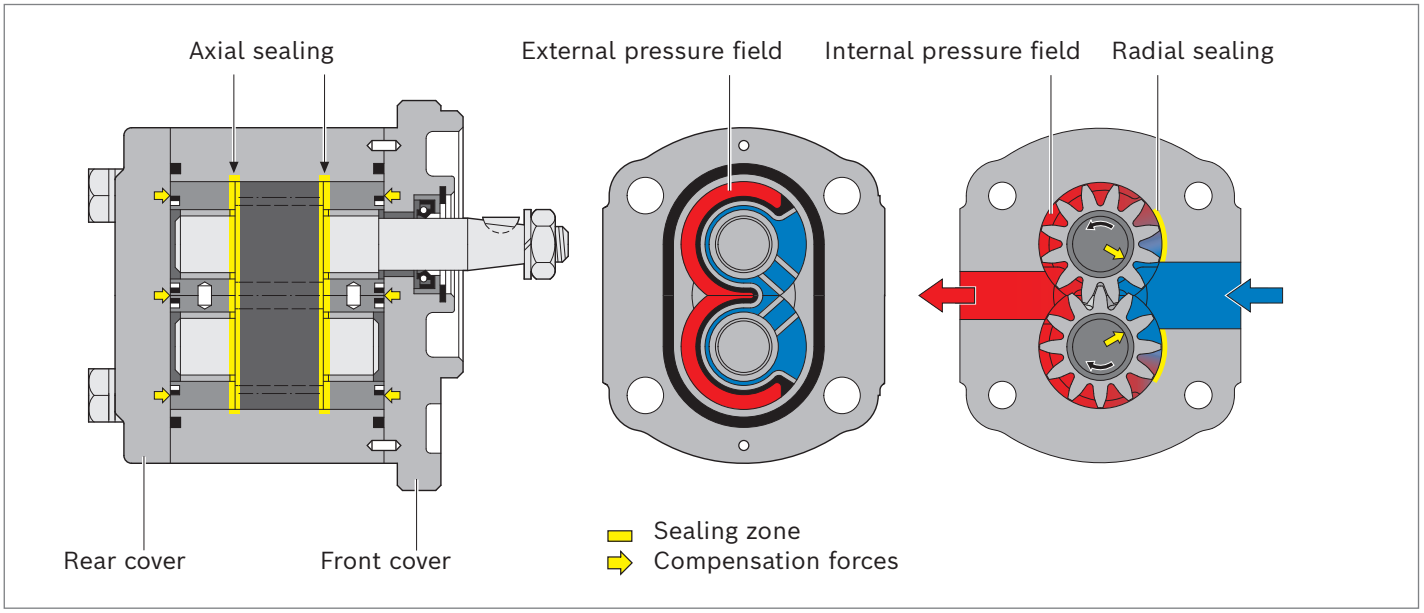
Pumping principle

The geometry of the displacement gearing, matched in form by the rotation of the drive shaft, results in the parabolic flow characteristic shown here on the next page. In a standard pump, this characteristic is repeated each time a gear tooth meshes. With their dual-flank system, the flow pulsation of SILENCE pumps is reduced by 75 % – with correspondingly lower excitation of downstream system components – at double the fundamental frequency. During this process, the gear pair exhibits an extremely reduced rear flank backlash, so that hydraulic sealing is provided not just by the front flank of the driven gear, but also by the rear flanks. In this way, the front and rear flanks alternately contribute to flow displacement. And by adapting the shape of the metering notches, the expansion of the hydraulic line of action is half that of the standard pump.

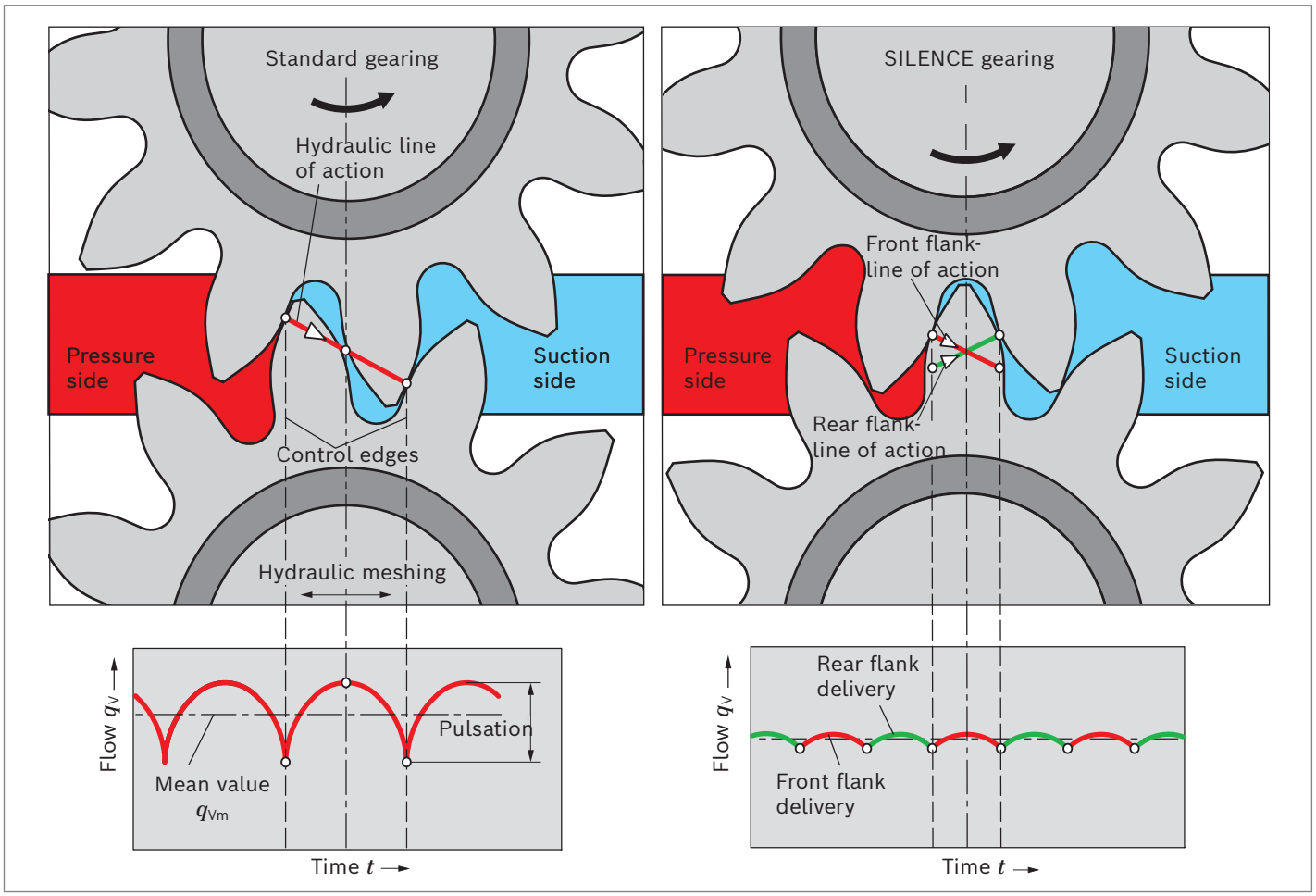
Construction

The external gear pump consists essentially of a pair of gear wheels supported in bearing bushings and the housing with a front cover and a rear cover.
The drive shaft protrudes from the front cover where it is usually sealed by the shaft seal. The bearing forces are absorbed by slide bearings. These bearings were designed for high pressures and have excellent emergency running properties, especially at low rotational speeds.
The gear wheels have 12 teeth. This keeps both flow pulsation and noise emission to a minimum. The sealing of the pressure chambers is achieved by forces depending on the working pressure. This ensures optimum efficiency.
The working pressure generated in the gear chambers is transferred to the outside of the bearing bushings in specifically designed pressure fields in such a way that they are pressed against the gears and seal them up. The pressurized compression areas are limited by special seals. The seal in the area between the gear teeth and the housing is ensured by the smallest of gaps that are set depending on the pressure between the gear teeth and housing.

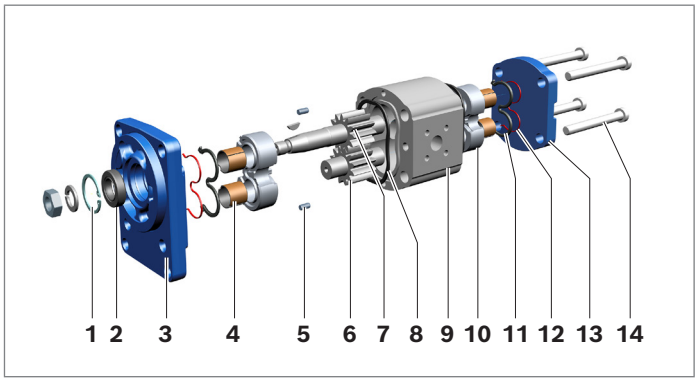
▼ **Axial and radial sealing of gear chambers**



▼ **Pumping principle of High Performance and SILENCE pump**



▼ **Principle design of external gear pump**



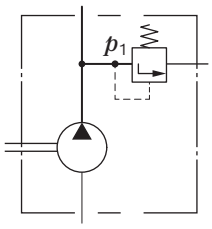
1 Retaining ring
2 Shaft seal
3 Front cover
4 Slide bearings
5 Centering pin
6 Gear wheel
7 Drive shaft
8 Housing seal ring
9 Pump housing
10 Bearing bushing
11 Axial field seal
12 Supporting element
13 Rear cover
14 Torx screws

Gear pumps with integrated valves

In order to reduce piping complexity, a flow control valve or pressure-relief valve can be integrated in the rear cover of the gear pump. Such solutions are used, for instance, for the hydraulic oil supply of power steering systems. The pump delivers a constant flow or maximum pressure irrespective of the rotational speed. The residual flow is either returned internally to the suction port or distributed externally to other consumers.

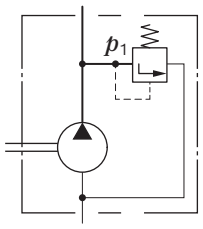
Pressure relief valve, with external residual flow
p_1 = 5 to 250 bar

T180XX (example)



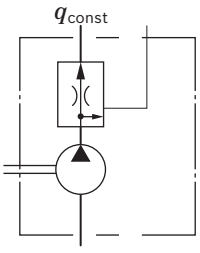
Pressure relief valve, with internal residual flow
p_1 = 5 to 250 bar

D180XX (example)



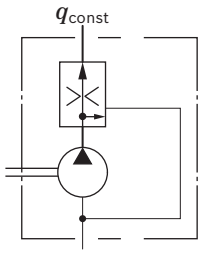
Flow control valve, with external residual flow
q_{const} = 2 to 30 l/min

EXXX12 (example)



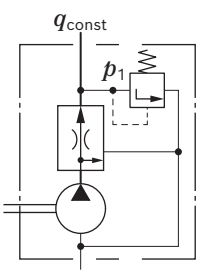
Flow control valve, with internal residual flow
q_{const} = 2 to 30 l/min

SXXX17 (example)



Flow control valve with pressure relief valve, with internal residual flow
q_{const} = 2 to 30 l/min; p_1 = 100 to 180 bar

V15011 (example)



Notice

In case of external gear pumps with integrated valves, the code of the port connection defines the code of the valve ports:

- For pumps with port connection 20 and 30 the valve ports are metric
- For pumps with port connection 12 the valve ports are UNF threaded (ISO 11926-1)
- For pumps with port connection 01 the valve ports are pipe threaded (ISO 228-1) (BSP)
- Deviations are described by a special number.

Type codes

Type code solo pump

01	02	03		04	05		06	07	08	09	10	11	12	13		14
AZ	**P**	**S**	**–**			**–**									**–**	

Product

01	External gear unit	**AZ**

Function

02	Pump	**P**

Model

03	SILENCE, platform F (4 ... 28 cm³/rev)	**S**

Series

04	Bearing diameter 18 mm	**1**
	Bearing diameter 20 mm	**2**

Version

05	Phosphated, high precision cover fixation	**1**
	Zinc plated, high precision cover fixation[1)]	**2**

Nominal size (NG)

06	Geometric displacement V_g [cm³/rev], see “Technical data”	**004**	**005**	**008**	**011**	**014**	**016**	**019**	**022**	**025**	**028**

Direction of rotation

07	Viewed on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Drive shaft			**Typical front cover**	
08	Tapered keyed shaft	1 : 5	B, P	**C**
		1 : 5	A, G	**S**
		1 : 8	O	**H**
	Tang drive		M, T	**N**
	Splined shaft	B17 × 14 according to DIN 5482	B, P	**F**
		SAE J744 16-4 9T	R, C	**R**
		SAE J744 19-4 11T, length 38 mm	R, C	**P**
	Parallel keyed shaft	ISO diameter 18 mm	B	**A**
		SAE J744 19-1, length 32 mm	R	**K**
		SAE J744 16-1, length 32 mm	R	**Q**

Front cover

09	Rectangular flange	spigot diameter 80 mm		**B**
		spigot diameter 36.47 mm	M8	**O**
	2-bolt flange	spigot diameter 82.55 mm	SAE J744 82-2 (A)	**R**
		spigot diameter 101.6 mm	SAE J744 101-2 (B)	**C**
	2-bolt mounting	spigot diameter 52 mm	with O-ring	**M**
		spigot diameter 50 mm	option 1 	**N**
		spigot diameter 50 mm	option 2 	**P**
	4-bolt mounting	spigot diameter 52 mm	with O-ring	**T**
	Outrigger bearing	spigot diameter 80 mm	type 1	**A**
		spigot diameter 80 mm	type 2	**G**

1) Corrosion-protected version, details see “Technical data”

01	02	03		04	05		06	07	08	09	10	11	12	13		14
AZ	**P**	**S**	**–**			**–**									**–**	

Port connection

			004	005	008	011	014	016	019	022	025	028	
10	Pipe thread according to ISO 228-1		●	●	●	●	●	●	●	●	●	●	**01**
	UN-thread according to ISO 11926-1 / ASME B 1.1, O-ring		●	●	●	●	●	●	●	●	●	●	**12**
	Square flange (German version)		●	●	●	●	●	●	●	●	●	●	**20**
	Square flange (Italian version)		●	●	●	●	●	●	●	●	●	●	**30**
	Metric thread according to ISO 6149, O-ring		●	●	●	●	●	●	●	●	●	●	**50**

Sealing material

11	NBR (nitrile rubber)	**M**
	FKM (fluorocarbon rubber)	**P**
	NBR (nitrile rubber), shaft seal in FKM (fluorocarbon rubber)	**K**

Rear cover

12	Standard (cast iron)		**B**
	Pressure relief valve	with internal residual flow	**D**
		with external residual flow	**T**
	Flow control valve	with internal residual flow	**S**
		with external residual flow	**E**
	Flow control valve and pressure relief valve	with internal residual flow	**V**

Valve settings

13	Flow in l/min, 2-digit, e.g. 9 l/min	**XXX09**
	Cracking pressure in bar, 3-digit, e.g. 180 bar	**180XX**
	Cracking pressure in bar, 3-digit, e.g. 180 bar and flow in l/min, 2-digit, e.g. 9 l/min	**18009**

Non standard version

14	Special version[2)] (characteristics not covered by type code)	**SXXXX**

● = Available **–** = Not available

Notice

- Not all of the variants according to the type code are possible.
- Please select the desired pump with the help of the selection table (preferred types) or after consultation with Bosch Rexroth.
- Special options are available on request.

2) For more information about special version, please contact us.

Type code multiple pump

01	02	03		04	05		06	07	08	09	10	11	12	13
AZ	**P**		**–**			**–**								

Product

01	External gear unit	**AZ**

Function

02	Pump	**P**

Model[1)]

03	Standard Performance	4.0 ... 25 cm^3/rev	Data sheet 10090	**W**
	High Performance	1.0 ... 7.1 cm^3/rev	Data sheet 10088	**B**
		4.0 ... 28 cm^3/rev	Data sheet 10089	**F**
		20.0 ... 36 cm^3/rev	Data sheet 10091	**N**
		22.5 ... 100 cm^3/rev	Data sheet 10093	**G**
	SILENCE	4.0 ... 28 cm^3/rev	Data sheet 10095	**S**
		20.0 ... 36 cm^3/rev	Data sheet 10092	**T**
		22.5 ... 100 cm^3/rev	Data sheet 10098	**U**
	SILENCE PLUS	12.0 ... 28 cm^3/rev	Data sheet 10094	**J**

Series (according to data sheet of pump stage 1)

04	Standard bearing	**1**
	Reinforced bearing	**2**

Version (according to data sheet of pump stage 1)

05	Phosphated, high precision cover fixation	**1**
	Zinc plated, high precision cover fixation	**2**

Nominal size (NG)[2)]

06	In accordance with data sheet for the individual series	

Direction of rotation

07	Viewed on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Drive shaft (according to pump stage 1)

08	In accordance with data sheet of pump stage 1	

Front cover (according to pump stage 1)

09	In accordance with data sheet of pump stage 1	

Port connection (per pump stage)[3)]

10	In accordance with data sheet for the individual series	

Sealing material

11	NBR (nitrile rubber)	**M**
	FKM (fluorocarbon rubber)	**P**
	NBR (nitrile rubber), shaft seal in FKM (fluorocarbon rubber)	**K**

Rear cover (according to last pump stage)

12	In accordance with data sheet of the last pump stage	

Non standard version

13	Special version (characteristics not covered by type code)	**SXXXX**

1) A letter is to be selected for each pump stage, e.g. triple pump AZPJ + AZPJ + AZPB: AZP**JJB**
2) A numerical value is to be selected for each pump stage, e.g. triple pump **028/016/2.0**
3) A numerical value is to be selected for each pump stage, e.g. triple pump **202020**

Notice

- Not all of the variants according to the type code are possible.
- Please select the desired pump with the help of the selection table (preferred types) or after consultation with Bosch Rexroth.
- Special options are available on request.

Example 4-fold pump:

AZPG...032... + AZPG...022... + AZPJ...016... + AZPJ...012...

01	02	03		04	05		06	07	08	09	10	11	12
AZ	**P**	**GGJJ**	**–**	**2**	**2**	**–**	**032/022/016/012**	**R**	**C**	**B**	**20202020**	**K**	**B**

Technical data

Operating conditions

Nominal size					**4**	**5**	**8**	**11**	**14**	**16**	**19**	**22**	**25**	**28**
Series					1x						2x			
Displacement geometric, per revolution			V_g	cm³	4	5.5	8	11	14	16	19	22.5	25	28
Pressure at suction port **S**[1]		absolute	p_e	bar	0.7 ... 3									
Maximum continuous pressure			p_1	bar	250	250	250	250	250	250	250	220	195	170
Maximum intermittent pressure[2]			p_2	bar	280	280	280	280	280	280	280	250	225	200
Maximum pressure peaks			p_3	bar	300	300	300	300	300	300	300	290	265	240
Minimum rotational speed at	ν = 12 mm²/s	p < 100 bar	n_{min}	rpm	600	500	500	500	500	500	500	500	500	500
		p = 100 ... 180 bar	n_{min}	rpm	1200	1200	1000	1000	800	800	800	800	800	800
		p = 180 bar ... p_2	n_{min}	rpm	1400	1400	1400	1200	1000	1000	1000	1000	1000	1000
	ν = 25 mm²/s	at p_2	n_{min}	rpm	700	700	700	600	500	500	500	500	500	500
Maximum rotational speed		at p_2	n_{max}	rpm	4000	4000	4000	3500	3000	3000	3500	3500	3000	3000

Rotary stiffness of drive shaft

Drive shaft				**C**	**S**	**H**	**N**	**F**	**R**	**P**	**A**	**K**	**Q**
Rotary stiffness	Series 1x (18 mm)	c	Nm/rad	215	293	246	264	250	220	305	290	314	232
	Series 2x (20 mm)	c	Nm/rad	246	352	287	312	292	251	370	349	383	268

General technical data

Weight	m	kg	See chapter “Dimensions”
Installation position			No restrictions
Mounting type			Flange or through-bolting with spigot
Port connections			See chapter “Port connections”
Direction of rotation, viewed on drive shaft			Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Drive shaft loading			Axial and radial forces only after consultation
Ambient temperature range	t	°C	–30 ... +80 with NBR seals (NBR = nitrile rubber)
			–20 ... +110 with FKM seals (FKM = fluorocarbon rubber)

Corrosion protection

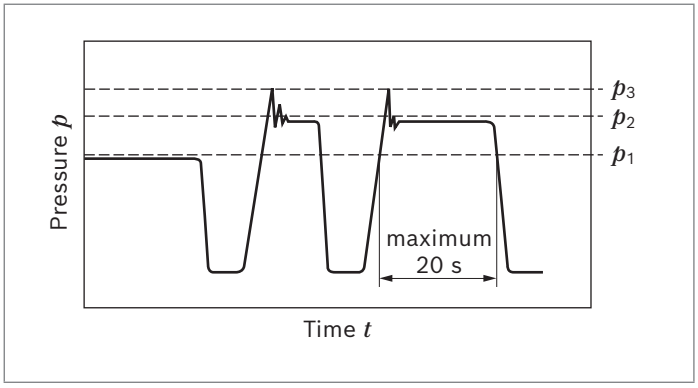
Version 1 (phosphated): Unit with low corrosion protection	The surface serves for protection against flash rust during transport or as priming for painting.
Version 2 (galvanized, passivated): Unit with corrosion protection	Degree of corrosion and rust according to DIN EN ISO 9227 — Test duration 96 h: no red rust

Notice

- When using pumps with constant pressures > 50 bar in combination with long pressure holding times > 20 s and constant speeds, prior approval by Bosch Rexroth is mandatory.
- Safety requirements pertaining to the whole systems are to be observed.
- Please contact us for applications with frequent load changes.

1) In the case of tandem pumps, the suction-side pressure difference between the individual pump stages must not exceed 0.5 bar.
2) Limited service life with threaded ports (applicable for applications with p_2 > 210 bar)

▼ **Pressure definition**

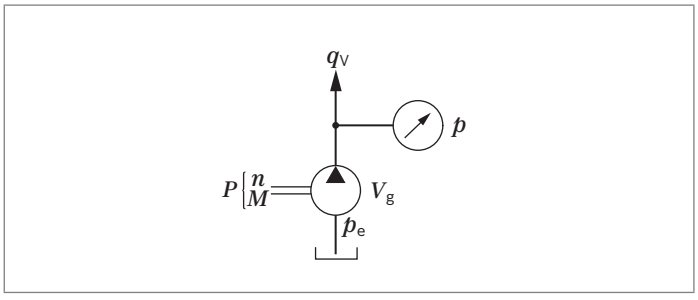


p_1: Maximum continuous pressure
p_2: Maximum intermittent pressure
p_3: Maximum pressure peaks

Determining the operating characteristics		
Flow	$q_v = \frac{V_g \times n \times \eta_v}{1000}$	[l/min]
Torque	$M = \frac{V_g \times \Delta p}{20 \times \pi \times \eta_{hm}}$	[Nm]
Power	$P = \frac{2 \pi \times M \times n}{60000} = \frac{q_v \times \Delta p}{600 \times \eta_t}$	[kW]

Key

V_g	Displacement per revolution [cm³]
Δp	Differential pressure [bar] ($\Delta p = p - p_e$)
n	Rotational speed [rpm]
η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

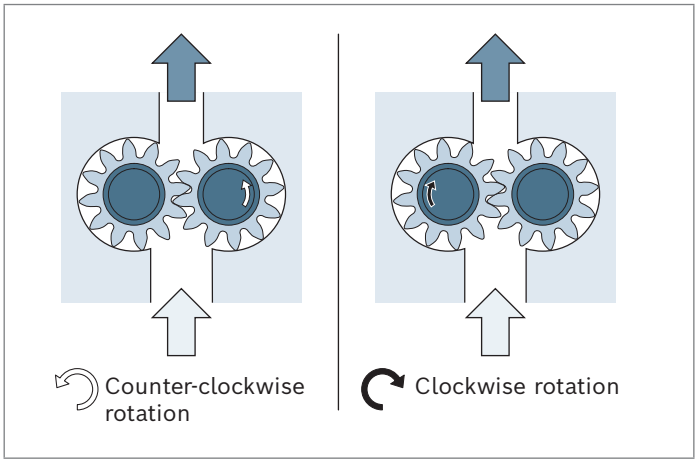


Notice
You can find diagrams for a rough calculation in chapter “Flow characteristic curves” and “Power diagrams”.

Direction of rotation

The dimensional drawings in the chapter “Dimensions” represent pumps for clockwise rotation. The position of the drive shaft and/or the position of suction and pressure port changes for counter-clockwise rotation.

▼ **Direction of rotation, viewed on drive shaft**



Hydraulic fluid

The external gear unit is designed for operation with HLP mineral oil according to DIN 51524, 1-3. Under higher load, however, Bosch Rexroth recommends at least HLP compliant with DIN 51524 Part 2.
See the following data sheet for application instructions and requirements for selecting hydraulic fluid, behavior during operation as well as disposal and environmental protection before you begin project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons

Other hydraulic fluids on request.

Selection of hydraulic fluid
Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235.
Hydraulic fluids with positive evaluation in the Fluid Rating are provided in the following technical data sheet:

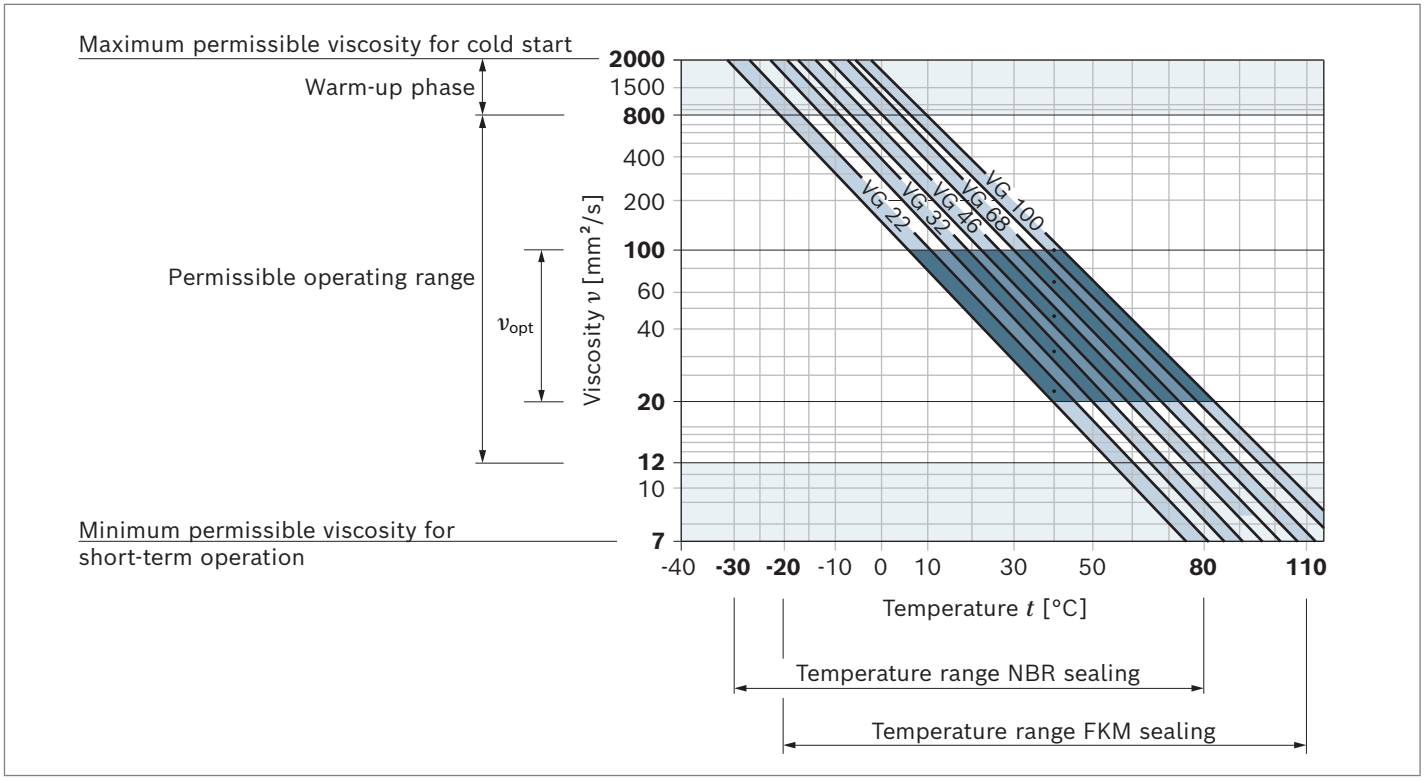
- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

Selection of hydraulic fluid shall make sure that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see “Selection diagram”)

Viscosity and temperature of hydraulic fluids

Viscosity range	
Permissible operating range	ν = 12 ... 800 mm²/s
Recommended in continuous operation	ν_{opt} = 20 ... 100 mm²/s
Permissible for cold start	ν_{max} ≤ 2000 mm²/s
Temperature range	
With NBR seals (NBR = nitrile rubber)	t = -30 °C ... +80 °C
With FKM seals (FKM = fluorocarbon rubber)	t = -20 °C ... +110 °C

▼ **Selection diagram**

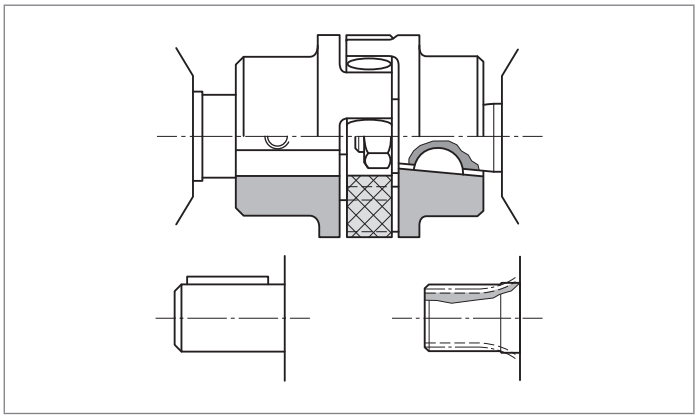


Observe the instructions for the filtration of the hydraulic fluid (see chapter “Project planning information”).

Drive

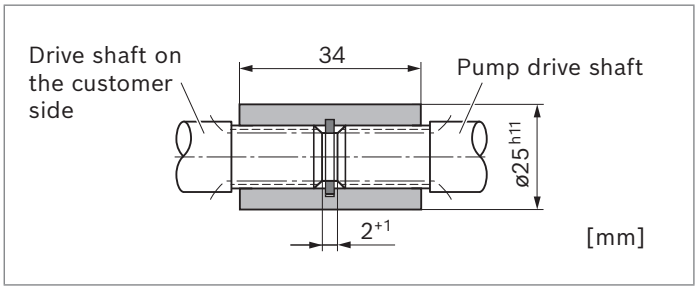
Elastic couplings

- The coupling may not transfer any radial or axial forces to the pump.
- The radial runout deviation from the shaft to the spigot should not exceed 0.2 mm.
- See the coupling manufacturer's assembly instructions for shaft misalignment tolerances.



Coupling sleeve

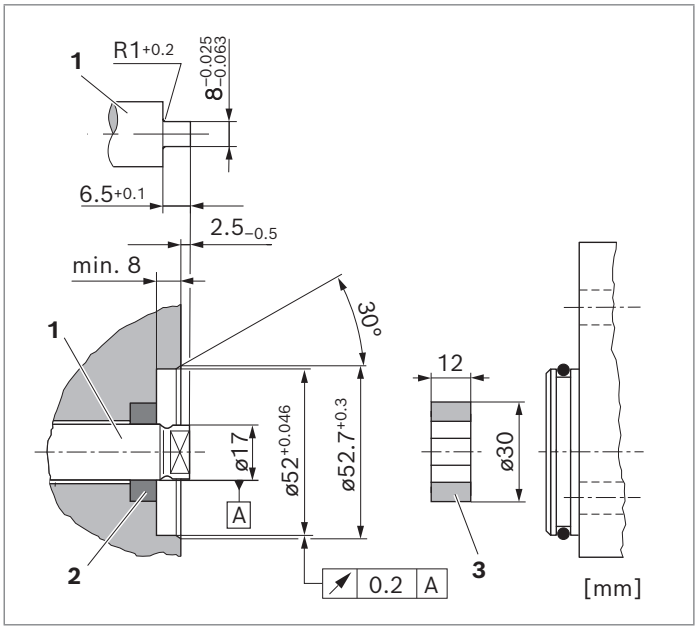
- To be used for splined shaft profile according to DIN and SAE
- Attention: Make sure no radial or axial forces act on the pump drive shaft or coupling sleeve. The coupling sleeve should freely move in the axial direction.
- The distance between the pump drive shaft and the output shaft on the customer side should be 2^{+1} mm
- Reserve installation space for the retaining ring.
- Oil-bath or oil-mist lubrication required



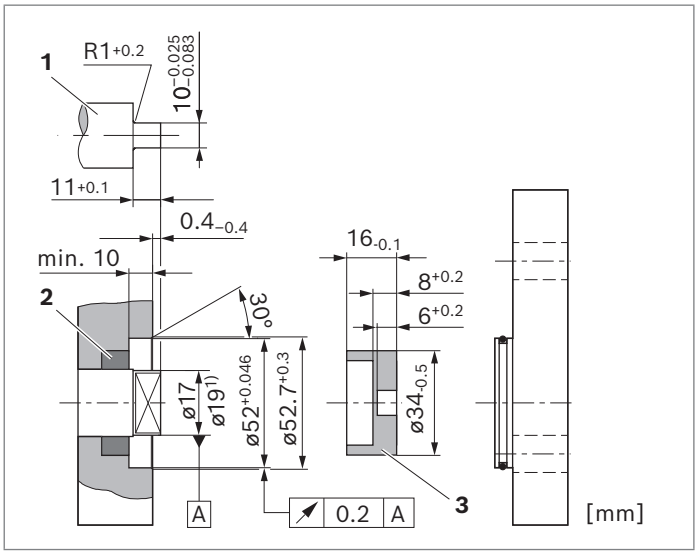
Tang drive coupling

- For attaching the pump directly to an electric motor or combustion engine, gearbox, etc.
- Pump drive shaft with special tang drive coupling and driver (**3**) (scope of delivery see offer drawing)
- No shaft seal
- Drive-side installation and sealing according to the following recommendations and dimensions
- Drive shaft on the customer side (**1**)
  - Case-hardened steel DIN 17210, e.g. 20MnCrS5 case-hardened 0.6 deep; HRC 60±3
  - Seal ring contact surface ground without rifling $R_t \leq 4$ µm
- Radial shaft seal ring on the customer side (**2**)
  - Provide with rubber cover (see DIN 3760, type AS, or double-lipped ring)
  - Provide installation edges with 15° chamfer or install shaft seal with protection sleeve

▼ **Nominal sizes 4 to 16**



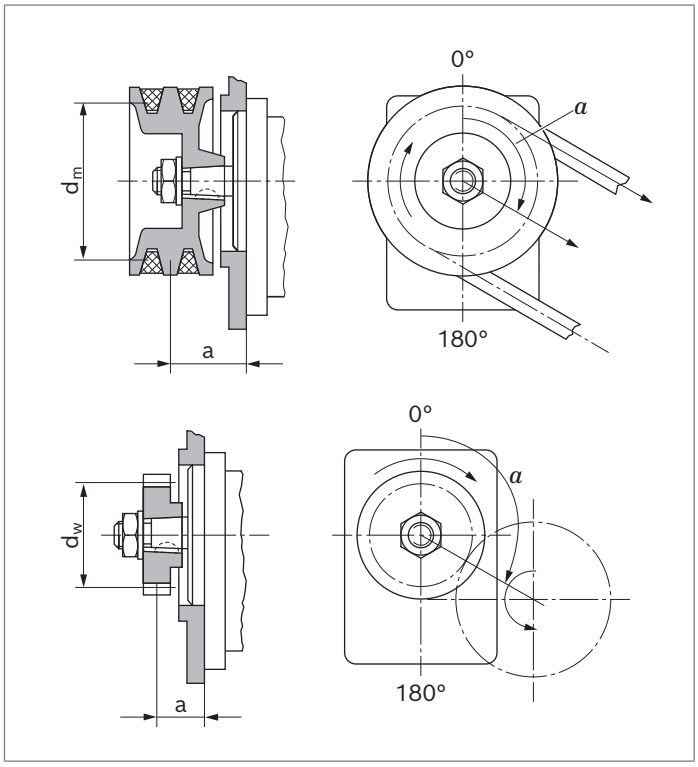
▼ **Nominal sizes 19 to 28**



1) See offer drawing (maximum 34 mm)

V-belts and straight gear wheels or helical toothed gear drives without outrigger bearing

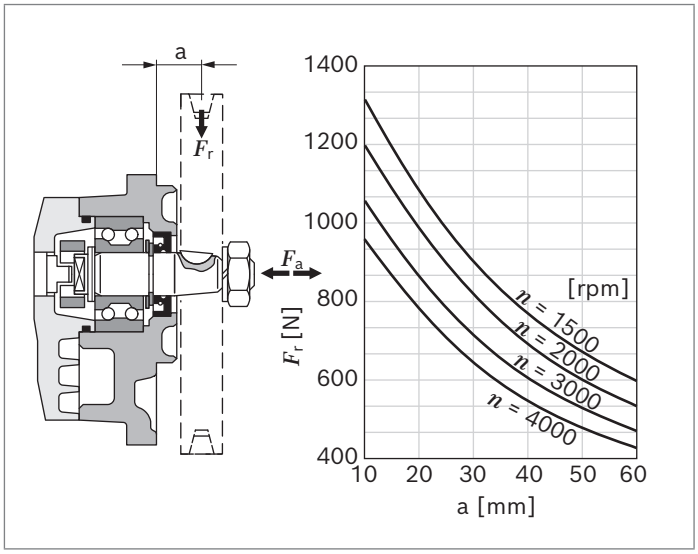
For V-belt or gear wheel drives, please contact us specifying the application and mounting conditions (dimensions a, d_m, d_w and angle α). For helical toothed gear drives, details of the helix angle β are also required.



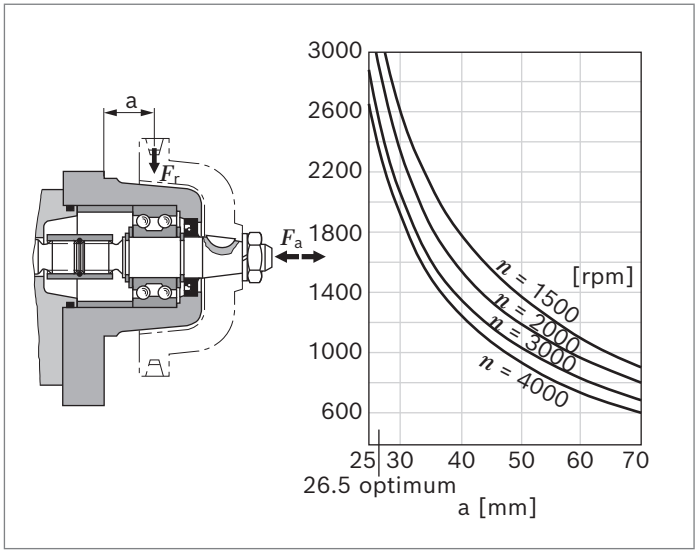
Outrigger bearing

Outrigger bearing are offered to eliminate possible problems when the pumps are driven by V-belts or gear wheels. The diagrams show the radial and axial load capacity in relation to a bearing service life of L_H = 1000 h.

▼ **Front cover A (type 1)**



▼ **Front cover G (type 2)**



Maximum transferable drive torques

▼ Tapered keyed shafts

Drive shaft code	Designation	M_{max}	Nominal size	$p_{2\ max}$ Series 1x	$p_{2\ max}$ Series 2x
		Nm		bar	bar
C	1 : 5	155	4 ... 16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200
H	1 : 8	160	4 ... 16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200

▼ Tapered keyed shafts with outrigger bearing

Drive shaft	Outrigger bearing	M_{max}	Nominal size	$p_{2\ max}$ Series 1x	$p_{2\ max}$ Series 2x
Code	Type (code)	Nm		bar	bar
S	Type 1 (A) (with tang drive coupling)	65	4 ... 11	280	–
			14	260	–
			16	230	–
			19	–	190
			22	–	160
			25	–	140
			28	–	130
	Type 1 (A) (with sleeve)	160	4 ... 16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200
	Type 2 (G)		4 ... 16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200

▼ Tang drive

Drive shaft code	Designation	M_{max}	Nominal size	$p_{2\ max}$ Series 1x	$p_{2\ max}$ Series 2x
		Nm		bar	bar
N	Tang drive	65	4 ... 11	280	–
			14	260	–
			16	220	–
		85	19	–	250
			22	–	210
			25	–	190
			28	–	170

▼ Splined shafts

Drive shaft code	Designation	M_{max}	Nominal size	$p_{2\ max}$ Series 1x	$p_{2\ max}$ Series 2x
		Nm		bar	bar
F	DIN 5482 B17 × 14	100	4 ... 16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200
R	SAE J744 16-4 9T	110	4 ... 16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200
P	SAE J744 19-4 11T	180	4 ... 16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200

▼ Parallel keyed shafts

Drive shaft code	Designation	M_{max}	Nominal size	$p_{2\ max}$ Series 1x	$p_{2\ max}$ Series 2x
		Nm		bar	bar
A	ISO diameter 18 mm	140	4 ... 14	280	–
			16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200
K	SAE J744 19-1, length 32 mm	140	4 ... 14	280	–
			16	280	–
			19	–	280
			22	–	250
			25	–	225
			28	–	200
Q	SAE J744 16-1, length 32 mm	80	4 ... 14	280	–
			16	280	–
			19	–	230
			22	–	200
			25	–	180
			28	–	160

Multiple gear pumps

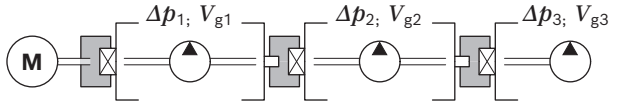
Gear pumps are well-suited to multiple arrangements, whereby the drive shaft of the first pump stage is extended to a second and possibly third pump stage. The shaft of the individual pump sections are normally connected via a driver or via a splined coupling (reinforced through drive). The individual pump stages are usually hydraulically isolated and have separate suction ports. On request a common suction port or separated but hydraulically connected suction ports are available.
For the configuration of multiple pumps, Bosch Rexroth recommends arranging the pump stage with the largest displacement on the drive side.

Notice
Basically, the parameters of the solo pumps apply, however certain restrictions need to be observed:

- **Maximum rotational speed:**
  This is determined by the largest pump stage used.
- **Pressures:**
  These are restricted by the maximum transmissible torques of the drive shaft, the through drive and the driver.

Addition of drive torques

Please note, that in multiple pump arrangements the drive torques of the individual pump stages will add up according to the following formula:

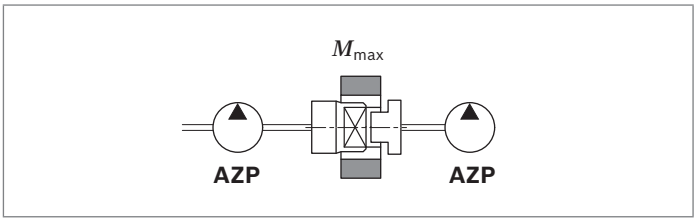


$$\frac{\Delta p_1 \times V_{g1} + \Delta p_2 \times V_{g2} + \Delta p_3 \times V_{g3}}{18 \times \pi} \leq M_{max}\ ^{1)} \qquad \begin{matrix} \Delta p \text{ [bar]} \\ V_g \text{ [cm}^3\text{]} \end{matrix}$$

This may result in pressure restrictions for the respective pump stages.

Standard through drive (tang drive coupling)

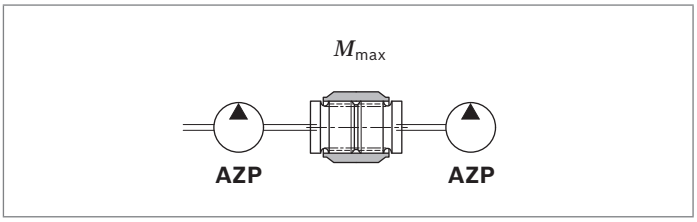
For AZPS pumps, the driver for the next pump stage can support loads up to M_{max} = 65 Nm (AZPS-1x) resp. M_{max} = 85 Nm (AZPS-2x). This may result in pressure limitations for subsequent pump stages.
Subsequent pumps of a smaller series determine the maximum transmissible torque.



Following pump		M_{max} [Nm]
Platform F	AZPW	52
	AZPF-1x	65
	AZPF-2x	85
	AZPS-1x	65
	AZPS-2x	85
	AZPJ	65
Platform B	AZPB-3x	25

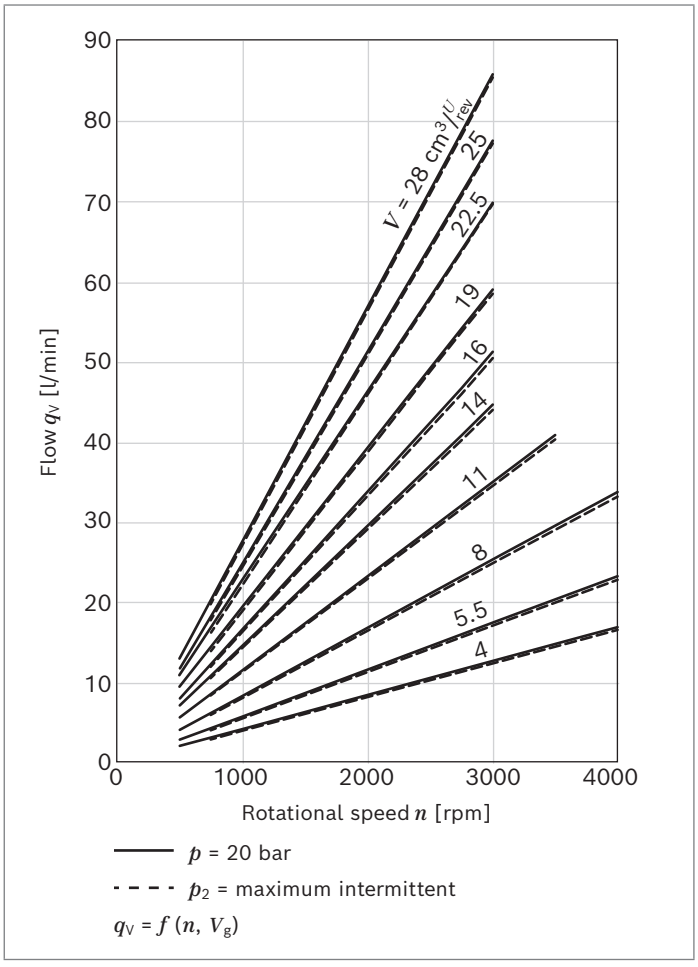
Reinforced through drive

Reinforced through drives (for up to M_{max} = 160 Nm) are available for applications with higher torques/torsional vibrations. Design available on request.



1) M_{max}: see table above “Maximum transferable drive torques”

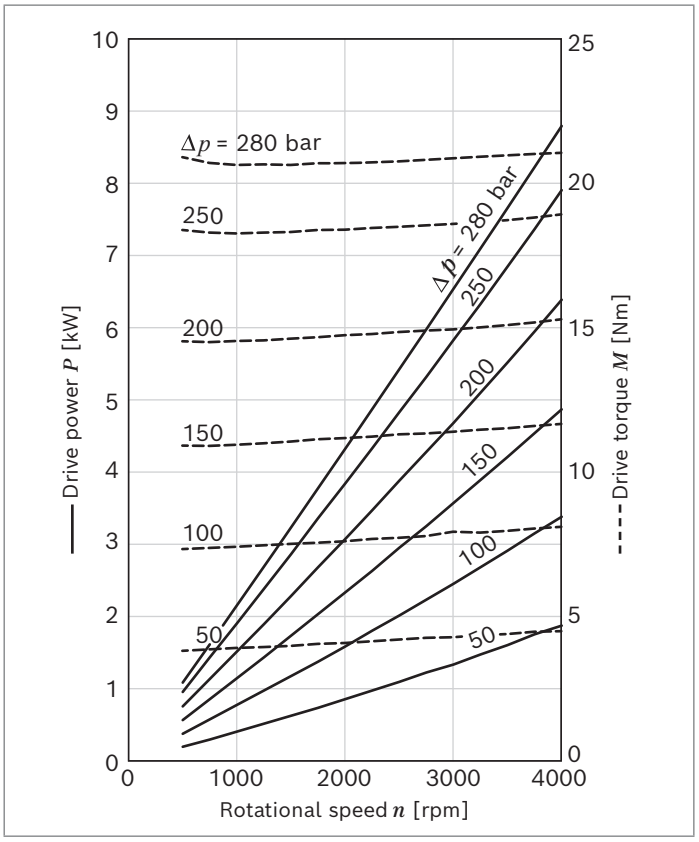
Flow characteristic curves



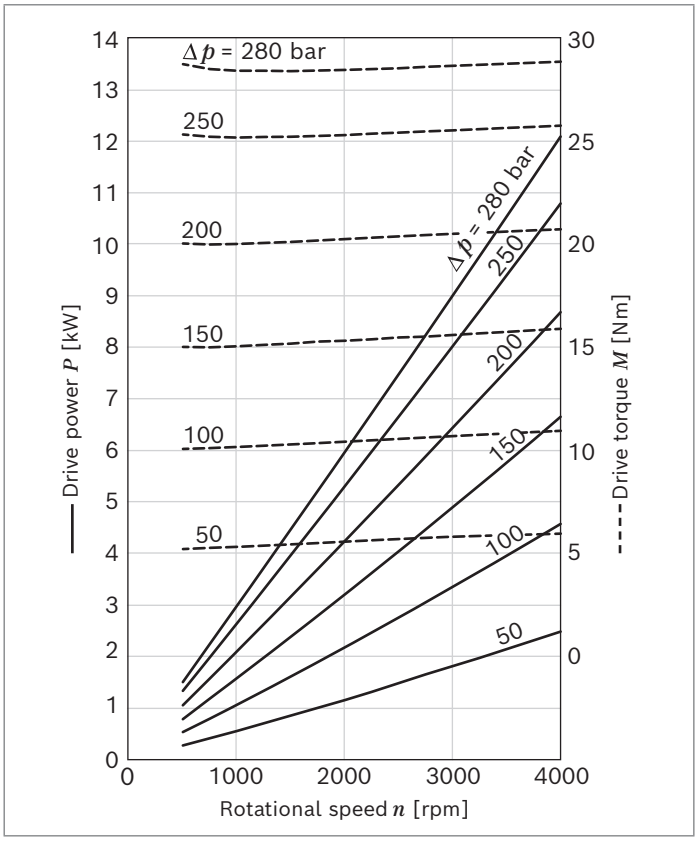
Notice
Characteristic curves measured at ν = 32 mm²/s and t = 50 °C

Power diagrams

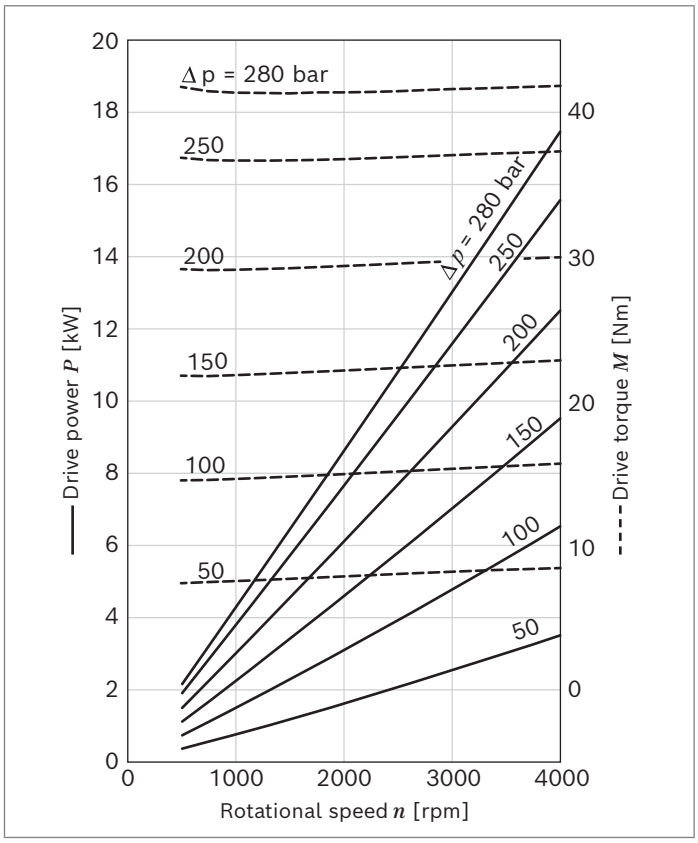
▼ **Nominal size 4**



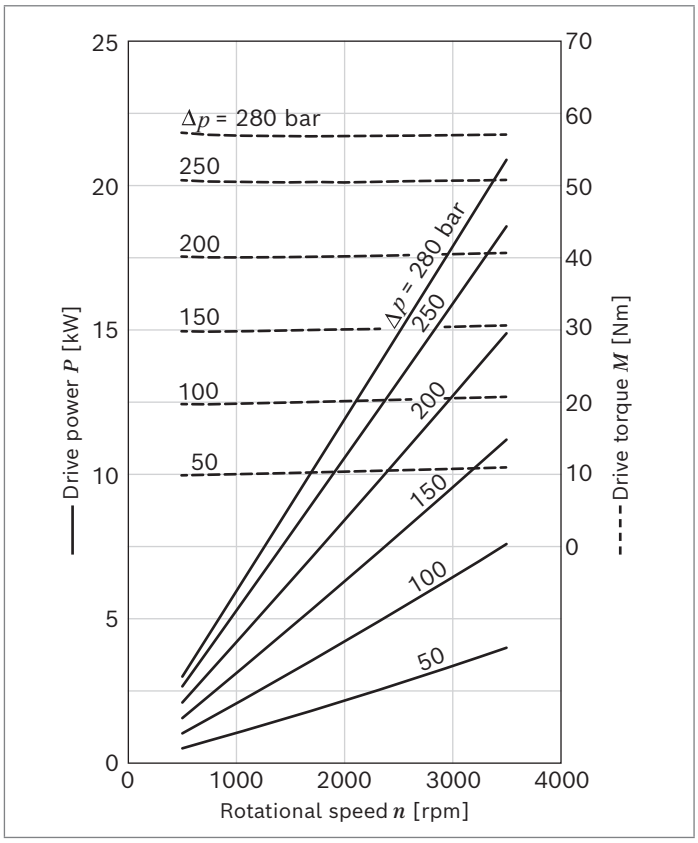
▼ **Nominal size 5**



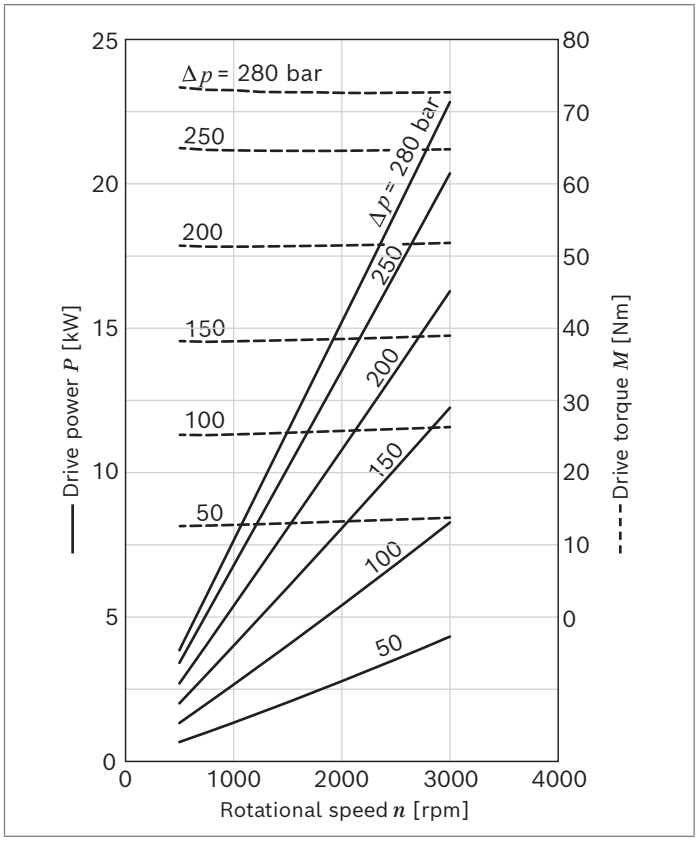
▼ **Nominal size 8**



▼ **Nominal size 11**



▼ **Nominal size 14**



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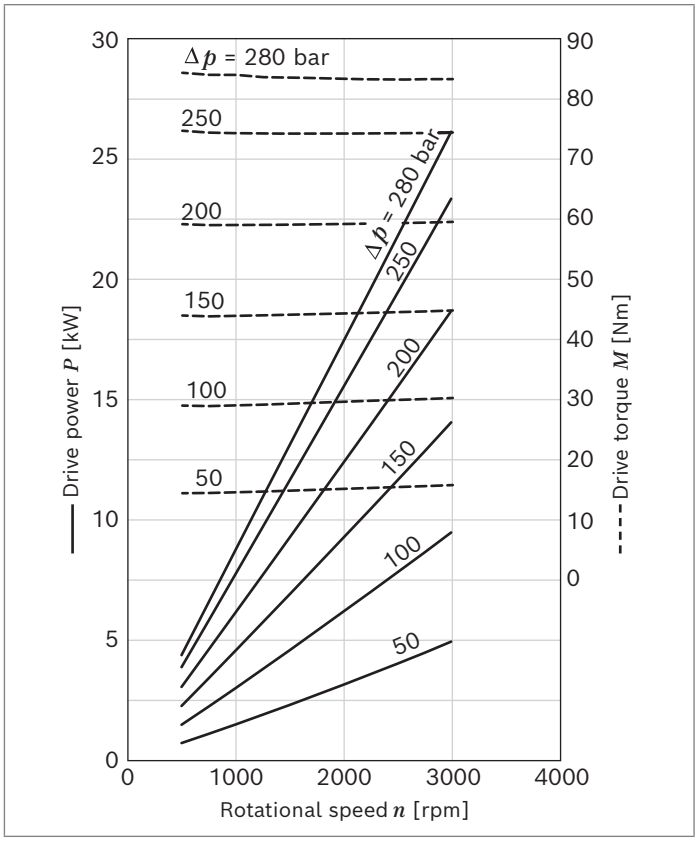

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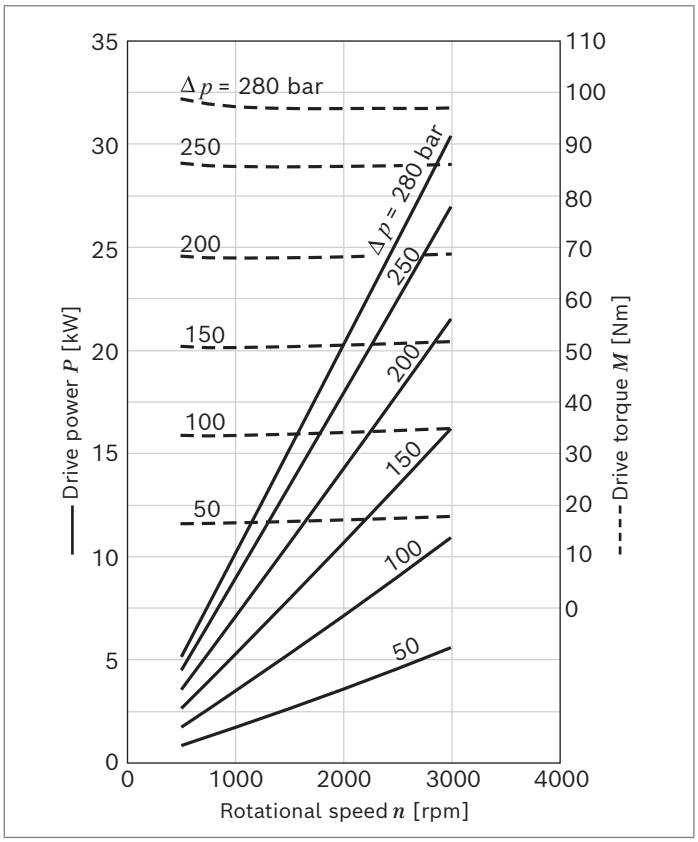

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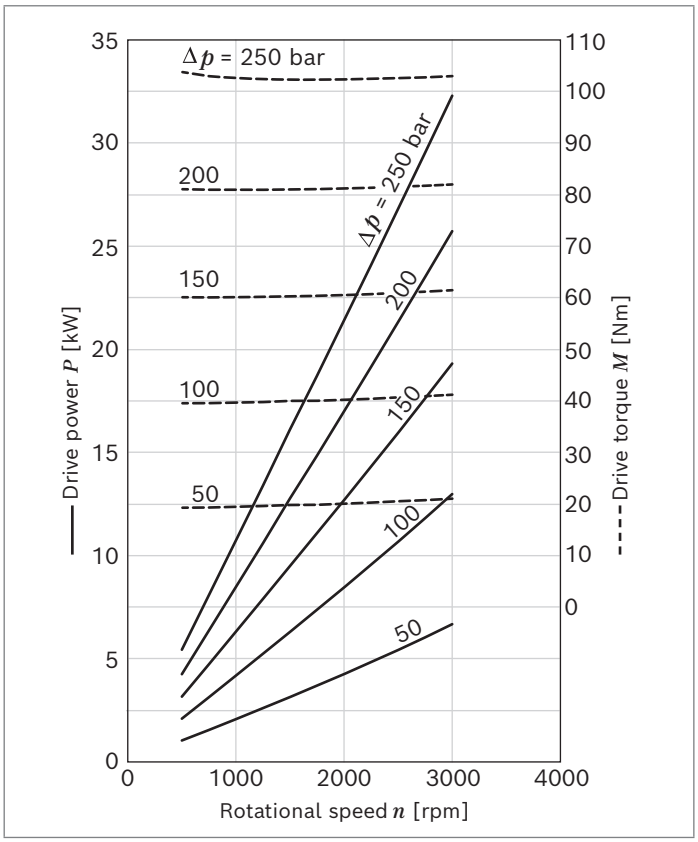

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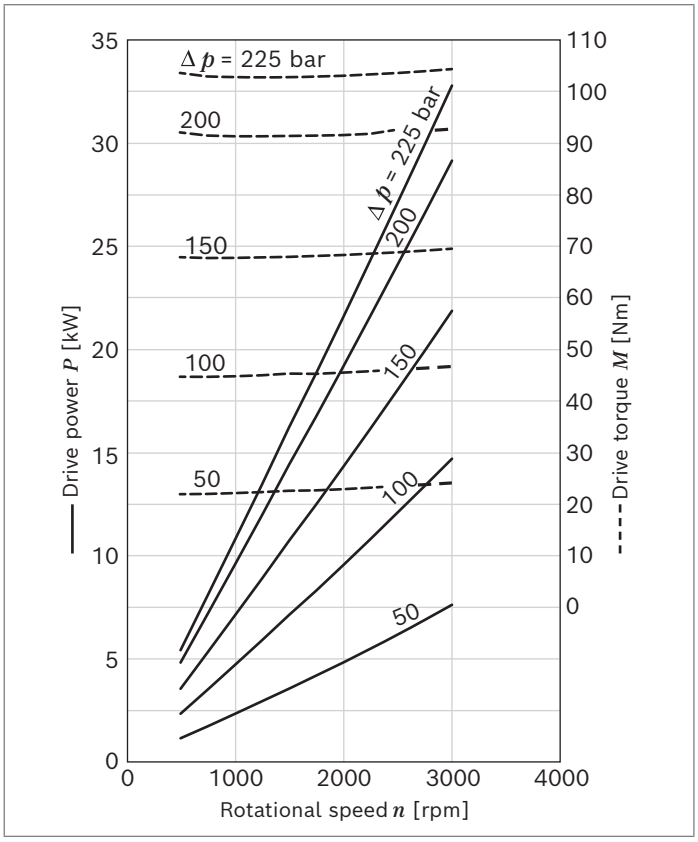
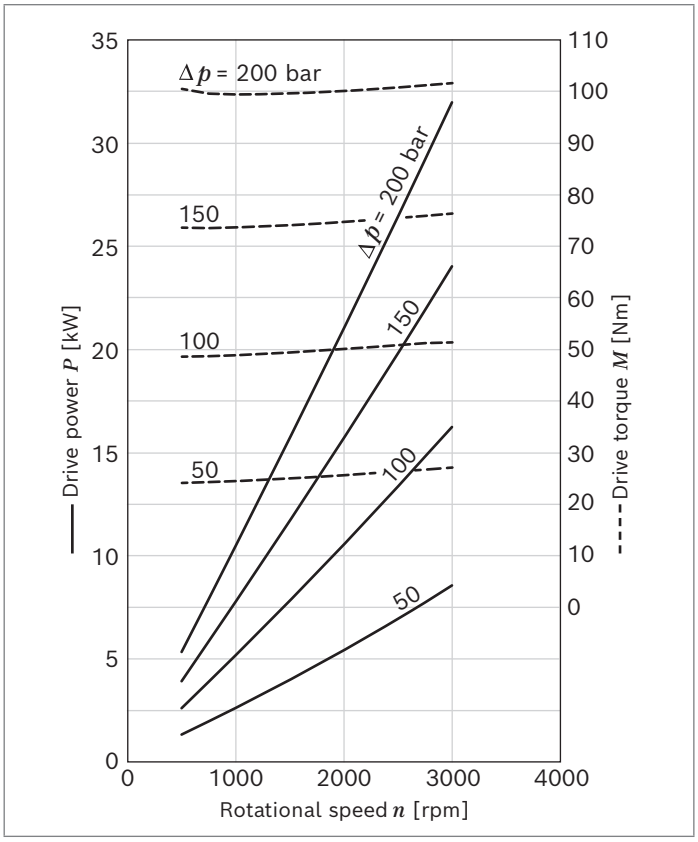


▼ **Nominal size 28**



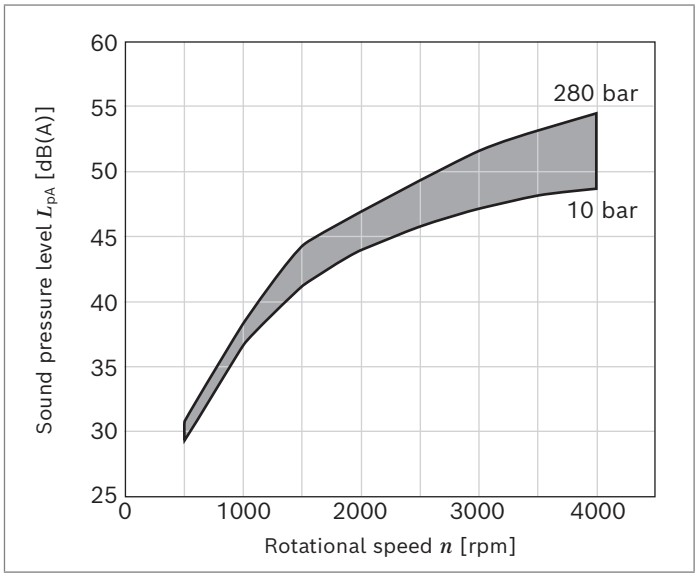
Noise charts

Noise levels dependent on the rotational speed, pressure range between 10 bar and pressure value p_2 (see chapter “Technical data”).
These are typical characteristic values for the respective size. They describe the airborne sound emitted solely by the pump.
Ambient influences (installation site, piping, other system components) were not taken into account.
The values refer to one individual pump.

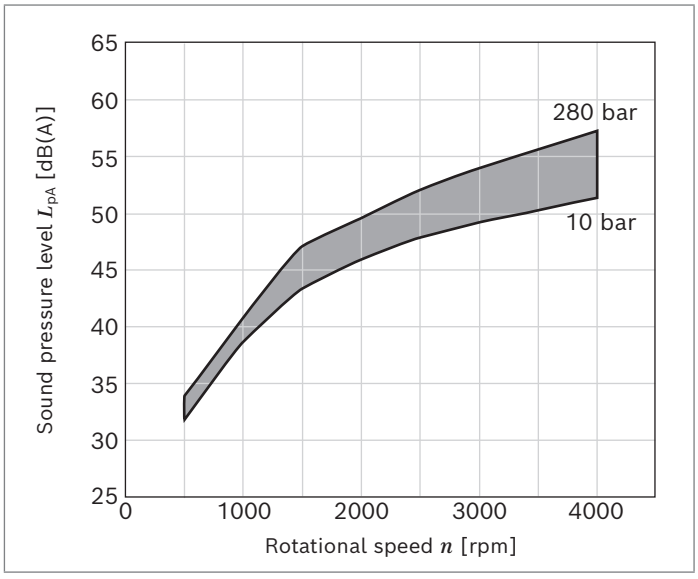
Notice

- Characteristic curves measured at v = 32 mm²/s and t = 50 °C.
- Sound pressure level calculated from noise measurements made in the low reflection measuring room according to DIN 45635, Part 26.
- Distance from measuring sensor to pump: 1 m.

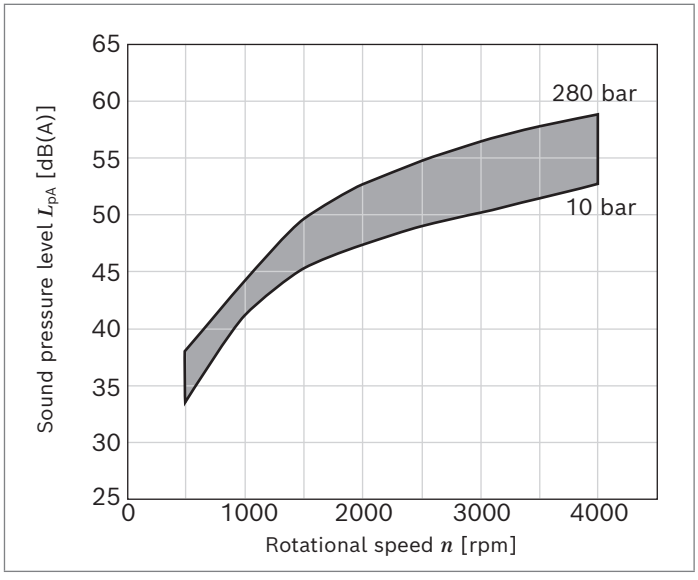
▼ **Nominal size 4**



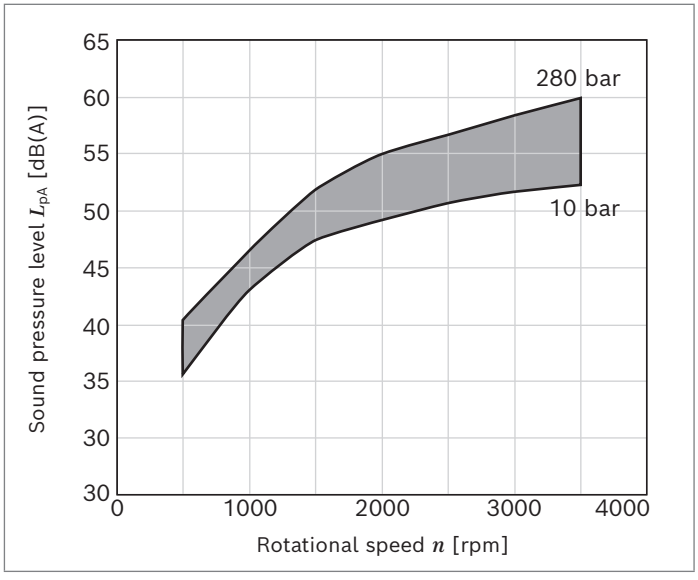
▼ **Nominal size 5**



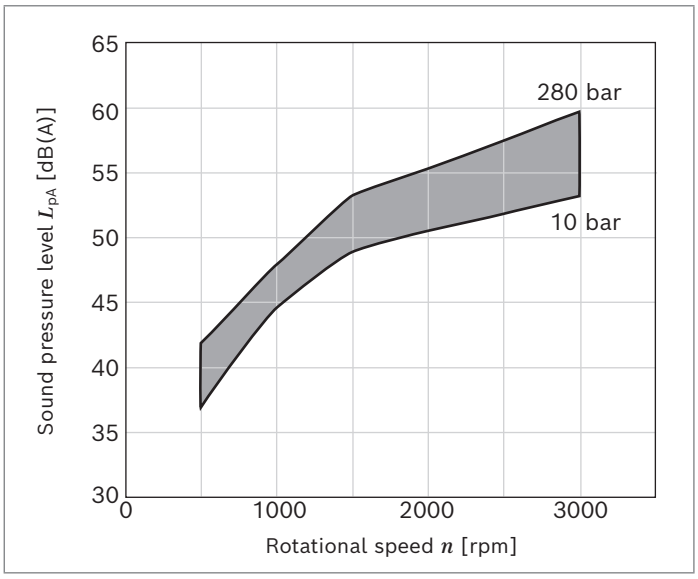
▼ **Nominal size 8**



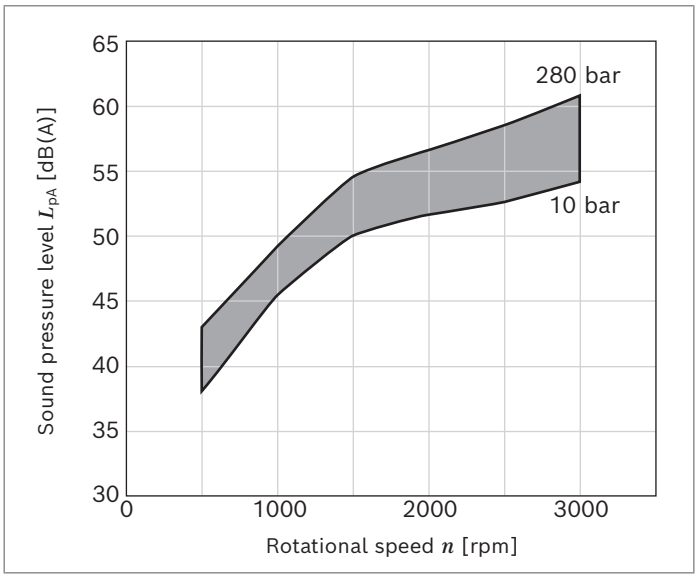
▼ **Nominal size 11**



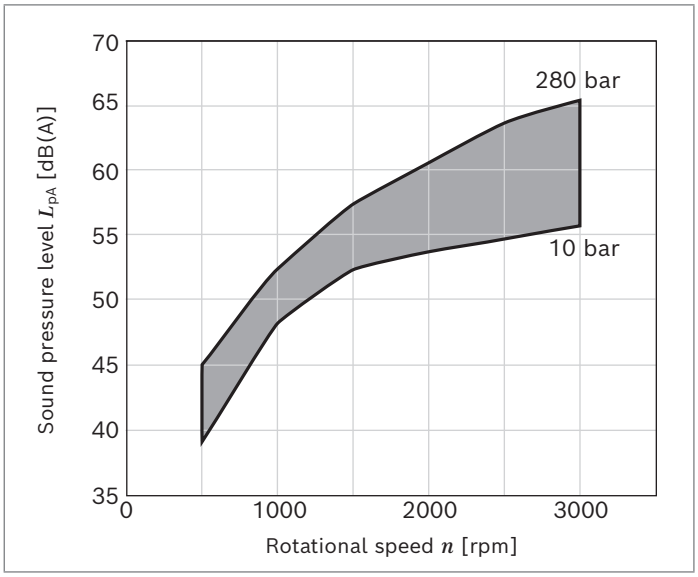
▼ **Nominal size 14**



▼ **Nominal size 16**



▼ **Nominal size 19**



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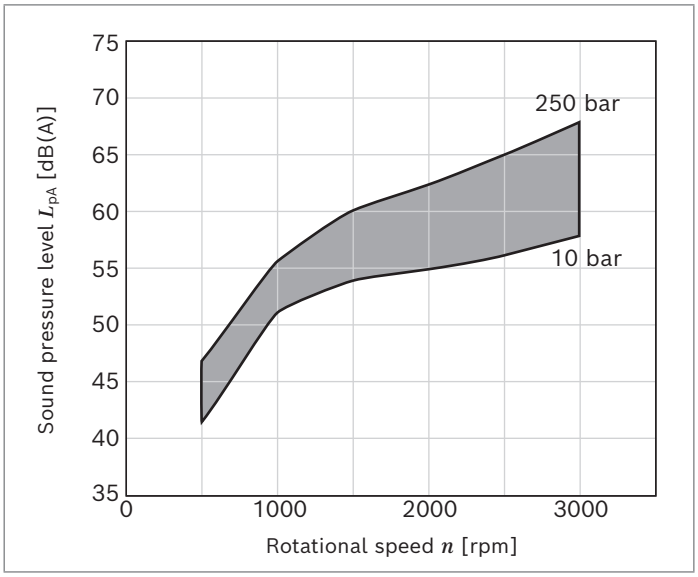

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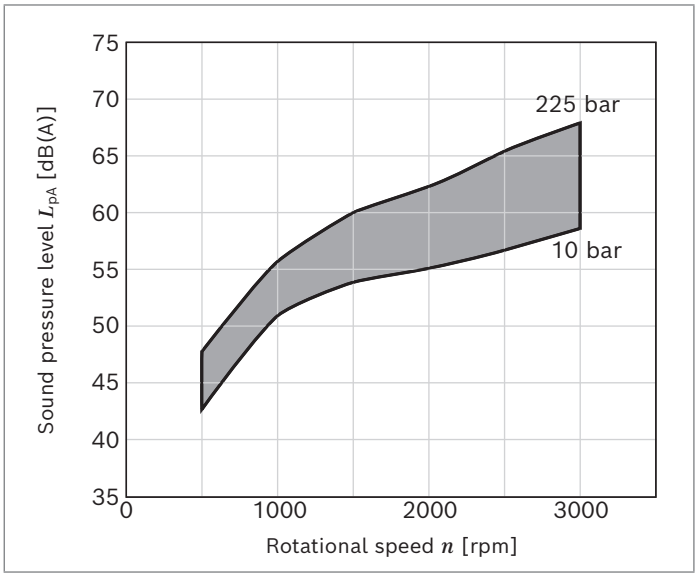
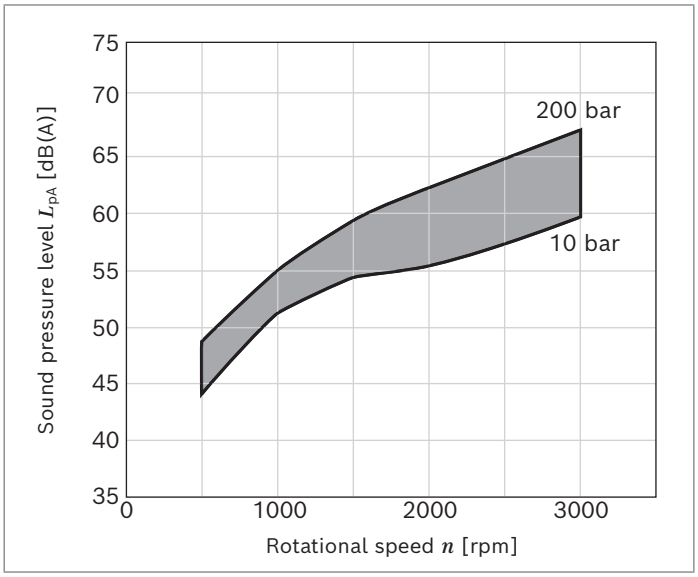


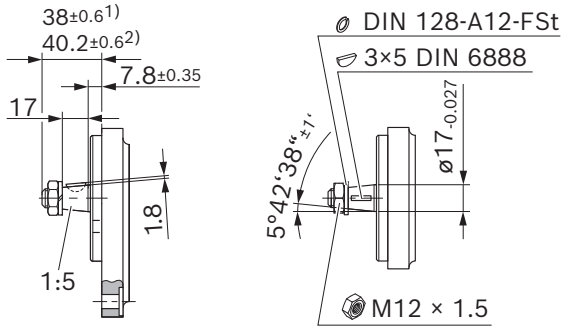
▼ **Nominal size 28**



Drive shafts

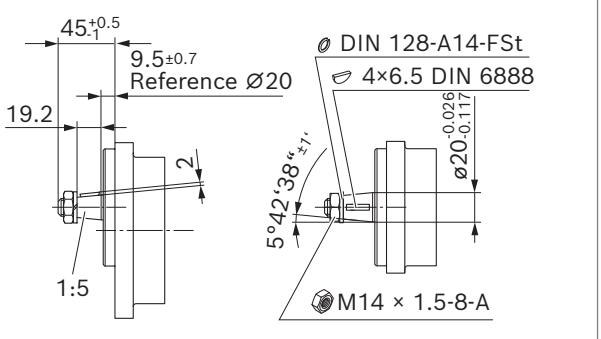
▼ **Tapered keyed shaft 1 : 5 (for front cover B, P)**

C



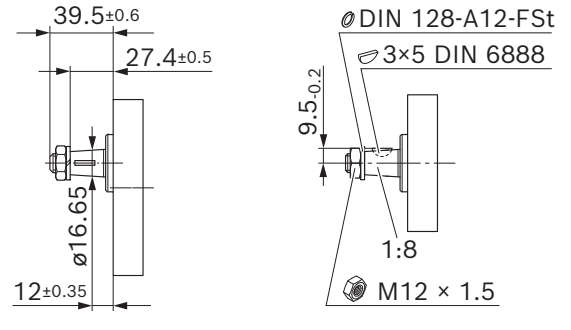
▼ **Tapered keyed shaft 1 : 5 (for front cover A, G)**

S



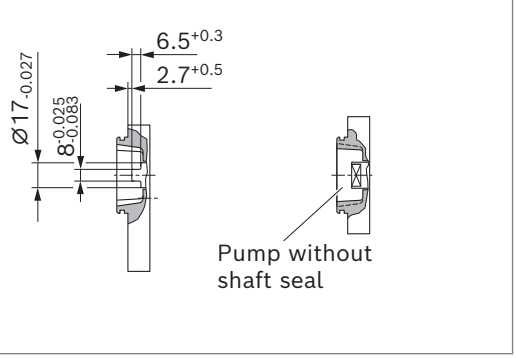
▼ **Tapered keyed shaft 1 : 8**

H



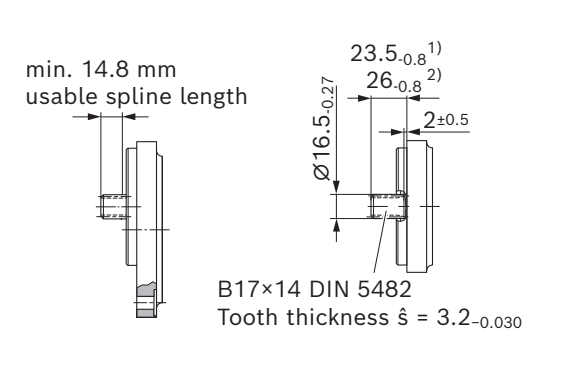
▼ **Tang drive**

N



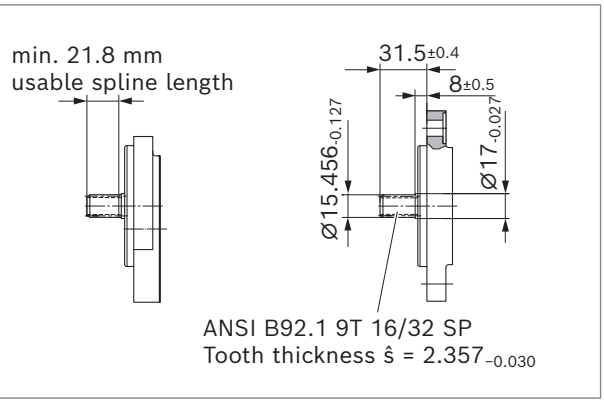
▼ **Splined shaft B17 × 14 according to DIN 5482**

F



▼ **Splined shaft SAE J744 16-4 9T**

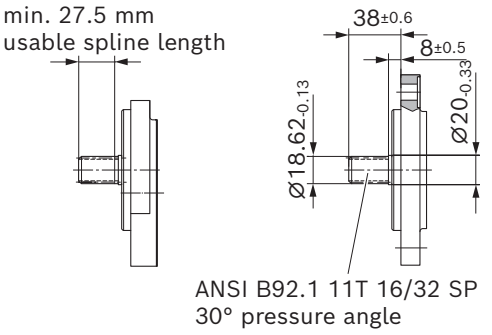
R



1) In combination with front cover B
2) In combination with front cover P

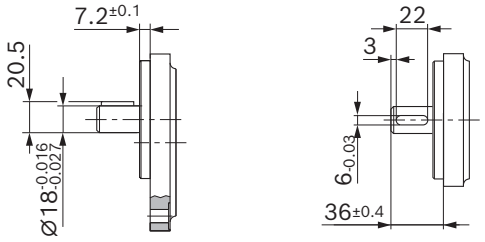
▼ Splined shaft SAE J744 19-4 11T, length 38 mm

P



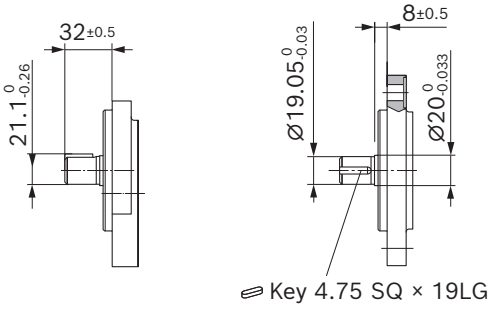
▼ Parallel keyed shaft ISO diameter 18 mm

A



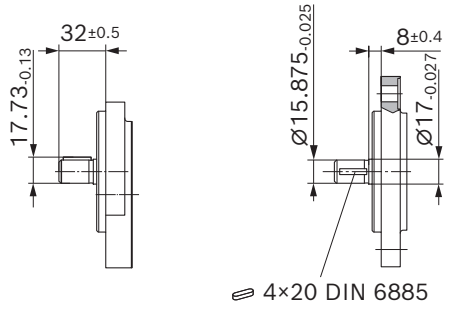
▼ Parallel keyed shaft SAE J744 19-1, length 32 mm

K



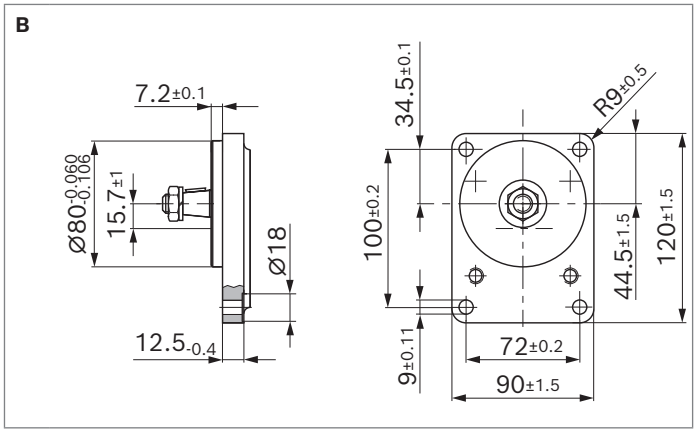
▼ Parallel keyed shaft SAE J744 16-1, length 32 mm

Q

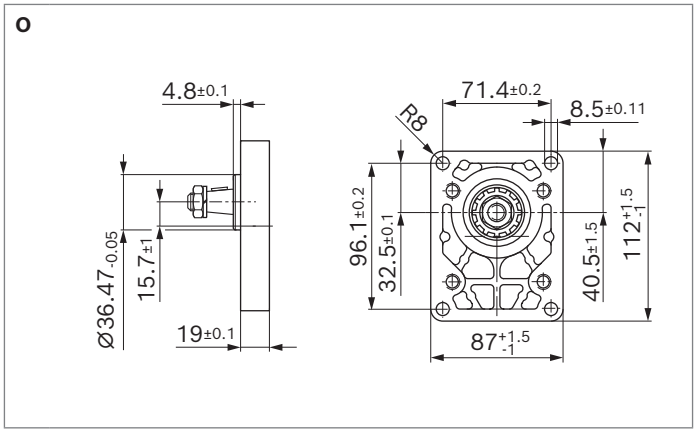


Front covers

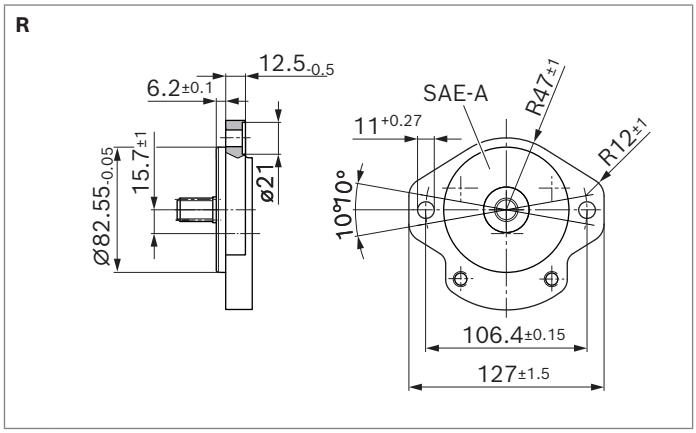
▼ **Rectangular flange spigot diameter 80 mm**



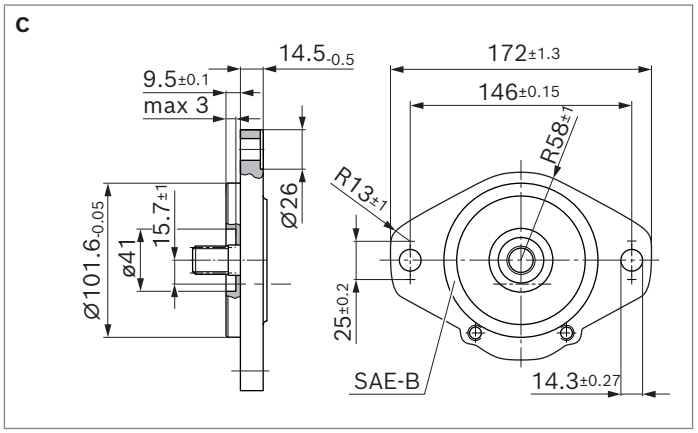
▼ **Rectangular flange spigot diameter 36.47 mm (M8)**



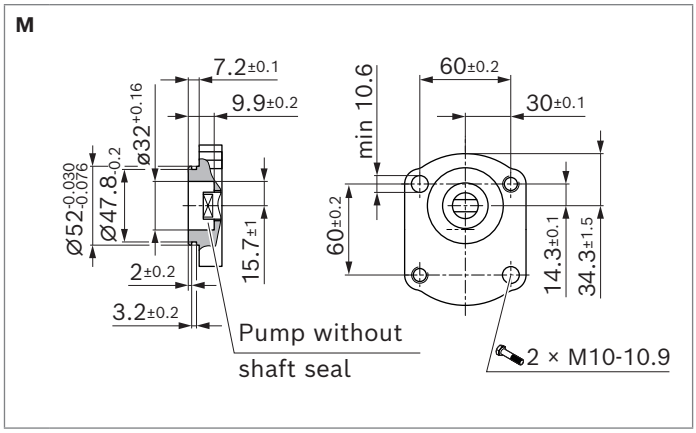
▼ **2-bolt flange spigot diameter 82.55 mm, SAE J744 82-2 (A)**



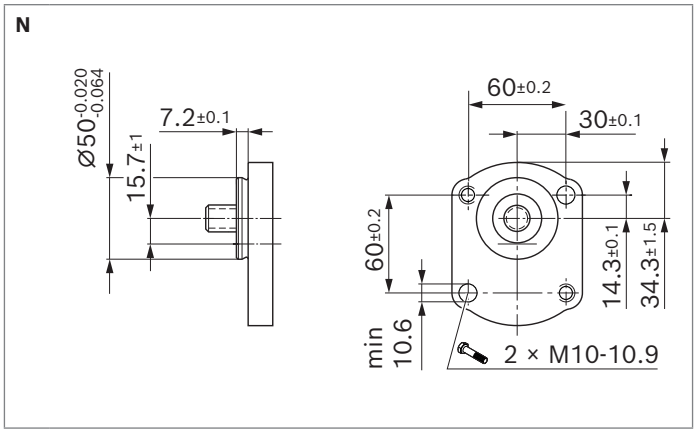
▼ **2-bolt flange spigot diameter 101.6 mm, SAE J744 101-2 (B)**



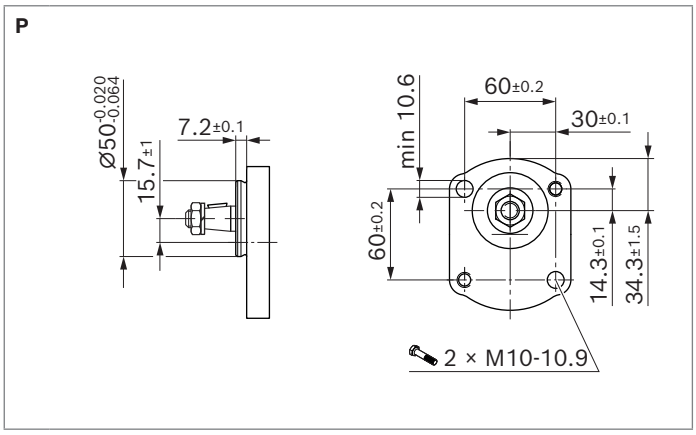
▼ **2-bolt mounting spigot diameter 52 mm (with O-ring)**



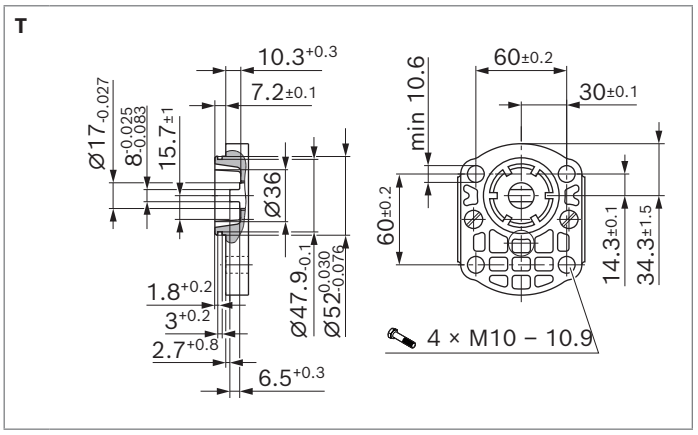
▼ **2-bolt mounting spigot diameter 50 mm (option 1)**



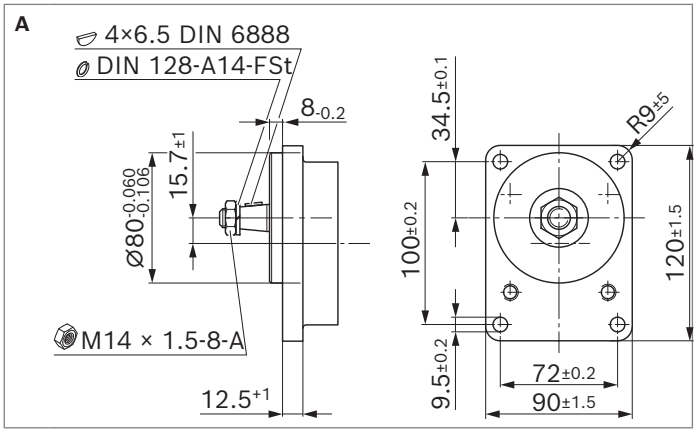
▼ **2-bolt mounting spigot diameter 50 mm (option 2)**



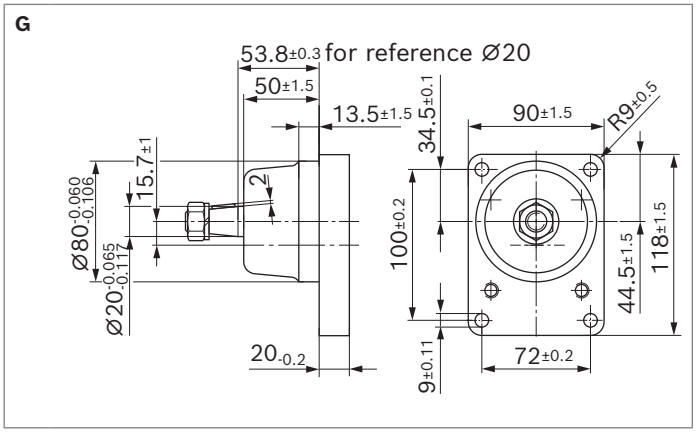
▼ **4-bolt mounting spigot diameter 52 mm (with O-ring)**



▼ **Outrigger bearing spigot diameter 80 mm (type 1)**



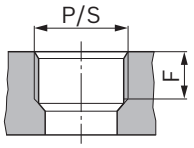
▼ **Outrigger bearing spigot diameter 80 mm (type 2)**



Port connections

▼ **Pipe thread according to ISO 228-1**[1)]

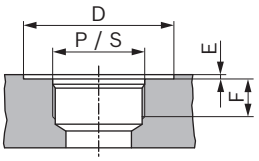
01



Nominal size	Pressure side		Suction side	
	P	F	S	F
		mm		mm
4 ... 16	G 1/2	16	G 3/4	16
19 ... 28	G 3/4		G 1	19

▼ **UN-thread according to ISO 11926-1 / ASME B 1.1, O-ring**[1)]

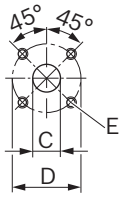
12



Nominal size	Pressure side				Suction side			
	P	D	E	F	S	D	E	F
		mm	mm	mm		mm	mm	mm
4 ... 5	3/4-16 UN-2B	25	0.5	14	7/8-14 UN-2B	25	0.5	17
8	7/8-14 UN-2B	35		17	1 1/16-12 UN-2B	35		19
11 ... 28					1 1/16-12 UN-2B	45		19

▼ **Square flange (German version)**

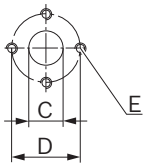
20



Nominal size	Pressure side			Suction side		
	C	D	E	C	D	E
	mm	mm		mm	mm	
4 ... 5	15	35	M6; 13 mm deep	15	40	M6; 13 mm deep
8 ... 16				20		
19 ... 28				26	55	M8; 13 mm deep

▼ **Square flange (Italian version)**

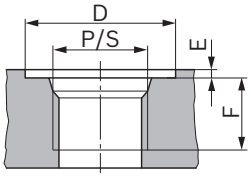
30



Nominal size	Pressure side			Suction side		
	C	D	E	C	D	E
	mm	mm		mm	mm	
4 ... 8	13.5	30.2	M6; 13 mm deep	13.5	30.2	M6; 13 mm deep
11 ... 28				20	39.7	M8; 13 mm deep

▼ **Metric thread according to ISO 6149, O-ring**[1)]

50



Nominal size	Pressure side				Suction side			
	P	D	E	F	S	D	E	F
		mm	mm	mm		mm	mm	mm
4 ... 5	M18 × 1.5	29	0.5	16	M18 × 1.5	29	0.5	16
8 ... 16	M22 × 1.5	34		18	M27 × 2	40		19
19 ... 28					M33 × 2	46		18

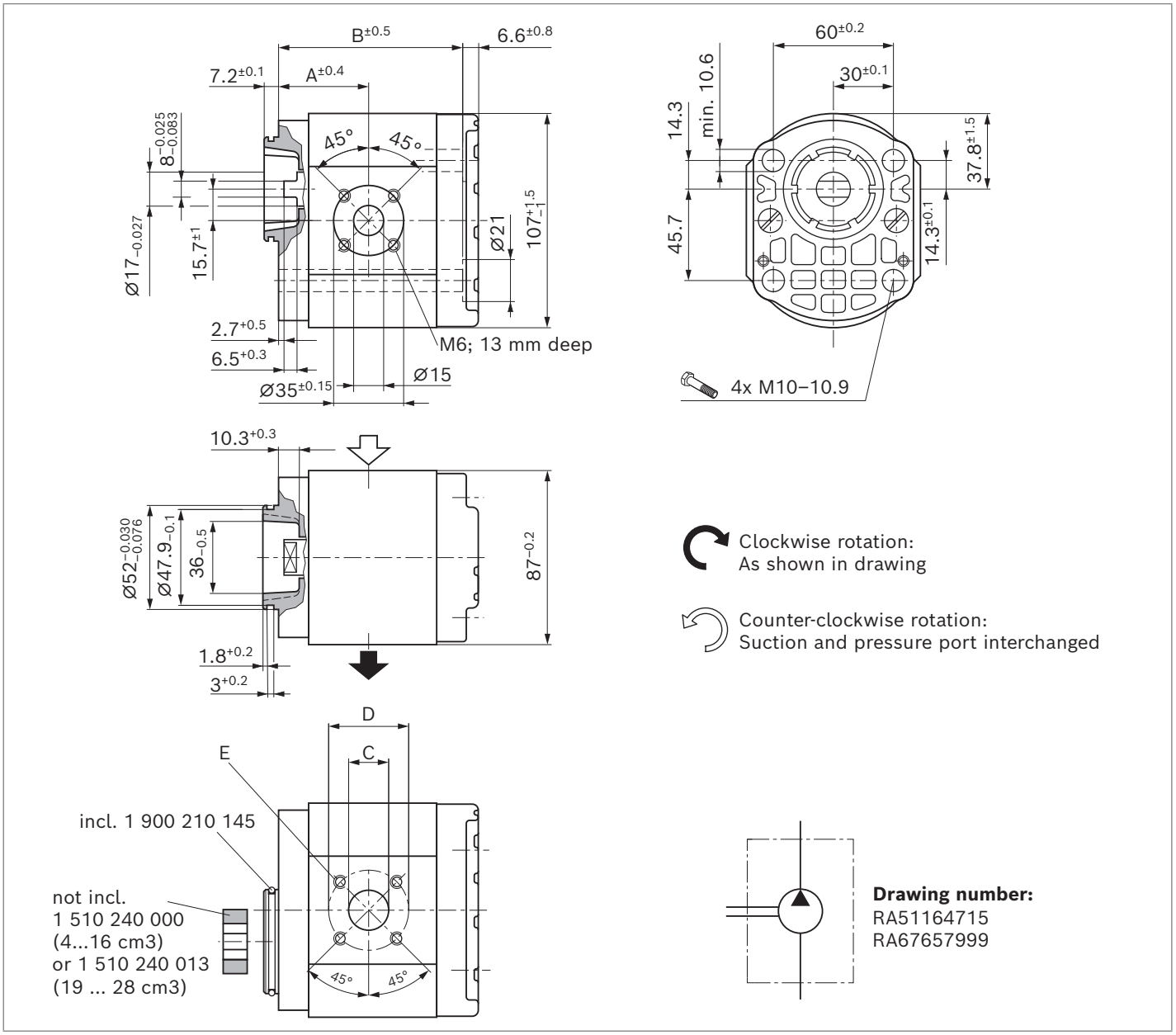
Notice
Depending on the design variant, the size of the threaded connections may differ from the sizes specified in the table. See information in the dimensional drawings.

1) Limited service life with threaded ports
(applicable for applications with p_2 > 210 bar)

Dimensions – Preferred program

Tang drive with 2-bolt mounting spigot diameter 52 mm, with O-ring

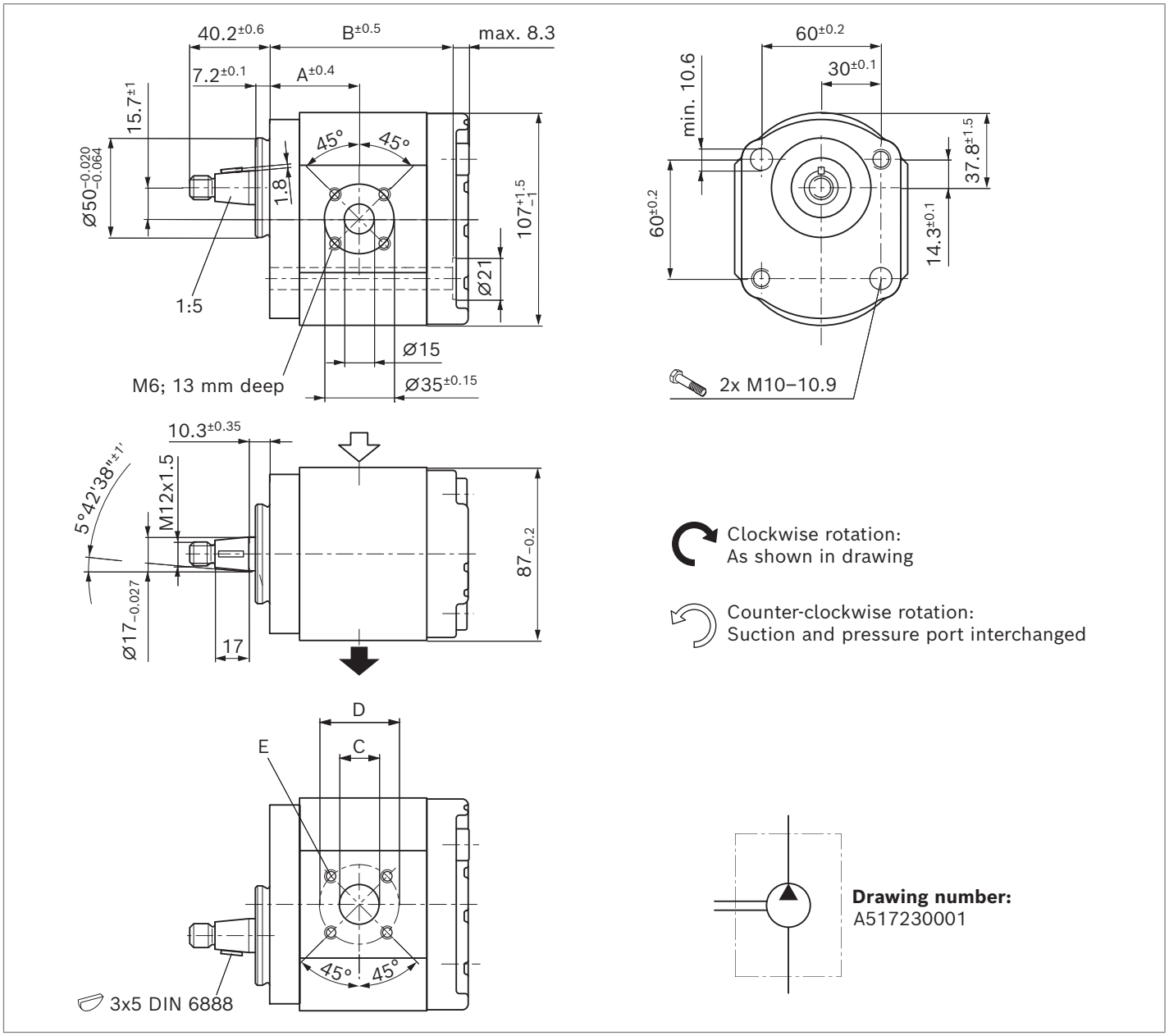
AZPS – XX – … **NM20**MB



NG	Material number		Maximum intermittent pressure p_2	Maximum speed n_{max}	Weight m	Dimensions A	B	C	D	E
	Direction of rotation									
	counter-clockwise	clockwise	bar	rpm	kg	mm	mm	mm	mm	mm
4	0 517 215 301	0 517 215 001	280	4000	2.15	37.4	73.7	15	40	M6; 13 deep
5	0 517 315 301	0 517 315 001	280	4000	2.2	38.6	76.2	15	40	
8	0 517 415 301	0 517 415 001	280	4000	2.3	40.7	80.3	20	40	
11	0 517 515 302	0 517 515 001	280	3500	2.4	44.5	85.3	20	40	
14	0 517 515 303	0 517 515 002	280	3000	2.55	45	90.3	20	40	
16	0 517 615 301	0 517 615 001	230	3000	2.6	45	93.7	20	40	
19	0 517 615 302	0 517 615 002	250	3500	3	55.8	110.7	26	55	M8; 13 deep
22.5	0 517 715 301	0 517 715 001	210	3500	3.2	58.5	116.1	26	55	
25	0 517 715 302	0 517 715 002	190	3000	3.3	60.6	120.3	26	55	
28	0 517 715 303	0 517 715 003	170	3000	3.4	63	125.1	26	55	

Tapered keyed shaft 1 : 5 with 2-bolt mounting spigot diameter 50 mm, option 2

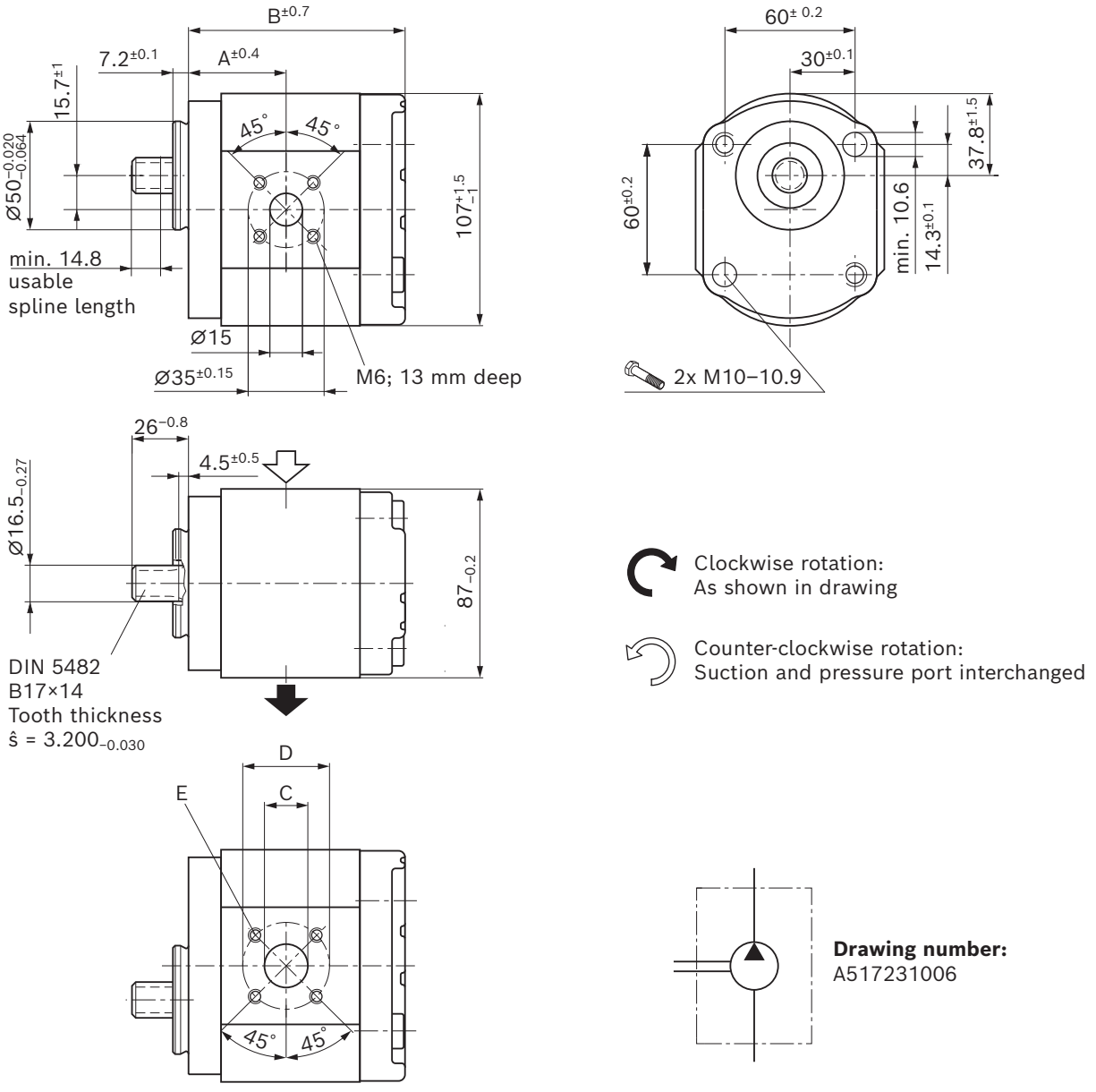
AZPS – XX – … **CP20**KB – S0007



NG	Material number Direction of rotation counter-clockwise	Maximum intermittent pressure p_2 bar	Maximum speed n_{max} rpm	Weight m kg	Dimensions A mm	B mm	C mm	D mm	E mm
4		280	4000						
5		280	4000						
8		280	4000						
11	0 517 515 304	280	3500	3.1	44.5	85.3	20	40	M6; 13 deep
14	0 517 515 306	280	3000	3.3	45	90.3	20	40	
16	0 517 615 303	280	3000	3.4	45	93.7	20	40	
19		280	3500						
22.5		250	3500						
25		225	3000						
28		200	3000						

Splined shaft B17x14 according to DIN 5482 with 2-bolt mounting spigot diameter 50 mm, option 1

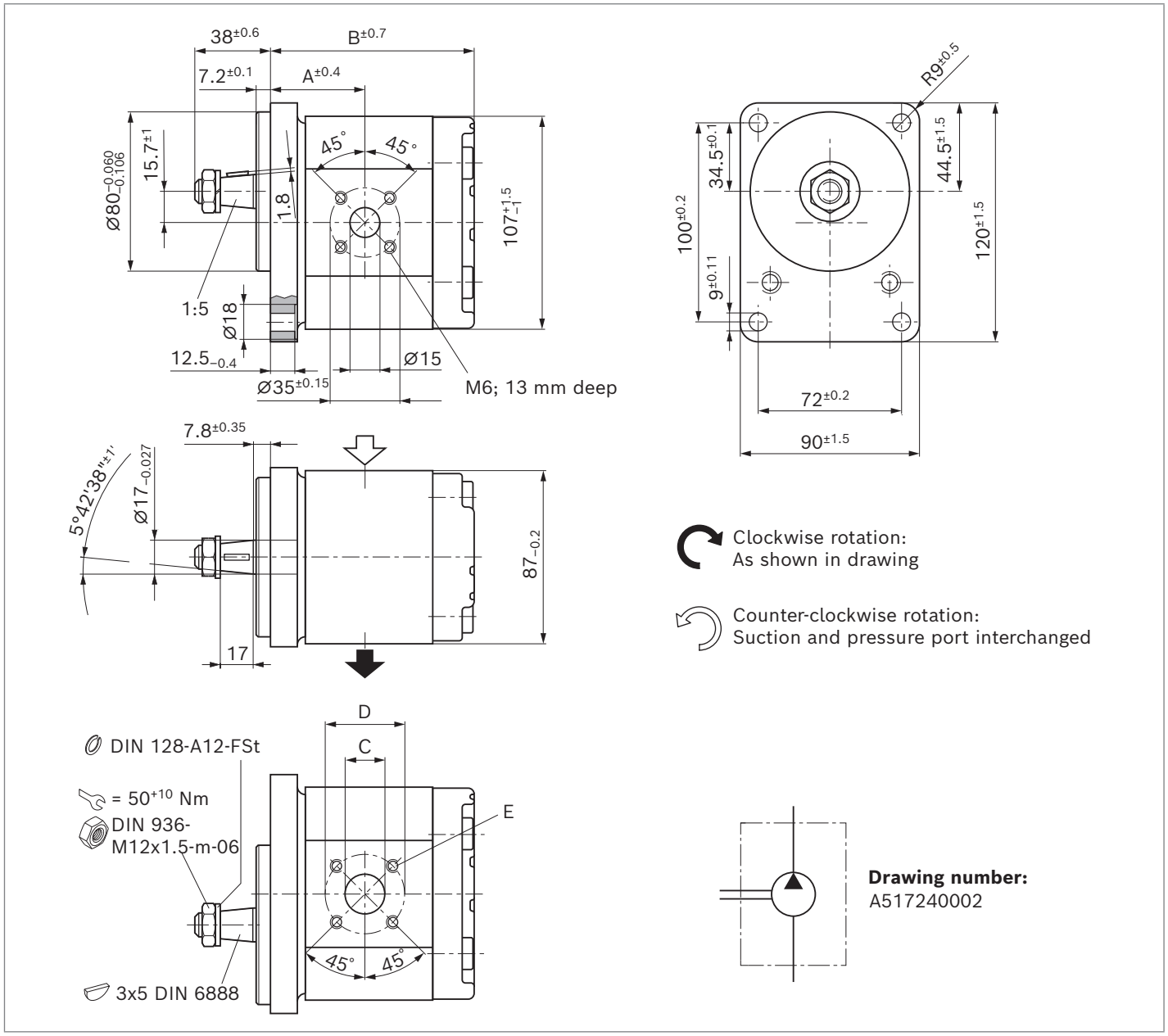
AZPS – XX – … **FN20**KB



NG	Material number Direction of rotation clockwise	Maximum intermittent pressure p_2 bar	Maximum speed n_{max} rpm	Weight m kg	Dimensions A mm	B mm	C mm	D mm	E mm
4		280	4000						
5		280	4000						
8		280	4000						
11		280	3500						M6; 13 deep
14		280	3000						
16	0 517 615 003	280	3000	3.3	45	100.5	20	40	
19		280	3500						
22.5		250	3500						
25		225	3000						
28		200	3000						

Tapered keyed shaft 1 : 5 with rectangular flange spigot diameter 80 mm

AZPS – XX – … **CB20**MB

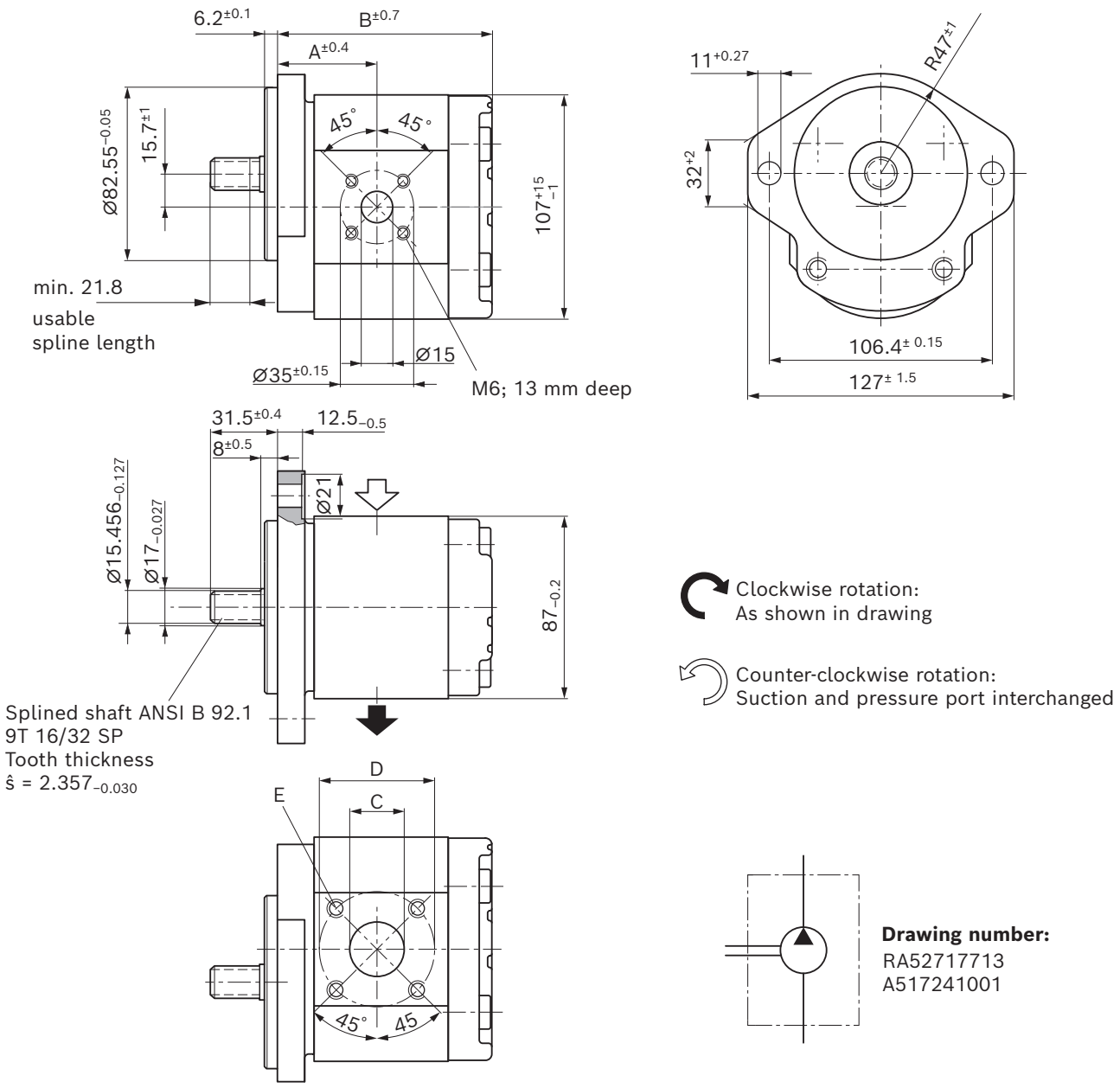


Drawing number:
A517240002

NG	Material number		Maximum intermittent	Maximum speed	Weight	Dimensions				
	Direction of rotation		pressure p_2	n_{max}	m	A	B	C	D	E
	counter-clockwise	clockwise	bar	rpm	kg	mm	mm	mm	mm	mm
4	0 517 225 301	0 517 225 001	280	4000	3.4	39.9	83	15	40	
5	0 517 325 301	0 517 325 001	280	4000	3.5	41.1	85.5	15	40	
8	0 517 425 301	0 517 425 001	280	4000	3.6	43.2	89.6	20	40	M6;
11	0 517 525 301	0 517 525 001	280	3500	3.8	47	94.6	20	40	13 deep
14	0 517 525 302	0 517 525 002	280	3000	3.9	47.5	99.6	20	40	
16	0 517 625 301	0 517 625 001	280	3000	4.4	47.5	103	20	40	
19	0 517 625 302	0 517 625 002	280	3500	4.5	58.3	120	26	55	
22.5	0 517 725 301	0 517 725 001	250	3500	4.6	61	125.4	26	55	M8;
25	0 517 725 302	0 517 725 002	225	3000	4.8	63.1	129.6	26	55	13 deep
28	0 517 725 303	0 517 725 003	200	3000	4.9	65.5	134.4	26	55	

Splined shaft SAE J744 16-4 9T with 2-bolt flange SAE J744 82-2 (A) spigot diameter 82.55 mm

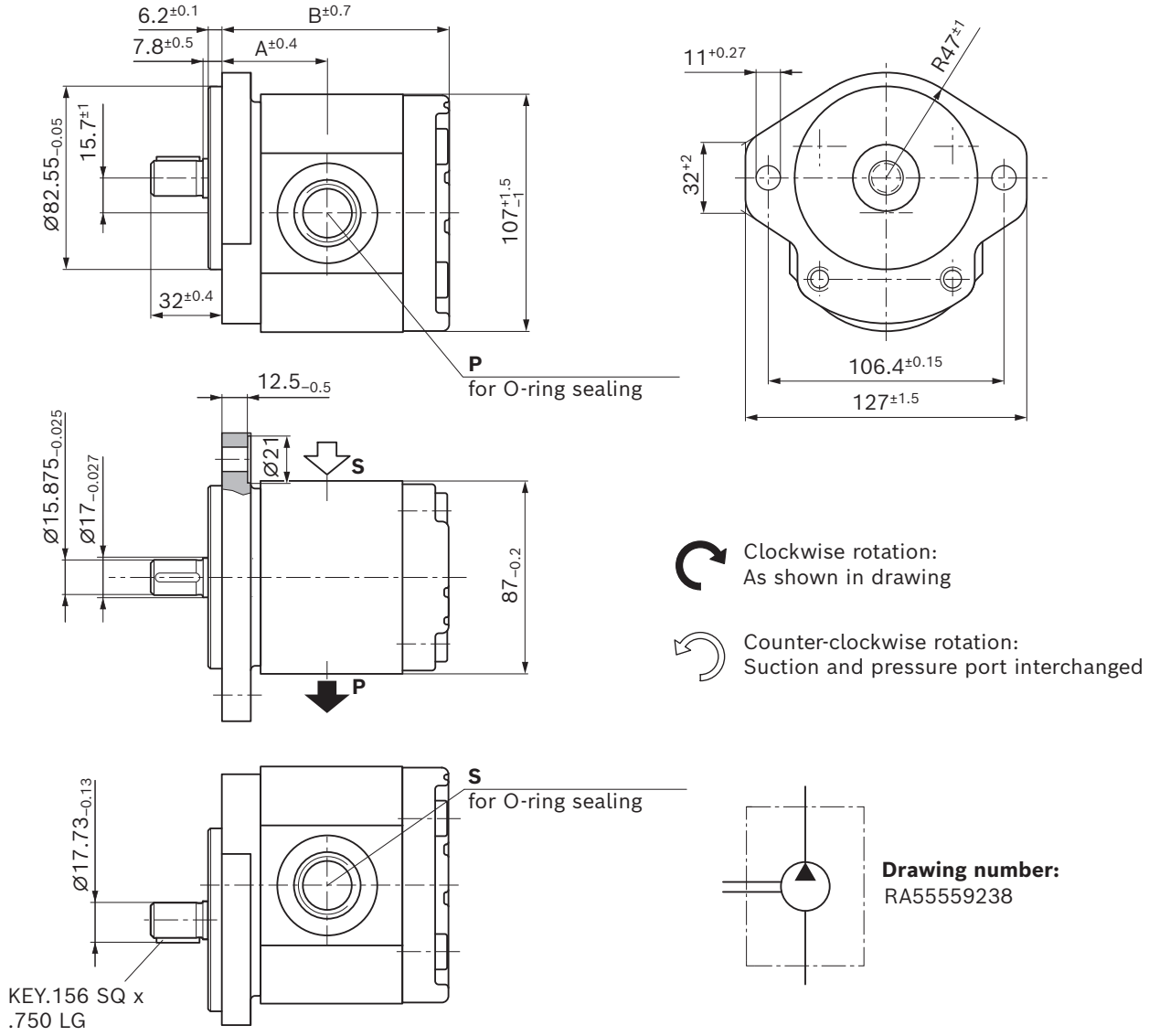
AZPS – XX – ... **RR20**MB



NG	Material number		Maximum intermittent pressure p_2	Maximum speed n_{max}	Weight m	Dimensions A	B	C	D	E
	Direction of rotation									
	counter-clockwise	clockwise	bar	rpm	kg	mm	mm	mm	mm	mm
4	0 517 225 302	0 517 225 002	280	4000	3.4	39.9	83	15	40	M6;
5	0 517 325 302	0 517 325 002	280	4000	3.5	41.1	85.5	15	40	13 deep
8	0 517 425 302	0 517 425 002	280	4000	3.6	43.2	89.6	20	40	
11	0 517 525 303	0 517 525 003	280	3500	3.7	47	94.6	20	40	
14	0 517 525 304	0 517 525 004	280	3000	3.9	47.5	99.6	20	40	
16	0 517 625 303 [1]	0 517 625 003	280	3000	3.9	47.5	103	20	40	
19	0 517 625 304	0 517 625 004	280	3500	4.4	58.3	120	26	55	M8;
22.5	0 517 725 304	0 517 725 004	250	3500	4.6	61	125.4	26	55	13 deep
25	0 517 725 305	0 517 725 005	225	3000	4.7	63.1	129.6	26	55	
28	0 517 725 306	0 517 725 006 [1]	200	3000	4.8	65.5	134.4	26	55	

1) AZPS – 1X – 0 1 6 L RR20PB

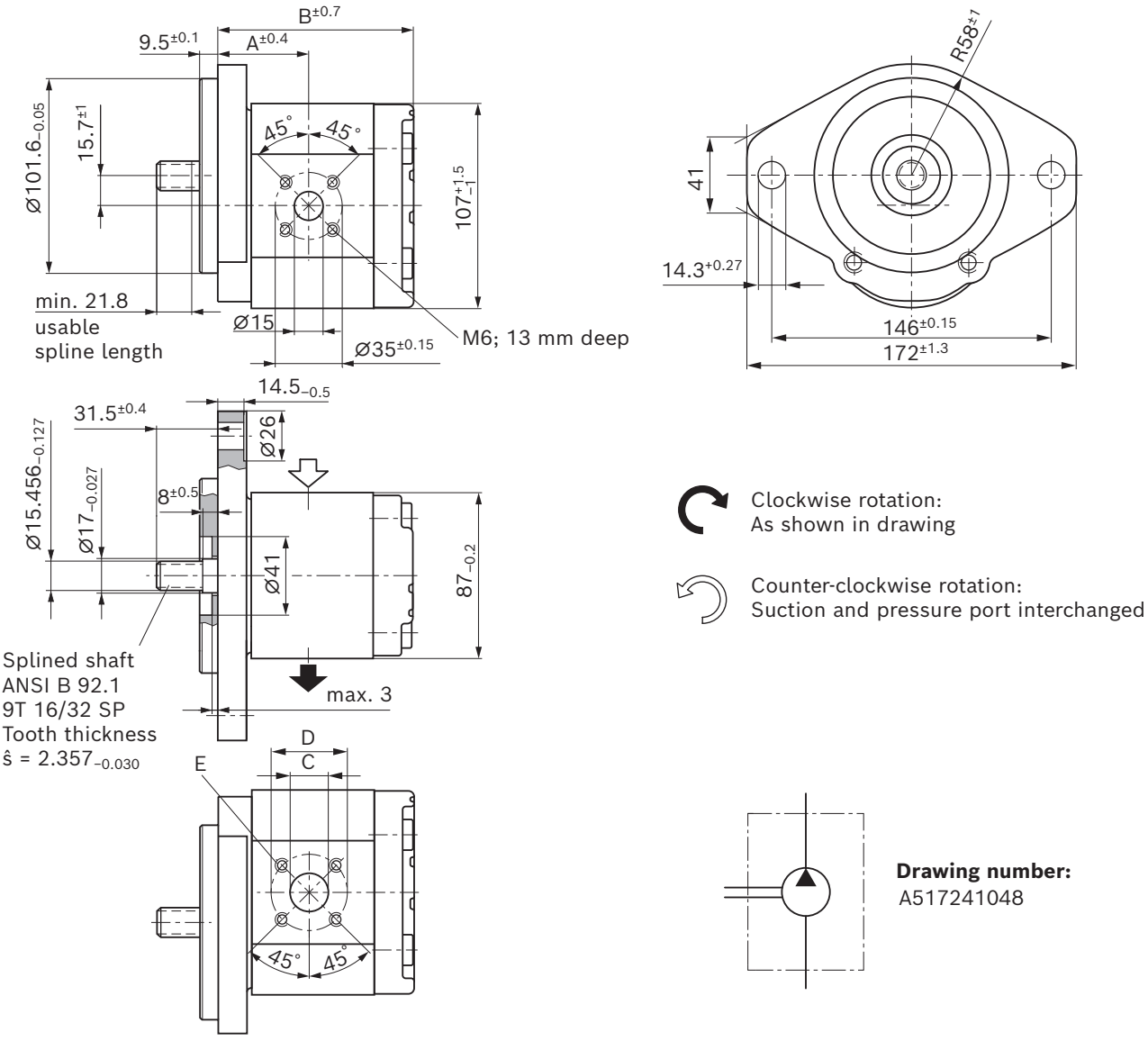
Parallel keyed shaft SAE J744 16-1, length 32 mm with 2-bolt flange SAE J744 82-2 (A) spigot diameter 82.55 mm
AZPS – XX – … **QR12**MB



NG	Material number Direction of rotation clockwise	Maximum intermittent pressure p_2 bar	Maximum speed n_{max} rpm	Weight m kg	Dimensions A mm	 B mm	 C mm	 P mm
4		260	4000					
5		260	4000					
8	0 517 425 003	260	4000	3.6	43.2	89.6	7/8-14 UNF-2B; 16 deep	7/8-14 UNF-2B; 16 deep
11		260	3500					
14		230	3000					
16		200	3000					
19		210	3500					
22.5		180	3500					
25		160	3000					
28		140	3000					

Splined shaft SAE J744 16-4 9T with 2-bolt flange SAE J744 101-2 (B) spigot diameter 101.6 mm

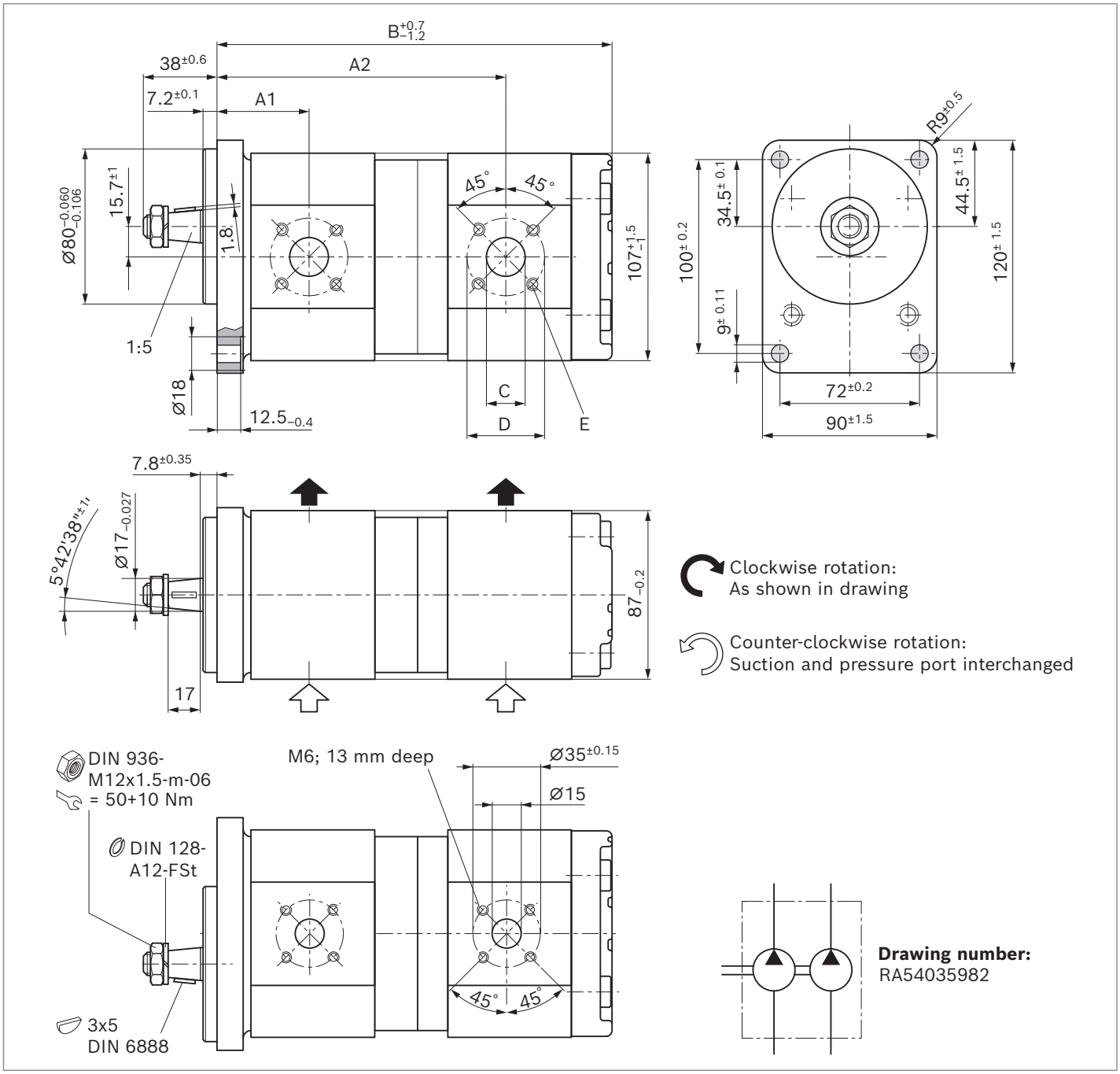
AZPS – XX – … **RC20**KB



NG	Material number Direction of rotation		Maximum intermittent pressure p_2	Maximum speed n_{max}	Weight m	Dimensions A	B	C	D	E
	counter-clockwise	clockwise	bar	rpm	kg	mm	mm	mm	mm	mm
4			280	4000						
5			280	4000						
8			280	4000						M6;
11	0 517 525 306		280	3500	4.3	47	95.2	20	40	13 deep
14			280	3000						
16			280	3000						
19			280	3500						
22.5			250	3500						M8;
25		0 517 725 008	225	3000	5.2	63.1	130.2	26	55	13 deep
28			200	3000						

Tapered keyed shaft 1 : 5 with rectangular flange spigot diameter 80 mm

AZPSS – XX – … **CB2020**MB

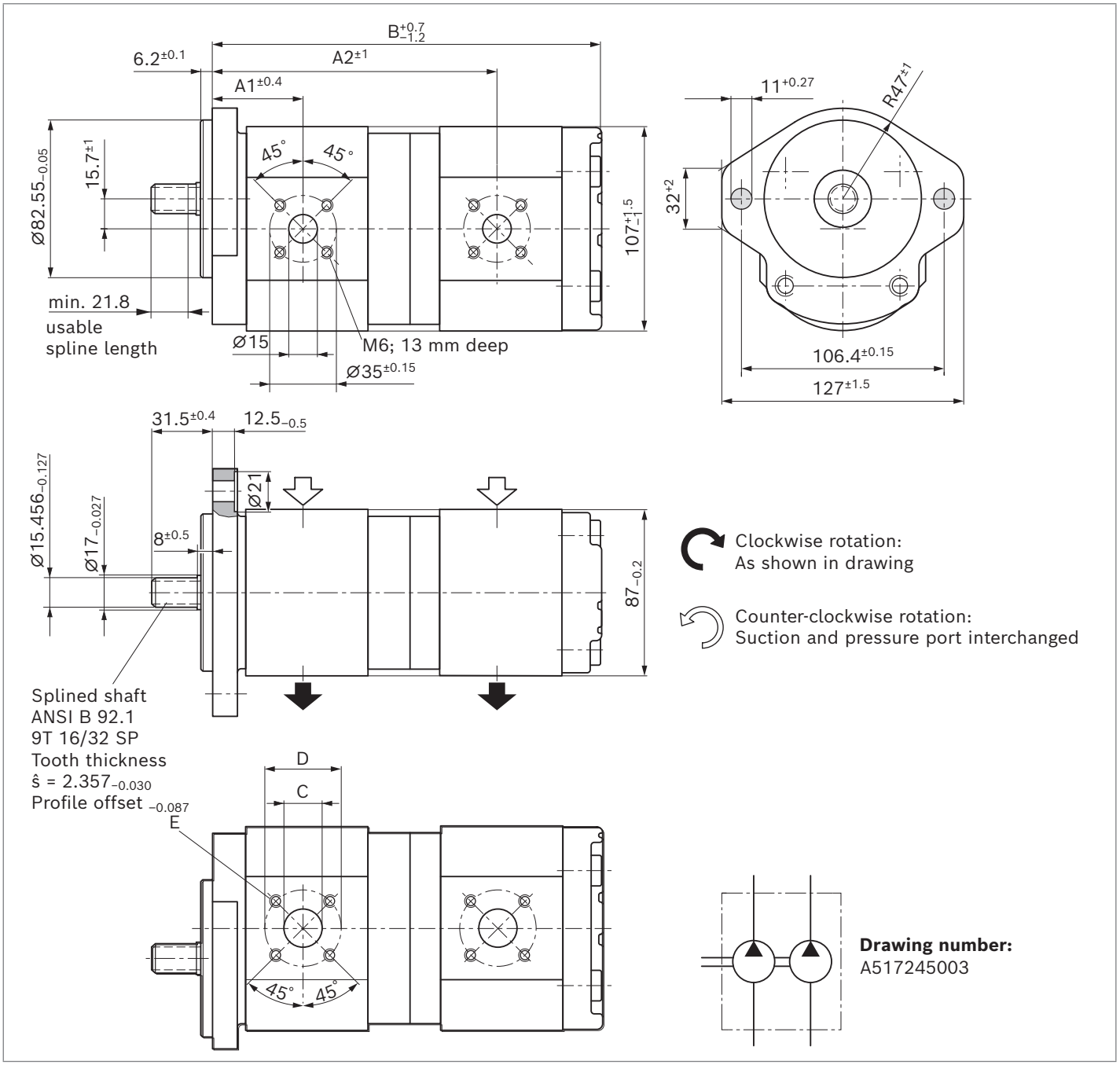


NG		Material number		Maximum intermittent pressure		Maximum speed	Weight	Dimensions					
		Direction of rotation		$p_{2\,I}$	$p_{2\,II}$	n_{max}	m	A_1	A_2	B	C [1]	D	E
P_I	P_{II}	counter-clockwise	clockwise	bar	bar	rpm	kg	mm	mm	mm	mm	mm	mm
5	4		0 517 365 001	280	280	4000	5.3	41.1	124.2	167	20	40	M6; 13 deep
14	11		0 517 565 011	280	260	3000	5.9	47.5	145.3	192.5	20	40	
16	5	0 517 665 304	0 517 665 018	280	280	3000	5.8	47.5	142.8	187	20	40	
16	8		0 517 665 026	280	280	3000	5.9	47.5	144.9	191.2	20	40	
16	11	0 517 665 305		280	280	3000	6.1	47.5	148.7	196.3	20	40	
16	16												

1) At pump section with size 4 and 5: C = 15 mm

Splined shaft SAE J744 16-4 9T with 2-bolt flange SAE J744 82-2 (A) spigot diameter 82.55 mm

AZPSS – XX – … **RR2020**MB



NG		Material number	Maximum intermittent pressure		Maximum speed	Weight	Dimensions					
		Direction of rotation	$p_{2\,I}$	$p_{2\,II}$	n_{max}	m	A_1	A_2	B	C [1]	D	E
P_I	P_{II}	clockwise	bar	bar	rpm	kg	mm	mm	mm	mm	mm	mm
16	5	0 517 665 007	280	280	3000	5.8	47.5	142.8	186.9	20	40	M6; 13 deep

1) At pump section with size 4 and 5: C = 15 mm

Project planning information

Technical data

All mentioned technical data are dependent on manufacturing tolerances and are applicable for certain boundary conditions.
Note that certain deviations are therefore possible and that technical data may vary when certain boundary conditions (e.g., viscosity) change.
Pumps delivered by Bosch Rexroth are tested for function and performance.
The pump may only be operated with the permissible data (see chapter “Technical data”).

Characteristic curves

When dimensioning the gear pump, observe the maximum possible application data on the basis of the characteristic curves shown.

Application information

External gear units are not approved in on-highway vehicles for safety-relevant functions, as well as functions in the drive train, for steering, braking and level regulation. Classified as on-highway vehicles are e.g. vehicles such as motorbikes, private cars, trucks, vans, freight cars, buses and trailers. The European vehicle classes L (motorbikes), M (private cars), N (vehicles for transporting goods such as trucks and vans) and O (trailers and semi-trailers) serve as reference.

Notice
When used as an auxiliary steering pump, the vehicle manufacturer should make sure that the steering system continues to operate safely, even if the auxiliary steering pump fails (regulation similar to ECE R-79 can be referred).

Filtration of the hydraulic fluid

Since the majority of premature failures in gear pumps occur due to contaminated hydraulic fluid, filtration should maintain a cleanliness level of 20/18/15 as defined by ISO 4406. Thus contamination can be reduced to an acceptable degree in terms of particle size and concentration.
Bosch Rexroth generally recommends full-flow filtration.
The basic contamination of the hydraulic fluid filled in should not exceed level 20/18/15 as defined by ISO 4406. New fluids are often above this value. In such instances, a filling device with a special filter should be used.
Bosch Rexroth is not liable for wear due to contamination.
For hydraulic systems or devices with function-related critical failure effects, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices.

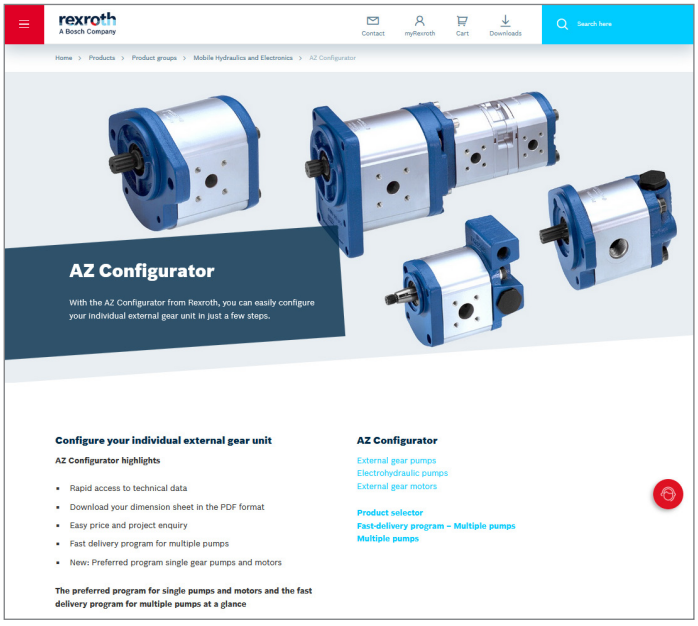
Further information

Installation drawings and dimensions are valid at date of publication, subject to modifications.
Further information and notes on project planning can be found in the “General instruction manual for external gear units”: www.boschrexroth.com/07012-B, chapter 5.5.

Information

AZ configurator

With our practical product selector, it will take you next to no time to find the right solution for your applications, no matter whether it is SILENCE PLUS or another external gear unit.
The selector guides you through a selection of features to all of the products available for order. By clicking on the order number, you can view and download the following product information: Data sheet, dimension sheet, operating conditions, and tightening torques.
You can order your selection directly via our online shop and at the same time benefit from an additional discount of 2%. And if you need something really quickly, simply use our fast delivery and preferred programs (GoTo). Then the goods will be sent within 10 working days.
You also have the possibility to easily and conveniently configure your individual external gear unit with our AZ configurator. All the necessary data that you need for the project planning of external gear units is requested by means of the menu navigation.
For an already existing configuration you receive as a result the order number, the type code, as well as further information. If your configuration does not lead to a product that is available for order, our online tools provide you with the possibility of sending a project request directly to Bosch Rexroth. We will then get in contact with you.
Link: www.boschrexroth.com/az-configurator

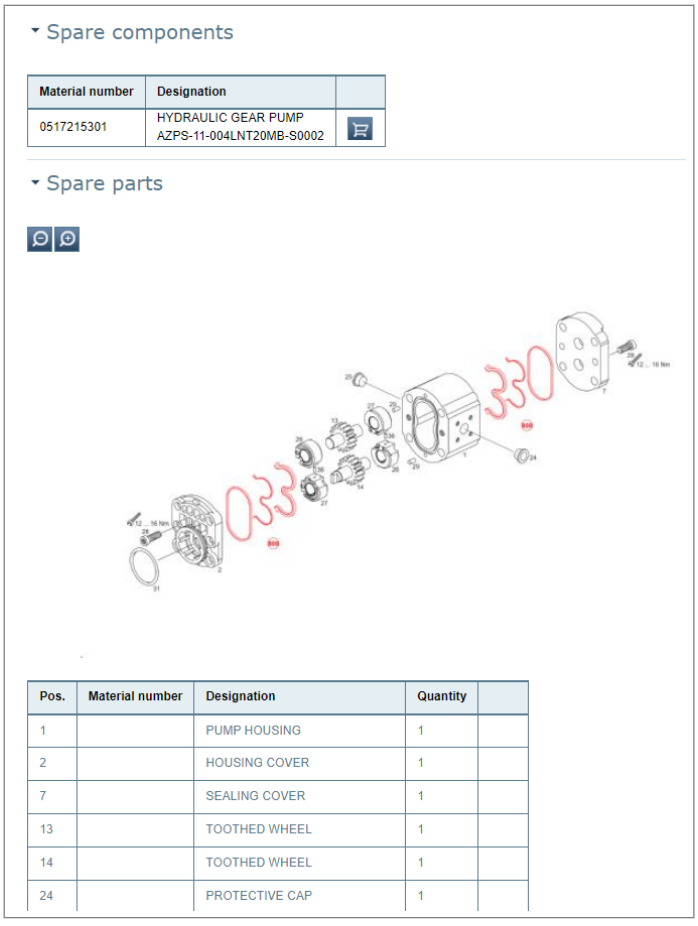


Spare parts

Spare parts can be found online at
www.boschrexroth.com/spc
Select “Spare parts and accessories” and enter the material number of the external gear units into the search field.

Example:
Material number: **0 517 215 301**
Type designation: AZPS-11-004LNT20MB-S0002

All available spare parts are listed under “Spare parts” and can be ordered via the shopping basket.



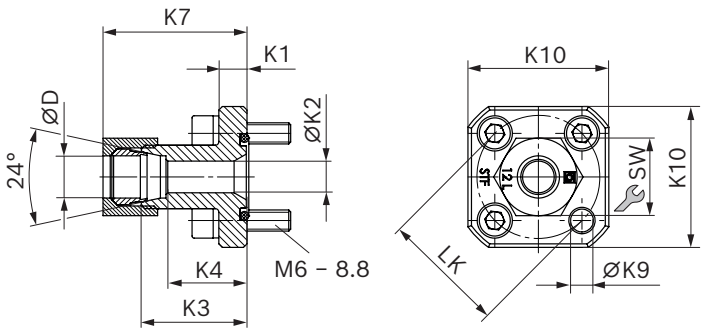
Further information

Extensive notes and suggestions can be found in the Hydraulic Trainer, volume 3: “Planning and Design of Hydraulic Power Systems”, order number R900018547.

Accessories

Straight flange, for square flange 20 (German version)

Complete screw connections with O-ring, metric screw set, nuts and olive.

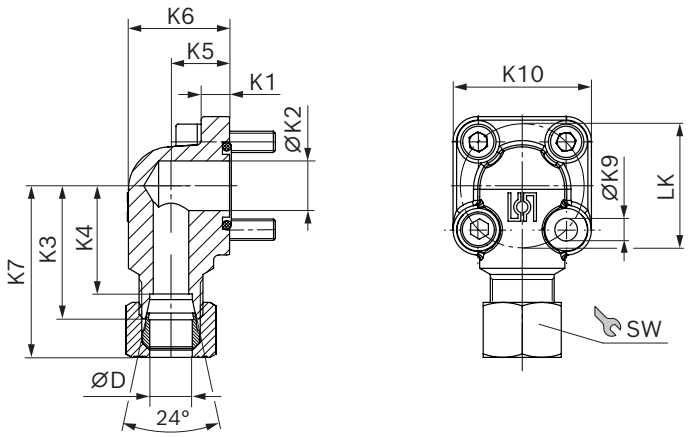


LK	D	Series [1]	Material number	p_{max}	K1	K2	K3	K4	K7	K9	K10	SW	Screws	O-ring	Weight
mm	mm			bar	mm	mm	mm	mm	mm	mm	mm	mm	4 ×	NBR	kg
35	10	L	1 515 702 064	315	8	7	30	23	38	6.5	40	19	M6 × 22	20 × 2.5	0.13
35	12	L	1 515 702 065	315	8	9	30	23	38.5	6.5	40	22	M6 × 22	20 × 2.5	0.14
35	15	L	1 515 702 066	250	8	11	30	23	39	6.5	40	27	M6 × 22	20 × 2.5	0.15
40	15	L	1 515 702 067	100	8	11	35	28	44	6.5	40	27	M6 × 22	26 × 2.5	0.16
40	18	L	1 515 702 068	100	8	14	35	27.5	44	6.5	40	32	M6 × 22	26 × 2.5	0.17
40	22	L	1 515 702 069	100	8	18	35	27.5	45	6.5	40	36	M6 × 22	26 × 2.5	0.16
40	28	L	1 515 702 008	100	8	19	35	27.5	45	6.5	40	41	M6 × 22	26 × 2.5	0.18

1) See DIN EN ISO 8434-1

90° angle flange, for square flange 20(German version)

Complete screw connections with O-ring, metric screw set, nuts and olive.

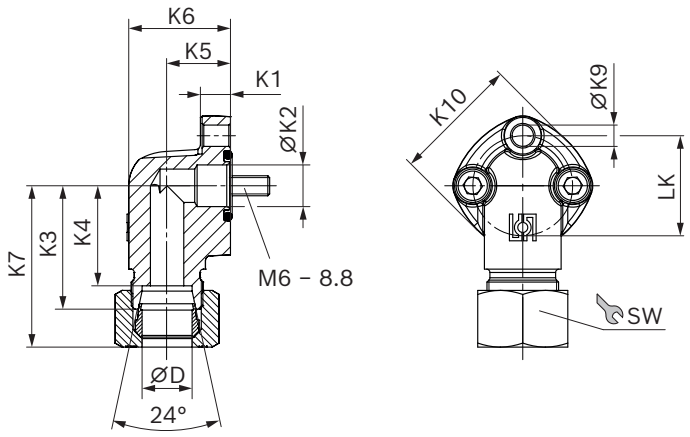


LK	D	Series[1]	Material number	p_{max}	K1	K2	K3	K4	K5	K6	K7	K9	K10	SW	Screws		O-ring	Weight
mm	mm			bar	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	2 ×	2 ×	NBR	kg
35	10	L	1 515 702 070	315	8	14	37.5	30.5	16.5	28.5	45	6.4	39	19	M6 × 22	M6 × 35	20 × 2.5	0.18
35	12	L	1 515 702 071	315	8	14	37.5	30.5	16.5	28.5	46	6.4	39	22	M6 × 22	M6 × 35	20 × 2.5	0.19
35	15	L	1 515 702 072	250	8	14	37.5	30.5	16.5	28.5	46	6.4	39	27	M6 × 22	M6 × 35	20 × 2.5	0.2
35	16	S	1 515 702 002	315	8	15	38	29.5	20	33	49	6.4	39	30	M6 × 22	M6 × 40	20 × 2.5	0.25
35	18	L	1 545 702 006	250	8	15	37.5	30	20	33	47	6.4	39	32	M6 × 22	M6 × 40	20 × 2.5	0.22
35	20	S	1 515 702 017	315	8	15	45	34.5	25	38	57	6.4	39	36	M6 × 22	M6 × 45	20 × 2.5	0.3
40	15	L	1 515 702 073	100	9	20	38	31	22.5	38	47	6.4	42	27	M6 × 22	M6 × 22	26 × 2.5	0.26
40	18	L	1 515 702 074	100	9	20	38	30.5	22.5	38	47.5	6.4	42	32	M6 × 22	M6 × 22	26 × 2.5	0.27
40	20	S	1 515 702 011	250	9	20	40	29.5	22.5	37	52	6.4	42	36	M6 × 22	M6 × 45	26 × 2.5	0.26
40	22	L	1 515 702 075	100	9	20	38	30.5	22.5	38	48	6.4	42	36	M6 × 22	M6 × 22	26 × 2.5	0.27
40	28	L	1 515 702 010	100	9	20	40	32.5	28	44	50.5	6.4	42	41	M6 × 22	M6 × 50	26 × 2.5	0.37
40	35	L	1 515 702 018	100	9	20	41	30.5	34	53	53	6.4	42	50	M6 × 22	M6 × 60	26 × 2.5	0.41
55	20	S	1 515 702 004	250	13	18.2	45	34.5	24	38	57	8.4	58	36	M8 × 25	M8 × 50	32 × 2.5	0.62
55	30	S	1 545 719 006	250	12	26.5	49	38.5	32	51	63.5	8.4	58	50	M8 × 25	M8 × 50	32 × 2.5	0.63
55	35	L	1 515 702 005	100	12	26.5	49	38.5	32	52	61	8.4	58	50	M8 × 25	M8 × 60	32 × 2.5	0.77
55	42	L	1 515 702 019	100	12	26.5	49	38	40	64	61.5	8.4	58	60	M8 × 25	M8 × 70	32 × 2.5	1.04

1) See DIN EN ISO 8434-1

90° angle flange, 3-hole, for square flange 30 (Italian version)

Complete screw connections with O-ring, metric screw set, nuts and olive.



LK	D	Series [1]	Material number	p_{max}	K1	K2	K3	K4	K5	K6	K7	K9	K10	SW	Screws	O-ring	Weight
mm	mm			bar	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	3 ×	NBR	kg
30	12	L	1 515 702 146	250	9	12.5	37	30	19	30.5	46	6.4	38	22	M6 × 25	16 × 2.5	0.18
30	15	L	1 515 702 147	250	9	12.5	37	30	19	30.5	45.5	6.4	38	27	M6 × 25	16 × 2.5	0.2
40	22	L	1 515 702 149	160	13.5	19	43	35.5	25	41	53	8.4	48	36	M8 × 30	24 × 2.5	0.4
40	28	L	1 515 702 150	160	13.5	19	43	35.5	25	41	53.5	8.4	48	41	M8 × 30	24 × 2.5	0.36

Notice
Permissible tightening torques can be found in the “General instruction manual for external gear units”:
www.boschrexroth.com/07012-B

1) See DIN EN ISO 8434-1

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