Pioneering for You

Glanded pumps, single-stage, single-volute

en Consulting guides

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1 General remarks

1.1 Notes on range of application

This consulting guide applies to:

- → electronically controlled glanded pumps of the following series
  - Stratos GIGA2.0-I/-D
  - Stratos GIGA, Stratos GIGA-D, Stratos GIGA B
  - IP-E, DP-E
  - IL-E, DL-E, BL-E
  - Yonos GIGA2.0-I/-D
  - Yonos GIGA-N
- → uncontrolled glanded pumps of the following series
  - IPL, DPL
  - IL, DL, BL
  - Atmos GIGA-I/-D/-B
  - Atmos GIGA-N
  - IPH-O/-W, IP-Z

1.2 Pump selection

Glanded pumps are ideally suited for use in conjunction with large systems covering a wide range of hot water and air-conditioning/cooling applications.

The technically correct selection of a pump involves a number of factors:

- → The correct pump size to achieve the required duty point
  The correct pump series to fulfil the process parameters (e.g., pressure and temperature)
- → The right materials to fulfil endurance requirements

The overview duty charts in the catalogue section “Series overview” permit a rough preliminary selection of the series to be made, which means the suitable size can be found more quickly within the series in question. Frequently, pumps of various series are found to be hydraulically suitable in the border area of the duty charts. Precise selection of the required pump size is possible only with the aid of the individual pump curve. These are provided in this catalogue and in the Wilo selection software (available for download on Windows and online at www.wilo-select.com).

The “Technical data” section of the catalogue provides information on the application limits with respect to pressure, temperature and possible material. In addition, this section of the catalogue provides information on the pump equipment.

1.3 Pump curve

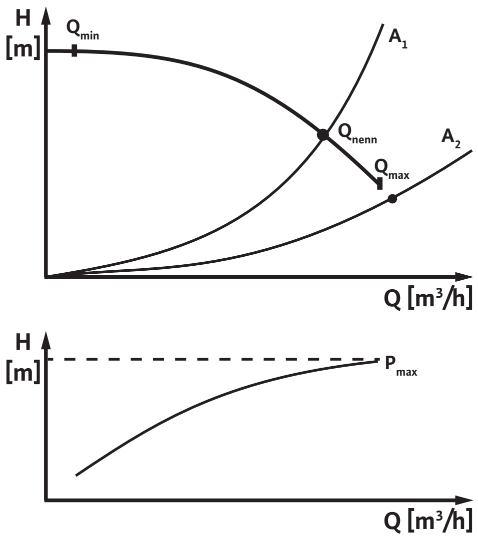

Fig. 1: Pump curve, schematic

Pump dimensioning is optimal when the duty point is in the range of the best efficiency. At the duty point, there is a balance between the performance capacity of the pump (Fig. 1, curve P) and the power consumption required to overcome the resistance of the pipe network (Fig. 1, curve A1). **Note:** The tolerances according to ISO 9906:2012-3B apply to all characteristic curves shown.

The point of highest efficiency is approximately in the upper third of the pump curve, or is indicated on the performance diagram. The consultant must find a design duty point to match the maximum requirements of the pump.

In the case of a heating pump, this is the capacity to meet the calculated standard heating load of the building.

All other duty points that occur in practice lie on the pump curve to the left of the duty point $Q_{nominal}$. The pump thus operates within its highest efficiency range. If the actual resistance of the pipe system is lower than that on which the pump selection has been based, then the duty point may lie outside the characteristic curve (Fig. 1, curve A2). This may lead to unacceptably high power consumption and hence overload the selected motor. In this case it is necessary to redetermine the duty point and, if necessary, use a more suitable pump.

The minimum volume flow Q_{min} of an uncontrolled glanded pump is 10 % of Q_{max} (Fig. 1). The minimum volume flow Q_{min} of an electronically controlled glanded pump can be calculated using the following formula: Q_{min} = 10 % x $Q_{max\ pump}$ x actual speed/max. speed

1.4 Cavitation

When selecting a pump, the prevention of cavitation must be taken into account. This is particularly the case in open systems (e. g. cooling tower systems) and at very high temperatures and low system pressures.

The pressure drop in a flowing fluid, e.g. due to frictional resistance in the pipe, a change in the absolute velocity and the geodesic head, leads to the local formation of vapour bubbles when the static pressure drops to the vapour pressure of the fluid.

The vapour bubbles are carried along by the flow and collapse suddenly when the static pressure rises above the vapour pressure again. This process is called cavitation. The collapse of the vapour bubbles causes micro-jets which, on hitting the surface of a wall, lead to damaging holes developing in the wall material.

To avoid cavitation, special attention must therefore be given to maintaining the correct pressure. If the available inlet pressure (or static pressure) in the pipe system is not high enough to meet the static head required for the pump (net positive suction head or NPSH), appropriate measures must be taken to increase the static head to at least achieve a balance.

The following measures can be taken:
- Increase the static pressure (pump positioning)
- Reduce the fluid temperature (reduced vapour pressure pD)
- Select a pump with a lower net positive suction head (NPSH) (usually a larger pump)

1.5 Net positive suction head NPSH

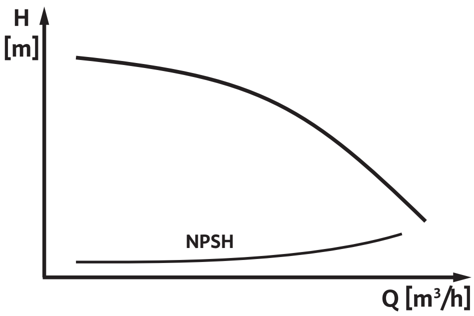

Fig. 2: NPSH pump curve diagram

The net positive suction head (NPSH) is pump specific and is displayed in the diagram of the pump curve. The NPSH values are based on the respective maximum impeller diameters. In order to allow for any uncertainty in the specification of the duty point, a safety margin of 0.5 m should be added to the values when selecting the pump.

1.6 Selecting the series

In addition to the hydraulic properties, the pump sought must be suitable for the operating conditions at the place of utilisation.

To assess suitability, determine the maximum values at installation location and compare them with the maximum permissible values of the pumps available for selection:
- Fluid temperature
- System pressure
- Ambient temperature
- Fluid resistance
- etc.

The characteristics and application limits of Wilo glanded pumps are described in more detail below.

2 Wilo glanded pumps

2.1 Design

In-line pumps

Single-stage, low-pressure centrifugal pumps incorporating the in-line design with suction pieces and discharge ports of the same nominal diameter flange with pressure measuring connections R 1/8. The drive is provided by air-cooled IEC standard motors.

The pump housing includes feet as standard.

Monobloc pumps

Single-stage low-pressure centrifugal pump with axial suction port and radially arranged pressure port. Flange with R 1/8 pressure measuring connections. The drive is provided by air-cooled IEC standard motors.

They are equipped with a lantern and mechanical seal and coupling. The pump housing includes feet as standard. The main dimensions are according to DIN EN 733.

Norm pumps

Single-stage low-pressure centrifugal pumps as baseplate pumps with axial suction ports with flanged bearing brackets and axle fastening for flexibly coupled drives (for example: IEC standard motors without motor flange or diesel motors). The main dimensions are according to DIN EN 733.

2.2 Fluids

The selection of materials for all parts that come in contact with the fluid is of importance for the chemical resistance of the pump.

The “List of most common fluids” table gives an overview of the most important fluids and the respective recommended mechanical seals and O-ring materials.

Details regarding other fluids are available on request.

In addition to the resistance of glanded pumps, particular significance is attached to the functional capability of the mechanical seal.

NOTICE

Observe the pressure and temperature limits of the series!

Fluids*	Category*	Additional note**	Temperature**	Abrasive solid content**	Mineral oil content**	Other contents**	Series (AQ1EG G)***	S1 (Q1Q1X4GG)***	S2 (AQ1VGG)***	S5 (Q1Q1EGG)***	S6 (Q1Q1VGG)***	EPDM (O-ring)****	FKM (O-ring)****
Water-glycol mixture min. 20 % ... max 50 %	Water/ glycol	[2], [5]	-20 °C ... 110 °C	X	X	With oil content		X					X
Water-glycol mixture min. 20 % ... max 50 %	Water/ glycol	[2], [5]	-20 °C ... 90 °C	X	X	With oil content (aggressive towards HNBR)					X		X
Water-glycol mixture min. 20 % ... max 50 %	Water/ glycol	[2], [4], [5]	(-30 °C) -20 °C ... 120 °C	X						X		X	
Water-glycol mixture min. 20 % ... max 40 %	Water/ glycol	[2], [5]	-20 °C ... 40 °C				X					X	
Water-glycol mixture min. 20 % ... max 40 %	Water/ glycol	[2], [5]	-20 °C ... 40 °C	X						X		X	
Heating water VdTÜV TCh 1466	Water		< 140°C			Conductivity < 100 µS, silicates < 10 mg/l, solid content (non-abrasive) < 10 mg/l (low-salt operating mode)	X					X	

Fluids*	Category*	Additional note**	Temperature**	Abrasive solid content**	Mineral oil content**	Other contents**	Series (AQ1EG G)***	S1 (Q1Q1X4GG)***	S2 (AQ1VGG)***	S5 (Q1Q1EGG)***	S6 (Q1Q1VGG)***	EPDM (O-ring)****	FKM (O-ring)****
Heating water VDI 2035	Water		< 100 °C			Conductivity < 300 µS, silicates < 10 mg/l, solid content (non-abrasive) < 10 mg/l	X					X	
Heating water	Water		< 120 °C	X		Conductivity < 850 µS, solid content < 50 mg/l				X		X	
Firefighting water (not drinking water)	Water		< 30 °C	X		Chloride < 250 mg/l, pH value > 7		X					X
Swimming pool water (not drinking water)	Water	[3]	< 35 °C	X		Chloride < 250 mg/l, pH value > 7		X					X
Reservoir water	Water		< 30 °C	X		Chloride < 250 mg/l, pH value > 7				X		X	
Partially desalinated water	Water		< 140 °C			Conductivity > 80 µS, silicates < 10 mg/l, pH value > 9	X					X	
Condensate (water) without abrasive substances	Water		< 100 °C				X					X	
Condensate (water) with abrasive constituents	Water		< 100 °C	X		Grain size maximum 10 µm				X		X	
Cooling media/ cooling brines	Cooling media	[2], [4], [6], [7], [8]	(-30 °C) -20 °C … 20 °C	X		Cooling media/cooling brines according to media data sheet compatible with EPDM				X		X	
Cooling media/ cooling brines	Cooling media	[2], [6], [7], [8]	-20 °C … 20 °C	X	X	Cooling media/cooling brines according to media data sheet compatible with FKM, HNBR		X					X
Cooling media/ cooling brines	Cooling media	[2], [6], [7], [8]	-20 °C … 20 °C	X	X	Cooling media/cooling brines according to media data sheet compatible with FKM					X		X
Suds	Washing solution		< 90 °C	X		Without fibrous materials				X		X	
Degreasing/ cleaning solution	Washing solution		< 60 °C	X	X	pH value 7.5 … 12		X					X
Water-oil emulsion	Water/oil	[2]	< 60 °C	X	X			X					X
Water-oil emulsion	Water/oil	[2]	< 60 °C		X				X			X	
Water with oil content	Water/oil	[1], [2]	0 °C … 90 °C		X				X				X
Diesel oil, heating oil	Oil	[1], [2]	< 60 °C		X				X				X

Fluids*	Category*	Additional note**	Temperature**	Abrasive solid content**	Mineral oil content**	Other contents**	Series (AQ1EG G)***	S1 (Q1Q1X4GG)***	S2 (AQ1VGG)***	S5 (Q1Q1EGG)***	S6 (Q1Q1VGG)***	EPDM (O-ring)****	FKM (O-ring)****
Mineral oil, thermal transfer oil	Oil	[1], [2]	< 140 °C		X				X				X
Oil with abrasive constituents	Oil	[1], [2]	< 110 °C	X	X						X		X

* Fluid

** Constraints

*** Mechanical seals

**** O-rings

Table 1: List of the most common fluids, others available on request

Legend for additional note

- [1] Test ATEX application
- [2] Check the rated power
- [3] Pump upstream of filter
- [4] Temperature range down to -30 °C on request (only in combination with ductile cast iron pump housing and lantern); if grey cast iron housing is used, only in combination with reduction of pressure
- [5] Operation at the limits of the constraints (glycol content, fluid temperature) reduces the service life
- [6] Check the resistance of the elastomer (FKM, EPDM, HNBR) to the fluid
- [7] Strictly observe the fluid manufacturer's instructions (dosage, material compatibility, etc.)
- [8] Higher fluid temperatures on request

2.3 Mechanical seal

2.3.1 General description

The mechanical seals used as standard in Wilo glanded pumps largely comply with DIN EN 12756. Mechanical seals are dynamic seals that are used to seal rotating shafts at medium to high pressures.

The dynamic sealing area of the mechanical seal consists of two surface-ground, low-wearing faces (for example, silicon carbide or carbon rings), which are pressed together by axial forces. The rotating ring rotates with the shaft, while the stationary ring is stationary in the housing. A spring and the fluid pressure press the rotating ring and stationary ring together.

In operation, there is usually hardly any visible leakage and no maintenance work is necessary (see “Leakage rate” chapter). However, a visual inspection is required at regular intervals. Under average operating conditions, the service life of a mechanical seal is between two and four years.

Extreme conditions can drastically reduce the service life.

Examples of extreme operating conditions:

- Continuous operation at temperature limits
- Dirt
- Admixtures
- Higher system pressure
- etc.

Service life when exposed to water at different temperatures

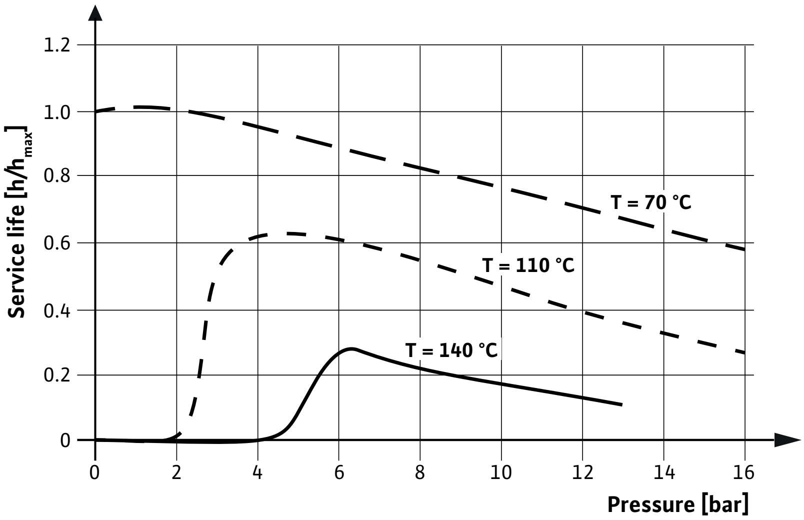

Fig. 3: Example: Reduction of service life at different media temperatures

2.3.2 Notes on operation

CAUTION

Risk of damage to the product!

Mechanical seals are wearing parts. Dry run is not permissible as it will lead to the destruction of the sealing surfaces.

The mechanical seal used as standard by Wilo for heating water in accordance with VDI 2035 has the material pairing AQ1EGG. Special fluid or operating conditions require special seals with other material combinations.

Examples of special fluid and operating conditions:

- → Solids
- → Oils
- → Substances in the fluid that attack EPDM
- → Oxygen in the system
- → etc.

In addition, due to corrosion inhibitors, for example, precipitation can occur which damages the mechanical seal.

The fluid list provides an overview of media, application limits and material pairings.

If additives are used (for example glycol) or in case of contamination by oil:

- → **Check the suitability of the mechanical seal**
- → **Check performance correction if necessary (for glycol additives from 20 % share of volume)**

2.3.3 Determining the power requirement of a pump

Formula for determining the power requirement P_2 of a pump:

$$P_2 = \frac{\rho \times Q \times H}{367 \times \eta}$$

Fig. 4: Determining the power requirement P2 of a pump

P_2	Power requirement [kW]
ρ (rho)	Density [kg/dm^3]
Q	Volume flow [m^3/h]
H	Delivery head [m]
η (eta)	Pump efficiency [%]

2.3.4 Mechanical seals – material identification code

A 5-part code describes the materials of a mechanical seal.

Component	Material code: material
1 Rotating ring	**A** Carbon-graphite (antimony impregnated) **B** Carbon-graphite (synthetic resin-impregnated), approved for use with foods **Q1** Silicon carbide
2 Stationary ring	**Q1** Silicon carbide
3 Secondary seals	**E** EPDM **V** FKM **WA** Water applicated, approved for drinking water **X4** HNBR
4 Spring	**G** Stainless steel
5 Other components	**G** Stainless steel

Table 2: Material identification code with typical materials

2.3.5 Leakage rate

To avoid their destruction, the sliding surfaces of a mechanical seal must not touch each other directly during operation. In order to limit the wear of the sliding surfaces during operation, a stable lubricating film is required.

That is why the design of mechanical seals allows a sealing gap to form between the sliding surfaces during operation. The fluid fills the sealing gap and forms the required lubricating film between the sliding surfaces. A mechanical seal must therefore never run dry!

Due to the functional principle of a mechanical seal and the sealing gap that forms, leaks will always occur during regular operation. The frequently expressed desire for “100 % impermeability” is thus physically impossible. It also contradicts the interest in a sufficiently long service life of the mechanical seal.

The following factors influence the amount of leakage:
- Fluid
- Pressure
- Temperature
- Speed
- Area ratio k
- Surface roughness of the sliding surfaces
- Material of the sliding surfaces
- Vibrations/impacts
- Process-related factors, for example frequent start-up, flushing with other fluid, etc.

The following formula yields the theoretical leakage in simplified terms of a mechanical seal under static conditions:

$$\mathrm{Q} = \frac{6\ x\ \pi\ x\ r_m\ x\ h^3 x\ \Delta\mathrm{p}}{\eta\ x\ b\ x\ 10^5}$$

Fig. 5: Calculating the theoretical leakage of a mechanical seal

Q	Leakage volumes [ml/h]
r_m	Average radius of the sliding surface [mm]

H	Average gap height [μm]
Δp	Pressure difference to be sealed [bar]
H	Dynamic viscosity of fluid [Pa × s]
B	Width of the sealing gap [mm]

For a rough estimate of the leakage, the average gap height h can be calculated.

Assumption: The gasket runs on a lubricating film with mixed friction (slight contact of the roughness peaks). Then a value for h is to be expected which corresponds approximately to the sum of the slip surface roughness.

Leakage increases during the running-in period. Do not worry about larger leakage amounts within the first 100 to 150 operating hours!

With water as the fluid and the standard seal, after a sufficient running-in phase and operating pressures of 3 ... 12 bar, the expected leakages are 0.1 ... 0.5 g/min.

With water as the fluid and the standard seal, after a sufficient running-in phase and operating pressures of 3 to 12 bar, the expected leakages are 0.1 to 0.5 g/min.

The lanterns of the Wilo glanded pumps have a drilled hole to enable the targeted drainage of leakage on-site.

2.4 Corrosion protection

The glanded pump series offer good protection against corrosion even in the standard version for indoor installation. Protective measures include, depending on the series:
- A cataphoretic coating of hydraulic castings
- External components made of stainless steel or with a galvanic coating
- An additional two-component paintwork for the motors

For pumps ordered with an option code for outdoor installation, an additional two-component paintwork is applied to the complete pump. The two-component paintwork also protects against:
- Corrosion due to high humidity
- Cooling and the danger of condensation
- Aggressive atmosphere in industrial environment

3 Installation notes

3.1 Installation location, outdoor installation

Installation location/air conditioning

The pumps must be protected from the weather and installed in a frost and dust-free, well-ventilated and vibration-insulated environment which is not potentially explosive. **Series pumps must not be installed outdoors!**

Uncontrolled pumps are available as variants for outdoor installation. A distinction is made between the climatic conditions to which the pumps are exposed when installed outdoors. Wilo distinguishes between pumps for three different climatic zones depending on temperature and relative humidity:

→ Pumps with protection for temperate climates
→ Tropicalised pumps
→ Very tropicalised pumps

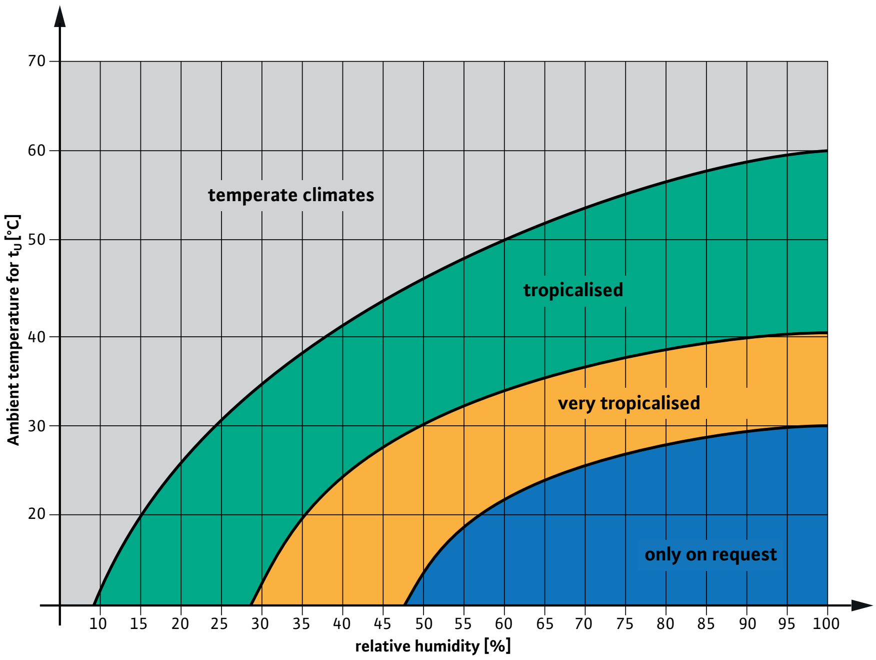

Fig. 6: Division of the climate zones for the selection of the equipment

For each of the three climate zones, there is the possibility to order pumps with a corresponding option code. There is a choice between a version with and without anti-condensation heater. **WARNING! Observe the maximum ambient temperature of the application!** As standard, all motors are only rated up to a maximum of 40 °C. This also applies to motors intended for different climatic zones. Additional options are available for higher temperatures.

Condensate drainage

The series usually have a condensate drain hole in the lantern. When the pumps are used in air-conditioning or cooling systems, the condensate that accumulates in the lantern drains off directly via this drilled hole. A drain pipe can be connected at this opening. In this way, even small quantities of fluid leakage can be drained.

Despite specially sealed centring rims, capillary action can draw air humidity into the motor interior where it accumulates in the case of outdoor installation or if there are corresponding ambient conditions in the case of indoor installation. The motors in all series are provided with condensate drilled holes which are sealed with a plug at the factory (to ensure protection class IP55).

When used in air conditioning/cooling and the pump is at a standstill, the following applies: To drain condensation water, remove the plug at regular intervals (maintenance schedule). **WARNING! In order to ensure the protection class of the motor, close the condensate drilled hole again with the plug afterwards!**

If the motor shaft is horizontal, the condensate drilled hole must be at the bottom. If necessary, turn the motor to the appropriate position.

Insulation

In the case of insulated systems only the pump housing may be insulated as a rule, but not the lantern, drive or differential pressure sensor.

In case of very heavy condensation, the surfaces of the lantern that are heavily wetted by condensation can also be additionally insulated (direct insulation of the individual surfaces). Ensure that the condensate drains out of the hole in the lantern.

If service is necessary, the dismantling of the lantern must not be obstructed.

The following components must always be freely accessible:
→ Air vent valve
→ Coupling
→ Coupling guard

Take DIN EN 12828 into account. When using insulation materials, pay attention to material compatibility. Ammonia compounds can cause stress corrosion cracking on brass materials (e.g. differential pressure sensor, air vent valve). Avoid direct contact with brass materials.

The following applies to electronic pumps and the use of DDGs with copper coils: To avoid damage and leakage at the connections for the differential pressure sensors, work carefully.

3.2 Installation/installation position

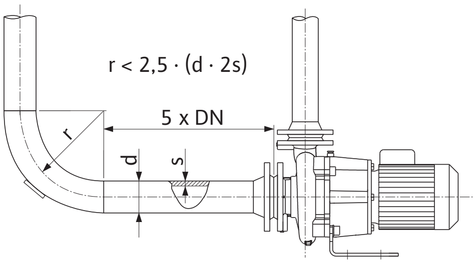

Fig. 7: Settling section upstream/downstream of the pump

Pipes and pumps should always be installed in a stress-free condition. The pipes must be fixed in such a way that the pump does not support the weight of the piping. A settling section must be provided upstream and downstream of the pump in the form of a straight pipe. Length of this settling section: at least 5 x DN of the pump flange.
This measure serves to avoid flow cavitation.

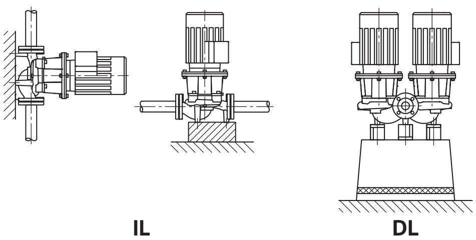

Fig. 8: Examples for installation positions; pump in in-line design

Glanded pumps in in-line design are conceived for direct installation in horizontal and vertical piping.

Installation with the motor and the terminal box facing downwards is not permitted. If the direction of flow of the fluid is downwards, turn the motor to a permissible position by loosening the fastening screws. **Do not damage the housing seal when doing this.** The air vent valve of the pump must always point upwards.

Above a certain motor power, install glanded pumps in in-line design only with vertical pump shaft. Refer to the respective installation and operating instructions for the exact values. Vertically installed pumps must be positioned on the pump support feet, preferably on a concrete base.

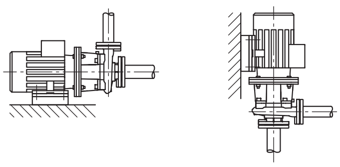

Fig. 9: Examples for installation positions; pump in monobloc design

3.3 Installing pumps on a base

Setting up the pump on an elastically supported base can provide better structure-borne sound insulation between the pump and the building. When the pump is at a standstill, vibrations from other units can cause bearing damage, for example in a system with several redundant pumps. To avoid possible damage due to external vibrations, place each pump on its own base.

When pumps are installed on floor slabs, elastic support is strongly recommended. Particular care must be taken with variable-speed pumps. Wilo recommends taking into account all constructionally and acoustically relevant criteria. A qualified building acoustics specialist should be tasked with dimensioning and design where necessary.

Select elastic elements according to the lowest excitation frequency. This is usually the rotation pump speed. In the case of variable speed, assume the lowest speed. To achieve an insulation level of 60 %, the lowest excitation frequency must be at least twice as high as the natural frequency of the elastic support. Therefore, the lower the speed, the smaller the spring resilience of the elastic elements must be.

Speed range	Elastic elements
≥ 3000 rpm	Natural cork panels
1000 … 2999 rpm	Rubber-metal elements
<1000 rpm	Screw spring

Table 3: Usual elements for vibration damping; speed-dependent

When constructing the base, avoid acoustic bridges – through plaster, tiles or auxiliary constructions. Sound bridges can cancel the insulating effect or greatly reduce it.

In the case of pipe connection, the flexure of the elastic elements under the weight of the pump and base must be taken into account. The consultant/installation company must ensure that the pipe connections to the pump are made stress-free. Any mass or vibration influences on the pump housing must be avoided. The use of compensators makes sense here.

3.4 Anticipated noise levels for Wilo glanded pumps (orientation values)

Valid for:

- → Atmos GIGA-I/-D/-B
- → CronoLine IL/DL/BL
- → VeroLine IPL/DPL

Series not listed are available on request.

Motor power P_N [kW]	Sound-pressure level pA (dB) [1]				
	Individual operation	**Dual operation**	**Individual operation**	**Dual operation**	**Individual operation**
	2-pole		**4-pole**		**6-pole**
0.09	–	–	39	–	–
0.12	50	53	43	46	–
0.18	51	54	43	46	–
0.25	54	57	47	50	–
0.37	54	57	47	50	–
0.55	54	57	51	54	–
0.75	60	63	51	54	–
1.1	60	63	53	56	–
1.5	67	70	55	58	–
2.2	67	70	59	62	–
3.0	67	70	59	62	–
4.0	67	70	59	62	–
5.5	71	74	63	66	65
7.5	71	74	63	66	68
11.0	74	77	65	68	–

Motor power P_N [kW]	Sound-pressure level pA (dB) [1]				
15.0	74	77	65	68	–
18.5	74	77	71	74	–
22.0	76	79	71	74	–
30.0	79	82	72	75	–
37.0	79	82	73	76	–
45.0	–	–	73	76	–
55.0	–	–	74	77	–
75.0	–	–	72	–	–
90.0	–	–	70	–	–
110.0	–	–	72	–	–
132.0	–	–	72	–	–
160.0	–	–	72	–	–
200.0	–	–	73	–	–

[1] Spatial mean value of sound-pressure levels within a cube-shaped measuring area at a distance of 1 m from the surface of the motor

Table 4: Anticipated noise levels for glanded pumps (orientation values for pumps with three-phase motor without speed control)

3.5 Measures for preventing propagation of water and structure-borne noise in piping

Rubber bellows expansion joint have proven effective as a means of reducing noise propagation in piping. In order to achieve optimal sound insulation on the part of the compensator, there must be an adequate fixed point on the side of the pipe to be protected. The fixed point must be separated from the elastically supported base. Always follow the installation instructions of the compensator manufacturer! When selecting the compensator, pay attention to resistance against temperature and constituents of the fluid. If necessary, switch to other designs, for example metal bellows expansion joints.

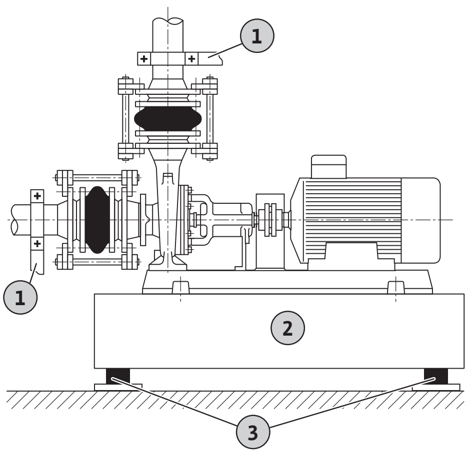

Fig. 10: Elements for preventing propagation of water and structure-borne noise in piping

1	Pipe fixed point
2	Concrete base as a settling mass
3	Spring elements, secured with dowels or glued on

In installation locations that are sensitive to noise, such as central roof areas, schools, concert halls or cinemas:

→ Consider special sound decoupling measures.

Comply with the following regulations, amongst others, regarding the permitted value for noise levels in occupied rooms:

→ DIN 4109 Sound insulation in buildings
→ VDI 2062 Vibration isolation
→ VDI 2715 Noise reduction in warm and hot-water heating systems
→ VDI 3733 Noises from piping
→ VDI 3743 Emissions characteristics of pumps

3.6 Permissible forces and torques on the pump flanges

Forces and torque exerted on the pump flanges by pipe loads can cause problems:

- Stagger and therefore misalignment of pump and drive shaft
- Deformation and overloading of the pump housing
- Overloading the fastening screw between the pump and the baseplate

Therefore, maximum permissible values have been defined for forces and torque acting on the flanges from the outside. These maximum values are defined depending on the load case. These are based on the standards EN ISO 5199 (2002) and CEN/TR 13931 (2009) as well as FEM calculations on selected representative pump housings.

The operator must ensure that the actual loads do not exceed the maximum permissible forces and torque of the selected pump.

In doing so, they must include all applicable constraints (ambient temperature, fluid temperature, pressure, etc.) in their considerations. If necessary, the operator must modify the piping network to reduce the loads acting on the pumps.

3.6.1 Load cases

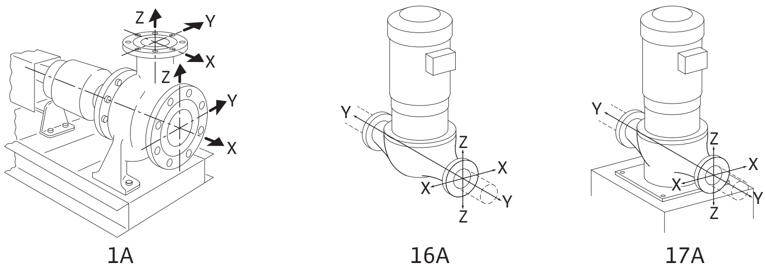

Fig. 11: Load cases, according to EN ISO 5199, Appendix B

Pump family	Series	Installation type	Load cases
Stratos	GIGA-D	Vertical	16A, 17A
Stratos	GIGA2.0-I/-D	Vertical	16A, 17A
Stratos	GIGA-B	Horizontal	1A
Yonos	GIGA2.0-I/-D	Vertical	16a, 17A
Atmos	GIGA-N/-B	Horizontal	1A
VeroLine, -Twin	IPL, DPL, IP-E, DP-E	Vertical	16A, 17A
CronoLine, -Twin	IL, DL, IL-E, DL-E	Vertical	16A, 17A
Crono	BL, BL-E	Horizontal	1A

Table 5: Assignment of series to load cases (according to EN ISO 5199, Appendix B)

3.6.2 Permissible external forces and torques on the flanges

All values as per ISO/DIN 5199 – class II (2002) – Appendix B.

Series IL/DL, IPL/DPL, Stratos GIGA-D

DN	Forces F [N]				Torques M [Nm]			
	F_X	F_Y	F_Z	Σ Forces F	M_X	M_Y	M_Z	Σ Torques M
Pressure and suction port								
32	450	525	425	825	550	375	425	800
40	550	625	500	975	650	450	525	665
50	750	825	675	1300	700	500	575	718
65	925	1050	850	1650	750	550	600	1100
80	1125	1250	1025	1975	800	575	650	1175
100	1500	1675	1350	2625	875	625	725	1300
125	1775	1975	1600	3100	1050	750	950	1525
150	2250	2500	2025	3925	1250	875	1025	1825
200	3000	3350	2700	5225	1625	1150	1325	2400
250	3725	4175	3375	6525	2225	1575	1825	3275

Table 6: Permissible values (pump suspended in pipe, case 16A grey cast iron material)

DN	Forces F [N]				Torques M [Nm]			
	F_X	F_Y	F_Z	Σ Forces F	M_X	M_Y	M_Z	Σ Torques M
Pressure and suction port								
32	338	394	319	619	300	125	175	550
40	413	469	375	731	400	200	275	700
50	563	619	506	975	450	250	325	775
65	694	788	638	1238	500	300	350	850
80	844	938	769	1481	550	325	400	925
100	1125	1256	1013	1969	625	375	475	1050
125	1331	1481	1200	2325	800	500	700	1068
150	1688	1875	1519	2944	1000	625	775	1575
200	2250	2513	2025	3919	1375	900	1075	2150
250	2794	3131	2531	4894	1975	1325	1575	3025

Table 7: Permissible values (vertical pump on support feet, case 17A, grey cast iron material)

Series BL, Stratos GIGA-B, Atmos GIGA-N, Atmos GIGA-B

DN	Forces F [N]				Torques M [Nm]			
	F_X	F_Y	F_Z	Σ Forces F	M_X	M_Y	M_Z	Σ Torques M
Suction port								
50	578	525	473	910	490	350	403	718
65	735	648	595	1155	525	385	420	770
80	875	788	718	1383	560	403	455	823
100	1173	1050	945	1838	613	738	508	910
125	1383	1243	1120	2170	735	525	665	1068
150	1750	1575	1418	2748	875	613	718	1278
200	2345	2100	1890	3658	1138	805	928	1680

Table 8: Permissible values (horizontal pump, suction port axial in a-axle, case 1A, grey cast iron material)

DN	Forces F [N]				Torques M [Nm]			
	F_X	F_Y	F_Z	Σ Forces F	M_X	M_Y	M_Z	Σ Torques M
Pressure port								
32	315	298	368	578	385	263	298	560
40	385	350	438	683	455	315	368	665
50	525	473	578	910	490	350	403	718
65	648	595	735	1155	525	385	420	770
80	788	718	875	1383	560	403	455	823
100	1050	945	1173	1838	613	438	508	910
125	1243	1120	1383	2170	735	525	665	1068
150	1575	1418	1750	2748	875	613	718	1278

Table 9: Permissible values (horizontal pump, upper discharge port axial in x-axle, case 1A, grey cast iron material)

3.6.3 Weighting and compensation equation

If not all working loads reach the maximum permitted values, one of these loads may exceed the normal limit value. This is under the condition that the following additional conditions are fulfilled:

- All force and torque components are limited to 1.4 times the maximum permitted value.
- The forces and torques acting on each flange meet the requirements of the compensation equation.

$$\left(\frac{\sum |F|_{\text{effective}}}{\sum |F|_{\text{max. permitted}}}\right)^2 + \left(\frac{\sum |M|_{\text{effective}}}{\sum |M|_{\text{max. permitted}}}\right)^2 \leq 2$$

Fig. 12: Compensation equation

$\Sigma F_{\text{effective}}$ and $\Sigma M_{\text{effective}}$ are the arithmetic sums of the effective values of both pump flanges (inlet and outlet).

$\Sigma F_{\text{max. permitted}}$ and $\Sigma M_{\text{max. permitted}}$ are the arithmetic sums of the maximum permitted values of both pump flanges (inlet and outlet).

The algebraic signs of Σ F and Σ M are not taken into consideration in the compensation equation.

3.7 Spacings and clearances

To ensure that approved lifting gear can be used for maintenance work, mount the pump in an easily accessible location.

Minimum axial distance between the fan cover of the motor and a wall or ceiling: refer to the installation and operating instructions of the pump

4 Electrics and motor technology

4.1 Electrical drive

The **rated power** and operating values of the electric drives specified in this consulting guide are valid for:

- Rated frequency of 50 Hz
- Rated voltage of 230/400 V to 3 kW or 400/690 V from 4 kW
- Ambient temperature (CT) of max. 40 °C
- Installation altitude up to 1000 m above NN

In cases outside these parameters: Reduce the rated power or select a larger motor type or a higher thermal class.

As standard, Wilo glanded pumps are equipped with electric motors that comply with the IEC standard in terms of power and design. Depending on the series, either motors with IEC standard flanges or with pump-specific flanges and shaft ends are used.

Usual speed gradations/operational speeds		
Number of poles	50 Hz	60 Hz
2	2900 rpm	3500 rpm
4	1450 rpm	1750 rpm
6	950 rpm	1150 rpm

Table 10: Speed gradations/operating speeds

4.2 Inrush current

The development of increasingly energy-efficient electric motors with higher efficiency requires new motor concepts. These include constructive modifications such as:

- Higher copper mass of the stator
- Optimised metal sheet cross-section geometry
- Higher quality metal sheet material

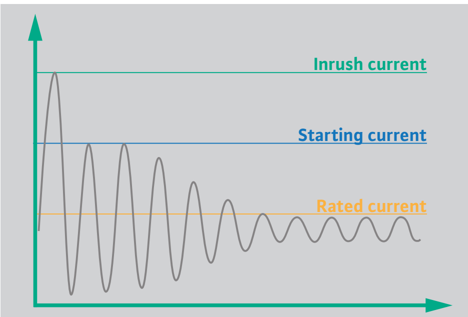

Fig. 13: Example: Starting curve of an IE3 motor

These measures for high-efficiency motors increase the inductance of the motors and cause higher inrush currents. The demands on switchgear technology (for example contactors and motor protection switches) also increase because they have to cope with higher inrush current peaks and higher starting currents.

In order to respond to these increasing requirements, the tripping behaviour of motor protection switches, for example, has been and is being adapted to the development. To avoid premature tripping when activating, for example, the response limits of the short-circuit releases are raised.

For easier selection of motor protection switches, products have also been labelled with the corresponding motor efficiency class, for example “IE3” or “IE3-Ready” (follow manufacturer’s instructions). In addition, various manufacturers offer dimensioning programs.

The low-voltage switchgear standard, IEC 60947-4-1 (motor starters, motor protection switches), as of October 2018, applies.

NOTICE

Check the suitability of all circuit breakers, contactors and motor starters, especially when replacing or refurbishing old systems!

4.3 Standard pumps on external frequency converters

If standard pumps are used on external frequency converters, the following aspects have to be considered regarding the insulation system and current-insulated bearings!

4.3.1 400 V power supply

The motors used by Wilo for glanded pumps are in principle suitable for operation on external frequency converters.

Set up and operate the installation in compliance with IEC TS 60034-25:2014. Due to the rapidly advancing development in the field of frequency converters, WILO SE cannot guarantee fault-free use of our motors on frequency converters provided by the customer.

With the Wilo-EFC, Wilo offers a series of external frequency converters. When combining these frequency converters with Wilo glanded pumps, always observe the relevant technical documentation.

4.3.2 500 V/690 V power supply

The motors which Wilo uses as standard for glanded pumps are **not** suited to be used on external frequency converters with 500 V/690 V.

When used in 500 V or 690 V mains, motors with a corresponding winding and reinforced insulation system are available as an option.

NOTICE

This type of usage must be explicitly stated when ordering.

The overall installation must comply with IEC TS 60034-25:2014.

4.3.3 Current-insulated bearings

Due to increasingly fast switching processes of the converter, drops in voltage can occur across the motor bearing even with motors of lower power. In the event of premature failure due to bearing current, we recommend the use of current-insulating bearings.

Always observe the following when connecting the frequency converter to the motor:
- Follow the installation instructions of the converter manufacturer!
- For rise times and peak voltages depending on cable length, refer to the respective installation and operating instructions.
- Use an appropriate cable with a sufficient cross-section (max. 5 % voltage loss).
- Connect correct shielding according to the recommendation of the frequency converter manufacturer.
- Lay the data cables (for example, PTC analysis) separately from the mains cable.
- Possibly plan the utilisation of a sine filter (LC) upon consultation of the converter manufacturer.

4.4 Use of explosion-protected pumps according to Directive 2014/34/EU

Potentially explosive atmospheres are those in which an explosive atmosphere (gaseous or dusty) may occur in hazardous quantities.

Depending on how frequently and/or with what probability an explosive atmosphere can occur, these areas are divided into zones. When dividing potentially explosive atmospheres into zones and determining the necessary protective measures, the operator must take into account the highest possible hazard potential in each case.

Decisions on the assignment of zones lie with the operator or the respective regulation authority. If the operator does not have a competent person available to assess the risk of explosion and determine the necessary measures, it is recommended that a competent body be called in.

Each Ex zone places different safety requirements on the pumps. The respective level of protection is matched to the hazard potential of each Ex zone. In Europe, Directive 2014/34/EU divides devices into device categories according to their level of protection. Internationally, the IEC 60079-0 standard defines the protection level by the EPL (Equipment Protection Level).

In addition, all devices are classified into device groups according to 2014/34/EU depending on its intended use.

These Wilo series are qualified for use in Ex zones:
- IL, BL, DL
- IPL-N, DPL-N

According to their intended use, these pumps are classified in device group II. They are suitable for use in Ex zones 1 and/or 2 and correspond to device category 2G and/or 3G. The corresponding device protection level EPL corresponds to Gb and/or Gc.

DANGER

Risk of fatal injury due to explosive atmosphere!

The above-mentioned pumps are approved exclusively for use in Ex zones where there is a risk of explosive gas mixtures of gas explosion groups IIB or IIA.

When selecting a pump, consider the ignition temperature of the explosive gas mixture. The maximum surface temperature of the pump must always remain below the ignition temperature. Consider all operating conditions and constraints!

NOTICE

To exclude hazards, avoid mistakes in the selection!

Before ordering an ATEX pump, request information on the Ex zone, the pumped media and fluid temperatures from the consultant and operator (Wilo order form “Ex pumps”, art. no. 2061635).

The suitability of the above-mentioned Wilo glanded pumps for use in Ex zones 1 and/or 2 has been verified. The testing was carried out by an accredited testing institute. The respective prototype test certificate can be provided on request.

Marking of Ex-protected glanded pumps, examples

Pump: Ex II 2G Ex h IIB T4...T3 Gb

Motor: Ex (xxxx) EN 60079 II 2G Ex eb IIC T3 Gb

(xxxx)	Registration number, EC type test certificate of the motor
EN 60079	Standard for ignition protection in electrical equipment
II	Device group
2	Equipment category
G	Ex-atmospheres due to gases, vapours, mist
Ex	General labelling on an explosion-proof component / device (pump, motor)

h	Production due to structural safety (c) and ignition source monitoring (b) *(c) and (b) according EN ISO 80079-37*
IIC **IIB** **IIA**	Explosion group, corresponding to the distribution of gases and vapours as a function of the ignition temperature (MESG=gap width limit): IIC: MESG < 0.5 mm IIB: 0.5 mm < MESG <0.9 mm IIA: MESG > 0.9 mm
T1 **T2 – T2D** **T3 – T3C** **T4 – T4A**	Temperature class with maximum surface temperature: T1 = 450 °C T2 = 300 °C, T2A = 280 °C, T2B = 260 °C, T2C = 230 °C, T2D = 215 °C T3 = 200 °C, T3A = 180 °C, T3B = 165 °C, T3C = 160 °C T4 = 135 °C, T4A = 120 °C
eb **db** **ec** **db eb**	Motor ignition protection class: eb = increased safety (high safety level) db = flameproof enclosure (high safety level) ec = non-sparking equipment (extended safety level) db eb = flameproof enclosure, increased terminal box safety (high safety level)

Table 11: Explanation of markings

5 Scope of delivery

Pump, including packaging, installation and operating instructions.

6 Accessories

6.1 Electronically controlled glanded pumps

- IF module: PLR or LON for the series IP-E, DP-E, IL-E, DL-E, BL-E, Yonos GIGA-N
- IF module: Modbus, BACnet or CAN for the series IP-E, DP-E, IL-E, DL-E from date of construction 10/2010, BL-E, Yonos GIGA-N
- Smart IF module (Gateways for remote maintenance)
- Sensors
  - Temperature sensors
  - Shock pulse transducers
  - DDGs
- Mounting brackets for installation on a base
- Blind flanges for twin-head pumps
- Supporting blocks for monobloc pumps

6.2 Uncontrolled glanded pumps

- Wilo control system for infinitely variable speed control for pump operation according to requirements
- Switchgears for the automatic control of duty and standby pumps
- WILO-EFC (external frequency converter)
- Smart IF module (Gateways for remote maintenance), only in connection with Wilo-EFC
- Mounting brackets for installation on a base
- Blind flanges for twin-head pumps
- Supporting blocks for monobloc pumps

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