SCHAEFFLER

Torque motors

RIB, RKI, RKIB

Catalogue

Contents

Foreword

In Suhl, Thuringia, Schaeffler develops and manufactures rotary and linear direct drives that meet the highest demands of industry with a workforce of approximately 140 employees.

Over many years, we have developed our torque motor series to create optimised products that reach the boundaries of physical and economic feasibility. In addition to complex mechanical and thermal simulations of both the motor and the rolling bearing arrangement, our tools for optimisation and further development also extend to the design of the magnetic and cooling circuits and magnet simulation. Each of our torque motor series features a specific combination of outstanding characteristics, such as high torque density, ultra-high speeds, exceptional synchronisation characteristics and low power loss. This allows us to cover virtually all applications in the field of direct drives.

If a suitable motor cannot be found from our extensive selection, however, we will develop a customised high-end positioning and drive system to meet your requirements. Unlike any other company in the market, Schaeffler is able to determine the optimum motor topology in line with your specifications and develop a drive to exceptionally high standards. Due to the close reciprocal relationship between torque motor and associated bearing arrangement, you will benefit in particular from our expertise in rolling bearing arrangements. Not least for this reason, we also offer rolling bearings for our torque motors that are tailored to the respective machine type.

This catalogue provides you with a detailed overview of our range of rotary direct drives, their characteristics and possible applications. Customers place their trust in direct drives from Schaeffler especially in the machine tool, medical equipment, automation, robotics, food, packaging, printing machinery, textile machinery, productronics and measuring equipment industries.

1 Technical principles

1.1 Legend of symbols used in formulas

I	A	Motor current
$I_{c\ eff}$	A	Effective continuous current, not cooled
$I_{c\ red}$	A	Reduced continuous current
$I_{cw\ eff}$	A	Effective continuous current, cooled
$I_{cw2\ eff}$	A	Effective continuous current for higher speeds in continuous operation
$I_{p\ eff}$	A	Effective peak current
$I_{pl\ eff}$	A	Effective peak current, linear range
$I_{u\ eff}$	A	Effective ultimate current
J	$kg \cdot m^2$	Mass moment of inertia
k_m	$Nm/\sqrt{W}$	Motor constant for torque motors
k_T	Nm/A	Torque constant
n	min^{-1}	Speed
n_{Ic}	min^{-1}	Limiting speed at $I_{c\ eff}$ and U_{DCL}
n_{Ip}	min^{-1}	Limiting speed at $I_{p\ eff}$ and U_{DCL}
n_{Iw}	min^{-1}	Knee speed
n_{Iw2}	min^{-1}	Operating speed FS at $I_{cw2\ eff}$ and U_{DCL}
n_{Iw3}	min^{-1}	Limiting speed at $I_{cw2\ eff}$ and U_{DCL} in continuous operation
n_{IwS1}	min^{-1}	Rated speed S1, cooled
n_{max}	min^{-1}	Max. speed
P_l	W	Power loss
$P_{max\ S1}$	N	Maximum rated power
R	Ω	Ohmic resistance
t	s	Time
T	Nm	Torque
t_b	s	Pause time
T_c	Nm	Continuous torque, not cooled
T_{cw}	Nm	Continuous torque, cooled
T_{cw2}	Nm	Torque at $I_{cw2\ eff}$ and n_{Iw2}
T_{cw3}	Nm	Torque at $I_{cw2\ eff}$ and n_{Iw3}
T_{eff}	Nm	Effective torque
T_F	Nm	Bearing frictional torque
t_m	s	Movement time
T_{max}	Nm	Max. torque
T_p	Nm	Peak torque
T_{pl}	Nm	Peak torque, linear range
$T_{safe\ eff}$	Nm	Effective torque, incl. safety factor
$T_{safe\ max}$	Nm	Max. torque, incl. safety factor
T_{sw}	Nm	Stall torque, cooled
T_u	Nm	Ultimate torque
T_W	Nm	Processing torque
T_Z	Nm	Weight force (additional torque)
U_{DCL}	V	DC link voltage
α	rad/s^2	Angular acceleration
α_{max}	rad/s^2	Max. angular acceleration
α_{S1}	rad/s^2	Angular acceleration in S1 operation
ϑ	°C	Temperature
ϑ_f	°C	Current feed temperature
ϑ_{max}	°C	Max. permissible winding temperature
ϑ_n	°C	Nominal response temperature
ϑ_{nf}	°C	Nominal feed temperature
φ	°	Movement angle
ω	rad/s	Angular velocity
ω_{max}	rad/s	Max. angular velocity

1.2 Advantages of torque motors

1.2.1 Performance capability

No conversion of the movement profile

There is no elasticity, play, friction or hysteresis in the drive chain resulting from transmission or coupling elements.

Multi-pole motor

Extremely high torques are produced as a result of the multi-pole design. The torques can be used from the speed > 0 up to the rated speed.

Thin, ring-shaped secondary part

The thin, ring-shaped design with a large, free inner diameter reduces motor inertia and yields a high acceleration rate.

Direct position measurement

High-precision, dynamic positioning operations are possible courtesy of the direct position measurement and rigid mechanical structure.

Controller compatibility

Torque motors from Schaeffler Industrial Drives can be operated with all common servo drives on the market.

1.2.2 Operating costs

No additional moving parts

The absence of additional moving parts makes assembly, adjustment and preventive maintenance of the drive unit easier.

Minimal wear in the drive chain

The drive chain is extremely durable even under very high alternating loads. The low amount of wear reduces machine downtimes.

High availability

In addition to the an increased life and reduced wear, the robust design of the torque motors also increases the availability of the entire machine.

Energy efficiency

The heat is reduced to a minimum to save energy in the servo drive and cooler.

1.2.3 Design

Hollow shaft

The hollow shaft with large diameter makes the integration or passage of other assemblies possible, such as shafts, rotary distributors and media lines. Bearing level, force generation and effective working area can all be in close proximity to each other.

Installation of the primary part (stator)

The ring for the stator can be easily integrated into the machine construction due to the small space requirement.

Low section height

A highly compact and axially short construction with a high torque is made possible by the large, free inside diameter.

Few components

The highly engineered design makes it easier to incorporate the motor components into the machine assembly. The small number and robust design of the parts decreases the failure rate and increases the mean time between failures.

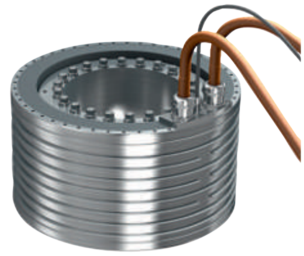
1.3 Characteristics of torque motors

A torque motor is made up of a primary part and a secondary part. The primary part contains an active coil system. The secondary part contains a permanent magnet system. In a concentric arrangement, the secondary part may either be the inner ring, in the case of an inner secondary part motor, or the outer ring, in the case of an outer secondary part motor. An energised primary part generates a force that acts on the secondary part as a result of the electromagnetic force.

A bearing maintains the air gap between the primary part and the secondary part. A measurement system for detecting the secondary part position is also required. Due to the wide range of application requirements, motor series have been developed with a wide variety of primary parts and secondary parts.

In terms of their structural design, torque motors can essentially be divided into motors with or without lamination stack or ironless motors. Further distinctions include the position and configuration of the secondary part as internal rotor or external rotor, or according to the magnet system. For example magnets can be glued on the surface of a steel ring, like they are in the RIB series. Or they can be integrated in a lamination stack – also referred to as buried magnets – in the RKIB series. The motors generate a consistently high torque over a wide speed range. The torque is determined by the active air gap area between the primary part and the secondary part as well as the structure. The designer must select the motor assemblies according to the power requirements. Conventional electric motors are classified according to power. Torque motors, by contrast, are classified according to the necessary torque.

1 Characteristics of torque motors

Motor series	Characteristics	Design
RIB ➤38 | 2	Internal running motor with high torque density • Ø up to 1030 mm • T_p up to 40000 Nm • Up to 10 m/s circumferential speed • Low cogging torque	
RKI and RKIB ➤74 | 3	Internal running motor with high power density • Ø up to 1030 mm • M_p up to 25000 Nm • Up to 30 m/s circumferential speed	

1.4 General motor characteristic values

1.4.1 Efficiency criteria

Power losses for torque motors are entered in the performance data according to winding and size ➤41 | 2.2. Although torque motors generate a high torque when stationary, they do not deliver any mechanical power. As a result, there is no reason to state the efficiency.

However, the motor constant k_m may be used for efficiency comparisons. The motor constant k_m defines the relationship between torque and copper loss generated at this torque. The power loss heats the motor. Furthermore, the motor constant k_m is accurate for the linear control range in a stationary state and at low speeds as well as at room temperature.

When the motor is subjected to a temperature increase, its efficiency decreases due to the increase in winding resistance. For speeds at a pole change frequency of 100 Hz or higher, the copper losses are joined by iron losses in the form of frequency dependent hysteresis losses and eddy current losses. Although the iron losses are not included in the motor constant k_m, they are relevant in the limiting speed range and should therefore be observed. The motor constant k_m only relates to the linear range of the torque–current characteristic curve ➤13 | 1.4.4.

1 Power loss

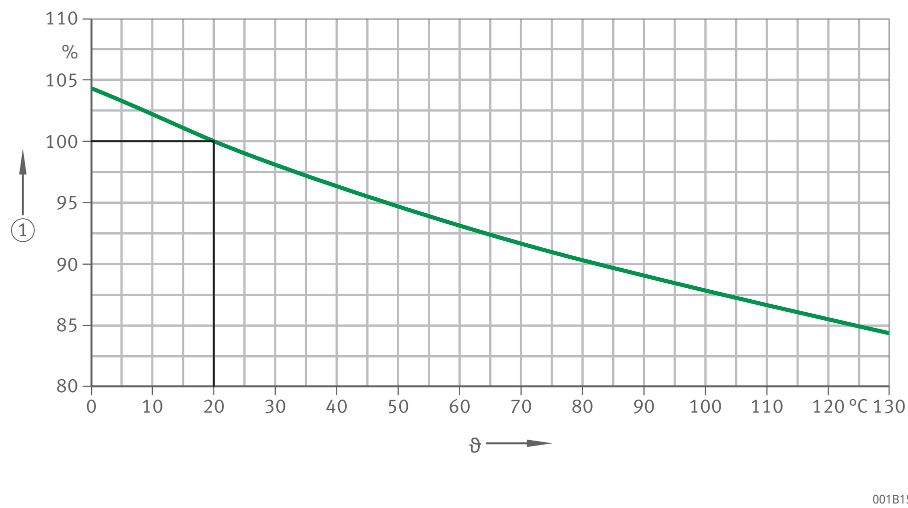
$$P_l = \left(\frac{T}{k_m}\right)^2$$

P_l	W	Power loss
T	Nm	Torque
k_m	Nm/√W	Motor constant

The motor constant k_m is dependent on the ohmic resistance and thus on the motor winding temperature. The motor constant k_m is stated in the performance data for +20 °C. The characteristic curve shows the motor constant as a function of the temperature.

1

1 Motor constant k_m as a function of temperature ϑ



1	Related motor constant	ϑ	Temperature

Thermal behaviour

An increase in temperature brings about an increase in winding resistance, which has the effect of reducing the motor constant k_m. At +130 °C, the motor constant k_m falls to 0,84 times its normal value. At a constant current, which in turn generates the torque, a higher power loss occurs in the heated motor than in the cold motor. This power loss further increases the motor temperature.

1.4.2 Winding designs and dependencies

First and foremost, the series determines the limiting speeds of a torque motor. The following designs are possible:

- RIB torque motor
  The primary part has a laminated iron core. For the secondary part, magnets are glued onto a steel ring.
- RKI torque motor and RKIB torque motor
  The primary part has a laminated iron core. For the secondary part, magnets are integrated into the laminated core.

Within a series, the size, the DC link voltage and the winding design affect the limiting speeds.

Voltage drops within the motor increase the voltage requirement with increasing speed. At the knee speed specified in the performance data, the voltage requirement corresponds to the DC link voltage of the servo converter with field-oriented control, after which the speed falls off rapidly. The higher the DC link voltage and the smaller the voltage constants associated with the winding $k_{\hat{u}}$, the higher the achievable limiting speeds. As there is a correlation between voltage constant and torque constant, the power requirement of the motor increases with higher speed requirements at the same torque. One or more standard windings are predefined for different limiting speeds and dynamic requirements at a fixed DC link voltage U_{DCL} ➤41 | 2.2.

1.4.2.1 Change in DC link voltage

The DC link voltage affects the winding-specific speed limits. If the DC link voltage changes by maximum ±10 %, a proportionality between the DC link voltage and the speed limits can be assumed for the pre-selection of the motor. Exact speed limits for customer-specific DC link voltages are available through the application engineers as well as through the sales department of Schaeffler Industrial Drives.

At lower DC link voltages, the limiting speed decreases. A torque–current characteristic curve shows the torque at different operating points. The torque–speed characteristic curves show the relationship between torque and speed at various operating points.

The torque–speed curves are available as a data sheet from the application engineers and the sales department of Schaeffler Industrial Drives.

Contact: sales-sid@schaeffler.com

1.4.3 Torque/speed characteristic curve

RIB torque motor

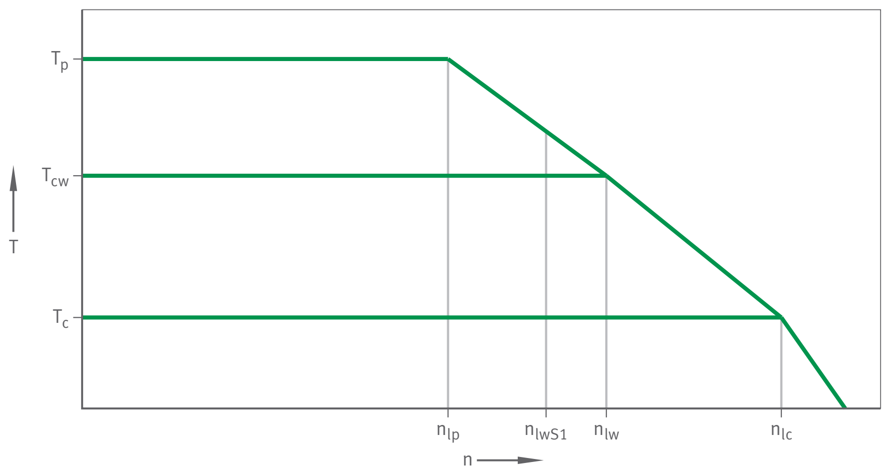
The torque–speed characteristic curve for a RIB torque motor shows the winding-specific speed limits as a function of the torque at a constant DC link voltage without field weakening. The characteristic curve does not describe the duty cycle and the associated thermal behaviour of the motor. The characteristic curve only represents the range that the motor can approach at a winding temperature of +20 °C.

Operating points at torques in excess of T_{cw} are subject to time restrictions in order to protect the primary part from overheating. At T_u, an excessively high secondary part output temperature can lead to demagnetisation.

At $n > n_{lwS1}$, the motor may only be operated for a specific amount of time due to additional frequency-dependent losses. Alternatively, the current can be reduced for continuous operation. The rated speed (S1), cooled, n_{lwS1}, can also be equal to n_{lw} depending on the motor size and winding design.

The limiting speed n_{lc} at $I_{c\ eff}$ and T_c is important for understanding the characteristic curve, but is not stated in the performance data due to its minor relevance.

2 RIB torque motor: Torque–speed characteristic curve



T	Nm	Torque
n	min^{-1}	Speed
T_c	Nm	Continuous torque, not cooled
T_{cw}	Nm	Continuous torque, cooled
T_p	Nm	Peak torque
n_{lc}	min^{-1}	Limiting speed at $I_{c\ eff}$ and U_{DCL}
n_{lp}	min^{-1}	Limiting speed at $I_{p\ eff}$ and U_{DCL}
n_{lw}	min^{-1}	Knee speed
n_{lwS1}	min^{-1}	Rated speed S1, cooled

Further information on the operating conditions for the speed limits n_{lp}, n_{lwS1} and n_{lw} and the associated torques T_p, T_{cw} and T_c can be found in the glossary ➤133|.

RKI torque motor and RKIB torque motor

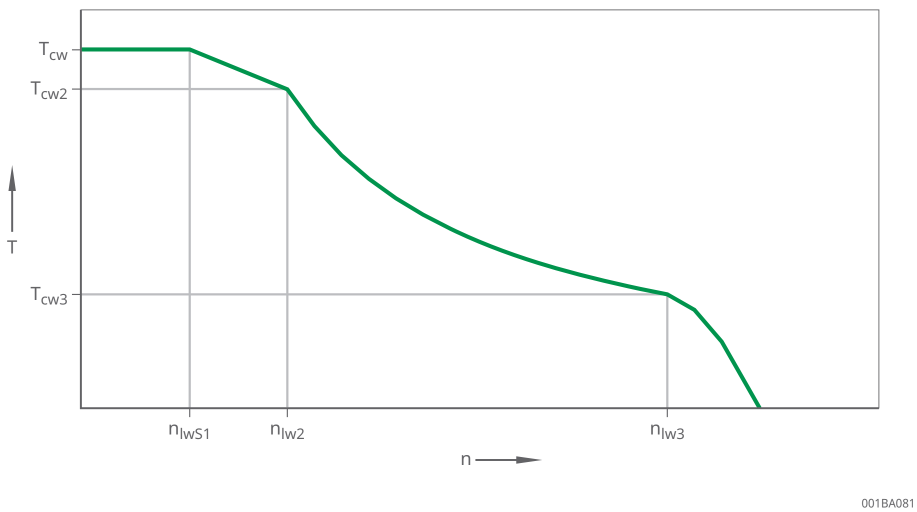
The torque–speed characteristic curve for continuous speeds shows the winding-specific speed limits as a function of the torque at high speeds and constant DC link voltage with field weakening. RKI torque motors and RKIB torque motors can operate continuously at the operating points shown in the characteristic curve.

Operation at the continuous torque T_{cw} is possible up to the speed n_{lwS1}. At higher speeds up to the speed n_{lw2}, continuous operation requires a reduction in current from $I_{cw\ eff}$ to $I_{cw2\ eff}$. The associated torque is T_{cw2}.

Between n_{lw2} and n_{lw3}, the maximum permissible continuous current is also $I_{cw2\ eff}$. The associated torque progression depends on the winding and the secondary part configuration. At n_{lw3} and $I_{cw2\ eff}$, the associated torque is T_{cw3}. The mechanical power at this operating point is P_{maxS1}. The precise progression between n_{lw2} and n_{lw3} can only be seen in the product-specific data sheet, which must be requested from Schaeffler Industrial Drives.

Further information on the speed limits and the operating conditions for the corresponding torques can be found in the glossary ➤133|.

3 RKIB torque motor: Torque–speed characteristic curve for continuous speeds



n	min^{-1}	Speed
T	Nm	Torque
T_{cw}	Nm	Continuous torque, cooled
T_{cw2}	Nm	Torque at $I_{cw2\ eff}$ and n_{lw2}
T_{cw3}	Nm	Torque at $I_{cw2\ eff}$ and n_{lw3}
n_{lwS1}	min^{-1}	Rated speed S1, cooled
n_{lw2}	min^{-1}	Operating speed FS at $I_{cw2\ eff}$ and U_{DCL}
n_{lw3}	min^{-1}	Limiting speed at $I_{cw2\ eff}$ and U_{DCL} in continuous operation

Control reserve
All specified speeds relate to a constant DC link voltage U_{DCL}. With frequency inverters without a stabilised DC link, U_{DCL} is not constant. The operating point must therefore be provided with a control reserve as a function of the DC link voltage fluctuation. Typically, with frequency inverters without a stabilised DC link, the speed at the operating point should not exceed approx. 80 % of the motor's possible speed at this operating point.

1.4.4 Torque/current characteristic curve

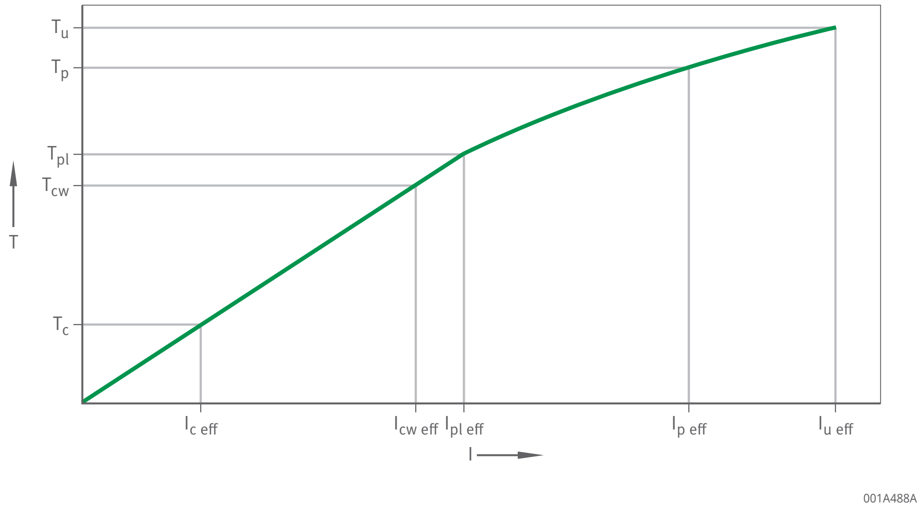
A motor current in the range between 0 A and the linear peak current $I_{pl\ eff}$ generates a linearly dependent torque. The peak current $I_{pl\ eff}$ generates the linear peak torque T_{pl}. The motor constant k_m is suitable for calculating the power loss in the range between 0 A and $I_{pl\ eff}$. The torque constant k_T is used in this range to calculate the torque on the basis of the current, or vice versa.

The value of the linear peak current $I_{pl\ eff}$ is independent of temperature. The value depends on the series and the winding design. It can be lower or higher than the value of the cooled continuous current $I_{cw\ eff}$. The linear peak current $I_{pl\ eff}$ and the associated linear peak torque T_{pl} are important for understanding the characteristic curve. However, as these values have very little practical relevance, they are not listed in the performance data.

The torque–current characteristic curve is no longer linear at $I > I_{p\ eff}$. The saturation of a motor's magnetic circuits causes this non-linearity. Between the torque–current points T_p at $I_{p\ eff}$ and T_u at $I_{u\ eff}$, the characteristic curve becomes non-linear. In this range, the gradient of the curve is variable and significantly lower than the value of the torque constant k_T.

The motor can be operated for a few seconds up to the operating point T_p, $I_{p\ eff}$. This is the maximum operating point for acceleration processes. Due to the risk of demagnetisation of the permanent magnets, the motor must not be operated beyond the limiting point T_u, $I_{u\ eff}$.

4 Torque as a function of motor current



T	Nm	Torque
I	A	Motor current
T_c	Nm	Continuous torque, not cooled
T_{cw}	Nm	Continuous torque, cooled
T_p	Nm	Peak torque
T_{pl}	Nm	Peak torque, linear range
T_u	Nm	Ultimate torque
$I_{c\ eff}$	A	Effective continuous current, not cooled
$I_{cw\ eff}$	A	Effective continuous current, cooled
$I_{p\ eff}$	A	Effective peak current
$I_{pl\ eff}$	A	Effective peak current, linear range
$I_{u\ eff}$	A	Effective ultimate current

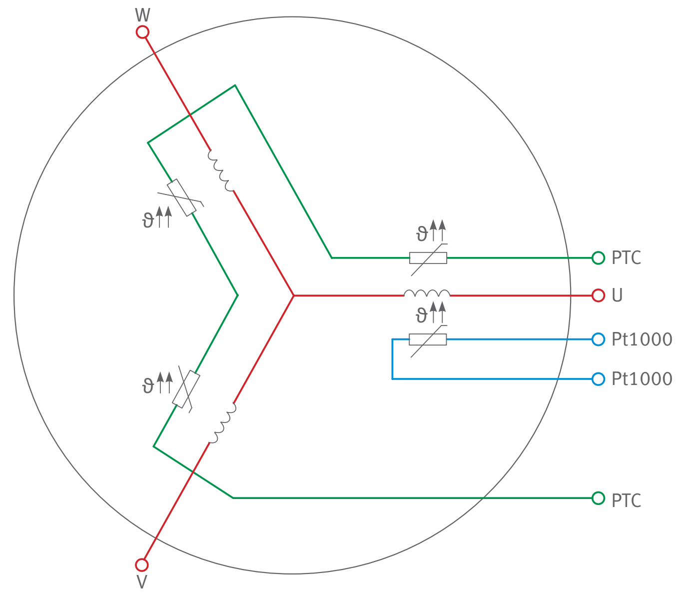
1.5 Thermal motor protection

1.5.1 Monitoring circuits I and II

Users often operate direct drives at their thermal performance limit. In addition, an unpredictable overload can occur during operation. The overload results in a current load that is higher than the permissible continuous current. In the event of overload, the effective motor current, the square mean value I^2t, must not exceed the permissible continuous motor current. For short-term overcurrent, the power electronics must have an I^2t motor protection model to control the motor current. This indirect temperature monitoring is very fast and reliable. During motor commissioning, the user must ensure that the I^2t monitoring is switched on.

Motors from Schaeffler Industrial Drives must be protected by means of motor temperature monitoring. Monitoring circuit I of the standard version contains 3 PTC sensors, connected in series, on the 3 phase windings. Monitoring circuit II also includes a Pt1000 sensor on one phase in the motor. This sensor enables pre-warning thresholds.

5 Standard connection of triplet PTC and Pt1000



The PTC and Pt1000 sensors have basic isolation from the motor. The sensors are not suitable for direct connection to PELV circuits or SELV circuits in accordance with DIN EN 61800-5-1.

1.5.2 Monitoring circuit I

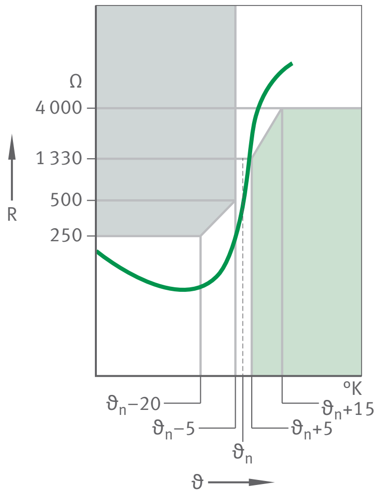
A PTC is a thermistor. A PTC has a thermal time constant of a few seconds. In contrast to that of the Pt1000, the resistance of the PTC rises very sharply when the nominal response temperature ϑ_n is exceeded. The resistance increases to a multiple of the cold value when the nominal response temperature is exceeded.

When using a triple PTC, i.e. three PTC sensors connected in series, the total resistance changes significantly. This considerable change also occurs if only one sensor exceeds the response temperature ϑ_n. The use of three PTC sensors ensures that the motor can still be shut down safely by a thermistor motor protection relay under asymmetrical phase load, e.g. at standstill. The thermistor motor protection relay typically trips between 1,5 kΩ and 3,5 kΩ, thus triggering a controller stop.

The PTC sensors detect the overtemperature of each winding with a deviation of only a few degrees.

1

6 PTC temperature characteristics



R	Resistance	ϑ	Temperature
ϑ_n	Nominal response temperature		

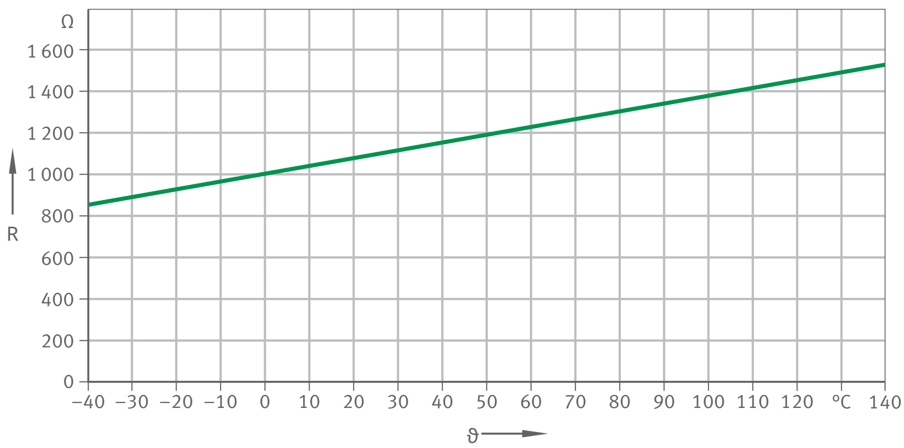
The thermistor motor protection relay also responds if the resistance in the PTC circuit is too low. The excessively low resistance may indicate a defect in the monitoring circuit. The thermistor motor protection relay ensures safe galvanic isolation of the controller from the PTC sensors in the motor. The thermistor motor protection relay is not included in the scope of delivery of the motor. PTC sensors of temperature monitoring circuit I are not suitable for temperature measurements. Monitoring circuit II is suitable for temperature measurements.

In principle, a thermistor motor protection relay connected to the servo converter must evaluate the PTC sensors for temperature protection of the motor.

1.5.3 Monitoring circuit II

The Pt1000 is a platinum measuring resistor temperature sensor. This sensor makes use of the temperature dependence of the electrical resistance of platinum. EN 60751 describes the sensor characteristic.

7 Pt1000 temperature characteristics

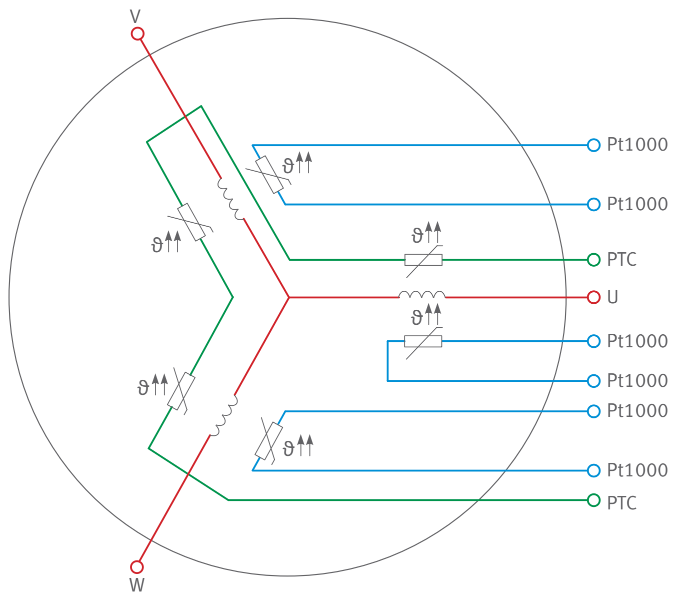


R	Resistance	ϑ	Temperature

The thermal time constant is a few seconds in the installed state. Pre-warning threshold and a shutdown limit are entered in the controller and protect the motor from overtemperature. The pre-warning threshold prevents immediate shutdown by the thermistor motor protection relay.

At standstill, depending on the application, constant currents can flow through the windings of the motor. The pole position determines the magnitude of the constant currents. The motor is not heated homogeneously through this dependency. Unmonitored windings may overheat. A Pt1000 sensor can only monitor one phase. The use and evaluation of three Pt1000 sensors ensure the monitoring of all phases. For applications that regularly reach the loading limit at standstill, Schaeffler Industrial Drives recommends the use and evaluation of three Pt1000 sensors.

8 Connection of triplet PTC and 3 Pt1000



1.6 Electrical connection technology

1.6.1 Standard cable connections

The standard cable connections of motors from Schaeffler Industrial Drives are equipped with an axial screw connection. For RIB torque motors, their relative position to the cooling connections is in the middle of the cable outlet. For RKI torque motors and RKIB torque motors with multiple cable outlets, the relative position cannot be universally defined. The quotation and delivery drawing and the 3D model take precedence and provide a binding position.

RIB torque motors are supplied with a 2 m cable. The cable length is measured from the motor outlet. RKI torque motors and RKIB torque motors are supplied with either a 2 m or a 5 m cable. Customised cable lengths are available.

The cross section of the power connection cable depends on the continuous current of the motor ➤18 | 2. As standard, dimensioning is based on the continuous current $I_{cw\ eff}$ at P_{lw} (cooled).

Axial, radial and tangential cable outlets can be used ➤38 | 12. The desired cable outlet is defined with the order. For motor currents over 70 A, the cable outlets are matched to the specific application.

1

The cables have the following characteristics:

- shielded
- resistant to oil and coolant courtesy of polyurethane outside surface
- flame resistant
- suitable for drag chain use

The cable ends are open with ferrules in the standard version. Application-specific cable outlets are possible.

2 Motor cable connections, standard

Cross-section	Continuous current	Diameter	min. bending radius, fixed	min. bending radius, flexible	Mass
–	A	mm	mm	mm	g/m
4G0,75	10,4	8	40	80	95
4G1,5	16,1	9	45	90	140
4G2,5	22	10,5	52,5	105	210
4G4	30	12,5	62,5	125	296
4G6	37	14,5	72,5	145	416
4G10	52	17	85	170	644
4G16	70	20,5	102,5	205	997

3 Motor connection assignments

Designation	Assignment
1/U	Phase U
2/V	Phase V
3/W	Phase W
GNYE	PE

The sensor cable enables temperature monitoring with the PTC and Pt1000 sensors. The cable ends are open with ferrules in the standard version. Application-specific cable outlets are possible.

4 Sensor cable connections, standard

Cross-section	Temperature monitoring	Diameter	min. bending radius, fixed	min. bending radius, flexible	Mass
–	–	mm	mm	mm	g/m
Sensor 4×0,14	P [1]	4,8	24	36	40
Sensor 7×0,14	–	5,7	29	43	67
Sensor 10×0,14	T [2]	6,7	34	50	87

[1] P = 1 Pt1000 + 3 PTC

[2] T = 3 Pt1000 + 3 PTC

5 Connection assignments, sensor variant P

Designation	Assignment
WH	PTC
BN	PTC
GN	Pt1000
YE	Pt1000

6 Connection assignments, sensor variant T

Designation	Assignment
WH	PTC
BN	PTC
GN	Pt1000-1
YE	Pt1000-1

Designation	Assignment
GY	Pt1000-2
PK	Pt1000-2
BU	Pt1000-3
RD	Pt1000-3

1.6.2 Special cable connections

For RKI torque motors and RKIB torque motors, the use of shielded single wires may make sense in certain cases. The selected wires and their positions can be found in the quotation and delivery drawings as well as the quotation circuit diagram. General characteristic values of the single wires can be found in the table.

7 Motor cable connections, special designs

Cross-section	Continuous current	Diameter	min. bending radius, fixed	min. bending radius, flexible	Mass
–	A	mm	mm	mm	g/m
4×(1×2,5)	22	4×6	24	45	4×58
4×(1×4)	30	4×6,5	26	49	4×77
4×(1×6)	37	4×7	28	53	4×101
4×(1×10)	52	4×8,5	34	64	4×146
4×(1×16)	70	4×10	40	75	4×223
4×(1×25)	88	4×12	48	90	4×329
4×(1×35)	110	4×13	52	98	4×444

1.6.3 Positive direction of rotation of the motor

The electrically positive direction of rotation corresponds to a clockwise rotating field in all three-phase motors, i.e. the phase voltages are induced in a U, V, W sequence. Motors from Schaeffler Industrial Drives have the following positive direction of rotation with secondary part movement:

- anticlockwise when viewing the side of the cable outlet from above
- clockwise when viewing the side facing away from the cable outlet at the bottom

9 Direction of rotation with the cable outlet at the top

1.6.4 Commutation

Synchronous motors should be operated with commutation where possible. Schaeffler recommends commutation that is based on the measuring system, since this is supported by modern servo drives and controllers.

1.6.5 Isolation strength and overvoltage phenomena

Schaeffler Industrial Drives develops, designs and manufactures motors according to the following directive: 2014/35/EU, Electrical equipment for use within certain voltage limits. The motors meet the requirements of the following directive: 2014/30/EU, Electromagnetic compatibility. The motors are intended to be used for the intended operation in a PDS (power drive system) in accordance with DIN EN 61800-5-1.

The insulation systems of the motors are designed to overvoltage category III and optimised for maximum life. The dielectric strength of the insulation systems is checked before delivery. Modern test methods, such as measuring the partial discharge inception voltage, ensure the life and performance of the motors over a long time period.

When installed, the motor is part of the PDS, which consists of the motor, motor cable and converter components such as the supply module, regenerative modules, drive controller and filter. Unwanted and unpredictable effects can occur within the PDS. Controller manufacturers often provide recommendations and project planning information that the user should observe and adhere to. Failure to do so may result in premature failure of the motor or converter insulation systems.

The following measures ensure safer operation, regardless of the converter:

- **Short cables and large-area cable shielding support**
  Short cables and large-area support/contact of the cable screen help avoid overvoltages caused by high frequency reflection on the motor cable. Motor cables with lengths of 10 m or higher between the motor and the converter increase the probability of overvoltages. Schaeffler Industrial Drives recommends measuring the voltage on the motor connection terminals using a suitable high-voltage technology when the machine is put into operation.
- **Selecting the right motor**
  The motors must be selected according to the DC link voltage of the converter. In most cases, the DC link voltage is 600 V. A lower DC link voltage reduces the dynamic response and maximum speed. A reinforced insulation system is required if the DC link voltage is 720 V or higher or the installation height is greater than 2000 m. In such cases, contact Schaeffler Industrial Drives. Motors with inductances well over 50 mH, measured from phase to phase, may only be used following individual checks by the manufacturer of the converter and Schaeffler Industrial Drives, as otherwise voltage spikes may cause resonances in the PDS (power drive system) and damage to the insulation system.

Instructions from the converter manufacturer must be observed. If any of the following applies, this must be specified in the request. Alternatively, measurement of the transient overshoot can be carried out during commissioning on site.

- PDS with multi-axis converter modules or regulated supplies:
  here, electrical oscillations relative to earth potential and the resulting voltage load can damage the motor's insulation system.
- Applications in which more pronounced insulation damage has occurred in the past
- Applications in which countermeasures already exist

For a DC link voltage of 600 V to 720 V, the overshoot between the motor phases must not exceed 1370 V. The peak-to-peak band between the motor phases must not exceed 2800 V.

Line reflections and electrical oscillations due to regulated supplies are superimposed in the measurement between motor phase and earth potential. Only the peak-to-peak band should be considered during the evaluation. The peak-to-peak band must not exceed 2350 V.

1.6.6 Short-circuit behaviour in permanent magnet synchronous motors

In an emergency, a short circuit of phases U, V and W can decelerate an axis driven by a torque motor. This emergency braking generates a short-circuit current. The magnitude and duration of the current load must be taken into account in the sizing of the PDS (power drive system). If the short-circuit current is higher than the cooled continuous current I_{CW}, Schaeffler Industrial Drives must be consulted. The braking behaviour of the motor is calculated based on speed and moment of inertia.

1.7 Cooling and cooling circuit

1.7.1 Heat distribution

The motor assembly transmits the power loss that occurs during motor operation to the machine. The design measures implemented for cooling, convection, conduction and radiation can be used to influence and control the heat distribution of the overall system. Knowledge of the heat sources in a motor is decisive for the structural design.

At low speeds, and therefore pole change frequencies < 100 Hz, heat is generated solely by copper loss in the motor windings. At higher speeds, and thus pole change frequencies > 100 Hz, iron losses in the secondary part and primary part as well as magnet losses in the secondary part also occur. The iron losses do not increase linearly with the pole change frequency and depend on the field weakening angle and current density.

Most of the heat generated in operation at pole change frequencies < 100 Hz can be dissipated through a liquid cooling system on the outer surface of the primary part. The so-called jacket cooling system is connected to the cooling circuit of a recooler. The cooling jacket is usually a structural component of the customer-specific machine design, but can also be provided separately by Schaeffler Industrial Drives. The cooling medium travels through openings in the cooling ribs – the so-called cooling meander – across different levels from inlet to outlet. The inlet and outlet can be assigned to the two connections as desired. The flow area is sealed to the outside with O-rings.

For machines with high power density, high speeds, and therefore pole change frequencies > 100 Hz, excellent dynamic response or high accuracy, Schaeffler Industrial Drives additionally recommends the use of a temperature control system (heating or cooling) for the surrounding structure or the secondary part. A rotary mainfold is typically used to cool the bearing and secondary part. Temperature control of the surrounding structure helps to minimise thermal distortion of the machine structure and the effect on the bearing preload, thereby increasing accuracy.

Continuous torques of torque motors with liquid cooling on the primary part are up to 300 % higher than in uncooled operation. To achieve high continuous torques, torque motors are operated with liquid cooling in most applications.

The design of motor cooling is influenced by the following factors:

- installation space
- accuracy requirements
- thermal sensitivity of the surrounding structure
- required speeds

1.7.2 Cooling media and their effect on cooling

The information in the performance data is based on water as the cooling medium. However, water requires additives that prevent corrosion and biological deposits in the cooling circuit. Use of a cooling medium that differs greatly from water has the effect of reducing the amount of heat that can be dissipated and thus also of changing the continuous torque, cooled T_{cw}, that is available in continuous operation. Upon request, Schaeffler Industrial Drives can provide help with sizing the application and determining the achievable motor data.

For sizing with a customer-specific cooling medium, the following information is required:

- type and density
- specific heat capacity
- kinematic viscosity
- technical data sheet with constituent substances

If cooling media with a significantly higher viscosity than that of water are used, the effect on the cooling must be checked before use. Motor parameters such as $I_{cw\ eff}$ or T_{cw} may need to be adjusted. Data for the medium used must be used and expected temperatures must be taken into account.

Water

Water is the most commonly used cooling medium. Water has a high specific heat capacity and is inexpensive. Water with additives that prevent corrosion and biological deposits in the cooling circuit is preferable to all other cooling media. Additives such as COOL CONCENTRATE or COOL X hardly affect properties such as density and viscosity. Water with one of these additives is a very efficient cooling medium with a specific heat capacity of 4,1 kJ/kg · K. This value approximately corresponds to the value for water.

8 Material properties of water

Temperature	Density [1]	Specific heat capacity	Dynamic viscosity	Kinematic viscosity
°C	kg/m³	kJ/kg · K	Pa · s	mm²/s
+20 [2]	998,21	4,1840	0,0010014	1,00319572
+25	997,05	4,1813	0,00088982	0,892452736
+30	995,65	4,1798	0,00079705	0,800532316

[1] According to DIN 1306, secondary conditions such as air pressure and gravitational acceleration apply 1 g, pressure p_n = 1,01325 bar

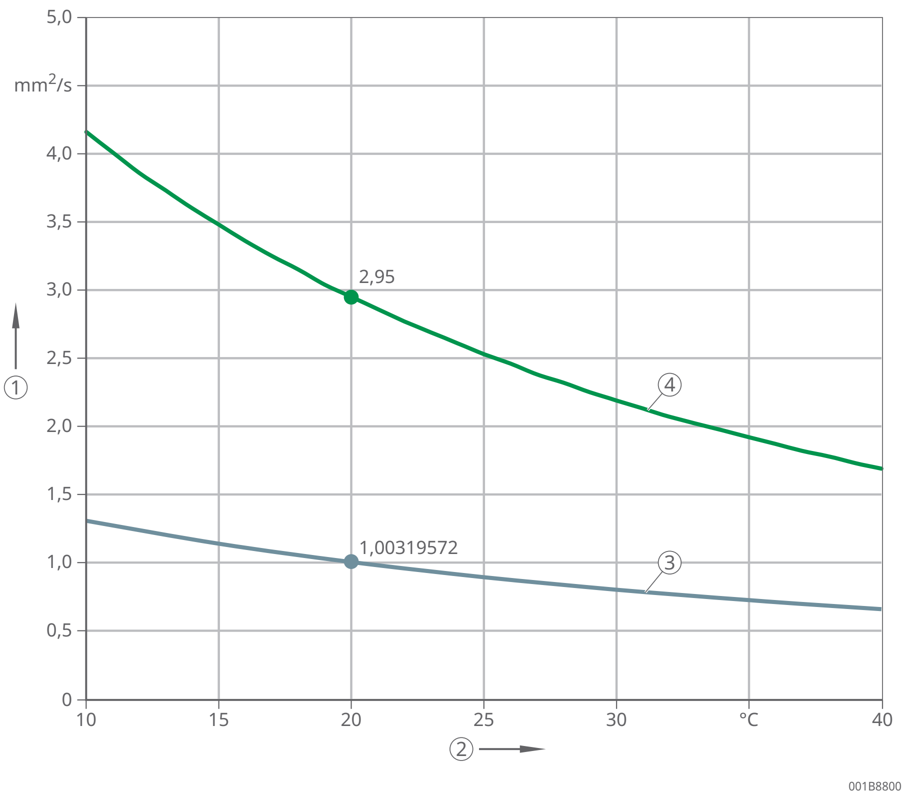
[2] Reference temperature.

Water–glycol mixture

A mixture of water and glycol has a lower freezing point than that of water and prevents corrosion. This mixture is often used for cold environments or applications in which frost protection is required. Due to the higher viscosity of the water–glycol mixture compared with that of pure water, there is a higher pressure loss in the pipe system. The circulating pump must deliver a correspondingly higher pressure.

1

10 Dependence of kinematic viscosity on temperature



1	Kinematic viscosity	2	Temperature
3	Cooling medium: 100% water	4	Cooling medium: 60% water, 40% ethylene glycol

Example:

A mixture of 40 % ethylene glycol, e.g. Antifrogen N, and 60 % water has a freezing point of –25 °C and a kinematic viscosity that is 2,95 times higher than that of water. The recommended flow rate can only be achieved with a significantly higher pressure. Correction factors can be used for a rough estimate.

9 Correction factors for ethylene glycol

Concentration	Freezing point	Correction factor for pressure difference
%	°C	–
20	–9	1,14
30	–16	1,23
40	–25	1,33
44	–30	1,38

The exact values for the cooling medium used must always be observed.

Oils

Oils are used as cooling media in some industrial applications. The application determines which oil is the right one. If oil is used, the volume flow necessary for cooling must always be achieved.

Upon request, Schaeffler Industrial Drives can provide help with sizing. The chemical compatibility of all components must be checked by the customer.

1.7.3 Influence of nominal data on the supply temperature and cooling medium

The specified continuous current for cooled operation $I_{cw\ eff}$ refers to the nominal cooling water feed temperature ϑ_{nf}.

The continuous current $I_{cw\ eff}$ is specified in the performance data ➤41 | 2.2.

Higher supply temperatures ϑ_f reduce the cooling capacity and, thus, also the continuous current. The reduced continuous current $I_{c\ red}$ is calculated from the following quadratic relationship:

𝑓2 Reduced continuous current

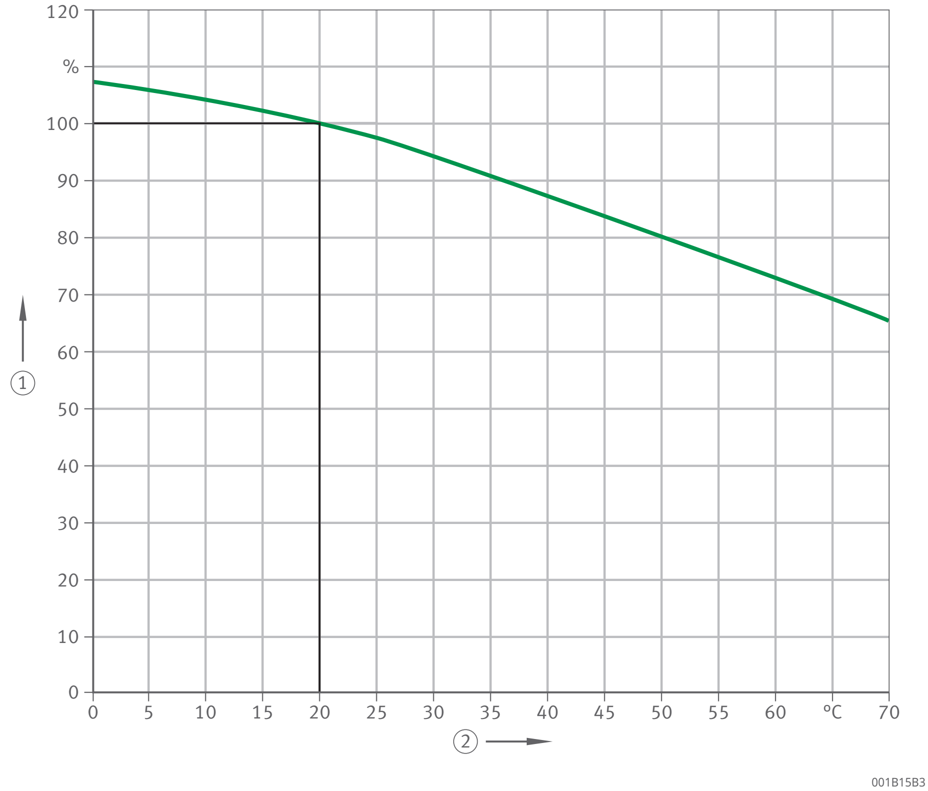
$$\frac{I_{c\ red}}{I_{cw\ eff}} = \sqrt{\frac{\vartheta_{max} - \vartheta_f}{\vartheta_{max} - \vartheta_{nf}}}$$

$I_{c\ red}$	A	Reduced continuous current
$I_{cw\ eff}$	A	Effective continuous current, cooled
ϑ_{max}	°C	Max. permissible winding temperature
ϑ_{nf}	°C	Nominal feed temperature
ϑ_f	°C	Current feed temperature

If customer-specific cooling media are used, the amount of waste heat that can be dissipated and, thus, also the cooled continuous torque that is available during continuous operation are changed. Upon request and with specification of the substance properties, engineers from Schaeffler Industrial Drives can determine the effect of the cooling medium used.

1

11 Relative continuous current $I_{c\ red}$ / $I_{cw\ eff}$ as a function of supply temperature ϑ_f
(ϑ_{nf} = +20 °C)



1	Relative continuous current $I_{c\ red}$ / $I_{cw\ eff}$ in %	2	Actual supply temperature ϑ_f
$I_{c\ red}$	Reduced continuous current	ϑ_{nf}	Nominal feed temperature
$I_{cw\ eff}$	Continuous current, cooled		

1.8 Arrangement of motors

1.8.1 Operating several motors in parallel on one axis

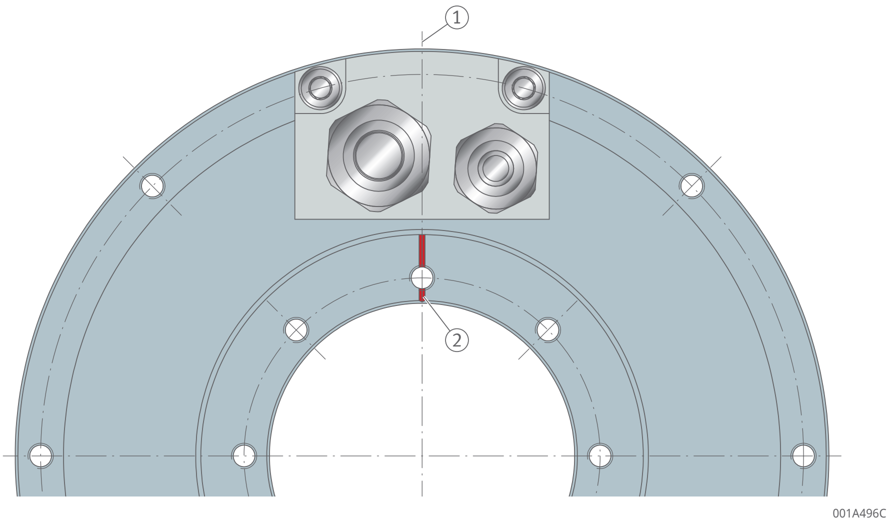
Driving an axis simultaneously with 2 or more synchronous motors makes sense in some applications. Such applications include pivot systems in five-axis machining centres, fork-type milling heads or machine spindles for hobbing machines. Identically built synchronous motors connected in parallel can be operated together on a converter. Only low speeds allow for satisfactory synchronisation quality if two torque motors are operated in parallel on one axis. Therefore, in practice, only torque motors in the RIB series are used for parallel operation. RIB series torque motors are slower than RKIB series torque motors.

1.8.2 Arrangement of motors

A distinction is made between the parallel tandem arrangement and the anti-parallel, i.e. mirrored, Janus arrangement of the primary parts.

Secondary part alignment

12 Zero axis and rotary markings in alignment



1 Zero axis	2 Secondary part (rotor) marking

In parallel operation, secondary parts must be aligned in the same angular position, regardless of the arrangement. The respective secondary part markings can be used for alignment.

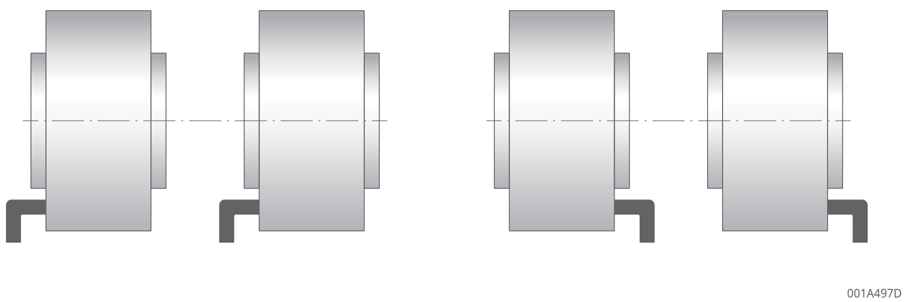
Primary part alignment

The aim is to align the coils of each phase in the same angular position. The primary part can be aligned using the zero axis. In a standard RIB motor with a single cable outlet, the zero axis is located between the holes on the cable clamp. In the case of customer-specific or multiple cable outlets, Schaeffler Industrial Drives must be consulted to determine the zero axis.

! Before parallel operation can be planned, Schaeffler Industrial Drives must be contacted.

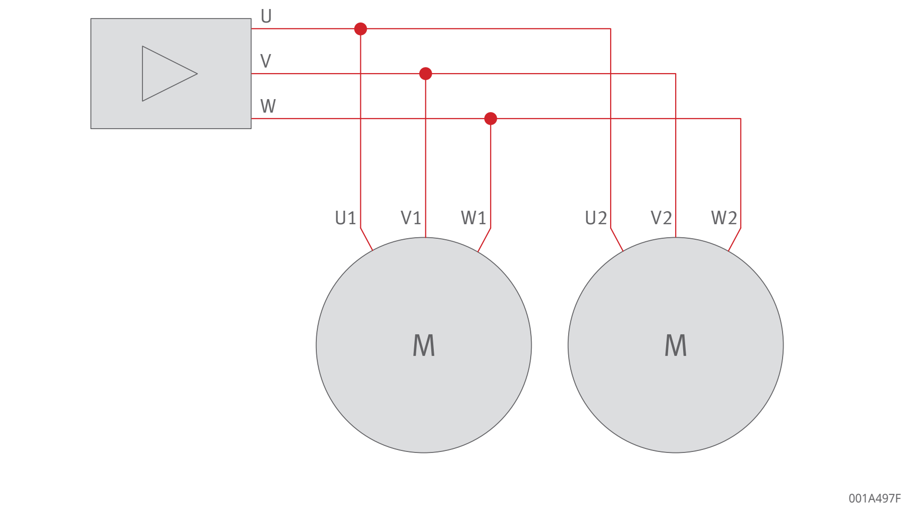
Tandem arrangement

13 Tandem arrangement



The cable outlets point in the same longitudinal direction.

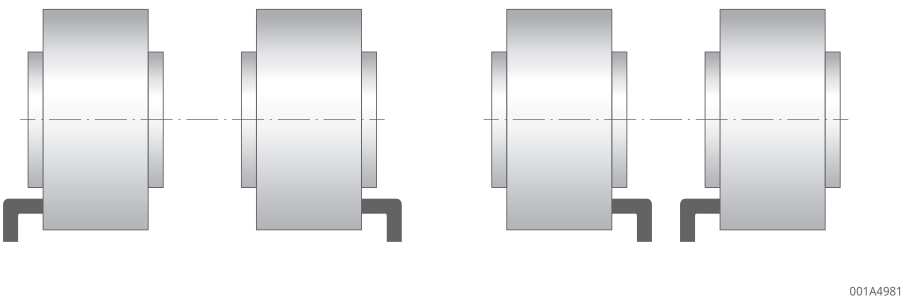
14 Tandem arrangement



The zero axes of the primary parts are also aligned with the cable outlets. In the case of flush coaxial cable outlets, the bolt circles must be concentrically arranged and the phase connections of the same names must be lined up.

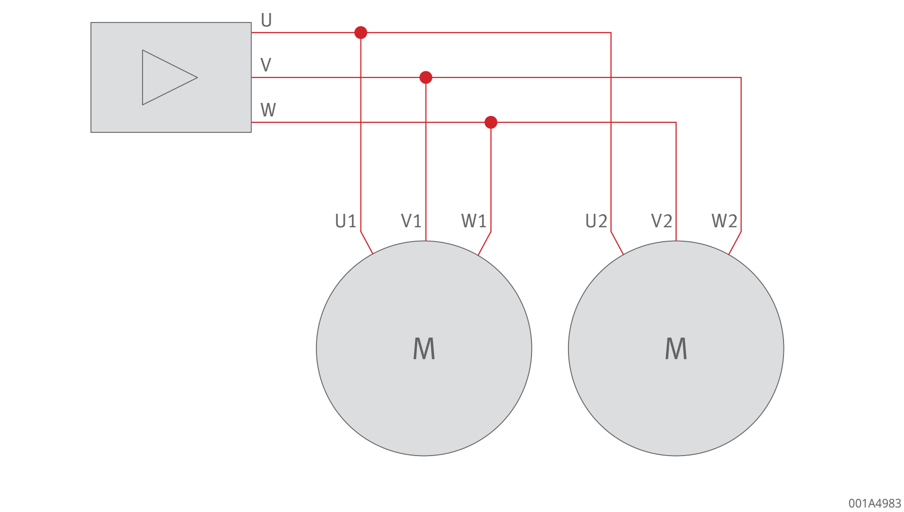
Janus arrangement

15 Janus arrangement



The cable outlets point in opposite longitudinal directions.

16 Janus arrangement



The zero axes must also match in the mirrored Janus arrangement. Depending on the position of the zero axis, it may be necessary to offset the bolt circles. Motors in a mirrored arrangement must work in the opposite direction of rotation. For this purpose, the phases V and W are interchanged on one of the two motors. As a result, the phases U1 and U2, V1 and W2 and W1 and V2 are connected together to the converter ➤28 | 16.

1.9 Operating several motors in parallel on one axis

1.9.1 Displacement of the cable outlet

In all arrangements, the primary parts and thus the cable outlets can be twisted relative to each other in steps of a certain size. Particularly in the Janus arrangement with internal cable outlets, it is possible to design a shorter overall axis by twisting the primary parts. The step size corresponds to a pair of poles and must be multiplied by an integer factor.

The twist angle is calculated as follows:

3 Torsion angle

$$\text{Torsion angle} = \frac{360°}{\text{Number of pole pairs}} \cdot x$$

x	–	any integer factor

In some series, a favourable twist angle is also achievable in the bolt circle, e.g. RIB11-3P-230xH:

4 Torsion angle in bolt circle

$$\text{Torsion angle} = \frac{360°}{22} \cdot 11 = 180°$$

1.9.2 Setting the phase coincidence

In all cases, it should be checked whether the parallel motors are aligned in phase with each other. If the phases are not aligned, there will be a speed-related decrease in torque constant and efficiency due to induced short-circuit currents.

Phase alignment is done through measurement of the back EMFs of the motors using a two-channel oscilloscope with simultaneous rotation of the connected secondary parts. In order for a good static function of the interconnected motors to be achieved, the phase offset between the two curves must not exceed ±5°. Mechanical adjustment of a secondary part or primary part can cancel out an existing electrical phase offset between the motors.

The following applies:

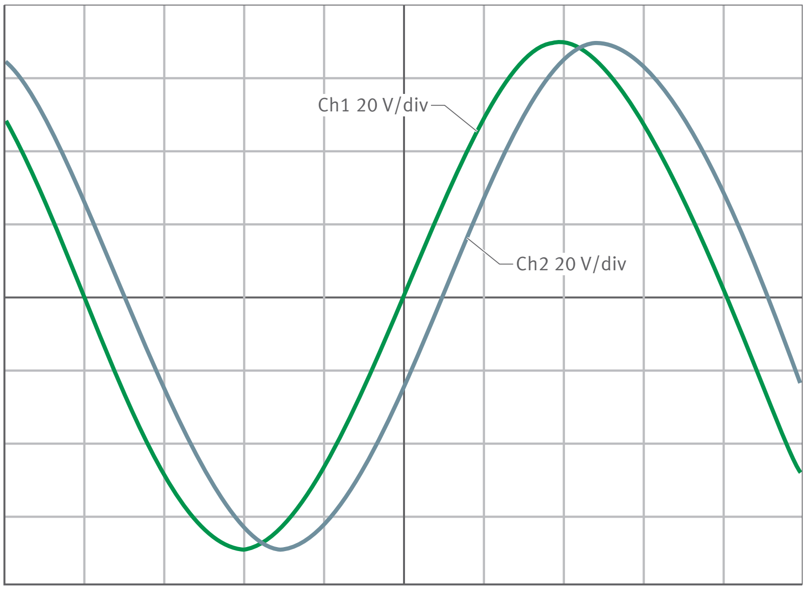
5 Mechanical angle theorem

$$\text{Mechanical angle set} = \frac{\text{Phase offset}}{\text{Number of pole pairs}}$$

With correct installation, clearance in the bolt circle bolted joint corresponding to the medium tolerance class EN 20273 is sufficient for fine adjustment. If more than two motors are connected in parallel, one is defined as the master and thus as the reference point for aligning all of the remaining motors.

1

17 Phase offset 22,5° between the back EMFs

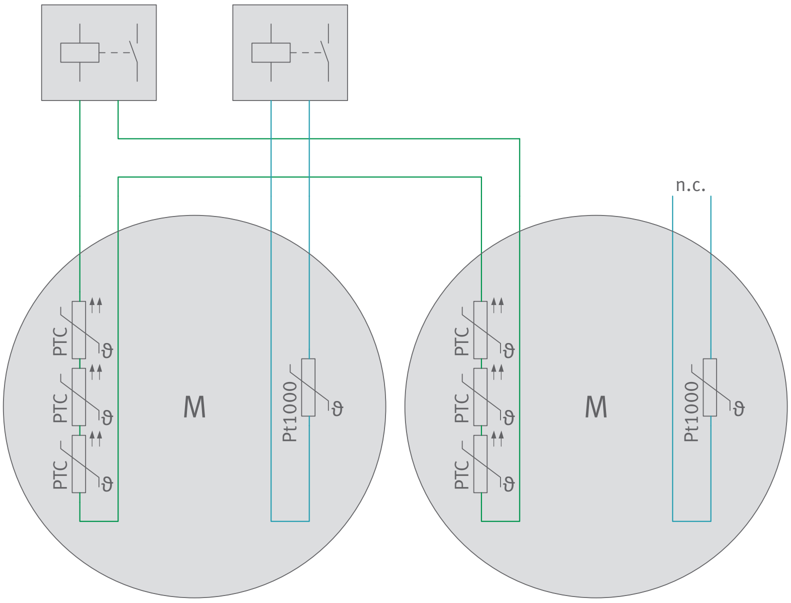


1.9.3 Evaluation of the temperature sensors

Incorrect or inaccurate alignment of the motors to each other may cause thermal overload of a motor. Integrated PTC sensors serve to protect the motor. The PTC sensors for each motor in the arrangement are connected in series and evaluated by a thermistor motor protection relay.

To prevent premature tripping of the motor protection system, Schaeffler Industrial Drives recommends using several or multi-channel thermistor motor protection relays in the event of three or more PTC monitoring circuits.

18 Connection of temperature sensors for several motors



1.9.4 Resulting motor data

The parallel connection of structurally identical, individual motors results in new electrical data for the converter on the current replacement motor. These electrical data can easily be determined from the following data for the individual motors:

- The number of pole pairs, torque constant, voltage constant, time constant and speeds remain unchanged.
- Currents, torques and damping constant multiply with the number of individual motors.
- Resistance and inductance are divided by the number of individual motors.

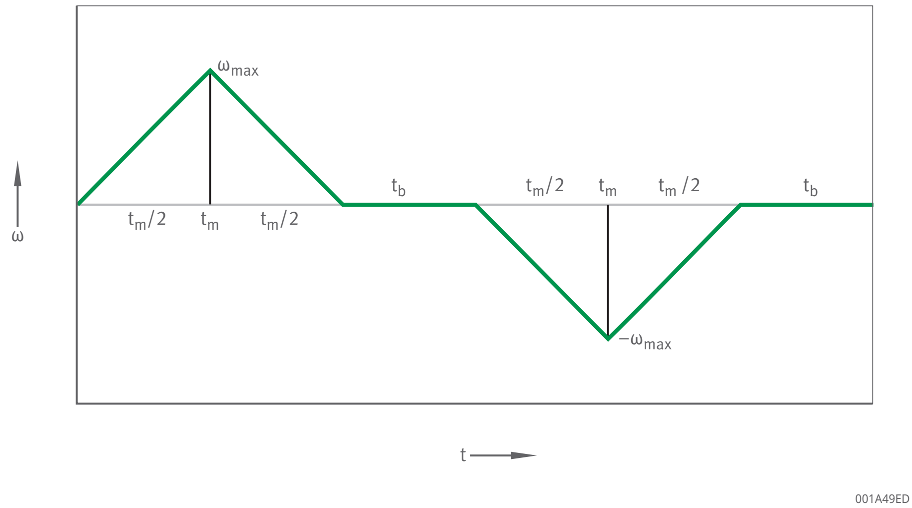
1.10 Selection of direct drives for rotary applications

1.10.1 Cycle applications

Cyclic operation consists of successive positioning movements with movement breaks in between. A simple positioning action takes the form of a positively accelerated movement and subsequent braking. If the value for negative acceleration is the same, then the acceleration time and braking time are the same. The maximum angular velocity ω_{max} is reached at the end of an acceleration phase.

A cycle is described in the ω-t diagram. The ω-t diagram for cyclic operation shows a forward/backward rotation with breaks.

19 ω-t- diagram for cycle operation



ω	Angular velocity	t	Time
t_m	Movement time	t_b	Pause time
ω_{max}	Max. angular velocity		

The α-t diagram for cyclic operation and the curve of the torque required for the movement are obtained from the forward/backward rotation with breaks:

6 Torque

$$T = J \cdot \alpha$$

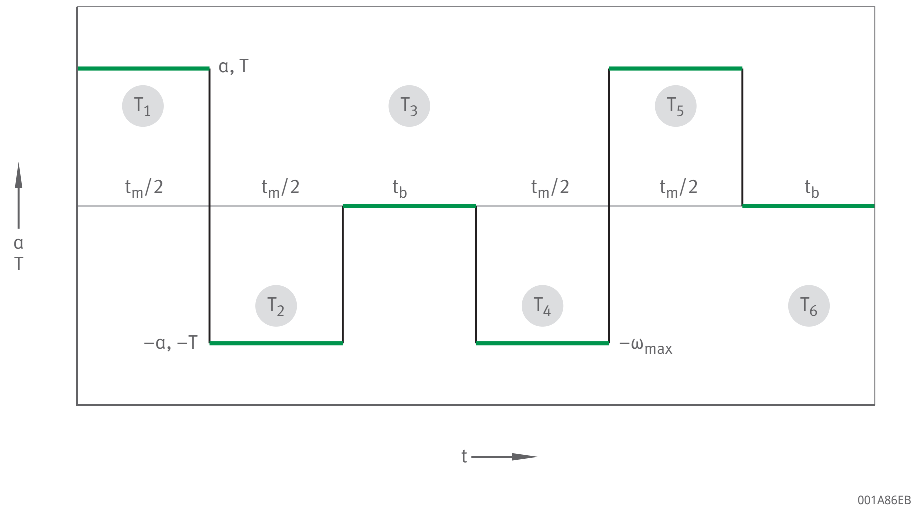
T	Nm	Torque
J	$kg \cdot m^2$	Mass moment of inertia
α	rad/s^2	Angular acceleration

1

Motor selection takes place on the basis of the following three criteria in accordance with the torque profile for a required cycle:

- max. torque in cycle ≤ T_p according to the performance data ➤41 | 2.2
- effective torque in cycle ≤ T_c (motor not cooled) or T_{cw} (water cooling) according to the performance data ➤41 | 2.2
- max. speed in cycle ≤ n_{lp} according to the performance data ➤41 | 2.2

20 α–t diagram for cyclic operation



α	Angular acceleration	t	Time
t_m	Movement time	t_b	Break time
ω_{max}	Max. angular velocity	T	Torque
T_1	Torque step 1, $T_1 = T$	T_2	Torque step 2, $T_2 = -T$
T_3	Torque step 3, $T_3 = 0$	T_4	Torque step 4, $T_4 = -T$
T_5	Torque step 5, $T_5 = T$	T_6	Torque step 6, $T_6 = 0$

The effective torque is equal to the root mean square of the torque profile consisting of six torque steps in the cycle.

7 Effective torque

$$T_{eff} = \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + \ldots + T_6^2 \cdot t_6}{t_1 + t_2 + \ldots + t_6}}$$

T_{eff}	Nm	Effective torque
T_1	Nm	Torque step 1, $T_1 = T$
t_1	s	Movement time 1, $t_1 = t_m/2$
T_2	Nm	Torque step 2, $T_2 = -T$
t_2	s	Movement time 2, $t_2 = t_m/2$
T_6	Nm	Torque step 6, $T_6 = 0$
t_6	s	Movement time 6, $t_6 = t_b$

We recommend a safety factor of 1,4 for the torques. The safety factor takes into account conditions such as motor operation in the non-linear range of the torque–current characteristic curve, for which the calculation equation for T_{eff} only applies in approximate terms.

The effective torque can be calculated with the following torques:

- $T_1 = T$
- $T_2 = -T$
- $T_3 = 0$
- $T_4 = -T$
- $T_5 = T$
- $T_6 = 0$

The effective torque can be calculated with the following times:

- $t_1 = t_m/2$
- $t_2 = t_m/2$
- $t_3 = t_b$
- $t_4 = t_m/2$
- $t_5 = t_m/2$
- $t_6 = t_b$

8 Effective torque

$$T_{eff} = T \cdot \sqrt{\frac{t_m}{t_m + t_b}}$$

T_{eff}	Nm	Effective torque
T	Nm	Torque
t_m	s	Movement time
t_b	s	Pause time

9 Effective torque

$$T_{eff} = J \cdot \alpha \cdot \sqrt{\frac{t_m}{t_m + t_b}}$$

T_{eff}	Nm	Effective torque
J	$kg \cdot m^2$	Mass moment of inertia
α	rad/s^2	Angular acceleration
t_m	s	Movement time
t_b	s	Pause time

If only torques of the same magnitude take effect in the cycle, this equation applies to the effective torque ➤33 | 9. Mass moment of inertia and angular accelerations are constant. The movement time divided by the sum of the movement time and break time goes underneath the root. The cycle time is included in the denominator.

Angular acceleration, max. angular velocity and max. rotational speed of a positioning movement can be calculated with the following:

10 Angular acceleration

$$\alpha = \frac{4 \cdot \varphi}{t_m^2}$$

α	rad/s^2	Angular acceleration
φ	°	Movement angle
t_m	s	Movement time

1

ƒ11 Max. angular velocity

$$\omega_{max} = \frac{2 \cdot \varphi}{t_m}$$

t_m	s	Movement time

ƒ12 Max. speed

$$n_{max} = \frac{30}{\pi} \cdot \omega_{max}$$

The calculation method shown here is idealised and simplified. For example, the increase in angular acceleration is infinitely high. In practice, angular acceleration is limited by motor inductance or other components. Safety factors or, in the case of highly dynamic movements, additional times of 15 ms to 20 ms per positioning operation are used to account for these effects in the design.

1.10.2 Example of cycle applications

10 Specified values

Specified values	Unit	Value
Movement angle φ	°	180
Movement time t_m	s	0,5
Cycle time $t_m + t_b$	s	1,35
Mass moment of inertia J	$kg \cdot m^2$	2,5
Frictional torque T_F	Nm	8
Safety factor SF	–	1,4

Calculation

Movement angle conversion:

ƒ13 Movement angle conversion

$$\varphi = \frac{\pi}{180} \cdot 180 \text{ rad} = 3{,}142 \text{ rad}$$

φ	°	Movement angle

Max. angular velocity:

ƒ14 Max. angular velocity

$$\omega_{max} = \frac{2 \cdot \varphi}{t_m} = \frac{2 \cdot 3{,}142}{0{,}5} \text{ rad/s} = 12{,}57 \text{ rad/s}$$

ω_{max}	rad/s	Max. angular velocity
φ	°	Movement angle
t_m	s	Movement time

1

Max. speed:

15 Max. speed

$$n_{max} = \frac{30}{\pi} \cdot \omega_{max} = \frac{30}{\pi} \cdot 12{,}57\ 1/s = 120\ min^{-1}$$

n_{max}	min^{-1}	Max. speed
ω_{max}	rad/s	Max. angular velocity

Angular acceleration:

16 Angular acceleration

$$\alpha = \frac{4 \cdot \varphi}{t_m^{\ 2}} = \frac{4 \cdot 3{,}142}{0{,}5^2}\ rad/s^2 = 50{,}27\ rad/s^2$$

α	rad/s^2	Angular acceleration
φ	°	Movement angle
t_m	s	Movement time

Taking into account the bearing frictional torque T_F, the maximum torque is obtained as follows:

17 Max. torque

$$T_{max} = (J \cdot \alpha) + T_F = (2{,}5 \cdot 50{,}27) + 8 = 133{,}68\ Nm$$

T_{max}	Nm	Max. torque
J	$kg \cdot m^2$	Mass moment of inertia
α	rad/s^2	Angular acceleration
T_F	Nm	Bearing frictional torque

Effective torque, taking into account the bearing frictional torque T_F:

18 Effective torque, taking into account the bearing frictional torque

$$T_{eff} = \left(J \cdot \alpha \cdot \sqrt{\frac{t_m}{t_m + t_b}}\right) + T_F = \left(2{,}5 \cdot 50{,}27 \cdot \sqrt{\frac{0{,}5}{1{,}35}}\right) + 8 = 84{,}48\ Nm$$

T_{eff}	Nm	Effective torque
J	$kg \cdot m^2$	Mass moment of inertia
α	rad/s^2	Angular acceleration
t_m	s	Movement time
t_b	s	Pause time
T_F	Nm	Bearing frictional torque

Taking into account the safety factor SF, the motor is selected according to the following requirements.
$T_{safe\ max} = T_{max} \times 1{,}4 \leq T_P$
$T_{safe\ eff} = T_{eff} \times 1{,}4 \leq T_{cw}$
$n_{max} \leq n_{lp}$

A safety factor for speed is only required when using frequency inverters with an unstabilised DC link voltage ➤11 | 1.4.3. In the present case, a frequency inverter with a stabilised DC link voltage of U_{DCL} = 600 V is used. It is therefore permissible to work without a safety factor for speed, and $n_{max} \leq n_{lp}$ applies. If $n_{max} > n_{lp}$, the operating point $T_{safe\ max}$ at n_{max} can be verified using the torque–speed characteristic curve at the corresponding DC link voltage.

1

The calculation results in the following motor requirements:

Without safety factor:

- T_p = 133,68 Nm
- T_{cw} = 84,48 Nm

With safety factor:

- $T_{safe\ max}$ = 187,15 Nm
- $T_{safe\ eff}$ = 118,27 Nm

Motor RIB17-3P-168x50-Z0.7 with T_p = 233 Nm, T_{cw} = 123 Nm and n_{lp} = 150 min^{-1} meets the requirement in the sample calculation in full.

1.10.3 NC rotary table applications

For water-cooled rotary table applications, the speed n, moment of inertia J, processing torque in motion T_W and stall torque T_{sw} as well as the angular accelerations α in S1 operation and α_{max} in S6 operation are usually known. Although the effective times of the torques change on a frequent basis, determining the effective torque as a continuous torque and the maximum torque as accurately as possible is necessary in order to select the optimal motor and to prevent exceeding of the maximum permissible winding temperature.

All load torques occurring during motor operation are incorporated into the torque calculation.

1.10.4 Example of NC rotary table applications

11 Specified values

Specified values	Unit	Value
Speed n	min^{-1}	60
Mass moment of inertia J	kg · m^2	4
Processing torque T_W	Nm	300
Frictional torque T_F	Nm	50
Weight force (additional torque) T_Z	Nm	0
Angular acceleration in S1 mode α_{S1}	°/s^2	9000
Max. angular acceleration in S6 operation for 3 s α_{max}	°/s^2	20000
Safety factor SF	–	1,4

Calculation

Conversion of angular acceleration into rad/s^2:

19 Angular acceleration

$$\alpha_{S1} = \frac{\pi}{180} \cdot \alpha_{S1}\left[°/s^2\right] = \frac{\pi}{180} \cdot 9000 = 157\ rad/s^2$$

α_{S1}	rad/s^2	Angular acceleration in S1 operation

20 Max. angular acceleration

$$\alpha_{max} = \frac{\pi}{180} \cdot \alpha_{max}\left[°/s^2\right] = \frac{\pi}{180} \cdot 20000 = 349\ rad/s^2$$

α_{max}	rad/s^2	Max. angular acceleration

Motor selection is based on the cooled stall torque T_{sw} and on the torques in motion for S1 operation, T_{cw}, and S6 operation, T_p. The safety factor SF of 1,4 ensures that the position can be reliably maintained and the control system safely responds to deviations.

ƒ21 Cooled stall torque, with water cooling

$$T_{sw} = \left(T_W + T_F + T_Z\right) \cdot 1{,}4 = 490\,\mathrm{N}$$

T_{sw}	Nm	Stall torque, cooled
T_W	Nm	Processing torque
T_F	Nm	Bearing frictional torque
T_Z	Nm	Weight force (additional torque)

ƒ22 Cooled continuous torque, with water cooling

$$T_{cw} = \left(J \cdot \alpha_{S1} + T_W + T_F + T_Z\right) \cdot 1{,}4 = 1369\,\mathrm{N}$$

T_{cw}	Nm	Continuous torque, cooled
J	$kg \cdot m^2$	Mass moment of inertia
α_{S1}	rad/s^2	Angular acceleration in S1 operation
T_W	Nm	Processing torque
T_F	Nm	Bearing frictional torque
T_Z	Nm	Weight force (additional torque)

ƒ23 Peak torque

$$T_p = \left(J \cdot \alpha_{max} + T_W + T_F + T_Z\right) \cdot 1{,}4 = 2444\,\mathrm{N}$$

T_p	Nm	Peak torque
J	$kg \cdot m^2$	Mass moment of inertia
α_{max}	rad/s^2	Max. angular acceleration
T_W	Nm	Processing torque
T_F	Nm	Bearing frictional torque
T_Z	Nm	Weight force (additional torque)

The calculation results in the following requirements:

T_p = 2444 Nm

T_{cw} = 1369 Nm

Motor RIB13-3P-690×50-Z4.2 with T_p = 3627 Nm, T_{cw} = 2166 Nm and n_{lp} = 61 min^{-1} meets the requirements in the sample calculation in full.

Speed control is used in this example. The NC rotary table should first start at a defined speed. The NC rotary table then processes the workpiece at this speed.

If a positioning operation is additionally required, as in the case of so-called reversers in position control, the required speed at T_P must be increased by a safety factor of 10 % to 20 %. The limiting speed n_{lp} of the motor must then be greater than the calculated speed complete with additional value.

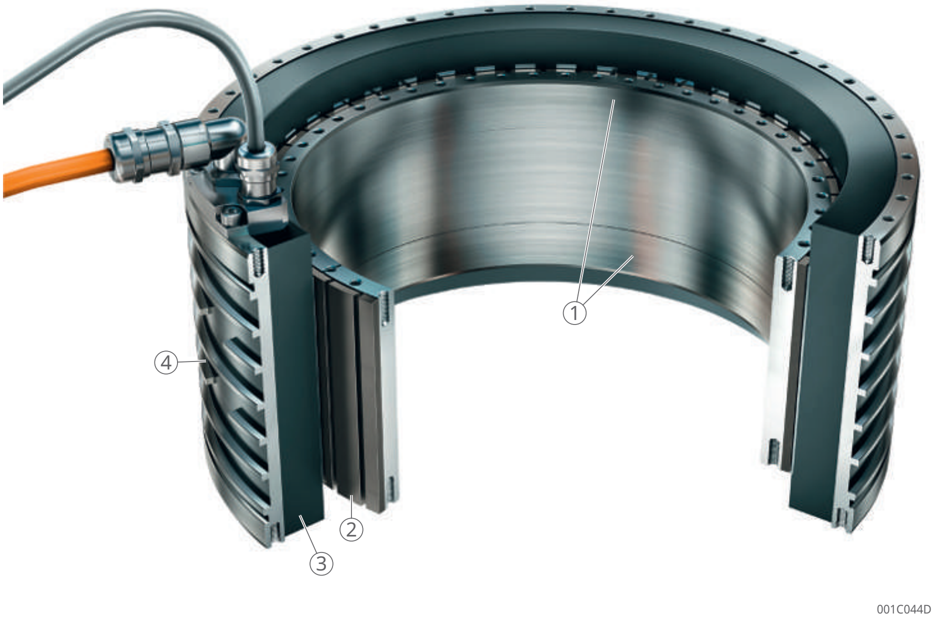
2

2 RIB torque motors

RIB torque motors are permanently excited synchronous motors with internal secondary parts.

The primary part is a laminated iron core fully encapsulated stator with external liquid cooling. The secondary part is made up of a steel ring with permanent magnets glued on in a radial arrangement. The steel ring provides the magnetic return path. The secondary part can be centred from both sides on the inner diameter and fastened at the end faces.

21 Design of the RIB torque motors



1	Secondary part: centring	2	Secondary part: steel return path ring with glued-on magnets
3	Primary part: laminated core with coils and encapsulation	4	Primary part: steel housing with cooling meander

Motors of this series are very efficient. They have high torque and low power losses at rated speed. The effective torque is available over a very large range. RIB torque motors are designed for circumferential speeds of up to 10 m/s. The low torque fluctuations allow the motors to be used for precision applications.

RIB torque motors have the following features:

- available in standard sizes
- active primary part heights in 25-mm steps
- various standard windings for different speeds
- 3 standard cable outlets possible

12 Standard cable outlets

Axial cable outlet	Tangential cable outlet	Radial cable outlet
		

Advantages:

- optimised for low power loss
- excellent dynamic response and high rigidity
- compact design
- maintenance-free
- good synchronisation characteristics
- reduced energy consumption courtesy of converter-based and application-based winding designs
- cost savings possible through downsizing
- high machine accuracy due to reduced heat from the motor

Applications:

- machine tools
- NC rotary tables
- indexing tables
- radial precision tracking units
- automation technology
- printing machinery
- packaging machinery
- servo presses

2.1 RIB ordering designation

22 RIB series, primary part

RIB XX – 3P – D×H – XX – P – O – M – PRIM

Short designation, motor
RIB Rotary, internal, Generation B

Type code
XX Type code

Number of motor phases
3P 3-phase

Size
D×H Effective air gap diameter × active height

Winding design
XX Application-specific

Temperature monitoring
P 3 PTC and 1 Pt1000
T 3 PTC and 3 Pt1000

Commutation type
O Without sensors, measuring system commutated

Design variant
M Standard built-in component
K With cooling in the ring
Note: additional ring provided by Schaeffler Industrial Drives

Motor part
PRIM Primary part

001CA07A

23 RIB series, secondary part

RI XX – 3P – D×H – M – SEK

Short designation, motor
RI Rotary, internal

Type code
XX Type code

Number of motor phases
3P 3-phase

Size
D×H Effective air gap diameter × active height

Design variant
M Standard built-in component

Motor part
SEK Secondary part

001CA08A

2.2 Product tables

2.2.1 Explanations

$\Delta\vartheta$	K	Cooling water temperature difference
dV/dt	l/min	Volume flow
F_a	kN	Axial attraction
F_r	kN/mm	Radial attraction
H_P	mm	Height of primary part
H_S	mm	Height of secondary part
$I_{c\ eff}$	A	Effective continuous current, not cooled
$I_{cw\ eff}$	A	Effective continuous current, cooled
$I_{p\ eff}$	A	Effective peak current
$I_{sw\ eff}$	A	Effective stall current, cooled
$I_{u\ eff}$	A	Effective ultimate current
J	$kg \cdot m^2$	Moment of inertia, secondary part
k_m	Nm/√W	Motor constant for torque motors
k_T	Nm/A	Torque constant
$k_{\hat{u}}$	V/(rad/s)	Back EMF constant, phase to phase
L	mH	Inductance, phase to phase
m_P	kg	Mass of primary part
m_S	kg	Mass of secondary part
n_{lp}	min^{-1}	Limiting speed at $I_{p\ eff}$ and U_{DCL}
n_{lw}	min^{-1}	Knee speed
n_{lwS1}	min^{-1}	Rated speed S1, cooled
n_P	–	Thread number, primary part
n_{PC}	–	Primary part thread number, cable side
n_S	–	Secondary part thread number
P	–	Number of pole pairs
P_{lc}	W	Power loss at T_c
P_{lp}	W	Power loss at T_p
P_{lw}	W	Power loss at T_{cw}
R_{20}	Ω	Electrical resistance, phase to phase
T_c	Nm	Continuous torque, not cooled
T_{cog}	Nm	Cogging torque
T_{cw}	Nm	Continuous torque, cooled
TD_P	mm	Thread depth, primary part
TD_{PC}	mm	Thread depth, primary part, cable side
TD_S	mm	Thread depth, secondary part
T_p	Nm	Peak torque
TP_P	°	Thread pitch, primary part
TP_{PC}	°	Thread pitch, primary part, cable side
TP_S	°	Thread pitch, secondary part
TS_P	–	Thread size, primary part
TS_{PC}	–	Thread size, primary part, cable side
TS_S	–	Thread size, secondary part
T_{sw}	Nm	Stall torque, cooled
T_u	Nm	Ultimate torque
U_{DCL}	V	DC link voltage
ϑ_{nf}	°C	Nominal feed temperature
ϑ_{PTC}	°C	Motor temperature switch-off threshold

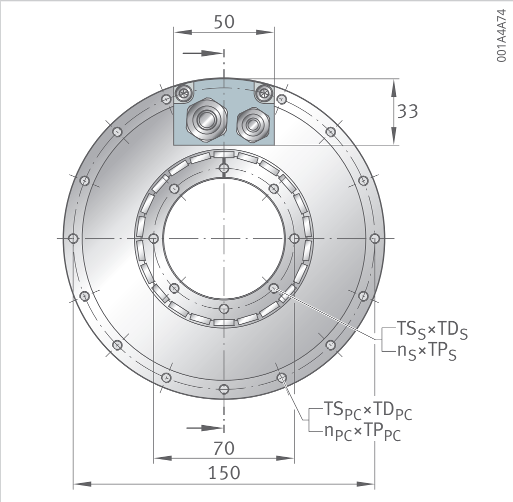
Tolerance range of the values: ±10 %.

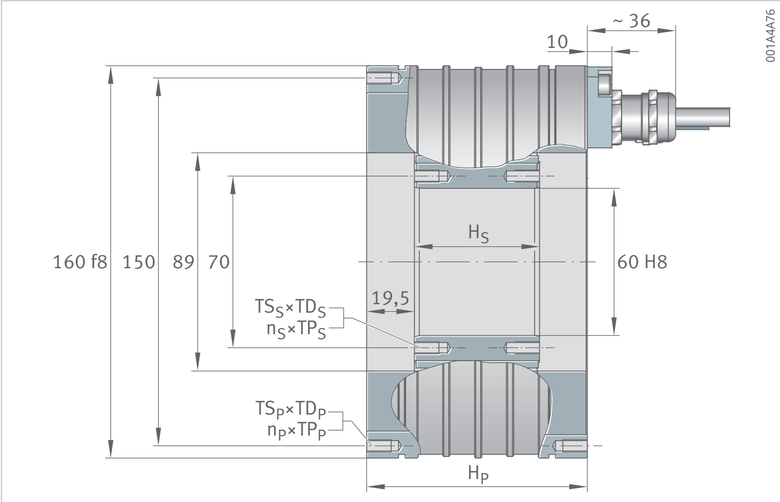
Binding data and drawings will be made available by agreement. We recommend obtaining support from our engineers in the motor design phase.

2.2.2 RIB11-3P-89xH
Geometric data

2

Size			89×25
Mass, secondary part	m_S	kg	0,5
Mass, primary part	m_P	kg	5,1
Height, secondary part	H_S	mm	26
Height, primary part	H_P	mm	70
Thread, secondary part	$TS_S \times TD_S$	–	M5×10
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	8×45
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M5×10
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	15×22,5
Thread, primary part	$TS_P \times TD_P$	–	M5×10
Thread, primary part, number×pitch	$n_P \times TP_P$	°	16×22,5

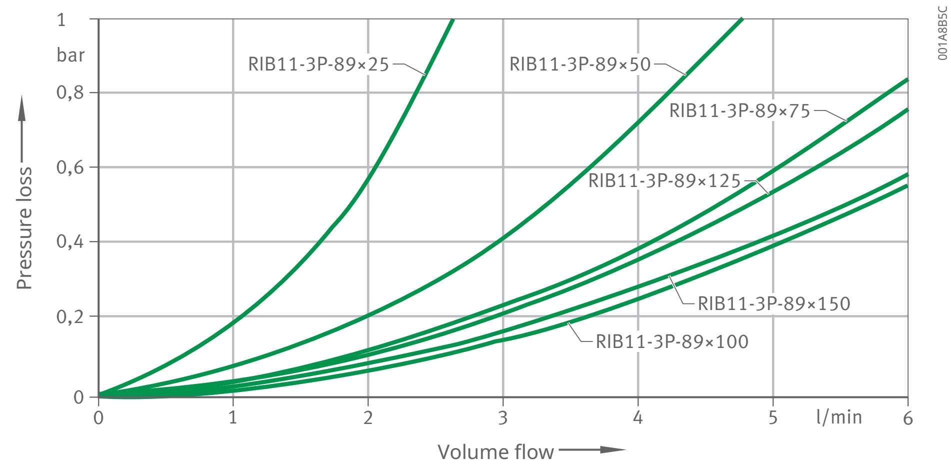




89×50	89×75	89×100	89×125	89×150
1,1	1,6	2,2	2,7	3,2
7,2	9,3	11,8	14,1	16,3
51	76	101	126	151
90	110	140	165	190
M5×10	M5×10	M5×10	M5×10	M5×10
8×45	8×45	16×22,5	16×22,5	16×22,5
M5×10	M5×10	M5×10	M5×10	M5×10
15×22,5	15×22,5	15×22,5	15×22,5	15×22,5
M5×10	M5×10	M5×10	M5×10	M5×10
16×22,5	16×22,5	16×22,5	16×22,5	16×22,5

2.2.3 RIB11-3P-89xH
Performance data

Size				89×25	89×25	89×50
Winding design				**Z0.9**	**Z1.7**	**Z0.9**
Torques	Ultimate torque	T_u	Nm	33	33	72
	Peak torque	T_p	Nm	30	30	67
	Continuous torque, cooled	T_{cw}	Nm	19	19	42
	Continuous torque, not cooled	T_c	Nm	7	7	15
	Stall torque, cooled	T_{sw}	Nm	14	14	32
	Cogging torque	T_{cog}	Nm	0,1	0,1	0,21
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{Ip}	min^{-1}	880	1829	438
	Knee speed	n_{Iw}	min^{-1}	1668	3419	790
	Rated speed S1, cooled	n_{IwS1}	min^{-1}	682	682	682
Currents	Effective ultimate current	$I_{u\ eff}$	A	21,1	42,2	21,1
	Effective peak current	$I_{p\ eff}$	A	16,9	33,8	16,9
	Effective continuous current, cooled	$I_{cw\ eff}$	A	7,7	15,4	8,4
	Effective continuous current, not cooled	$I_{c\ eff}$	A	2,5	5,1	2,9
	Effective stall current, cooled	$I_{sw\ eff}$	A	5,6	11,1	6,1
Power losses	Power loss at T_p	P_{Ip}	W	1971	1971	2957
	Power loss at T_{cw}	P_{Iw}	W	556	556	995
	Power loss at T_c	P_{Ic}	W	44	44	89
Electrical characteristic values	DC link voltage	U_{DCL}	V	600	600	600
	Electrical resistance, phase to phase	R_{20}	Ω	4,6	1,2	6,9
	Inductance, phase to phase	L	mH	25	6,3	47,5
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	2,1	1,1	4,2
General characteristic values	Number of pole pairs	P	–	11	11	11
	Motor constant	k_m	Nm/√W	0,99	0,99	1,61
	Torque constant	k_T	Nm/A	2,6	1,3	5,2
	Motor temperature switch-off threshold	ϑ_{PTC}	°C	110	110	110
	Axial attraction	F_a	kN	0,1	0,1	0,1
	Radial attraction	F_r	kN/mm	0,5	0,5	1
	Moment of inertia, secondary part	J	kg · m²	0,00075	0,00075	0,0015
Cooling conditions	Volume flow	dV/dt	l/min	1,6	1,6	2,9
	Nominal feed temperature	ϑ_{nf}	°C	20	20	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5	5	5

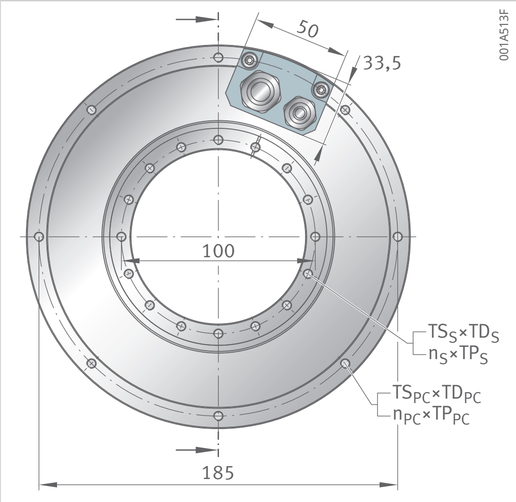


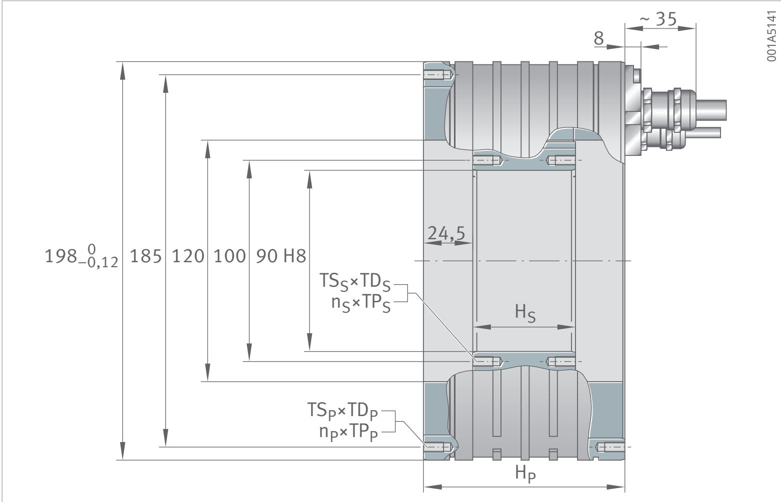
Cooling water temperature: +20 °C

89×50	89×75	89×75	89×100	89×100	89×125	89×125	89×150	89×150
Z1.7	**Z0.9**	**Z1.7**	**Z1.4**	**Z2.7**	**Z1.4**	**Z2.7**	**Z1.4**	**Z2.7**
72	110	110	147	147	184	184	221	221
67	102	102	134	134	167	167	200	200
42	62	62	79	79	100	100	121	121
15	23	23	31	31	40	40	49	49
32	46	46	60	60	76	76	91	91
0,21	0,32	0,32	0,43	0,43	0,53	0,53	0,64	0,64
937	269	607	359	780	276	616	222	507
1647	512	1091	682	1430	532	1127	434	928
682	512	682	682	682	532	682	434	682
42,2	21,1	42,2	35,5	70,9	35,5	70,9	35,5	70,9
33,8	16,9	33,8	28,4	56,7	28,4	56,7	28,4	56,7
16,9	8,3	16,5	13,4	26,8	13,5	27,1	13,6	27,3
5,8	3	5,9	5	10	5,1	10,3	5,3	10,5
12,1	5,9	11,9	9,6	19,3	9,8	19,5	9,8	19,7
2957	4337	4337	5723	5723	6783	6783	7737	7737
995	1401	1401	1725	1725	2090	2090	2419	2419
89	133	133	177	177	221	221	266	266
600	600	600	600	600	600	600	600	600
1,7	10,1	2,5	4,7	1,2	5,6	1,4	6,4	1,6
11,9	71,3	17,8	33,7	8,4	42,1	10,5	50,5	12,6
2,1	6,4	3,2	5,1	2,5	6,3	3,2	7,6	3,8
11	11	11	11	11	11	11	11	11
1,61	2	2	2,32	2,32	2,67	2,67	3	3
2,6	7,8	3,9	6,2	3,1	7,7	3,9	9,3	4,6
110	110	110	110	110	110	110	110	110
0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
1	1,5	1,5	2	2	2,4	2,4	2,9	2,9
0,0015	0,00225	0,00225	0,003	0,003	0,00375	0,00375	0,0045	0,0045
2,9	4	4	4,9	4,9	6	6	6,9	6,9
20	20	20	20	20	20	20	20	20
5	5	5	5	5	5	5	5	5

2.2.4 RIB11-3P-120xH
Geometric data

Size			120×25
Mass, secondary part	m_S	kg	0,9
Mass, primary part	m_P	kg	7,9
Height, secondary part	H_S	mm	26
Height, primary part	H_P	mm	80
Thread, secondary part	$TS_S \times TD_S$	–	M5×10
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	16×22,5
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M5×10
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	8×45
Thread, primary part	$TS_P \times TD_P$	–	M5×10
Thread, primary part, number×pitch	$n_P \times TP_P$	°	8×45



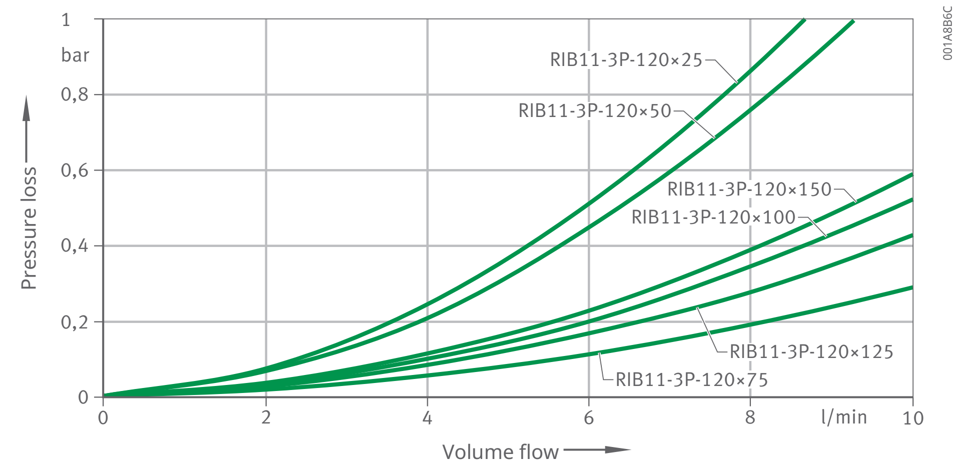


120×50	120×75	120×100	120×125	120×150
1,7	2,6	3,4	4,3	5,1
10,8	13,7	17,2	20,4	23,6
51	76	101	126	151
100	120	150	175	200
M5×10	M5×10	M6×10	M6×10	M6×10
16×22,5	16×22,5	16×22,5	16×22,5	16×22,5
M5×10	M5×10	M5×10	M5×10	M5×10
8×45	8×45	15×22,5	15×22,5	15×22,5
M5×10	M5×10	M5×10	M5×10	M5×10
8×45	8×45	16×22,5	16×22,5	16×22,5

2.2.5 RIB11-3P-120xH
Performance data

2

Size				120×25	120×25	120×50
Winding design				**Z0.7**	**Z1.5**	**Z1.5**
Torques	Ultimate torque	T_u	Nm	68	68	157
	Peak torque	T_p	Nm	62	62	139
	Continuous torque, cooled	T_{cw}	Nm	32	32	77
	Continuous torque, not cooled	T_c	Nm	10	10	26
	Stall torque, cooled	T_{sw}	Nm	25	25	59
	Cogging torque	T_{cog}	Nm	0,21	0,21	0,42
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{Ip}	min^{-1}	468	1002	509
	Knee speed	n_{Iw}	min^{-1}	886	1843	849
	Rated speed S1, cooled	n_{IwS1}	min^{-1}	682	682	682
Currents	Effective ultimate current	$I_{u\ eff}$	A	18	36,1	36,1
	Effective peak current	$I_{p\ eff}$	A	14,4	28,8	28,8
	Effective continuous current, cooled	$I_{cw\ eff}$	A	6,4	12,7	14,1
	Effective continuous current, not cooled	$I_{c\ eff}$	A	1,9	3,7	4,7
	Effective stall current, cooled	$I_{sw\ eff}$	A	4,8	9,6	10,6
Power losses	Power loss at T_p	P_{lp}	W	2472	2472	3794
	Power loss at T_{cw}	P_{lw}	W	651	651	1222
	Power loss at T_c	P_{lc}	W	41	41	102
Electrical characteristic values	DC link voltage	U_{DCL}	V	600	600	600
	Electrical resistance, phase to phase	R_{20}	Ω	7,9	2	3
	Inductance, phase to phase	L	mH	51,4	12,8	23,5
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	4,2	2,1	4,6
General characteristic values	Number of pole pairs	P	–	11	11	11
	Motor constant	k_m	Nm/√W	1,51	1,51	2,62
	Torque constant	k_T	Nm/A	5,2	2,6	5,6
	Motor temperature switch-off threshold	ϑ_{PTC}	°C	110	110	110
	Axial attraction	F_a	kN	0,16	0,16	0,16
	Radial attraction	F_r	kN/mm	0,5	0,5	0,9
	Moment of inertia, secondary part	J	$kg \cdot m^2$	0,0023	0,0023	0,0046
Cooling conditions	Volume flow	dV/dt	l/min	1,9	1,9	3,5
	Nominal feed temperature	ϑ_{nf}	°C	20	20	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5	5	5

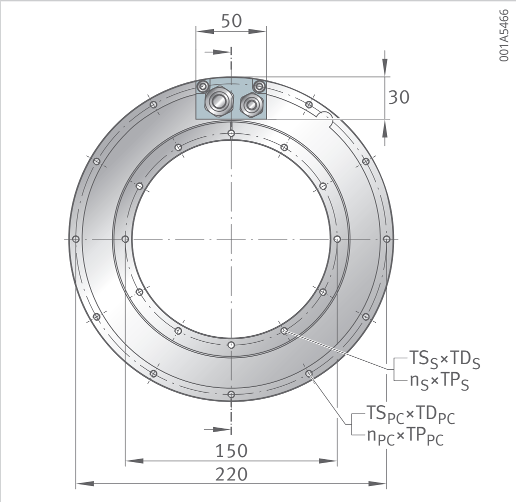


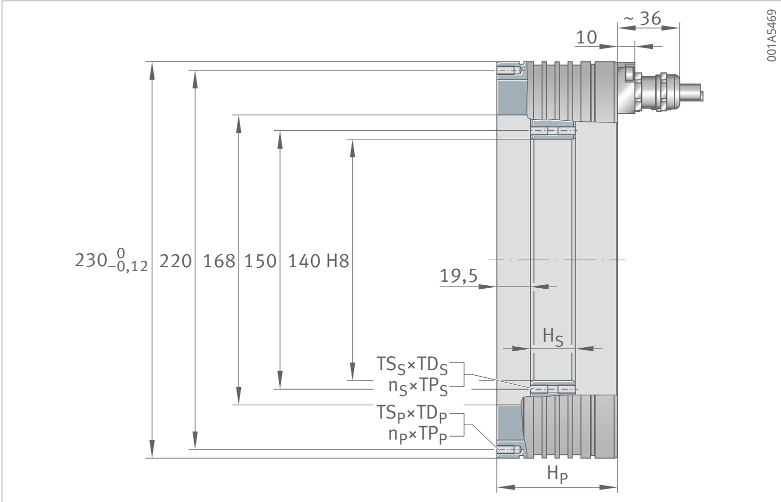
Cooling water temperature: +20 °C

120×75	120×75	120×100	120×100	120×125	120×125	120×150	120×150
Z1.4	**Z2.9**	**Z1.4**	**Z2.9**	**Z1.4**	**Z2.9**	**Z1.5**	**Z2.9**
236	236	314	314	393	393	471	471
208	208	277	277	346	346	416	416
126	126	171	171	219	219	250	264
45	45	62	62	80	80	92	98
97	97	131	131	167	167	191	202
0,63	0,63	0,84	0,84	1,05	1,05	1,26	1,26
298	645	222	494	172	395	154	328
479	1005	356	758	276	598	260	495
479	682	356	682	276	598	260	495
32,2	64,5	32,2	64,5	32,2	64,5	36,1	64,5
25,8	51,6	25,8	51,6	25,8	51,6	28,8	51,6
13,7	27,5	13,9	27,9	14,3	28,6	15,2	28,8
4,8	9,6	5	10	5,1	10,2	5,5	10,4
10,3	20,6	10,5	20,9	10,7	21,4	11,4	21,6
4425	4425	5454	5454	6483	6483	8393	7512
1697	1697	2153	2153	2688	2688	3158	3158
153	153	205	205	256	256	307	307
600	600	600	600	600	600	600	600
4,4	1,1	5,5	1,4	6,5	1,6	6,7	1,9
42,8	10,7	54,1	13,5	66,2	16,5	62,1	19,4
7,7	3,8	10,2	5,1	12,8	6,4	13,7	7,7
11	11	11	11	11	11	11	11
3,63	3,63	4,36	4,36	5	5	5,28	5,58
9,4	4,7	12,5	6,2	15,6	7,8	16,8	9,4
110	110	110	110	110	110	110	110
0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
1,4	1,4	1,8	1,8	2,2	2,2	2,7	2,7
0,0069	0,0069	0,0091	0,0091	0,0114	0,0114	0,0136	0,0136
4,9	4,9	6,2	6,2	7,7	7,7	9	9
20	20	20	20	20	20	20	20
5	5	5	5	5	5	5	5

2.2.6 RIB17-3P-168xH
Geometric data

Size			**168×25**
Mass, secondary part	m_S	kg	1,2
Mass, primary part	m_P	kg	7,2
Height, secondary part	H_S	mm	26
Height, primary part	H_P	mm	70
Thread, secondary part	$TS_S \times TD_S$	–	M5×10
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	12×30
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M5×10
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	11×30
Thread, primary part	$TS_P \times TD_P$	–	M5×10
Thread, primary part, number×pitch	$n_P \times TP_P$	°	12×30

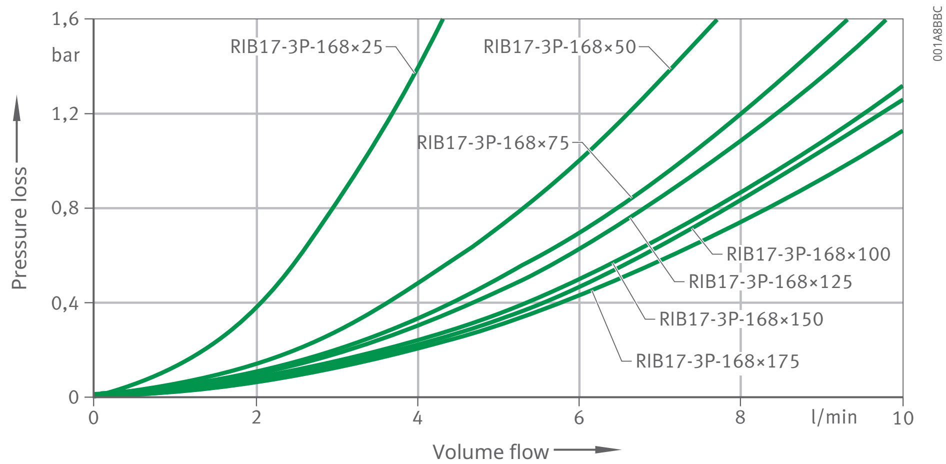




168×50	168×75	168×100	168×125	168×150	168×175
2,4	3,6	4,8	6	7,2	8,4
10,1	13,3	16,5	19,8	23	26,2
51	76	101	126	151	176
90	115	140	165	190	215
M5×10	M5×10	M5×10	M5×10	M6×10	M6×10
12×30	24×15	24×15	24×15	24×15	24×15
M5×10	M5×10	M5×10	M5×10	M5×10	M5×10
11×30	21×15	21×15	21×15	21×15	21×15
M5×10	M5×10	M5×10	M5×10	M5×10	M5×10
12×30	24×15	24×15	24×15	24×15	24×15

2.2.7 RIB17-3P-168xH
Performance data

Size				168×25	168×25	168×50	168×50
Winding design				**Z0.7**	**Z1.4**	**Z0.7**	**Z1.4**
Torques	Ultimate torque	T_u	Nm	130	130	272	272
	Peak torque	T_p	Nm	112	112	233	233
	Continuous torque, cooled	T_{cw}	Nm	58	58	123	123
	Continuous torque, not cooled	T_c	Nm	16	16	37	37
	Stall torque, cooled	T_{sw}	Nm	43	43	90	90
	Cogging torque	T_{cog}	Nm	0,59	0,59	1,16	1,16
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{Ip}	min^{-1}	337	757	150	376
	Knee speed	n_{Iw}	min^{-1}	585	1242	272	602
	Rated speed S1, cooled	n_{IwS1}	min^{-1}	441	441	272	441
Currents	Effective ultimate current	$I_{u\ eff}$	A	19,3	38,7	19,3	38,7
	Effective peak current	$I_{p\ eff}$	A	15,5	30,9	15,5	30,9
	Effective continuous current, cooled	$I_{cw\ eff}$	A	6,9	13,8	7,2	14,5
	Effective continuous current, not cooled	$I_{c\ eff}$	A	1,9	3,7	2,2	4,3
	Effective stall current, cooled	$I_{sw\ eff}$	A	5	10	5,3	10,5
Power losses	Power loss at T_p	P_{Ip}	W	3402	3402	5053	5053
	Power loss at T_{cw}	P_{Iw}	W	912	912	1487	1487
	Power loss at T_c	P_{Ic}	W	50	50	99	99
Electrical characteristic values	DC link voltage	U_{DCL}	V	600	600	600	600
	Electrical resistance, phase to phase	R_{20}	Ω	9,5	2,4	14,1	3,5
	Inductance, phase to phase	L	mH	37,3	9,3	69,3	17,3
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	6,9	3,5	14	7
General characteristic values	Number of pole pairs	P	–	17	17	17	17
	Motor constant	k_m	Nm/√W	2,25	2,25	3,73	3,73
	Torque constant	k_T	Nm/A	8,5	4,2	17,1	8,6
	Motor temperature switch-off threshold	ϑ_{PTC}	°C	110	110	110	110
	Axial attraction	F_a	kN	0,28	0,28	0,28	0,28
	Radial attraction	F_r	kN/mm	1	1	2	2
	Moment of inertia, secondary part	J	$kg \cdot m^2$	0,0071	0,0071	0,0141	0,0141
Cooling conditions	Volume flow	dV/dt	l/min	2,6	2,6	4,3	4,3
	Nominal feed temperature	ϑ_{nf}	°C	20	20	20	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5	5	5	5

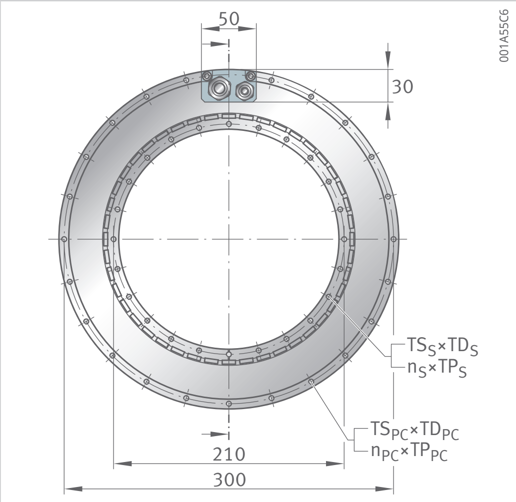


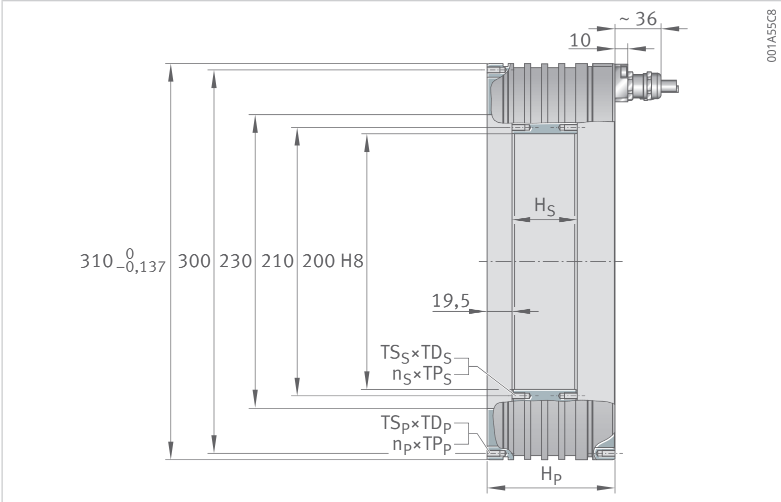
Cooling water temperature: +20 °C

168×75	168×75	168×100	168×100	168×125	168×125	168×150	168×150	168×175	168×175
Z1.8	**Z3.4**	**Z1.8**	**Z3.4**	**Z1.8**	**Z3.4**	**Z1.8**	**Z3.4**	**Z1.8**	**Z3.4**
408	408	544	544	690	690	816	816	951	951
350	350	467	467	591	591	700	700	817	817
185	185	249	249	305	305	372	372	429	429
58	58	80	80	100	100	126	126	144	144
137	137	184	184	221	221	273	273	314	314
1,69	1,69	2,25	2,25	2,81	2,81	3,57	3,57	3,94	3,94
314	688	227	516	162	381	131	322	100	265
504	1061	370	790	282	611	231	509	191	430
441	441	370	441	282	441	231	441	191	430
48,6	97,3	48,6	97,3	48,6	97,3	48,6	97,3	48,6	97,3
38,9	77,8	38,9	77,8	38,9	77,8	38,9	77,8	38,9	77,8
18,4	36,8	18,6	37,3	18,3	36,5	18,4	36,7	18,2	36,3
5,7	11,4	5,9	11,8	6	11,9	6,2	12,3	6	12,1
13,4	26,7	13,5	27	13,3	26,5	13,3	26,7	13,2	26,4
6975	6975	8643	8643	10579	10579	11914	11914	14450	14450
2098	2098	2662	2662	3131	3131	3564	3564	4226	4226
149	149	199	199	249	249	298	298	348	348
600	600	600	600	600	600	600	600	600	600
3,1	0,8	3,8	1	4,7	1,2	5,2	1,3	6,4	1,6
16,1	4	20,8	5,2	28,6	7,1	32,3	8,1	37,8	9,5
8,3	4,2	11,1	5,6	13,6	6,8	16,7	8,4	19,5	9,7
17	17	17	17	17	17	17	17	17	17
4,76	4,76	5,71	5,71	6,32	6,32	7,29	7,29	7,72	7,72
10,2	5,1	13,6	6,8	16,7	8,4	20,5	10,2	23,9	11,9
110	110	110	110	110	110	110	110	110	110
0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28
3	3	3,9	3,9	4,9	4,9	5,9	5,9	6,8	6,8
0,0211	0,0211	0,0282	0,0282	0,0353	0,0353	0,0424	0,0424	0,0494	0,0494
6	6	7,8	7,8	9	9	10,3	10,3	12,5	12,5
20	20	20	20	20	20	20	20	20	20
5	5	5	5	5	5	5	5	5	5

2.2.8 RIB11-3P-230xH
Geometric data

Size			**230×25**
Mass, secondary part	m_S	kg	1,8
Mass, primary part	m_P	kg	13,2
Height, secondary part	H_S	mm	26
Height, primary part	H_P	mm	80
Thread, secondary part	$TS_S \times TD_S$	–	M5×10
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	24×15
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M5×10
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	23×15
Thread, primary part	$TS_P \times TD_P$	–	M5×10
Thread, primary part, number×pitch	$n_P \times TP_P$	°	24×15

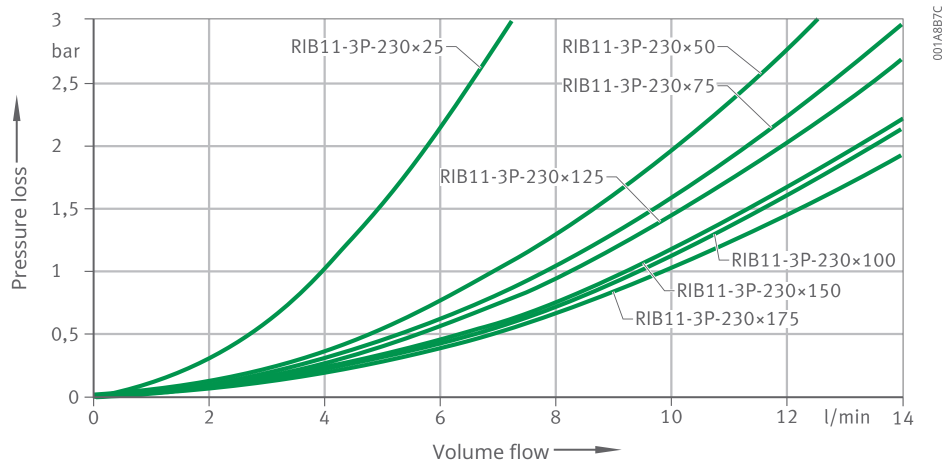




	230×50	230×75	230×100	230×125	230×150	230×175
	3,5	5,3	7	8,8	10,5	12,3
	17,9	22,7	28,4	33,7	39	44,4
	51	76	101	126	151	176
	100	120	150	175	200	225
	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10
	24×15	24×15	48×7,5	48×7,5	48×7,5	48×7,5
	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10
	23×15	23×15	45×7,5	45×7,5	45×7,5	45×7,5
	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10
	24×15	24×15	48×7,5	48×7,5	48×7,5	48×7,5

2.2.9 RIB11-3P-230xH
Performance data

Size				**230×25**	**230×25**	**230×50**	**230×50**
Winding design				**Z1.8**	**Z3.3**	**Z1.8**	**Z3.3**
Torques	Ultimate torque	T_u	Nm	239	239	501	501
	Peak torque	T_p	Nm	219	219	457	457
	Continuous torque, cooled	T_{cw}	Nm	130	130	277	277
	Continuous torque, not cooled	T_c	Nm	39	39	92	92
	Stall torque, cooled	T_{sw}	Nm	106	106	225	225
	Cogging torque	T_{cog}	Nm	0,42	0,42	0,83	0,83
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{Ip}	min^{-1}	312	655	141	306
	Knee speed	n_{Iw}	min^{-1}	555	1143	255	534
	Rated speed S1, cooled	n_{IwS1}	min^{-1}	341	341	255	341
Currents	Effective ultimate current	$I_{u\ eff}$	A	42,7	85,4	42,7	85,4
	Effective peak current	$I_{p\ eff}$	A	34,2	68,3	34,2	68,3
	Effective continuous current, cooled	$I_{cw\ eff}$	A	16,3	32,6	16,8	33,6
	Effective continuous current, not cooled	$I_{c\ eff}$	A	4,3	8,7	5	10,1
	Effective stall current, cooled	$I_{sw\ eff}$	A	12,4	24,8	12,8	25,5
Power losses	Power loss at T_p	P_{Ip}	W	4252	4252	6336	6336
	Power loss at T_{cw}	P_{Iw}	W	1337	1337	2114	2114
	Power loss at T_c	P_{Ic}	W	69	69	137	137
Electrical characteristic values	DC link voltage	U_{DCL}	V	600	600	600	600
	Electrical resistance, phase to phase	R_{20}	Ω	2,4	0,6	3,6	0,9
	Inductance, phase to phase	L	mH	16,5	4,1	34,6	8,7
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	7,3	3,6	15	7,5
General characteristic values	Number of pole pairs	P	–	22	22	22	22
	Motor constant	k_m	Nm/√W	4,66	4,66	7,87	7,87
	Torque constant	k_T	Nm/A	8,9	4,4	18,3	9,2
	Motor temperature switch-off threshold	ϑ_{PTC}	°C	120	120	120	120
	Axial attraction	F_a	kN	0,35	0,35	0,35	0,35
	Radial attraction	F_r	kN/mm	1	1	2	2
	Moment of inertia, secondary part	J	kg · m²	0,0192	0,0192	0,0384	0,0384
Cooling conditions	Volume flow	dV/dt	l/min	3,9	3,9	6,1	6,1
	Nominal feed temperature	ϑ_{nf}	°C	20	20	20	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5	5	5	5



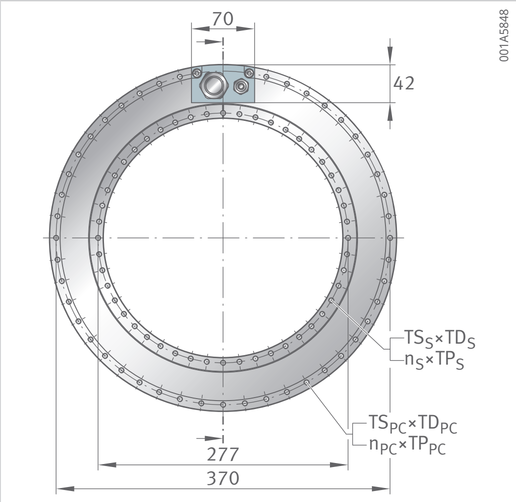
Cooling water temperature: +20 °C

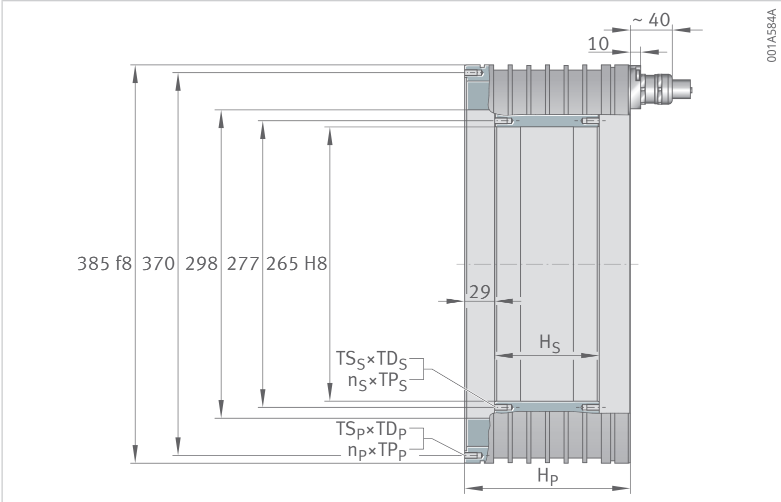
230×75	230×75	230×100	230×100	230×125	230×125	230×150	230×150	230×175	230×175
Z1.8	**Z3.3**	**Z1.8**	**Z3.3**	**Z3.0**	**Z4.5**	**Z3.0**	**Z4.5**	**Z3.0**	**Z4.5**
774	774	1032	1032	1289	1289	1550	1550	1809	1809
703	703	938	938	1172	1172	1409	1409	1644	1644
422	422	567	567	702	702	852	852	997	997
147	147	202	202	254	254	312	312	368	368
342	342	460	460	569	569	691	691	808	808
1,25	1,25	1,67	1,67	2,08	2,08	2,5	2,5	2,92	2,92
91	205	65	155	103	230	82	188	67	159
166	355	122	266	182	386	148	317	124	269
166	341	122	266	182	341	148	317	124	269
42,7	85,4	42,7	85,4	74,7	149,4	74,7	149,4	74,7	149,4
34,2	68,3	34,2	68,3	59,8	119,6	59,8	119,6	59,8	119,6
17,1	34,2	17,2	34,4	29,8	59,6	30,1	60,2	30,2	60,4
5,4	10,7	5,5	11,1	9,7	19,5	9,9	19,9	10	20,1
13	26	13,1	26,2	22,7	45,3	22,9	45,8	23	45,9
8379	8379	10463	10463	12941	12941	14916	14916	17017	17017
2891	2891	3668	3668	4445	4445	5222	5222	5999	5999
206	206	274	274	343	343	411	411	480	480
600	600	600	600	600	600	600	600	600	600
4,8	1,2	6	1,5	2,4	0,6	2,8	0,7	3,2	0,8
49,9	12,5	63,4	15,8	25,3	6,3	30,5	7,6	35,6	8,9
22,4	11,2	29,9	14,9	21,3	10,7	25,7	12,8	29,9	15
22	22	22	22	22	22	22	22	22	22
10,25	10,25	12,22	12,22	13,74	13,74	15,39	15,39	16,81	16,81
27,5	13,7	36,6	18,3	26,1	13,1	31,4	15,7	36,7	18,3
120	120	120	120	120	120	120	120	120	120
0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35
3	3	4	4	5	5	6	6	7	7
0,0576	0,0576	0,0768	0,0768	0,096	0,096	0,1152	0,1152	0,1344	0,1344
8,3	8,3	10,5	10,5	12,7	12,7	15	15	17,2	17,2
20	20	20	20	20	20	20	20	20	20
5	5	5	5	5	5	5	5	5	5

2.2.10 RIB13-3P-298xH
Geometric data

2

Size			298×25	298×50
Mass, secondary part	m_S	kg	2,6	5,1
Mass, primary part	m_P	kg	20,9	28,2
Height, secondary part	H_S	mm	26	51
Height, primary part	H_P	mm	90	110
Thread, secondary part	$TS_S \times TD_S$	–	M6×12	M6×12
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	24×15	24×15
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M6×12	M6×12
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	23×15	23×15
Thread, primary part	$TS_P \times TD_P$	–	M6×12	M6×12
Thread, primary part, number×pitch	$n_P \times TP_P$	°	24×15	24×15

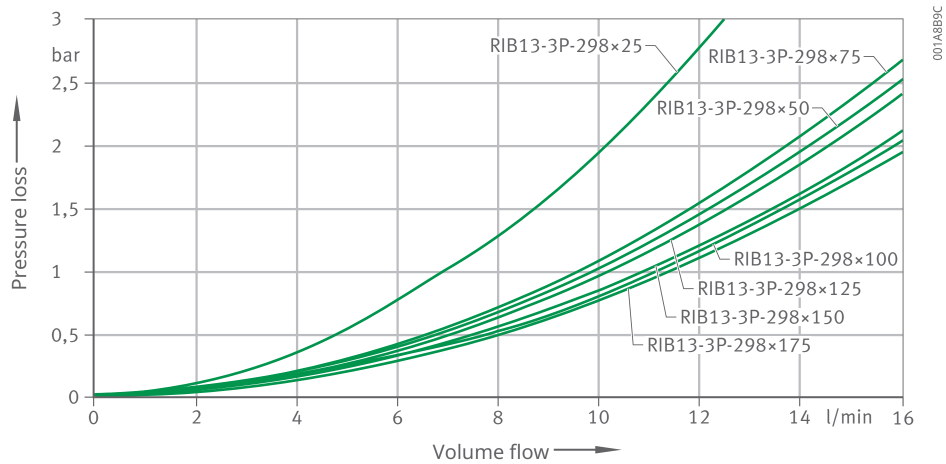




298×75	298×100	298×125	298×150	298×175
7,7	10,2	12,8	15,3	17,9
35,2	44,2	51,9	59,7	67,6
76	101	126	151	176
130	160	185	210	235
M6×12	M6×12	M6×12	M6×12	M6×12
24×15	48×7,5	48×7,5	48×7,5	48×7,5
M6×12	M6×12	M6×12	M6×12	M6×12
23×15	45×7,5	45×7,5	45×7,5	45×7,5
M6×12	M6×12	M6×12	M6×12	M6×12
24×15	48×7,5	48×7,5	48×7,5	48×7,5

2.2.11 RIB13-3P-298xH
Performance data

Size				298×25	298×25	298×25	298×50	298×50
Winding design				**Z1.7**	**Z2.9**	**Z3.8**	**Z1.7**	**Z2.9**
Torques	Ultimate torque	T_u	Nm	353	353	353	754	754
	Peak torque	T_p	Nm	312	312	312	664	664
	Continuous torque, cooled	T_{cw}	Nm	177	183	180	421	434
	Continuous torque, not cooled	T_c	Nm	60	62	61	144	148
	Stall torque, cooled	T_{sw}	Nm	140	144	142	332	343
	Cogging torque	T_{cog}	Nm	0,42	0,42	0,42	0,83	0,83
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	242	408	695	121	208
	Knee speed	n_{lw}	min^{-1}	393	644	1097	181	300
	Rated speed S1, cooled	n_{lwS1}	min^{-1}	288	288	288	189	288
Currents	Effective ultimate current	$I_{u\ eff}$	A	37,1	60	100	37,1	60
	Effective peak current	$I_{p\ eff}$	A	29,7	48	80	29,7	48
	Effective continuous current, cooled	$I_{cw\ eff}$	A	15,3	25,5	41,8	17,2	28,7
	Effective continuous current, not cooled	$I_{c\ eff}$	A	5	8,3	13,6	5,6	9,3
	Effective stall current, cooled	$I_{sw\ eff}$	A	11,5	19,1	31,4	12,9	21,5
Power losses	Power loss at T_p	P_{lp}	W	3770	3542	3654	4795	4506
	Power loss at T_{cw}	P_{lw}	W	1350	1350	1350	2178	2178
	Power loss at T_c	P_{lc}	W	105	105	105	170	170
Electrical characteristic values	DC link voltage	U_{DCL}	V	600	600	600	600	600
	Electrical resistance, phase to phase	R_{20}	Ω	2,8	1	0,4	3,6	1,3
	Inductance, phase to phase	L	mH	20,2	7,7	2,8	37,6	14,4
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	10	6,2	3,7	21	13
General characteristic values	Number of pole pairs	P	–	26	26	26	26	26
	Motor constant	k_m	Nm/√W	5,9	6,09	6	11,03	11,38
	Torque constant	k_T	Nm/A	12,2	7,5	4,5	25,7	15,9
	Motor temperature switch-off threshold	ϑ_{PTC}	°C	110	110	110	110	110
	Axial attraction	F_a	kN	0,48	0,48	0,48	0,48	0,48
	Radial attraction	F_r	kN/mm	1,3	1,3	1,3	2,6	2,6
	Moment of inertia, secondary part	J	$kg \cdot m^2$	0,05	0,05	0,05	0,1	0,1
Cooling conditions	Volume flow	dV/dt	l/min	3,9	3,9	3,9	6,4	6,4
	Nominal feed temperature	ϑ_{nf}	°C	20	20	20	20	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5	5	5	5	5

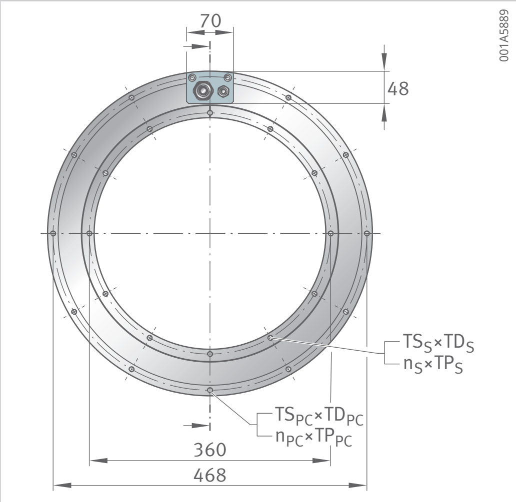


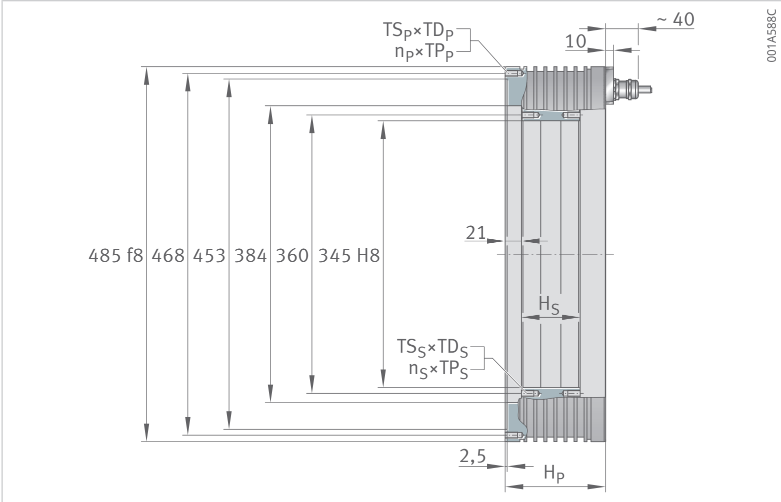
Cooling water temperature: +20 °C

298×50	298×75	298×75	298×75	298×100	298×100	298×100	298×125	298×125	298×150	298×150	298×175	298×175
Z3.8	**Z1.7**	**Z2.9**	**Z3.8**	**Z1.7**	**Z2.9**	**Z3.8**	**Z2.9**	**Z3.8**	**Z2.9**	**Z3.8**	**Z2.9**	**Z3.8**
754	1130	1130	1130	1507	1507	1507	1884	1884	2261	2261	2637	2637
664	996	996	996	1328	1328	1328	1660	1660	1992	1992	2324	2324
427	631	651	641	852	879	865	1101	1084	1317	1296	1552	1528
146	247	254	250	343	354	349	455	448	557	549	659	649
337	488	503	496	659	680	669	852	839	1019	1003	1200	1182
0,83	1,25	1,25	1,25	1,67	1,67	1,67	2,08	2,08	2,5	2,5	2,92	2,92
357	80	144	252	56	105	186	82	148	66	122	55	103
516	121	205	356	86	150	262	118	209	97	173	81	146
288	121	205	288	86	150	262	118	209	97	173	81	146
100	37,1	60	100	37,1	60	100	60	100	60	100	60	100
80	29,7	48	80	29,7	48	80	48	80	48	80	48	80
47,1	17,2	28,7	47,1	17,5	29,1	47,7	29,2	47,9	29,1	47,7	29,4	48,2
15,3	6,4	10,7	17,5	6,7	11,1	18,3	11,5	18,8	11,7	19,2	11,9	19,5
35,3	12,9	21,5	35,4	13,1	21,8	35,8	21,9	35,9	21,8	35,8	22	36,1
4647	6785	6376	6577	8293	7793	8038	9210	9500	10627	10961	12044	12422
2178	3085	3085	3085	3867	3867	3867	4593	4593	5262	5262	6085	6085
170	315	315	315	420	420	420	525	525	629	629	734	734
600	600	600	600	600	600	600	600	600	600	600	600	600
0,5	5,1	1,8	0,7	6,3	2,3	0,8	2,7	1	3,1	1,1	3,5	1,3
5,2	50,4	19,3	7	67,2	25,8	9,3	31,5	11,4	37,5	13,5	43,3	15,6
7,8	31,4	19,5	11,7	41,9	26	15,6	32,4	19,5	38,9	23,4	45,4	27,3
26	26	26	26	26	26	26	26	26	26	26	26	26
11,2	13,9	14,33	14,11	16,76	17,29	17,02	19,88	19,57	22,21	21,87	24,34	23,96
9,5	38,5	23,8	14,3	51,4	31,8	19,1	39,7	23,8	47,7	28,6	55,6	33,4
110	110	110	110	110	110	110	110	110	110	110	110	110
0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48
2,6	3,8	3,8	3,8	5,1	5,1	5,1	6,4	6,4	7,6	7,6	8,9	8,9
0,1	0,15	0,15	0,15	0,2	0,2	0,2	0,25	0,25	0,3	0,3	0,35	0,35
6,4	8,8	8,8	8,8	11,1	11,1	11,1	13,2	13,2	15,1	15,1	17,4	17,4
20	20	20	20	20	20	20	20	20	20	20	20	20
5	5	5	5	5	5	5	5	5	5	5	5	5

2.2.12 RIB11-3P-384xH
Geometric data

Size			384×25
Mass, secondary part	m_S	kg	4
Mass, primary part	m_P	kg	30,3
Height, secondary part	H_S	mm	26
Height, primary part	H_P	mm	90
Thread, secondary part	$TS_S \times TD_S$	–	M8×16
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	12×30
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M8×16
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	11×30
Thread, primary part	$TS_P \times TD_P$	–	M8×16
Thread, primary part, number×pitch	$n_P \times TP_P$	°	12×30

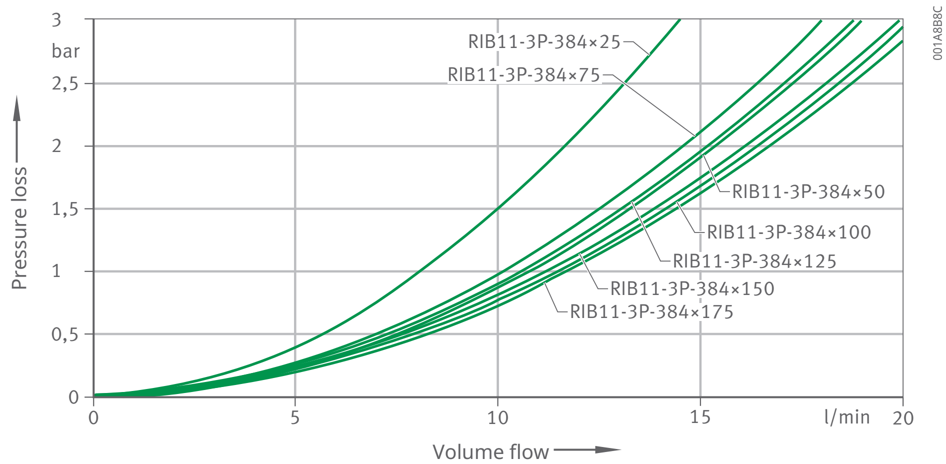




384×50	384×75	384×100	384×125	384×150	384×175
8	12	16	20	24	28
41	52	65,7	78,6	91,4	104,1
51	76	101	126	151	176
110	130	160	185	210	235
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
12×30	12×30	24×15	24×15	24×15	48×7,5
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
11×30	11×30	23×15	23×15	23×15	45×7,5
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
12×30	12×30	24×15	24×15	24×15	48×7,5

2.2.13 RIB11-3P-384xH
Performance data

Size				384×25	384×25	384×25	384×50	384×50
Winding design				**Z1.7**	**Z2.5**	**Z3.7**	**Z1.7**	**Z2.5**
Torques	Ultimate torque	T_u	Nm	573	573	573	1182	1182
	Peak torque	T_p	Nm	512	512	512	1057	1057
	Continuous torque, cooled	T_{cw}	Nm	307	307	302	655	655
	Continuous torque, not cooled	T_c	Nm	97	97	95	233	233
	Stall torque, cooled	T_{sw}	Nm	233	233	230	498	498
	Cogging torque	T_{cog}	Nm	1,54	1,54	1,54	3,07	3,07
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	117	183	335	62	101
	Knee speed	n_{lw}	min^{-1}	213	328	599	108	169
	Rated speed S1, cooled	n_{lwS1}	min^{-1}	213	227	227	108	169
Currents	Effective ultimate current	$I_{u\ eff}$	A	40,7	61,1	108,4	40,7	61,1
	Effective peak current	$I_{p\ eff}$	A	32,6	48,9	86,7	32,6	48,9
	Effective continuous current, cooled	$I_{cw\ eff}$	A	16,3	24,5	42,7	16,9	25,3
	Effective continuous current, not cooled	$I_{c\ eff}$	A	4,7	7	12,3	5,5	8,2
	Effective stall current, cooled	$I_{sw\ eff}$	A	11,8	17,6	30,8	12,2	18,2
Power losses	Power loss at T_p	P_{lp}	W	5163	5163	5327	7599	7599
	Power loss at T_{cw}	P_{lw}	W	1737	1737	1737	2735	2735
	Power loss at T_c	P_{lc}	W	107	107	107	213	213
Electrical charac-teristic values	DC link voltage	U_{DCL}	V	600	600	600	600	600
	Electrical resistance, phase to phase	R_{20}	Ω	3,2	1,4	0,5	4,8	2,1
	Inductance, phase to phase	L	mH	30,8	13,7	4,3	50,4	22,4
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	16,9	11,3	6,3	34,8	23,2
General charac-teristic values	Number of pole pairs	P	–	33	33	33	33	33
	Motor constant	k_m	Nm/√W	9,38	9,38	9,23	15,95	15,95
	Torque constant	k_T	Nm/A	20,7	13,8	7,8	42,7	28,4
	Motor temperature switch-off threshold	ϑ_{PTC}	°C	110	110	110	110	110
	Axial attraction	F_a	kN	0,67	0,67	0,67	0,67	0,67
	Radial attraction	F_r	kN/mm	1,8	1,8	1,8	3,6	3,6
	Moment of inertia, secondary part	J	kg · m²	0,13	0,13	0,13	0,26	0,26
Cooling con-ditions	Volume flow	dV/dt	l/min	5	5	5	7,8	7,8
	Nominal feed temperature	ϑ_{nf}	°C	20	20	20	20	20
	Cooling water temperature difference	Δϑ	K	5	5	5	5	5

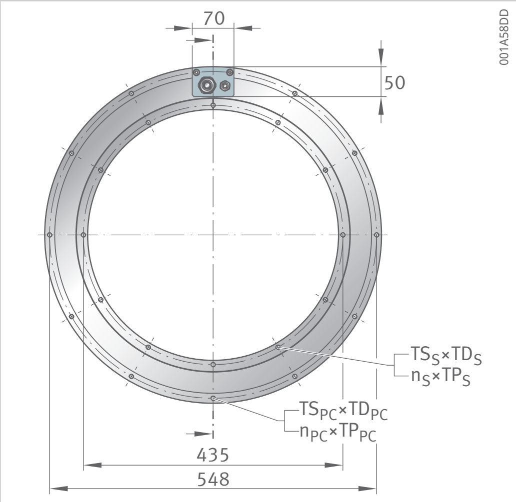


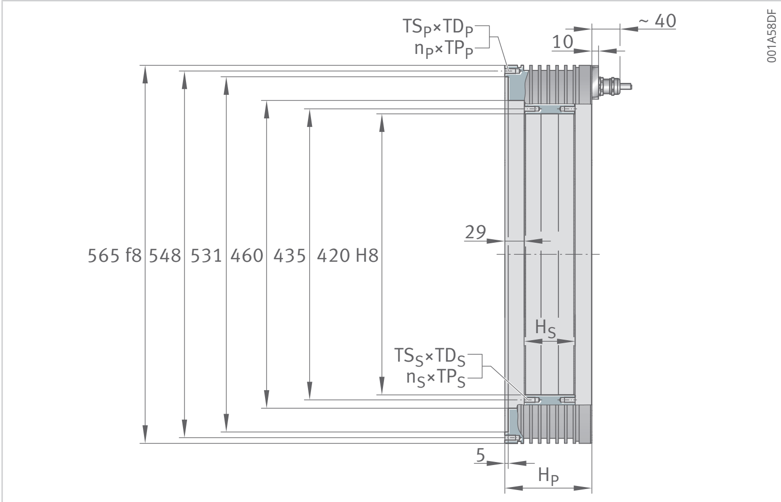
Cooling water temperature: +20 °C

384×50	384×75	384×75	384×75	384×100	384×100	384×125	384×125	384×150	384×150	384×175	384×175
Z3.7	Z1.7	Z2.5	Z3.7	Z2.5	Z3.7	Z2.5	Z3.7	Z2.5	Z4.0	Z2.5	Z4.0
1182	1828	1828	1828	2462	2462	3077	3077	3692	3692	4308	4308
1057	1634	1634	1634	2201	2201	2751	2751	3301	3301	3852	3852
645	1022	1022	1006	1372	1351	1738	1711	2106	2106	2473	2473
229	384	384	378	536	527	685	674	835	835	985	985
490	776	776	764	1042	1026	1320	1300	1599	1599	1879	1879
3,07	4,61	4,61	4,61	6,14	6,14	7,68	7,68	9,21	9,21	10,75	10,75
190	39	67	129	48	97	36	76	28	72	22	61
313	69	111	207	81	154	63	122	51	114	42	96
227	69	111	207	81	154	63	122	51	114	42	96
108,4	40,7	61,1	108,4	61,1	108,4	61,1	108,4	61,1	122,2	61,1	122,2
86,7	32,6	48,9	86,7	48,9	86,7	48,9	86,7	48,9	97,8	48,9	97,8
44,2	17	25,5	44,6	25,5	44,5	25,8	45,1	26	52,1	26,2	52,4
14,3	5,8	8,7	15,2	9	15,8	9,3	16,2	9,4	18,8	9,5	19
31,8	12,3	18,4	32,1	18,3	32	18,6	32,4	18,7	37,5	18,9	37,8
7840	10034	10034	10353	12469	12865	14905	15378	17340	17340	19776	19776
2735	3671	3671	3671	4539	4539	5570	5570	6602	6602	7633	7633
213	320	320	320	427	427	534	534	640	640	747	747
600	600	600	600	600	600	600	600	600	600	600	600
0,7	6,3	2,8	0,9	3,5	1,1	4,2	1,4	4,8	1,2	5,5	1,4
7,1	70,1	31,2	9,9	39,9	12,7	48,7	15,5	57,4	14,3	66,1	16,5
13,1	53,9	35,9	20,2	48,4	27,3	60,5	34,1	72,5	36,3	84,6	42,3
33	33	33	33	33	33	33	33	33	33	33	33
15,71	21,47	21,47	21,14	25,93	25,53	29,65	29,19	32,99	32,99	36,04	36,04
16	66	44	24,8	59,2	33,4	74	41,7	88,8	44,4	103,7	51,8
110	110	110	110	110	110	110	110	110	110	110	110
0,67	0,67	0,67	0,67	0,67	0,67	0,67	0,67	0,67	0,67	0,67	0,67
3,6	5,3	5,3	5,3	7,1	7,1	8,8	8,8	10,6	10,6	12,4	12,4
0,26	0,39	0,39	0,39	0,52	0,52	0,65	0,65	0,78	0,78	0,91	0,91
7,8	10,5	10,5	10,5	13	13	16	16	18,9	18,9	14,6	14,6
20	20	20	20	20	20	20	20	20	20	20	20
5	5	5	5	5	5	5	5	5	5	7,5	7,5

2.2.14 RIB19-3P-460xH
Geometric data

Size			**460×25**
Mass, secondary part	m_S	kg	4,9
Mass, primary part	m_P	kg	37,6
Height, secondary part	H_S	mm	26
Height, primary part	H_P	mm	90
Thread, secondary part	$TS_S \times TD_S$	–	M8×16
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	12×30
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M8×16
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	11×30
Thread, primary part	$TS_P \times TD_P$	–	M8×16
Thread, primary part, number×pitch	$n_P \times TP_P$	°	12×30

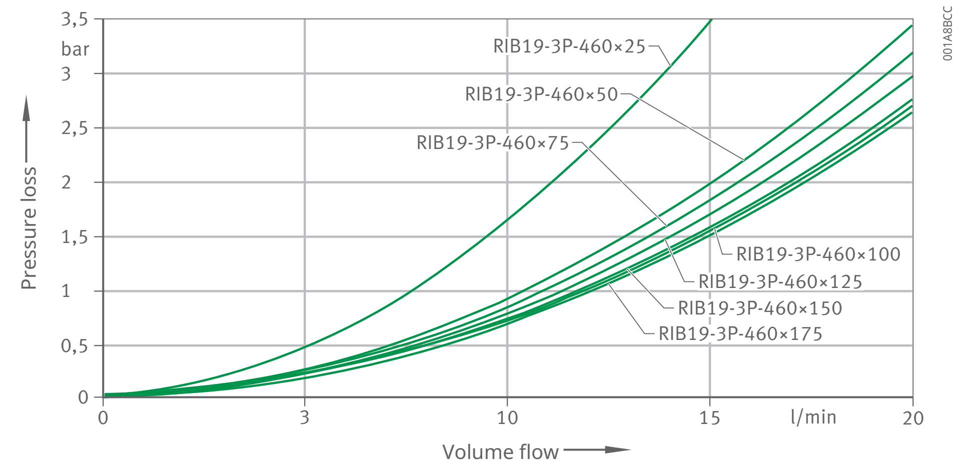




460×50	460×75	460×100	460×125	460×150	460×175
9,8	14,6	19,5	24,4	29,3	34,2
50,4	63,4	79,1	93,5	107,8	122,1
51	76	101	126	151	176
110	130	160	185	210	235
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
12×30	24×15	24×15	24×15	48×7,5	48×7,5
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
11×30	23×15	23×15	23×15	45×7,5	45×7,5
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
12×30	24×15	24×15	24×15	48×7,5	48×7,5

2.2.15 RIB19-3P-460xH
Performance data

Size				460×25	460×25	460×25	460×50	460×50
Winding design				**Z1.7**	**Z2.5**	**Z3.8**	**Z1.7**	**Z2.5**
Torques	Ultimate torque	T_u	Nm	888	888	888	1813	1813
	Peak torque	T_p	Nm	755	755	755	1541	1541
	Continuous torque, cooled	T_{cw}	Nm	447	436	434	977	953
	Continuous torque, not cooled	T_c	Nm	137	134	134	335	327
	Stall torque, cooled	T_{sw}	Nm	334	326	325	731	713
	Cogging torque	T_{cog}	Nm	1,97	1,97	1,97	3,95	3,95
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	83	131	247	42	69
	Knee speed	n_{lw}	min^{-1}	143	226	419	70	112
	Rated speed S1, cooled	n_{lwS1}	min^{-1}	143	197	197	70	112
Currents	Effective ultimate current	$I_{u\ eff}$	A	41,2	62,3	112,4	41,2	62,3
	Effective peak current	$I_{p\ eff}$	A	30,4	46	83	30,4	46
	Effective continuous current, cooled	$I_{cw\ eff}$	A	15,7	23,2	41,8	16,9	24,9
	Effective continuous current, not cooled	$I_{c\ eff}$	A	4,6	6,9	12,3	5,5	8,2
	Effective stall current, cooled	$I_{sw\ eff}$	A	11,4	16,9	30,3	12,2	18,1
Power losses	Power loss at T_p	P_{lp}	W	5349	5623	5658	7508	7892
	Power loss at T_{cw}	P_{lw}	W	1927	1927	1927	3103	3103
	Power loss at T_c	P_{lc}	W	125	125	125	250	250
Electrical characteristic values	DC link voltage	U_{DCL}	V	600	600	600	600	600
	Electrical resistance, phase to phase	R_{20}	Ω	3,9	1,8	0,5	5,4	2,5
	Inductance, phase to phase	L	mH	39,5	17,3	5,3	68,9	30,1
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	24,1	15,9	8,8	49,3	32,6
General characteristic values	Number of pole pairs	P	–	38	38	38	38	38
	Motor constant	k_m	Nm/√W	12,28	11,98	11,94	21,17	20,65
	Torque constant	k_T	Nm/A	29,6	19,5	10,8	60,3	39,9
	Motor temperature switch-off threshold	ϑ_{PTC}	°C	110	110	110	110	110
	Axial attraction	F_a	kN	0,74	0,74	0,74	0,74	0,74
	Radial attraction	F_r	kN/mm	1,9	1,9	1,9	3,8	3,8
	Moment of inertia, secondary part	J	$kg \cdot m^2$	0,24	0,24	0,24	0,47	0,47
Cooling conditions	Volume flow	dV/dt	l/min	5,5	5,5	5,5	8,9	8,9
	Nominal feed temperature	ϑ_{nf}	°C	20	20	20	20	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5	5	5	5	5



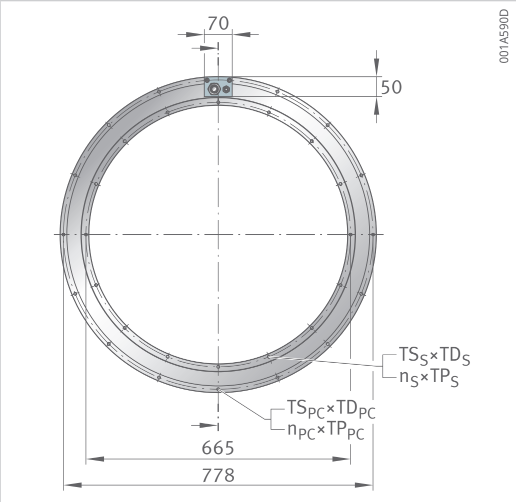
Cooling water temperature: +20 °C

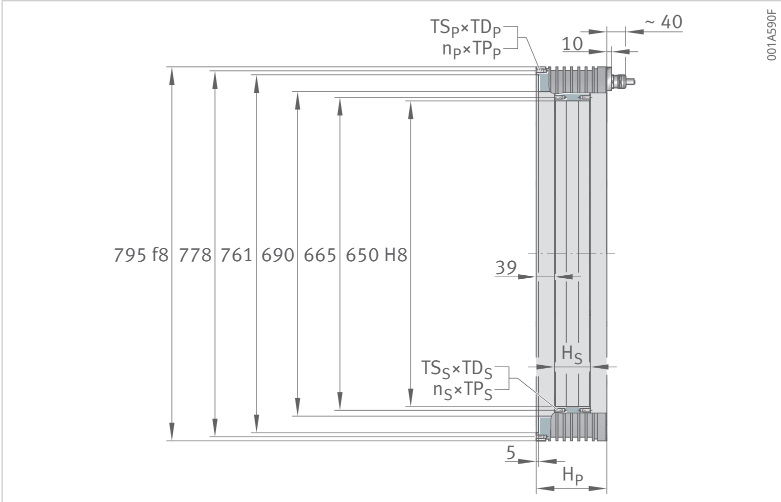
460×50	460×75	460×75	460×100	460×100	460×125	460×125	460×125	460×150	460×150	460×175	460×175
Z3.8	**Z2.5**	**Z3.8**	**Z2.5**	**Z3.8**	**Z2.5**	**Z3.8**	**Z4.9**	**Z3.8**	**Z4.9**	**Z3.8**	**Z4.9**
1813	2775	2775	3751	3751	4689	4689	4689	5739	5739	6695	6695
1541	2330	2330	3144	3144	3930	3930	3930	4811	4811	5612	5612
950	1417	1413	1961	1955	2494	2486	2557	3081	3169	3628	3731
326	522	520	726	723	931	929	955	1158	1191	1369	1408
711	1061	1057	1467	1462	1866	1860	1913	2305	2371	2714	2791
3,95	5,92	5,92	7,89	7,89	9,87	9,87	9,87	11,84	11,84	13,82	13,82
134	45	92	33	69	24	53	84	44	70	36	59
211	75	144	54	106	41	83	125	67	103	56	86
197	75	144	54	106	41	83	125	67	103	56	86
112,4	62,3	112,4	62,3	112,4	62,3	112,4	164,6	112,4	164,6	112,4	164,6
83	46	83	46	83	46	83	121,6	83	121,6	83	121,6
44,8	24,4	44	25,1	45,2	25,5	46	69,2	46,5	70,1	47	70,7
14,7	8,6	15,4	8,9	16	9,2	16,5	24,8	16,8	25,3	17	25,6
32,5	17,7	31,9	18,2	32,8	18,5	33,3	50,2	33,8	50,8	34,1	51,3
7941	10851	10919	13318	13401	15784	15882	15016	18364	17362	20846	19708
3103	4112	4112	5322	5322	6531	6531	6531	7740	7740	8950	8950
250	375	375	500	500	626	626	626	751	751	876	876
600	600	600	600	600	600	600	600	600	600	600	600
0,8	3,4	1,1	4,2	1,3	5	1,5	0,7	1,8	0,8	2	0,9
9,2	41,4	12,7	52,3	16,1	65,4	20,1	9,4	23,1	10,8	27	12,6
18	49,8	27,6	66,4	36,8	83	46	31,4	56,3	38,5	65,7	44,9
38	38	38	38	38	38	38	38	38	38	38	38
20,58	26,95	26,87	32,44	32,33	37,24	37,13	38,18	42,26	43,46	46,28	47,59
22,1	61	33,8	81,4	45,1	101,7	56,3	38,5	69	47,1	80,5	55
110	110	110	110	110	110	110	110	110	110	110	110
0,74	0,74	0,74	0,74	0,74	0,74	0,74	0,74	0,74	0,74	0,74	0,74
3,8	5,7	5,7	7,5	7,5	9,4	9,4	9,4	11,3	11,3	13,2	13,2
0,47	0,71	0,71	0,94	0,94	1,18	1,18	1,18	1,41	1,41	1,65	1,65
8,9	11,8	11,8	15,2	15,2	18,7	18,7	18,7	14,8	14,8	17,1	17,1
20	20	20	20	20	20	20	20	20	20	20	20
5	5	5	5	5	5	5	5	7,5	7,5	7,5	7,5

2.2.16 RIB13-3P-690xH

Geometric data

Size			690×25
Mass, secondary part	m_S	kg	7,6
Mass, primary part	m_P	kg	62,9
Height, secondary part	H_S	mm	26
Height, primary part	H_P	mm	110
Thread, secondary part	TS_S×TD_S	–	M8×16
Thread, secondary part, number×pitch	n_S×TP_S	°	16×22,5
Thread, primary part, cable side	TS_{PC}×TD_{PC}	–	M8×16
Thread, primary part, cable side, number×pitch	n_{PC}×TP_{PC}	°	15×22,5
Thread, primary part	TS_P×TD_P	–	M8×16
Thread, primary part, number×pitch	n_P×TP_P	°	16×22,5



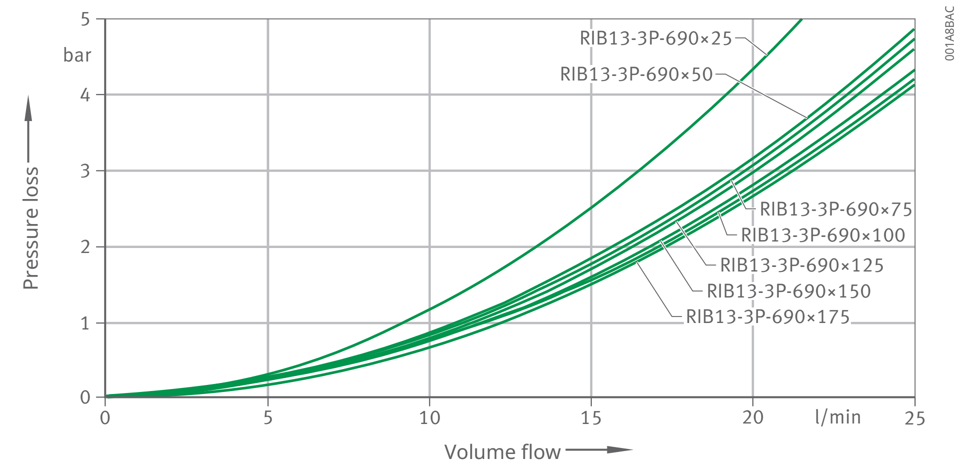


690×50	690×75	690×100	690×125	690×150	690×175
15,2	22,8	30,4	38	45,6	53,2
81,6	99,8	122,9	143,2	163,7	184,1
51	76	101	126	151	176
130	150	180	205	230	255
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
16×22,5	32×11,25	32×11,25	64×5,625	64×5,625	64×5,625
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
15×22,5	31×11,25	31×11,25	61×5,625	61×5,625	61×5,625
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
16×22,5	32×11,25	32×11,25	64×5,625	64×5,625	64×5,625

2.2.17 RIB13-3P-690xH
Performance data

2

Size				690×25	690×25	690×25	690×50	690×50	690×75
Winding design				**Z2.2**	**Z3.3**	**Z4.2**	**Z3.3**	**Z4.2**	**Z3.3**
Torques	Ultimate torque	T_u	Nm	1978	1978	1978	4059	4059	6244
	Peak torque	T_p	Nm	1768	1768	1768	3627	3627	5579
	Continuous torque, cooled	T_{cw}	Nm	989	956	989	2094	2166	3288
	Continuous torque, not cooled	T_c	Nm	356	344	356	829	857	1363
	Stall torque, cooled	T_{sw}	Nm	769	743	769	1628	1684	2557
	Cogging torque	T_{cog}	Nm	1,47	1,47	1,47	2,94	2,94	4,41
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{Ip}	min^{-1}	37	65	101	38	61	26
	Knee speed	n_{Iw}	min^{-1}	70	123	184	66	101	44
	Rated speed S1, cooled	n_{IwS1}	min^{-1}	70	115	115	66	101	44
Currents	Effective ultimate current	$I_{u\ eff}$	A	49,1	81,5	122,7	81,5	122,7	81,5
	Effective peak current	$I_{p\ eff}$	A	39,3	65,2	98,2	65,2	98,2	65,2
	Effective continuous current, cooled	$I_{cw\ eff}$	A	19,3	30,9	48,2	33	51,5	33,7
	Effective continuous current, not cooled	$I_{c\ eff}$	A	6,8	10,9	17	12,8	20	13,7
	Effective stall current, cooled	$I_{sw\ eff}$	A	14,7	23,6	36,7	25,2	39,2	25,7
Power losses	Power loss at T_p	P_{Ip}	W	7758	8303	7758	12076	11284	15850
	Power loss at T_{cw}	P_{Iw}	W	2510	2510	2510	4160	4160	5690
	Power loss at T_c	P_{Ic}	W	233	233	233	466	466	699
Electrical characteristic values	DC link voltage	U_{DCL}	V	600	600	600	600	600	600
	Electrical resistance, phase to phase	R_{20}	Ω	3,4	1,3	0,5	1,9	0,8	2,5
	Inductance, phase to phase	L	mH	41,4	15	6,6	23,1	10,2	31
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	42,7	25,7	17,1	52,8	35,1	81,3
General characteristic values	Number of pole pairs	P	–	65	65	65	65	65	65
	Motor constant	k_m	Nm/√W	23,34	22,56	23,34	38,38	39,7	51,53
	Torque constant	k_T	Nm/A	52,3	31,5	20,9	64,7	42,9	99,5
	Motor temperature switch-off threshold	ϑ_{PTC}	°C	110	110	110	110	110	110
	Axial attraction	F_a	kN	1,11	1,11	1,11	1,11	1,11	1,11
	Radial attraction	F_r	kN/mm	3,3	3,3	3,3	6,6	6,6	9,9
	Moment of inertia, secondary part	J	$kg \cdot m^2$	0,85	0,85	0,85	1,7	1,7	2,55
Cooling conditions	Volume flow	dV/dt	l/min	7,4	7,4	7,4	12,3	12,3	16,9
	Nominal feed temperature	ϑ_{nf}	°C	20	20	20	20	20	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5	5	5	5	5	5



Cooling water temperature: +20 °C

690×75	690×100	690×100	690×100	690×125	690×125	690×125	690×150	690×150	690×150	690×175	690×175
Z4.2	**Z3.3**	**Z4.2**	**Z5.9**	**Z3.3**	**Z4.2**	**Z5.9**	**Z3.3**	**Z4.2**	**Z5.9**	**Z4.2**	**Z5.9**
6244	8366	8366	8366	10457	10457	10457	12549	12549	12549	14640	14640
5579	7475	7475	7475	9343	9343	9343	11212	11212	11212	13081	13081
3401	4504	4659	4504	5712	5909	5712	6924	7163	6924	8421	8140
1410	1895	1960	1895	2425	2508	2425	2958	3060	2958	3613	3493
2645	3502	3623	3502	4441	4595	4441	5384	5570	5384	6548	6329
4,41	2,94	2,94	2,94	7,35	7,35	7,35	4,41	4,41	4,41	10,3	10,3
43	19	33	58	14	26	46	10	20	38	17	29
68	32	51	90	25	40	71	19	32	58	27	47
68	32	51	90	25	40	71	19	32	58	27	47
122,7	81,5	122,7	203,7	81,5	122,7	203,7	81,5	122,7	203,7	122,7	203,7
98,2	65,2	98,2	163	65,2	98,2	163	65,2	98,2	163	98,2	163
52,5	34,5	53,7	86,2	35	54,5	87,4	35,3	55,1	88,3	55,5	89
21,3	14,2	22,1	35,5	14,5	22,7	36,4	14,8	23	37	23,3	37,4
40	26,3	40,9	65,7	26,6	41,5	66,6	26,9	42	67,3	42,3	67,8
14811	19624	18337	19624	23398	21864	23398	27172	25390	27172	28916	30946
5690	7364	7364	7364	9037	9037	9037	10711	10711	10711	12384	12384
699	932	932	932	1165	1165	1165	1399	1399	1399	1632	1632
600	600	600	600	600	600	600	600	600	600	600	600
1	3,1	1,3	0,5	3,7	1,5	0,6	4,3	1,8	0,7	2	0,8
13,7	37,6	16,6	6	46,1	20,3	7,4	55,3	24,4	8,8	28,4	11,5
53,9	108,9	72,3	43,5	136,1	90,3	54,4	163,3	108,4	65,3	126,5	76,2
65	65	65	65	65	65	65	65	65	65	65	65
53,3	62,05	64,19	62,05	71,03	73,48	71,03	79,09	81,82	79,09	89,45	86,47
66,1	133,3	88,5	53,3	166,7	110,6	66,7	200	132,8	80	154,9	93,3
110	110	110	110	110	110	110	110	110	110	110	110
1,11	1,11	1,11	1,11	1,11	1,11	1,11	1,11	1,11	1,11	1,11	1,11
9,9	13,1	13,1	13,1	16,4	16,4	16,4	19,7	19,7	19,7	23	23
2,55	3,4	3,4	3,4	4,25	4,25	4,25	5,1	5,1	5,1	5,95	5,95
16,9	14,6	14,6	14,6	17,9	17,9	17,9	15,9	15,9	15,9	18,4	18,4
20	20	20	20	20	20	20	20	20	20	20	20
5	7,5	7,5	7,5	7,5	7,5	7,5	10	10	10	10	10

3

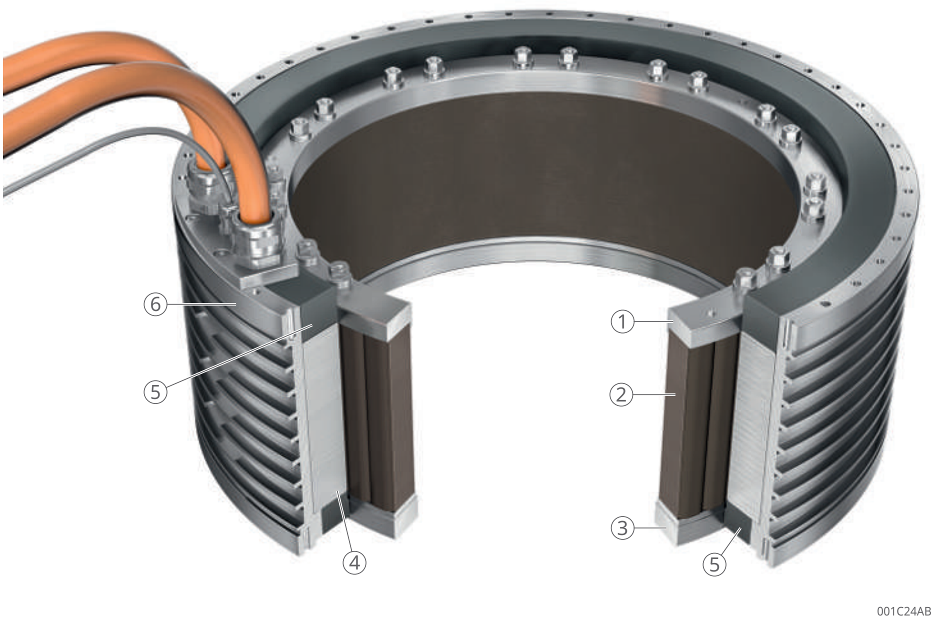
3 RKI torque motors and RKIB torque motors

RKI torque motors and RKIB torque motors are permanently excited synchronous motors with internal secondary parts.

The primary part is a laminated iron core fully encapsulated stator with external liquid cooling.

The secondary part consists of permanent magnets which are integrated into a lamination stack. The magnetic return path is provided by the lamination stack. The secondary part can only be centred from the inside on one side via a centring ring. The secondary part is fastened at the end face of the centring ring.

24 Design of the RKI torque motors and RKIB torque motors



1	Secondary part: retaining ring	2	Secondary part: lamination stack with integrated magnets
3	Secondary part: centring ring	4	Primary part: lamination stack with coils
5	Primary part: encapsulation	6	Primary part: steel housing with cooling meander

The lamination stack of the secondary part reduces eddy current losses to a minimum. At the same speed, the secondary part is heated less than in a RIB motor and does not limit the speed of the motor. The lower amount of rotor heating enables significantly higher speeds and thus a significantly higher mechanical power to be achieved. In addition, the arrangement of the permanent magnets in the secondary part maximises the magnetic flux. The innovative design and the associated concentrating of the magnetic field yield higher torques. The energy efficiency is better and there is less energy consumed for cooling. The magnet configuration variations R20, R22 and V22 result in motors with optimised cost-to-benefit ratios.

RKI torque motors and RKIB torque motors have the following features:

- available in standard sizes
- active primary part heights in 25-mm steps
- various standard windings and magnet configurations for different speeds and powers

Advantages

- low power loss
- excellent dynamic response and high rigidity
- compact design
- maintenance-free
- good synchronisation characteristics
- reduced energy consumption courtesy of converter-based and application-based winding designs
- cost savings possible through downsizing
- high machine accuracy due to reduced heat from the motor

Compared with standard motors of the RIB series, these motors can achieve the following values with the same installation space, depending on the magnet configuration, motor optimisation and operating point:

- +30 % torque
- +400 % speed
- +400 % mechanical power
- –40 % heat loss capacity

Application in the following machine tools:

- rotary tables in standard milling machines
- rotary tables in milling machines with rotation option
- rotary tables in hard turning machines
- main drives in servo presses
- workpiece grinding spindles in grinding machines

3

3.1 RKI and RKIB ordering designation

25 RKI series and RKIB series

RKI5---- | 3P | 0230 | 050 | ZX.X- | P | O | M | C | A | 2.0 | RDDM | R22 | Y

Short designation, motor
RKI----- Series and type code
RKIB---- Series and type code
(selected by Schaeffler Industrial Drives based on motor part and effective air gap diameter)

Number of motor phases
3P 3-phase

Effective air gap diameter
0230 – 0690 4-digit code with units of mm; values below 1,000 are filled with leading zeroes (0230, 0298, 0384, 0460, 0690)

Active height
050 – 175 3-digit code with units of mm; values below 100 are filled with leading zeroes (050, 075, 100, 125, 150, 175)

Winding design
ZX.X- Option for PRIM and RDDM
N---- Option for SEK

Temperature monitoring
P 3 PTC and 3 Pt1000, option for PRIM and RDDM
T 3 PTC and 3 Pt1000, option for PRIM and RDDM
N Option for SEK

Commutation type
O Without sensors, measuring system commutated, option for PRIM and RDDM
N Option for SEK

Design variant
M Standard built-in component, option for PRIM and RDDM
N Option for SEK

Connection type
C 4-conductor shielded cable, option for PRIM and RDDM
N Option for SEK

Direction of connection
A Axial, option for PRIM and RDDM
R Radial, option for PRIM and RDDM
T Tangential, option for PRIM and RDDM
N Option for SEK

Cable length
2.0 Cable length in m, option for PRIM and RDDM
5.0 Cable length in m, option for PRIM and RDDM
N.N Option for SEK

Motor part
PRIM Primary part
SEK Secondary part
RDDM Torque motor consisting of primary part and secondary part

Magnet configuration
N-- Option PRIM
R22 Torque-optimised
V22 CO_2- and performance-optimised
R20 Cost- and performance-optimised

Standard product (determined by Schaeffler Industrial Drives)
Y Standard
N Non-standard

001CA09A

3

3.2 Product tables

3.2.1 Explanations

$\Delta\vartheta$	K	Cooling water temperature difference
D_{SA}	mm	Inner diameter, secondary part, assembly side
D_{SN}	mm	Inner diameter, secondary part, non-assembly side
D_{STA}	mm	Thread pitch diameter, secondary part, assembly side
dV/dt	l/min	Volume flow
F_a	kN	Axial attraction
F_r	kN/mm	Radial attraction
H_P	mm	Height of primary part
H_{P0}	mm	Distance between housing and cooling inlet
H_{P1}	mm	Distance between cooling inlet and cooling outlet
H_{P2}	mm	Height of axial cable screw
H_{P3}	mm	Height of right-angle cable screw
H_S	mm	Height of secondary part
$I_{c\ eff}$	A	Effective continuous current, not cooled
$I_{cw\ eff}$	A	Effective continuous current, cooled
$I_{cw2\ eff}$	A	Effective continuous current for higher speeds in continuous operation
$I_{p\ eff}$	A	Effective peak current
$I_{sw\ eff}$	A	Effective stall current, cooled
$I_{u\ eff}$	A	Effective ultimate current
J	$kg \cdot m^2$	Moment of inertia, secondary part
k_m	Nm/√W	Motor constant for torque motors
k_T	Nm/A	Torque constant
$k_{\hat{u}}$	V/(rad/s)	Back EMF constant, phase to phase
L	mH	Inductance, phase to phase
m_P	kg	Mass of primary part
m_S	kg	Mass of secondary part
n_{lp}	min^{-1}	Limiting speed at $I_{p\ eff}$ and U_{DCL}
n_{lw}	min^{-1}	Knee speed
n_{lw2}	min^{-1}	Operating speed FS at $I_{cw2\ eff}$ and U_{DCL}
n_{lw3}	min^{-1}	Limiting speed at $I_{cw2\ eff}$ and U_{DCL} in continuous operation
n_{lwS1}	min^{-1}	Rated speed S1, cooled
n_P	–	Thread number, primary part
n_{PC}	–	Primary part thread number, cable side
n_S	–	Secondary part thread number
P	–	Number of pole pairs
P_{lc}	W	Power loss at T_c
P_{lp}	W	Power loss at T_p
P_{lw}	W	Power loss at T_{cw}
$P_{max\ S1}$	N	Maximum rated power
R_{20}	Ω	Electrical resistance, phase to phase
T_c	Nm	Continuous torque, not cooled
T_{cog}	Nm	Cogging torque
T_{cw}	Nm	Continuous torque, cooled
T_{cw2}	Nm	Torque at $I_{cw2\ eff}$ and n_{lw2}
T_{cw3}	Nm	Torque at $I_{cw2\ eff}$ and n_{lw3}
TD_P	mm	Thread depth, primary part
TD_{PC}	mm	Thread depth, primary part, cable side
TD_S	mm	Thread depth, secondary part
T_p	Nm	Peak torque
TP_P	°	Thread pitch, primary part
TP_{PC}	°	Thread pitch, primary part, cable side
TP_S	°	Thread pitch, secondary part
TS_P	–	Thread size, primary part
TS_{PC}	–	Thread size, primary part, cable side

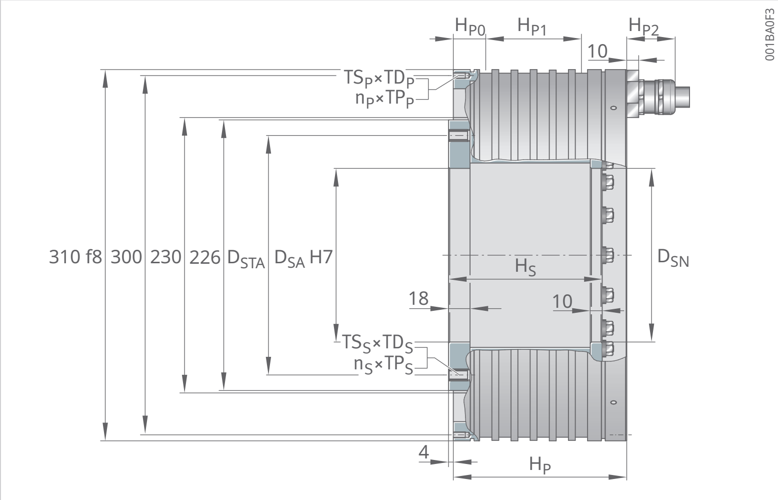
TS_S	–	Thread size, secondary part
T_{sw}	Nm	Stall torque, cooled
T_u	Nm	Ultimate torque
U_{DCL}	V	DC link voltage
ϑ_{nf}	°C	Nominal feed temperature
ϑ_{PTC}	°C	Motor temperature switch-off threshold

Tolerance range of the values: ±10 %.

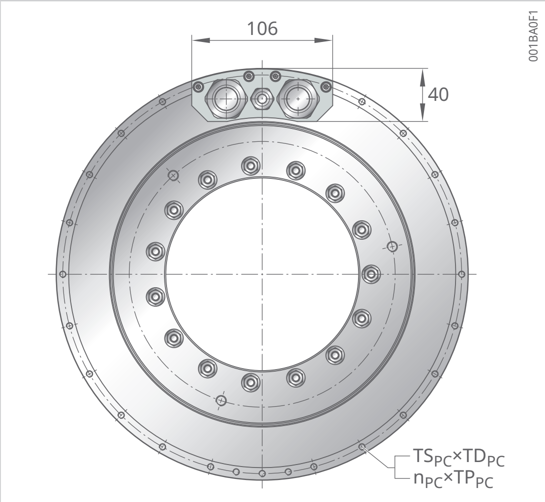
Binding data and drawings will be made available by agreement. We recommend obtaining support from our engineers in the motor design phase.

3

3.2.2 RKI5-3P-230xH Geometric data



Size			**230×50**
Magnet configuration			**R20**
Winding design			**Z2**
Power cable	–	–	1×4G10
Mass, secondary part	m_S	kg	9,7
Mass, primary part	m_P	kg	17,4
Height, secondary part	H_S	mm	79
Height, primary part	H_P	mm	95
Distance between housing and cooling inlet	H_{P0}	mm	27
Distance between cooling inlet and cooling outlet	H_{P1}	mm	39
Height, axial cable screw	H_{P2}	mm	40,5
Height, right-angle cable screw	H_{P3}	mm	48,5
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	200
Inner diameter, secondary part, assembly side	D_{SA}	mm	145
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	145
Thread, secondary part	$TS_S \times TD_S$	–	M8×14
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	24×15
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M5×10
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	23×15
Thread, primary part	$TS_P \times TD_P$	–	M5×10
Thread, primary part, cable side, number×pitch	$n_P \times TP_P$	°	24×15



Magnet configurations R20 and R22
Axial cable outlet, 2×4G10

230×50	230×75	230×75	230×100	230×100	230×125	230×125	230×150	230×150
R22	**R20**	**R22**	**R20**	**R22**	**R20**	**R22**	**R20**	**R22**
Z2	**Z2**	**Z2**	**Z3.3**	**Z3.3**	**Z3.3**	**Z3.3**	**Z4**	**Z4**
1×4G10	1×4G10	1×4G10	2×4G10	2×4G10	2×4G10	2×4G10	3×4G10	3×4G10
10,2	13,6	14,3	17,4	18,3	21,2	22,4	25,0	26,5
17,4	24,3	24,3	30,3	30,3	43,3	43,3	49,2	49,2
79	104	104	129	129	154	154	179	179
95	120	120	145	145	170	170	195	195
27	31	31	27	27	28	28	29	29
39	48	48	80	80	109	109	133	133
40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5
48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5
200	200	200	200	200	200	200	200	200
145	145	145	145	145	145	145	145	145
145	145	145	145	145	145	145	145	145
M8×14	M8×14	M8×14	M8×14	M8×14	M8×14	M8×14	M8×14	M8×14
24×15	24×15	24×15	24×15	24×15	24×15	24×15	24×15	24×15
M5×10	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10
23×15	23×15	23×15	21×15	21×15	43×7.5	43×7.5	39×7.5	39×7.5
M5×10	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10	M5×10
24×15	24×15	24×15	24×15	24×15	48×7.5	48×7.5	48×7.5	48×7.5

3.2.3 RKI5-3P-230xH
Performance data

3

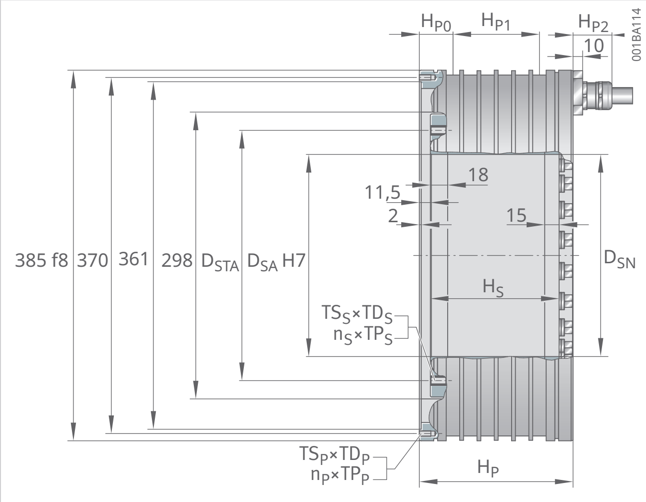
Size				**230×50**
Magnet configuration				**R20**
Winding design				**Z2**
Torques	Ultimate torque	T_u	Nm	381
	Peak torque	T_p	Nm	353
	Continuous torque, cooled	T_{cw}	Nm	201
	Torque at $I_{cw2\ eff}$ and n_{lw2}	T_{cw2}	Nm	185
	Torque at $I_{cw2\ eff}$ and n_{lw3}	T_{cw3}	Nm	122
	Continuous torque, not cooled	T_c	Nm	88
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	153
	Cogging torque	T_{cog}	Nm	1,3
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	1011
	Knee speed	n_{lw}	min^{-1}	1271
	Rated speed (S1), cooled	n_{lwS1}	min^{-1}	500
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{lw2}	min^{-1}	1297
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{lw3}	min^{-1}	2200
Currents	Effective ultimate current	$I_{u\ eff}$	A	141,8
	Effective peak current	$I_{p\ eff}$	A	113,5
	Effective continuous current, cooled	$I_{cw\ eff}$	A	47,0
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	42,3
	Effective continuous current, not cooled	$I_{c\ eff}$	A	18,7
	Effective stall current, cooled	$I_{sw\ eff}$	A	33,8
Power losses	Power loss at T_p	P_{lp}	W	4904
	Power loss at T_{cw}	P_{lw}	W	1097
	Power loss at T_c	P_{lc}	W	133
Mechanical power	Max. rated power	$P_{max\ S1}$	W	28000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,25
	Inductance, phase to phase	L	mH	2,8
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	3,8
General characteristic values	Number of pole pairs	P	–	15
	Motor constant at +20 °C	k_m	Nm/√W	7,6
	Torque constant	k_T	Nm/A	4,7
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	100
	Axial attraction	F_a	kN	0,43
	Radial attraction	F_r	kN/mm	4,9
	Moment of inertia, secondary part	J	kg · m²	0,092
Cooling conditions	Volume flow	dV/dt	l/min	3,1
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

3

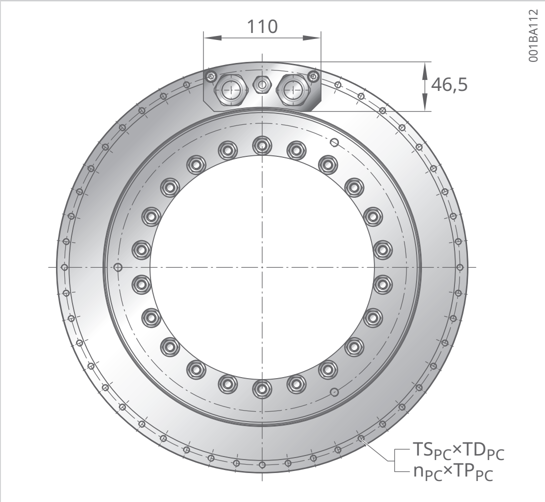
230×50	**230×75**	**230×75**	**230×100**	**230×100**	**230×125**	**230×125**	**230×150**	**230×150**
R22	**R20**	**R22**	**R20**	**R22**	**R20**	**R22**	**R20**	**R22**
Z2	**Z2**	**Z2**	**Z3.3**	**Z3.3**	**Z3.3**	**Z3.3**	**Z4**	**Z4**
522	561	772	751	1029	939	1126	1126	1117
475	529	703	710	937	887	1126	1065	1117
252	317	396	421	532	536	671	643	814
229	291	360	387	484	493	610	592	740
155	91	167	174	293	212	391	239	623
104	135	160	180	209	222	255	265	307
189	236	294	324	395	412	498	495	604
1,5	1,9	2,2	2,3	2,7	2,9	3,3	3,5	4,0
1010	694	681	895	875	719	710	865	886
1166	850	775	1070	979	855	787	1019	930
500	500	500	500	500	500	500	500	500
1179	867	783	1087	988	869	795	1035	938
1600	2200	1200	2200	1400	1800	1100	2200	1150
141,8	141,8	141,8	236,4	236,4	236,4	181,2	335,9	190,4
113,5	113,5	113,5	189,1	189,1	189,1	181,2	268,8	190,4
47,0	49,3	49,3	82,8	82,8	84,4	84,4	119,9	119,9
42,3	44,4	44,4	74,6	74,6	76,0	76,0	107,9	107,9
18,7	19,1	19,1	31,2	31,2	30,8	30,8	43,5	43,5
33,8	35,5	35,5	59,6	59,6	60,8	60,8	86,4	86,4
4904	6313	6313	8039	8039	9506	8730	11266	5652
1097	1554	1554	2011	2011	2468	2468	2925	2925
133	178	178	219	219	251	251	295	295
26000	21000	21000	40000	43000	40000	45000	55000	75000
600	600	600	600	600	600	600	600	600
0,25	0,33	0,33	0,15	0,15	0,18	0,18	0,10	0,10
1,8	3,8	2,5	1,7	1,1	2,1	1,4	1,2	0,8
4,6	5,8	6,8	4,7	5,5	5,9	6,8	5,0	5,8
15	15	15	15	15	15	15	15	15
9,0	10,1	12,0	12,2	14,1	14,0	16,1	15,4	17,9
5,6	7,1	8,4	5,8	6,7	7,2	8,3	6,1	7,1
100	100	100	100	100	100	100	100	100
0,67	0,43	0,67	0,43	0,67	0,43	0,67	0,43	0,67
5,1	7,3	7,7	9,7	10,2	12,1	12,8	14,6	15,3
0,096	0,128	0,134	0,165	0,173	0,202	0,212	0,239	0,251
3,1	4,5	4,5	5,8	5,8	7,1	7,1	8,4	8,4
20	20	20	20	20	20	20	20	20
5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0

3

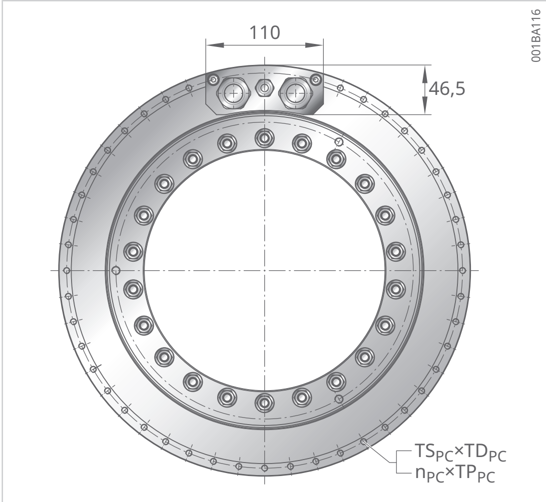
3.2.4 RKIB11-3P-298xH Geometric data, Part 1



Size			298×50
Magnet configuration			**R20**
Winding design			**Z3.8**
Power cable	–	–	1×4G10
Mass, secondary part	m_S	kg	16,0
Mass, primary part	m_P	kg	28,2
Height, secondary part	H_S	mm	84
Height, primary part	H_P	mm	110
Distance between housing and cooling inlet	H_{P0}	mm	34
Distance between cooling inlet and cooling outlet	H_{P1}	mm	42
Height, axial cable screw	H_{P2}	mm	40,5
Height, right-angle cable screw	H_{P3}	mm	48,5
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	260
Inner diameter, secondary part, assembly side	D_{SA}	mm	210
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	210
Thread, secondary part	$TS_S \times TD_S$	–	M8×15
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	30×12
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M6×12
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	21×15
Thread, primary part	$TS_P \times TD_P$	–	M6×12
Thread, primary part, cable side, number×pitch	$n_P \times TP_P$	°	24×15



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

298×50	**298×50**	**298×50**	**298×50**	**298×50**	**298×75**	**298×75**	**298×75**
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z3.8	**Z3.8**	**Z6.1**	**Z6.1**	**Z6.1**	**Z5.7**	**Z5.7**	**Z5.7**
1×4G10	1×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10
14,2	16,4	16,0	14,2	16,4	22,0	19,4	22,5
28,2	28,2	28,2	28,2	28,2	35,2	35,2	35,2
84	84	84	84	84	109	109	109
110	110	110	110	110	130	130	130
34	34	34	34	34	33	33	33
42	42	42	42	42	65	65	65
40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5
48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5
276	260	260	276	260	260	276	260
225	210	210	225	210	210	225	210
227	210	210	227	210	210	227	210
M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15
30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12
M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12
21×15	21×15	21×15	21×15	21×15	21×15	21×15	21×15
M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12
24×15	24×15	24×15	24×15	24×15	24×15	24×15	24×15

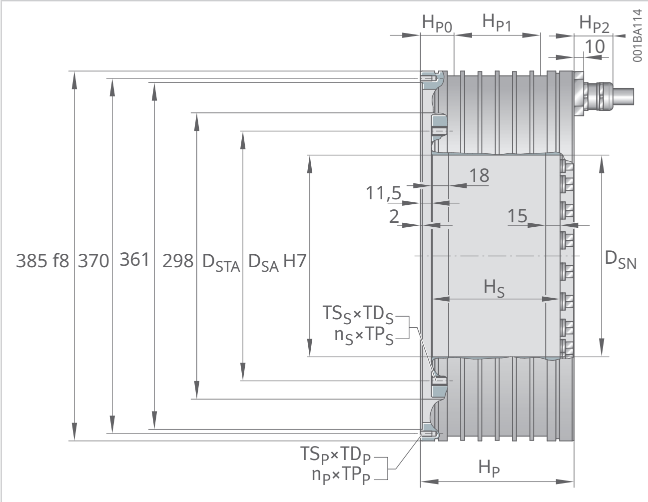
3.2.5 RKIB11-3P-298xH
Performance data, Part 1

3

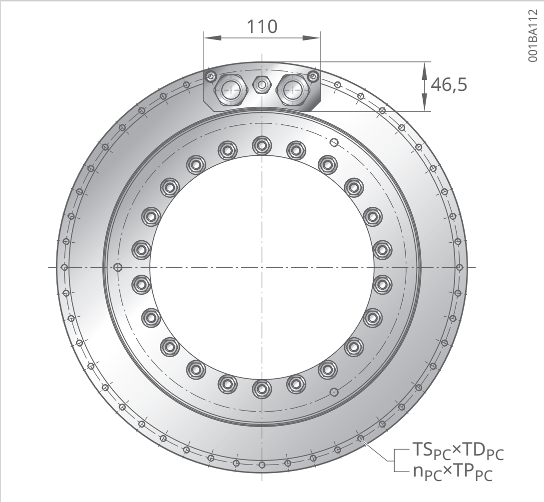
Size				**298×50**
Magnet configuration				**R20**
Winding design				**Z3.8**
Torques	Ultimate torque	T_u	Nm	631
	Peak torque	T_p	Nm	587
	Continuous torque, cooled	T_{cw}	Nm	421
	Torque at $I_{cw2\ eff}$ and n_{lw2}	T_{cw2}	Nm	387
	Torque at $I_{cw2\ eff}$ and n_{lw3}	T_{cw3}	Nm	153
	Continuous torque, not cooled	T_c	Nm	163
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	324
	Cogging torque	T_{cog}	Nm	2,2
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	423
	Knee speed	n_{lw}	min^{-1}	506
	Rated speed (S1), cooled	n_{lwS1}	min^{-1}	273
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{lw2}	min^{-1}	523
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{lw3}	min^{-1}	1500
Currents	Effective ultimate current	$I_{u\ eff}$	A	98,2
	Effective peak current	$I_{p\ eff}$	A	78,6
	Effective continuous current, cooled	$I_{cw\ eff}$	A	45,4
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	40,9
	Effective continuous current, not cooled	$I_{c\ eff}$	A	15,5
	Effective stall current, cooled	$I_{sw\ eff}$	A	33,1
Power losses	Power loss at T_p	P_{lp}	W	4827
	Power loss at T_{cw}	P_{lw}	W	2178
	Power loss at T_c	P_{lc}	W	187
Mechanical power	Max. rated power	$P_{max\ S1}$	W	24000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,52
	Inductance, phase to phase	L	mH	6,3
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	8,6
General characteristic values	Number of pole pairs	P	–	22
	Motor constant at +20 °C	k_m	Nm/√W	11,9
	Torque constant	k_T	Nm/A	10,5
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	110
	Axial attraction	F_a	kN	0,49
	Radial attraction	F_r	kN/mm	6,3
	Moment of inertia, secondary part	J	$kg \cdot m^2$	0,290
Cooling conditions	Volume flow	dV/dt	l/min	6,2
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

298×50	298×50	298×50	298×50	298×50	298×75	298×75	298×75
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z3.8	**Z3.8**	**Z6.1**	**Z6.1**	**Z6.1**	**Z5.7**	**Z5.7**	**Z5.7**
702	820	631	702	820	968	1043	1230
626	727	587	626	727	885	930	1091
408	497	421	408	497	628	616	750
392	452	344	356	402	578	592	703
159	263	255	255	274	286	306	506
158	175	163	158	175	253	246	274
328	374	324	328	374	485	496	570
2,1	2,4	2,2	2,1	2,4	3,2	3,1	3,2
419	410	872	864	846	560	560	526
526	491	1030	1070	1002	659	682	620
273	273	273	273	273	273	273	273
534	507	1105	1123	1066	678	691	633
1500	1000	1500	1500	1500	1500	1500	1000
98,2	98,2	196,4	196,4	196,4	182,4	182,4	182,4
78,6	78,6	157,1	157,1	157,1	145,9	145,9	145,9
45,4	45,4	90,8	90,8	90,8	85,7	85,7	85,7
40,9	40,9	72,6	72,6	72,6	77,1	77,1	77,1
15,5	15,5	30,9	30,9	30,9	30,1	30,1	30,1
33,1	33,1	66,3	66,3	66,3	62,6	62,6	62,6
4827	4827	4827	4827	4827	6616	6616	6616
2178	2178	2178	2178	2178	3085	3085	3085
187	187	187	187	187	281	281	281
25000	27500	40000	40000	43000	45000	48000	53000
600	600	600	600	600	600	600	600
0,52	0,52	0,13	0,13	0,13	0,21	0,21	0,21
6,0	5,4	1,6	1,5	1,3	2,5	2,3	2,3
8,3	9,2	4,3	4,2	4,6	6,9	6,7	7,4
22	22	22	22	22	22	22	22
11,5	12,8	11,9	11,5	12,8	15,1	14,7	16,4
10,2	11,3	5,3	5,1	5,6	8,4	8,2	9,1
110	110	130	130	130	110	110	110
0,47	0,71	0,49	0,47	0,71	0,49	0,47	0,71
6,2	6,6	6,3	6,2	6,6	9,5	9,4	9,8
0,248	0,269	0,290	0,248	0,269	0,362	0,339	0,371
6,2	6,2	6,2	6,2	6,2	8,8	8,8	8,8
20	20	20	20	20	20	20	20
5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0

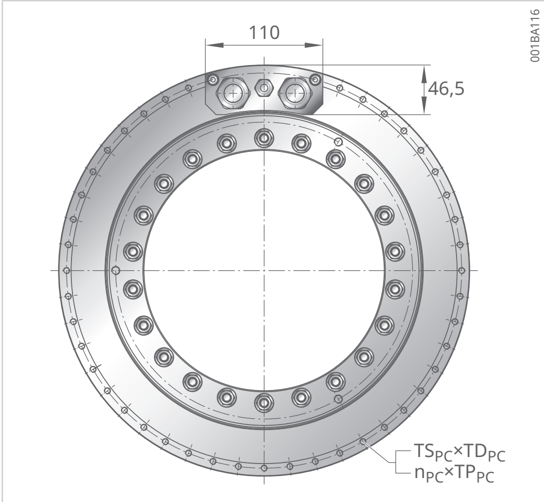
3.2.6 RKIB11-3P-298xH Geometric data, Part 2



Size			**298×100**
Magnet configuration			**R20**
Winding design			**Z5.7**
Power cable	–	–	2×4G10
Mass, secondary part	m_S	kg	27,8
Mass, primary part	m_P	kg	44,2
Height, secondary part	H_S	mm	134
Height, primary part	H_P	mm	160
Distance between housing and cooling inlet	H_{P0}	mm	35
Distance between cooling inlet and cooling outlet	H_{P1}	mm	90
Height, axial cable screw	H_{P2}	mm	40,5
Height, right-angle cable screw	H_{P3}	mm	48,5
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	260
Inner diameter, secondary part, assembly side	D_{SA}	mm	210
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	210
Thread, secondary part	$TS_S×TD_S$	–	M8×15
Thread, secondary part, number×pitch	$n_S×TP_S$	°	30×12
Thread, primary part, cable side	$TS_{PC}×TD_{PC}$	–	M6×12
Thread, primary part, cable side, number×pitch	$n_{PC}×TP_{PC}$	°	43×7.5
Thread, primary part	$TS_P×TD_P$	–	M6×12
Thread, primary part, cable side, number×pitch	$n_P×TP_P$	°	48×7.5



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

298×100	**298×100**	**298×100**	**298×100**	**298×100**	**298×125**	**298×125**	**298×125**	**298×125**	**298×125**	**298×125**
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**V22**	**R20**	**V22**	**R22**
Z5.7	**Z5.7**	**Z6.1**	**Z6.1**	**Z6.1**	**Z5.7**	**Z5.7**	**Z5.7**	**Z7.9**	**Z7.9**	**Z7.9**
2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	4×4G10	4×4G10	4×4G10
24,9	28,5	27,8	24,9	28,5	34,1	29,9	35,1	34,1	29,9	35,1
44,2	44,2	44,2	44,2	44,2	51,9	51,9	51,9	51,9	51,9	51,9
134	134	134	134	134	159	159	159	159	159	159
160	160	160	160	160	185	185	185	185	185	185
35	35	35	35	35	35	35	35	35	35	35
90	90	90	90	90	116	116	116	116	116	116
40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5
48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5
276	260	260	276	260	260	276	260	260	276	260
225	210	210	225	210	210	225	210	210	225	210
227	210	210	227	210	210	227	210	210	227	210
M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15
30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12
M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12
43×7.5	43×7.5	43×7.5	43×7.5	43×7.5	38×7.5	38×7.5	38×7.5	38×7.5	38×7.5	38×7.5
M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12
48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5

3.2.7 RKIB11-3P-298xH
Performance data, Part 2

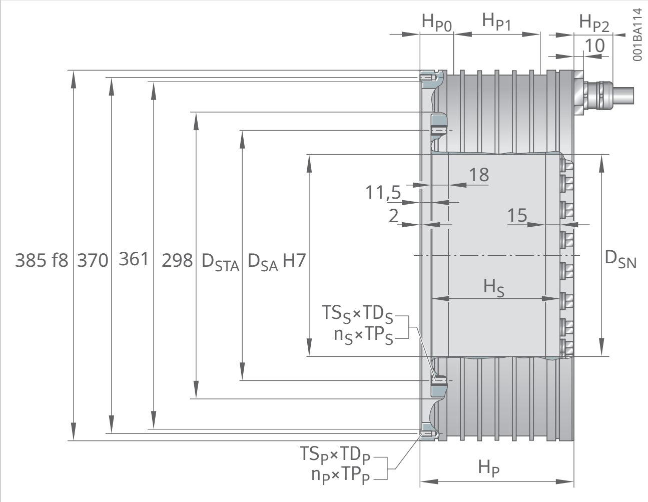
Size				**298×100**
Magnet configuration				**R20**
Winding design				**Z5.7**
Torques	Ultimate torque	T_u	Nm	1331
	Peak torque	T_p	Nm	1213
	Continuous torque, cooled	T_{cw}	Nm	858
	Torque at $I_{cw2\ eff}$ and n_{lw2}	T_{cw2}	Nm	790
	Torque at $I_{cw2\ eff}$ and n_{lw3}	T_{cw3}	Nm	302
	Continuous torque, not cooled	T_c	Nm	336
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	662
	Cogging torque	T_{cog}	Nm	3,9
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	404
	Knee speed	n_{lw}	min^{-1}	482
	Rated speed (S1), cooled	n_{lwS1}	min^{-1}	273
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{lw2}	min^{-1}	497
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{lw3}	min^{-1}	1500
Currents	Effective ultimate current	$I_{u\ eff}$	A	182,4
	Effective peak current	$I_{p\ eff}$	A	145,9
	Effective continuous current, cooled	$I_{cw\ eff}$	A	86,8
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	78,1
	Effective continuous current, not cooled	$I_{c\ eff}$	A	29,9
	Effective stall current, cooled	$I_{sw\ eff}$	A	63,4
Power losses	Power loss at T_p	P_{lp}	W	8086
	Power loss at T_{cw}	P_{lw}	W	3867
	Power loss at T_c	P_{lc}	W	340
Mechanical power	Max. rated power	$P_{max\ S1}$	W	47500
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,25
	Inductance, phase to phase	L	mH	3,4
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	9,2
General characteristic values	Number of pole pairs	P	–	22
	Motor constant at +20 °C	k_m	Nm/√W	18,2
	Torque constant	k_T	Nm/A	11,2
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	110
	Axial attraction	F_a	kN	0,49
	Radial attraction	F_r	kN/mm	12,7
	Moment of inertia, secondary part	J	kg · m²	0,510
Cooling conditions	Volume flow	dV/dt	l/min	11,1
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

3

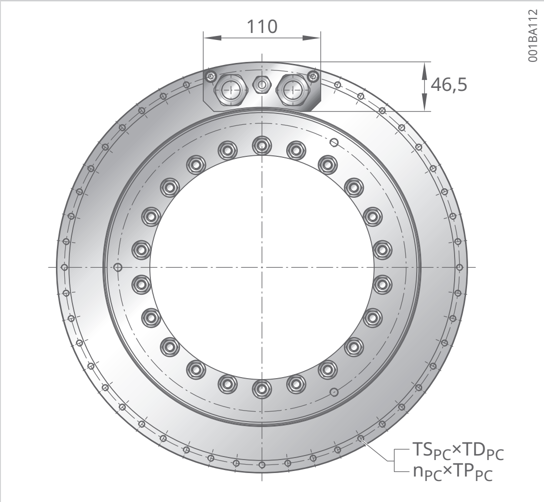
298×100	**298×100**	**298×100**	**298×100**	**298×100**	**298×125**	**298×125**	**298×125**	**298×125**	**298×125**	**298×125**
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z5.7	**Z5.7**	**Z6.1**	**Z6.1**	**Z6.1**	**Z5.7**	**Z5.7**	**Z5.7**	**Z7.9**	**Z7.9**	**Z7.9**
1391	1632	1331	1391	1632	1664	1738	2040	1664	1738	2040
1240	1455	1213	1240	1455	1516	1550	1819	1516	1550	1819
832	999	886	859	1032	1093	1060	1273	1121	1088	1306
800	929	770	755	906	1006	1019	1183	1032	1046	1214
299	420	325	312	382	306	306	363	573	586	898
326	367	347	337	391	410	398	462	421	408	474
670	786	661	670	803	843	853	1001	865	875	1027
3,8	4,3	3,9	3,8	4,3	4,9	4,7	5,4	4,9	4,7	5,4
410	405	438	444	440	321	326	325	580	588	589
501	466	515	535	500	382	397	371	674	700	659
273	273	273	273	273	273	273	273	273	273	273
508	474	542	560	516	394	403	378	695	710	671
1500	1000	1500	1500	1150	1500	1500	1000	1500	1500	1000
182,4	182,4	196,4	196,4	196,4	182,4	182,4	182,4	319,1	319,1	319,1
145,9	145,9	157,1	157,1	157,1	145,9	145,9	145,9	255,3	255,3	255,3
86,8	85,9	96,5	96,5	95,5	88,5	88,5	87,5	158,8	158,8	157,1
78,1	77,3	82,0	82,0	81,2	79,6	79,6	78,8	142,9	142,9	141,4
29,9	29,6	33,3	33,3	32,9	29,2	29,2	28,9	52,4	52,4	51,9
63,4	62,7	70,5	70,5	69,7	64,6	64,6	63,9	115,9	115,9	114,7
8086	8260	7586	7586	7748	9556	9556	9761	9080	9080	9275
3867	3867	3867	3867	3867	4746	4746	4746	4746	4746	4746
340	340	340	340	340	383	383	383	383	383	383
47000	44000	51000	49000	46000	48000	48000	38000	90000	92000	94000
600	600	600	600	600	600	600	600	600	600	600
0,25	0,26	0,20	0,20	0,21	0,30	0,30	0,31	0,09	0,09	0,09
3,2	2,7	2,9	2,8	2,3	4,2	4,0	3,2	1,4	1,3	1,0
8,9	10,4	8,5	8,3	9,7	11,5	11,1	13,0	6,6	6,4	7,5
22	22	22	22	22	22	22	22	22	22	22
17,7	20,5	18,8	18,3	21,2	21,0	20,3	23,6	21,5	20,9	24,2
10,9	12,8	10,4	10,1	11,9	14,0	13,6	16,0	8,0	7,8	9,1
110	110	130	130	130	110	110	110	110	110	110
0,47	0,71	0,49	0,47	0,71	0,49	0,47	0,71	0,49	0,47	0,71
12,5	13,1	12,7	12,5	13,1	15,8	15,6	16,4	15,8	15,6	16,4
0,431	0,473	0,510	0,431	0,473	0,559	0,525	0,575	0,559	0,525	0,575
11,1	11,1	11,1	11,1	11,1	13,6	13,6	13,6	13,6	13,6	13,6
20	20	20	20	20	20	20	20	20	20	20
5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0

3

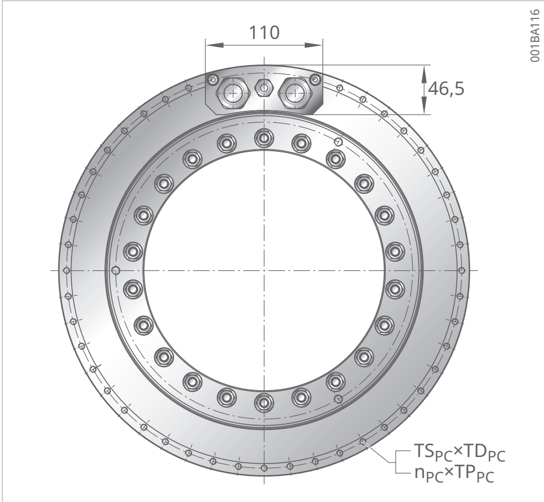
3.2.8 RKIB11-3P-298xH Geometric data, Part 3



Size			298×150
Magnet configuration			**R20**
Winding design			**Z6.1**
Power cable	–	–	2×4G10
Mass, secondary part	m_S	kg	39,9
Mass, primary part	m_P	kg	59,7
Height, secondary part	H_S	mm	184
Height, primary part	H_P	mm	210
Distance between housing and cooling inlet	H_{P0}	mm	35
Distance between cooling inlet and cooling outlet	H_{P1}	mm	140
Height, axial cable screw	H_{P2}	mm	40,5
Height, right-angle cable screw	H_{P3}	mm	48,5
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	260
Inner diameter, secondary part, assembly side	D_{SA}	mm	210
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	210
Thread, secondary part	TS_S×TD_S	–	M8×15
Thread, secondary part, number×pitch	n_S×TP_S	°	30×12
Thread, primary part, cable side	TS_{PC}×TD_{PC}	–	M6×12
Thread, primary part, cable side, number×pitch	n_{PC}×TP_{PC}	°	38×7.5
Thread, primary part	TS_P×TD_P	–	M6×12
Thread, primary part, cable side, number×pitch	n_P×TP_P	°	48×7.5



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

298×150	298×150	298×150	298×150	298×150	298×175	298×175	298×175	298×175	298×175	298×175
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z6.1	**Z6.1**	**Z7.9**	**Z7.9**	**Z7.9**	**Z5.7**	**Z5.7**	**Z5.7**	**Z7.9**	**Z7.9**	**Z7.9**
2×4G10	2×4G10	4×4G10	4×4G10	4×4G10	2×4G10	2×4G10	2×4G10	4×4G10	4×4G10	4×4G10
35,2	41,2	39,9	35,2	41,2	46,2	40,4	47,6	46,2	40,4	47,6
59,7	59,7	59,7	59,7	59,7	67,6	67,6	67,6	67,6	67,6	67,6
184	184	184	184	184	209	209	209	209	209	209
210	210	210	210	210	235	235	235	235	235	235
35	35	35	35	35	37	37	37	37	37	37
140	140	140	140	140	161	161	161	161	161	161
40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5
48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5
276	260	260	276	260	260	276	260	260	276	260
225	210	210	225	210	210	225	210	210	225	210
227	210	210	227	210	210	227	210	210	227	210
M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15	M8×15
30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12	30×12
M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12
38×7.5	38×7.5	38×7.5	38×7.5	38×7.5	38×7.5	38×7.5	38×7.5	38×7.5	38×7.5	38×7.5
M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12	M6×12
48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5	48×7.5

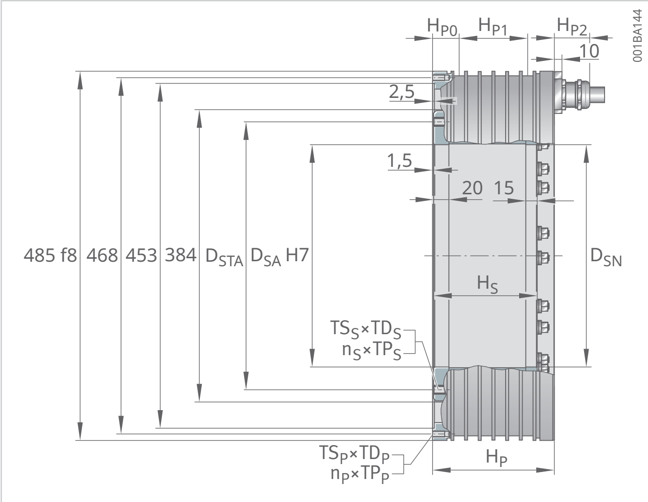
3.2.9 RKIB11-3P-298xH
Performance data, Part 3

Size				**298×150**
Magnet configuration				**R20**
Winding variant				**Z6.1**
Torques	Ultimate torque	T_u	Nm	1997
	Peak torque	T_p	Nm	1819
	Continuous torque, cooled	T_{cw}	Nm	1350
	Torque at $I_{cw2\ eff}$ and n_{lw2}	T_{cw2}	Nm	1243
	Torque at $I_{cw2\ eff}$ and n_{lw3}	T_{cw3}	Nm	318
	Continuous torque, not cooled	T_c	Nm	508
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	865
	Cogging torque	T_{cog}	Nm	5,9
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	290
	Knee speed	n_{lw}	min^{-1}	340
	Rated speed (S1), cooled	n_{lwS1}	min^{-1}	273
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{lw2}	min^{-1}	351
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{lw3}	min^{-1}	1500
Currents	Effective ultimate current	$I_{u\ eff}$	A	196,4
	Effective peak current	$I_{p\ eff}$	A	157,1
	Effective continuous current, cooled	$I_{cw\ eff}$	A	98,1
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	88,3
	Effective continuous current, not cooled	$I_{c\ eff}$	A	32,5
	Effective stall current, cooled	$I_{sw\ eff}$	A	71,6
Power losses	Power loss at T_p	P_{lp}	W	10344
	Power loss at T_{cw}	P_{lw}	W	5444
	Power loss at T_c	P_{lc}	W	442
Mechanical power	Max. rated power	$P_{max\ S1}$	W	50000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,28
	Inductance, phase to phase	L	mH	4,3
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	12,8
General characteristic values	Number of pole pairs	P	–	22
	Motor constant at +20 °C	k_m	Nm/√W	24,2
	Torque constant	k_T	Nm/A	15,6
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	130
	Axial attraction	F_a	kN	0,49
	Radial attraction	F_r	kN/mm	19,0
	Moment of inertia, secondary part	J	$kg \cdot m^2$	0,740
Cooling conditions	Volume flow	dV/dt	l/min	15,6
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

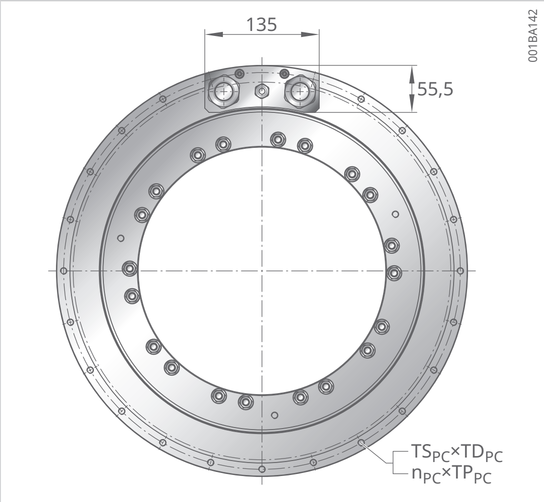
3

298×150	298×150	298×150	298×150	298×150	298×175	298×175	298×175	298×175	298×175	298×175
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z6.1	**Z6.1**	**Z7.9**	**Z7.9**	**Z7.9**	**Z5.7**	**Z5.7**	**Z5.7**	**Z7.9**	**Z7.9**	**Z7.9**
1937	2448	1997	2086	2448	2330	2434	2856	2330	2434	2856
1764	2182	1819	1860	2182	2122	2170	2546	2122	2170	2546
1309	1572	1341	1301	1562	1515	1469	1765	1554	1508	1810
1205	1462	1235	1251	1453	1394	1413	1640	1431	1449	1683
318	735	573	579	812	220	212	509	560	573	668
493	572	505	490	569	571	554	644	586	569	660
875	1027	865	875	1027	1208	1223	1434	1240	1254	1471
5,7	6,5	5,9	5,7	6,5	6,8	6,6	7,5	6,8	6,6	7,5
302	294	483	490	493	227	230	229	414	420	421
353	333	562	584	551	272	283	264	483	502	472
273	273	273	273	273	227	230	229	273	273	273
364	339	580	593	560	281	287	269	498	509	480
1500	650	1500	1500	1000	1300	1350	600	1500	1500	1000
196,4	196,4	319,1	319,1	319,1	182,4	182,4	182,4	319,1	319,1	319,1
157,1	157,1	255,3	255,3	255,3	145,9	145,9	145,9	255,3	255,3	255,3
98,1	97,0	158,3	158,3	156,7	87,6	87,6	86,7	157,2	157,2	155,6
88,3	87,3	142,5	142,5	141,0	78,8	78,8	78,0	141,5	141,5	140,0
32,5	32,1	52,5	52,5	51,9	29,1	29,1	28,8	52,2	52,2	51,6
71,6	70,8	71,6	71,6	70,8	71,6	71,6	70,8	118,7	118,7	117,4
10344	10566	10477	10477	10701	12497	12497	12765	11874	11874	12128
5444	5444	5444	5444	5444	6085	6085	6085	6085	6085	6085
442	442	442	442	442	496	496	496	496	496	496
50000	50000	90000	91000	85000	30000	30000	32000	88000	90000	70000
600	600	600	600	600	600	600	600	600	600	600
0,28	0,29	0,11	0,11	0,11	0,39	0,39	0,40	0,12	0,12	0,12
4,1	3,2	1,6	1,5	1,2	5,7	5,4	4,3	1,9	1,8	1,4
12,4	14,5	7,9	7,6	8,9	16,0	15,6	18,3	9,2	8,9	10,4
22	22	22	22	22	22	22	22	22	22	22
23,4	27,2	24,0	23,3	27,0	25,7	24,9	28,9	26,3	25,5	29,6
15,2	17,8	9,6	9,3	11,0	19,7	19,1	22,4	11,2	10,9	12,8
130	130	130	130	130	130	130	130	130	130	130
0,47	0,71	0,49	0,47	0,71	0,49	0,47	0,71	0,49	0,47	0,71
18,7	19,7	19,0	18,7	19,7	22,2	21,8	22,9	22,2	21,8	22,9
0,618	0,677	0,740	0,618	0,677	0,756	0,710	0,779	0,756	0,710	0,779
15,6	15,6	15,6	15,6	15,6	17,4	17,4	17,4	17,4	17,4	17,4
20	20	20	20	20	20	20	20	20	20	20
5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0

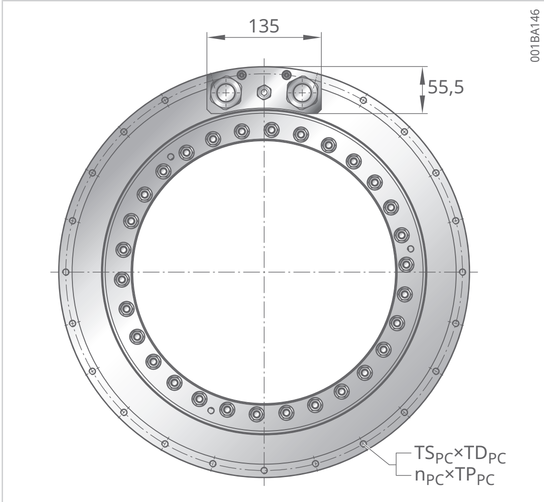
3.2.10 RKIB5-3P-384xH Geometric data, Part 1



Size			**384×50**
Magnet configuration			**R20**
Winding design			**Z5.8**
Power cable	–	–	2×4G10
Mass, secondary part	m_S	kg	21,8
Mass, primary part	m_P	kg	41,0
Height, secondary part	H_S	mm	86
Height, primary part	H_P	mm	110
Distance between housing and cooling inlet	H_{P0}	mm	33
Distance between cooling inlet and cooling outlet	H_{P1}	mm	45
Height, axial cable screw	H_{P2}	mm	46,5
Height, right-angle cable screw	H_{P3}	mm	53,8
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	352
Inner diameter, secondary part, assembly side	D_{SA}	mm	292
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	292
Thread, secondary part	TS_S×TD_S	–	M10×15
Thread, secondary part, number×pitch	n_S×TP_S	°	24×15
Thread, primary part, cable side	TS_{PC}×TD_{PC}	–	M8×16
Thread, primary part, cable side, number×pitch	n_{PC}×TP_{PC}	°	11×30
Thread, primary part	TS_P×TD_P	–	M8×16
Thread, primary part, cable side, number×pitch	n_P×TP_P	°	12×30



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

384×50	**384×50**	**384×75**	**384×75**	**384×75**	**384×100**	**384×100**	**384×100**	**384×125**	**384×125**	**384×125**
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z5.8	**Z5.8**	**Z5.8**	**Z5.8**	**Z5.8**	**Z5.8**	**Z5.8**	**Z5.8**	**Z7.2**	**Z7.2**	**Z7.2**
2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G16	2×4G16	2×4G16
16,3	22,8	30,0	21,8	31,4	38,1	27,5	40,0	46,3	33,2	48,7
41,0	41,0	52,0	52,0	52,0	65,7	65,7	65,7	78,6	78,6	78,6
86	86	111	111	111	136	136	136	161	161	161
110	110	130	130	130	160	160	160	185	185	185
33	33	33	33	33	35	35	35	35	35	35
45	45	65	65	65	90	90	90	116	116	116
46,5	46,5	46,5	46,5	46,5	46,5	46,5	46,5	46,5	46,5	46,5
53,8	53,8	53,8	53,8	53,8	53,8	53,8	53,8	53,8	53,8	53,8
360	352	352	360	352	352	360	352	352	360	352
310	292	292	310	292	292	310	292	292	310	292
312	292	292	312	292	292	312	292	292	312	292
M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15
30×12	24×15	24×15	30×12	24×15	24×15	30×12	24×15	24×15	30×12	24×15
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
11×30	11×30	11×30	11×30	11×30	21×15	21×15	21×15	21×15	21×15	21×15
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
12×30	12×30	12×30	12×30	12×30	24×15	24×15	24×15	24×15	24×15	24×15

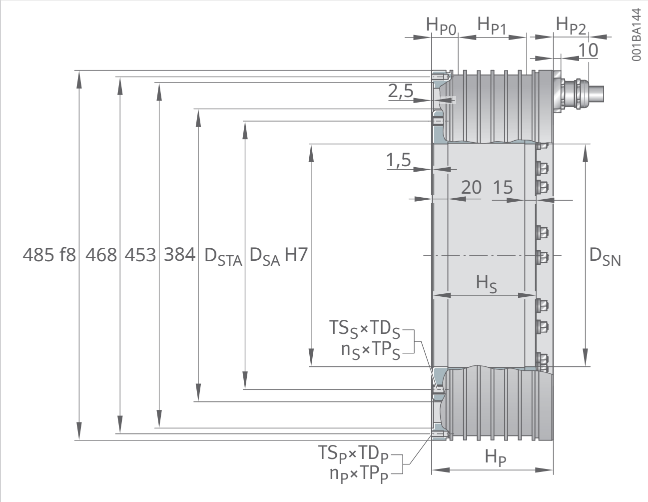
3.2.11 RKIB5-3P-384xH
Performance data, Part 1

Size				**384×50**
Magnet configuration				**R20**
Winding design				**Z5.8**
Torques	Ultimate torque	T_u	Nm	1164
	Peak torque	T_p	Nm	1040
	Continuous torque, cooled	T_{cw}	Nm	646
	Torque at $I_{cw2\ eff}$ and n_{Iw2}	T_{cw2}	Nm	595
	Torque at $I_{cw2\ eff}$ and n_{Iw3}	T_{cw3}	Nm	399
	Continuous torque, not cooled	T_c	Nm	251
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	498
	Cogging torque	T_{cog}	Nm	2,0
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{Ip}	min^{-1}	476
	Knee speed	n_{Iw}	min^{-1}	611
	Rated speed (S1), cooled	n_{IwS1}	min^{-1}	200
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{Iw2}	min^{-1}	630
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{Iw3}	min^{-1}	1100
Currents	Effective ultimate current	$I_{u\ eff}$	A	216,8
	Effective peak current	$I_{p\ eff}$	A	173,4
	Effective continuous current, cooled	$I_{cw\ eff}$	A	85,9
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	77,3
	Effective continuous current, not cooled	$I_{c\ eff}$	A	28,3
	Effective stall current, cooled	$I_{sw\ eff}$	A	61,9
Power losses	Power loss at T_p	P_{Ip}	W	8292
	Power loss at T_{cw}	P_{Iw}	W	2732
	Power loss at T_c	P_{Ic}	W	221
Mechanical power	Max. rated power	$P_{max\ S1}$	W	46000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,18
	Inductance, phase to phase	L	mH	2,1
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	7,3
General characteristic values	Number of pole pairs	P	–	30
	Motor constant at +20 °C	k_m	Nm/√W	17,0
	Torque constant	k_T	Nm/A	8,9
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	110
	Axial attraction	F_a	kN	0,61
	Radial attraction	F_r	kN/mm	9,0
	Moment of inertia, secondary part	J	$kg \cdot m^2$	0,628
Cooling conditions	Volume flow	dV/dt	l/min	7,8
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

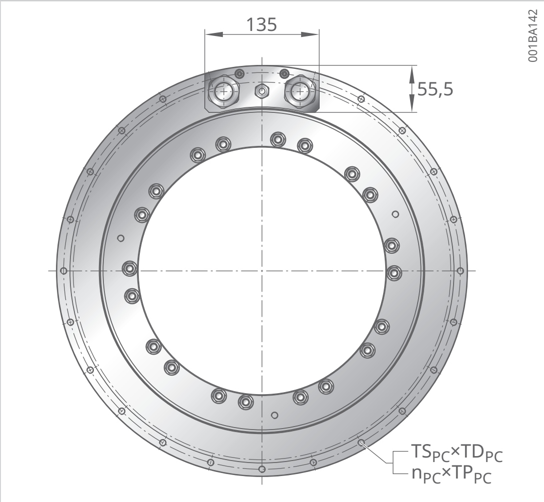
384×50	384×50	384×75	384×75	384×75	384×100	384×100	384×100	384×125	384×125	384×125
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z5.8	**Z5.8**	**Z5.8**	**Z5.8**	**Z5.8**	**Z5.8**	**Z5.8**	**Z5.8**	**Z7.2**	**Z7.2**	**Z7.2**
1230	1440	1746	1846	2161	2327	2461	2881	2909	3076	3601
1146	1275	1559	1719	1912	2079	2291	2549	2599	2864	3186
728	761	994	1120	1172	1314	1480	1549	1643	1851	1937
669	701	916	1030	1079	1210	1361	1425	1514	1702	1782
434	597	417	443	537	399	425	394	722	764	1035
263	285	376	395	428	502	527	571	627	652	706
553	585	767	851	901	1013	1124	1191	1267	1406	1489
2,1	2,4	3,1	3,2	3,6	4,1	4,3	4,8	5,4	5,6	6,3
466	485	321	314	329	241	236	246	285	279	293
589	594	407	392	397	308	296	298	361	347	351
200	200	200	200	200	200	200	200	200	200	200
607	606	419	404	405	316	304	304	371	357	357
1100	800	1100	1100	800	1100	1100	800	900	900	600
216,8	216,8	216,8	216,8	216,8	216,8	216,8	216,8	314,8	314,8	314,8
173,4	173,4	173,4	173,4	173,4	173,4	173,4	173,4	251,8	251,8	251,8
85,9	85,9	88,2	88,2	88,2	87,4	87,4	87,4	127,0	127,0	127,0
77,3	77,3	79,4	79,4	79,4	78,7	78,7	78,7	114,3	114,3	114,3
28,3	28,3	28,3	28,3	28,3	28,3	28,3	28,3	40,7	40,7	40,7
61,9	61,9	63,5	63,5	63,5	62,9	62,9	62,9	91,4	91,4	91,4
8292	8292	10805	10805	10805	13318	13318	13318	16330	16330	16330
2732	2732	3749	3749	3749	4539	4539	4539	5570	5570	5570
221	221	288	288	288	356	356	356	427	427	427
50000	50000	48000	51000	45000	46000	49000	33000	68000	72000	65000
600	600	600	600	600	600	600	600	600	600	600
0,18	0,18	0,24	0,24	0,24	0,30	0,30	0,30	0,17	0,17	0,17
2,0	1,6	3,0	2,8	2,3	3,9	3,7	2,9	2,3	2,2	1,7
7,6	8,2	11,0	11,4	12,3	14,6	15,2	16,4	12,6	13,1	14,2
30	30	30	30	30	30	30	30	30	30	30
17,7	19,2	22,4	23,3	25,2	26,9	28,0	30,3	30,4	31,6	34,2
9,3	10,1	13,4	14,0	15,1	17,9	18,6	20,1	15,4	16,0	17,3
110	110	110	110	110	110	110	110	110	110	110
0,65	1,00	0,61	0,65	1,00	0,61	0,65	1,00	0,61	0,65	1,00
9,3	10,4	13,5	13,9	15,6	18,0	18,5	20,8	22,5	23,2	26,0
0,500	0,655	0,865	0,673	0,905	1,102	0,850	1,155	1,338	1,027	1,405
7,8	7,8	10,7	10,7	10,7	13,0	13,0	13,0	16,0	16,0	16,0
20	20	20	20	20	20	20	20	20	20	20
5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0

3

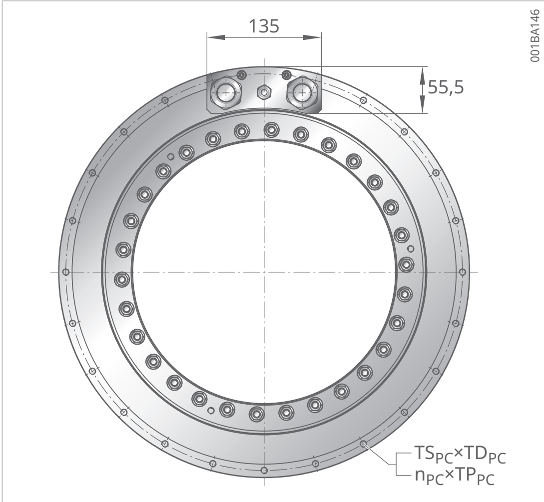
3.2.12 RKIB5-3P-384xH Geometric data, Part 2



Size			**384×150**
Magnet configuration			**R20**
Winding design			**Z8.4**
Power cable	–	–	4×4G10
Mass, secondary part	m_S	kg	54,5
Mass, primary part	m_P	kg	91,4
Height, secondary part	H_S	mm	186
Height, primary part	H_P	mm	210
Distance between housing and cooling inlet	H_{P0}	mm	35
Distance between cooling inlet and cooling outlet	H_{P1}	mm	140
Height, axial cable screw	H_{P2}	mm	46,5
Height, right-angle cable screw	H_{P3}	mm	53,8
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	352
Inner diameter, secondary part, assembly side	D_{SA}	mm	292
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	292
Thread, secondary part	$TS_S×TD_S$	–	M10×15
Thread, secondary part, number×pitch	$n_S×TP_S$	°	24×15
Thread, primary part, cable side	$TS_{PC}×TD_{PC}$	–	M8×16
Thread, primary part, cable side, number×pitch	$n_{PC}×TP_{PC}$	°	18×15
Thread, primary part	$TS_P×TD_P$	–	M8×16
Thread, primary part, cable side, number×pitch	$n_P×TP_P$	°	24×15



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

384×150	**384×150**	**384×175**	**384×175**	**384×175**
V22	**R22**	**R20**	**V22**	**R22**
Z8.4	**Z8.4**	**Z8.4**	**Z8.4**	**Z8.4**
4×4G10	4×4G10	4×4G10	4×4G10	4×4G10
38,9	57,3	62,6	44,5	65,9
91,4	91,4	104,1	104,1	104,1
186	186	211	211	211
210	210	235	235	235
35	35	37	37	37
140	140	161	161	161
46,5	46,5	46,5	46,5	46,5
53,8	53,8	53,8	53,8	53,8
360	352	352	360	352
310	292	292	310	292
312	292	292	312	292
M10×15	M10×15	M10×15	M10×15	M10×15
30×12	24×15	24×15	30×12	24×15
M8×16	M8×16	M8×16	M8×16	M8×16
18×15	18×15	38×7.5	38×7.5	38×7.5
M8×16	M8×16	M8×16	M8×16	M8×16
24×15	24×15	48×7.5	48×7.5	48×7.5

3.2.13 RKIB5-3P-384xH
Performance data, Part 2

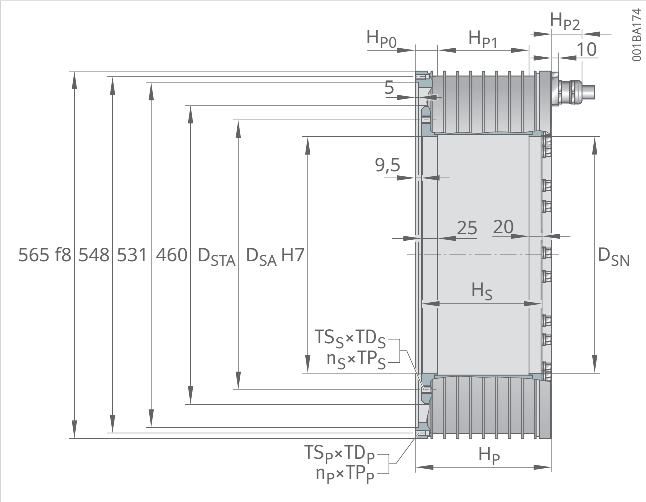
3

Size				**384×150**
Magnet configuration				**R20**
Winding design				**Z8.4**
Torques	Ultimate torque	T_u	Nm	3491
	Peak torque	T_p	Nm	3119
	Continuous torque, cooled	T_{cw}	Nm	2025
	Torque at $I_{cw2\ eff}$ and n_{lw2}	T_{cw2}	Nm	1866
	Torque at $I_{cw2\ eff}$ and n_{lw3}	T_{cw3}	Nm	1040
	Continuous torque, not cooled	T_c	Nm	761
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	1267
	Cogging torque	T_{cog}	Nm	6,4
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	335
	Knee speed	n_{lw}	min^{-1}	416
	Rated speed (S1), cooled	n_{lwS1}	min^{-1}	200
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{lw2}	min^{-1}	427
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{lw3}	min^{-1}	900
Currents	Effective ultimate current	$I_{u\ eff}$	A	433,6
	Effective peak current	$I_{p\ eff}$	A	346,8
	Effective continuous current, cooled	$I_{cw\ eff}$	A	179,6
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	161,7
	Effective continuous current, not cooled	$I_{c\ eff}$	A	56,7
	Effective stall current, cooled	$I_{sw\ eff}$	A	129,3
Power losses	Power loss at T_p	P_{lp}	W	18343
	Power loss at T_{cw}	P_{lw}	W	6602
	Power loss at T_c	P_{lc}	W	491
Mechanical power	Max. rated power	$P_{max\ S1}$	W	98000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,10
	Inductance, phase to phase	L	mH	1,4
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	11,0
General characteristic values	Number of pole pairs	P	–	30
	Motor constant at +20 °C	k_m	Nm/√W	34,4
	Torque constant	k_T	Nm/A	13,4
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	110
	Axial attraction	F_a	kN	0,61
	Radial attraction	F_r	kN/mm	27,0
	Moment of inertia, secondary part	J	kg · m²	1,575
Cooling conditions	Volume flow	dV/dt	l/min	18,9
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

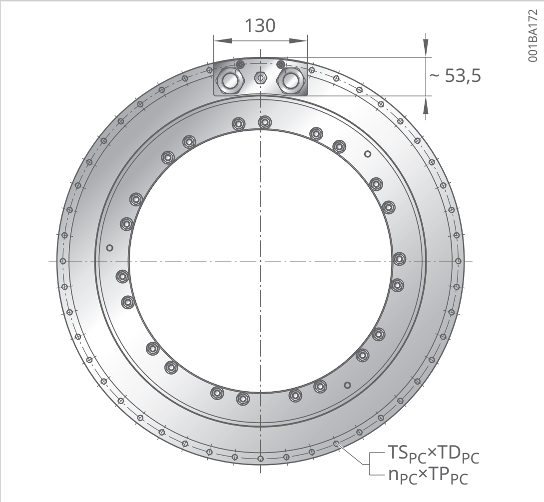
3

384×150	384×150	384×175	384×175	384×175
V22	**R22**	**R20**	**V22**	**R22**
Z8.4	**Z8.4**	**Z8.4**	**Z8.4**	**Z8.4**
3691	4321	4073	4306	5041
3437	3824	3638	4010	4461
2281	2387	2382	2684	2808
2098	2197	2195	2469	2585
1103	1592	1008	1072	1480
792	857	880	915	990
1406	1489	1267	1406	1489
6,7	7,5	7,5	7,9	8,8
328	344	285	279	293
400	404	354	341	345
200	200	200	200	200
411	411	364	350	351
900	600	900	900	600
433,6	433,6	433,6	433,6	433,6
346,8	346,8	346,8	346,8	346,8
179,6	179,6	181,1	181,1	181,1
161,7	161,7	163,0	163,0	163,0
56,7	56,7	56,2	56,2	56,2
129,3	129,3	130,4	130,4	130,4
18343	18343	20856	20856	20856
6602	6602	7633	7633	7633
491	491	548	548	548
104000	100000	95000	101000	93000
600	600	600	600	600
0,10	0,10	0,12	0,12	0,12
1,3	1,0	1,6	1,6	1,2
11,4	12,3	12,8	13,3	14,4
30	30	30	30	30
35,7	38,7	37,6	39,1	42,3
14,0	15,1	15,7	16,3	17,6
110	110	110	110	110
0,65	1,00	0,61	0,65	1,00
27,8	31,2	31,5	32,4	36,4
1,204	1,655	1,812	1,381	1,905
18,9	18,9	21,9	21,9	21,9
20	20	20	20	20
5,0	5,0	5,0	5,0	5,0

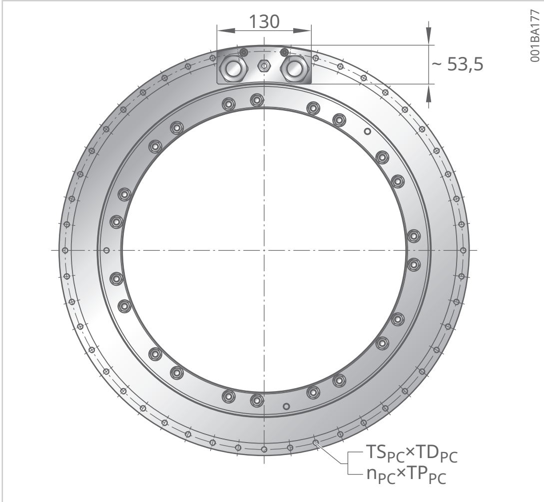
3.2.14 RKIB11-3P-460xH Geometric data, Part 1



Size			460×50
Magnet configuration			**R20**
Winding design			**Z6.0**
Power cable	–	–	2×4G10
Mass, secondary part	m_S	kg	27,2
Mass, primary part	m_P	kg	50,4
Height, secondary part	H_S	mm	86
Height, primary part	H_P	mm	110
Distance between housing and cooling inlet	H_{P0}	mm	34
Distance between cooling inlet and cooling outlet	H_{P1}	mm	42
Height, axial cable screw	H_{P2}	mm	40,5
Height, right-angle cable screw	H_{P3}	mm	48,5
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	415
Inner diameter, secondary part, assembly side	D_{SA}	mm	364
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	364
Thread, secondary part	$TS_S \times TD_S$	–	M10×15
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	24×15
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M8×16
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	11×30
Thread, primary part	$TS_P \times TD_P$	–	M8×16
Thread, primary part, cable side, number×pitch	$n_P \times TP_P$	°	12×30



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

460×50	**460×50**	**460×75**	**460×75**	**460×75**	**460×100**	**460×100**	**460×100**	**460×125**	**460×125**	**460×125**
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z6.0	**Z6.0**	**Z6.0**	**Z6.0**	**Z6.0**	**Z6.0**	**Z6.0**	**Z6.0**	**Z7.5**	**Z7.5**	**Z7.5**
2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G16	2×4G16	2×4G16
19,2	28,2	37,4	26,2	39,0	47,7	33,2	49,7	57,9	40,2	60,5
50,4	50,4	63,4	63,4	63,4	79,1	79,1	79,1	93,5	93,5	93,5
86	86	111	111	111	136	136	136	161	161	161
110	110	130	130	130	160	160	160	185	185	185
34	34	33	33	33	35	35	35	35	35	35
42	42	65	65	65	90	90	90	116	116	116
40,5	40,5	40,5	40,5	40,5	40,5	40,5	40,5	46,5	46,5	46,5
48,5	48,5	48,5	48,5	48,5	48,5	48,5	48,5	53,8	53,8	53,8
435	415	415	435	415	415	435	415	415	435	415
390	364	364	390	364	364	390	364	364	390	364
392	364	364	392	364	364	392	364	364	392	364
M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15	M10×15
33×10.99	24×15	24×15	33×10.99	24×15	24×15	33×10.99	24×15	24×15	33×10.99	24×15
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
11×30	11×30	23×15	23×15	23×15	23×15	23×15	23×15	23×15	23×15	23×15
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
12×30	12×30	24×15	24×15	24×15	24×15	24×15	24×15	24×15	24×15	24×15

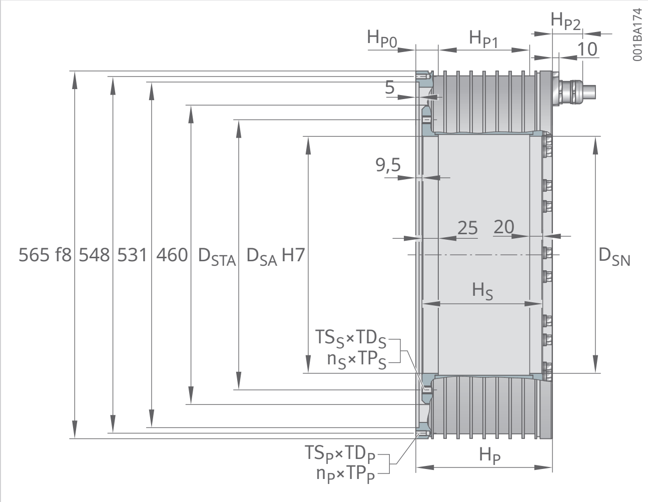
3.2.15 RKIB11-3P-460xH
Performance data, Part 1

Size				**460×50**
Magnet configuration				**R20**
Winding design				**Z6.0**
Torques	Ultimate torque	T_u	Nm	1470
	Peak torque	T_p	Nm	1341
	Continuous torque, cooled	T_{cw}	Nm	928
	Torque at $I_{cw2\ eff}$ and n_{Iw2}	T_{cw2}	Nm	865
	Torque at $I_{cw2\ eff}$ and n_{Iw3}	T_{cw3}	Nm	430
	Continuous torque, not cooled	T_c	Nm	331
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	757
	Cogging torque	T_{cog}	Nm	3,3
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{Ip}	min^{-1}	326
	Knee speed	n_{Iw}	min^{-1}	396
	Rated speed (S1), cooled	n_{IwS1}	min^{-1}	182
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{Iw2}	min^{-1}	415
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{Iw3}	min^{-1}	1000
Currents	Effective ultimate current	$I_{u\ eff}$	A	179,9
	Effective peak current	$I_{p\ eff}$	A	143,9
	Effective continuous current, cooled	$I_{cw\ eff}$	A	85,5
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	77,0
	Effective continuous current, not cooled	$I_{c\ eff}$	A	25,9
	Effective stall current, cooled	$I_{sw\ eff}$	A	62,4
Power losses	Power loss at T_p	P_{Ip}	W	6084
	Power loss at T_{cw}	P_{Iw}	W	2903
	Power loss at T_c	P_{Ic}	W	198
Mechanical power	Max. rated power	$P_{max\ S1}$	W	45000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,20
	Inductance, phase to phase	L	mH	3,1
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	10,4
General characteristic values	Number of pole pairs	P	–	33
	Motor constant at +20 °C	k_m	Nm/√W	23,6
	Torque constant	k_T	Nm/A	12,8
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	110
	Axial attraction	F_a	kN	0,78
	Radial attraction	F_r	kN/mm	10,1
	Moment of inertia, secondary part	J	$kg \cdot m^2$	1,168
Cooling conditions	Volume flow	dV/dt	l/min	8,3
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

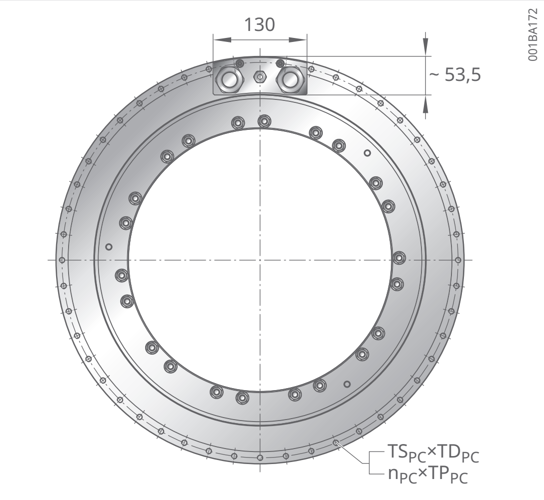
460×50	460×50	460×75	460×75	460×75	460×100	460×100	460×100	460×125	460×125	460×125
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z6.0	**Z6.0**	**Z6.0**	**Z6.0**	**Z6.0**	**Z6.0**	**Z6.0**	**Z6.0**	**Z7.5**	**Z7.5**	**Z7.5**
1576	2033	2205	2364	3049	2940	3152	4066	3675	3940	5082
1441	1784	2012	2161	2676	2683	2882	3569	3353	3602	4461
963	1195	1457	1512	1875	1977	2052	2545	2442	2535	3143
886	1099	1357	1391	1725	1842	1888	2342	2276	2332	2893
458	614	468	487	707	458	477	1091	668	678	1504
325	407	500	490	604	657	644	807	809	793	995
742	931	1188	1165	1461	1613	1581	1983	1993	1953	2449
3,4	3,5	4,9	5,1	5,3	6,5	6,8	7,1	8,2	8,4	8,9
331	337	227	229	230	172	173	173	213	214	213
407	379	267	273	254	201	205	190	247	253	232
182	182	182	182	182	182	182	182	182	182	182
429	393	280	288	263	210	216	197	258	265	240
1000	700	1000	1000	500	1000	1000	350	1000	1000	400
179,9	179,9	179,9	179,9	179,9	179,9	179,9	179,9	269,8	269,8	269,8
143,9	143,9	143,9	143,9	143,9	143,9	143,9	143,9	215,9	215,9	215,9
85,5	85,5	89,5	89,5	89,5	91,1	91,1	91,1	135,0	135,0	135,0
77,0	77,0	80,5	80,5	80,5	82,0	82,0	82,0	121,5	121,5	121,5
25,9	25,9	26,1	26,1	25,6	25,7	25,7	25,7	38,0	38,0	38,0
62,4	62,4	65,3	65,3	65,3	66,5	66,5	66,5	98,6	98,6	98,6
6084	6084	7873	7873	7873	9663	9663	9663	11929	11929	11929
2903	2903	4112	4112	4112	5230	5230	5230	6306	6306	6306
198	198	259	259	250	309	309	309	370	370	370
48000	45000	49000	51000	37000	48000	50000	40000	70000	71000	63000
600	600	600	600	600	600	600	600	600	600	600
0,20	0,20	0,25	0,25	0,25	0,31	0,31	0,31	0,17	0,17	0,17
2,8	2,2	4,3	3,9	2,9	5,5	5,0	3,6	2,9	2,7	1,9
10,2	12,8	15,6	15,3	19,2	20,8	20,4	25,6	17,4	17,0	21,4
33	33	33	33	33	33	33	33	33	33	33
23,1	29,0	31,1	30,4	38,2	37,4	36,6	46,0	42,1	41,2	51,7
12,5	15,7	19,2	18,8	23,5	25,5	25,0	31,4	21,3	20,9	26,2
110	110	110	110	110	110	110	110	110	110	110
0,76	1,27	0,78	0,76	1,27	0,78	0,76	1,27	0,78	0,76	1,27
9,9	11,0	15,1	14,8	16,4	20,2	19,8	21,9	25,2	24,7	27,4
0,877	1,213	1,612	1,198	1,679	2,055	1,519	2,144	2,499	1,840	2,610
8,3	8,3	11,8	11,8	11,8	15,0	15,0	15,0	18,1	18,1	18,1
20	20	20	20	20	20	20	20	20	20	20
5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0

3

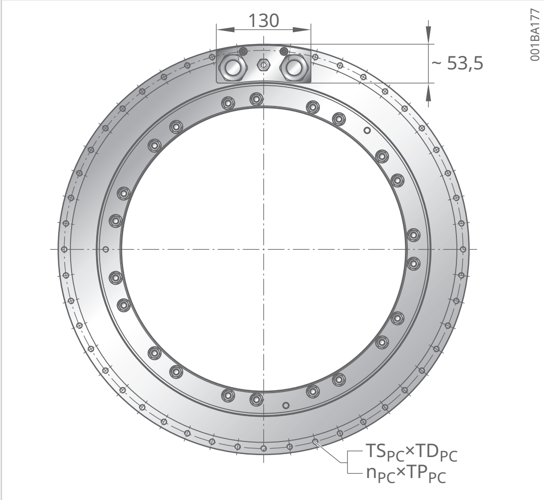
3.2.16 RKIB11-3P-460xH Geometric data, Part 2



Size			**460×150**
Magnet configuration			**R20**
Winding design			**Z8.0**
Power cable	–	–	3×4G10
Mass, secondary part	m_S	kg	68,1
Mass, primary part	m_P	kg	107,8
Height, secondary part	H_S	mm	186
Height, primary part	H_P	mm	210
Distance between housing and cooling inlet	H_{P0}	mm	35
Distance between cooling inlet and cooling outlet	H_{P1}	mm	140
Height, axial cable screw	H_{P2}	mm	40,5
Height, right-angle cable screw	H_{P3}	mm	48,5
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	415
Inner diameter, secondary part, assembly side	D_{SA}	mm	364
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	364
Thread, secondary part	TS_S×TD_S	–	M10×15
Thread, secondary part, number×pitch	n_S×TP_S	°	24×15
Thread, primary part, cable side	TS_{PC}×TD_{PC}	–	M8×16
Thread, primary part, cable side, number×pitch	n_{PC}×TP_{PC}	°	36×7.5
Thread, primary part	TS_P×TD_P	–	M8×16
Thread, primary part, cable side, number×pitch	n_P×TP_P	°	48×7.5



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

460×150	**460×150**	**460×175**	**460×175**	**460×175**
V22	**R22**	**R20**	**V22**	**R22**
Z8.0	**Z8.0**	**Z8.0**	**Z8.0**	**Z8.0**
3×4G10	3×4G10	3×4G10	3×4G10	3×4G10
47,2	71,2	78,3	54,2	82,0
107,8	107,8	122,1	122,1	122,1
186	186	211	211	211
210	210	235	235	235
35	35	37	37	37
140	140	161	161	161
40,5	40,5	40,5	40,5	40,5
48,5	48,5	48,5	48,5	48,5
435	415	415	435	415
390	364	364	390	364
392	364	364	392	364
M10×15	M10×15	M10×15	M10×15	M10×15
33×10.99	24×15	24×15	33×10.99	24×15
M8×16	M8×16	M8×16	M8×16	M8×16
36×7.5	36×7.5	36×7.5	36×7.5	36×7.5
M8×16	M8×16	M8×16	M8×16	M8×16
48×7.5	48×7.5	48×7.5	48×7.5	48×7.5

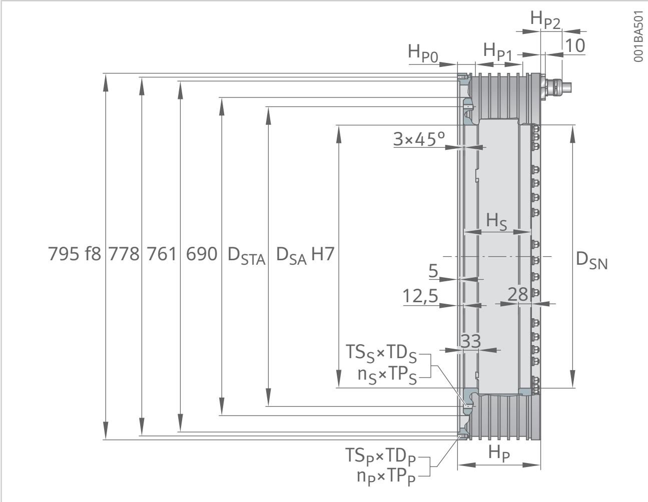
3.2.17 RKIB11-3P-460xH
Performance data, Part 2

Size				**460×150**
Magnet configuration				**R20**
Winding design				**Z8.0**
Torques	Ultimate torque	T_u	Nm	4410
	Peak torque	T_p	Nm	4024
	Continuous torque, cooled	T_{cw}	Nm	3020
	Torque at $I_{cw2\ eff}$ and n_{lw2}	T_{cw2}	Nm	2814
	Torque at $I_{cw2\ eff}$ and n_{lw3}	T_{cw3}	Nm	735
	Continuous torque, not cooled	T_c	Nm	995
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	2464
	Cogging torque	T_{cog}	Nm	9,8
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	193
	Knee speed	n_{lw}	min^{-1}	221
	Rated speed (S1), cooled	n_{lwS1}	min^{-1}	182
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{lw2}	min^{-1}	231
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{lw3}	min^{-1}	1000
Currents	Effective ultimate current	$I_{u\ eff}$	A	291,2
	Effective peak current	$I_{p\ eff}$	A	232,9
	Effective continuous current, cooled	$I_{cw\ eff}$	A	150,1
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	135,1
	Effective continuous current, not cooled	$I_{c\ eff}$	A	42,0
	Effective stall current, cooled	$I_{sw\ eff}$	A	109,6
Power losses	Power loss at T_p	P_{lp}	W	13080
	Power loss at T_{cw}	P_{lw}	W	7340
	Power loss at T_c	P_{lc}	W	426
Mechanical power	Max. rated power	$P_{max\ S1}$	W	77000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,16
	Inductance, phase to phase	L	mH	3,0
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	19,3
General characteristic values	Number of pole pairs	P	–	33
	Motor constant at +20 °C	k_m	Nm/√W	48,2
	Torque constant	k_T	Nm/A	23,7
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	110
	Axial attraction	F_a	kN	0,78
	Radial attraction	F_r	kN/mm	30,2
	Moment of inertia, secondary part	J	$kg \cdot m^2$	2,942
Cooling conditions	Volume flow	dV/dt	l/min	21,0
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

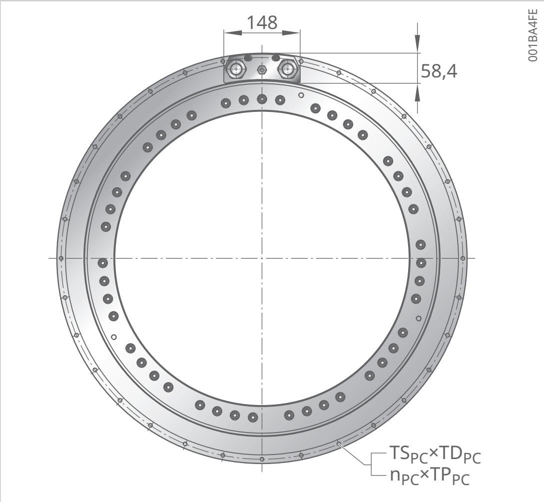
3

460×150	460×150	460×175	460×175	460×175
V22	**R22**	**R20**	**V22**	**R22**
Z8.0	**Z8.0**	**Z8.0**	**Z8.0**	**Z8.0**
4728	6098	5145	5516	7115
4322	5353	4695	5043	6245
3134	3887	3523	3656	4535
2883	3577	3283	3364	4173
745	1265	668	678	1528
975	1223	1151	1128	1415
2415	3029	2874	2818	3533
10,1	10,6	11,4	11,8	12,4
195	193	165	167	164
226	208	189	194	178
182	182	182	182	178
238	215	198	203	184
1000	400	1000	1000	325
291,2	291,2	291,2	291,2	291,2
232,9	232,9	232,9	232,9	232,9
150,1	150,1	150,1	150,1	150,1
135,1	135,1	135,1	135,1	135,1
42,0	42,0	41,7	41,7	41,7
109,6	109,6	109,6	109,6	109,6
13080	13080	14848	14848	14848
7340	7340	8333	8333	8333
426	426	475	475	475
78000	53000	70000	71000	52000
600	600	600	600	600
0,16	0,16	0,18	0,18	0,18
2,7	1,9	3,4	3,1	2,2
18,9	23,8	22,5	22,1	27,7
33	33	33	33	33
47,2	59,2	52,8	51,7	64,9
23,2	29,1	27,6	27,1	33,9
110	110	110	110	110
0,76	1,27	0,78	0,76	1,27
29,6	32,9	35,3	34,6	38,3
2,160	3,076	3,386	2,481	3,542
21,0	21,0	15,9	15,9	15,9
20	20	20	20	20
5,0	5,0	7,5	7,5	7,5

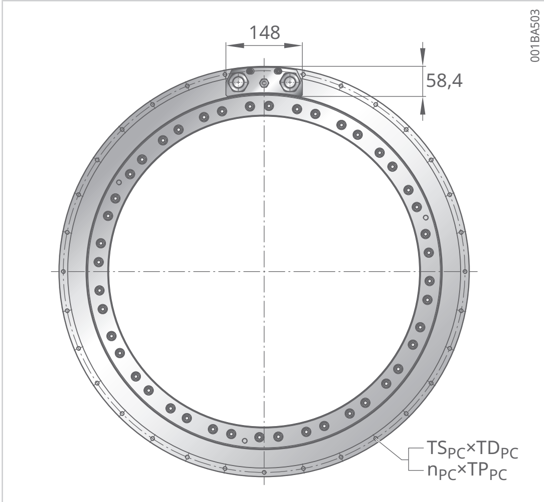
3.2.18 RKIB11-3P-690xH Geometric data, Part 1



Size			**690×50**
Magnet configuration			**R20**
Winding design			**Z6.1**
Power cable	–	–	2×4G10
Mass, secondary part	m_S	kg	60,1
Mass, primary part	m_P	kg	81,6
Height, secondary part	H_S	mm	98
Height, primary part	H_P	mm	130
Distance between housing and cooling inlet	H_{P0}	mm	37
Distance between cooling inlet and cooling outlet	H_{P1}	mm	56
Height, axial cable screw	H_{P2}	mm	40,5
Height, right-angle cable screw	H_{P3}	mm	48,5
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	650
Inner diameter, secondary part, assembly side	D_{SA}	mm	570
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	571
Thread, secondary part	$TS_S \times TD_S$	–	M10×20
Thread, secondary part, number×pitch	$n_S \times TP_S$	°	36×10
Thread, primary part, cable side	$TS_{PC} \times TD_{PC}$	–	M8×16
Thread, primary part, cable side, number×pitch	$n_{PC} \times TP_{PC}$	°	15×22.5
Thread, primary part	$TS_P \times TD_P$	–	M8×16
Thread, primary part, cable side, number×pitch	$n_P \times TP_P$	°	16×22.5



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

690×50	**690×50**	**690×75**	**690×75**	**690×75**	**690×100**	**690×100**	**690×100**	**690×125**	**690×125**	**690×125**
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z6.1	**Z6.1**	**Z6.1**	**Z6.1**	**Z6.1**	**Z7.5**	**Z7.5**	**Z7.5**	**Z8.8**	**Z8.8**	**Z8.8**
2×4G10	2×4G10	2×4G10	2×4G10	2×4G10	2×4G16	2×4G16	2×4G16	5×4G10	5×4G10	5×4G10
44,2	61,9	75,1	54,6	77,7	90,1	65,0	93,5	105,1	75,3	109,4
81,6	81,6	99,8	99,8	99,8	122,9	122,9	122,9	143,2	143,2	143,2
98	98	123	123	123	148	148	148	173	173	173
130	130	150	150	150	180	180	180	205	205	205
37	37	36	36	36	39	39	39	38	38	38
56	56	78	78	78	103	103	103	130	130	130
40,5	40,5	40,5	40,5	40,5	46,5	46,5	46,5	40,5	40,5	40,5
48,5	48,5	48,5	48,5	48,5	53,8	53,8	53,8	48,5	48,5	48,5
660	650	650	660	650	650	660	650	650	660	650
602	570	570	602	570	570	602	570	570	602	570
603	571	571	603	571	571	603	571	571	603	571
M10×20	M10×20	M10×20	M10×20	M10×20	M10×20	M10×20	M10×20	M10×20	M10×20	M10×20
44×8.182	36×10	36×10	44×8.182	36×10	36×10	44×8.182	36×10	36×10	44×8.182	36×10
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
15×22.5	15×22.5	31×11.25	31×11.25	31×11.25	31×11.25	31×11.25	31×11.25	49×5.625	49×5.625	49×5.625
M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16	M8×16
16×22.5	16×22.5	32×11.25	32×11.25	32×11.25	32×11.25	32×11.25	32×11.25	64×5.625	64×5.625	64×5.625

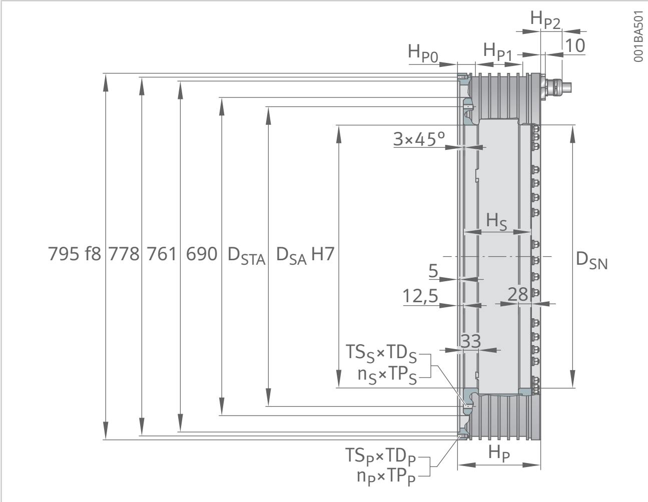
3.2.19 RKIB11-3P-690xH
Performance data, Part 1

Size				690×50
Magnet configuration				**R20**
Winding design				**Z6.1**
Torques	Ultimate torque	T_u	Nm	3775
	Peak torque	T_p	Nm	3445
	Continuous torque, cooled	T_{cw}	Nm	2225
	Torque at $I_{cw2\ eff}$ and n_{Iw2}	T_{cw2}	Nm	2024
	Torque at $I_{cw2\ eff}$ and n_{Iw3}	T_{cw3}	Nm	653
	Continuous torque, not cooled	T_c	Nm	882
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	1714
	Cogging torque	T_{cog}	Nm	6,3
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{Ip}	min^{-1}	165
	Knee speed	n_{Iw}	min^{-1}	202
	Rated speed (S1), cooled	n_{IwS1}	min^{-1}	109
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{Iw2}	min^{-1}	208
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{Iw3}	min^{-1}	600
Currents	Effective ultimate current	$I_{u\ eff}$	A	209,5
	Effective peak current	$I_{p\ eff}$	A	167,6
	Effective continuous current, cooled	$I_{cw\ eff}$	A	87,8
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	79,0
	Effective continuous current, not cooled	$I_{c\ eff}$	A	31,3
	Effective stall current, cooled	$I_{sw\ eff}$	A	64,1
Power losses	Power loss at T_p	P_{Ip}	W	11299
	Power loss at T_{cw}	P_{Iw}	W	4160
	Power loss at T_c	P_{Ic}	W	394
Mechanical power	Max. rated power	$P_{max\ S1}$	W	41000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,27
	Inductance, phase to phase	L	mH	2,8
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	23,0
General characteristic values	Number of pole pairs	P	–	55
	Motor constant at +20 °C	k_m	Nm/√W	44,4
	Torque constant	k_T	Nm/A	28,2
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	110
	Axial attraction	F_a	kN	1,20
	Radial attraction	F_r	kN/mm	14,7
	Moment of inertia, secondary part	J	kg · m²	6,093
Cooling conditions	Volume flow	dV/dt	l/min	11,9
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	5,0

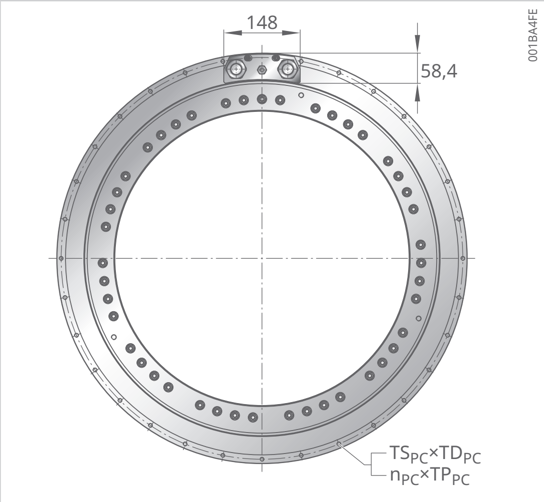
690×50	690×50	690×75	690×75	690×75	690×100	690×100	690×100	690×125	690×125	690×125
V22	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**	**R20**	**V22**	**R22**
Z6.1	**Z6.1**	**Z6.1**	**Z6.1**	**Z6.1**	**Z7.5**	**Z7.5**	**Z7.5**	**Z8.8**	**Z8.8**	**Z8.8**
3587	4796	5663	5380	7194	7551	7173	9592	9438	8966	11990
3273	4275	5167	4909	6413	6890	6545	8551	8612	8182	10689
2113	2641	3491	3317	4145	4763	4525	5656	6080	5776	7220
1923	2429	3177	3018	3812	4335	4118	5201	5533	5257	6639
716	788	764	917	955	796	1035	1655	1432	1592	2960
838	1024	1312	1246	1524	1750	1663	2033	2167	2058	2568
1628	2012	2690	2556	3158	3670	3487	4308	4685	4451	5499
6,0	7,7	9,5	9,0	11,6	12,6	12,0	15,4	15,8	15,0	19,3
170	155	110	113	103	120	124	113	137	141	129
210	185	133	138	121	143	149	131	161	167	148
109	109	109	109	109	109	109	109	109	109	109
216	188	137	142	124	147	153	134	165	172	151
600	400	500	500	300	600	600	300	600	600	300
209,5	209,5	209,5	209,5	209,5	299,8	299,8	299,8	419,1	419,1	419,1
167,6	167,6	167,6	167,6	167,6	239,9	239,9	239,9	335,3	335,3	335,3
87,8	87,8	91,9	91,9	91,9	134,5	134,5	134,5	192,0	192,0	192,0
79,0	79,0	82,7	82,7	82,7	121,1	121,1	121,1	172,8	172,8	172,8
31,3	31,3	31,1	31,1	31,1	44,5	44,5	44,5	61,6	61,6	62,8
64,1	64,1	67,1	67,1	67,1	98,2	98,2	98,2	140,2	140,2	140,2
11299	11299	14622	14622	14622	18072	18072	18072	21268	21268	21268
4160	4160	5893	5893	5893	7626	7626	7626	9360	9360	9360
394	394	502	502	502	622	622	622	717	717	747
45000	33000	40000	48000	30000	50000	65000	52000	90000	100000	93000
600	600	600	600	600	600	600	600	600	600	600
0,27	0,27	0,35	0,35	0,35	0,21	0,21	0,21	0,13	0,13	0,13
2,8	2,4	4,0	4,0	3,5	2,5	2,5	2,2	1,6	1,6	1,4
21,8	26,7	34,5	32,8	40,0	32,1	30,5	37,3	28,7	27,3	33,4
55	55	55	55	55	55	55	55	55	55	55
42,2	51,6	58,5	55,6	68,0	70,2	66,7	81,6	80,9	76,9	94,0
26,7	32,7	42,2	40,1	49,0	39,3	37,4	45,7	35,2	33,4	40,9
110	110	110	110	110	110	110	110	110	110	110
1,14	1,89	1,20	1,14	1,89	1,20	1,14	1,89	1,20	1,14	1,89
14,4	15,8	22,1	21,5	23,6	29,4	28,7	31,5	36,8	35,9	39,4
4,668	6,271	7,657	5,793	7,924	9,222	6,918	9,578	10,787	8,044	11,231
11,9	11,9	16,9	16,9	16,9	14,6	14,6	14,6	17,9	17,9	17,9
20	20	20	20	20	20	20	20	20	20	20
5,0	5,0	5,0	5,0	5,0	7,5	7,5	7,5	7,5	7,5	7,5

3

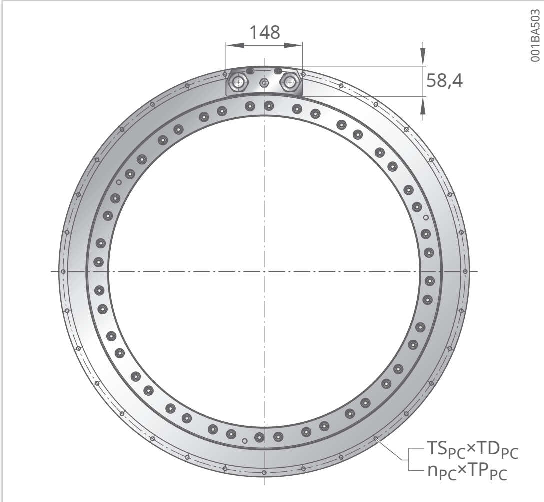
3.2.20 RKIB11-3P-690xH Geometric data, Part 2



Size			**690×150**
Magnet configuration			**R20**
Winding design			**Z8.8**
Power cable	–	–	5×4G10
Mass, secondary part	m_S	kg	120,1
Mass, primary part	m_P	kg	163,7
Height, secondary part	H_S	mm	198
Height, primary part	H_P	mm	230
Distance between housing and cooling inlet	H_{P0}	mm	40
Distance between cooling inlet and cooling outlet	H_{P1}	mm	151
Height, axial cable screw	H_{P2}	mm	40,5
Height, right-angle cable screw	H_{P3}	mm	48,5
Thread pitch diameter, secondary part, assembly side	D_{STA}	mm	650
Inner diameter, secondary part, assembly side	D_{SA}	mm	570
Inner diameter, secondary part, non-assembly side	D_{SN}	mm	571
Thread, secondary part	TS_S×TD_S	–	M10×20
Thread, secondary part, number×pitch	n_S×TP_S	°	36×10
Thread, primary part, cable side	TS_{PC}×TD_{PC}	–	M8×16
Thread, primary part, cable side, number×pitch	n_{PC}×TP_{PC}	°	49×5.625
Thread, primary part	TS_P×TD_P	–	M8×16
Thread, primary part, cable side, number×pitch	n_P×TP_P	°	64×5.625



Magnet configuration R20 and R22
Axial cable outlet, 2×4G10



Magnet configuration V22
Axial cable outlet, 2×4G10

690×150	**690×150**	**690×175**	**690×175**	**690×175**
V22	**R22**	**R20**	**V22**	**R22**
Z8.8	**Z8.8**	**Z8.8**	**Z8.8**	**Z8.8**
5×4G10	5×4G10	5×4G10	5×4G10	5×4G10
85,7	125,2	135,1	96,1	141,1
163,7	163,7	184,1	184,1	184,1
198	198	223	223	223
230	230	255	255	255
40	40	42	42	42
151	151	172	172	172
40,5	40,5	40,5	40,5	40,5
48,5	48,5	48,5	48,5	48,5
660	650	650	660	650
602	570	570	602	570
603	571	571	603	571
M10×20	M10×20	M10×20	M10×20	M10×20
44×8.182	36×10	36×10	44×8.182	36×10
M8×16	M8×16	M8×16	M8×16	M8×16
49×5.625	49×5.625	49×5.625	49×5.625	49×5.625
M8×16	M8×16	M8×16	M8×16	M8×16
64×5.625	64×5.625	64×5.625	64×5.625	64×5.625

3.2.21 RKIB11-3P-690xH
Performance data, Part 2

Size				**690×150**
Magnet configuration				**R20**
Winding design				**Z8.8**
Torques	Ultimate torque	T_u	Nm	11326
	Peak torque	T_p	Nm	10335
	Continuous torque, cooled	T_{cw}	Nm	7387
	Torque at $I_{cw2\ eff}$ and n_{lw2}	T_{cw2}	Nm	6722
	Torque at $I_{cw2\ eff}$ and n_{lw3}	T_{cw3}	Nm	1114
	Continuous torque, not cooled	T_c	Nm	2593
	Stall torque, cooled at $I_{sw\ eff}$	T_{sw}	Nm	5692
	Cogging torque	T_{cog}	Nm	19,0
Speeds	Limiting speed at $I_{p\ eff}$ and U_{DCL}	n_{lp}	min^{-1}	113
	Knee speed	n_{lw}	min^{-1}	133
	Rated speed (S1), cooled	n_{lwS1}	min^{-1}	109
	Operating speed FS at $I_{cw2\ eff}$ and V_{DCL}	n_{lw2}	min^{-1}	137
	Limiting speed at $I_{cw2\ eff}$ and V_{DCL} in continuous operation	n_{lw3}	min^{-1}	600
Currents	Effective ultimate current	$I_{u\ eff}$	A	419,1
	Effective peak current	$I_{p\ eff}$	A	335,3
	Effective continuous current, cooled	$I_{cw\ eff}$	A	194,4
	Effective continuous current for higher speeds (S1)	$I_{cw2\ eff}$	A	174,9
	Effective continuous current, not cooled	$I_{c\ eff}$	A	61,4
	Effective stall current, cooled	$I_{sw\ eff}$	A	141,9
Power losses	Power loss at T_p	P_{lp}	W	24591
	Power loss at T_{cw}	P_{lw}	W	11093
	Power loss at T_c	P_{lc}	W	825
Mechanical power	Max. rated power	$P_{max\ S1}$	W	70000
Electrical characteristic values	DC link voltage	U_{DCL}	V	600
	Electrical resistance, phase to phase	R_{20}	Ω	0,15
	Inductance, phase to phase	L	mH	1,9
	Back EMF constant, phase to phase	$k_{\hat{u}}$	V/(rad/s)	34,5
General characteristic values	Number of pole pairs	P	–	55
	Motor constant at +20 °C	k_m	Nm/√W	90,3
	Torque constant	k_T	Nm/A	42,2
	Motor temperature switch-off-threshold	ϑ_{PTC}	°C	110
	Axial attraction	F_a	kN	1,20
	Radial attraction	F_r	kN/mm	44,2
	Moment of inertia, secondary part	J	$kg \cdot m^2$	12,351
Cooling conditions	Volume flow	dV/dt	l/min	15,9
	Nominal feed temperature	ϑ_{nf}	°C	20
	Cooling water temperature difference	$\Delta\vartheta$	K	10,0

3

690×150	690×150	690×175	690×175	690×175
V22	**R22**	**R20**	**V22**	**R22**
Z8.8	**Z8.8**	**Z8.8**	**Z8.8**	**Z8.8**
10760	14389	13214	12553	16787
9818	12826	12057	11454	14964
7018	8771	8698	8263	10328
6386	8066	7915	7520	9497
1512	3629	1035	1432	3907
2463	3076	3067	2913	3562
5408	6681	6703	6367	7867
18,0	23,1	22,1	21,0	27,0
117	107	95	97	91
138	122	112	116	104
109	109	109	109	104
142	125	115	120	106
600	250	600	600	220
419,1	419,1	419,1	419,1	419,1
335,3	335,3	335,3	335,3	335,3
194,4	194,4	196,2	196,2	196,2
174,9	174,9	176,6	176,6	176,6
61,4	62,7	62,2	62,2	62,2
141,9	141,9	143,2	143,2	143,2
24591	24591	27914	27914	27914
11093	11093	12826	12826	12826
825	861	962	962	962
95000	95000	65000	90000	90000
600	600	600	600	600
0,15	0,15	0,17	0,17	0,17
1,9	1,6	2,3	2,3	1,9
32,8	40,0	40,2	38,2	46,7
55	55	55	55	55
85,8	104,9	98,9	93,9	114,8
40,1	49,0	49,3	46,8	57,2
110	110	110	110	110
1,14	1,89	1,20	1,14	1,89
43,1	47,3	51,5	50,2	55,1
9,169	12,884	13,916	10,295	14,537
15,9	15,9	18,4	18,4	18,4
20	20	20	20	20
10,0	10,0	10,0	10,0	10,0

3

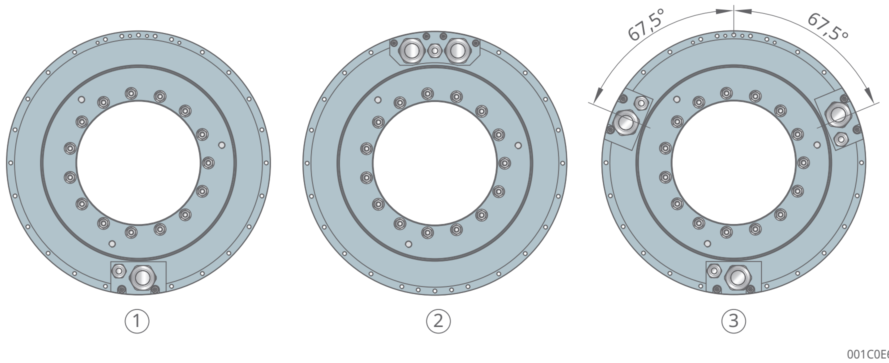
3.3 Cable outlets

Cable outlets are defined by the user. Axial and right-angle cable outlets are possible. A right-angle cable outlet can be executed radially or tangentially. Drawings and dimensions for the three standard cable outlet variants of axial, radial and tangential are given in this section in order of size. Dimensions and bending radii are listed in a table ➤18|▦2. Performance data and geometric data can be found in the product tables.

3.3.1 Cable outlets for RKI5-3P-230xH

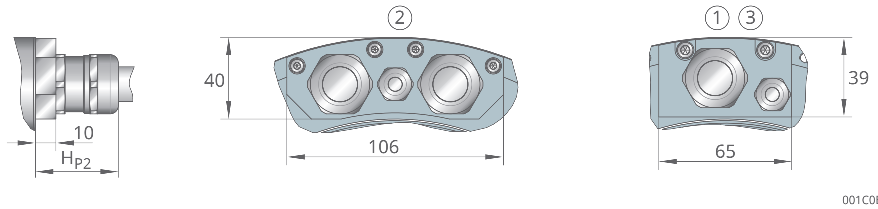
Data for motor selection can be found in the product tables.

26 Cable outlet positions



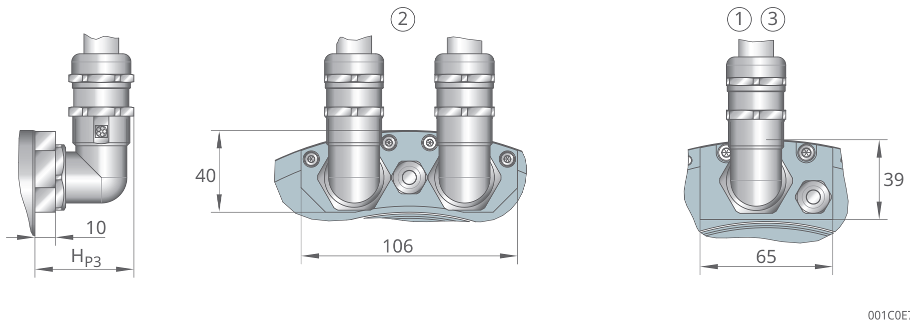
1	RKI5-3P-230xH-Z2 with 1×4G10	2	RKI5-3P-230xH-Z3.3 with 2×4G10
3	RKI5-3P-230xH-Z4 with 3×4G10		

27 Axial cable outlet



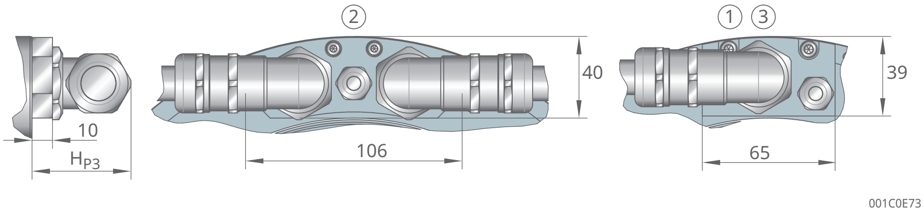
1	RKI5-3P-230xH-Z2 with 1×4G10	2	RKI5-3P-230xH-Z3.3 with 2×4G10
3	RKI5-3P-230xH-Z4 with 3×4G10		

28 Radial cable outlet



1	RKI5-3P-230xH-Z2 with 1×4G10	2	RKI5-3P-230xH-Z3.3 with 2×4G10
3	RKI5-3P-230xH-Z4 with 3×4G10		

29 Tangential cable outlet



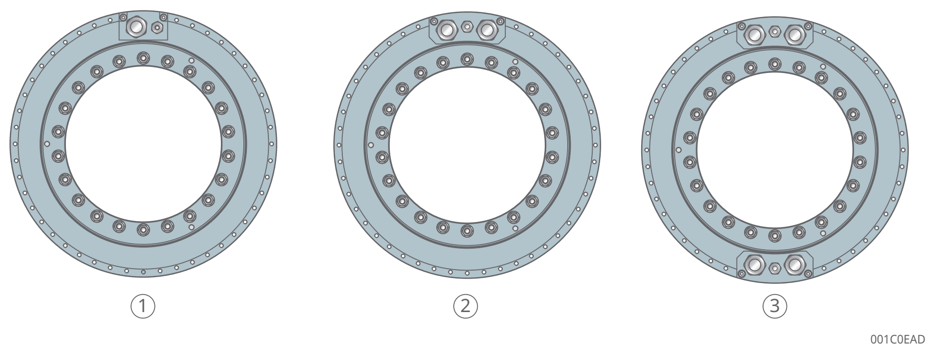
1	RKI5-3P-230xH-Z2 with 1×4G10	2	RKI5-3P-230xH-Z3.3 with 2×4G10
3	RKI5-3P-230xH-Z4 with 3×4G10		

3

3.3.2 Cable outlets for RKIB11-3P-298xH

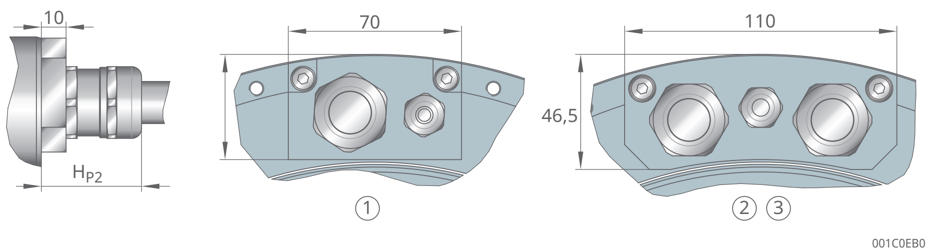
Data for motor selection can be found in the product tables.

30 Cable outlet positions



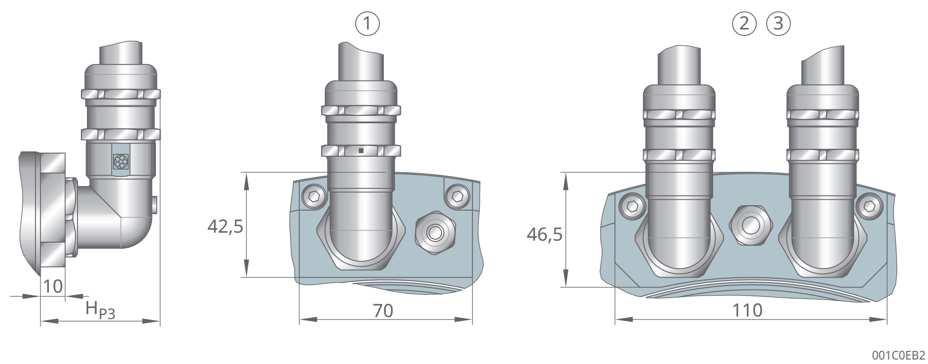
1	RKIB11-3P-298xH-Z3.8 with 1×4G10	2	RKIB11-3P-298xH-Z5.7 with 2×4G10 RKIB11-3P-298xH-Z6.1 with 2×4G10
3	RKIB11-3P-298xH-Z7.9 with 4×4G10		

31 Axial cable outlet



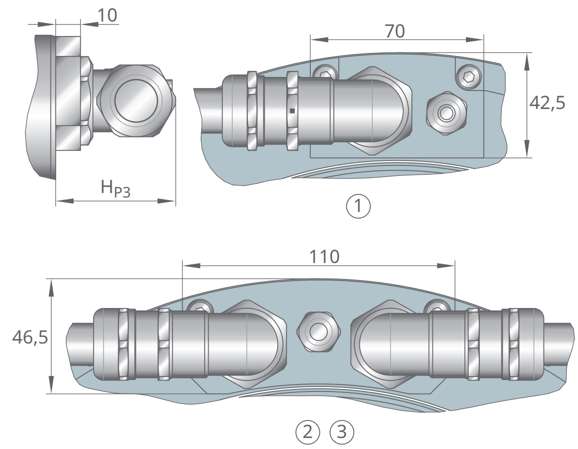
1	RKIB11-3P-298xH-Z3.8 with 1×4G10	2	RKIB11-3P-298xH-Z5.7 with 2×4G10 RKIB11-3P-298xH-Z6.1 with 2×4G10
3	RKIB11-3P-298xH-Z7.9 with 4×4G10		

32 Radial cable outlet



1	RKIB11-3P-298xH-Z3.8 with 1×4G10	2	RKIB11-3P-298xH-Z5.7 with 2×4G10 RKIB11-3P-298xH-Z6.1 with 2×4G10
3	RKIB11-3P-298xH-Z7.9 with 4×4G10		

33 Tangential cable outlet

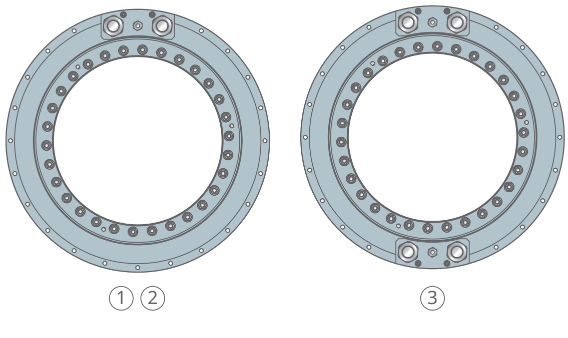


1	RKIB11-3P-298xH-Z3.8 with 1×4G10	2	RKIB11-3P-298xH-Z5.7 with 2×4G10 RKIB11-3P-298xH-Z6.1 with 2×4G10
3	RKIB11-3P-298xH-Z7.9 with 4×4G10		

3.3.3 Cable outlets for RKIB5-3P-384xH

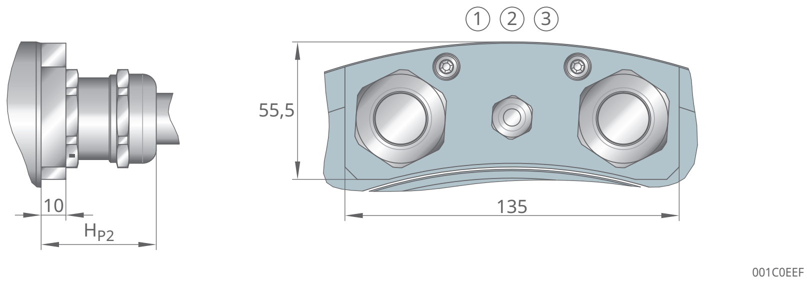
Data for motor selection can be found in the product tables.

34 Cable outlet positions



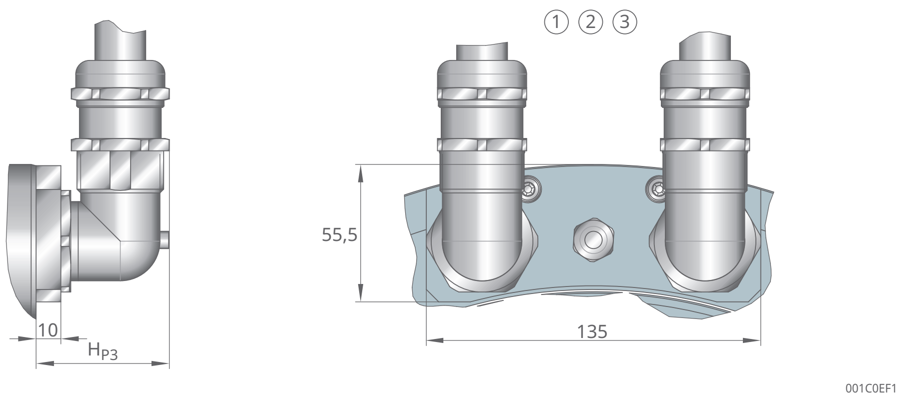
1	RKIB5-3P-384xH-Z5.8 with 2×4G10	2	RKIB5-3P-384xH-Z7.2 with 2×4G16
3	RKIB5-3P-384xH-Z8.4 with 4×4G10		

35 Axial cable outlet



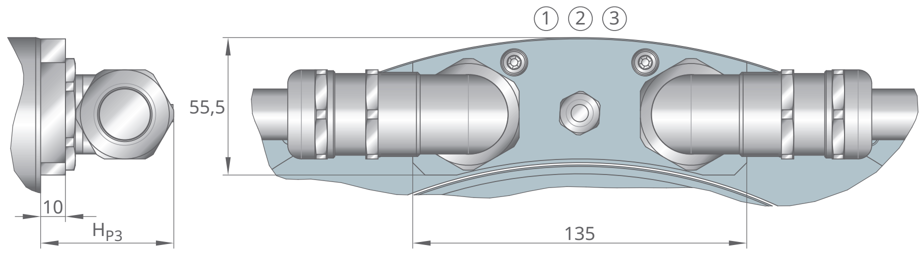
1	RKIB5-3P-384xH-Z5.8 with 2×4G10	2	RKIB5-3P-384xH-Z7.2 with 2×4G16
3	RKIB5-3P-384xH-Z8.4 with 4×4G10		

36 Radial cable outlet



1	RKIB5-3P-384xH-Z5.8 with 2×4G10	2	RKIB5-3P-384xH-Z7.2 with 2×4G16
3	RKIB5-3P-384xH-Z8.4 with 4×4G10		

37 Tangential cable outlet

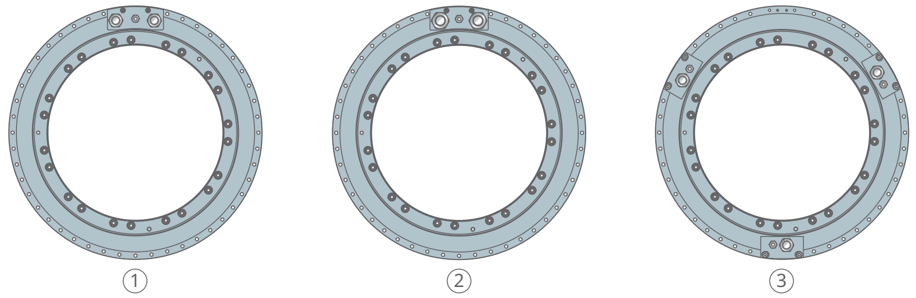


1	RKIB5-3P-384xH-Z5.8 with 2×4G10	2	RKIB5-3P-384xH-Z7.2 with 2×4G16
3	RKIB5-3P-384xH-Z8.4 with 4×4G10		

3.3.4 Cable outlets for RKIB11-3P-460xH

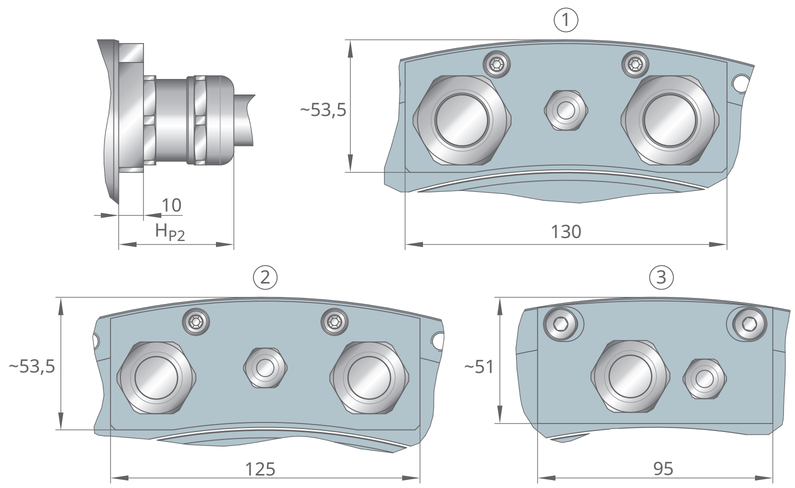
Data for motor selection can be found in the product tables.

38 Cable outlet positions



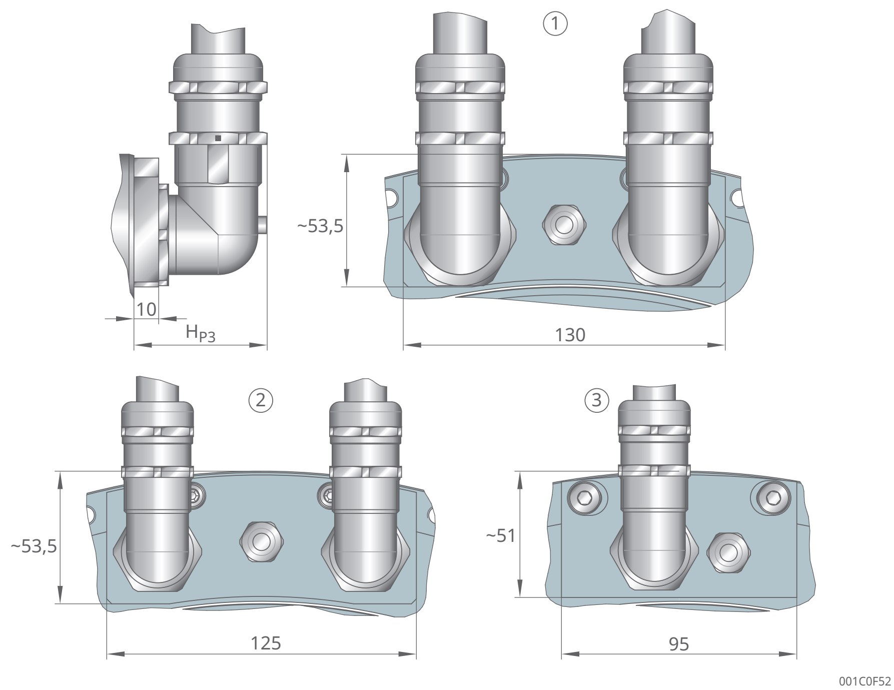
1	RKIB11-3P-460xH-Z7.5 with 2×4G16	2	RKIB11-3P-460xH-Z6.0 with 2×4G10
3	RKIB11-3P-460xH-Z8.0 with 3×4G10		

39 Axial cable outlet



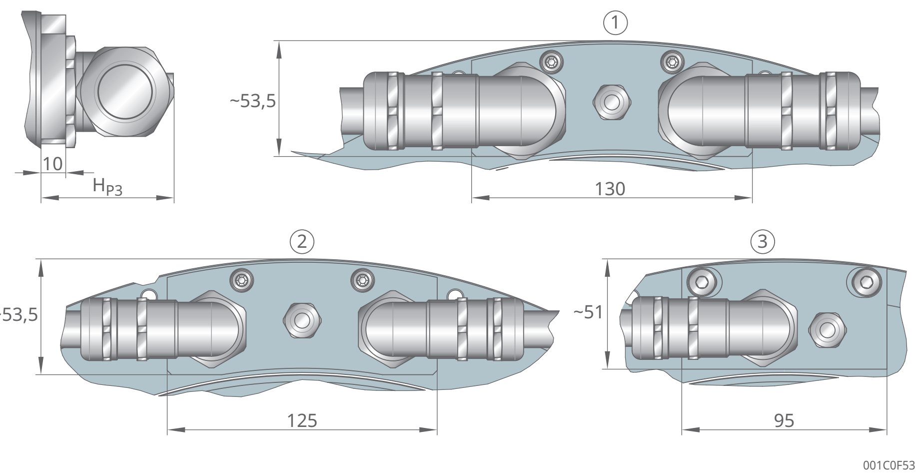
1	RKIB11-3P-460xH-Z7.5 with 2×4G16	2	RKIB11-3P-460xH-Z6.0 with 2×4G10
3	RKIB11-3P-460xH-Z8.0 with 3×4G10		

40 Radial cable outlet



1	RKIB11-3P-460xH-Z7.5 with 2×4G16	2	RKIB11-3P-460xH-Z6.0 with 2×4G10
3	RKIB11-3P-460xH-Z8.0 with 3×4G10		

41 Tangential cable outlet

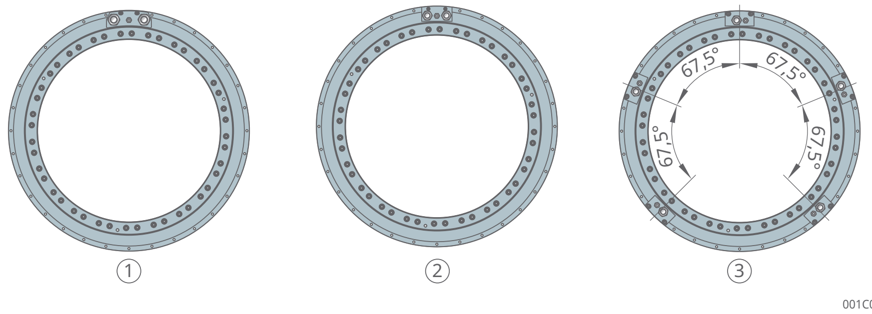


1	RKIB11-3P-460xH-Z7.5 with 2×4G16	2	RKIB11-3P-460xH-Z6.0 with 2×4G10
3	RKIB11-3P-460xH-Z8.0 with 3×4G10		

3.3.5 Cable outlets for RKIB11-3P-690xH

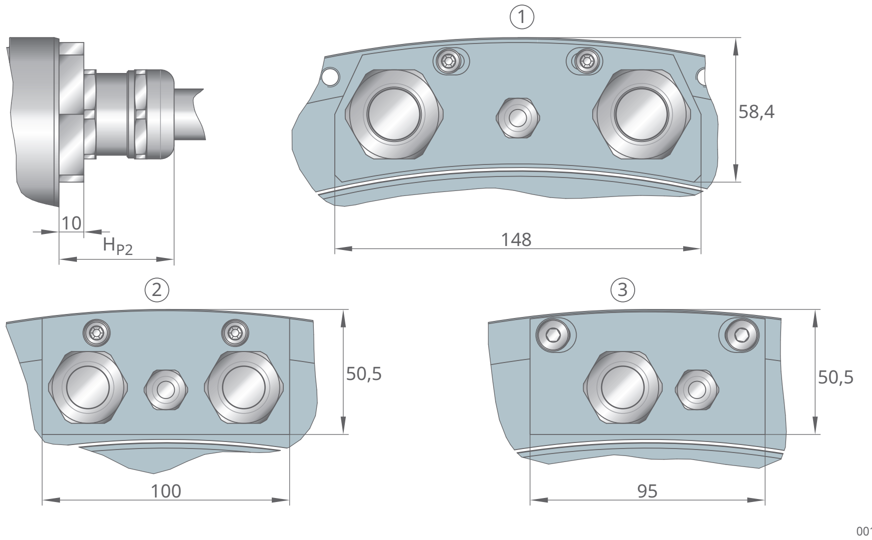
Data for motor selection can be found in the product tables.

42 Cable outlet positions



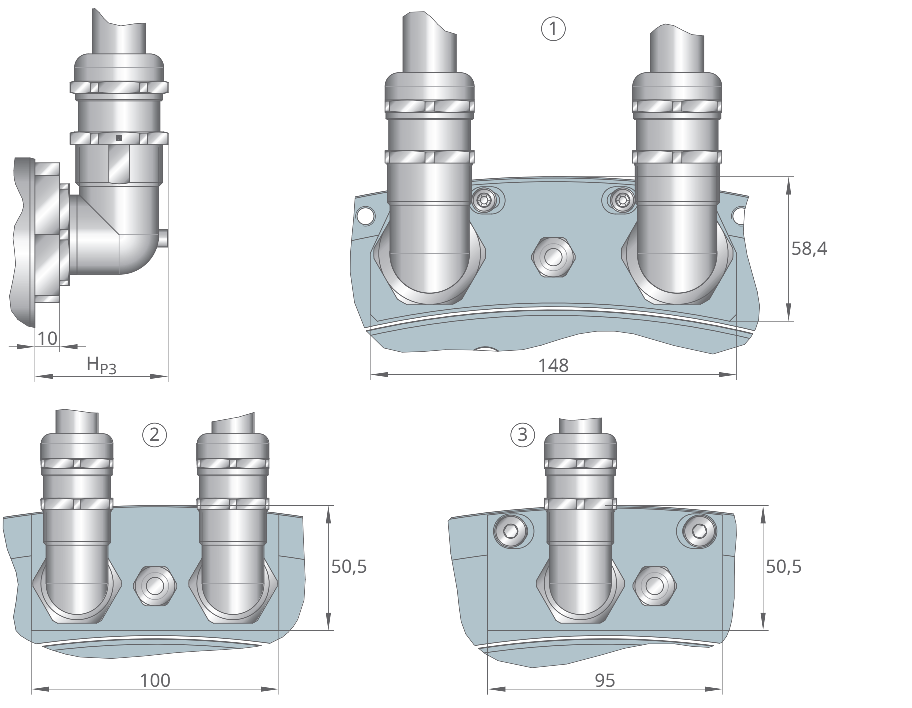
1	RKIB11-3P-690xH-Z7.5 with 2×4G16	2	RKIB11-3P-690xH-Z6.1 with 2×4G10
3	RKIB11-3P-690xH-Z8.8 with 5×4G10		

43 Axial cable outlet



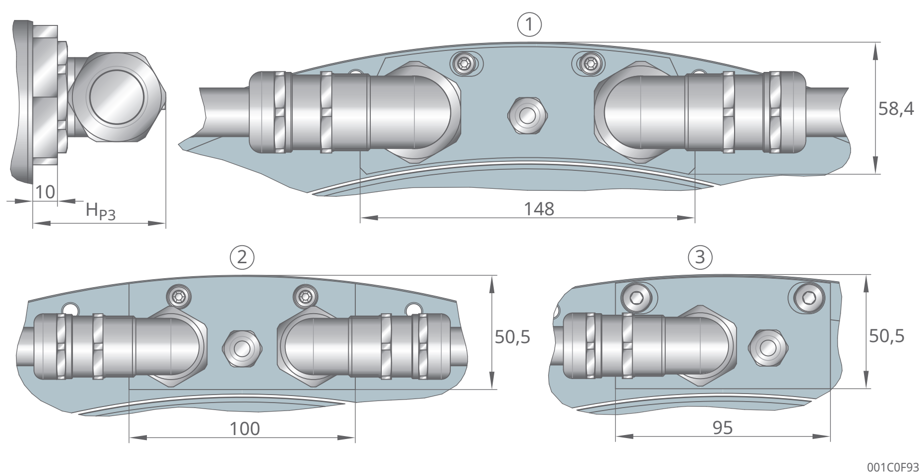
1	RKIB11-3P-690xH-Z7.5 with 2×4G16	2	RKIB11-3P-690xH-Z6.1 with 2×4G10
3	RKIB11-3P-690xH-Z8.8 with 5×4G10		

44 Radial cable outlet



1	RKIB11-3P-690xH-Z7.5 with 2×4G16	2	RKIB11-3P-690xH-Z6.1 with 2×4G10
3	RKIB11-3P-690xH-Z8.8 with 5×4G10		

45 Tangential cable outlet



1	RKIB11-3P-690xH-Z7.5 with 2×4G16	2	RKIB11-3P-690xH-Z6.1 with 2×4G10
3	RKIB11-3P-690xH-Z8.8 with 5×4G10		

4 Appendix

4.1 Checklist for torque motors

With this checklist, a fast and targeted response can be made to a request. All fields must be completed. The sales team of Schaeffler Industrial Drives can answer any questions in advance.

Company	Contact	Industry · Project name

Telephone	Email

Application

Main operating mode	◯ Continuous operation S1 mode, e.g. in NC axes	◯ Continuous operation periodic duty S6, e.g. in cyclic applications
Parallel operation of multiple motors	◯ Yes, tandem arrangement ◯ Yes, Janus arrangement	◯ No
Motor type, if known		
If applicable, installation compatibility with	Manufacturer	Type
Installation space	Min. inner diameter mm	Max. outer diameter mm
	Max. height mm	

Required operating points

Operating point 1

Torque ______ Nm

Speed ______ min^{-1}

- ◯ Continuous duty (S1)
- ◯ Continuous operation periodic duty (S6)
- ◯ Standstill

Operating point 2

Torque ______ Nm

Speed ______ min^{-1}

- ◯ Continuous duty (S1)
- ◯ Continuous operation periodic duty (S6)
- ◯ Standstill

Servo drive

Manufacturer ______

Type ______

DC link voltage

DC ______ V

Current during continuous duty (S1)

______ A

Peak current

______ A

Cooling

- ◯ Water, standard
- ◯ Other
- ◯ Natural convection or not cooled

O-rings

- ◯ Yes
- ◯ No

O-rings are required for water cooling

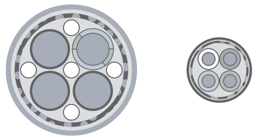
Cable outlet

- ◯ Axial, preferred variant

- ◯ Tangential

- ◯ Radial

Cable type	◯ Separate motor and sensor lines	◯ Desired cable type



Cable length	◯ 1 m long, open ends, RIB standard		
	◯ 2 m long, open ends, RKIB standard, preferred variant		
	◯ 5 m long, open ends, RKIB standard		
	◯ ___ m long, open ends		
Temperature monitoring	◯ Triple PTC and Pt1000	◯ Triple PTC and 3×Pt1000	
Technical documentation	☐ Paper	☐ CD	☐ PDF
	Language		
Required quantities	◯ Single item	◯ Prototype	
	◯ Series		
Contact	Schaeffler Industrial Drives AG & Co. KG Tel. +49 3681 7574-0 sales-sid@schaeffler.com		

Glossary

dV/dt, volume flow

Flow rate per unit of time required for the specified cooling water temperature difference $\Delta\vartheta$ for the given power loss P_{lc} to be achieved.

F_a, axial attraction force

Axial magnetic attractive force that draws the secondary part into the primary part.

f_P (n), pole change frequency

The pole change frequency is calculated from the quotient of the speed in mm/s and the pole pair width. The pole change frequency has units of Hz.

F_r, radial attraction force

Radial magnetic attractive force between secondary part and primary part, which changes depending on the eccentricity of the secondary part relative to the primary part.

$I_{c\ eff}$, effective continuous current, not cooled

Current at which the associated power loss leads to a relatively low amount of heating of the motor without forced cooling based on the size of the mounting base.

$I_{cw\ eff}$, effective continuous current, cooled

Current that is permissible during continuous operation with water cooling at a pole change frequency of 0,1 Hz or higher up to a speed of n_{lkS1}.

$I_{cw2\ eff}$, effective continuous current for higher speeds in continuous operation

Effective continuous current that is permissible during continuous operation with water cooling at a pole change frequency of 0,1 Hz or higher up to a speed of n_{lw3}. Up to a speed of n_{lw2}, the associated torque has the value T_{cw2}. Then the associated torque drops until at n_{lw3} it reaches the value T_{cw3}.

$I_{p\ eff}$, effective peak current

Current that is in the range of iron saturation. We recommend using this current as a sizing quantity; please also see T_p. $I_{p\ eff}$ may be increased up to the limit value $I_{u\ eff}$ provided that the magnet temperature does not exceed +60 °C and a pulse width of 1 s to max. 3 s is used in pulse mode.

$I_{pl\ eff}$, peak current, linear range

Effective peak current up to which an approximately proportional torque curve occurs.

$I_{sw\ eff}$, effective stall current, cooled

Max. permissible current during continuous operation with water cooling at pole change frequencies of 0 Hz to 0,1 Hz. Because the current is distributed differently in the motor phases, the motor current must be reduced to this value for local overheating to be prevented. In the determination of the effective stall current, the thermally most unfavourable secondary part position is considered.

$I_{u\ eff}$, effective ultimate current

Current at which the magnetic circuit is in high saturation. The max. current density in the winding or the incipient risk of demagnetisation at a magnet temperature of +60 °C determines the effective ultimate current. An I^2t control system can prevent overheating of the primary part, but not demagnetisation of the secondary part.

k_m, motor constant

Value for the efficiency of a motor. The motor constant is the ratio of torque to power loss.

It is only constant as long as the motor is in static operation and in the linear control range. An example of this is positioning operations with low speeds and torques.

The value changes depending on the temperature. At a winding temperature of +130 °C, the motor constant decreases to 0,84 times the normal value.

k_T, torque constant

Torque constant which, when multiplied by the current in the linear dynamic range, represents the motor torque that is being produced: $T = I \cdot k_T$.

$k_{\hat{u}}$, back EMF constant

Voltage constant for generator operation. The peak value of the armature back EMF arising at the motor terminals is calculated through multiplication of the back EMF constant by the speed: $U_{EMF} = k_{\hat{u}} \cdot n$.

L, inductance, phase to phase

Inductance between two motor phases, applies to the linear range between torque and current.

n_{lc}, limiting speed

Winding-dependent speed limit without taking the dynamic heat losses into account when operating at $I_{c\ eff}$ and without field weakening. The motor torque drops significantly after this point.

n_{lp}, limiting speed

Winding-dependent speed limit without taking the dynamic heat losses into account when operating at $I_{p\ eff}$ and without field weakening. The motor torque drops significantly after this point.

n_{lw}, knee speed

Winding-dependent speed limit without taking the dynamic heat losses into account when operating at $I_{cw\ eff}$ and without field weakening. At higher speeds, the motor torque drops sharply.

n_{lw2}, limiting speed without field weakening at $I_{cw2\ eff}$

Winding-dependent max. speed up to which no field weakening is necessary. Dynamic heat losses in operation at $I_{cw2\ eff}$ are taken into account. From this speed, max. $I_{cw2\ eff}$ may be used in continuous operation.

n_{lw3}, limiting speed at $I_{cw2\ eff}$ in continuous operation

Speed up to which the motor can be operated continuously at $I_{cw2\ eff}$.

n_{lwS1}, rated speed (S1), cooled

Speed limit up to which the motor can be continuously operated at $I_{cw\ eff}$.

P, number of pole pairs

Number of magnetic pole pairs on the rotor.

P_l, power loss

The ohmic loss occurring in the motor winding, also called copper loss, which leads to a time-dependent temperature increase. The heat supply through the current that flows in the respective mode of operation and the heat dissipation through the cooling influence the temperature increase.

The current in the upper control range, at T_p, generates a high power loss P_l, as the power loss increases proportionally with the square of current. The continuous current only heats the motor windings by a relatively small amount.

P_l is calculated in a simplified manner with the aid of the motor constant k_m for a movement section with the required torque T: $P_l = (T/k_m)^2$.

P_{lc}, power loss

Ohmic power loss at $I_{c\ eff}$.

P_{lp}, power loss

Ohmic peak power loss at $I_{p\ eff}$.

P_{lw}, power loss

Ohmic power loss at $I_{cw\ eff}$.

$P_{max\ S1}$, max. rated power

Max. rated motor power that is available up to a speed of n_{lw3}. This rated power serves as a reference point for the motor selection. The operating speed of the available rated power is winding-dependent and not specified in more detail.

R_{20}, electrical resistance

Winding resistance between two motor phases at +20 °C. At +130 °C, the winding resistance increases to 1,4 times the normal value.

T_c, continuous torque, not cooled

Motor torque at continuous current $I_{c\ eff}$ at which the motor can be operated in a thermally stable manner, without cooling, but is subject to a temperature increase in the process.

T_{cog}, cogging torque

Torque, also known as cogging, which acts in a pulsating manner depending on the rotor position. The specified value is the peak value in the de-energised state.

T_{cw}, continuous torque, cooled

Motor torque at $I_{cw\ eff}$ that is available as a continuous torque in rated operation with water cooling. Depending on the PTC sensor used, this torque results in a temperature gradient between winding and cooling of 90 K at ϑ_{PTC} = +110 °C or 100 K at ϑ_{PTC} = +120 °C.

T_{cw2}, torque at $I_{cw2\ eff}$ and n_{lw2}

Motor torque at $I_{cw2\ eff}$ that is available as a continuous torque in rated operation with water cooling up to a speed of n_{lw2}.

T_{cw3}, torque at $I_{cw2\ eff}$ and n_{lw3}

Motor torque at $I_{cw2\ eff}$. In rated operation with water cooling, this torque is available as a continuous torque up to a speed of n_{lw3}.

T_p, peak torque

Torque at $I_{p\ eff}$ that can be safely reached in the saturation range and at all operating temperatures. The peak torque can be used for max. 1–3 s. With magnet temperatures up to +60 °C and in pulsed mode, T_p can be increased up to the value of T_u.

T_{pl}, peak torque, linear range

Motor torque that is reached at the end of the linear control range. T_{pl} is calculated with the help of the peak current in the linear range and the torque constant: $T_{pl} = I_{pl\ eff} \cdot k_T$

T_{sw}, stall torque, cooled

Stall torque that is continuously available at standstill and at pole change frequencies of up to 0,1 Hz.

T_u, ultimate torque

Max. permissible torque with strong saturation of the magnetic circuit. The ultimate torque may only be reached for < 1 s. When reaching the ultimate torque, observe the maximum temperature of the primary part and magnets of +60°C. At higher temperatures, the primary part is destroyed within a very short time and the secondary part is demagnetised. Do not use the ultimate torque as a sizing quantity, but observe it during short-circuit braking.

U_{DCL}, DC link voltage

DC voltage that the converter provides to the inverter. The inverter then provides the DC link voltage minus the losses in the inverter to the motor. The DC link voltage determines the achievable speeds.

$\Delta\vartheta$, cooling water temperature difference

Max. temperature difference between cooling water inlet and outlet.

ϑ_{nf}, nominal feed temperature

Cooling water inlet temperature required to use $I_{cw\ eff}$ or $I_{sw\ eff}$ continuously while maintaining the remaining cooling conditions ($\Delta\vartheta$ and dV/dt). If these cooling conditions are maintained, with continuous use of $I_{cw\ eff}$ and $I_{sw\ eff}$, the sensor temperature settles to just below ϑ_{PTC} at the least favourable phase angle between the coils.

ϑ_{PTC}, motor temperature switch-off threshold

Temperature at which the servo drive must be switched off for the motor to be protected from overheating. This temperature is measured with a PTC sensor that triggers a thermistor motor protection relay connected to the servo drive.

For water cooling, maintained cooling conditions (dv/dt and $\Delta\vartheta$) and continuous use of $I_{cw\ eff}$, the motor heats up to just below the switch-off temperature.

Schaeffler Industrial Drives AG & Co. KG
Mittelbergstraße 2
98527 Suhl
Germany
www.schaeffler-industrial-drives.com
sales-sid@schaeffler.com
Phone +49 3681 7574-0

All information has been carefully compiled and checked by us, but we cannot guarantee complete accuracy. We reserve the right to make corrections. Therefore, please always check whether more up-to-date or amended information is available. This publication supersedes all deviating information from older publications. Printing, including excerpts, is only permitted with our approval.
© Schaeffler Technologies AG & Co. KG
RE 1 / 03 / en-GB / 2025-09