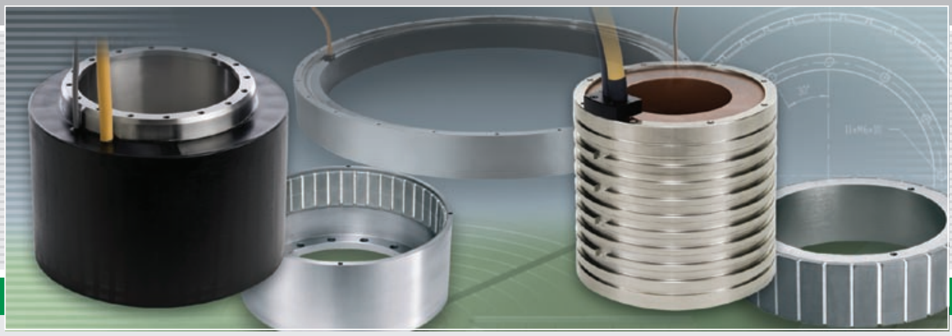
IDAM
INA Drives & Mechatronics



RDDM
Rotary Direct Drive Motors

SCHAEFFLER

LuK INA FAG

The Perfect Drive for Every Application.

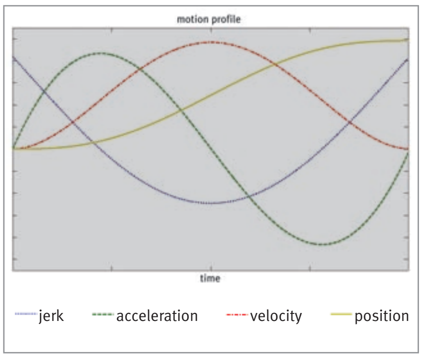
INA - Drives & Mechatronics AG & Co. KG, a member of the Schaeffler Group, is a specialist for linear and rotary direct drives. To complement these products, we also offer directly driven positioning systems and all the necessary controllers and mechatronic assemblies.
In addition to standard products, IDAM also develops and produces customised drive solutions.
In modern machines and equipment, direct drives are increasingly replacing standard drive solutions because of ever-stricter requirements for dynamics, precision and cost-effectiveness.

Directly linking the motor and the moving mass increases the dynamic and static rigidity, enabling high-performance positioning movements.
Direct drives are low wearing, which reduces maintenance and operating costs while also increasing availability.
For more than 20 years, teams at IDAM have been producing direct drives and complex drive systems for the following sectors: machine tools and production machinery, automation, productronics/semicon, metrology and medical engineering.

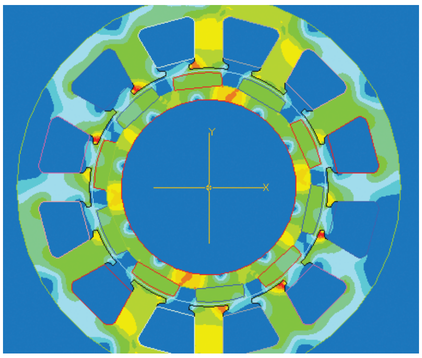
Models and simulations are integrated into the development process for direct drives and positioning systems, making the process more efficient.

IDAM has a cutting-edge quality management system. At IDAM, quality management is a dynamic process that is checked daily and continuously improved. IDAM is certified to DIN EN ISO 9001:2008.

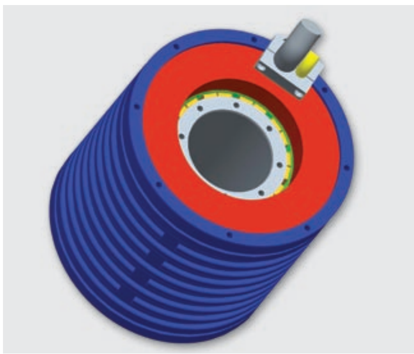
The layout of the magnetic circuit and the magnetic simulation form the basis of the design work. Specially developed tools are also used to develop and design the motors and systems, including tools for mechanical and thermal simulation. IDAM customers can access the results of these simulations to improve their adjacent constructions.



Motion profile with higher-order polynomial



FEM model



CAD model

Contents

Benefits of Rotary Direct Drives

Performance

1. No transformation of the movement pattern
There is no elasticity, no play, little friction and no hysteresis in the drive train resulting from transmission or coupling elements.

2. Multi-pole motor
Very high torques are produced owing to the multi-pole design. These can be used from a speed › 0 up to the nominal speed.

3. Thin, ring-shaped rotor
The motor has low inertia owning to the thin, ring-shaped design with a large, free internal diameter. This is the basis for fast acceleration.

4. External rotor construction
With the external rotor, the torque is increased in comparison to the internal rotor for the same motor size.

5. Direct position measurement
Direct position measurement and the rigid mechanical structure enable highly precise, dynamic positioning operations.

Operating costs

1. No additional moving parts
This reduces the effort of installing, adjusting and maintaining the drive assembly.

2. Minimal wear in the drive train
The drive train has a very long service life, even if subjected to extreme alternating loads. This reduces machine downtime.

3. High availability
In addition to the longer service life and reduced wear, the sturdiness of the torque motors increases their availability.

Design

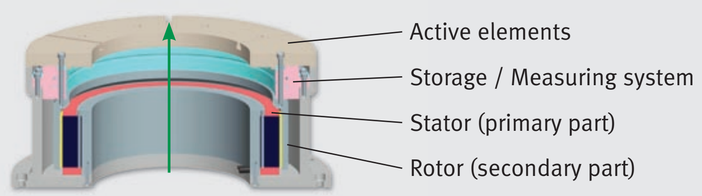
1. Hollow shaft
The hollow shaft with a large diameter makes integration or lead-through of other assemblies possible (shafts, rotary distributors, supply lines etc.). Bearing level, generation of force and effective working area may be very close to one another.

2. Installation of primary part
The ring for the primary part can be easily integrated in the machine design owing to the small space requirement (thin ring).

3. Small height
A very compact and axially small design with a high torque is produced in combination with the large, free internal diameter (hollow shaft).

4. Few parts
The well-engineered design makes it easier to integrate the motor parts into the machine concept.
There are only a few, very sturdy parts, which reduces the fail rate (high MTBF*).

*MTBF: Mean time between failures



Maximum internal diameter for all types of lead-throughs

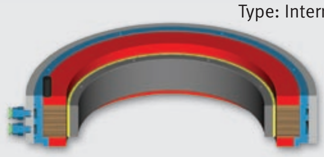
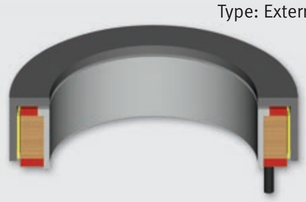
Characteristics of Rotary Direct Drive Motors

Rotary direct drive motors comprise a primary and a secondary part. The primary part contains an active coil system and the secondary part a permanent magnetic system.
In a concentric arrangement, the rotor can either be the inner or the outer ring (internal rotor motor or external rotor motor).
If the primary part (coil system) is supplied with power, a torque for the respective secondary part will develop as a result of the electromagnetic force.

A suitable guide system for the preservation of the air gap between the primary and secondary part is just as necessary as an angle measuring system for recording the rotor position in order to operate the motor. The selection for the system components is based on many years of IDAM application experience.

Depending on the type of motor, there are differences in the design of the primary and secondary part depending on the physical and constructional arrays.

The design of the rotary direct drive motors differs depending on whether the construction is slotted, slotless or ironless.
The motors generate a consistently high torque via a broad speed range. The torque is determined by an active air gap area between the primary and secondary part. These assemblies must be chosen by the design engineer according to the performance requirements. As opposed to conventional motors, direct drive motors are classified according to the required torque and not according to the performance.

Motor types	*Features*	*Construction*
Slotted motors		Type: Internal rotor  Type: External rotor 
RI/RE series	Internal rotor/ external rotor | high torque up to ∅ 1030 mm | T_p up to 15000 Nm, on request up to 100000 Nm | low cogging	
RKI series	High-performance internal rotor | up to 30% more torque | up to 4-times higher speeds in comparison to standard motors | customised	
HSRV/SRV types	Internal rotor | high speed, up to 50 m/s peripheral speed | for spindle applications | customised | low cogging	
Slotless motors		Type: RMK  Type: RMF 
RMK/RMF types	Customised or integrated motors | cogging-free on any diameters up to 2500 mm | for peripheral speeds up to 15 m/s	
Ironless motors		Type: UPR 
UPR types	Highly developed and low cost | for pc board connection | customised | dynamic | precise | highly efficient	

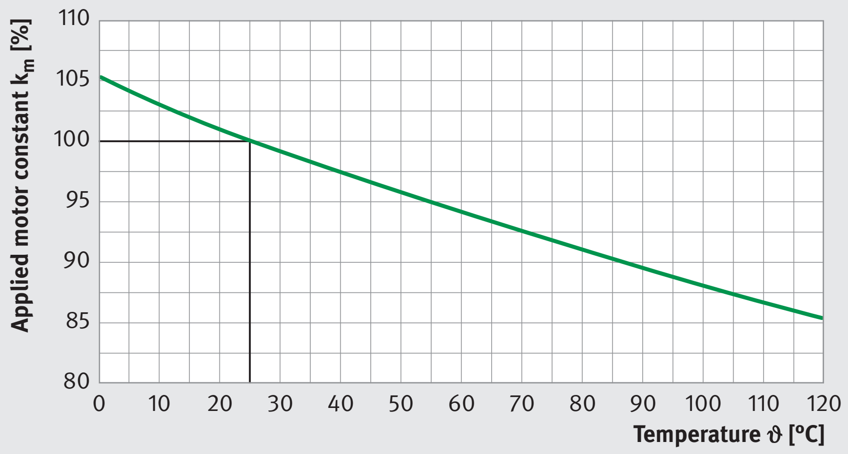
General Motor Values – Efficiency Criteria

With certain motor sizes, the torques and the resulting power losses (copper losses) for various operating points in part 1 of the technical parameters are fixed, regardless of the winding design. Since torque motors can generate a high torque when stationary but do not deliver any mechanical power, an efficiency specification is not practical here.
However, the motor constant k_m can be used for comparing efficiency levels. It conveys the ratio between the torque and power loss generated or heating and applies exactly to the linear modulation range when the motor is stationary (and at lower speeds) as well as at room temperature.
When the motor heats up, its efficiency becomes reduced due to the increase in the winding resistance (see figure). If the speed increases, there will also be frequency-dependent losses caused by changes in magnetisation and eddy current losses (in addition to the copper losses P_l) which are not recorded in motor constant k_m, but are relevant in the limiting speed range and must be noted. The motor constant k_m only relates to the linear range of the torque-current characteristic.

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

P_l - Copper loss
T - Torque

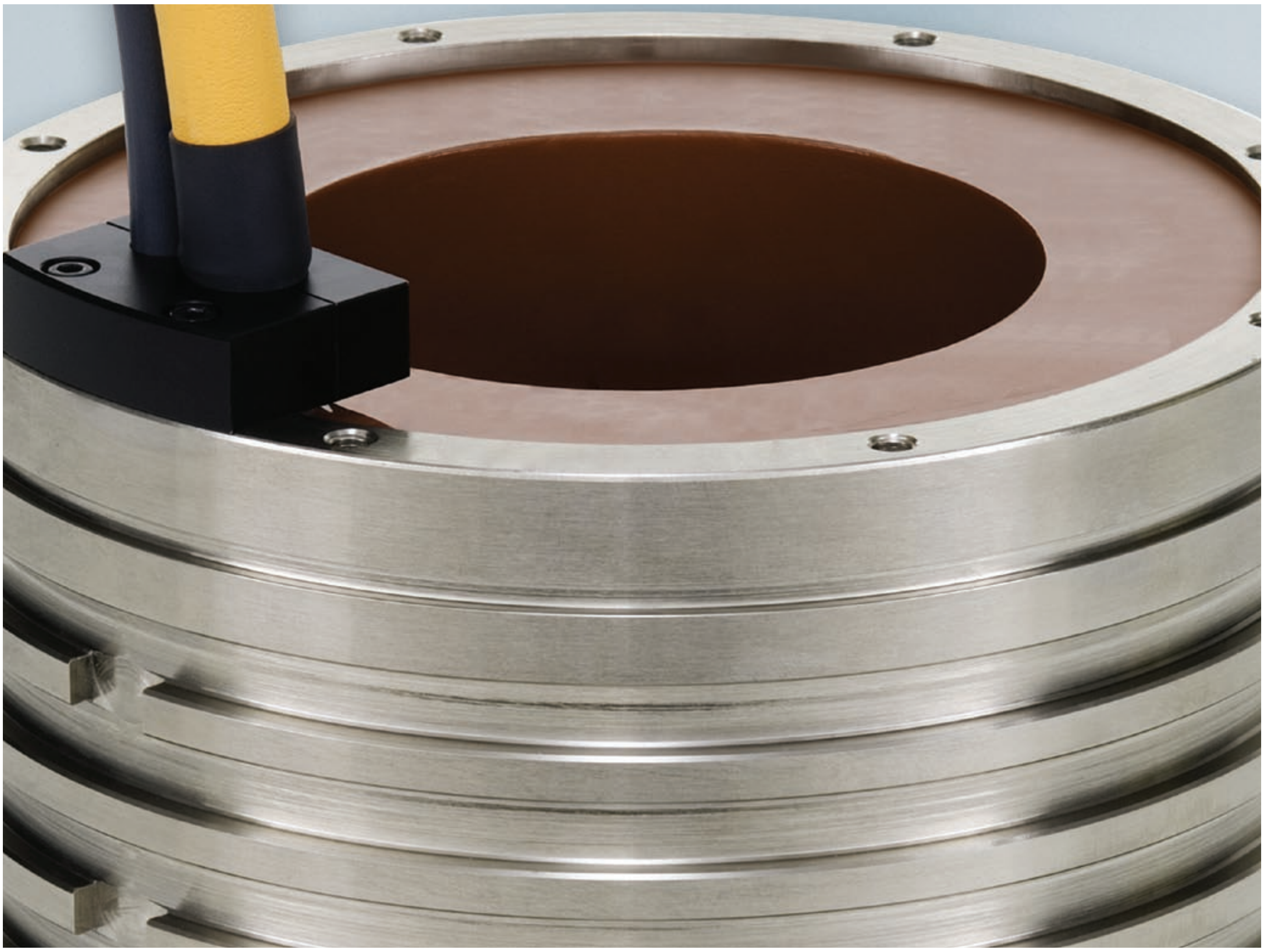
The motor constant k_m depends on the ohmic resistance and thus on the winding temperature of a motor. In the motor data sheets, k_m is given for 25 °C. The diagram shows the motor constant related to the data sheet value depending on the temperature.



Motor constant vs. temperature

Winding Designs and Dependencies

The attainable final limit speed of each torque motor mainly depends on the winding design and the DC link voltage U_{DCL}. Voltage drops inside the motor increase the voltage requirement as the speed gets faster.
With the limiting speeds indicated in the data sheets, the voltage requirement for field-oriented control corresponds with the DC link voltage of the servo converter. After that, the speed quickly drops. The higher the DC link voltage and the smaller the voltage constants k_u caused by the winding, the higher the attainable limiting speeds are. Since voltage and torque constants correlate, the power requirement increases the higher the speed demands are when the torques are equal.
In part 2 of the technical parameters (winding data), two standard windings WL and WM per motor size were predefined for varying limiting speeds and requirements on dynamics with a fixed DC link voltage U_{DCL}.
With low DC link voltages, the limiting speed is reduced nearly proportionally.
The torque develops in various operating points from the torque-current characteristic. The torque-speed characteristics represent the correlation between the torque and speed in various operating points.

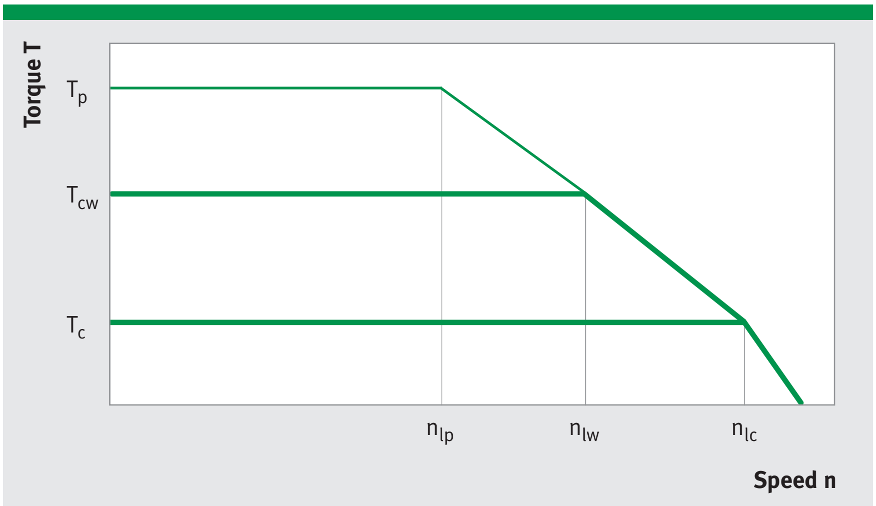


Torque-Speed Characteristic

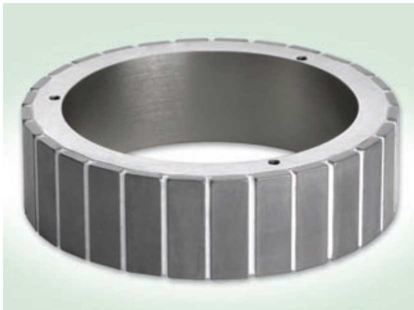
The speed limits n_{lp}, n_{lw}, n_{lc} are only calculated in relation to the winding-specific parameters. If the motor is not operated in field weakening, then the motor can be operated using the torques T_p, T_{cw}, T_c and the corresponding speed limits n_{lp}, n_{lw}, n_{lc}. In the end, the motor speed drops to zero depending on the voltage.

At high speeds and torques, additional frequency-dependent heat losses arise in the motor (caused by eddy currents and change in magnetisation).
Taking these thermal losses into account, a further speed limit is produced in the n_{cr} range during continuous operation.

Controlled motor movements require sufficient distance (0.8 times the relevant maximum speed) for possible operating points from the sloping range of the T-n characteristic.
The peak torque T_p must only be used in short time operation. The maximum permissible heat power loss P_{lw} for water cooling and P_{lc} in uncooled operation must not be exceeded.



Torque vs. speed



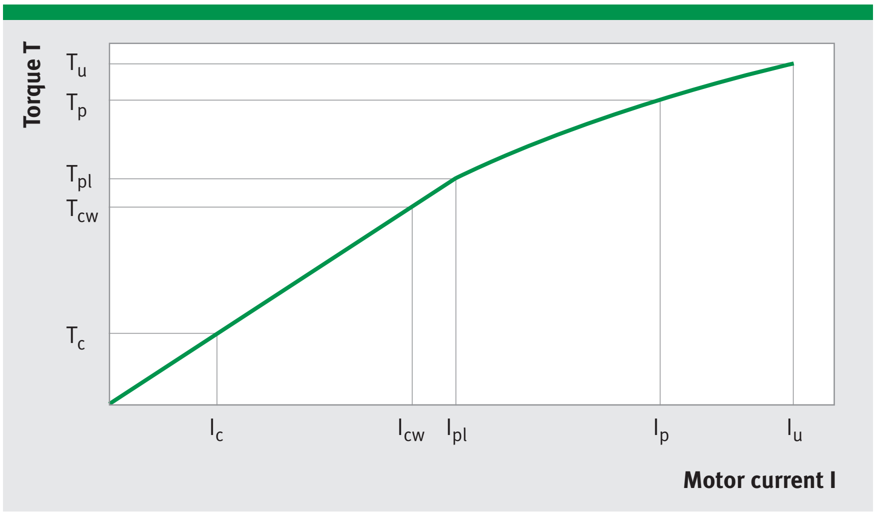
The winding-specific speed limits are somewhat proportional to U_{DCL}. The continuous operation of these motors is limited to the limiting speed for continuous operation n_{cr} since additional frequency-dependent losses occur (see glossary).
A reduction in the duty cycle or the current is required depending on these additional losses.

Torque-Current Characteristic

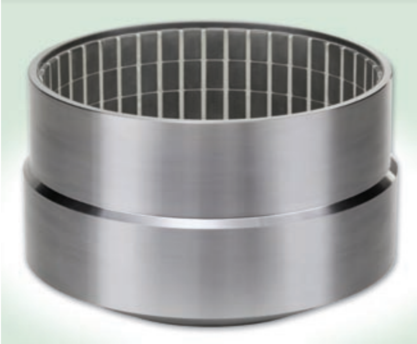
The linear range of the characteristic curve from the origin (0.0) up to the point (T_{pl}, I_{pl}) is characterised by the torque constant k_T. The operating points of the motor are found here for uncooled operation (T_c, I_c) and cooled operation (T_{cw}, I_{cw}).

The non-linearity of the T-I characteristic for large currents is formed as a consequence of saturation in the magnetic circuits of a motor. The naturally curved range of the characteristic curve is described in the data sheet and in the diagram by the torque-current points (T_p, I_p) and (T_u, I_u).
It has a changeable and substantially lower rise than k_T.

The motor can briefly (in seconds) be operated up to operating point (T_p, I_p). This operating point must be used as a maximum for acceleration phases.
The limit point (T_u, I_u) may never – not even for a short period of time – be exceeded due to risk of demagnetisation of the permanent magnets.



Torque vs. motor current



All parameters are explained in the glossary.

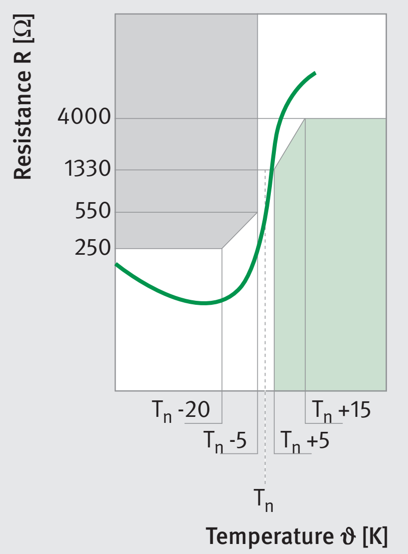
Thermal Motor Protection

Monitoring circuits I and II

Direct drives are often operated to their thermal performance limit. In addition to this, unpredictable overloads could arise in the process. This involves an additional current load above the permissible continuous motor current. This is why the power electronics for motors should generally have overload protection for monitoring the motor current. At the same time, the effective value (root-mean-square I^2t) of the motor current may only exceed the permissible continuous motor current for a short period of time. This type of indirect temperature monitoring is both very fast and reliable.
IDAM motors also have as standard further thermal motor protection by means of PTC and KTY sensors.

Monitoring circuit I

There are three PTC sensors wired in series on the three phase windings to protect the motor. Furthermore, a KTY84-130 is included on one phase in the motor.

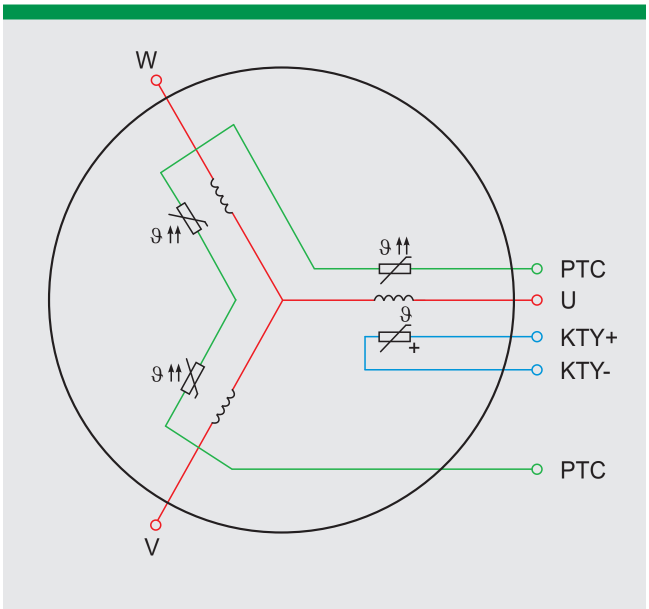


PTC temperature characteristic

A PTC is a resistor. Its thermal time constant when integrated lies under 5 s. In contrast to the KTY, its resistance increases very steeply when the nominal response temperature T_n is exceeded and will increase to several times its cold value.
When the three PTC elements are series connected, this behaviour generates a clear change in the overall resistance even if only one of the elements exceeds the response temperature T_n.
The use of the three PTC sensors guarantees reliable shutdown even when the motor is at standstill with an asymmetric phase load. Typically, a downstream standard motor protection tripping unit triggers between 1.5 to 3.5 kOhm.

Up to a few degrees deviation, the excess temperature of each winding is thus recorded.
The tripping unit also reacts to a too low resistance in the PTC circuit, which normally indicates a defect in the monitoring circuit. Moreover, it provides for reliable galvanic isolation of the control system from the PTC sensors in the motor. The motor protection tripping unit is not included in the scope of delivery.
PTC sensors are not suitable for temperature measurements. If required, the KTY must be used.
At the customer's request, further monitoring sensors can be integrated.

The PTC sensors must always be evaluated for temperature protection.

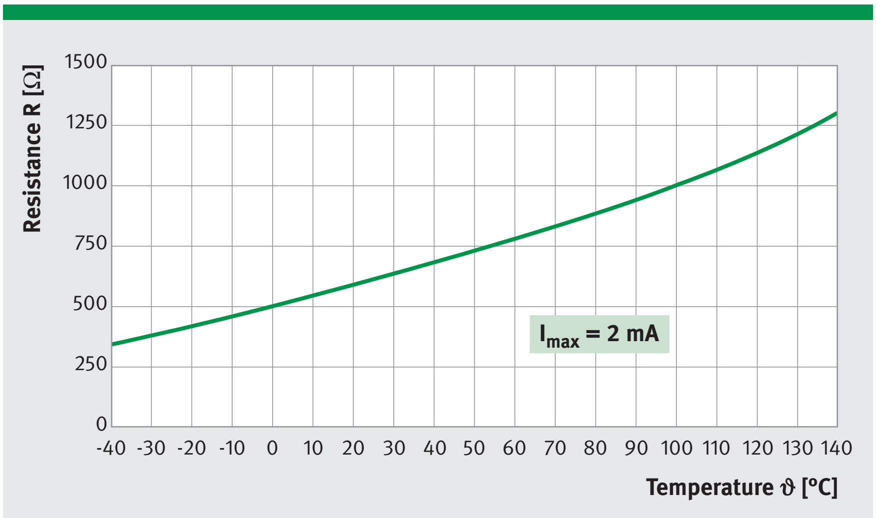


Standard wiring of PTC and KTY

Monitoring circuit II

The KTY84-130 is a semiconductor resistor with a positive temperature coefficient. The measurement is performed with delay depending on the type of motor.

To protect the motor from excess temperatures, you must define a switch-off limit in the control system. The sensor can only measure in one phase.



KTY temperature characteristic

When the motor is at standstill, constant currents flow through the windings whose size depends on the respective pole position. This is why the motor is not heated up homogeneously, which may lead to the overheating of non-monitored windings.

The PTC and KTY sensors have a basic insulation for the motor. They are not suitable for the direct connection to PELV/SELV circuits acc. to DIN EN 50178.

Electrical Connection Technology

The standard cable connections for the IDAM motors are designed axially. Their relative position to the cooling connections is defined in the drawings.
The cable length from the motor outlet is 1.0 m or according to the customer's request. The cross-section of the power connection cable depends on the continuous motor current and is documented in the catalogue drawing. By default, dimensioning is carried out to continuous current I_{cw} at P_{lw} (cooled).

The motor cables are available from 4G0.75 mm². The sensor cable allows you to monitor the temperature using PTC and KTY. The design of the wire ends is open with wire end ferrules.
In the technical data (page 28ff), the cable outlets are shown axially, radially and tangentially. This must be defined specifically when ordering. As from motor currents above 70 A, the cable outlets are adjusted to match the application.

Characteristics of the lines

- Shielded
- Oil-resistant and coolant-resistant (PUR outer sheath)
- Flame-retardant
- UL/CSA certified
- Suitable for cable carriers

Continuous current (cooled) I_{cw} in A	Line cross-section A in mm²	Diameter (± 10%) d in mm	Bending radius moved dynamically r_d in mm	Bending radius laid statically r_s in mm	Weight m in g/m
Sensor	4x0.14	5.1	min. 10x d	min. 5x d	40
≤ 10	4G0.75	7.6			110
≤ 16	4G1.5	9.0			150
≤ 22	4G2.5	11.0			230
≤ 30	4G4	12.5			310
≤ 37	4G6	14.5			440
≤ 52	4G10	18.0			700
≤ 70	4G16	21.5			1050

Pin assignments

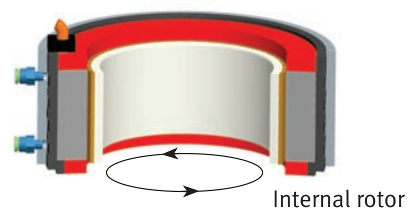
Motor	
1/U	Phase U
2/V	Phase V
3/W	Phase W
GNYE	PE

Sensor	
WH	PTC
BN	PTC
GN	+ KTY
YE	- KTY

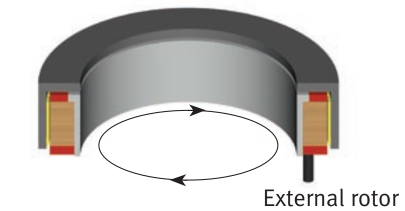
Positive rotating direction of motor

The electrically positive rotating direction matches a clockwise rotating field for all three-phase motors, i.e. the phase voltages are induced in the order U, V, W.
IDAM motors have this positive rotating direction in the rotor movement

- Clockwise when looking at the side facing away from the cable outlet
- Anticlockwise when looking at the side of the cable outlet.



Rotating direction for cable outlet, top



Rotating direction for cable outlet, bottom

Commutation

Synchronous motors are preferably run commutated. IDAM torque motors have no Hall sensors by default. IDAM recommends the measuring system related commutation, because it is supported by modern servo converters and control systems.

Dielectric Strength

Dielectric strength for DC link voltages up to 600 V_{DC}

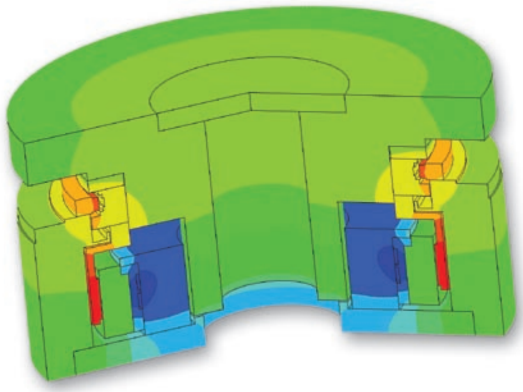
IDAM motors are tested by sophisticated high-voltage test methods prior to delivery and potted under vacuum.
IDAM motors comply therefore with EU Directive 2006/95/EC and standards EN 60034, EN 60204.
It is vital that you observe the type related voltages used for running the motors. Higher DC link voltages are possible upon request.

Overvoltages on the motor terminals in converter operation

Due to extremely fast switching power semiconductors, which produce high dU/dt loads, considerably higher voltage levels may appear on the motor terminals than the actual converter voltage, particularly in conjunction with longer connecting cables (from approx. 5 m) between the motor and converter. This subjects the motor insulation to very high loads. The dU/dt values of the PWM modules should not be higher than 8 kV/µs. Keep the connecting cables for the motors short if possible.
To protect the motors, an oscillographic measurement of the voltage present on the motor (PWM) is always required in the specific configuration above the winding and to PE. The voltage peaks present should not be much more than 1 kV. From approximately 2 kV, gradual damage of the insulation can be expected.
To reduce the overvoltage peaks and dU/dt loads, IDAM recommends using motor filters.
IDAM engineers will support you in determining when voltages are too high and in the selection of motor filters.

Observe the recommendations and project advice of the control system manufacturer.

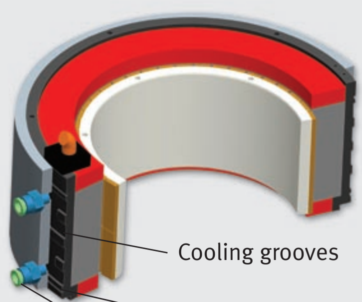
Cooling and Cooling Circuit



Power loss and heat loss

In addition to the power loss which is described by the motor constant k_m, frequency-dependent losses in the motor are also produced - particularly with higher control frequencies (in a range between 150 – 200 Hz). These losses together contribute to the heating up of the motor assemblies and system assemblies.
With low control frequencies in the motors, the following applies: Motors with a higher k_m produce less power loss in comparison to motors with a lesser k_m.
IDAM offers extensive thermal simulations for an unrestricted view of the motor assemblies, bearing assemblies and system assemblies in a thermal sense.

The power loss produced during motor operation is transmitted to the machine through the motor assemblies. This heat distribution through convection, conduction and radiation can be specifically influenced and controlled by means of a constructive design for the overall system. The continuous torques for the motors are approx. 50% higher with liquid cooling than in uncooled operation. The motors must be designed and incorporated in the machine construction according to the installation space available, precision requirements and cooling requirements.



Cooling

In high-performance production machines or highly dynamic devices with the associated higher bearing load, it is preferable that operations are run using a cooling system.
If a complete thermal decoupling of the motor and machine is required (e.g. for preventing thermal distortion in the machine construction in precision machines), then precision cooling is required in addition. The actual cooling system is then described as the main cooling system or performance cooling.

Air gap diameter	Description of O-ring	Order number
89	150x2 NBR 90	212043
168	225x2 NBR 70	01684
250	295x3 NBR 90	212099
298	375x3 NBR 90	212100
384	470x4 NBR 90	212101
460	530x4 NBR 90	212102
690	785x5 NBR 70	105935
920	1005x6 NBR 70	212103

O-ring types for cooled RI motors

The cooling system for the motors is designed as jacket cooling, which must be connected up to the cooling circuit for a cooling unit by the user. The cooling jacket is supplied as a component of the motor as an option, or is already an integral component of the machine construction of the customer.
The cooling medium gets into the cooling ribs via openings over various levels from the inlet to the outlet. The inlet and outlet can be assigned to both connections as desired. The flow range is sealed from the outside via O-rings.

When using water as a coolant, use additives which prevent corrosion and biological deposits from building up in the cooling circuit.

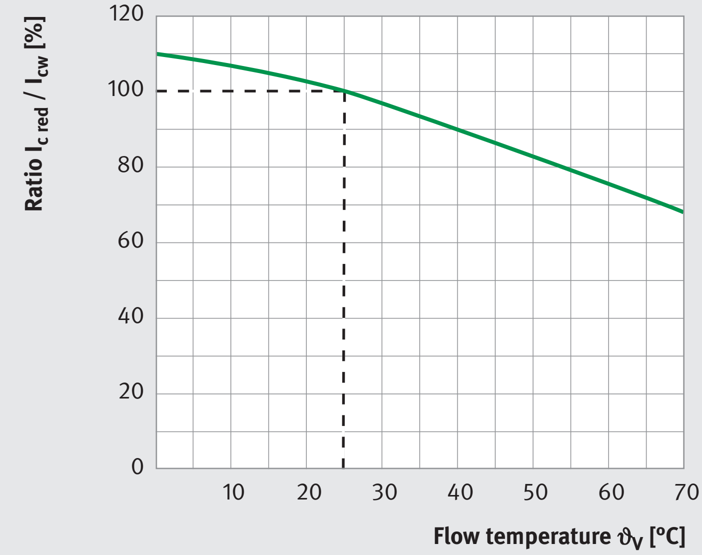
Dependency on the Nominal Data of the Flow Temperature and the Cooling Medium

The continuous current I_{cw} given in the data sheet for cooled operation relates to the nominal flow temperature ϑ_{nV} of the cooling water.
Higher flow temperatures ϑ_V lead to a reduction in the cooling performance and thus the continuous current, too.
The reduced continuous current $I_{c\,red}$ can be calculated using the following quadratic correlations:

$$\frac{I_{c\,red}}{I_{cw}} = \sqrt{\frac{\vartheta_{max} - \vartheta_V}{\vartheta_{max} - \vartheta_{nV}}}$$

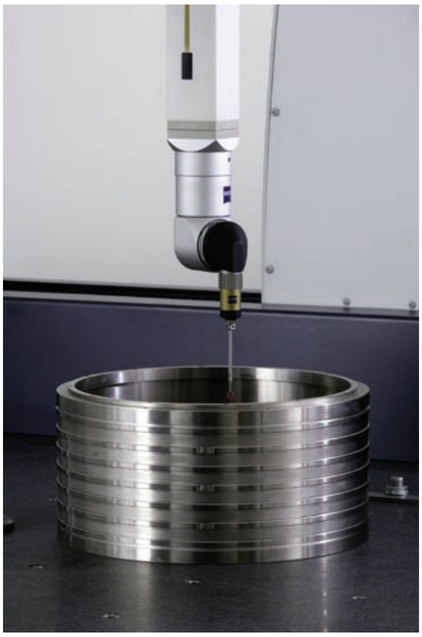
$I_{c\,red}$	Reduced continuous current [A]
I_{cw}	Continuous current, cooled ϑ_{nV} [A]
ϑ_V	Current flow temperature [°C]
ϑ_{nV}	Nominal flow temperature [°C]
ϑ_{max}	Maximum permissible winding temperature [°C]

(applies to constant motor current)



Relative continuous current $I_{c\,red}$ / I_{cw} vs. flow temperature ϑ_V (ϑ_{nV} = 25 °C)

The use of customer-specific cooling media results in changes to the liquid-cooled continuous torque. The affect caused by the cooling medium used can be determined when the substance properties are identified by the IDAM engineer.

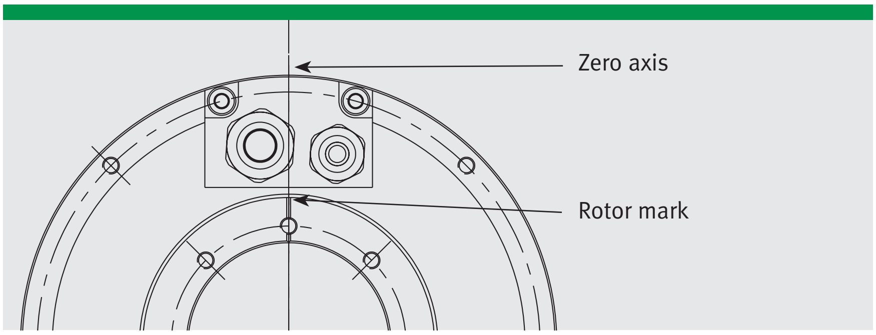


Operating Several Motors in Parallel on One Axis

In some applications, it makes practical sense to drive one axis with two or more synchronous motors at the same time. Such applications could be, for example, swing bridges in 5-axis machining centres, fork milling heads or tool spindles for gear hobbing applications.
Structurally identical motors can be operated and be connected in parallel using the same converter.

Turning and milling on 5-axis machining centre GS 1400/5-FDT – Productivity through hybrid machining in one setting (source: ALZMETALL)

Arrangement of the motors

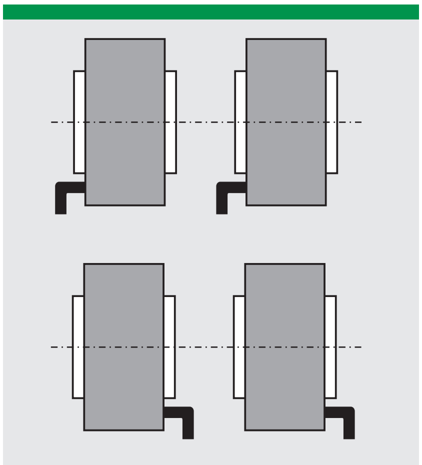


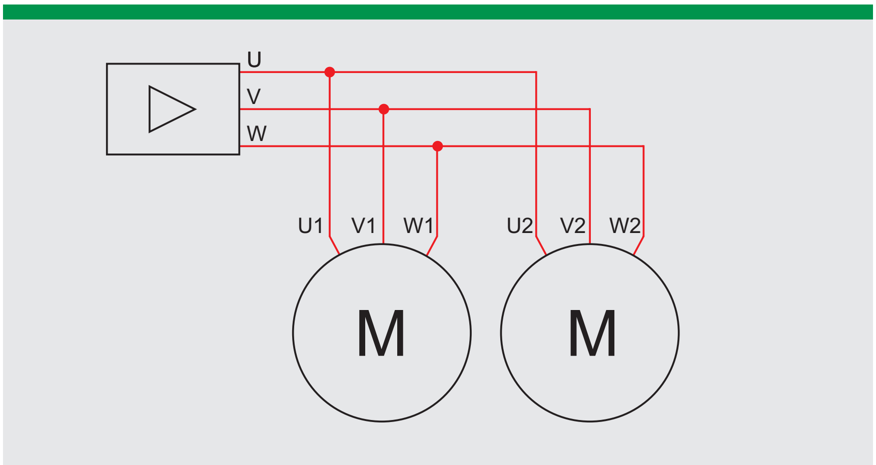
Zero axis and rotor mark in alignment

A distinction is made between the true parallel tandem arrangement and the antiparallel (mirror-image) Janus arrangement of the stators.
Please observe that the rotors must be arranged on a common axis such that the rotor mark, and thus the poles of the magnet, are equally in alignment.

The zero axis for aligning the stators is located normally in a central position between the bores of the cable clamp. Exceptions are the RI11-3P-89xH and RI11-3P-920xH series, special windings and special housings. In any case, you should notify us if using applications in parallel mode.

Tandem arrangement

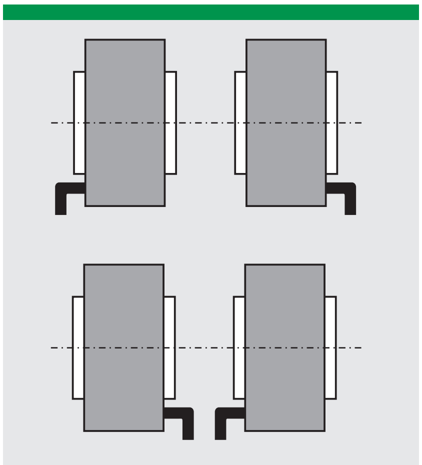


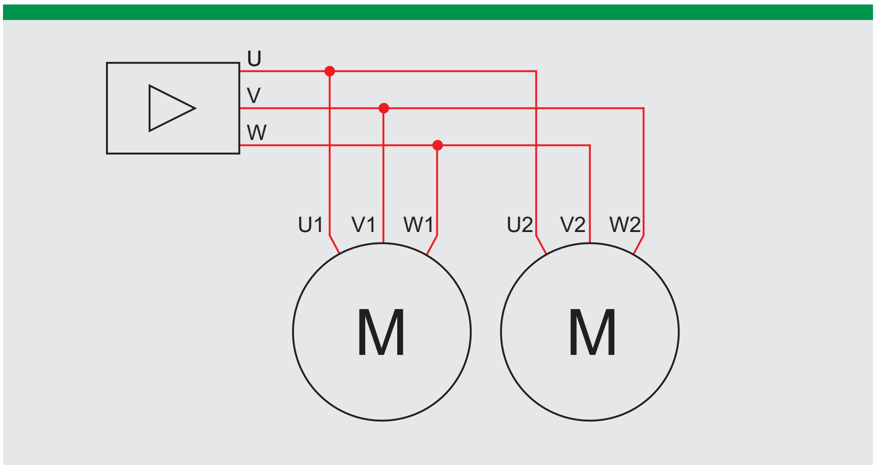


The cable outlets point in the same longitudinal direction.

The zero axes of the stators are also aligned with the cable outlets. When the cable outlets are aligned, you simply bring the bolt patterns into line and combine the phase connections equally.

Janus arrangement





The cable outlets point in the opposite longitudinal direction.

The zero axes also have to match up in the mirror-image arrangement. Offsetting the bolt patterns may be necessary depending on the position of the zero axis. Mirror-arranged motors must operate in the opposite direction of rotation. To do so, you interchange the phases V and W, only phase U is now mutually shared.

Operating Several Motors in Parallel on One Axis

Shifting of cable outlet

In all arrangements, the stators and thus the cable outlets may be twisted against each other in a certain grid. A shorter overall axis may be constructed by twisting the stators, particularly in the Janus arrangement with inner cable outlets.

The grid is equal to one pole pair and must be multiplied by any integer factor, allowing the twisting angle to be calculated as follows:

$$\text{Twisting angle} = \frac{360°}{\text{Number of pole pairs}} \cdot n$$

In some series, a favourable twisting angle is also possible in the bolt pattern, e.g. RI11-3P-250xH:

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

Setting for the phase coincidence

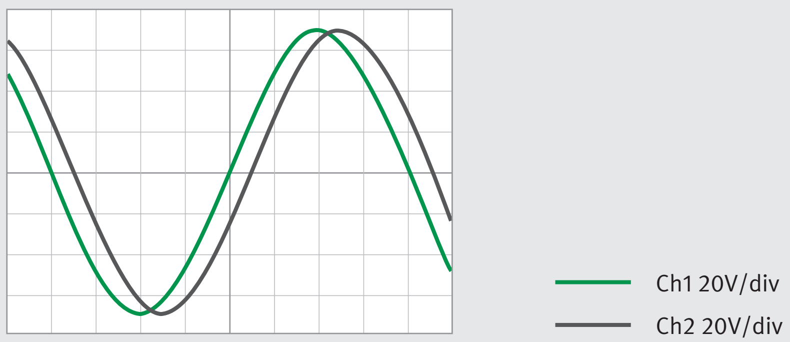
A check must always be made as to whether the parallel motors are aligned in phase to one another. If the phases do not match up, the torque constant and efficiency are reduced depending on the speed owing to induced short-circuit currents.

To adjust the phases, the respective reverse voltage in the motors is measured with a dual-channel oscilloscope during simultaneous rotation of the connected rotors. The phase displacement of the two curves should not be greater than ±5°, so that good static functioning of the interconnected motors can be ensured. An electrical phase displacement between the motors can be cancelled by mechanical adjustment of one rotor or stator respectively.

The following applies:

$$\text{Mechanical angular displacement} = \frac{\text{Phase displacement}}{\text{Number of pole pairs}}$$

With professional installation, play in the bolt-pattern screwing connection (acc. to mean tolerance class EN20273) normally suffices for a fine adjustment. If more than two motors are connected in parallel, you should define one of them as the master, which is used as the reference point for the alignment of all the other motors.



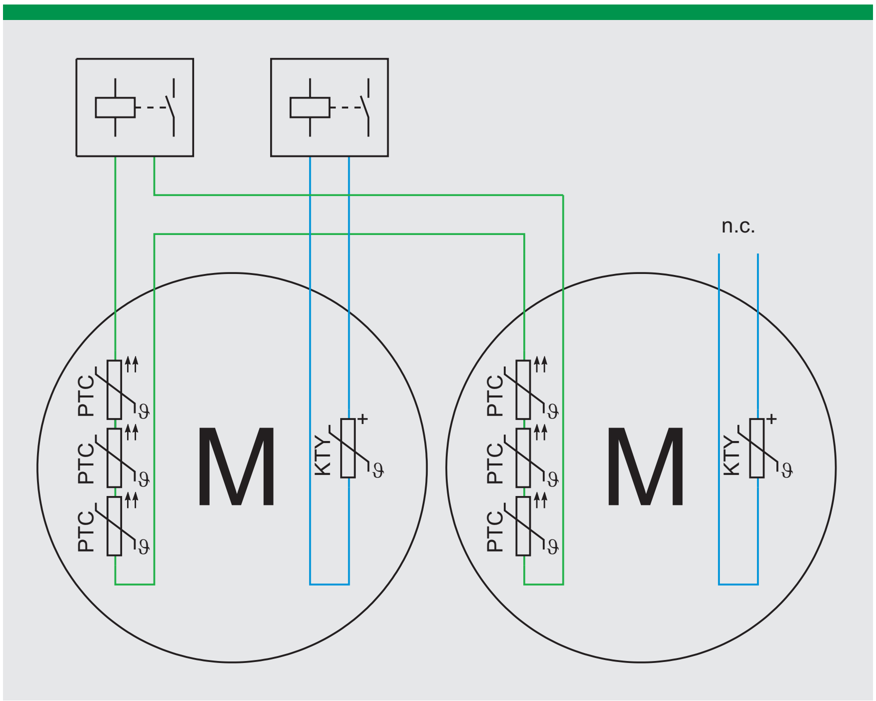
22.5° phase displacement between the reverse voltages

Evaluation of temperature sensor systems

Thermal overload in a motor could be caused in the event of faulty or inaccurate alignment of the motors to one another. The integrated PTC sensors must be used for protecting the motors.
To do this, the PTC sensors for each motor in the arrangement are connected in series and evaluated via a motor protection tripping unit.

To prevent premature tripping of the motor protection, we recommend several or multi-channel motor protection tripping units in the event of three or more PTC monitoring circuits.

The temperature can be observed individually using the KTY or via a KTY evaluation unit for several motors as well. Unused connections must be securely isolated.



Connection of temperature sensors for several motors

Resulting motor data

When the structurally identical single motors are connected in parallel this produces for the converter new electrical data for the replacement motor now available. They can be easily determined from the data for the single motors:

- The number of pole pairs, torque constants, voltage constants, time constants as well as speeds remain unchanged.
- Currents, torques and the damping constant multiply according to the number of single motors.
- Resistance and inductance are divided through the number of single motors.

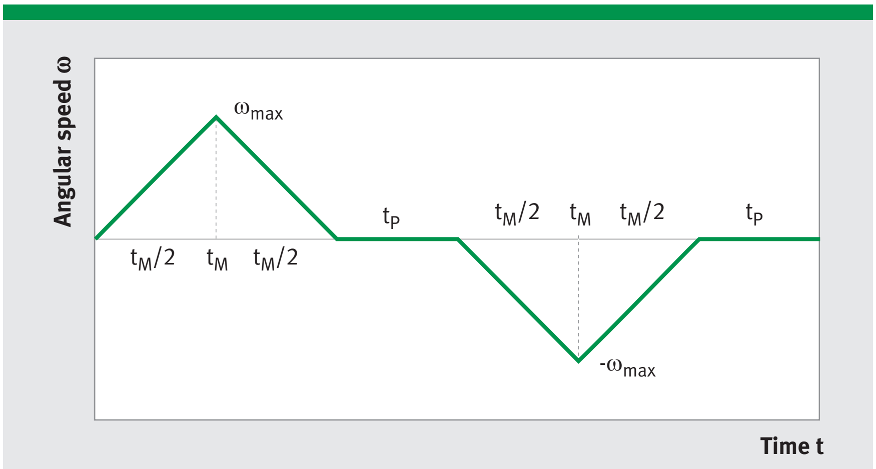
Selection of Direct Drives for Rotary Applications

Cyclic applications

Cyclic operation consists of consecutive positioning movements with movement pauses in between.

Simple positioning takes place as a positively accelerated movement and subsequent braking (negative acceleration is mostly of the same amount - in that case, acceleration time = braking time applies).

The maximum angular speed ω_{max} is reached at the end of an acceleration phase.

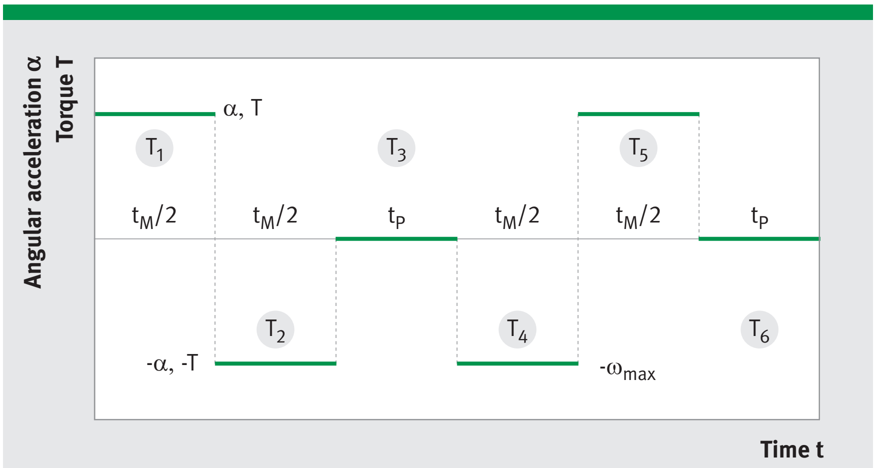


ω-t diagram for cyclic operation

A cycle is described in the ω(t) diagram (ω: angular speed, t: time). The figure shows a forwards-backwards rotation with pauses (t_M: movement time, t_P: pause time).

This produces the following α(t) diagram (α: angular acceleration) and the course of the torque required for the movement: $T = J \times \alpha$

(T: torque in Nm, J: mass moment of inertia in kgm^2, α: angular acceleration in rad/s^2).



α-t diagram for cyclic operation

The motor is selected according to three criteria in accordance with the torque curve for a required cycle:

- Maximum torque in cycle ≤ T_P acc. to data sheet
- Effective torque in cycle ≤ T_c (motor not cooled) or T_{cw} (water cooling) acc. to data sheet
- Maximum speed in cycle ≤ n_{lp} acc. to data sheet

The effective torque is equal to the root-mean-square of the torque curve (six torque cycles) in the cycle.

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

The safety factor 1.4 in the calculation example (pages 22 and 23) takes into consideration, among other things, the motor operation in the non-linear range of the torque-current characteristic where the calculation equation for T_{rms} only approximately applies.

The torques $T_1 = T$; $T_2 = -T$; $T_3 = 0$; $T_4 = -T$; $T_5 = T$; $T_6 = 0$ and times $t_1 = t_M/2$; $t_2 = t_M/2$; $t_3 = t_P$; $t_4 = t_M/2$; $t_5 = t_M/2$; $t_6 = t_P$ are used to calculate the effective torque.

$$T_{rms} = T \cdot \sqrt{\frac{t_M}{t_M + t_P}}$$

$$T_{rms} = J \cdot \alpha \cdot \sqrt{\frac{t_M}{t_M + t_P}}$$

This equation then applies to the effective torque only if torques of the same amount have an effect in the cycle (mass moment of inertia and angular accelerations are constant). At the same time, “the sum of the movement times divided by the sum of the movement times plus pause times” is put underneath the root.

Therefore the cycle time is in the denominator.

Angular acceleration, maximum angular speed and maximum speed of a positioning movement is calculated using:

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

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

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

φ	Movement angle (positioning angle) in rad
t_M	Movement time in s
α	Angular acceleration in rad/s²
ω_{max}	Maximum angular speed in rad/s
n_{max}	Maximum speed in rpm

The described positioning movement runs (theoretically) with an infinite jerk. If jerk limitation is programmed in the servo converter, then the positioning times are extended correspondingly. Constant positioning times in this case require greater accelerations.

Selection of Direct Drives for Rotary Applications

Example: Cyclic applications

Specified values:

Movement angle φ in °	180
Movement time t_M in s	0.5
Cycle time $t_M + t_P$ in s	1.35

Mass moment of inertia J in kgm^2	2.5
Friction torque T_F in Nm	8
Safety factor SF	1.4

Calculation:

Conversion of movement angle in rad:

$$\varphi = \frac{\pi}{180} \cdot 180 \text{ rad} = 3.142 \text{ rad}$$

Maximum angular speed:

$$\omega_{max} = \frac{2 \cdot \varphi}{t_B} = \frac{2 \cdot 3.142}{0.5} \text{ rad/s} = 12.57 \text{ rad/s}$$

Maximum speed:

$$n_{max} = \frac{30}{\pi} \cdot \omega_{max} = \frac{30}{\pi} \cdot 12.57 \text{ 1/s} = 120.0 \text{ rpm}$$

Angular acceleration:

$$\alpha = \frac{4 \cdot \varphi}{t_M^2} = \frac{4 \cdot 3.142}{0.5^2} \text{ rad/s}^2 = 50.27 \text{ rad/s}^2$$

Resulting in consideration of friction torque T_F is a maximum torque:

$$T_{max} = (J \cdot \alpha) + T_F = (2.5 \cdot 50.27) + 8 = 133.68 \text{ Nm}$$

Effective torque in accordance with friction torque T_F:

$$T_{rms} = \left(J \cdot \alpha \cdot \sqrt{\frac{t_M}{t_M + t_P}} \right) + T_F = \left(2.5 \cdot 50.27 \cdot \sqrt{\frac{0.5}{1.35}} \right) + 8 = 84.48 \text{ Nm}$$

In accordance with friction torque T_F and the safety factor, you select the motor with the requirements

$1.4 \cdot T_{max} \leq T_p$ | $1.4 \cdot T_{rms} \leq T_{cw}$ | $1.4 \cdot n_{max} \leq n_{lp}$

The motor RI17-3P-168x75-WM, with water cooling, has the calculated parameters.

NC rotary table applications

The speed n, the mass moment of inertia J, the machining torque T_M (in motion) and T_s (standstill) and the angular accelerations α (S1 mode) and α_{max} (S6 mode) are mostly known for rotary table applications.

The machining times, which means the action times of the torques, often change. Nevertheless, it is necessary to determine the effective torque as the continuous torque and the maximum torque as precisely as possible so that the optimal motor can be selected and to prevent the maximum permissible winding temperature from being exceeded. All load torques produced in motor operation are included in the torque calculation.

Example: Rotary table applications

Specified values:

Speed n in rpm	70
Mass moment of inertia J in kgm^2	4
Machining torque T_M in Nm	300
Friction torque T_F in Nm	50
Weight force (additional torque) T_Z in Nm	0

Angular acceleration (S1) α_{S1} in °/s²	9000
Max. angular acceleration (S6. 3 s)	
α_{max} in °/s²	20000
Safety factor SF	1.4

Calculation:

Conversion of the accelerations in rad/s^2:

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

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

The motor is selected with safety factor (stable control) in accordance with stall torque T_s and in accordance with the torques in motion for S1 and S6 mode T_c and T_p:

$$T_{sw} = (T_M + T_F + T_Z) \cdot 1.4 = 490\ Nm\ \text{(with water cooling)}$$

$$T_{cw} = (J \cdot \alpha + T_M + T_F + T_Z) \cdot 1.4 = 1369\ Nm\ \text{(with water cooling)}$$

$$T_p = (J \cdot \alpha + T_M + T_F + T_Z) \cdot 1.4 = 2444\ Nm$$

If speed n is to be attained at the end of the accelerated movement with a defined speed-time function (exact ramp), then the motor must be selected in accordance with the speed for torque T_p (with safety factor):

Calculation of the speed:

$$n_{lp} = 1.4 \cdot n = 98\ rpm$$

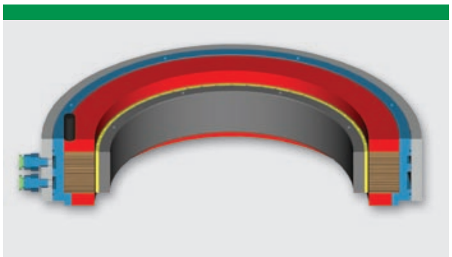
The motor RI13-3P-690x50-WM, with water cooling, meets these requirements.

RI Torque Motors
Features, benefits, applications

Features

RI torque motors are slotted, permanent magnet excited AC synchronous motors with an internal rotor.
The coils for the primary part are inserted in grooves of the laminated iron core. The secondary part is an iron ring with permanent magnets fastened to it. This motor series is optimised to maximum efficiency, which means:
Maximum torque in the available installation space at nominal speed and lower power loss.

The usable torque is linearly available over a very large range. The definition of the torque characteristics using distinctive operating points allows a conceptual design based on our dimensioning examples.
The low torque fluctuations allow the motors to be used for precision applications.



RI (internal rotor) motors are offered in different categories:

- with 8 fixed diameters from 160 to 1030 mm outer diameter
- with stators at 6 different heights in 25 mm steps
- with 2 standard windings for low and medium speeds

Benefits

- Speed manipulating range 0 - 100% of nominal speed
- Compact design
- Highly dynamic and high rigidity
- Higher speeds possible
- Higher torque compared to DC motors with the same dimensions
- Completely protected design always possible owing to external cooling
- Reduced heat dissipation in the machine bed
- Higher accelerating and stopping capability owing to a more favourable ratio between torque and moment of inertia
- Practical zero maintenance
- No limitation of motor diameter
- Good synchronisation characteristics

Applications

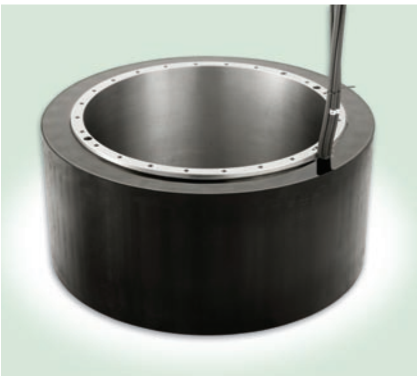
- Automation technology
- Printing and packaging machinery
- Presses
- As the CNC axis in machine tools
- NC indexing tables
- Other exact radial tracking systems

RE Torque Motors
Features, benefits, applications

Features

RE torque motors are slotted, permanent magnet excited AC synchronous motors with an external rotor.
The permanent magnets are arranged in an externally rotating drum (rotor).
RE motors can often be integrated more favourably into corresponding rotary systems and have somewhat higher torques than the RI motors with the same installation spaces. The structure of the magnetic circuits is, however, the same in principle.

The system is cooled at the interior stator housing. The magnetic circuits for the motors are designed and optimised according to the latest findings.
Cogging and load pulsation have been reduced practically to values that are no longer relevant.
RE motors are mainly used in mechanical engineering as direct turntable drives or in swivel axes.



RE (external rotor) motors are offered in different categories:

- with 7 fixed diameters from 230 to 734 mm outer diameter
- with stators at 6 different heights in 25 mm steps
- with 2 standard windings for low and medium speeds

Benefits

- Maximum power density in the smallest installation spaces owing to coordinated single components
- Compact design
- Highly dynamic and high rigidity
- Highly efficient cooling
- Top values in synchronisation owing to its optimised design
- Practical zero maintenance
- Adapted speeds and windings
- Higher torques in comparison to the RI series for the same motor size

Applications

- Grinding machines
- Milling machines
- Machining centres
- HSC machines
- Tool changers
- Milling heads
- Swivel axes
- Rotary tables

Type Designation

RI and RE series, primary part

XXXX - 3P - DxH - X - X - X - X - PRIM

Short designation of motor type

RI RI series, internal running motor (internal rotor)

RE RE series, external running motor (external rotor)

Model code

Number of motor phases

3P 3-phase

Dimensions

Effective diameter in the air gap x package size (mm)

Winding types

WL Low speed, low current requirement

WM Medium speed

Other winding designs on request.

Temperature monitoring

0 Standard (3x PTC in series and 1x KTY84-130)

S Special design on request

Commutation type

0 Without sensors, measuring-system commutated

Other designs on request.

Model variant

0 Built-in set (motor is integrated in customer's system)

M Complete motor (parts are manufactured by IDAM)

K With cooling in the ring (additional ring is provided by IDAM)

Motor part

PRIM Primary part

The six-digit IDAM article number in the order confirmation is binding for the unequivocal designation of the motor.

Type Designation

RI and RE series, secondary part

XXXX - 3P - DxH - X - SEK

Short designation of motor type

RI RI series, internal running motor (internal rotor)

RE RE series, external running motor (external rotor)

Model code

Number of motor phases

3P 3-phase

Dimensions

Effective diameter in the air gap x package size (mm)

Model variant

O Built-in set (motor is integrated in customer's system)

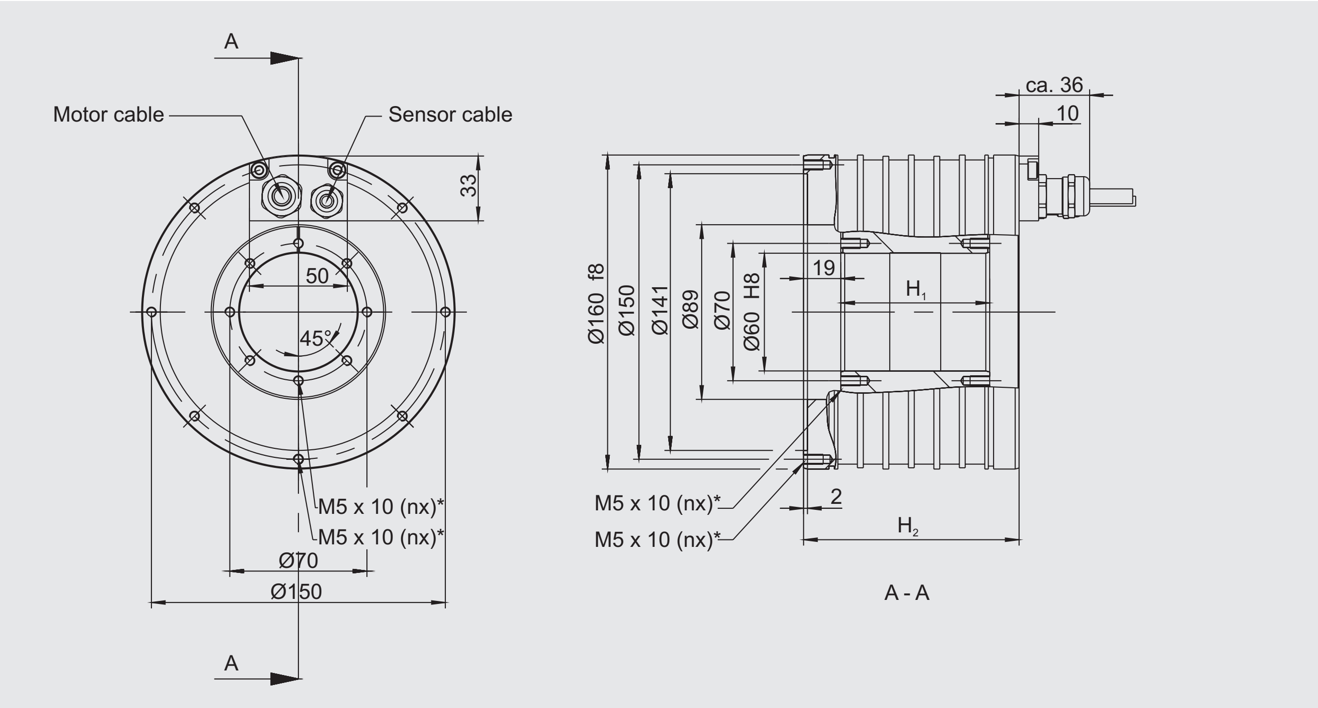
M Complete motor (parts are manufactured by IDAM)

Motor part

SEK Secondary part

Technical Data: Series RI11-3P-89xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RI11-3P-** **89x25 • 89x50 • 89x75**	**RI11-3P-** **89x100 • 89x125 • 89x150**
Fastening thread of rotor	M5 x 10, 8 x (45°)	M5 x 10, 16 x (22.5°)
Fastening thread of stator – cable side	M5 x 10, 7 x (45°)	M5 x 10, 13 x (22.5°)
Fastening thread of stator	M5 x 10, 8 x (45°)	M5 x 10, 16 x (22.5°)

Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RI11-3P-89xH

Winding-independent data

Technical data	Symbol	Unit	RI11-3P-89x25	RI11-3P-89x50	RI11-3P-89x75	RI11-3P-89x100	RI11-3P-89x125	RI11-3P-89x150
Number of pole pairs	P		11	11	11	11	11	11
Maximum operating voltage	U	V	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	32.4	64.9	97.3	130	162	195
Peak torque (saturation range) at I_p	T_p	Nm	23.5	46.9	70.4	94	117	141
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	17.2	34.5	51.7	69	86	103
Continuous torque cooled at I_{cw}	T_{cw}	Nm	12.6	29.2	46.7	64	82	100
Continuous torque not cooled at I_c	T_c	Nm	4.9	11.0	17.1	23	28	33
Stall torque cooled at I_{sw}	T_{sw}	Nm	8.9	20.8	33.2	46	59	71
Stall torque not cooled at I_s	T_s	Nm	3.4	7.8	12.2	16	20	24
Ripple torque (typical cogging) at I = 0	T_r	Nm	0.07	0.14	0.21	0.3	0.4	0.4
Power loss at T_p (25 °C)	P_{lp}	W	1130	1669	2207	2745	3283	3821
Power loss at T_{pl} (25 °C)	P_{lpl}	W	442	652	862	1072	1283	1493
Power loss at T_{cw}	P_{lw}	W	304	609	913	1218	1522	1826
Power loss at T_c (25 °C)	P_{lc}	W	35	66	94	120	140	155
Thermical resistance with water cooling	R_{th}	K/W	0.329	0.164	0.110	0.082	0.066	0.055
Motor constant (25 °C)	k_m	Nm/√W	0.82	1.35	1.76	2.11	2.41	2.68
Cooling water flow rate of main cooling system	dV/dt	l/min	0.87	1.74	2.61	3.48	4.35	5.22
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RI11-3P-89x25	RI11-3P-89x50	RI11-3P-89x75	RI11-3P-89x100	RI11-3P-89x125	RI11-3P-89x150
Height of rotor	H_1	mm	26.0	51.0	76.0	101.0	126.0	151.0
Height of stator	H_2	mm	70.0	90.0	110.0	140.0	165.0	190.0
Rotor mass	m_1	kg	0.5	1.1	1.6	2.2	2.7	3.2
Stator mass	m_2	kg	5.1	7.2	9.3	11.8	14.1	16.3
Moment of inertia of rotor	J	kgm^2	0.00075	0.0015	0.00225	0.0030	0.00375	0.0045
Axial attraction	F_a	kN	0.1	0.1	0.1	0.1	0.1	0.1
Radial attraction/eccentricity	F_r	kN/mm	0.5	1.0	1.5	2.0	2.4	2.9

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for “power loss”: ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

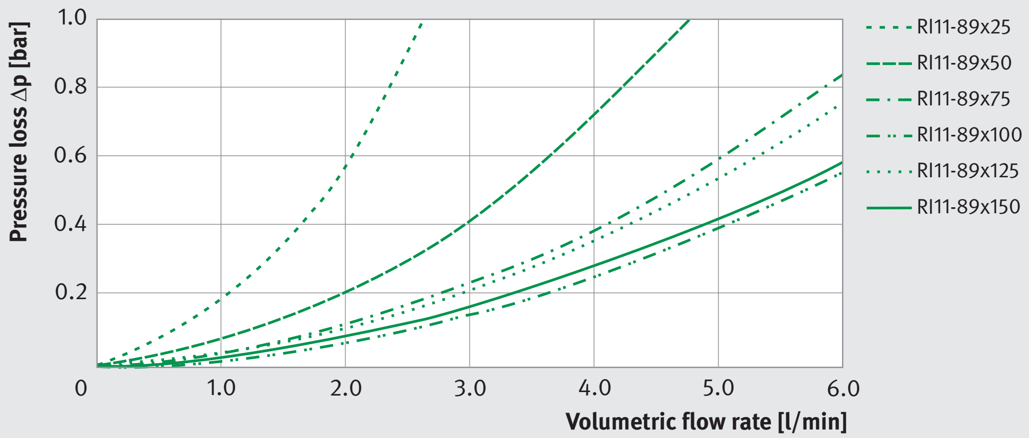
Technical Data: Series RI11-3P-89xH

Winding-dependent data

Winding data	Symbol	Unit	RI11-3P-89x25-WL	RI11-3P-89x25-WM	RI11-3P-89x50-WL	RI11-3P-89x50-WM	RI11-3P-89x75-WL	RI11-3P-89x75-WM
Torque constant	k_T	Nm/A_{rms}	2.43	1.22	4.86	2.43	7.30	3.65
Back EMF constant, phase to phase	k_u	V/(rad/s)	1.99	0.99	3.98	1.99	5.97	2.98
Limiting speed at I_p and U_{DCL}	n_{lp}	rpm	1207	2512	578	1233	367	807
Limiting speed at I_{cw} and U_{DCL}	n_{lw}	rpm	2023	4149	911	1901	568	1208
Limiting speed at I_c and U_{DCL}	n_{lc}	rpm	2621	5303	1272	2595	831	1708
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	818	818	818	818	818	818
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	5.85	1.46	8.64	2.16	11.43	2.86
Inductance, phase to phase	L	mH	22.9	5.7	45.9	11.5	68.8	17.2
Ultimate current (1 s)	I_u	A_{rms}	19.1	38.1	19.1	38.1	19.1	38.1
Peak current (saturation range)	I_p	A_{rms}	11.3	22.7	11.3	22.7	11.3	22.7
Peak current (linear range)	I_{pl}	A_{rms}	7.1	14.2	7.1	14.2	7.1	14.2
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	5.2	10.3	6.0	12.0	6.4	12.8
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.0	4.0	2.3	4.5	2.3	4.7
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	3.7	7.3	4.3	8.5	4.5	9.1
Stall current at n = 0 (not cooled)	I_s	A_{rms}	1.4	2.8	1.6	3.2	1.7	3.3
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

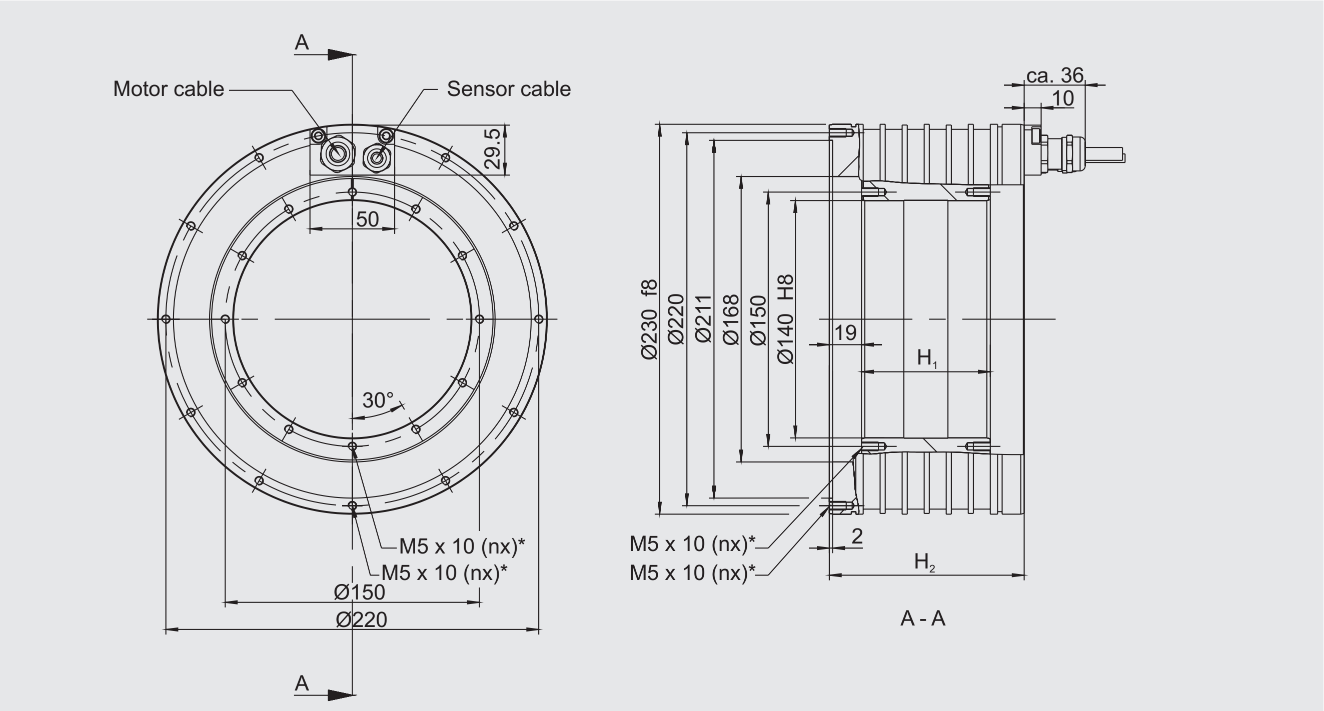
RI11-3P-89x100-WL	RI11-3P-89x100-WM	RI11-3P-89x125-WL	RI11-3P-89x125-WM	RI11-3P-89x150-WL	RI11-3P-89x150-WM	Symbol
9.73	4.86	12.16	6.08	14.59	7.30	k_T
7.96	3.98	9.95	4.97	11.94	5.97	k_u
260	593	195	464	151	377	n_{lp}
403	875	307	680	243	553	n_{lw}
614	1270	486	1012	401	841	n_{lc}
818	818	818	818	818	818	n_{cr}
14.21	3.55	17.00	4.25	19.79	4.95	R_{25}
91.7	22.9	114.6	28.7	137.6	34.4	L
19.1	38.1	19.1	38.1	19.1	38.1	I_u
11.3	22.7	11.3	22.7	11.3	22.7	I_p
7.1	14.2	7.1	14.2	7.1	14.2	I_{pl}
6.6	13.3	6.8	13.6	6.9	13.8	I_{cw}
2.4	4.7	2.3	4.7	2.3	4.6	I_c
4.7	9.4	4.8	9.6	4.9	9.8	I_{sw}
1.7	3.4	1.7	3.3	1.6	3.2	I_s
130	130	130	130	130	130	ϑ
100	100	100	100	100	100	ϑ
600	600	600	600	600	600	U_{DCL}



Pressure losses: RI11-3P-89xH, water (20 °C)

Technical Data: Series RI17-3P-168xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	RI17-3P- 168x25 • 168x50 • 168x75	RI17-3P- 168x100 • 168x125 • 168x150 • 168x175
Fastening thread of rotor	M5 x 10, 12 x (30°)	M5 x 10, 24 x (15°)
Fastening thread of stator – cable side	M5 x 10, 11 x (30°)	M5 x 10, 21 x (15°)
Fastening thread of stator	M5 x 10, 12 x (30°)	M5 x 10, 24 x (15°)

Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RI17-3P-168xH

Winding-independent data

Technical data	Symbol	Unit	RI17-3P-168x25	RI17-3P-168x50	RI17-3P-168x75	RI17-3P-168x100	RI17-3P-168x125	RI17-3P-168x150	RI17-3P-168x175
Number of pole pairs	P		17	17	17	17	17	17	17
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	110	220	327	436	539	647	755
Peak torque (saturation range) at I_p	T_p	Nm	93	186	276	369	456	547	639
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	65	129	192	256	317	380	443
Continuous torque cooled at I_{cw}	T_{cw}	Nm	36	85	135	187	238	290	343
Continuous torque not cooled at I_c	T_c	Nm	16	36	56	75	92	108	124
Stall torque cooled at I_{sw}	T_{sw}	Nm	25	60	96	133	169	206	243
Stall torque not cooled at I_s	T_s	Nm	11	25	39	53	65	77	88
Ripple torque (typical cogging) at I = 0	T_r	Nm	0.3	0.6	0.8	1.1	1.4	1.6	1.9
Power loss at T_p (25 °C)	P_{lp}	W	2909	4173	5438	6702	7967	9232	10496
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1136	1630	2124	2618	3112	3606	4100
Power loss at T_{cw}	P_{lw}	W	455	911	1366	1822	2277	2733	3188
Power loss at T_c (25 °C)	P_{lc}	W	66	124	178	227	264	293	323
Thermical resistance with water cooling	R_{th}	K/W	0.220	0.110	0.073	0.055	0.044	0.037	0.031
Motor constant (25 °C)	k_m	Nm/√W	1.92	3.20	4.17	5.00	5.68	6.33	6.92
Cooling water flow rate of main cooling system	dV/dt	l/min	1.30	2.60	3.90	5.21	6.51	7.81	9.11
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RI17-3P-168x25	RI17-3P-168x50	RI17-3P-168x75	RI17-3P-168x100	RI17-3P-168x125	RI17-3P-168x150	RI17-3P-168x175
Height of rotor	H_1	mm	26.0	51.0	76.0	101.0	126.0	151.0	176.0
Height of stator	H_2	mm	70.0	90.0	115.0	140.0	165.0	190.0	215.0
Rotor mass	m_1	kg	1.2	2.4	3.6	4.8	6.0	7.2	8.4
Stator mass	m_2	kg	7.2	10.1	13.3	16.5	19.8	23.0	26.2
Moment of inertia of rotor	J	kgm^2	0.007	0.014	0.021	0.028	0.035	0.042	0.049
Axial attraction	F_a	kN	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Radial attraction/eccentricity	F_r	kN/mm	1.0	2.0	3.0	3.9	4.9	5.9	6.8

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for "power loss": ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

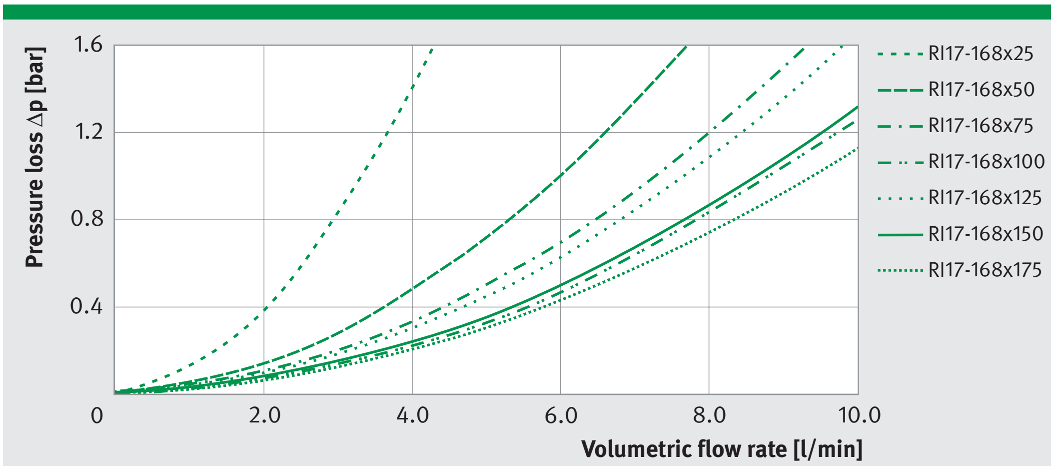
Technical Data: Series RI17-3P-168xH

Winding-dependent data

Winding data	Symbol	Unit	RI17-3P-168x25-WL	RI17-3P-168x25-WM	RI17-3P-168x50-WL	RI17-3P-168x50-WM	RI17-3P-168x75-WL	RI17-3P-168x75-WM
Torque constant	k_T	Nm/A_{rms}	6.73	3.37	13.47	6.73	20.00	10.00
Back EMF constant, phase to phase	k_u	V/(rad/s)	5.51	2.75	11.02	5.51	16.36	8.18
Limiting speed at I_p and U_{DCL}	n_{Ip}	rpm	456	1008	204	484	119	310
Limiting speed at I_{cw} and U_{DCL}	n_{Iw}	rpm	824	1721	372	802	230	513
Limiting speed at I_c and U_{DCL}	n_{Ic}	rpm	957	1952	463	956	303	634
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	529	529	529	529	529	529
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	8.22	2.06	11.80	2.95	15.37	3.84
Inductance, phase to phase	L	mH	24.8	6.2	49.7	12.4	74.5	18.6
Ultimate current (1 s)	I_u	A_{rms}	19.5	38.9	19.5	38.9	19.5	38.9
Peak current (saturation range)	I_p	A_{rms}	15.4	30.7	15.4	30.7	15.4	30.7
Peak current (linear range)	I_{pl}	A_{rms}	9.6	19.2	9.6	19.2	9.6	19.2
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	5.3	10.7	6.3	12.6	6.8	13.5
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.3	4.6	2.6	5.3	2.8	5.6
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	3.8	7.6	4.5	8.9	4.8	9.6
Stall current at n = 0 (not cooled)	I_s	A_{rms}	1.6	3.3	1.9	3.8	2.0	3.9
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

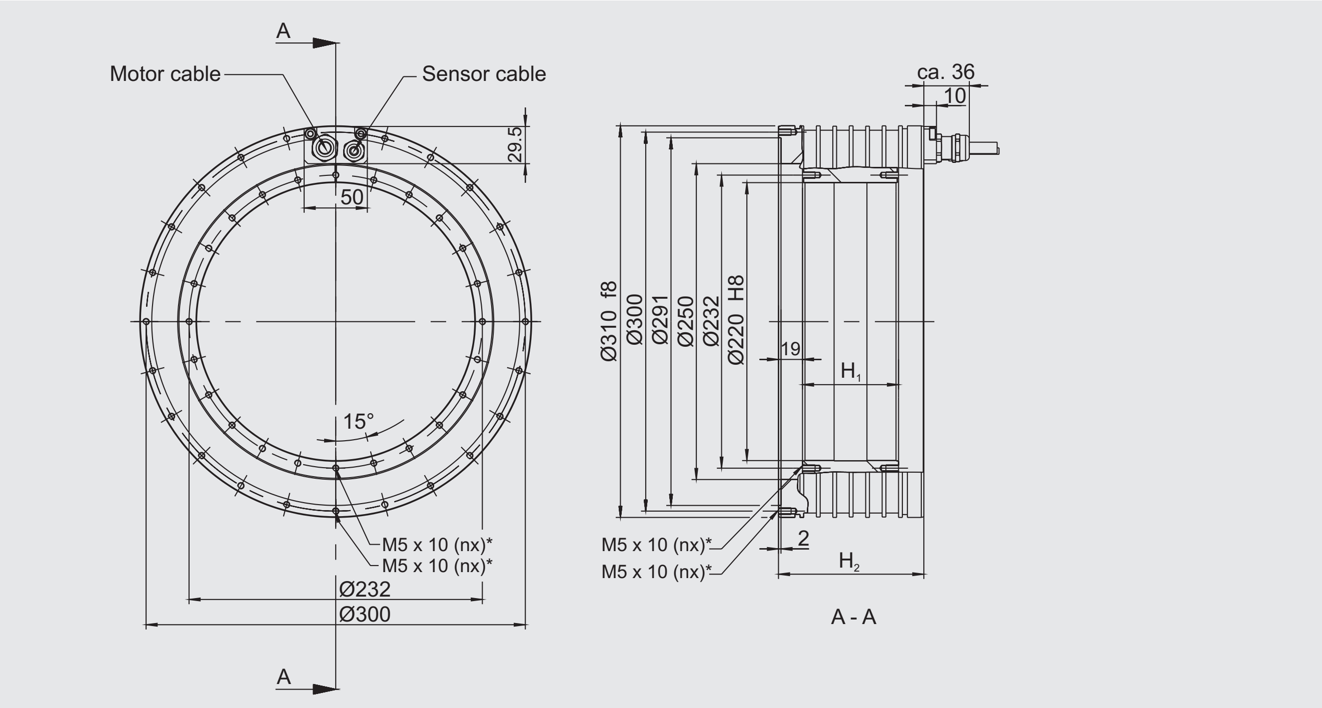
RI17-3P-168x100-WL	RI17-3P-168x100-WM	RI17-3P-168x125-WL	RI17-3P-168x125-WM	RI17-3P-168x150-WL	RI17-3P-168x150-WM	RI17-3P-168x175-WL	RI17-3P-168x175-WM	Symbol
26.67	13.33	33.00	16.50	39.60	19.80	46.20	23.10	k_T
21.81	10.91	26.99	13.50	32.39	16.19	37.79	18.89	k_u
74	221	46	168	25	131	8	105	n_{lp}
159	369	118	286	90	230	70	190	n_{lw}
221	469	175	376	143	311	120	264	n_{lc}
529	529	529	529	529	529	529	529	n_{cr}
18.95	4.74	22.52	5.63	26.09	6.52	29.67	7.42	R_{25}
99.4	24.8	124.2	31.1	149.1	37.3	173.9	43.5	L
19.5	38.9	19.5	38.9	19.5	38.9	19.5	38.9	I_u
15.4	30.7	15.4	30.7	15.4	30.7	15.4	30.7	I_p
9.6	19.2	9.6	19.2	9.6	19.2	9.6	19.2	I_{pl}
7.0	14.0	7.2	14.4	7.3	14.7	7.4	14.8	I_{cw}
2.8	5.7	2.8	5.6	2.7	5.5	2.7	5.4	I_c
5.0	10.0	5.1	10.2	5.2	10.4	5.3	10.5	I_{sw}
2.0	4.0	2.0	4.0	1.9	3.9	1.9	3.8	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}



Pressure losses: RI17-3P-168xH, water (20 °C)

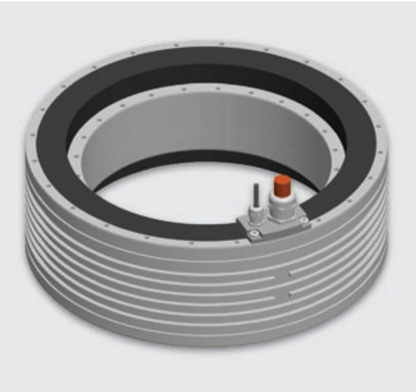
Technical Data: Series RI11-3P-250xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	RI11-3P- 250x25 • 250x50 • 250x75	RI11-3P- 250x100 • 250x125 • 250x150 • 250x175
Fastening thread of rotor	M5 x 10, 24 x (15°)	M5 x 10, 48 x (7.5°)
Fastening thread of stator – cable side	M5 x 10, 23 x (15°)	M5 x 10, 45 x (7.5°)
Fastening thread of stator	M5 x 10, 24 x (15°)	M5 x 10, 48 x (7.5°)



Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RI11-3P-250xH

Winding-independent data

Technical data	Symbol	Unit	RI11-3P-250x25	RI11-3P-250x50	RI11-3P-250x75	RI11-3P-250x100	RI11-3P-250x125	RI11-3P-250x150	RI11-3P-250x175
Number of pole pairs	P		22	22	22	22	22	22	22
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	211	422	626	835	1033	1240	1447
Peak torque (saturation range) at I_p	T_p	Nm	176	353	524	699	865	1038	1211
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	114	228	339	451	559	670	782
Continuous torque cooled at I_{cw}	T_{cw}	Nm	76	182	291	404	514	628	743
Continuous torque not cooled at I_c	T_c	Nm	34	79	124	169	207	243	280
Stall torque cooled at I_{sw}	T_{sw}	Nm	54	129	206	287	365	446	527
Stall torque not cooled at I_s	T_s	Nm	24	56	88	120	147	173	199
Ripple torque (typical cogging) at I = 0	T_r	Nm	0.5	1.1	1.6	2.1	2.6	3.1	3.6
Power loss at T_p (25 °C)	P_{lp}	W	3473	4920	6367	7814	9261	10708	12155
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1072	1519	1965	2412	2858	3305	3752
Power loss at T_{cw}	P_{lw}	W	628	1256	1885	2513	3141	3769	4397
Power loss at T_c (25 °C)	P_{lc}	W	98	184	265	338	393	436	481
Thermical resistance with water cooling	R_{th}	K/W	0.159	0.080	0.053	0.040	0.032	0.027	0.023
Motor constant (25 °C)	k_m	Nm/√W	3.48	5.85	7.64	9.19	10.45	11.66	12.77
Cooling water flow rate of main cooling system	dV/dt	l/min	1.79	3.59	5.38	7.18	8.97	10.77	12.56
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RI11-3P-250x25	RI11-3P-250x50	RI11-3P-250x75	RI11-3P-250x100	RI11-3P-250x125	RI11-3P-250x150	RI11-3P-250x175
Height of rotor	H_1	mm	26.0	51.0	76.0	101.0	126.0	151.0	176.0
Height of stator	H_2	mm	70.0	90.0	115.0	140.0	165.0	190.0	215.0
Rotor mass	m_1	kg	1.9	3.8	5.7	7.6	9.6	11.5	13.4
Stator mass	m_2	kg	9.9	13.7	18.1	22.4	26.7	31.1	35.4
Moment of inertia of rotor	J	kgm^2	0.026	0.052	0.078	0.104	0.131	0.157	0.183
Axial attraction	F_a	kN	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Radial attraction/eccentricity	F_r	kN/mm	1.1	2.1	3.1	4.1	5.1	6.1	7.1

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for "power loss": ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

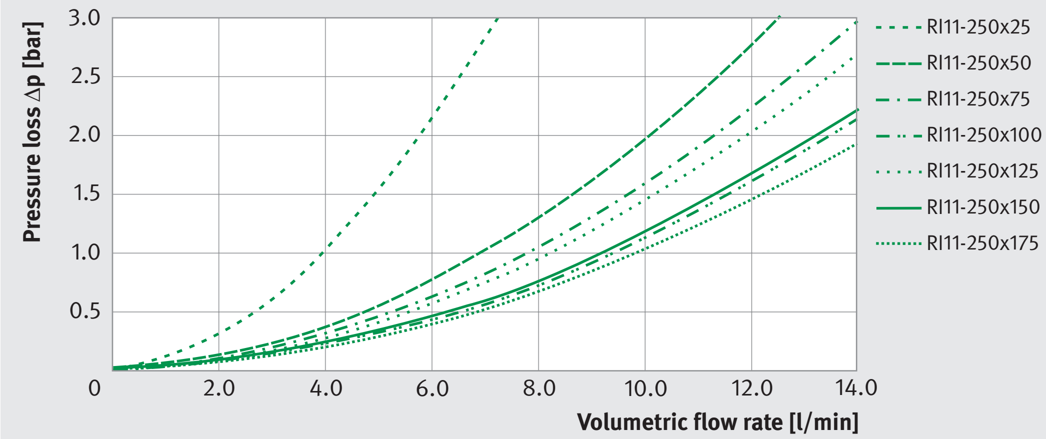
Technical Data: Series RI11-3P-250xH

Winding-dependent data

Winding data	Symbol	Unit	RI11-3P-250x25-WL	RI11-3P-250x25-WM	RI11-3P-250x50-WL	RI11-3P-250x50-WM	RI11-3P-250x75-WL	RI11-3P-250x75-WM
Torque constant	k_T	Nm/A_{rms}	8.44	6.78	16.88	13.56	25.06	20.14
Back EMF constant, phase to phase	k_u	V/(rad/s)	6.90	5.55	13.81	11.09	20.50	16.47
Limiting speed at I_p and U_{DCL}	n_{Ip}	rpm	433	557	201	263	123	166
Limiting speed at I_{cw} and U_{DCL}	n_{Iw}	rpm	687	866	316	402	198	255
Limiting speed at I_c and U_{DCL}	n_{Ic}	rpm	772	967	375	472	247	312
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	409	409	409	409	409	409
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	3.92	2.53	5.56	3.58	7.19	4.64
Inductance, phase to phase	L	mH	12.4	8.0	24.7	16.0	37.1	24.0
Ultimate current (1 s)	I_u	A_{rms}	31.2	38.9	31.2	38.9	31.2	38.9
Peak current (saturation range)	I_p	A_{rms}	24.3	30.3	24.3	30.3	24.3	30.3
Peak current (linear range)	I_{pl}	A_{rms}	13.5	16.8	13.5	16.8	13.5	16.8
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	9.1	11.3	10.8	13.4	11.6	14.4
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	4.1	5.1	4.7	5.9	5.0	6.2
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	6.4	8.0	7.6	9.5	8.2	10.3
Stall current at n = 0 (not cooled)	I_s	A_{rms}	2.9	3.6	3.3	4.2	3.5	4.4
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for "electrical resistance": ±10% • Tolerance range of value for "inductance": ±15%

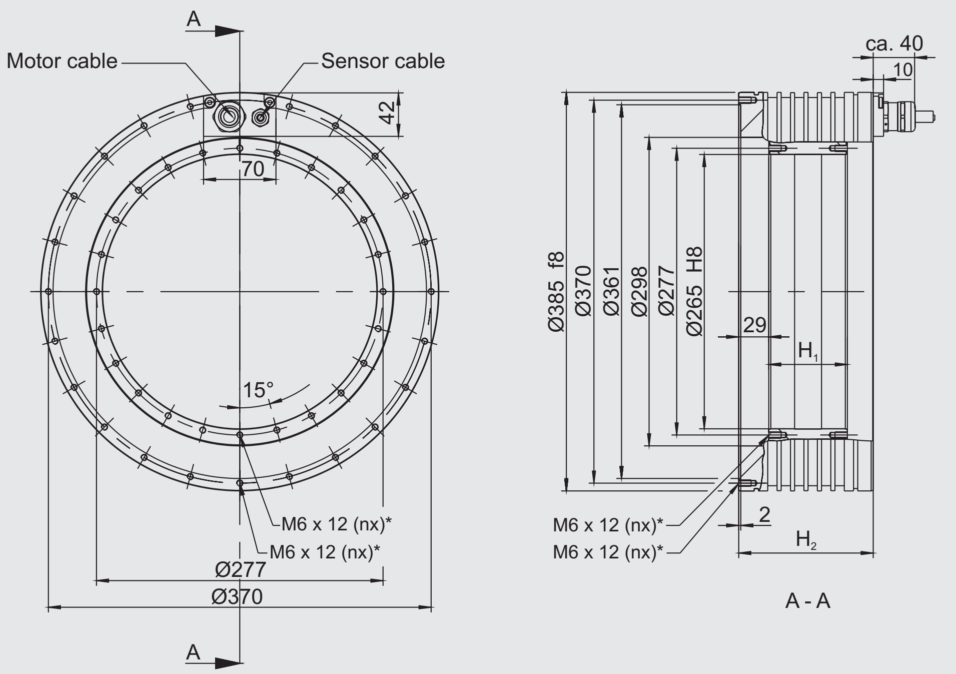
RI11-3P-250x100-WL	RI11-3P-250x100-WM	RI11-3P-250x125-WL	RI11-3P-250x125-WM	RI11-3P-250x150-WL	RI11-3P-250x150-WM	RI11-3P-250x175-WL	RI11-3P-250x175-WM	Symbol
33.42	26.85	41.35	33.23	49.62	39.87	57.89	46.52	k_T
27.33	21.97	33.82	27.18	40.59	32.62	47.35	38.05	k_u
83	116	59	86	42	65	30	50	n_{lp}
140	182	106	140	83	111	66	91	n_{lw}
181	230	144	183	118	151	100	128	n_{lc}
409	409	409	409	409	409	409	409	n_{cr}
8.83	5.69	10.46	6.74	12.09	7.80	13.73	8.85	R_{25}
49.5	32.0	61.9	39.9	74.2	47.9	86.6	55.9	L
31.2	38.9	31.2	38.9	31.2	38.9	31.2	38.9	I_u
24.3	30.3	24.3	30.3	24.3	30.3	24.3	30.3	I_p
13.5	16.8	13.5	16.8	13.5	16.8	13.5	16.8	I_{pl}
12.1	15.0	12.4	15.5	12.6	15.7	12.8	16.0	I_{cw}
5.0	6.3	5.0	6.2	4.9	6.1	4.8	6.0	I_c
8.6	10.7	8.8	11.0	9.0	11.2	9.1	11.3	I_{sw}
3.6	4.5	3.6	4.4	3.5	4.3	3.4	4.3	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}



Pressure losses: RI11-3P-250xH, water (20 °C)

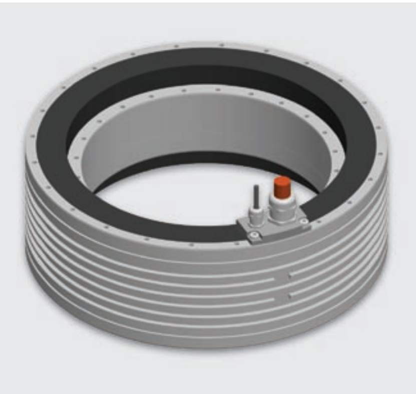
Technical Data: Series RI13-3P-298xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RI13-3P-** **298x25 • 298x50 • 298x75**	**RI13-3P-** **298x100 • 298x125 • 298x150 • 298x175**
Fastening thread of rotor	M6 x 12, 24 x (15°)	M6 x 12, 48 x (7.5°)
Fastening thread of stator – cable side	M6 x 12, 23 x (15°)	M6 x 12, 45 x (7.5°)
Fastening thread of stator	M6 x 12, 24 x (15°)	M6 x 12, 48 x (7.5°)



Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RI13-3P-298xH
Winding-independent data

Technical data	Symbol	Unit	RI13-3P-298x25	RI13-3P-298x50	RI13-3P-298x75	RI13-3P-298x100	RI13-3P-298x125	RI13-3P-298x150	RI13-3P-298x175
Number of pole pairs	P		26	26	26	26	26	26	26
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	357	715	1062	1415	1752	2102	2452
Peak torque (saturation range) at I_p	T_p	Nm	262	524	779	1039	1286	1543	1800
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	191	381	566	755	934	1121	1308
Continuous torque cooled at I_{cw}	T_{cw}	Nm	142	338	541	752	959	1173	1387
Continuous torque not cooled at I_c	T_c	Nm	63	145	227	308	379	446	513
Stall torque cooled at I_{sw}	T_{sw}	Nm	101	240	384	534	681	833	985
Stall torque not cooled at I_s	T_s	Nm	44	103	161	219	269	316	364
Ripple torque (typical cogging) at I = 0	T_r	Nm	0.8	1.6	2.3	3.1	3.9	4.6	5.4
Power loss at T_p (25 °C)	P_{lp}	W	2774	3911	5047	6184	7275	8412	9549
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1083	1528	1972	2416	2842	3286	3730
Power loss at T_{cw}	P_{lw}	W	779	1559	2338	3117	3897	4676	5455
Power loss at T_c (25 °C)	P_{lc}	W	117	220	316	402	468	519	573
Thermical resistance with water cooling	R_{th}	K/W	0.128	0.064	0.043	0.032	0.026	0.021	0.018
Motor constant (25 °C)	k_m	Nm/√W	5.79	9.75	12.75	15.36	17.52	19.56	21.42
Cooling water flow rate of main cooling system	dV/dt	l/min	2.23	4.45	6.68	8.91	11.13	13.36	15.59
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RI13-3P-298x25	RI13-3P-298x50	RI13-3P-298x75	RI13-3P-298x100	RI13-3P-298x125	RI13-3P-298x150	RI13-3P-298x175
Height of rotor	H_1	mm	26.0	51.0	76.0	101.0	126.0	151.0	176.0
Height of stator	H_2	mm	90.0	110.0	130.0	160.0	185.0	210.0	235.0
Rotor mass	m_1	kg	2.6	5.1	7.7	10.2	12.8	15.3	17.9
Stator mass	m_2	kg	20.9	28.2	35.2	44.2	51.9	59.7	67.6
Moment of inertia of rotor	J	kgm^2	0.05	0.10	0.15	0.20	0.25	0.30	0.35
Axial attraction	F_a	kN	0.48	0.48	0.48	0.48	0.48	0.48	0.48
Radial attraction/eccentricity	F_r	kN/mm	1.3	2.6	3.8	5.1	6.4	7.6	8.9

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for "power loss": ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

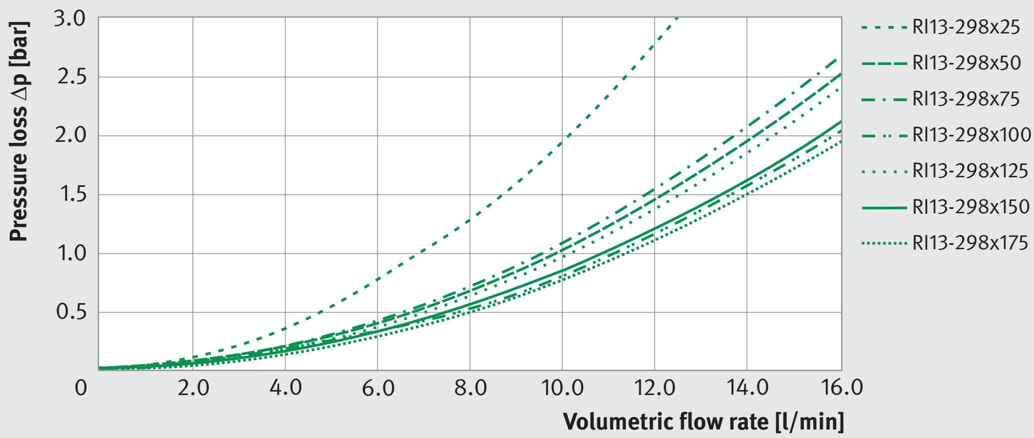
Technical Data: Series RI13-3P-298xH

Winding-dependent data

Winding data	Symbol	Unit	RI13-3P-298x25-WL	RI13-3P-298x25-WM	RI13-3P-298x50-WL	RI13-3P-298x50-WM	RI13-3P-298x75-WL	RI13-3P-298x75-WM
Torque constant	k_T	Nm/A_{rms}	9.8	4.9	19.5	9.8	29.0	14.5
Back EMF constant, phase to phase	k_u	V/(rad/s)	8.0	4.0	16.0	8.0	23.7	11.9
Limiting speed at I_p and U_{DCL}	n_{Ip}	rpm	331	687	160	338	103	223
Limiting speed at I_{cw} and U_{DCL}	n_{Iw}	rpm	526	1078	237	493	149	314
Limiting speed at I_c and U_{DCL}	n_{Ic}	rpm	649	1314	314	641	207	424
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	346	346	346	346	346	346
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	1.90	0.47	2.68	0.67	3.46	0.86
Inductance, phase to phase	L	mH	12.6	3.1	25.1	6.3	37.7	9.4
Ultimate current (1 s)	I_u	A_{rms}	48.8	97.5	48.8	97.5	48.8	97.5
Peak current (saturation range)	I_p	A_{rms}	31.2	62.4	31.2	62.4	31.2	62.4
Peak current (linear range)	I_{pl}	A_{rms}	19.5	39.0	19.5	39.0	19.5	39.0
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	14.5	29.0	17.3	34.6	18.6	37.3
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	6.4	12.8	7.4	14.8	7.8	15.6
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	10.3	20.6	12.3	24.5	13.2	26.5
Stall current at n = 0 (not cooled)	I_s	A_{rms}	4.5	9.1	5.3	10.5	5.5	11.1
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

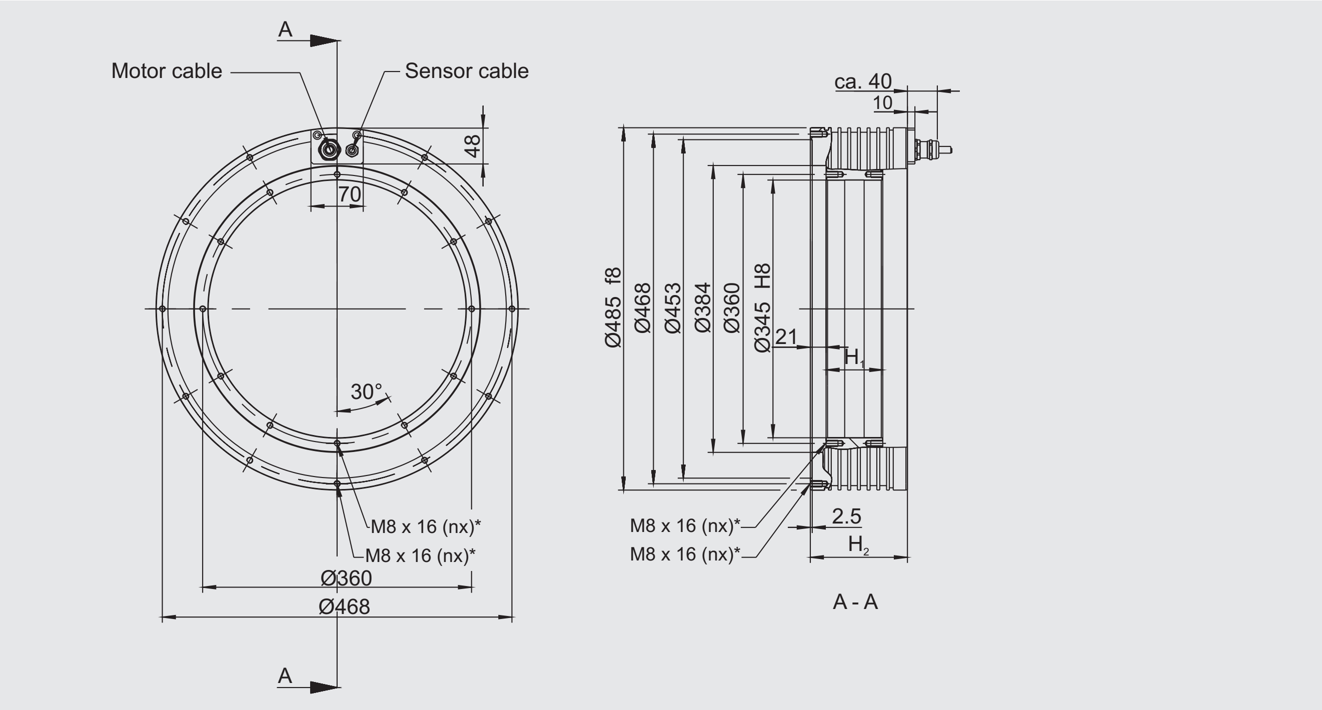
RI13-3P-298x100-WL	RI13-3P-298x100-WM	RI13-3P-298x125-WL	RI13-3P-298x125-WM	RI13-3P-298x150-WL	RI13-3P-298x150-WM	RI13-3P-298x175-WL	RI13-3P-298x175-WM	Symbol
38.7	19.4	47.9	24.0	57.5	28.7	67.1	33.5	k_T
31.7	15.8	39.2	19.6	47.0	23.5	54.9	27.4	k_u
74	164	57	130	45	106	37	89	n_{lp}
106	227	81	178	65	144	53	121	n_{lw}
152	315	122	253	101	210	85	180	n_{lc}
346	346	346	346	346	346	346	346	n_{cr}
4.23	1.06	4.98	1.25	5.76	1.44	6.54	1.63	R_{25}
50.2	12.6	62.8	15.7	75.3	18.8	87.9	22.0	L
48.8	97.5	48.8	97.5	48.8	97.5	48.8	97.5	I_u
31.2	62.4	31.2	62.4	31.2	62.4	31.2	62.4	I_p
19.5	39.0	19.5	39.0	19.5	39.0	19.5	39.0	I_{pl}
19.4	38.9	20.0	40.1	20.4	40.8	20.7	41.4	I_{cw}
8.0	15.9	7.9	15.8	7.8	15.5	7.6	15.3	I_c
13.8	27.6	14.2	28.4	14.5	29.0	14.7	29.4	I_{sw}
5.7	11.3	5.6	11.2	5.5	11.0	5.4	10.9	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}



Pressure losses: RI13-3P-298xH, water (20 °C)

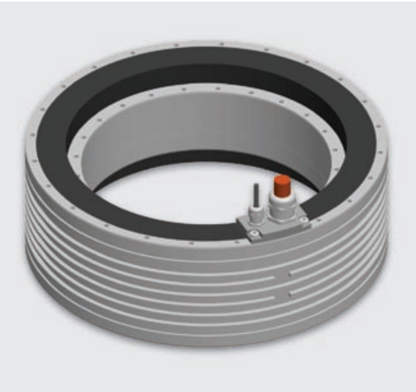
Technical Data: Series RI11-3P-384xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RI11-3P-** **384x25 • 384x50 • 384x75**	**RI11-3P-** **384x100 • 384x125 • 384x150 • 384x175**
Fastening thread of rotor	M8 x 16, 12 x (30°)	M8 x 16, 24 x (15°)
Fastening thread of stator – cable side	M8 x 16, 11 x (30°)	M8 x 16, 23 x (15°)
Fastening thread of stator	M8 x 16, 12 x (30°)	M8 x 16, 24 x (15°)



Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RI11-3P-384xH

Winding-independent data

Technical data	Symbol	Unit	RI11-3P-384x25	RI11-3P-384x50	RI11-3P-384x75	RI11-3P-384x100	RI11-3P-384x125	RI11-3P-384x150	RI11-3P-384x175
Number of pole pairs	P		33	33	33	33	33	33	33
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	552	1098	1646	2184	2717	3260	3784
Peak torque (saturation range) at I_p	T_p	Nm	485	966	1449	1922	2391	2869	3330
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	320	637	956	1268	1577	1892	2196
Continuous torque cooled at I_{cw}	T_{cw}	Nm	220	520	839	1159	1479	1807	2126
Continuous torque not cooled at I_c	T_c	Nm	85	200	323	447	570	697	820
Stall torque cooled at I_{sw}	T_{sw}	Nm	157	369	595	823	1050	1283	1510
Stall torque not cooled at I_s	T_s	Nm	60	142	230	317	405	495	582
Ripple torque (typical cogging) at I = 0	T_r	Nm	1.5	2.9	4.3	5.8	7.2	8.6	10.0
Power loss at T_p (25 °C)	P_{lp}	W	6136	8736	11335	13935	16535	19135	21735
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1582	2253	2923	3594	4264	4934	5605
Power loss at T_{cw}	P_{lw}	W	976	1952	2927	3903	4879	5855	6830
Power loss at T_c (25 °C)	P_{lc}	W	112	223	335	446	558	669	781
Thermical resistance with water cooling	R_{th}	K/W	0.102	0.051	0.034	0.026	0.020	0.017	0.015
Motor constant (25 °C)	k_m	Nm/√W	8.05	13.42	17.67	21.15	24.14	26.93	29.33
Cooling water flow rate of main cooling system	dV/dt	l/min	2.79	5.58	8.36	11.15	13.94	16.73	19.52
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RI11-3P-384x25	RI11-3P-384x50	RI11-3P-384x75	RI11-3P-384x100	RI11-3P-384x125	RI11-3P-384x150	RI11-3P-384x175
Height of rotor	H_1	mm	26.0	51.0	76.0	101.0	126.0	151.0	176.0
Height of stator	H_2	mm	90.0	110.0	130.0	160.0	185.0	210.0	235.0
Rotor mass	m_1	kg	4.0	8.0	12.0	16.0	20.0	24.0	28.0
Stator mass	m_2	kg	30.3	41.0	52.0	65.7	78.6	91.4	104.1
Moment of inertia of rotor	J	kgm^2	0.13	0.26	0.39	0.52	0.65	0.78	0.91
Axial attraction	F_a	kN	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Radial attraction/eccentricity	F_r	kN/mm	1.8	3.6	5.3	7.1	8.8	10.6	12.4

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for “power loss”: ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

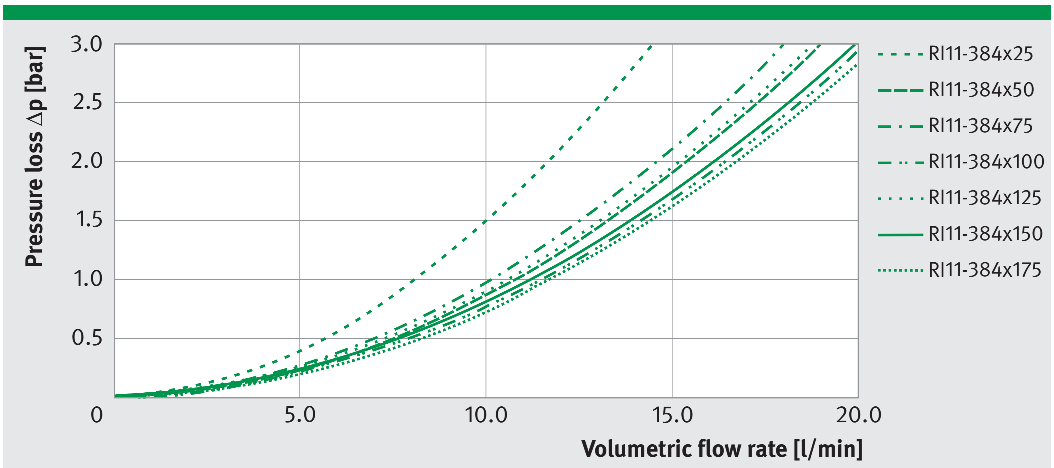
Technical Data: Series RI11-3P-384xH

Winding-dependent data

Winding data	Symbol	Unit	RI11-3P-384x25-WL	RI11-3P-384x25-WM	RI11-3P-384x50-WL	RI11-3P-384x50-WM	RI11-3P-384x75-WL	RI11-3P-384x75-WM
Torque constant	k_T	Nm/A_{rms}	18.1	10.8	35.9	21.5	53.9	32.2
Back EMF constant, phase to phase	k_u	V/(rad/s)	14.8	8.8	29.4	17.6	44.1	26.4
Limiting speed at I_p and U_{DCL}	n_{lp}	rpm	144	257	66	124	40	79
Limiting speed at I_{cw} and U_{DCL}	n_{lw}	rpm	287	494	129	226	79	142
Limiting speed at I_c and U_{DCL}	n_{lc}	rpm	356	603	172	294	112	192
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	273	273	273	273	273	273
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	3.36	1.19	4.78	1.70	6.20	2.21
Inductance, phase to phase	L	mH	19.8	7.1	39.6	14.2	59.4	21.3
Ultimate current (1 s)	I_u	A_{rms}	43.6	72.9	43.6	72.9	43.6	72.9
Peak current (saturation range)	I_p	A_{rms}	34.9	58.4	34.9	58.4	34.9	58.4
Peak current (linear range)	I_{pl}	A_{rms}	17.7	29.6	17.7	29.6	17.7	29.6
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	12.2	20.5	14.5	24.3	15.6	26.1
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	4.7	7.9	5.6	9.4	6.0	10.1
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	8.7	14.5	10.3	17.2	11.0	18.5
Stall current at n = 0 (not cooled)	I_s	A_{rms}	3.3	5.6	4.0	6.6	4.3	7.1
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

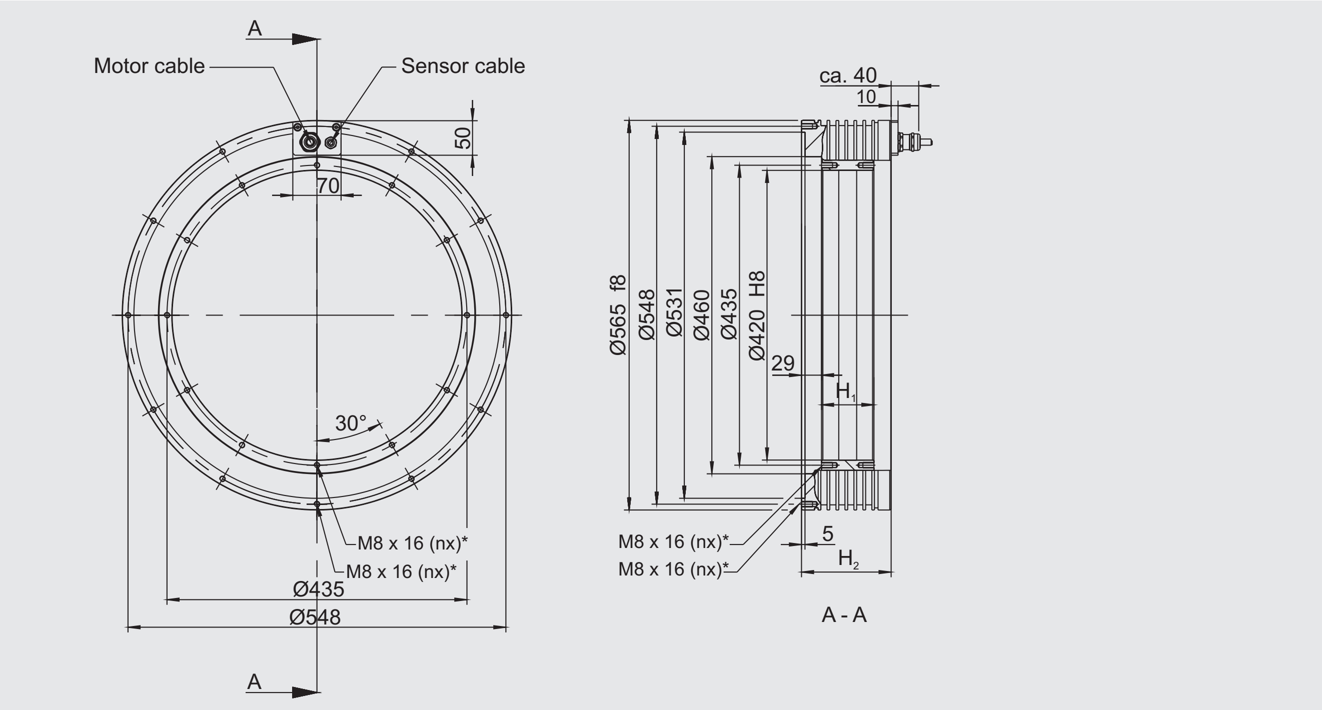
RI11-3P-384x100-WL	RI11-3P-384x100-WM	RI11-3P-384x125-WL	RI11-3P-384x125-WM	RI11-3P-384x150-WL	RI11-3P-384x150-WM	RI11-3P-384x175-WL	RI11-3P-384x175-WM	Symbol
71.5	42.8	88.9	53.2	106.7	63.8	123.9	74.1	k_T
58.5	35.0	72.7	43.5	87.3	52.2	101.3	60.6	k_u
26	56	17	43	11	33	6	26	n_{lp}
55	102	41	78	32	63	25	52	n_{lw}
82	142	64	113	52	92	44	78	n_{lc}
273	273	273	273	273	273	273	273	n_{cr}
7.62	2.71	9.04	3.22	10.46	3.72	11.89	4.23	R_{25}
79.2	28.3	98.9	35.4	118.7	42.5	138.5	49.6	L
43.6	72.9	43.6	72.9	43.6	72.9	43.6	72.9	I_u
34.9	58.4	34.9	58.4	34.9	58.4	34.9	58.4	I_p
17.7	29.6	17.7	29.6	17.7	29.6	17.7	29.6	I_{pl}
16.2	27.2	16.6	27.9	16.9	28.4	17.2	28.8	I_{cw}
6.2	10.5	6.4	10.8	6.5	10.9	6.6	11.1	I_c
11.5	19.3	11.8	19.8	12.0	20.2	12.2	20.4	I_{sw}
4.4	7.4	4.6	7.6	4.6	7.8	4.7	7.9	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}



Pressure losses: RI11-3P-384xH, water (20 °C)

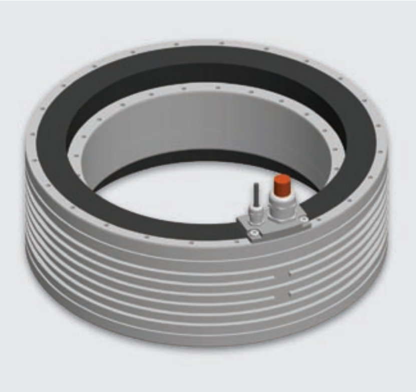
Technical Data: Series RI19-3P-460xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	RI19-3P- 460x25 • 460x50 • 460x75	RI19-3P- 460x100 • 460x125 • 460x150 • 460x175
Fastening thread of rotor	M8 x 16, 12 x (30°)	M8 x 16, 24 x (15°)
Fastening thread of stator – cable side	M8 x 16, 11 x (30°)	M8 x 16, 23 x (15°)
Fastening thread of stator	M8 x 16, 12 x (30°)	M8 x 16, 24 x (15°)



Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RI19-3P-460xH

Winding-independent data

Technical data	Symbol	Unit	RI19-3P-460x25	RI19-3P-460x50	RI19-3P-460x75	RI19-3P-460x100	RI19-3P-460x125	RI19-3P-460x150	RI19-3P-460x175
Number of pole pairs	P		38	38	38	38	38	38	38
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	838	1675	2488	3317	4105	4926	5747
Peak torque (saturation range) at I_p	T_p	Nm	642	1284	1906	2542	3145	3774	4403
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	472	944	1402	1869	2313	2775	3238
Continuous torque cooled at I_{cw}	T_{cw}	Nm	323	783	1252	1740	2211	2703	3197
Continuous torque not cooled at I_c	T_c	Nm	146	344	537	730	895	1052	1210
Stall torque cooled at I_{sw}	T_{sw}	Nm	229	556	889	1235	1570	1919	2270
Stall torque not cooled at I_s	T_s	Nm	104	244	382	518	635	747	859
Ripple torque (typical cogging) at I = 0	T_r	Nm	1.9	3.9	5.7	7.6	9.4	11.3	13.2
Power loss at T_p (25 °C)	P_{lp}	W	4824	6560	8489	10419	12348	14278	16207
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1884	2563	3316	4070	4824	5577	6331
Power loss at T_{cw}	P_{lw}	W	1146	2293	3439	4585	5731	6878	8024
Power loss at T_c (25 °C)	P_{lc}	W	181	339	487	621	722	802	885
Thermical resistance with water cooling	R_{th}	K/W	0.087	0.044	0.029	0.022	0.017	0.015	0.012
Motor constant (25 °C)	k_m	$Nm/\sqrt{W}$	10.87	18.65	24.34	29.30	33.30	37.16	40.69
Cooling water flow rate of main cooling system	dV/dt	l/min	3.28	6.55	9.83	13.10	16.38	19.65	15.28
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	7.50

Mechanical data	Symbol	Unit	RI19-3P-460x25	RI19-3P-460x50	RI19-3P-460x75	RI19-3P-460x100	RI19-3P-460x125	RI19-3P-460x150	RI19-3P-460x175
Height of rotor	H_1	mm	26.0	51.0	76.0	101.0	126.0	151.0	176.0
Height of stator	H_2	mm	90.0	110.0	130.0	160.0	185.0	210.0	235.0
Rotor mass	m_1	kg	4.9	9.8	14.6	19.5	24.4	29.3	34.2
Stator mass	m_2	kg	37.6	50.4	63.4	79.1	93.5	107.8	122.1
Moment of inertia of rotor	J	kgm^2	0.24	0.47	0.71	0.94	1.18	1.41	1.65
Axial attraction	F_a	kN	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Radial attraction/eccentricity	F_r	kN/mm	1.9	3.8	5.7	7.5	9.4	11.3	13.2

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for "power loss": ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

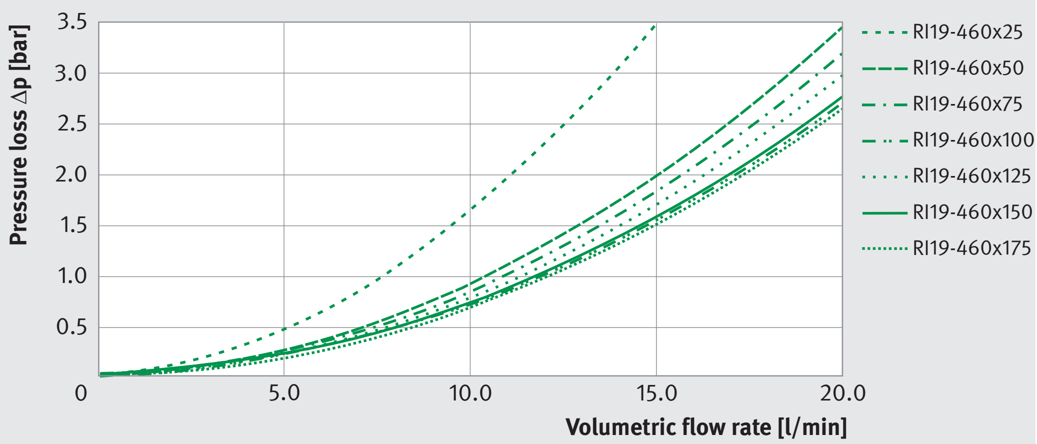
Technical Data: Series RI19-3P-460xH

Winding-dependent data

Winding data	Symbol	Unit	RI19-3P-460x25-WL	RI19-3P-460x25-WM	RI19-3P-460x50-WL	RI19-3P-460x50-WM	RI19-3P-460x75-WL	RI19-3P-460x75-WM
Torque constant	k_T	Nm/A_{rms}	37.4	18.7	74.9	37.4	111.2	55.6
Back EMF constant, phase to phase	k_u	V/(rad/s)	30.6	15.3	61.2	30.6	90.9	45.5
Limiting speed at I_p and U_{DCL}	n_{Ip}	rpm	69	156	30	75	17	48
Limiting speed at I_{cw} and U_{DCL}	n_{Iw}	rpm	127	270	54	120	32	75
Limiting speed at I_c and U_{DCL}	n_{Ic}	rpm	162	335	76	161	49	105
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	237	237	237	237	237	237
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	7.90	1.98	10.75	2.69	13.91	3.48
Inductance, phase to phase	L	mH	56.3	14.1	112.6	28.2	168.9	42.2
Ultimate current (1 s)	I_u	A_{rms}	31.5	63.0	31.5	63.0	31.5	63.0
Peak current (saturation range)	I_p	A_{rms}	20.2	40.3	20.2	40.3	20.2	40.3
Peak current (linear range)	I_{pl}	A_{rms}	12.6	25.2	12.6	25.2	12.6	25.2
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	8.6	17.3	10.5	20.9	11.3	22.5
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	3.9	7.8	4.6	9.2	4.8	9.7
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	6.1	12.2	7.4	14.9	8.0	16.0
Stall current at n = 0 (not cooled)	I_s	A_{rms}	2.8	5.5	3.3	6.5	3.4	6.9
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for "electrical resistance": ±10% • Tolerance range of value for "inductance": ±15%

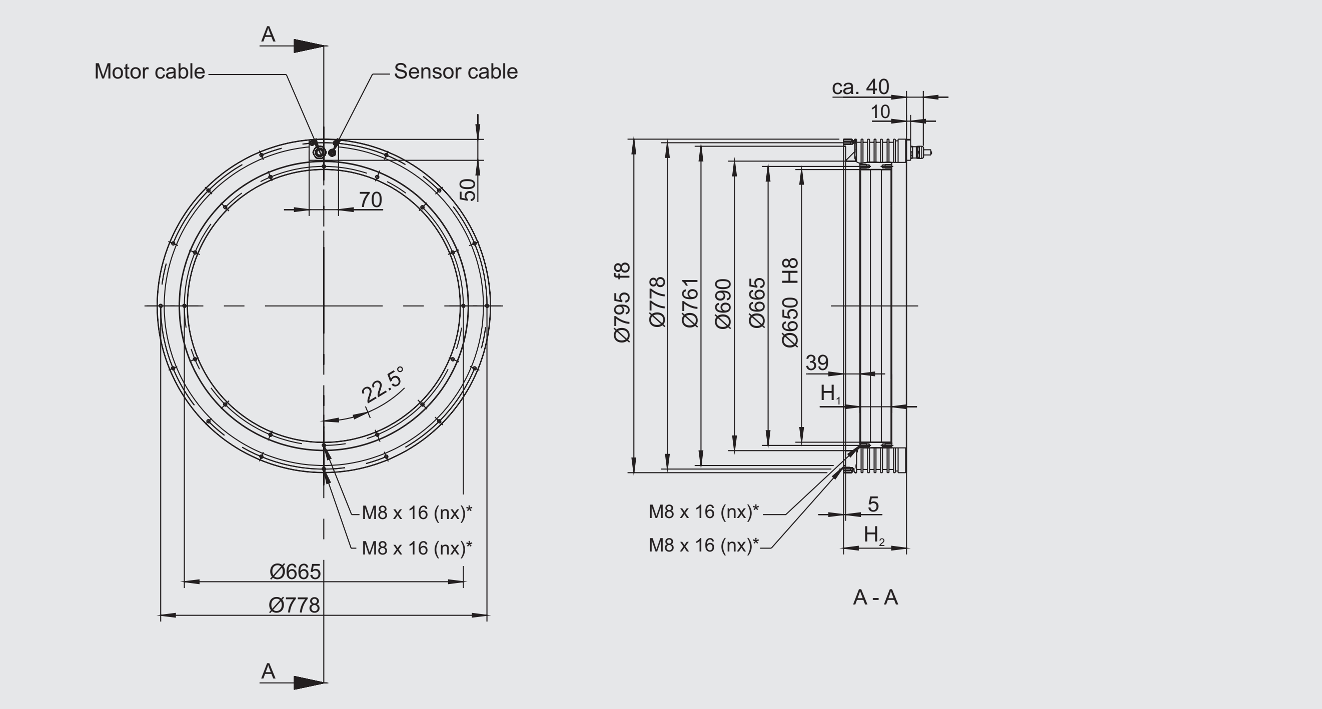
RI19-3P-460x100-WL	RI19-3P-460x100-WM	RI19-3P-460x125-WL	RI19-3P-460x125-WM	RI19-3P-460x150-WL	RI19-3P-460x150-WM	RI19-3P-460x175-WL	RI19-3P-460x175-WM	Symbol
148.2	74.1	183.4	91.7	220.1	110.1	256.8	128.4	k_T
121.2	60.6	150.0	75.0	180.0	90.0	210.0	105.0	k_u
10	34	5	25	1	19	0	15	n_{lp}
21	53	15	40	10	32	7	26	n_{lw}
35	77	28	62	22	51	19	43	n_{lc}
237	237	237	237	237	237	237	237	n_{cr}
17.07	4.27	20.23	5.06	23.39	5.85	26.55	6.64	R_{25}
225.3	56.3	281.6	70.4	337.9	84.5	394.2	98.6	L
31.5	63.0	31.5	63.0	31.5	63.0	31.5	63.0	I_u
20.2	40.3	20.2	40.3	20.2	40.3	20.2	40.3	I_p
12.6	25.2	12.6	25.2	12.6	25.2	12.6	25.2	I_{pl}
11.7	23.5	12.1	24.1	12.3	24.6	12.4	24.9	I_{cw}
4.9	9.9	4.9	9.8	4.8	9.6	4.7	9.4	I_c
8.3	16.7	8.6	17.1	8.7	17.4	8.8	17.7	I_{sw}
3.5	7.0	3.5	6.9	3.4	6.8	3.3	6.7	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}



Pressure losses: RI19-3P-460xH, water (20 °C)

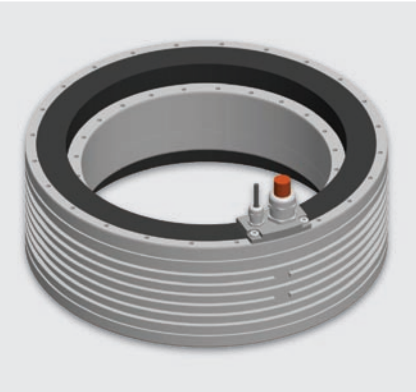
Technical Data: Series RI13-3P-690xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RI13-3P-** **690x25 • 690x50 • 690x75**	**RI13-3P-** **690x100 • 690x125 • 690x150 • 690x175**
Fastening thread of rotor	M8 x 16, 16 x (22.5°)	M8 x 16, 32 x (11.25°)
Fastening thread of stator – cable side	M8 x 16, 15 x (22.5°)	M8 x 16, 31 x (11.25°)
Fastening thread of stator	M8 x 16, 16 x (22.5°)	M8 x 16, 32 x (11.25°)



Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RI13-3P-690xH

Winding-independent data

Technical data	Symbol	Unit	RI13-3P-690x25	RI13-3P-690x50	RI13-3P-690x75	RI13-3P-690x100	RI13-3P-690x125	RI13-3P-690x150	RI13-3P-690x175
Number of pole pairs	P		65	65	65	65	65	65	65
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	1947	3894	5782	7709	9539	11447	13355
Peak torque (saturation range) at I_p	T_p	Nm	1471	2942	4369	5825	7208	8649	10091
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	1082	2163	3212	4283	5300	6360	7420
Continuous torque cooled at I_{cw}	T_{cw}	Nm	708	1683	2691	3740	4752	5810	6871
Continuous torque not cooled at I_c	T_c	Nm	328	755	1182	1606	1968	2314	2661
Stall torque cooled at I_{sw}	T_{sw}	Nm	503	1195	1911	2655	3374	4125	4879
Stall torque not cooled at I_s	T_s	Nm	233	536	839	1140	1397	1643	1890
Ripple torque (typical cogging) at I = 0	T_r	Nm	4.4	8.8	13.1	17.5	21.6	25.9	30.3
Power loss at T_p (25 °C)	P_{lp}	W	7544	10687	13830	16973	20116	23259	26403
Power loss at T_{pl} (25 °C)	P_{lpl}	W	2947	4175	5402	6630	7858	9086	10314
Power loss at T_{cw}	P_{lw}	W	1643	3286	4928	6571	8214	9857	11500
Power loss at T_c (25 °C)	P_{lc}	W	271	509	731	932	1083	1202	1327
Thermical resistance with water cooling	R_{th}	K/W	0.061	0.030	0.020	0.015	0.012	0.010	0.009
Motor constant (25 °C)	k_m	Nm/√W	19.92	33.48	43.70	52.60	59.79	66.72	73.06
Cooling water flow rate of main cooling system	dV/dt	l/min	4.69	9.39	14.08	18.77	15.65	18.77	16.43
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	7.50	7.50	10.00

Mechanical data	Symbol	Unit	RI13-3P-690x25	RI13-3P-690x50	RI13-3P-690x75	RI13-3P-690x100	RI13-3P-690x125	RI13-3P-690x150	RI13-3P-690x175
Height of rotor	H_1	mm	26.0	51.0	76.0	101.0	126.0	151.0	176.0
Height of stator	H_2	mm	110.0	130.0	150.0	180.0	205.0	230.0	255.0
Rotor mass	m_1	kg	7.6	15.2	22.8	30.4	38.0	45.6	53.2
Stator mass	m_2	kg	62.9	81.6	99.8	122.9	143.2	163.7	184.1
Moment of inertia of rotor	J	kgm^2	0.85	1.70	2.55	3.40	4.25	5.10	5.95
Axial attraction	F_a	kN	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Radial attraction/eccentricity	F_r	kN/mm	3.3	6.6	9.9	13.1	16.4	19.7	23.0

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for "power loss": ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

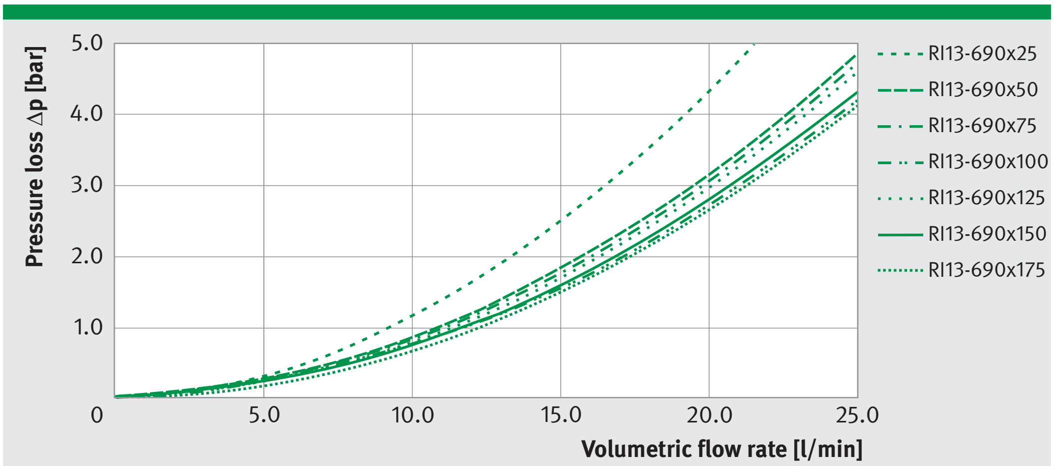
Technical Data: Series RI13-3P-690xH

Winding-dependent data

Winding data	Symbol	Unit	RI13-3P-690x25-WL	RI13-3P-690x25-WM	RI13-3P-690x50-WL	RI13-3P-690x50-WM	RI13-3P-690x75-WL	RI13-3P-690x75-WM
Torque constant	k_T	Nm/A_{rms}	35.9	25.0	71.8	49.9	106.6	74.1
Back EMF constant, phase to phase	k_u	V/(rad/s)	29.4	20.4	58.7	40.8	87.2	60.6
Limiting speed at I_p and U_{DCL}	n_{Ip}	rpm	73	110	34	53	21	34
Limiting speed at I_{cw} and U_{DCL}	n_{Iw}	rpm	136	200	60	90	37	56
Limiting speed at I_c and U_{DCL}	n_{Ic}	rpm	172	250	82	120	53	79
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	138	138	138	138	138	138
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	2.17	1.05	3.07	1.49	3.97	1.92
Inductance, phase to phase	L	mH	14.5	7.0	29.1	14.1	43.6	21.1
Ultimate current (1 s)	I_u	A_{rms}	75.3	108.4	75.3	108.4	75.3	108.4
Peak current (saturation range)	I_p	A_{rms}	48.2	69.3	48.2	69.3	48.2	69.3
Peak current (linear range)	I_{pl}	A_{rms}	30.1	43.3	30.1	43.3	30.1	43.3
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	19.7	28.3	23.4	33.7	25.2	36.2
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	9.1	13.1	10.5	15.1	11.1	15.9
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	14.0	20.1	16.6	23.9	17.9	25.7
Stall current at n = 0 (not cooled)	I_s	A_{rms}	6.5	9.3	7.5	10.7	7.9	11.3
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

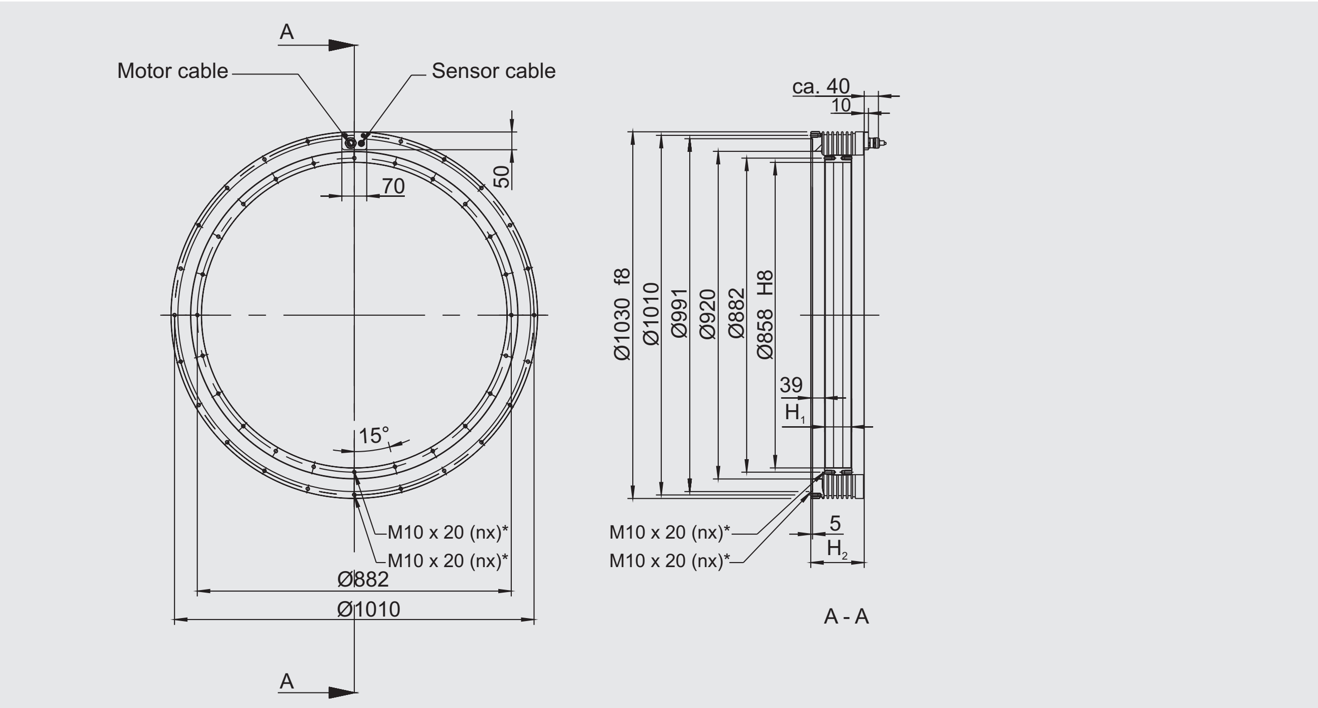
RI13-3P-690x100-WL	RI13-3P-690x100-WM	RI13-3P-690x125-WL	RI13-3P-690x125-WM	RI13-3P-690x150-WL	RI13-3P-690x150-WM	RI13-3P-690x175-WL	RI13-3P-690x175-WM	Symbol
142.2	98.8	175.9	122.3	211.1	146.7	246.3	171.2	k_T
116.3	80.8	143.9	100.0	172.7	120.0	201.5	140.0	k_u
14	24	10	18	7	14	5	11	n_{lp}
26	40	19	30	15	24	12	20	n_{lw}
39	58	31	46	25	38	21	32	n_{lc}
138	138	138	138	138	138	138	138	n_{cr}
4.87	2.36	5.77	2.80	6.68	3.24	7.58	3.67	R_{25}
58.2	28.1	72.7	35.1	87.3	42.2	101.8	49.2	L
75.3	108.4	75.3	108.4	75.3	108.4	75.3	108.4	I_u
48.2	69.3	48.2	69.3	48.2	69.3	48.2	69.3	I_p
30.1	43.3	30.1	43.3	30.1	43.3	30.1	43.3	I_{pl}
26.3	37.8	27.0	38.8	27.5	39.5	27.9	40.1	I_{cw}
11.3	16.2	11.2	16.1	11.0	15.7	10.8	15.5	I_c
18.7	26.8	19.2	27.5	19.5	28.1	19.8	28.4	I_{sw}
8.0	11.5	7.9	11.4	7.8	11.2	7.7	11.0	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}



Pressure losses: RI13-3P-690xH, water (20 °C)

Technical Data: Series RI11-3P-920xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RI11-3P-** **920x25 • 920x50 • 920x75**	**RI11-3P-** **920x100 • 920x125 • 920x150 • 920x175**
Fastening thread of rotor	M10 x 20, 24 x (15°)	M10 x 20, 48 x (7.5°)
Fastening thread of stator – cable side	M10 x 20, 23 x (15°)	M10 x 20, 47 x (7.5°)
Fastening thread of stator	M10 x 20, 24 x (15°)	M10 x 20, 48 x (7.5°)

Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RI11-3P-920xH

Winding-independent data

Technical data	Symbol	Unit	RI11-3P-920x25	RI11-3P-920x50	RI11-3P-920x75	RI11-3P-920x100	RI11-3P-920x125	RI11-3P-920x150	RI11-3P-920x175
Number of pole pairs	P		66	66	66	66	66	66	66
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	3681	7363	11044	14725	18406	22088	25769
Peak torque (saturation range) at I_p	T_p	Nm	3323	6645	9968	13290	16613	19936	23258
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	1888	3776	5664	7551	9439	11327	13215
Continuous torque cooled at I_{cw}	T_{cw}	Nm	1249	2967	4792	6660	8549	10451	12361
Continuous torque not cooled at I_c	T_c	Nm	585	1348	2130	2893	3582	4211	4845
Stall torque cooled at I_{sw}	T_{sw}	Nm	887	2107	3402	4728	6070	7420	8777
Stall torque not cooled at I_s	T_s	Nm	415	957	1512	2054	2543	2990	3440
Ripple torque (typical cogging) at I = 0	T_r	Nm	10.0	19.9	29.9	39.9	49.8	59.8	69.8
Power loss at T_p (25 °C)	P_{lp}	W	15046	21315	27584	33853	40122	46392	52661
Power loss at T_{pl} (25 °C)	P_{lpl}	W	3761	5329	6896	8463	10031	11598	13165
Power loss at T_{cw}	P_{lw}	W	2139	4279	6418	8557	10697	12836	14975
Power loss at T_c (25 °C)	P_{lc}	W	361	679	975	1242	1444	1603	1769
Thermical resistance with water cooling	R_{th}	K/W	0.047	0.023	0.016	0.012	0.009	0.008	0.007
Motor constant (25 °C)	k_m	Nm/√W	30.78	51.72	68.20	82.08	94.25	105.18	115.17
Cooling water flow rate of main cooling system	dV/dt	l/min	6.11	12.22	18.34	16.30	15.28	18.34	17.11
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	7.50	10.00	10.00	12.50

Mechanical data	Symbol	Unit	RI11-3P-920x25	RI11-3P-920x50	RI11-3P-920x75	RI11-3P-920x100	RI11-3P-920x125	RI11-3P-920x150	RI11-3P-920x175
Height of rotor	H_1	mm	26.0	51.0	76.0	101.0	126.0	151.0	176.0
Height of stator	H_2	mm	110.0	130.0	150.0	180.0	205.0	230.0	255.0
Rotor mass	m_1	kg	15.6	31.1	46.7	62.3	77.8	93.4	109.0
Stator mass	m_2	kg	89.7	115.7	141.1	172.6	201.0	229.5	257.9
Moment of inertia of rotor	J	kgm^2	3.07	6.14	9.21	12.28	15.35	18.42	21.49
Axial attraction	F_a	kN	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Radial attraction/eccentricity	F_r	kN/mm	3.5	7.0	10.4	13.9	17.3	20.8	24.3

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for “power loss”: ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

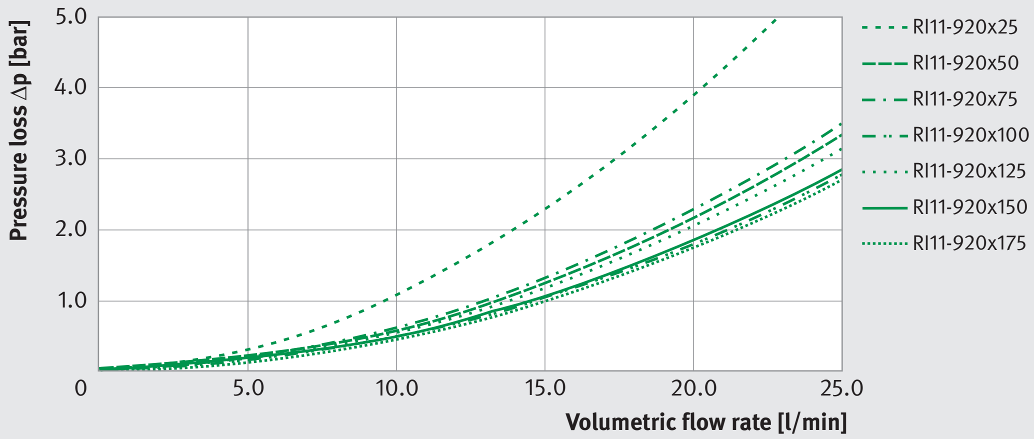
Technical Data: Series RI11-3P-920xH

Winding-dependent data

Winding data	Symbol	Unit	RI11-3P-920x25-WLZ	RI11-3P-920x25-WMZ	RI11-3P-920x50-WLZ	RI11-3P-920x50-WMZ	RI11-3P-920x75-WLZ	RI11-3P-920x75-WMZ
Torque constant	k_T	Nm/A_{rms}	59.2	36.0	118.3	72.1	177.5	108.1
Back EMF constant, phase to phase	k_u	V/(rad/s)	48.4	29.5	96.8	59.0	145.2	88.5
Limiting speed at I_p and U_{DCL}	n_{lp}	rpm	51	94	22	44	11	27
Limiting speed at I_{cw} and U_{DCL}	n_{lw}	rpm	95	162	42	75	26	47
Limiting speed at I_c and U_{DCL}	n_{lc}	rpm	108	181	52	88	33	57
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	136	136	136	136	136	136
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	2.5	0.9	3.5	1.3	4.6	1.7
Inductance, phase to phase	L	mH	12.9	4.7	25.1	9.3	37.7	14.0
Ultimate current (1 s)	I_u	A_{rms}	79.8	130.9	79.8	130.9	79.8	130.9
Peak current (saturation range)	I_p	A_{rms}	63.8	104.7	63.8	104.7	63.8	104.7
Peak current (linear range)	I_{pl}	A_{rms}	31.9	52.4	31.9	52.4	31.9	52.4
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	21.0	34.6	24.9	41.2	26.8	44.3
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	9.8	16.2	11.3	18.7	11.9	19.7
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	14.9	24.6	17.7	29.2	19.1	31.5
Stall current at n = 0 (not cooled)	I_s	A_{rms}	7.0	11.5	8.0	13.3	8.5	14.0
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

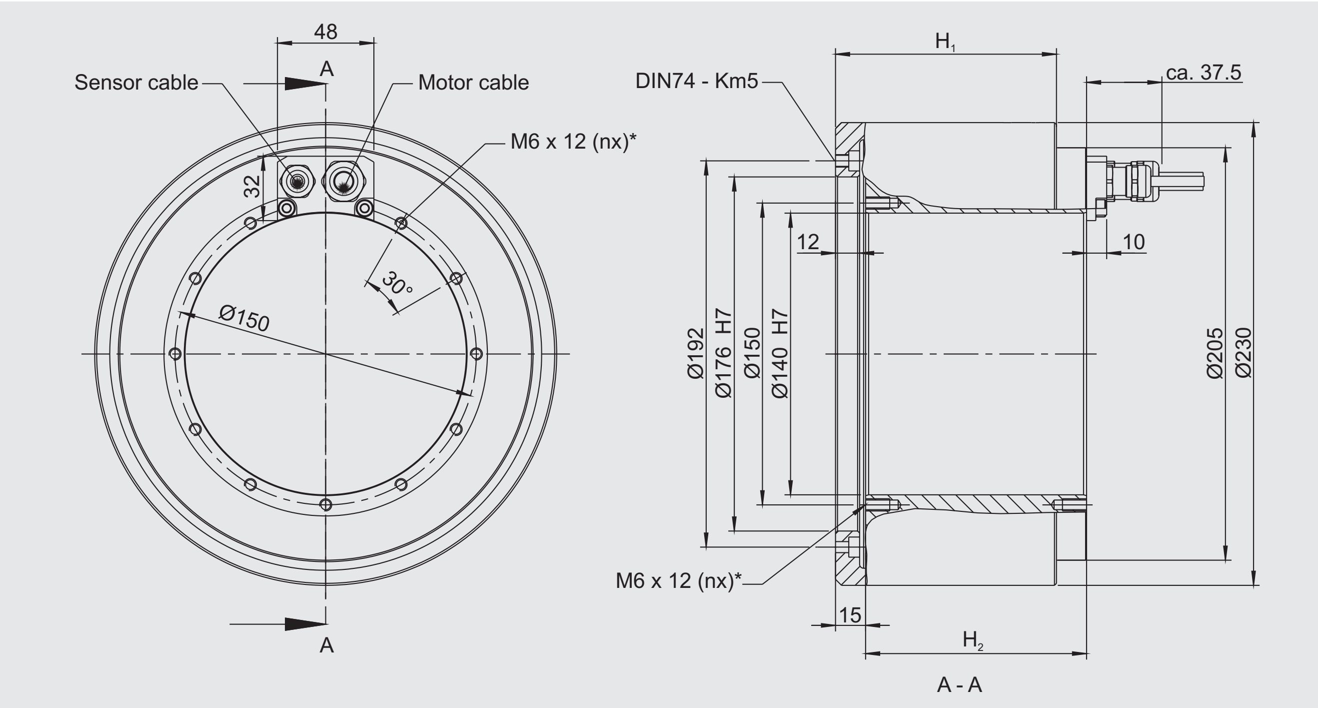
RI11-3P-920x100-WLZ	RI11-3P-920x100-WMZ	RI11-3P-920x125-WLZ	RI11-3P-920x125-WMZ	RI11-3P-920x150-WLZ	RI11-3P-920x150-WMZ	RI11-3P-920x175-WLZ	RI11-3P-920x175-WMZ	Symbol
236.6	144.2	295.8	180.2	354.9	216.3	414.1	252.3	k_T
193.5	117.9	241.9	147.4	290.3	176.9	338.7	206.4	k_u
6	18	3	13	0	9	0	7	n_{lp}
17	33	13	25	9	20	7	16	n_{lw}
24	42	19	33	15	27	13	23	n_{lc}
136	136	136	136	136	136	136	136	n_{cr}
5.6	2.1	6.6	2.4	7.7	2.8	8.7	3.2	R_{25}
50.2	18.7	62.8	23.3	75.3	28.0	87.9	32.6	L
79.8	130.9	79.8	130.9	79.8	130.9	79.8	130.9	I_u
63.8	104.7	63.8	104.7	63.8	104.7	63.8	104.7	I_p
31.9	52.4	31.9	52.4	31.9	52.4	31.9	52.4	I_{pl}
28.0	46.2	28.7	47.4	29.3	48.3	29.7	49.0	I_{cw}
12.2	20.1	12.0	19.9	11.8	19.5	11.6	19.2	I_c
19.9	32.8	20.4	33.7	20.8	34.3	21.1	34.8	I_{sw}
8.6	14.2	8.5	14.1	8.4	13.8	8.3	13.6	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}



Pressure losses: RI11-3P-920xH, water (20 °C)

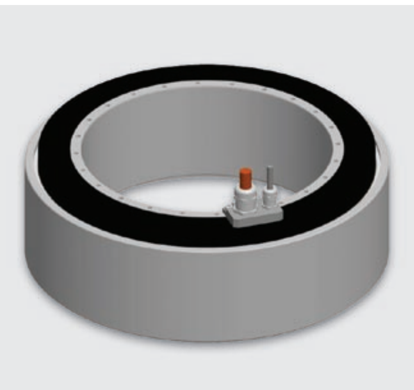
Technical Data: Series RE19-3P-205xH

Drawing



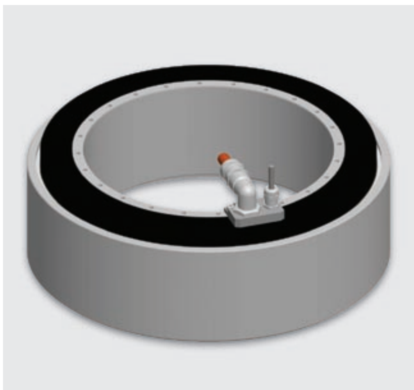
*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RE19-3P-** **205x25 • 205x50 • 205x75**	**RE19-3P-** **205x100 • 205x125 • 205x150 • 205x175**
Fastening thread of rotor	Km5, 12 x (30°)	Km5, 24 x (15°)
Fastening thread of stator – cable side	M6 x 12, 11 x (30°)	M6 x 12, 21 x (15°)
Fastening thread of stator	M6 x 12, 12 x (30°)	M6 x 12, 24 x (15°)



Standard: Cable outlet – axial

Option: Cable outlet – tangential



Option: Cable outlet – radial

Technical Data: Series RE19-3P-205xH

Winding-independent data

Technical data	Symbol	Unit	RE19-3P-205x25	RE19-3P-205x50	RE19-3P-205x75	RE19-3P-205x100	RE19-3P-205x125	RE19-3P-205x150	RE19-3P-205x175
Number of pole pairs	P		19	19	19	19	19	19	19
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	134	252	379	505	631	757	883
Peak torque (saturation range) at I_p	T_p	Nm	114	215	322	429	536	644	751
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	79	158	237	315	394	473	552
Continuous torque cooled at I_{cw}	T_{cw}	Nm	39	90	144	198	254	309	365
Continuous torque not cooled at I_c	T_c	Nm	21	48	75	101	124	146	167
Stall torque cooled at I_{sw}	T_{sw}	Nm	27	64	102	141	180	219	259
Stall torque not cooled at I_s	T_s	Nm	15	34	53	72	88	104	119
Ripple torque (typical cogging) at $I = 0$	T_r	Nm	0.3	0.6	1.0	1.3	1.6	1.9	2.3
Power loss at T_p (25 °C)	P_{lp}	W	2848	4205	5561	6918	8274	9630	10987
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1113	1643	2172	2702	3232	3762	4292
Power loss at T_{cw}	P_{lw}	W	348	695	1043	1390	1738	2085	2433
Power loss at T_c (25 °C)	P_{lc}	W	80	151	217	277	322	357	394
Thermical resistance with water cooling	R_{th}	K/W	0.288	0.144	0.096	0.072	0.058	0.048	0.041
Motor constant (25 °C)	k_m	Nm/√W	2.36	3.89	5.08	6.07	6.94	7.72	8.43
Cooling water flow rate of main cooling system	dV/dt	l/min	0.99	1.99	2.98	3.97	4.97	5.96	6.95
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RE19-3P-205x25	RE19-3P-205x50	RE19-3P-205x75	RE19-3P-205x100	RE19-3P-205x125	RE19-3P-205x150	RE19-3P-205x175
Height of rotor	H_1	mm	60.0	85.0	110.0	135.0	160.0	185.0	210.0
Height of stator	H_2	mm	60.0	85.0	110.0	135.0	160.0	185.0	210.0
Rotor mass	m_1	kg	4.0	5.5	6.9	8.4	9.8	11.3	12.7
Stator mass	m_2	kg	6.2	9.3	12.3	15.4	18.5	21.6	24.7
Moment of inertia of rotor	J	kgm^2	0.046	0.064	0.081	0.099	0.116	0.134	0.151
Axial attraction	F_a	kN	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Radial attraction/eccentricity	F_r	kN/mm	0.9	1.8	2.7	3.5	4.4	5.3	6.1

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for "power loss": ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

Technical Data: Series RE19-3P-205xH

Winding-dependent data

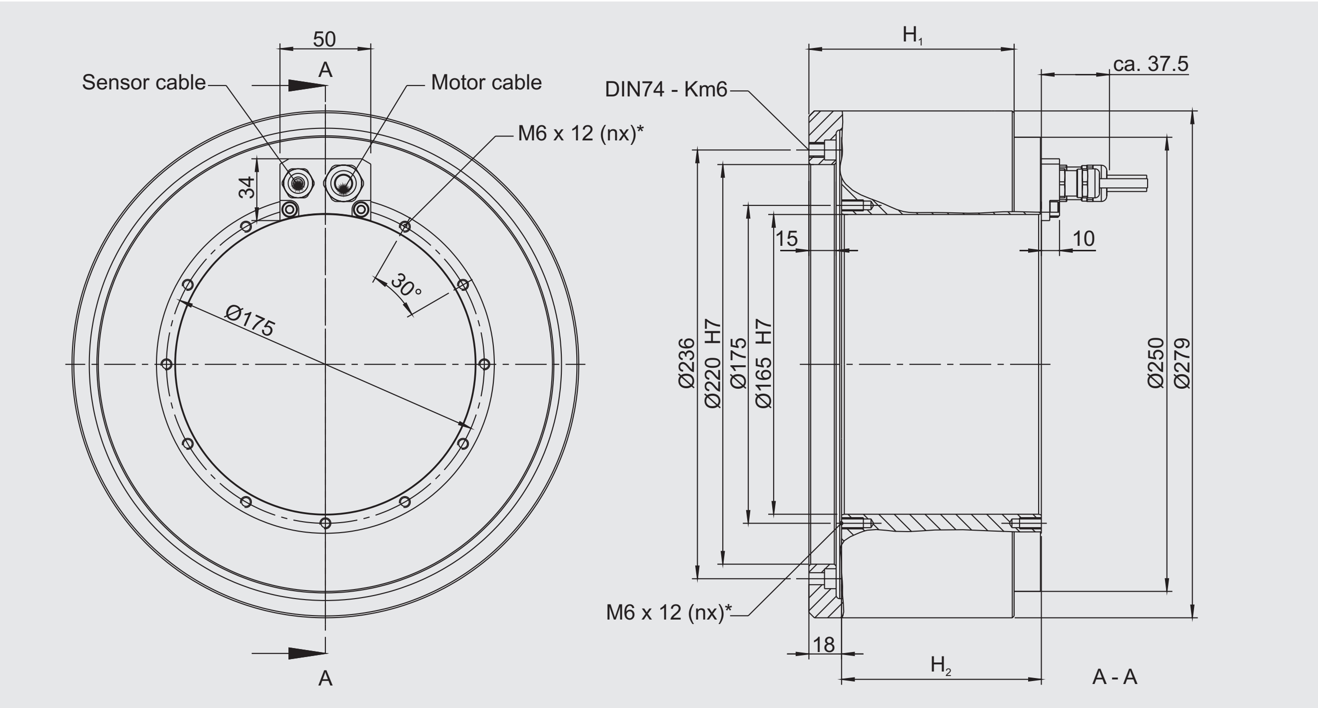
Winding data	Symbol	Unit	RE19-3P-205x25-WL	RE19-3P-205x25-WM	RE19-3P-205x50-WL	RE19-3P-205x50-WM	RE19-3P-205x75-WL	RE19-3P-205x75-WM
Torque constant	k_T	Nm/A_{rms}	7.66	3.83	15.32	7.66	22.98	11.49
Back EMF constant, phase to phase	k_u	V/(rad/s)	6.27	3.13	12.53	6.27	18.80	9.40
Limiting speed at I_p and U_{DCL}	n_{lp}	rpm	425	932	191	447	111	285
Limiting speed at I_{cw} and U_{DCL}	n_{lw}	rpm	764	1582	352	750	220	481
Limiting speed at I_c and U_{DCL}	n_{lc}	rpm	839	1711	405	838	262	550
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	474	474	352	474	220	474
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	7.00	1.75	10.33	2.58	13.66	3.42
Inductance, phase to phase	L	mH	22.1	5.5	44.2	11.0	66.3	16.6
Ultimate current (1 s)	I_u	A_{rms}	20.6	41.2	20.6	41.2	20.6	41.2
Peak current (saturation range)	I_p	A_{rms}	16.5	32.9	16.5	32.9	16.5	32.9
Peak current (linear range)	I_{pl}	A_{rms}	10.3	20.6	10.3	20.6	10.3	20.6
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	5.0	10.1	5.9	11.7	6.3	12.5
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.8	5.5	3.1	6.2	3.3	6.5
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	3.6	7.2	4.2	8.3	4.4	8.9
Stall current at n = 0 (not cooled)	I_s	A_{rms}	2.0	3.9	2.2	4.4	2.3	4.6
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

RE19-3P-205x100-WL	RE19-3P-205x100-WM	RE19-3P-205x125-WL	RE19-3P-205x125-WM	RE19-3P-205x150-WL	RE19-3P-205x150-WM	RE19-3P-205x175-WL	RE19-3P-205x175-WM	Symbol
30.65	15.32	38.31	19.15	45.97	22.98	53.63	26.81	k_T
25.07	12.53	31.33	15.67	37.60	18.80	43.87	21.93	k_u
69	203	43	153	24	120	9	96	n_{lp}
155	349	116	271	90	219	72	182	n_{lw}
191	407	150	323	122	267	103	227	n_{lc}
155	349	116	271	90	219	72	182	n_{cr}
17.00	4.25	20.33	5.08	23.66	5.92	26.99	6.75	R_{25}
88.4	22.1	110.5	27.6	132.6	33.1	154.7	38.7	L
20.6	41.2	20.6	41.2	20.6	41.2	20.6	41.2	I_u
16.5	32.9	16.5	32.9	16.5	32.9	16.5	32.9	I_p
10.3	20.6	10.3	20.6	10.3	20.6	10.3	20.6	I_{pl}
6.5	13.0	6.6	13.2	6.7	13.4	6.8	13.6	I_{cw}
3.3	6.6	3.2	6.5	3.2	6.3	3.1	6.2	I_c
4.6	9.2	4.7	9.4	4.8	9.5	4.8	9.7	I_{sw}
2.3	4.7	2.3	4.6	2.3	4.5	2.2	4.4	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}

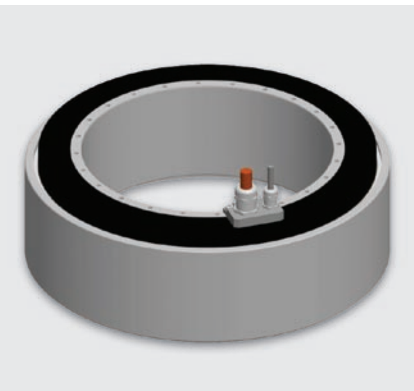
Technical Data: Series RE11-3P-250xH

Drawing



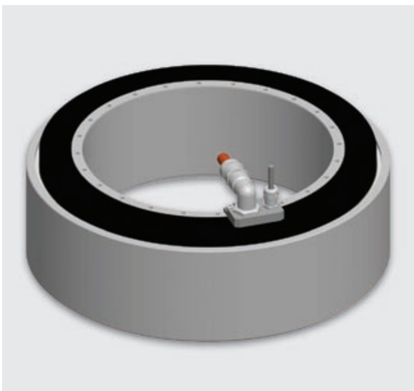
*Note: The number (n) of fastening threads depends on the height.

Fastening threads	RE11-3P- 250x25 • 250x50 • 250x75	RE11-3P- 250x100 • 250x125 • 250x150 • 250x175
Fastening thread of rotor	Km6, 12 x (30°)	Km6, 24 x (15°)
Fastening thread of stator – cable side	M6 x 12, 11 x (30°)	M6 x 12, 21 x (15°)
Fastening thread of stator	M6 x 12,12 x (30°)	M6 x 12, 24 x (15°)



Standard: Cable outlet – axial

Option: Cable outlet – tangential



Option: Cable outlet – radial

Technical Data: Series RE11-3P-250xH

Winding-independent data

Technical data	Symbol	Unit	RE11-3P-250x25	RE11-3P-250x50	RE11-3P-250x75	RE11-3P-250x100	RE11-3P-250x125	RE11-3P-250x150	RE11-3P-250x175
Number of pole pairs	P		22	22	22	22	22	22	22
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	249	497	738	984	1218	1462	1706
Peak torque (saturation range) at I_p	T_p	Nm	178	356	528	705	872	1047	1221
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	131	262	389	518	641	770	898
Continuous torque cooled at I_{cw}	T_{cw}	Nm	69	162	258	358	455	556	657
Continuous torque not cooled at I_c	T_c	Nm	39	89	138	187	229	269	310
Stall torque cooled at I_{sw}	T_{sw}	Nm	49	115	184	255	323	394	466
Stall torque not cooled at I_s	T_s	Nm	27	63	98	133	163	191	220
Ripple torque (typical cogging) at I = 0	T_r	Nm	0.5	1.1	1.6	2.1	2.6	3.1	3.7
Power loss at T_p (25 °C)	P_{lp}	W	2867	4114	5361	6607	7854	9101	10347
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1120	1607	2094	2581	3068	3555	4042
Power loss at T_{cw}	P_{lw}	W	402	803	1205	1606	2008	2409	2811
Power loss at T_c (25 °C)	P_{lc}	W	98	184	265	338	393	436	481
Thermical resistance with water cooling	R_{th}	K/W	0.249	0.125	0.083	0.062	0.050	0.042	0.036
Motor constant (25 °C)	k_m	Nm/√W	3.91	6.53	8.49	10.20	11.58	12.91	14.12
Cooling water flow rate of main cooling system	dV/dt	l/min	1.15	2.29	3.44	4.59	5.74	6.88	8.03
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RE11-3P-250x25	RE11-3P-250x50	RE11-3P-250x75	RE11-3P-250x100	RE11-3P-250x125	RE11-3P-250x150	RE11-3P-250x175
Height of rotor	H_1	mm	63.0	88.0	113.0	138.0	163.0	188.0	213.0
Height of stator	H_2	mm	60.0	85.0	110.0	135.0	160.0	185.0	210.0
Rotor mass	m_1	kg	6.2	8.3	10.4	12.4	14.5	16.6	18.7
Stator mass	m_2	kg	9.3	14.1	18.9	23.7	28.5	33.4	38.2
Moment of inertia of rotor	J	kgm^2	0.106	0.142	0.179	0.216	0.253	0.290	0.326
Axial attraction	F_a	kN	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Radial attraction/eccentricity	F_r	kN/mm	1.1	2.1	3.1	4.1	5.1	6.1	7.1

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for "power loss": ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

Technical Data: Series RE11-3P-250xH

Winding-dependent data

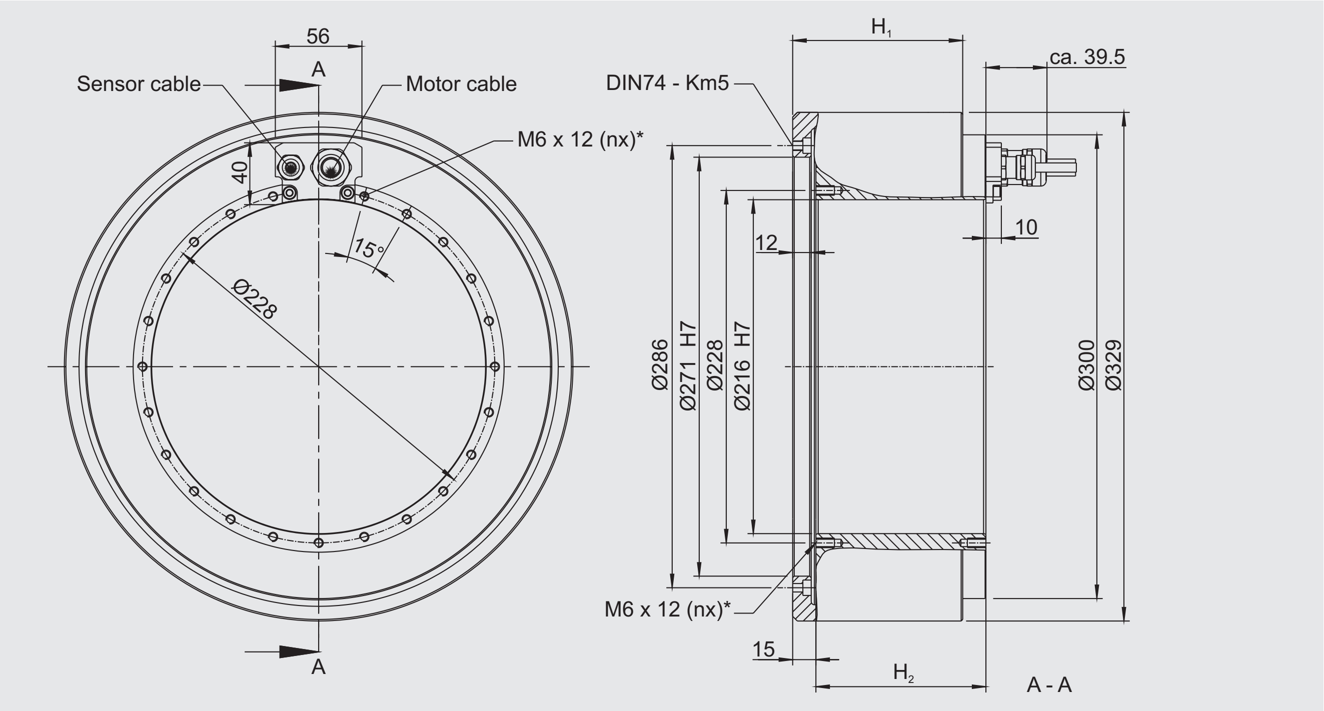
Winding data	Symbol	Unit	RE11-3P-250x25-WL	RE11-3P-250x25-WM	RE11-3P-250x50-WL	RE11-3P-250x50-WM	RE11-3P-250x75-WL	RE11-3P-250x75-WM
Torque constant	k_T	Nm/A_{rms}	12.50	6.25	25.00	12.50	37.14	18.57
Back EMF constant, phase to phase	k_u	V/(rad/s)	10.23	5.11	20.45	10.23	30.38	15.19
Limiting speed at I_p and U_{DCL}	n_{Ip}	rpm	272	598	123	288	73	185
Limiting speed at I_{cw} and U_{DCL}	n_{Iw}	rpm	466	968	214	457	134	295
Limiting speed at I_c and U_{DCL}	n_{Ic}	rpm	511	1045	246	511	160	338
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	409	409	214	409	134	295
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	6.82	1.70	9.78	2.45	12.75	3.19
Inductance, phase to phase	L	mH	28.5	7.1	57.0	14.3	85.6	21.4
Ultimate current (1 s)	I_u	A_{rms}	26.2	52.3	26.2	52.3	26.2	52.3
Peak current (saturation range)	I_p	A_{rms}	16.7	33.5	16.7	33.5	16.7	33.5
Peak current (linear range)	I_{pl}	A_{rms}	10.5	20.9	10.5	20.9	10.5	20.9
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	5.5	11.0	6.5	13.0	7.0	13.9
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	3.1	6.2	3.5	7.1	3.7	7.4
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	3.9	7.8	4.6	9.2	4.9	9.9
Stall current at n = 0 (not cooled)	I_s	A_{rms}	2.2	4.4	2.5	5.0	2.6	5.3
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

RE11-3P-250x100-WL	RE11-3P-250x100-WM	RE11-3P-250x125-WL	RE11-3P-250x125-WM	RE11-3P-250x150-WL	RE11-3P-250x150-WM	RE11-3P-250x175-WL	RE11-3P-250x175-WM	Symbol
49.52	24.76	61.28	30.64	73.54	36.77	85.79	42.90	k_T
40.50	20.25	50.13	25.06	60.15	30.08	70.18	35.09	k_u
47	132	31	101	19	80	10	64	n_{lp}
94	214	71	167	55	135	44	112	n_{lw}
117	250	92	200	75	165	63	140	n_{lc}
94	214	71	167	55	135	44	112	n_{cr}
15.71	3.93	18.68	4.67	21.64	5.41	24.61	6.15	R_{25}
114.1	28.5	142.6	35.7	171.1	42.8	199.7	49.9	L
26.2	52.3	26.2	52.3	26.2	52.3	26.2	52.3	I_u
16.7	33.5	16.7	33.5	16.7	33.5	16.7	33.5	I_p
10.5	20.9	10.5	20.9	10.5	20.9	10.5	20.9	I_{pl}
7.2	14.5	7.4	14.8	7.6	15.1	7.7	15.3	I_{cw}
3.8	7.6	3.7	7.5	3.7	7.3	3.6	7.2	I_c
5.1	10.3	5.3	10.5	5.4	10.7	5.4	10.9	I_{sw}
2.7	5.4	2.7	5.3	2.6	5.2	2.6	5.1	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}

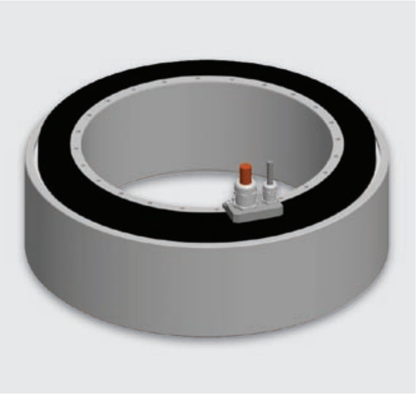
Technical Data: Series RE13-3P-300xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RE13-3P-** **300x25 • 300x50 • 300x75**	**RE13-3P-** **300x100 • 300x125 • 300x150 • 300x175**
Fastening thread of rotor	Km5, 24 x (15°)	Km5, 48 x (7.5°)
Fastening thread of stator – cable side	M6 x 12, 23 x (15°)	M6 x 12, 45 x (7.5°)
Fastening thread of stator	M6 x 12, 24 x (15°)	M6 x 12, 48 x (7.5°)



Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RE13-3P-300xH

Winding-independent data

Technical data	Symbol	Unit	RE13-3P-300x25	RE13-3P-300x50	RE13-3P-300x75	RE13-3P-300x100	RE13-3P-300x125	RE13-3P-300x150	RE13-3P-300x175
Number of pole pairs	P		26	26	26	26	26	26	26
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	308	617	916	1221	1511	1814	2094
Peak torque (saturation range) at I_p	T_p	Nm	244	488	725	967	1197	1436	1658
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	158	316	470	626	775	930	1074
Continuous torque cooled at I_{cw}	T_{cw}	Nm	97	231	369	513	651	796	932
Continuous torque not cooled at I_c	T_c	Nm	53	122	190	258	317	372	424
Stall torque cooled at I_{sw}	T_{sw}	Nm	69	164	262	364	463	565	662
Stall torque not cooled at I_s	T_s	Nm	37	86	135	183	225	264	301
Ripple torque (typical cogging) at I = 0	T_r	Nm	0.7	1.5	2.2	2.9	3.6	4.3	5.0
Power loss at T_p (25 °C)	P_{lp}	W	3489	4943	6396	7850	9304	10758	12211
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1058	1498	1939	2380	2821	3261	3702
Power loss at T_{cw}	P_{lw}	W	518	1036	1554	2072	2591	3109	3627
Power loss at T_c (25 °C)	P_{lc}	W	118	221	318	405	471	523	577
Thermical resistance with water cooling	R_{th}	K/W	0.193	0.097	0.064	0.048	0.039	0.032	0.028
Motor constant (25 °C)	k_m	Nm/√W	4.86	8.17	10.67	12.84	14.59	16.29	17.65
Cooling water flow rate of main cooling system	dV/dt	l/min	1.48	2.96	4.44	5.92	7.40	8.88	10.36
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RE13-3P-300x25	RE13-3P-300x50	RE13-3P-300x75	RE13-3P-300x100	RE13-3P-300x125	RE13-3P-300x150	RE13-3P-300x175
Height of rotor	H_1	mm	60.0	85.0	110.0	135.0	160.0	185.0	210.0
Height of stator	H_2	mm	60.0	85.0	110.0	135.0	160.0	185.0	210.0
Rotor mass	m_1	kg	6.7	9.2	11.6	14.1	16.5	19.0	21.4
Stator mass	m_2	kg	11.6	17.6	23.5	29.4	35.3	41.2	47.1
Moment of inertia of rotor	J	kgm^2	0.16	0.22	0.29	0.35	0.41	0.47	0.53
Axial attraction	F_a	kN	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Radial attraction/eccentricity	F_r	kN/mm	1.2	2.4	3.6	4.8	6.0	7.2	8.4

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for “power loss”: ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

Technical Data: Series RE13-3P-300xH

Winding-dependent data

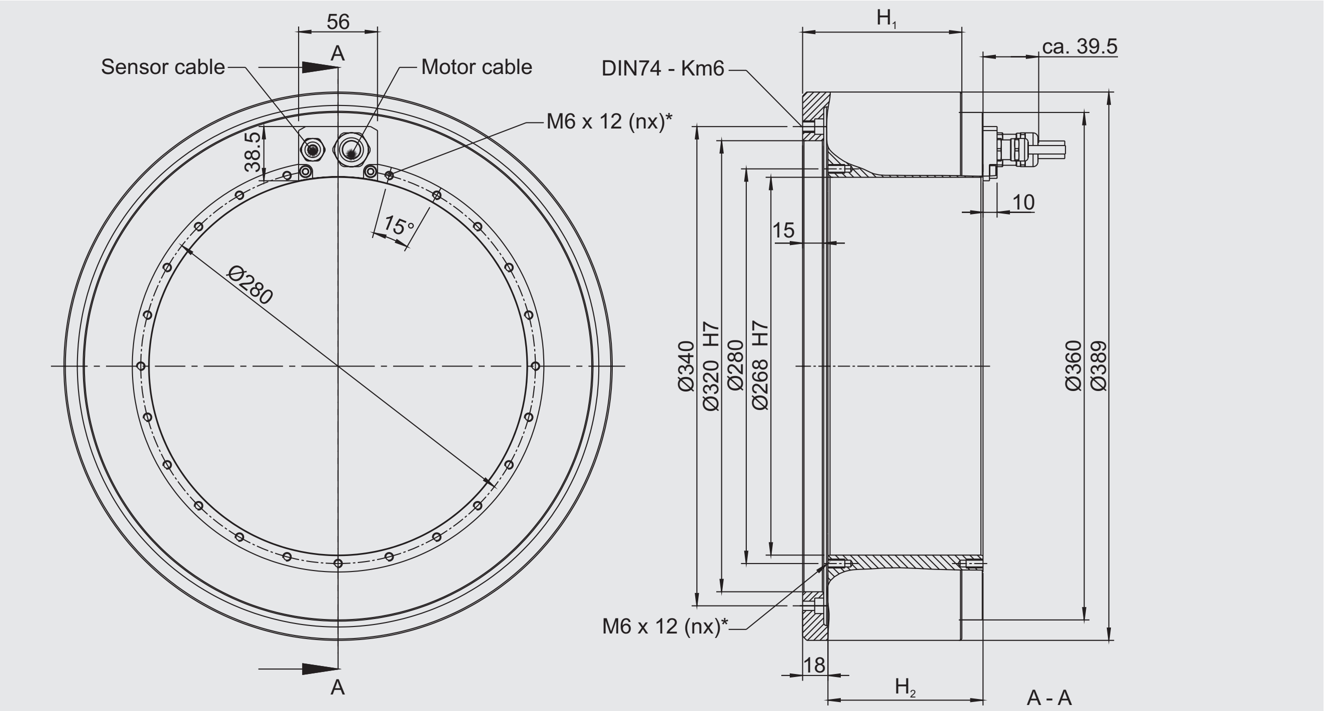
Winding data	Symbol	Unit	RE13-3P-300x25-WL	RE13-3P-300x25-WM	RE13-3P-300x50-WL	RE13-3P-300x50-WM	RE13-3P-300x75-WL	RE13-3P-300x75-WM
Torque constant	k_T	Nm/A_{rms}	13.74	6.87	27.49	13.74	40.82	20.41
Back EMF constant, phase to phase	k_u	V/(rad/s)	11.24	5.62	22.48	11.24	33.39	16.69
Limiting speed at I_p and U_{DCL}	n_{Ip}	rpm	226	492	104	238	63	154
Limiting speed at I_{cw} and U_{DCL}	n_{Iw}	rpm	409	849	186	397	116	255
Limiting speed at I_c and U_{DCL}	n_{Ic}	rpm	461	942	222	459	144	303
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	346	346	186	346	116	255
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	5.32	1.33	7.54	1.89	9.76	2.44
Inductance, phase to phase	L	mH	24.9	6.2	49.8	12.5	74.7	18.7
Ultimate current (1 s)	I_u	A_{rms}	28.8	57.5	28.8	57.5	28.8	57.5
Peak current (saturation range)	I_p	A_{rms}	20.9	41.8	20.9	41.8	20.9	41.8
Peak current (linear range)	I_{pl}	A_{rms}	11.5	23.0	11.5	23.0	11.5	23.0
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	7.1	14.1	8.4	16.8	9.0	18.1
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	3.8	7.7	4.4	8.8	4.7	9.3
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	5.0	10.0	6.0	11.9	6.4	12.8
Stall current at n = 0 (not cooled)	I_s	A_{rms}	2.7	5.5	3.1	6.3	3.3	6.6
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

RE13-3P-300x100-WL	RE13-3P-300x100-WM	RE13-3P-300x125-WL	RE13-3P-300x125-WM	RE13-3P-300x150-WL	RE13-3P-300x150-WM	RE13-3P-300x175-WL	RE13-3P-300x175-WM	Symbol
54.42	27.21	67.34	33.67	80.81	40.41	93.32	46.66	k_T
44.52	22.26	55.08	27.54	66.10	33.05	76.33	38.17	k_u
41	111	28	85	19	68	12	55	n_{lp}
82	184	62	143	48	116	39	97	n_{lw}
105	224	83	179	68	148	58	127	n_{lc}
82	184	62	143	48	116	39	97	n_{cr}
11.98	2.99	14.20	3.55	16.41	4.10	18.63	4.66	R_{25}
99.6	24.9	124.5	31.1	149.4	37.4	174.3	43.6	L
28.8	57.5	28.8	57.5	28.8	57.5	28.8	57.5	I_u
20.9	41.8	20.9	41.8	20.9	41.8	20.9	41.8	I_p
11.5	23.0	11.5	23.0	11.5	23.0	11.5	23.0	I_{pl}
9.4	18.8	9.7	19.3	9.9	19.7	10.0	20.0	I_{cw}
4.7	9.5	4.7	9.4	4.6	9.2	4.5	9.1	I_c
6.7	13.4	6.9	13.7	7.0	14.0	7.1	14.2	I_{sw}
3.4	6.7	3.3	6.7	3.3	6.5	3.2	6.5	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}

Technical Data: Series RE11-3P-360xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RE11-3P-** **360x25 • 360x50 • 360x75**	**RE11-3P-** **360x100 • 360x125 • 360x150 • 360x175**
Fastening thread of rotor	Km6, 24 x (15°)	Km6, 48 x (7.5°)
Fastening thread of stator – cable side	M6 x 12, 23 x (15°)	M6 x 12, 45 x (7.5°)
Fastening thread of stator	M6 x 12, 24 x (15°)	M6 x 12, 48 x (7.5°)

Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RE11-3P-360xH

Winding-independent data

Technical data	Symbol	Unit	RE11-3P-360x25	RE11-3P-360x50	RE11-3P-360x75	RE11-3P-360x100	RE11-3P-360x125	RE11-3P-360x150	RE11-3P-360x175
Number of pole pairs	P		33	33	33	33	33	33	33
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	467	924	1372	1829	2262	2715	3167
Peak torque (saturation range) at I_p	T_p	Nm	437	866	1285	1714	2120	2544	2968
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	267	528	784	1045	1293	1551	1810
Continuous torque cooled at I_{cw}	T_{cw}	Nm	160	374	595	826	1047	1279	1511
Continuous torque not cooled at I_c	T_c	Nm	86	196	305	413	506	594	683
Stall torque cooled at I_{sw}	T_{sw}	Nm	114	265	423	586	744	908	1073
Stall torque not cooled at I_s	T_s	Nm	61	139	216	293	359	422	485
Ripple torque (typical cogging) at I = 0	T_r	Nm	1.3	2.6	3.9	5.1	6.4	7.6	8.9
Power loss at T_p (25 °C)	P_{lp}	W	5395	7740	10086	12431	14777	17122	19468
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1349	1935	2521	3108	3694	4281	4867
Power loss at T_{cw}	P_{lw}	W	630	1261	1891	2521	3152	3782	4412
Power loss at T_c (25 °C)	P_{lc}	W	141	266	382	486	565	627	692
Thermical resistance with water cooling	R_{th}	K/W	0.159	0.079	0.053	0.040	0.032	0.026	0.023
Motor constant (25 °C)	k_m	Nm/√W	7.26	12.00	15.61	18.74	21.27	23.71	25.94
Cooling water flow rate of main cooling system	dV/dt	l/min	1.80	3.60	5.40	7.20	9.01	10.81	12.61
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RE11-3P-360x25	RE11-3P-360x50	RE11-3P-360x75	RE11-3P-360x100	RE11-3P-360x125	RE11-3P-360x150	RE11-3P-360x175
Height of rotor	H_1	mm	63.0	88.0	113.0	138.0	163.0	188.0	213.0
Height of stator	H_2	mm	60.0	85.0	110.0	135.0	160.0	185.0	210.0
Rotor mass	m_1	kg	9.5	12.4	15.4	18.4	21.3	24.3	27.2
Stator mass	m_2	kg	15.3	23.3	31.2	39.1	47.1	55.0	62.9
Moment of inertia of rotor	J	kgm^2	0.39	0.42	0.53	0.63	0.74	0.84	0.95
Axial attraction	F_a	kN	0.59	0.59	0.59	0.59	0.59	0.59	0.59
Radial attraction/eccentricity	F_r	kN/mm	1.6	3.2	4.7	6.3	7.8	9.4	10.9

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for “power loss”: ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

Technical Data: Series RE11-3P-360xH

Winding-dependent data

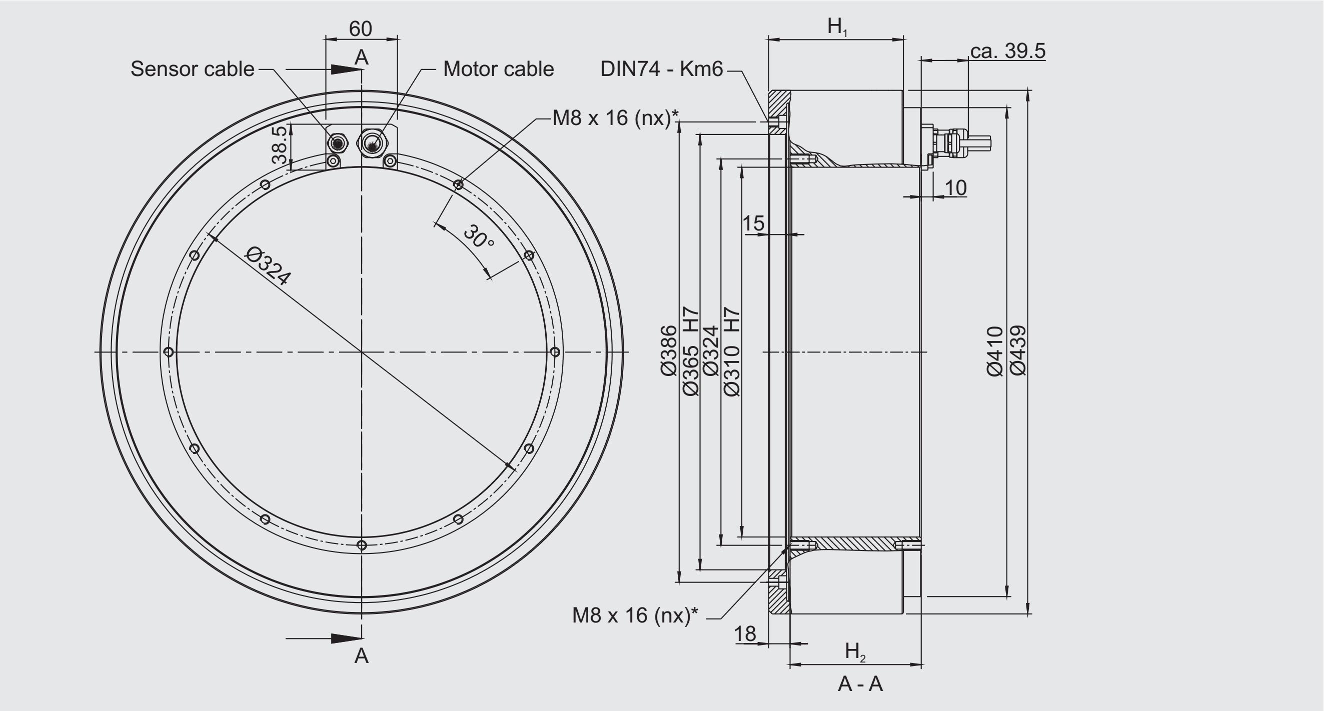
Winding data	Symbol	Unit	RE11-3P-360x25-WL	RE11-3P-360x25-WM	RE11-3P-360x50-WL	RE11-3P-360x50-WM	RE11-3P-360x75-WL	RE11-3P-360x75-WM
Torque constant	k_T	Nm/A_{rms}	12.35	8.24	24.46	16.30	36.31	24.21
Back EMF constant, phase to phase	k_u	V/(rad/s)	10.10	6.74	20.00	13.34	29.70	19.80
Limiting speed at I_p and U_{DCL}	n_{lp}	rpm	245	381	116	185	73	119
Limiting speed at I_{cw} and U_{DCL}	n_{lw}	rpm	468	714	219	337	139	217
Limiting speed at I_c and U_{DCL}	n_{lc}	rpm	521	789	255	389	168	257
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	273	273	219	273	139	217
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	1.93	0.86	2.77	1.23	3.61	1.60
Inductance, phase to phase	L	mH	9.5	4.2	19.0	8.4	28.5	12.7
Ultimate current (1 s)	I_u	A_{rms}	54.0	80.9	54.0	80.9	54.0	80.9
Peak current (saturation range)	I_p	A_{rms}	43.2	64.8	43.2	64.8	43.2	64.8
Peak current (linear range)	I_{pl}	A_{rms}	21.6	32.4	21.6	32.4	21.6	32.4
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	12.9	19.4	15.3	22.9	16.4	24.6
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	7.0	10.5	8.0	12.0	8.4	12.6
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	9.2	13.8	10.8	16.3	11.6	17.5
Stall current at n = 0 (not cooled)	I_s	A_{rms}	5.0	7.4	5.7	8.5	6.0	8.9
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

RE11-3P-360x100-WL	RE11-3P-360x100-WM	RE11-3P-360x125-WL	RE11-3P-360x125-WM	RE11-3P-360x150-WL	RE11-3P-360x150-WM	RE11-3P-360x175-WL	RE11-3P-360x175-WM	Symbol
48.41	32.27	59.89	39.93	71.87	47.91	83.85	55.90	k_T
39.60	26.40	48.99	32.66	58.79	39.19	68.59	45.72	k_u
51	86	37	66	28	53	21	43	n_{lp}
100	158	77	123	62	100	51	83	n_{lw}
124	191	99	153	81	127	69	108	n_{lc}
100	158	77	123	62	100	51	83	n_{cr}
4.45	1.98	5.29	2.35	6.13	2.72	6.96	3.10	R_{25}
38.0	16.9	47.5	21.1	57.0	25.3	66.5	29.6	L
54.0	80.9	54.0	80.9	54.0	80.9	54.0	80.9	I_u
43.2	64.8	43.2	64.8	43.2	64.8	43.2	64.8	I_p
21.6	32.4	21.6	32.4	21.6	32.4	21.6	32.4	I_{pl}
17.1	25.6	17.5	26.2	17.8	26.7	18.0	27.0	I_{cw}
8.5	12.8	8.4	12.7	8.3	12.4	8.1	12.2	I_c
12.1	18.2	12.4	18.6	12.6	19.0	12.8	19.2	I_{sw}
6.1	9.1	6.0	9.0	5.9	8.8	5.8	8.7	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}

Technical Data: Series RE11-3P-410xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RE11-3P-** **410x25 • 410x50 • 410x75**	**RE11-3P-** **410x100 • 410x125 • 410x150 • 410x175**
Fastening thread of rotor	Km6, 24 x (15°)	Km6, 48 x (7.5°)
Fastening thread of stator – cable side	M8 x 16, 11 x (30°)	M8 x 16, 23 x (15°)
Fastening thread of stator	M8 x 16, 12 x (30°)	M8 x 16, 24 x (15°)

Standard: Cable outlet – axial

Option: Cable outlet – tangential

Option: Cable outlet – radial

Technical Data: Series RE11-3P-410xH

Winding-independent data

Technical data	Symbol	Unit	RE11-3P-410x25	RE11-3P-410x50	RE11-3P-410x75	RE11-3P-410x100	RE11-3P-410x125	RE11-3P-410x150	RE11-3P-410x175
Number of pole pairs	P		33	33	33	33	33	33	33
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	586	1172	1741	2321	2871	3445	4019
Peak torque (saturation range) at I_p	T_p	Nm	439	879	1305	1740	2152	2583	3013
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	335	670	995	1326	1641	1969	2297
Continuous torque cooled at I_{cw}	T_{cw}	Nm	206	505	805	1116	1416	1729	2043
Continuous torque not cooled at I_c	T_c	Nm	110	262	409	554	678	796	915
Stall torque cooled at I_{sw}	T_{sw}	Nm	146	359	571	792	1005	1228	1451
Stall torque not cooled at I_s	T_s	Nm	78	186	290	393	481	565	650
Ripple torque (typical cogging) at I = 0	T_r	Nm	1.3	2.6	3.9	5.2	6.5	7.7	9.0
Power loss at T_p (25 °C)	P_{lp}	W	3792	5052	6583	8114	9646	11177	12708
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1481	1974	2572	3170	3768	4366	4964
Power loss at T_{cw}	P_{lw}	W	730	1459	2189	2919	3648	4378	5108
Power loss at T_c (25 °C)	P_{lc}	W	161	303	434	554	644	715	789
Thermical resistance with water cooling	R_{th}	K/W	0.137	0.069	0.046	0.034	0.027	0.023	0.020
Motor constant (25 °C)	k_m	Nm/√W	8.70	15.08	19.61	23.55	26.73	29.79	32.60
Cooling water flow rate of main cooling system	dV/dt	l/min	2.08	4.17	6.25	8.34	10.42	12.51	14.59
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RE11-3P-410x25	RE11-3P-410x50	RE11-3P-410x75	RE11-3P-410x100	RE11-3P-410x125	RE11-3P-410x150	RE11-3P-410x175
Height of rotor	H_1	mm	63.0	88.0	113.0	138.0	163.0	188.0	213.0
Height of stator	H_2	mm	60.0	85.0	110.0	135.0	160.0	185.0	210.0
Rotor mass	m_1	kg	11.0	14.3	17.6	20.8	24.1	27.3	30.6
Stator mass	m_2	kg	19.3	29.3	39.3	49.2	59.1	69.1	79.0
Moment of inertia of rotor	J	kgm^2	0.48	0.62	0.77	0.92	1.07	1.22	1.37
Axial attraction	F_a	kN	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Radial attraction/eccentricity	F_r	kN/mm	1.6	3.2	4.8	6.4	7.9	9.5	11.1

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for "power loss": ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

Technical Data: Series RE11-3P-410xH

Winding-dependent data

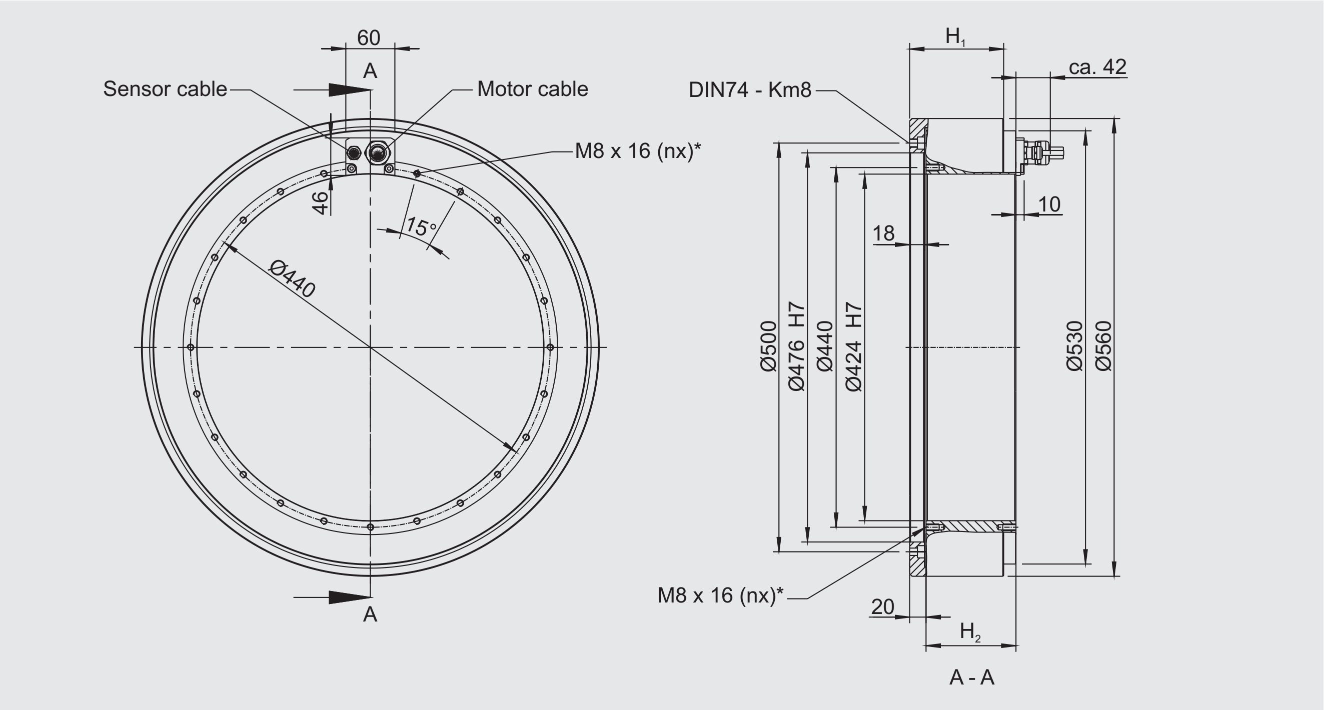
Winding data	Symbol	Unit	RE11-3P-410x25-WL	RE11-3P-410x25-WM	RE11-3P-410x50-WL	RE11-3P-410x50-WM	RE11-3P-410x75-WL	RE11-3P-410x75-WM
Torque constant	k_T	Nm/A_{rms}	15.74	10.50	33.91	22.60	50.34	32.87
Back EMF constant, phase to phase	k_u	V/(rad/s)	12.88	8.58	27.74	18.49	41.18	26.89
Limiting speed at I_p and U_{DCL}	n_{Ip}	rpm	227	353	100	159	63	104
Limiting speed at I_{cw} and U_{DCL}	n_{Iw}	rpm	364	556	154	238	97	155
Limiting speed at I_c and U_{DCL}	n_{Ic}	rpm	407	617	182	278	119	187
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	273	273	154	273	97	155
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	2.18	0.97	3.37	1.50	4.39	1.95
Inductance, phase to phase	L	mH	12.1	5.4	28.2	12.5	42.3	18.8
Ultimate current (1 s)	I_u	A_{rms}	53.2	79.8	49.4	74.1	49.4	74.1
Peak current (saturation range)	I_p	A_{rms}	34.0	51.1	31.6	47.4	31.6	47.4
Peak current (linear range)	I_{pl}	A_{rms}	21.3	31.9	19.8	29.6	19.8	27.4
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	13.1	19.6	14.9	22.4	16.0	24.0
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	7.0	10.5	7.7	11.6	8.1	12.2
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	9.3	13.9	10.6	15.9	11.4	17.0
Stall current at n = 0 (not cooled)	I_s	A_{rms}	5.0	7.5	5.5	8.2	5.8	8.6
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for "electrical resistance": ±10% • Tolerance range of value for "inductance": ±15%

RE11-3P-410x100-WL	RE11-3P-410x100-WM	RE11-3P-410x125-WL	RE11-3P-410x125-WM	RE11-3P-410x150-WL	RE11-3P-410x150-WM	RE11-3P-410x175-WL	RE11-3P-410x175-WM	Symbol
67.12	44.75	83.04	55.36	99.65	66.43	116.25	77.50	k_T
54.90	36.60	67.92	45.28	81.51	54.34	95.09	63.39	k_u
44	74	33	57	25	46	19	37	n_{lp}
69	110	53	86	42	69	34	57	n_{lw}
88	136	70	109	57	90	48	76	n_{lc}
69	110	53	86	42	69	34	57	n_{cr}
5.41	2.41	6.44	2.86	7.46	3.31	8.48	3.77	R_{25}
56.3	25.0	70.4	31.3	84.5	37.6	98.6	43.8	L
49.4	74.1	49.4	74.1	49.4	74.1	49.4	74.1	I_u
31.6	47.4	31.6	47.4	31.6	47.4	31.6	47.4	I_p
19.8	29.6	19.8	29.6	19.8	29.6	19.8	29.6	I_{pl}
16.6	24.9	17.1	25.6	17.4	26.0	17.6	26.4	I_{cw}
8.3	12.4	8.2	12.2	8.0	12.0	7.9	11.8	I_c
11.8	17.7	12.1	18.2	12.3	18.5	12.5	18.7	I_{sw}
5.9	8.8	5.8	8.7	5.7	8.5	5.6	8.4	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}

Technical Data: Series RE11-3P-530xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RE11-3P-** **530x25 • 530x50 • 530x75**	**RE11-3P-** **530x100 • 530x125 • 530x150 • 530x175**
Fastening thread of rotor	Km8, 24 x (15°)	Km8, 48 x (7.5°)
Fastening thread of stator – cable side	M8 x 16, 24 x (15°)	M8 x 16, 45 x (7.5°)
Fastening thread of stator	M8 x 16, 24 x (15°)	M8 x 16, 48 x (7.5°)


Standard: Cable outlet – axial


Option: Cable outlet – tangential


Option: Cable outlet – radial

Technical Data: Series RE11-3P-530xH

Winding-independent data

Technical data	Symbol	Unit	RE11-3P-530x25	RE11-3P-530x50	RE11-3P-530x75	RE11-3P-530x100	RE11-3P-530x125	RE11-3P-530x150	RE11-3P-530x175
Number of pole pairs	P		44	44	44	44	44	44	44
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	1148	2296	3410	4547	5683	6752	7877
Peak torque (saturation range) at I_p	T_p	Nm	870	1740	2584	3445	4307	5116	5969
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	656	1312	1949	2598	3248	3858	4501
Continuous torque cooled at I_{cw}	T_{cw}	Nm	340	808	1292	1795	2304	2789	3299
Continuous torque not cooled at I_c	T_c	Nm	178	410	641	871	1078	1255	1443
Stall torque cooled at I_{sw}	T_{sw}	Nm	241	574	917	1275	1636	1980	2342
Stall torque not cooled at I_s	T_s	Nm	126	291	455	618	765	891	1025
Ripple torque (typical cogging) at I = 0	T_r	Nm	2.6	5.2	7.8	10.3	12.9	15.3	17.9
Power loss at T_p (25 °C)	P_{lp}	W	7592	10755	13918	17081	20245	23408	26571
Power loss at T_{pl} (25 °C)	P_{lpl}	W	2832	4012	5192	6373	7553	8733	9913
Power loss at T_{cw}	P_{lw}	W	989	1977	2966	3955	4944	5932	6921
Power loss at T_c (25 °C)	P_{lc}	W	208	391	562	716	832	924	1019
Thermical resistance with water cooling	R_{th}	K/W	0.101	0.051	0.034	0.025	0.020	0.017	0.014
Motor constant (25 °C)	k_m	Nm/√W	12.33	20.71	27.04	32.55	37.37	41.29	45.21
Cooling water flow rate of main cooling system	dV/dt	l/min	2.82	5.65	8.47	11.30	14.12	16.95	19.77
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Mechanical data	Symbol	Unit	RE11-3P-530x25	RE11-3P-530x50	RE11-3P-530x75	RE11-3P-530x100	RE11-3P-530x125	RE11-3P-530x150	RE11-3P-530x175
Height of rotor	H_1	mm	65.0	90.0	115.0	140.0	165.0	190.0	215.0
Height of stator	H_2	mm	60.0	85.0	110.0	135.0	160.0	190.0	215.0
Rotor mass	m_1	kg	16.8	21.2	25.5	29.9	34.3	38.7	43.1
Stator mass	m_2	kg	27.7	42.0	56.2	70.3	84.4	99.9	114.1
Moment of inertia of rotor	J	kgm^2	1.19	1.51	1.84	2.17	2.50	2.82	3.15
Axial attraction	F_a	kN	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Radial attraction/eccentricity	F_r	kN/mm	2.1	4.2	6.3	8.4	10.5	12.6	14.7

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for “power loss”: ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

Technical Data: Series RE11-3P-530xH

Winding-dependent data

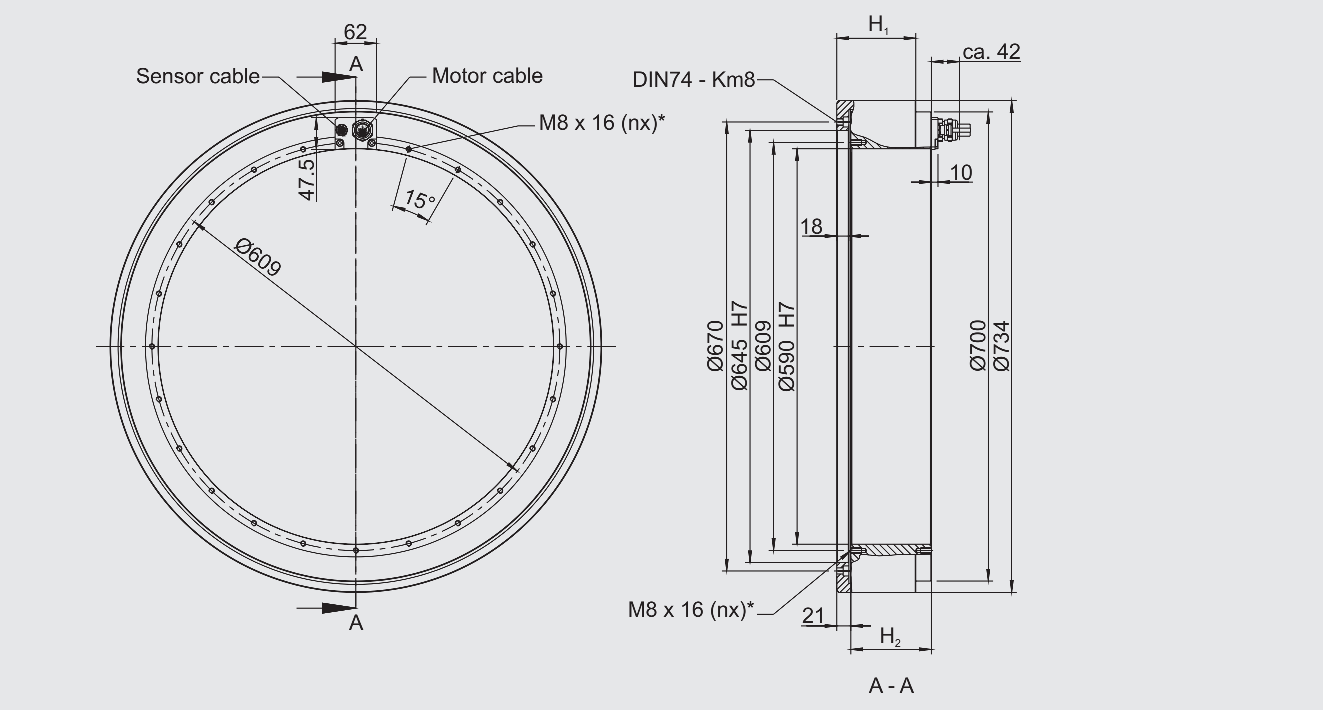
Winding data	Symbol	Unit	RE11-3P-530x25-WL	RE11-3P-530x25-WM	RE11-3P-530x50-WL	RE11-3P-530x50-WM	RE11-3P-530x75-WL	RE11-3P-530x75-WM
Torque constant	k_T	Nm/A_{rms}	24.74	12.37	49.48	24.74	73.48	36.74
Back EMF constant, phase to phase	k_u	V/(rad/s)	20.23	10.12	40.47	20.23	60.10	30.05
Limiting speed at I_p and U_{DCL}	n_{lp}	rpm	123	269	56	130	34	84
Limiting speed at I_{cw} and U_{DCL}	n_{lw}	rpm	230	477	105	224	66	144
Limiting speed at I_c and U_{DCL}	n_{lc}	rpm	258	527	125	257	81	170
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	230	205	105	205	66	144
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	2.68	0.67	3.80	0.95	4.92	1.23
Inductance, phase to phase	L	mH	13.0	3.2	25.9	6.5	38.9	9.7
Ultimate current (1 s)	I_u	A_{rms}	66.3	132.6	66.3	132.6	66.3	132.6
Peak current (saturation range)	I_p	A_{rms}	43.4	86.8	43.4	86.8	43.4	86.8
Peak current (linear range)	I_{pl}	A_{rms}	26.5	53.0	26.5	53.0	26.5	53.0
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	13.7	27.5	16.3	32.7	17.6	35.2
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	7.2	14.4	8.3	16.6	8.7	17.4
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	9.8	19.5	11.6	23.2	12.5	25.0
Stall current at n = 0 (not cooled)	I_s	A_{rms}	5.1	10.2	5.9	11.8	6.2	12.4
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

RE11-3P-530x100-WL	RE11-3P-530x100-WM	RE11-3P-530x125-WL	RE11-3P-530x125-WM	RE11-3P-530x150-WL	RE11-3P-530x150-WM	RE11-3P-530x175-WL	RE11-3P-530x175-WM	Symbol
97.97	48.99	122.46	61.23	145.49	72.74	169.73	84.87	k_T
80.14	40.07	100.17	50.09	119.00	59.50	138.84	69.42	k_u
22	60	15	46	9	37	5	30	n_{lp}
46	104	35	81	27	66	22	55	n_{lw}
60	126	47	100	39	84	32	71	n_{lc}
46	104	35	81	27	66	22	55	n_{cr}
6.04	1.51	7.16	1.79	8.28	2.07	9.40	2.35	R_{25}
51.9	13.0	64.9	16.2	77.8	19.5	90.8	22.7	L
66.3	132.6	66.3	132.6	66.3	132.6	66.3	132.6	I_u
43.4	86.8	43.4	86.8	43.4	86.8	43.4	86.8	I_p
26.5	53.0	26.5	53.0	26.5	53.0	26.5	53.0	I_{pl}
18.3	36.6	18.8	37.6	19.2	38.3	19.4	38.9	I_{cw}
8.9	17.8	8.8	17.6	8.6	17.2	8.5	17.0	I_c
13.0	26.0	13.4	26.7	13.6	27.2	13.8	27.6	I_{sw}
6.3	12.6	6.2	12.5	6.1	12.2	6.0	12.1	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}

Technical Data: Series RE13-3P-700xH

Drawing



*Note: The number (n) of fastening threads depends on the height.

Fastening threads	**RE13-3P-** **700x25 • 700x50 • 700x75**	**RE13-3P-** **700x100 • 700x125 • 700x150 • 700x175**
Fastening thread of rotor	Km8, 24 x (15°)	Km8, 48 x (15°)
Fastening thread of stator – cable side	M8 x 16, 23 x (15°)	M8 x 16, 47 x (7.5°)
Fastening thread of stator	M8 x 16, 24 x (15°)	M8 x 16, 48 x (7.5°)


Standard: Cable outlet – axial


Option: Cable outlet – tangential


Option: Cable outlet – radial

Technical Data: Series RE13-3P-700xH

Winding-independent data

Technical data	Symbol	Unit	RE13-3P-700x25	RE13-3P-700x50	RE13-3P-700x75	RE13-3P-700x100	RE13-3P-700x125	RE13-3P-700x150	RE13-3P-700x175
Number of pole pairs	P		65	65	65	65	65	65	65
Maximum operating voltage	U	V	600	600	600	600	600	600	600
Ultimate torque (1 s) at I_u	T_u	Nm	1616	3232	4848	6399	7999	9599	11199
Peak torque (saturation range) at I_p	T_p	Nm	1178	2356	3534	4664	5830	6996	8162
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	898	1796	2693	3555	4444	5333	6221
Continuous torque cooled at I_{cw}	T_{cw}	Nm	662	1563	2515	3453	4426	5405	6387
Continuous torque not cooled at I_c	T_c	Nm	340	778	1225	1643	2032	2386	2743
Stall torque cooled at I_{sw}	T_{sw}	Nm	470	1109	1786	2451	3142	3837	4535
Stall torque not cooled at I_s	T_s	Nm	241	552	869	1167	1443	1694	1948
Ripple torque (typical cogging) at I = 0	T_r	Nm	3.5	7.1	10.6	14.0	17.5	21.0	24.5
Power loss at T_p (25 °C)	P_{lp}	W	4913	7049	9185	11321	13458	15594	17730
Power loss at T_{pl} (25 °C)	P_{lpl}	W	1919	2754	3588	4422	5257	6091	6926
Power loss at T_{cw}	P_{lw}	W	1356	2711	4067	5423	6778	8134	9490
Power loss at T_c (25 °C)	P_{lc}	W	275	517	742	945	1099	1220	1346
Thermical resistance with water cooling	R_{th}	K/W	0.074	0.037	0.025	0.018	0.015	0.012	0.011
Motor constant (25 °C)	k_m	Nm/√W	20.49	34.22	44.96	53.46	61.29	68.33	74.76
Cooling water flow rate of main cooling system	dV/dt	l/min	3.87	7.75	11.62	15.49	19.37	15.49	18.08
Temperature difference of cooling water	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00	5.00	7.50	7.50

Mechanical data	Symbol	Unit	RE13-3P-700x25	RE13-3P-700x50	RE13-3P-700x75	RE13-3P-700x100	RE13-3P-700x125	RE13-3P-700x150	RE13-3P-700x175
Height of rotor	H_1	mm	68.0	93.0	118.0	143.0	168.0	193.0	218.0
Height of stator	H_2	mm	70.0	95.0	120.0	145.0	170.0	195.0	220.0
Rotor mass	m_1	kg	25.1	31.9	38.7	45.4	52.2	59.0	65.7
Stator mass	m_2	kg	43.8	63.9	83.5	103.3	122.9	142.5	162.1
Moment of inertia of rotor	J	kgm^2	3.11	3.99	4.86	5.74	6.61	7.49	8.36
Axial attraction	F_a	kN	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Radial attraction/eccentricity	F_r	kN/mm	3.1	6.2	9.3	12.3	15.4	18.5	21.5

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±5% • Tolerance range of value for “power loss”: ±10%
Binding data and drawings are passed on to the customer upon request. We recommend the support of our engineers for the motor layout.

Technical Data: Series RE13-3P-700xH

Winding-dependent data

Winding data	Symbol	Unit	RE13-3P-700x25-WL	RE13-3P-700x25-WM	RE13-3P-700x50-WL	RE13-3P-700x50-WM	RE13-3P-700x75-WL	RE13-3P-700x75-WM
Torque constant	k_T	Nm/A_{rms}	25.04	19.97	50.07	39.94	75.11	59.92
Back EMF constant, phase to phase	k_u	V/(rad/s)	20.48	16.34	40.96	32.67	61.43	49.01
Limiting speed at I_p and U_{DCL}	n_{lp}	rpm	143	182	69	88	44	57
Limiting speed at I_{cw} and U_{DCL}	n_{lw}	rpm	217	274	99	126	62	80
Limiting speed at I_c and U_{DCL}	n_{lc}	rpm	253	319	122	155	80	101
Limiting speed for continuous operation at I_{cw}*	n_{cr}	rpm	217	138	99	138	62	80
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	0.99	0.64	1.43	0.91	1.86	1.19
Inductance, phase to phase	L	mH	6.1	3.9	12.1	7.7	18.2	11.6
Ultimate current (1 s)	I_u	A_{rms}	89.6	112.4	89.6	112.4	89.6	112.4
Peak current (saturation range)	I_p	A_{rms}	57.4	71.9	57.4	71.9	57.4	71.9
Peak current (linear range)	I_{pl}	A_{rms}	35.9	45.0	35.9	45.0	35.9	45.0
Continuous current at P_{lw} (cooled)	I_{cw}	A_{rms}	26.4	33.1	31.2	39.1	33.5	41.9
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	13.6	17.0	15.5	19.4	16.3	20.4
Stall current at n = 0 (cooled)	I_{sw}	A_{rms}	18.8	23.5	22.2	27.7	23.8	29.7
Stall current at n = 0 (not cooled)	I_s	A_{rms}	9.6	12.1	11.0	13.8	11.6	14.5
Permissible winding temperature	ϑ	°C	130	130	130	130	130	130
Switch-off threshold of thermal sensor	ϑ	°C	100	100	100	100	100	100
DC link voltage (max. 600 V_{DC})	U_{DCL}	V	600	600	600	600	600	600

*See glossary • Subject to changes without advance notification, according to technical progress.
Tolerance range of values: ±5% • Tolerance range of value for “electrical resistance”: ±10% • Tolerance range of value for “inductance”: ±15%

RE13-3P-700x100-WL	RE13-3P-700x100-WM	RE13-3P-700x125-WL	RE13-3P-700x125-WM	RE13-3P-700x150-WL	RE13-3P-700x150-WM	RE13-3P-700x175-WL	RE13-3P-700x175-WM	Symbol
99.14	79.09	123.92	98.86	148.71	118.63	173.49	138.41	k_T
81.09	64.69	101.37	80.87	121.64	97.04	141.91	113.21	k_u
32	42	24	32	19	26	15	21	n_{lp}
45	58	34	45	27	36	22	30	n_{lw}
59	75	47	60	39	49	33	42	n_{lc}
45	58	34	45	27	36	22	30	n_{cr}
2.29	1.46	2.73	1.74	3.16	2.02	3.59	2.29	R_{25}
24.3	15.5	30.4	19.3	36.4	23.2	42.5	27.0	L
89.6	112.4	89.6	112.4	89.6	112.4	89.6	112.4	I_u
57.4	71.9	57.4	71.9	57.4	71.9	57.4	71.9	I_p
35.9	45.0	35.9	45.0	35.9	45.0	35.9	45.0	I_{pl}
34.8	43.6	35.7	44.7	36.3	45.5	36.8	46.1	I_{cw}
16.6	20.7	16.4	20.5	16.0	20.1	15.8	19.8	I_c
24.7	30.9	25.4	31.7	25.8	32.3	26.1	32.7	I_{sw}
11.8	14.7	11.6	14.6	11.4	14.3	11.2	14.0	I_s
130	130	130	130	130	130	130	130	ϑ
100	100	100	100	100	100	100	100	ϑ
600	600	600	600	600	600	600	600	U_{DCL}

RKI Torque Motors

Features, benefits, applications

Features

RKI motors are slotted, high-performance internal rotors. The internal design was completely revised for this series. While the rotor is still a homogenous steel element in the RI drive, for the RKI series it consists of one assembly whose core forms a laminated magnet carrier. The eddy current losses can thus be reduced to a minimum. The rotor is heated up less and is no longer the limiting factor for the performance of the motor. This is why considerably higher speeds are possible. In addition, the permanent magnets in the rotor are arranged such that the magnetic flux is maximised. The innovative design and the bundling of the magnetic field linked to it makes higher torques possible. The energy efficiency is improved and the operating costs are reduced significantly owing to less cooling.
A variation in the magnetic material means that it is possible to offer motors with an optimised cost-benefit ratio.

RKI (internal rotor) motors are offered:

- with 7 fixed diameters from 230 to 1030 mm outer diameter
- with stators at different heights in 25 mm steps
- with 2 standard windings for high torque and high speeds
- with 3 magnet versions R10 (high speed or Eco version), R12 (moderate speed and torque), R22 (high torque, maximum torque density in the installation space)

Benefits

In comparison to RI internal rotor standard motors, you can achieve

- **+30%** more torque*
- **+400%** more speed
- **+400%** more mechanical performance
- **-40%** less heat loss depending on the motor optimisation.

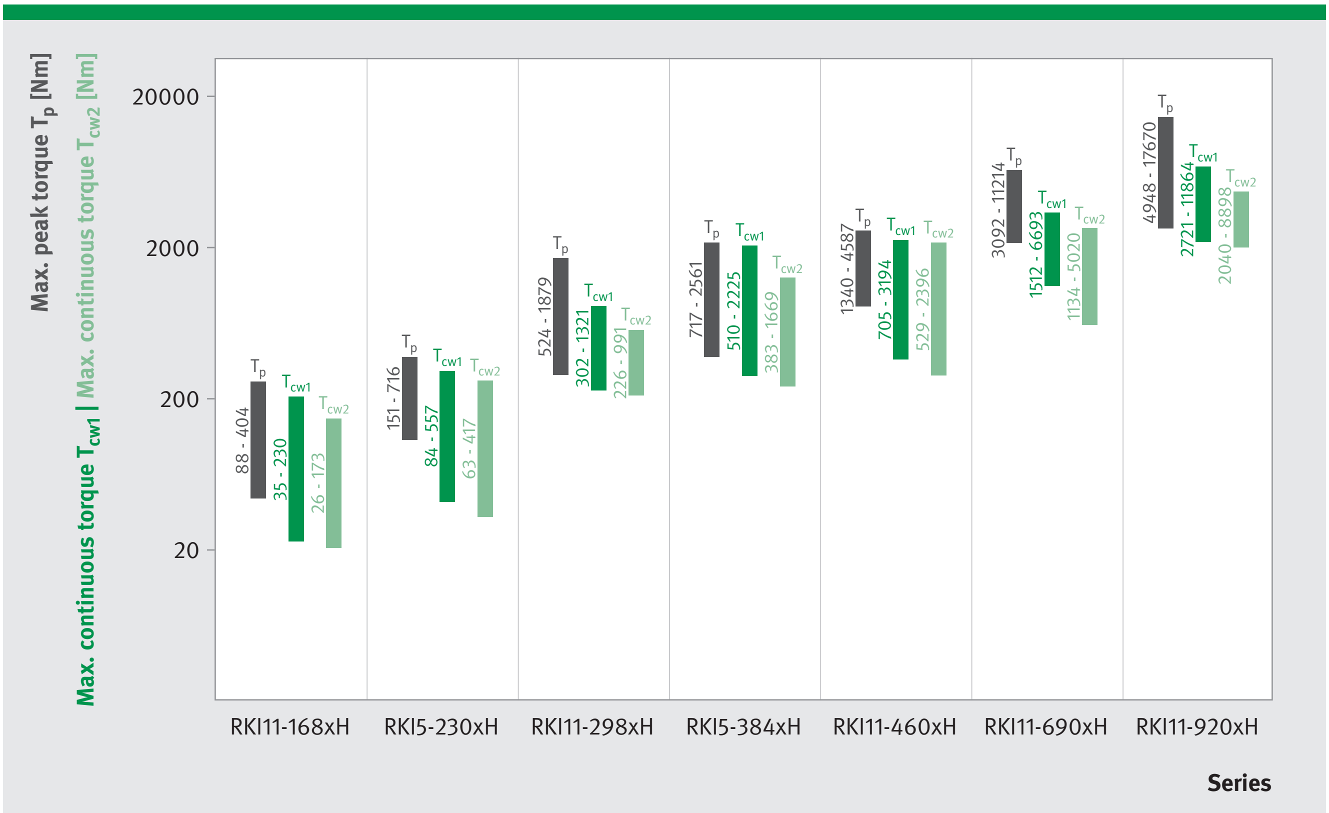
Applications

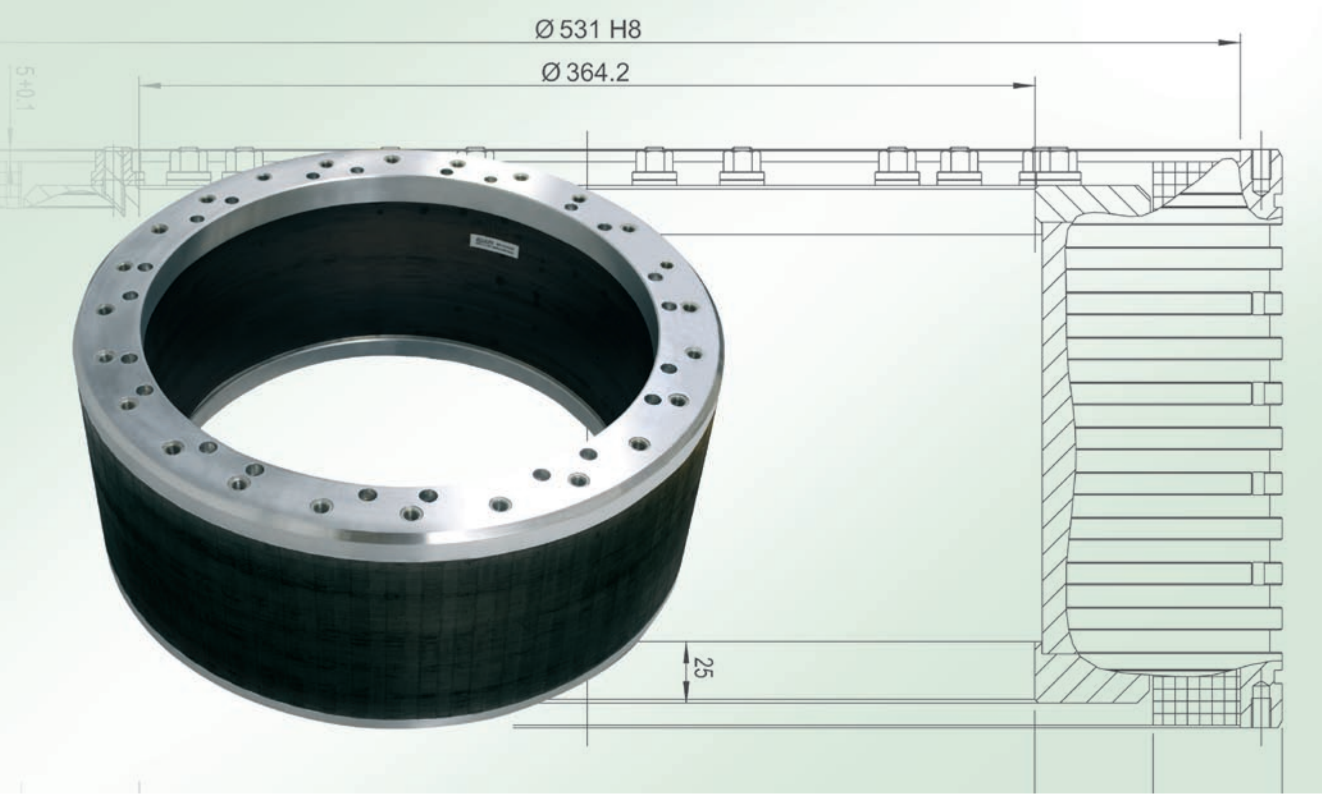
- In the rotary tables industry and fast rotating rotary axes
- In swivel axes
- In workpiece spindles
- Automation technology
- Printing and packaging machinery
- Presses
- As the CNC axis in machine tools
- High-precision positioning applications

* When using magnetic material of the highest quality class

RKI Torque Motors

Torque ranges





RMK/RMF Torque Motors

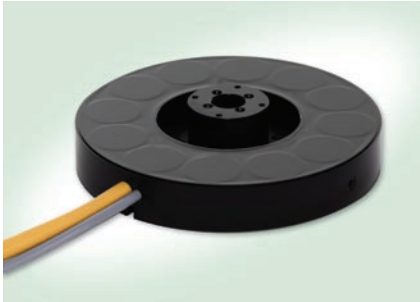
Features, benefits, applications

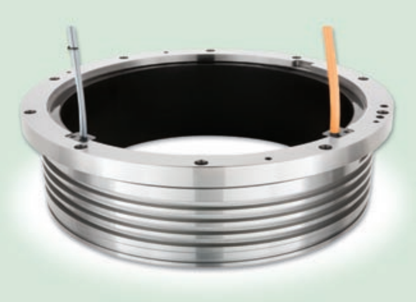
Features

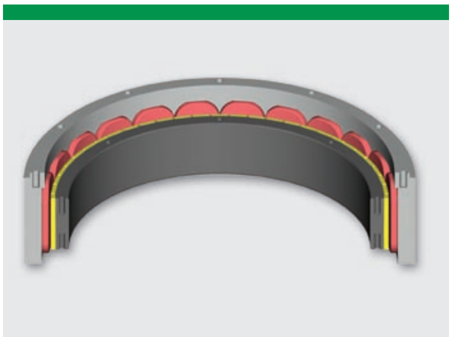
RMK/RMF integrated motors are slotless, iron-core permanent magnet excited AC synchronous motors. In slotless motors, the coil windings are arranged in an air gap between the magnetic ring and primary part ring.
Slotless motors do not generate any cogging forces. This excellent characteristic in the motor series guarantees very smooth motion.

These motors offer the following features for the application owing to coreless windings and the larger air gap:

- Very small electrical time constant
- Highly dynamic in controlled operation
- Medium final speed
- Relatively low attraction forces
- Power generation of approx. 2.5 to 3 N/cm² per active air gap area
- High level of flexibility in the construction and in the size of the diameter







RMK/RMF motors can be built as a disk rotor blade variant or as a coaxial construction with an internal or external rotor. These customised motors are characterised by the following parameters listed.

- Diameter range: 70 mm to 2500 mm
- Torque range: 2 Nm to 15000 Nm
- Speed range: up to 15 m/s peripheral speed

Benefits RMF

- Flat design
- Medium torque requirements in machines with little or no forces in the direction of movement
- Can be used in high-precision applications
- Optimum synchronisation

Benefits RMK

- Coaxial design
- Medium torque requirements in machines with little or no forces in the direction of movement
- Can be used in high-precision applications
- Optimum synchronisation

Applications

- In rotary axes
- In grinding machines
- In measuring machines
- In high-precision positioning axes

HSRV/SRV Torque Motors
Features, benefits, applications

Features

HSRV/SRV motors are designed in a similar way to the motors in the RI series. They are designed for high-speed applications owing to a specially developed structuring of the coil system.

These motors reach high peripheral speeds (up to 50 m/s) with a simultaneously high available torque and an extremely low noise level.
HSRV/SRV motors are designed customer-specifically and in accordance with the respective requirement.

HSRV/SRV motors are developed and produced customer-specifically.

- Diameter range: 100 mm to 2500 mm
- Torque range: 2 Nm to 6000 Nm

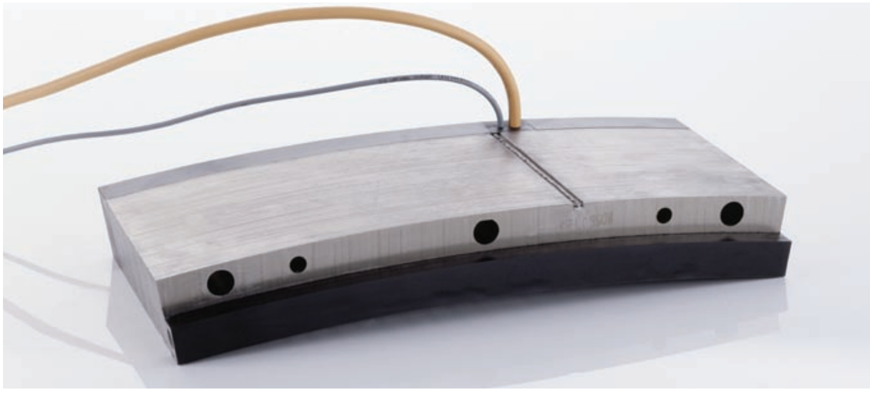
Benefits

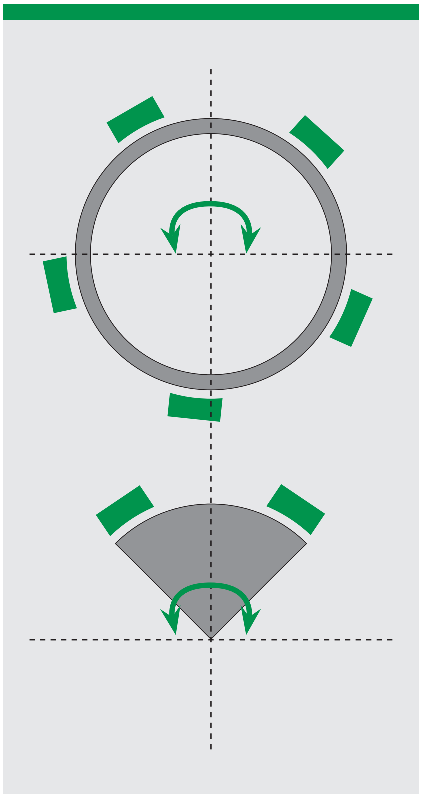
- Maximum peripheral speeds with high torque available simultaneously
- Low vibration and low noise level
- Special winding structures
- No cogging effects

Applications

- In the medical industry
- In spindles
- In honing heads
- In fast rotating rotary tables

Segment Motors





The IDAM integrated motors in all series can also be designed customer-specifically in a segmental construction. Unlike the continuous rings in the motors, the primary part and/or the secondary part is designed as a segment in these motors. This design offers special benefits in motors with diameters above 1260 mm or for special geometrical requirements.

- Motor segments (primary parts) are easy to produce.
- The torque can be scaled using the number of segments.
- Very large diameters are economically viable.
- A redundant setup of torque motors in a segmental construction is therefore possible.
- Secondary parts can be segmented for movements less than 180°.
- Very suitable in small drives to reduce the moving masses.

In combination with HSR magnet systems, large segment motors are suitable for high-speed motors with large diameters.

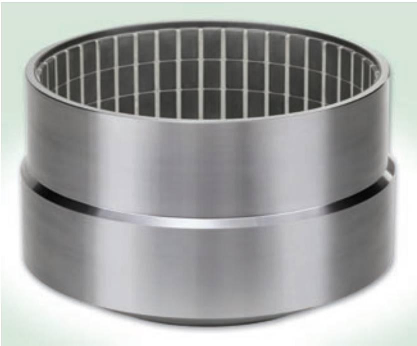
This design offers the following benefits:

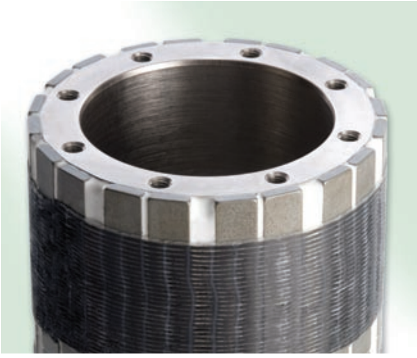
- Cost-effective segmental construction
- Variation in the number of segments
- Feasibility of large motors
- Redundant design possible
- Reduction in expenditure for service and maintenance
- Reduction in mass

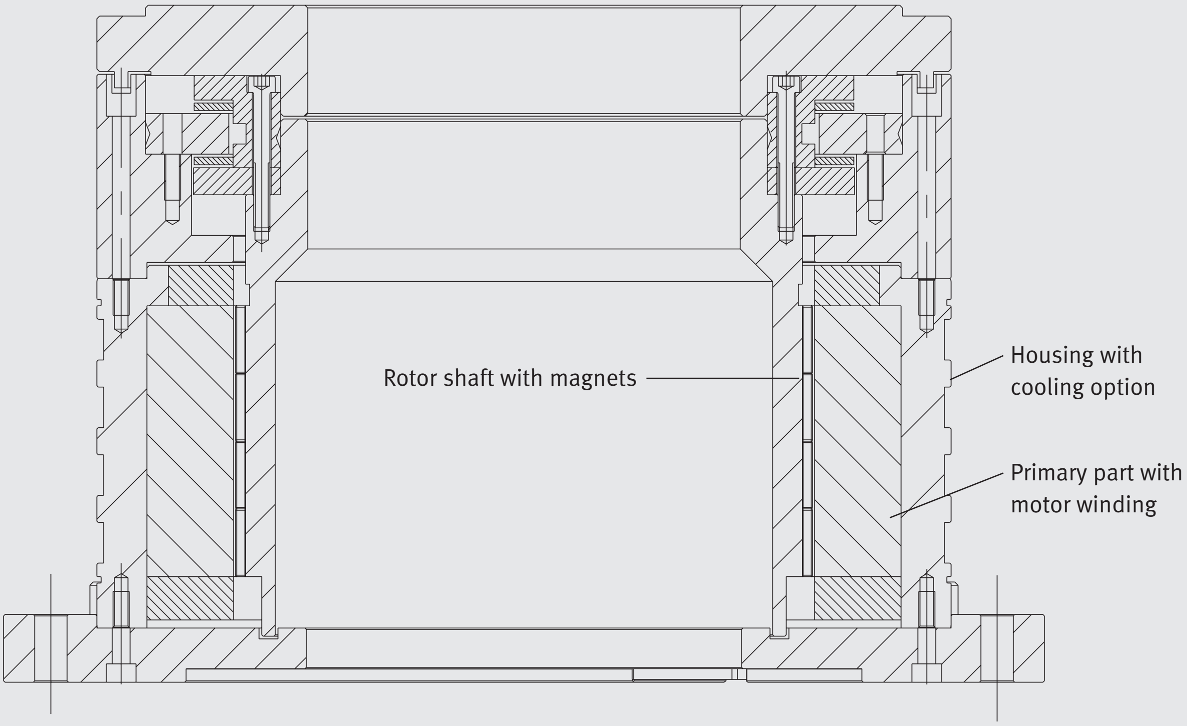
Motors in Special Design

Besides designing the motors as integrated motors, a functional integration of machine parts and motor parts can be implemented for customer-specific solutions. This gives the user the option for optimal integration in his machine.
The electromagnetic system for the primary part can be integrated in the housing of a rotary table or in a machine assembly without losing installation space.
The magnetic system for the secondary part can be directly applied to the shaft to be driven.

All technical data and dimensions can be referred to in the standard data sheets. Our engineers can provide you with intensive technical advice to support you in the successful implementation of your system.
The increased design outlay is economically viable even for small batch sizes. In any case, the advantages of the direct drive can be implemented extensively for the benefit of the performance.







Checklist for Your Enquiry

By fax to: +49 3681 7574-30

This checklist can also be found on our website at www.idam.de in the download centre.

Company	Contact person	Industry/project name
Telephone	**Fax**	**E-mail**

Short description

Motor ☐ **System** ☐ **Axis in multi-axis system** ☐

Spatial position of rotary axis

Type of weight counterbalance: ____________

Installation conditions for drive

(if necessary, sketch or drawing)

Max. installation dimensions [mm]: ____________

(length/width/height)

Mechanical interface: ____________

Required cable length from motor [m]: ____________

Ambient conditions

Temperature [K]: ____________

Contamination: ____________

Protection class (IP): ____________

Movement parameters

Angle of rotation φ [degrees]: ____________

Moment of inertia for additional mass [kgm^2]: ____________

Disturbance torque [Nm]: ____________

Maximum rotary speed [rpm]: ____________

Flutter [%] at rotary speed: ____________

Shortest acceleration or

deceleration time [ms]: ____________

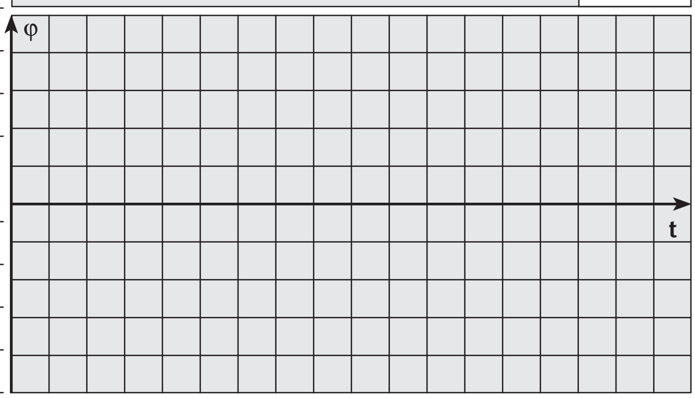
Overshoot in position [degrees]: ____________

Settling time [ms]: ____________

Typical cycle per time period (diagram): ____________

Service life/operating hours [h]: ____________

Sketch



Required accuracy

(if necessary, sketch or drawing)

For diameter [mm]: ____________

Radial accuracy [µm]: ____________

Axial accuracy [µm]: ____________

Cooling

Cooling permissible?

Yes ☐ No ☐

Oil ☐ Water ☐ Air ☐

Max. permissible heating of

Primary part [K]: ____________

Secondary part [K]: ____________

Controller

Available? Yes ☐ No ☐

DC link voltage [V_{DC}]: ____________

Controller type:

Components: Servo controller only ☐

Complete controller ☐

Positioning: point-to-point control ☐

path control ☐

Total cable length from motor to controller [m]: ____________

Interfaces: ____________

Options: ____________

Sketch

General information

Accessories: ____________

Unique piece ☐ Series ☐ Prototype for series ☐

Expected annual need: ____________

Planned series-production start: ____________

Price suggestion or

costs of previous solution: ____________

Desired date of quotation: ____________

Technical documentation

Medium: Paper ☐ CD ☐

Language: ____________

Further processing by: ____________ Date: ____________

Created by: ____________ Date: ____________

Feasibility checked by: ____________ Date: ____________

Technical Information and Advice

IDAM offers you cutting-edge technology and expert advice.
The IDAM application technicians will be happy to help you select the perfect drive for your application.

Get in contact with us.
Phone: +49 3681 7574-0

Automation/medical engineering
E-mail: idam.automation@schaeffler.com

Productronic/measuring technology
E-mail: idam.productronic@schaeffler.com

Production machinery/heavy industries
E-mail: idam.pm@schaeffler.com

Automotive
E-mail: idam.automotive@schaeffler.com

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E-mail: idam.finland@schaeffler.com

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E-mail: idam.israel@schaeffler.com

Italy
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E-mail: idam.italia@schaeffler.com

Japan
Phone: +81 45 274 8302
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Netherlands
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E-mail: idam.nederland@schaeffler.com

Russia
Phone: +7 495 7377660
E-mail: idam.russia@schaeffler.com

Singapore
Phone: +65 6540 8683
E-mail: idam.singapore@schaeffler.com

Spain/Portugal
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E-mail: idam.iberia@schaeffler.com

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E-mail: idam.taiwan@schaeffler.com

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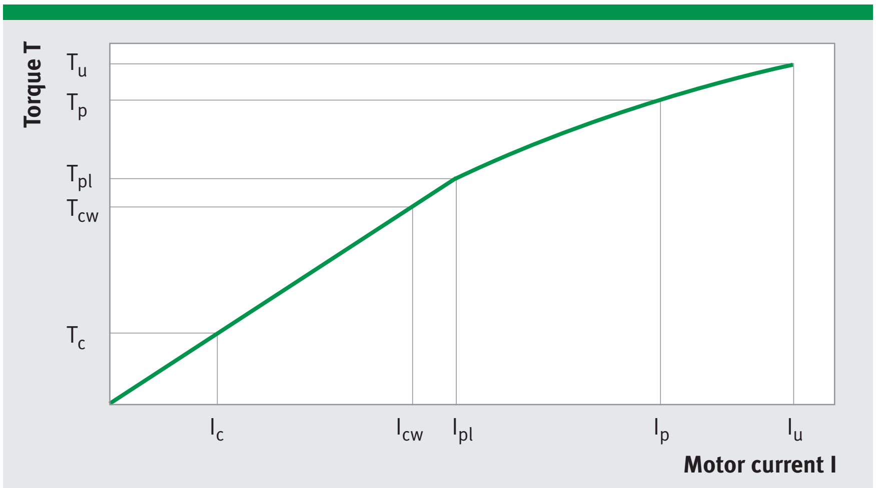
Glossary

Winding-independent parameters

Saturation behaviour

The torque initially increases linearly the more the effective current rises, goes into a curvature range and then increases more in a flatter linear way again. The curve is produced from the magnetic saturation of the overall magnetic circuit.



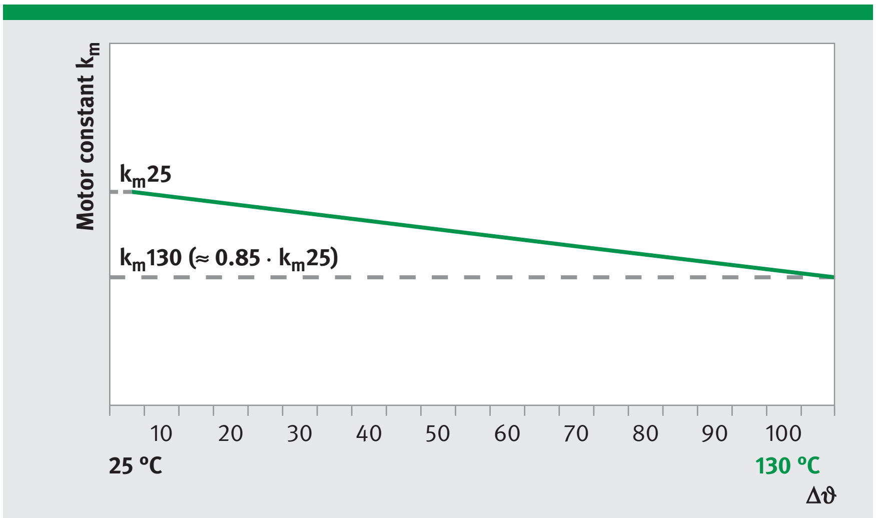
Torque curve depending on the current

Symbol	Meaning	Unit	Explanation
T_u	Ultimate torque	Nm	Ultimate torque with high saturation in the magnetic circuit. When this is exceeded, there is a risk of demagnetisation posed for the heated up motor (magnet temperature 80 °C) or thermal destruction within a very short period of time. It should not be used as a dimensioning size, but must be observed in the case of short-circuit braking.
T_p	Peak torque	Nm	Briefly (in seconds) producible peak torque at I_p which is reliably attained in the saturation range and at all operating temperatures. 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	Nm	Briefly (a few seconds) producible motor torque which is attained at the end of the linear modulation range at $I_{pl} \cdot k_T$.
T_c	Continuous torque, not cooled	Nm	Continuous motor torque at continuous current I_c at which the motor can be used for thermally stable running without cooling, but is heated up in doing so.
T_{cw}	Continuous torque, cooled	Nm	Motor torque at I_{cw} which is available as a continuous torque in nominal operation with water cooling and where a temperature gradient of approx. 100 K is set between the winding and cooling.

Symbol	Meaning	Unit	Explanation
T_s	Stall torque	Nm	Stall torque when the motor is stationary and with a control frequency up to approx. 1 Hz which is produced with the respective stall current owing to the uneven power distribution in the individual motor phases.
P_l	Power loss	W	The thermal output produced in the motor winding which leads to a time-dependent increase in temperature depending on the operational mode (current) and the ambient conditions (cooling). In the upper modulation range (at T_p), P_l is especially high because of the quadratic dependence on the current, while in the continuous current range, only relatively low heating occurs. P_l is calculated with the help of the motor constant k_m for one movement section using the required torque T: $P_l = (T/k_m)^2$
P_{lp}	Power loss	W	Peak power loss at I_p
P_{lpl}	Power loss	W	Peak power loss at I_{pl}
P_{lc}	Power loss	W	Power loss at I_c
P_{lw}	Power loss	W	Power loss at I_{cw}
ϑ	Winding temperature	°C	Permissible winding temperature recorded by sensors with a specified offset. The motor surface temperature being set depends on • The specific installation conditions (dimensions of machine construction) • Heat dissipation conditions • Operational mode and thus on the mean power used and can only be determined when this fact is known.
R_{th}	Thermical resistance	K/W	Thermical resistance which is used to be able to determine the temperature difference between winding and housing, or the cooling basis for specific power loss.
τ_{el}	Electrical time constant	ms	Electrical time constant which describes the L/R ratio. The ratio is approximately constant, irrespective of the winding design. The effective time constant in terms of the control technology is less, depending on the degree of excess voltage.

Symbol	Meaning	Unit	Explanation
k_m	Motor constant	$Nm/\sqrt{W}$	The motor constant which conveys the relation between generated torque and power loss, thus the efficiency. It depends on the temperature and is only completely accurate during static operation as well as in the linear modulation range of the motor, e.g. in positioning procedures at low speeds. At a winding temperature of 130 °C, it goes back to about 0.85 of the value.
T_r	Ripple torque	Nm	Ripple torque as the sum of torques caused by reluctance (cogging) which is effective in the direction of rotation when the de-energised motor is moving and operates as the ripple-torque during operation.

Thermal behaviour



k_m25 depending on the temperature

- k_m is a motor constant which conveys the relation between the generated torque and power loss.
- It depends on the temperature.

A temperature rise means that the winding resistance increases, which entails a reduction in the k_m.

At 130 °C, the motor constant goes back to about 0.85 of the value (see diagram). When the current or torque is constant, then an increased power loss is generated in the already heated up motor in comparison to a motor that is still cold. This leads to an even higher motor temperature.

Glossary
Winding-dependent parameters

Symbol	Meaning	Unit	Explanation
k_T	Torque constant	Nm/A_{rms}	Torque constant, which, when multiplied by the current, produces a resulting motor torque in the linear modulation range: $T_c = I_c \cdot k_T$
k_u	Back EMF constant	V/(rad/s)	Voltage constant, which (in generator operation), when multiplied by the speed, produces the armature countervoltage resulting at the motor terminals: $U_{EMF} = k_u \cdot n$
n_{lp}	Limiting speed	rpm	Winding-dependent speed limit without taking the dynamic heat losses into account when the peak current I_p and no field weakening are used. The torque for the motor drops after this point.
n_{lw}	Limiting speed	rpm	Winding-dependent speed limit without taking the dynamic heat losses into account when the water-cooled continuous current I_{cw} and no field weakening are used. The torque for the motor drops after this point.
n_{lc}	Limiting speed	rpm	Winding-dependent speed limit without taking the dynamic heat losses into account when the air-cooled continuous current I_c and no field weakening are used. The torque for the motor drops after this point.
n_{cr}	Limiting speed	rpm	Speed limit under consideration of the additional frequency-dependent heat losses (caused by eddy currents and change in magnetisation losses). Continuous, water-cooled operation at speed n_{cr} is possible if the permissible current is approx. 45% of the water-cooled continuous current I_{cw}. The speed n_{cr} at current I_{cw} is possible for a duty cycle of approx. 20%. To attain a duty cycle of 100% with current I_{cw}, a speed reduction to approx. 0.2 x n_{cr} is required. The torque (current) or the duty cycle for speed n_{cr} can be increased by using a special winding variant (Z winding).
U_{DCL}	DC link voltage	V	Direct current link voltage or supply voltage of the power controlling elements. The higher the speed and associated increasing countervoltage and frequency-dependent losses are, the greater this voltage has to be.
R_{25}	Winding resistance	Ω	Winding resistance at 25 °C. At 130 °C, it increases to approx. 1.4 times this value.

Symbol	Meaning	Unit	Explanation
I_u	Ultimate current	A_{rms}	Ultimate current at which the magnetic circuit has high saturation. It is determined either by the maximum current density in the winding or by the incipient risk of demagnetisation at a magnet temperature of 80 °C (see also T_u).
I_p	Peak current	A_{rms}	Peak effective current in the iron saturation range and should be used as the dimensioning size (see also T_p). When the rotor is only moderately warm (magnet temperature max. 60 °C) and for pulsed mode (max. 1 s), I_p can be increased to the limit value I_u.
I_{pl}	Peak current, linear range	A_{rms}	Effective peak current up to which an approximately proportional torque curve occurs.
I_c	Continuous current, not cooled	A_{rms}	Effective continuous current at which the associated power loss leads to relatively low heating of the motor without forced cooling, depending on the size of the fastening base.
I_{cw}	Continuous current, cooled	A_{rms}	Effective continuous current which is permissible during continuous operation with water cooling.
I_s	Stall current	A_{rms}	Effective stall current when the motor is stationary and with control frequencies up to approx. 1 Hz. Owing to the varying power distribution in the motor phases, the motor current must be reduced to this value to prevent local overheating, if no noticeable movement takes place across a pole pair.

Overview of Publications

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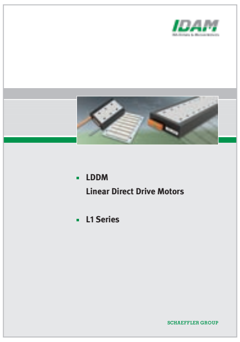
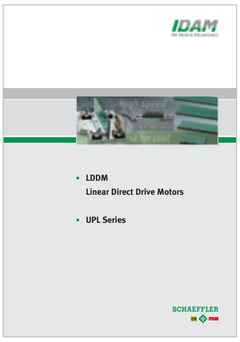
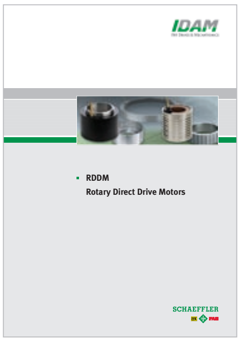


LDDM – Linear direct drive motors: L1 series

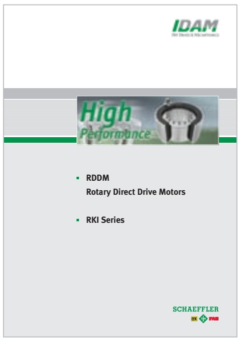
LDDM – Linear direct drive motors: L2U series



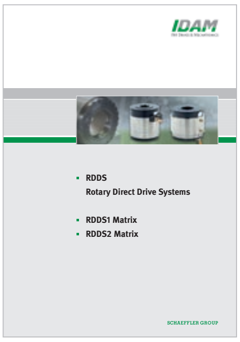
LDDM – Linear direct drive motors: UPL series



RDDM – Rotary direct drive motors



RDDM – Rotary direct drive motors: RKI series



RDDS – Rotary direct drive systems

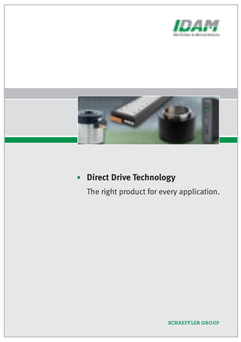


Image brochure IDAM direct drive technology

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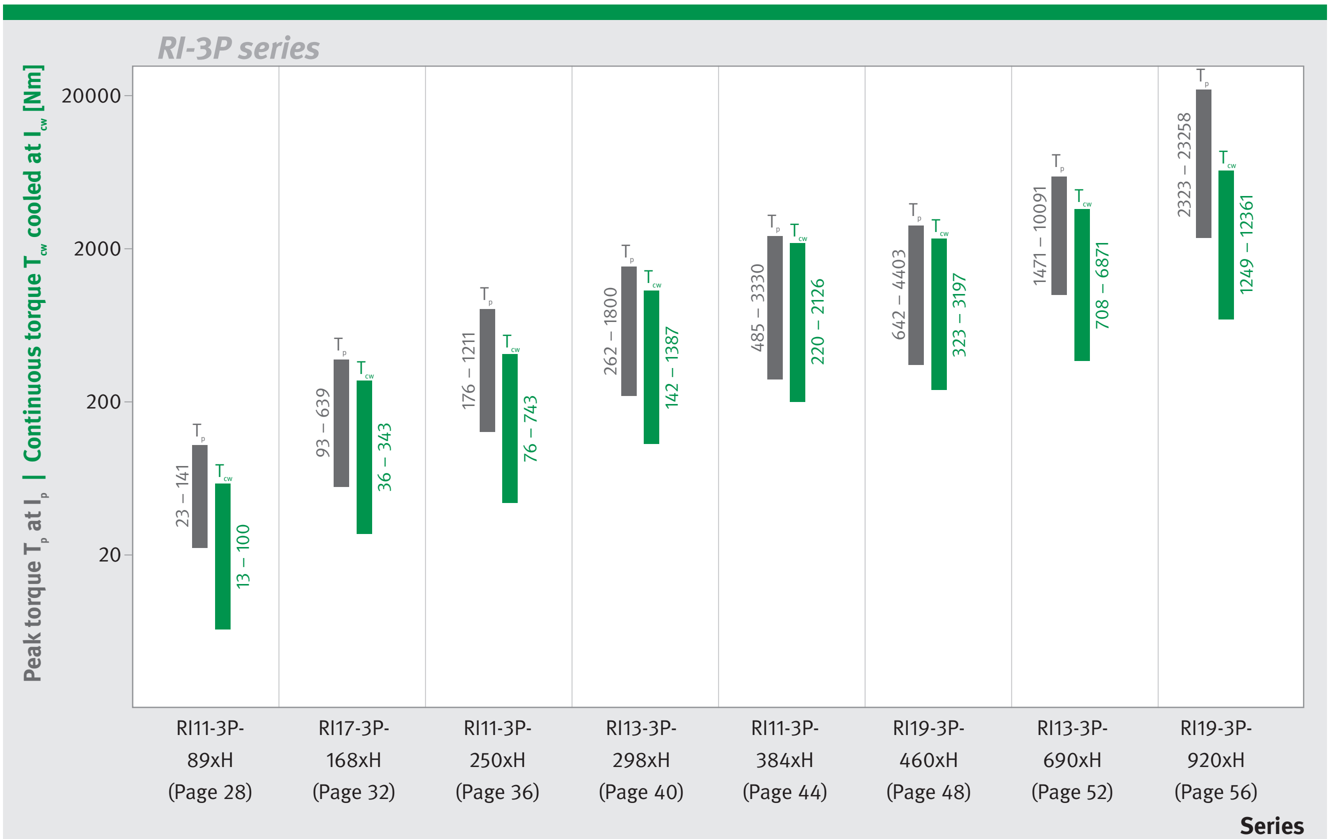
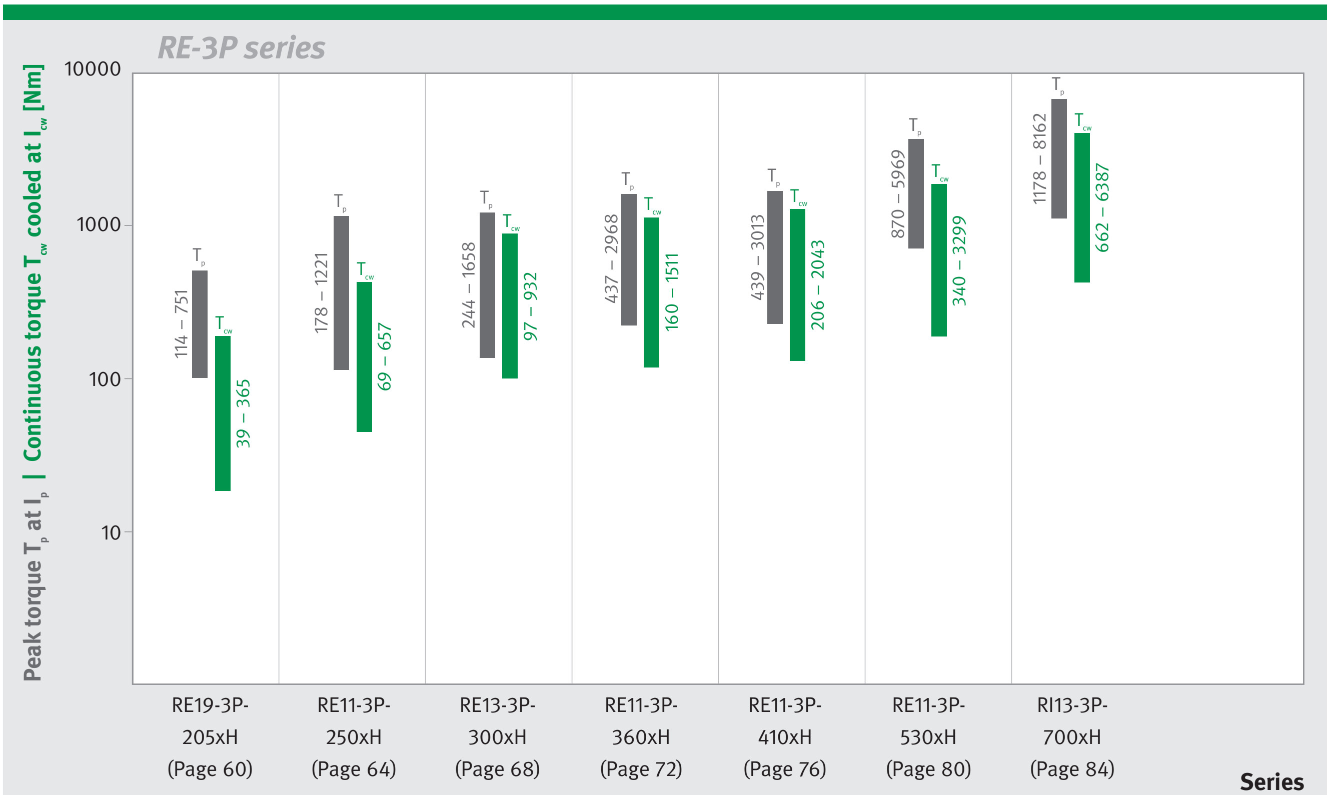
At a Glance: Torque Ranges of the RI/RE Motors

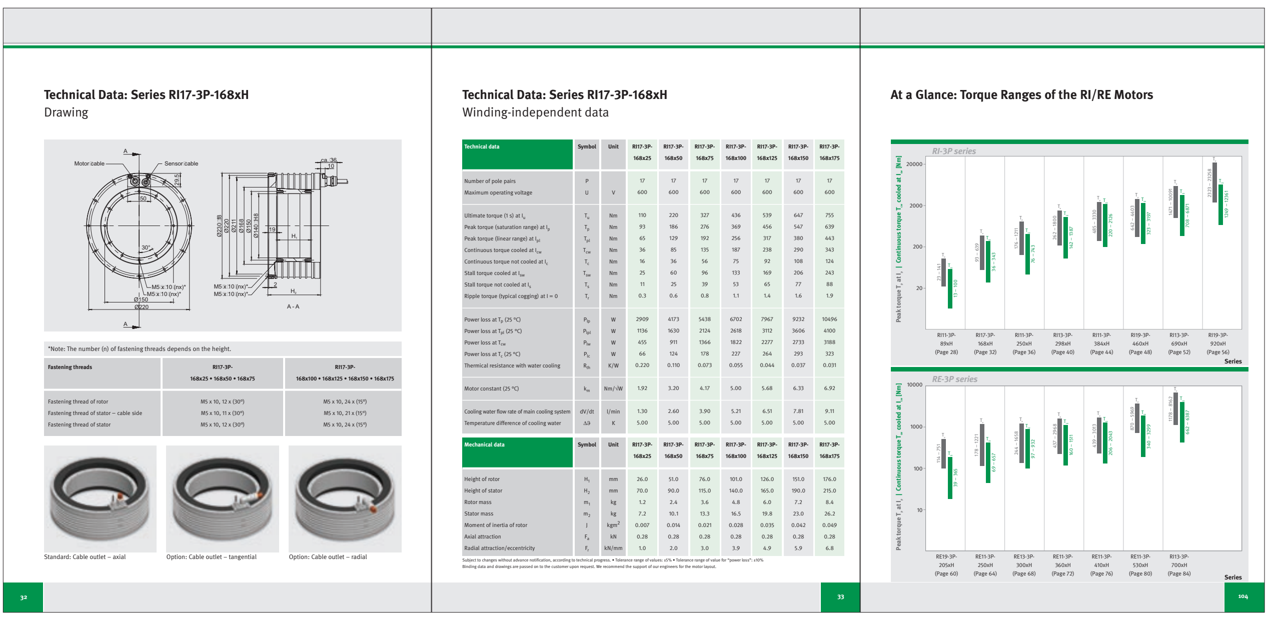




At a Glance: Torque Ranges of the RI/RE Motors

To facilitate the selection of the rotary motor best suited for your application, you can see the peak torques and continuous torques for all RI and RE motors at a glance.

To do this, please open up this page.



INA – Drives & Mechatronics AG & Co. KG
Mittelbergstrasse 2
98527 Suhl, Germany

Phone +49 3681 | 7574-0
Fax +49 3681 | 7574-30

E-mail idam@schaeffler.com
Web www.idam.de

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