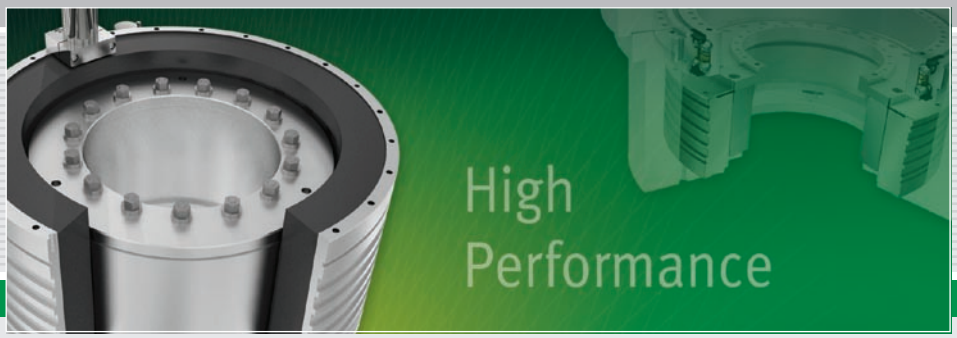
IDAM

INA Drives & Mechatronics



Torque Motors

RKI Series

SCHAEFFLER

LuK INA FAG

IDAM Direct Drives: Precise. Fast. Efficient.

INA – Drives & Mechatronics AG & Co. KG, a member of the Schaeffler Group, is a specialist in 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. This allows maintenance and operating costs to be reduced whilst also increasing availability.
Teams at IDAM have been developing and producing direct drives and complex drive systems for the following sectors: machine tools and production machinery, automation, productronics/semicon, measuring technology and medical engineering for over 20 years.
Models and simulations are integrated into the development process for direct drives and positioning systems, making the process more efficient.
IDAM has a state-of-the-art 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.

ZERTIFIKAT ◆ CERTIFICATE ◆

TÜV SÜD Management Service

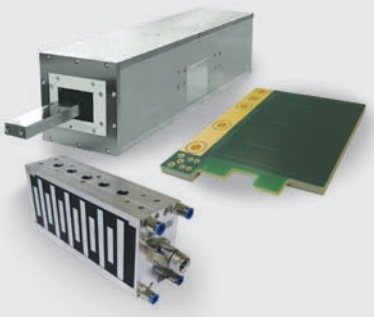
CERTIFICATE
ISO 9001:2008

EMAS
VERIFIED
ENVIRONMENTAL
MANAGEMENT
DE-158-00016

INTECHNICA
FUTURE SECURE BUSINESS GROWTH

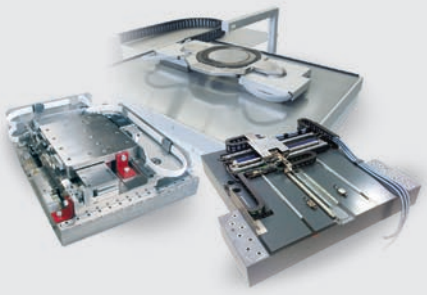
Certificate
ISO 14001

IDAM uses specially developed tools to develop and design the motors, including tools for magnetic, mechanical and thermal simulation. This produces results that our customers can use to optimise their subsequent designs.



Linear direct drives

Rotary direct drives



Multi-axis positioning systems

Contents

Benefits of Rotary Direct Drives

Performance

1. No conversion of the motion form
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. 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.

4. Energy efficiency
Heat is reduced to a minimum, thus saving energy in the frequency converter and heat exchanger.

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 can 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

RKI Torque Motors

Features, advantages, applications

Features

- Slotted, permanent magnet excited AC synchronous direct drive motors
- High performance internal rotor
- Static and dynamic load rigidity
- Very good synchronisation
- Best values of motor constant
- Downsizing possible
- Performance upgrade for existing torque motor applications
- Less cooling capacity necessary
- Eddy current losses are reduced to a minimum
- Magnetic flux will be increased by a special magnetic configuration

Advantages

Compared to standard motors (internal rotor):

- **+30%** more torque
- **+400%** more speed
- **+500%** more mechanical power output
- **-60%** less power loss
- Up to **60%** lower TCO (Total Costs of Ownership)

Applications

- Rotary tables for turning and milling
- Swiveling axes
- Workpiece spindles
- Automation technology
- Printing and packaging machines
- Presses
- In machine tools as CNC axis
- High-precision positioning applications

RKI Torque Motors

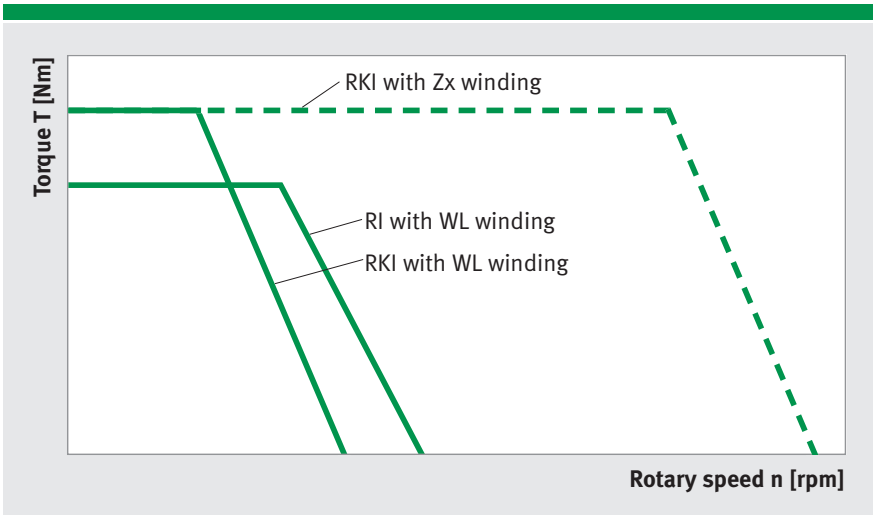
Design, torque, cogging torques, active force pulsation

The RKI rotary direct drive differs primarily from the standard RI series due to its innovative rotor design. This results in two effects. On one hand the magnetic field is concentrated and an increased force which is increased up to approximately 30% generated in the air gap. The increased force results in a proportionally higher torque for the same otherwise unchanged stator design and same current load.
On the other hand, this innovative rotor design drastically reduces core loss and magnetic flux leakage in the rotor. For rotors which are normally not cooled, it is prerequisite for considerably higher rotary speeds (up to around factor 4) compared to standard torque motors.

Higher torques and higher rotary speeds result in higher power outputs:
$P_{mech} = T \times n$.
As a rule, higher performance converters are required to operate RKI motors with a higher base current (see also winding adaptations on page 7).

The magnetic circuits of the RKI motors have been optimised using FEM calculations such that disruptive cogging torques have been eliminated as far as possible when in the zero-current state. They are therefore practically not relevant for most applications.

Even when active force pulsation (torque fluctuations) occurs during active current feed, the values for all motor series have been reduced to below 1% of the respective reference torque.
RKI motors therefore offer an advantageous combination of high power output and very good synchronous features, i.e. the significant prerequisites for demanding applications in mechanical engineering.



Comparison of the torque and the rotary speed of the RI and RKI series with different windings

RKI Torque Motors
Winding adaptation, efficiency

As a rule, the winding of each RKI torque motor has to be adapted to the application (T-n operating points) and to the most frequently specified current and voltage limits. It is only in this way that the main features listed previously will be able to show their full advantage.

Depending on its rotary speed, each motor induces a counter voltage which is proportional to the generated torque in the linear modulation range. The voltage constant is a measure for the induced voltage and, in addition to inductivity, is an important influencing factor for the voltage requirement of the motor at a given rotary speed.

As the operating voltage of 600 V_{DCL} (intermediate circuit voltage) is given by the converter, the voltage constant has to be adapted for more powerful and faster motors.
The torque can be maintained up to the so-called limiting speed (also transition speed or operating speed for field weakening). It would then rapidly drop without further field weakening.

The voltage constant and/or the proportional torque constant is adapted to all basic conditions (also inductivity and resistance) by modifying the number of windings and winding cross-section or by changing the internal winding connection.

For example:
Halving the number of windings at the same torque, the same intermediate circuit voltage and the same dissipation leads to a doubling of the power requirement with double the winding cross-section.
At the same current density, inductivity and electrical resistance drop to a quarter, whereby the electrical time constant L/R remains constant.

The higher current level at higher rotary speeds and/or the necessity for field weakening from the limiting speed (transition speed) is of importance for the user.

Direct comparison of an RI standard motor series with WL winding against the RKI series with the same WL winding reveals that the achievable rotary speed drops for this version of the RKI series.

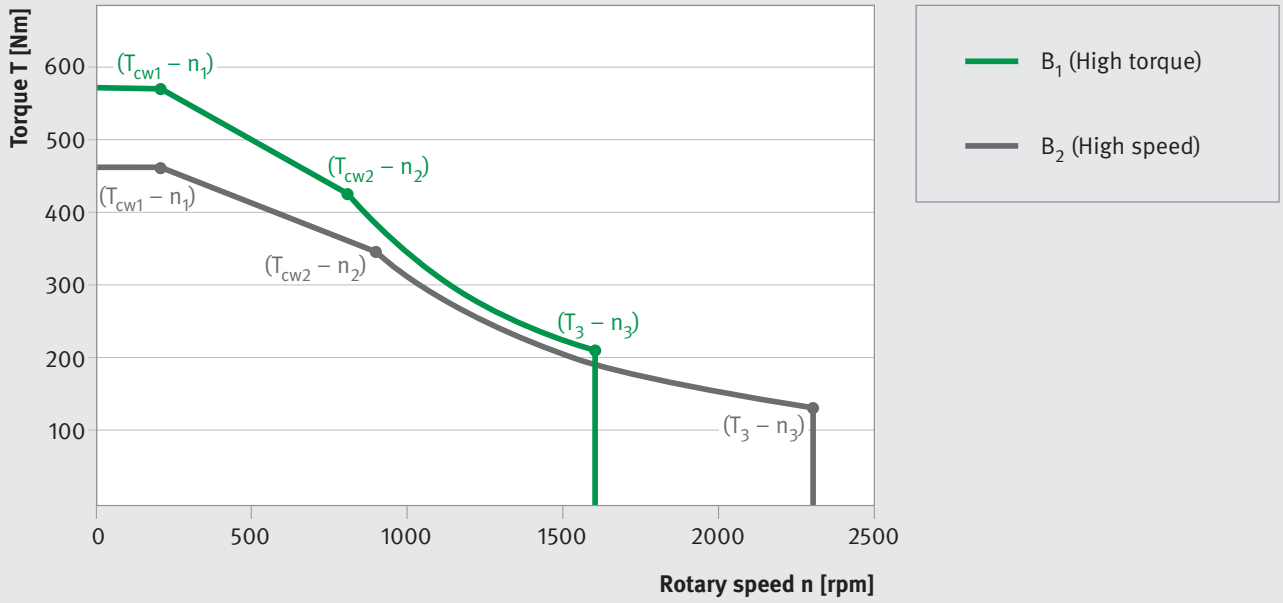
The RKI series with high current winding Zx on the other hand makes a higher torque and a considerably increased rotary speed possible. Adapting the winding can result in a five-fold increase in mechanical power output.

A further significant improvement can be observed, even when only observing efficiency and consequently the heat loss at a delivered torque. A direct comparison is possible using the motor constant. The motor constant k_m (Nm/√W) states how much warmth is generated at a specific torque. The power loss in W is $P_l = (T/k_m)^2$. This means a four-fold loss when constant k_m is halved.

A comparison of the RI and RKI series shows that up to 60% of the power loss can be saved at the same delivered torque. Less warmth is generated and less cooling is therefore required. This in turn means lower operating costs (TCO).

Torque-Rotary Speed Characteristic

Example: RKI5-230x100



T(n) diagram using RKI5-230x100 as an example

The T(n) diagram considers the current and speed dependent total losses of the motor and associated torque and rotary speed limitations independently of the actual winding design. The torque curves, which are possible for a short period due to the winding, can lie considerably above these thermal limiting curves.

The motor losses comprise current-dependent copper losses in the winding and rotary speed and current-dependent core losses in the stator and the rotor. The torque must be reduced as the rotary speed increases to ensure a constant balance between the total losses and the permissible motor temperature with required stator water cooling.

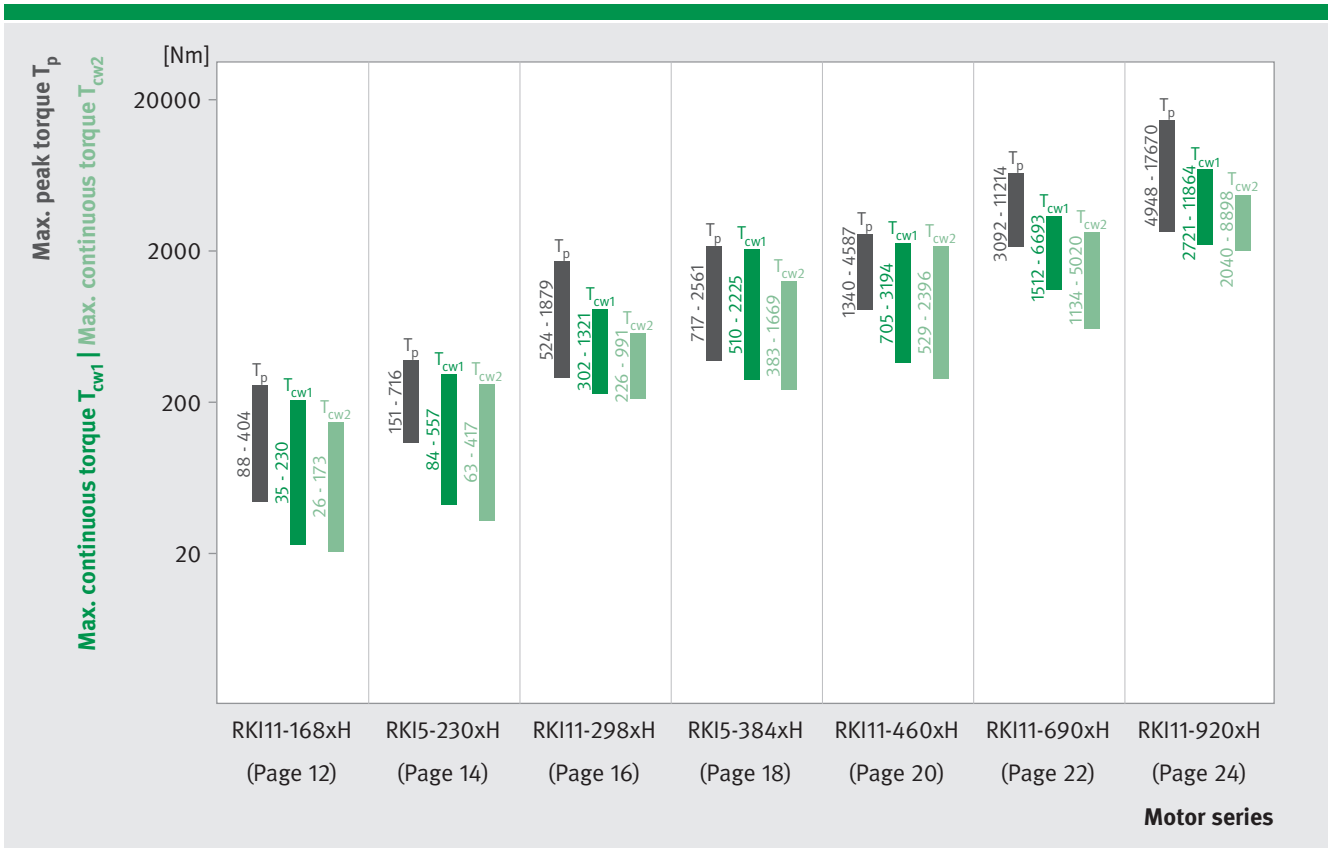
The static continuous torque T_{cw1} can be maintained up to rotary speed n_1. Up to rotary speed n_2, the continuous torque is to be reduced by reducing the current to T_{cw2} when core losses are increasing.

Under the precondition that the rotary speed n_2 approximately corresponds to the operating speed for field weakening, the motor can be operated from this operating point ($T_{cw2} – n_2$) at constant power output and thus with approximately constant total losses up to rotary speed n_3. The torque drops according to the equation $T = P_{cont} / n$ to the value T_3. Winding dependent limitations can be superimposed on this thermally conditioned torque curve.

The curves for B_1 or B_2 consider the pre-magnetisation range for different types of magnets fitted to the rotor.

RKI Series

Torque ranges



Designation

RKI series, primary part

XXXXX - 3P - DxH - X - X - X - X - PRIM

Short designation of motor type

RKI RKI series, high performance internal running motor

Model code

Number of motor phases

3P 3-phase

Dimensions

Effective diameter air gap x active height (mm)

Winding types

WLx Low speed, low current requirement

WMx Medium speed

WHx High speed, high current requirement

XXX Other winding designs on request

Temperature monitoring

O Standard (2 monitoring circuits)

S Special design on request

Commutation type

O Without sensors, measuring system commutated

S Special design on request

Model variant

O Ring provided by the customer

M Complete motor (parts are manufactured by IDAM)

K Stator ring with cooling plus additional jacket and O-ring seals

Motor part

PRIM Primary part

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

Designation

RKI series, secondary part

XXXXX - 3P - DxH - SEK - RXX

Short designation of motor type

RKI RKI series, high performance internal running motor

Model code

Number of motor phases

3P 3-phase

Dimensions

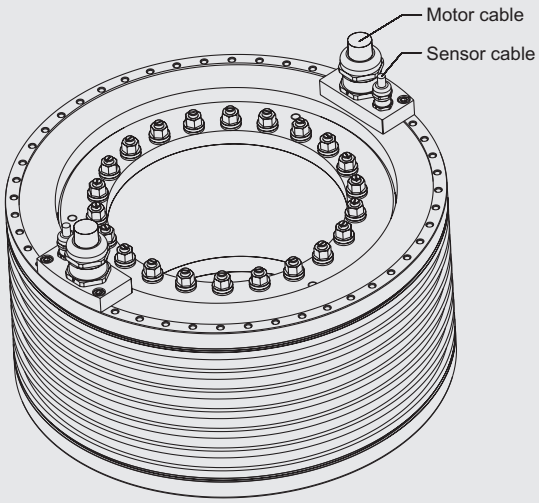
Effective diameter air gap x active height (mm)

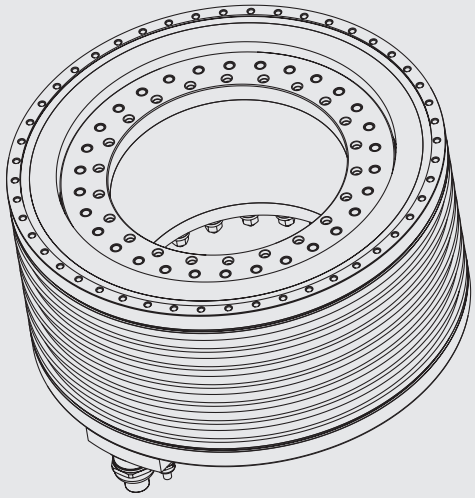
Motor part

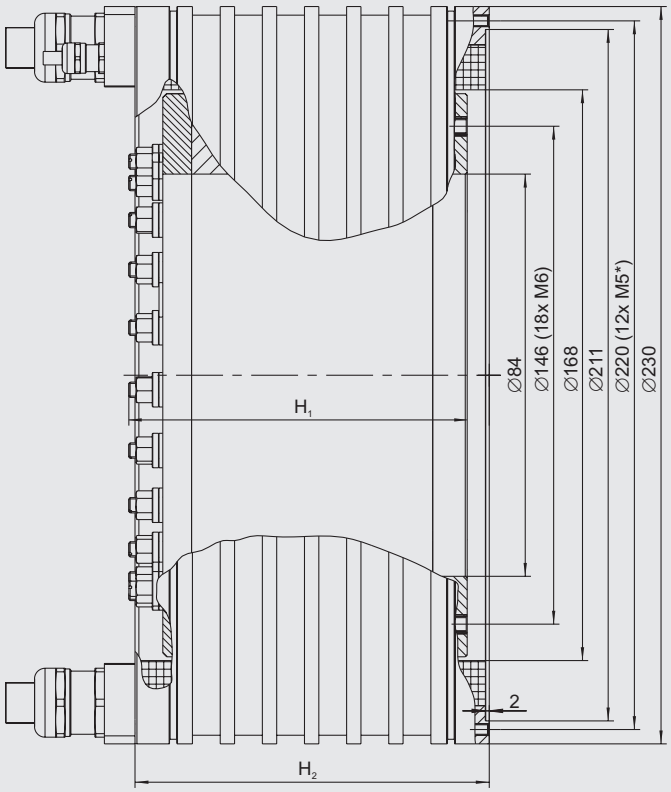
SEK Secondary part

Magnetic configuration

RKI11-168xH
Drawing







*Note: The number of threads is doubled from the height of 100 mm.

Mechanical interfaces	Symbol	Unit	RKI11-168x25	RKI11-168x50	RKI11-168x100
Height of rotor	H_1	mm	68	93	143
Height of stator	H_2	mm	70	95	145
Inertia of rotor	J	kgm^2	0.020	0.033	0.061

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

RKI11-168xH

Technical data (dimensioning examples)

Technical data	Symbol	Unit	RKI11-168x25 (High torque)	RKI11-168x25 (High speed)	RKI11-168x50 (High torque)	RKI11-168x50 (High speed)	RKI11-168x100 (High torque)	RKI11-168x100 (High speed)
Number of pole pairs	P		11	11	11	11	11	11
Ultimate torque (1 s) at I_u	T_u	Nm	117	103	233	207	466	413
Max. peak torque (saturation range)	T_p	Nm	101	88	202	176	404	351
Max. continuous torque (up to n_1 - cooled)	T_{cw1}	Nm	43	35	103	83	230	187
Max. continuous torque (up to n_2 - cooled)	T_{cw2}	Nm	32	26	77	63	173	140
Torque at n_{max} (cooled)	T_3	Nm	16	11	39	26	86	58
Max. stall torque (cooled)	T_{sw}	Nm	31	25	73	59	164	133
Ripple torque (cogging, reluctance torque)	T_r	Nm	0.3	0.3	0.6	0.5	1.2	1.1
Power loss (copper) at T_p (130 °C)	P_{lp}	W	3570	3522	5058	4989	8033	7924
Power loss (copper) at T_{cw1} (120 °C)	P_{lw}	W	455	455	911	911	1822	1822
Motor constant (25 °C)	k_m	Nm/√W	2.56	2.08	4.31	3.50	6.84	5.56
Electrical time constant	τ_e	ms	5.3	4.1	7.4	5.8	9.4	7.3
Water flow (cooling)	dV/dt	l/min	1.9	1.9	3.7	3.7	7.4	7.4
Water temperature difference (cooling)	$\Delta\vartheta$	K	3.5	3.5	3.5	3.5	3.5	3.5
Max. DC link voltage	$U_{DCL-max}$	V_{DC}	650	650	650	650	650	650
Max. continuous current (speed dependent)	I_{cw}	A_{rms}	60.0	60.0	60.0	60.0	60.0	60.0
Dynamic specific values (thermally conditioned)								
Limiting speed for T_{cw1}	n_1	rpm	273	273	273	273	273	273
Limiting speed for T_{cw2}	n_2	rpm	1091	1227	1091	1227	1091	1227
Max. speed for P_{cont} = constant	n_{max}	rpm	2182	3000	2182	3000	2182	3000
Max. continuous power output (in field weakening)	P_{cont}	kW	3.7	3.4	8.8	8.0	19.7	18.1

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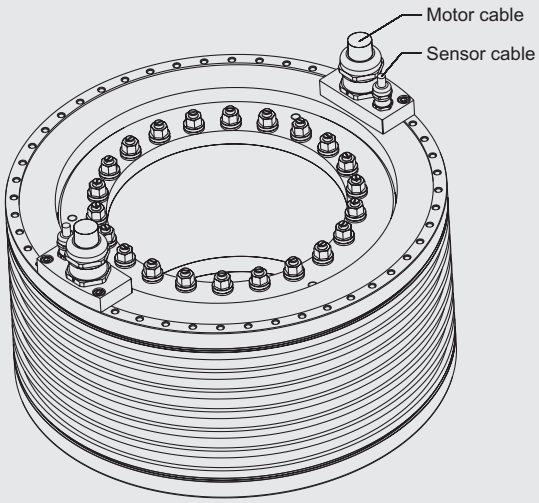
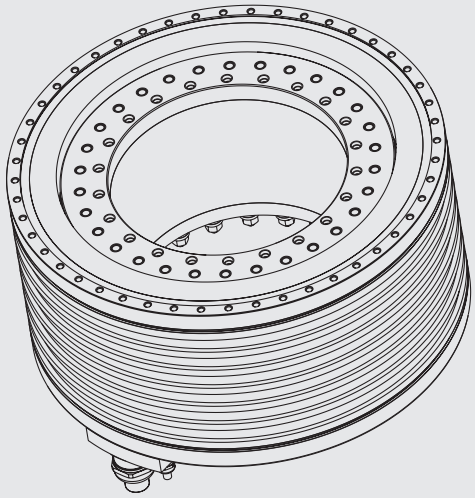
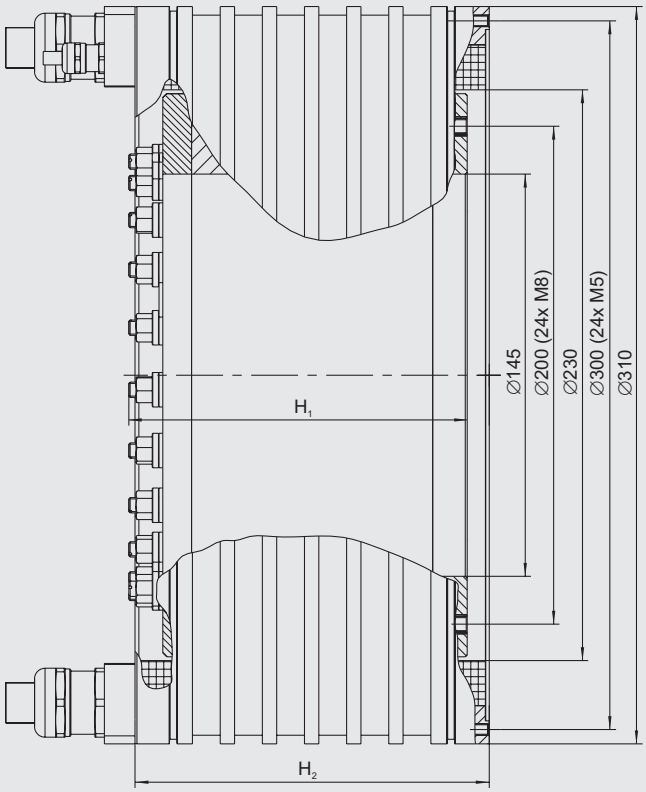
RKI5-230xH

Drawing







Mechanical interfaces	Symbol	Unit	RKI5-230x25	RKI5-230x50	RKI5-230x100
Height of rotor	H_1	mm	65	90	140
Height of stator	H_2	mm	70	95	145
Inertia of rotor	J	kgm^2	0.061	0.104	0.189

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RKI5-230xH

Technical data (dimensioning examples)

Technical data	Symbol	Unit	RKI5-230x25 (High torque)	RKI5-230x25 (High speed)	RKI5-230x50 (High torque)	RKI5-230x50 (High speed)	RKI5-230x100 (High torque)	RKI5-230x100 (High speed)
Number of pole pairs	P		15	15	15	15	15	15
Ultimate torque (1 s) at I_u	T_u	Nm	208	176	415	351	831	702
Max. peak torque (saturation range)	T_p	Nm	179	151	358	301	716	603
Max. continuous torque (up to n_1 - cooled)	T_{cw1}	Nm	104	84	248	200	557	450
Max. continuous torque (up to n_2 - cooled)	T_{cw2}	Nm	78	63	186	150	417	337
Torque at n_{max} (cooled)	T_3	Nm	39	26	93	61	209	138
Max. stall torque (cooled)	T_{sw}	Nm	74	60	176	142	395	319
Ripple torque (cogging, reluctance torque)	T_r	Nm	0.5	0.5	1.1	0.9	2.1	1.8
Power loss (copper) at T_p (130 °C)	P_{lp}	W	3288	3288	4658	4658	7398	7398
Power loss (copper) at T_{cw1} (120 °C)	P_{lw}	W	628	628	1256	1256	2513	2513
Motor constant (25 °C)	k_m	Nm/√W	5.27	4.26	8.86	7.16	14.07	11.36
Electrical time constant	τ_e	ms	6.1	7.9	8.6	11.2	10.9	14.1
Water flow (cooling)	dV/dt	l/min	2.6	2.6	5.1	5.1	10.3	10.3
Water temperature difference (cooling)	$\Delta\vartheta$	K	3.5	3.5	3.5	3.5	3.5	3.5
Max. DC link voltage	$U_{DCL-max}$	V_{DC}	650	650	650	650	650	650
Max. continuous current (speed dependent)	I_{cw}	A_{rms}	80.0	80.0	80.0	80.0	80.0	80.0
Dynamic specific values (thermally conditioned)								
Limiting speed for T_{cw1}	n_1	rpm	200	200	200	200	200	200
Limiting speed for T_{cw2}	n_2	rpm	800	900	800	900	800	900
Max. speed for P_{cont} = constant	n_{max}	rpm	1600	2200	1600	2200	1600	2200
Max. continuous power output (in field weakening)	P_{cont}	kW	6.6	6.0	15.6	14.2	35.0	31.8

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±10%
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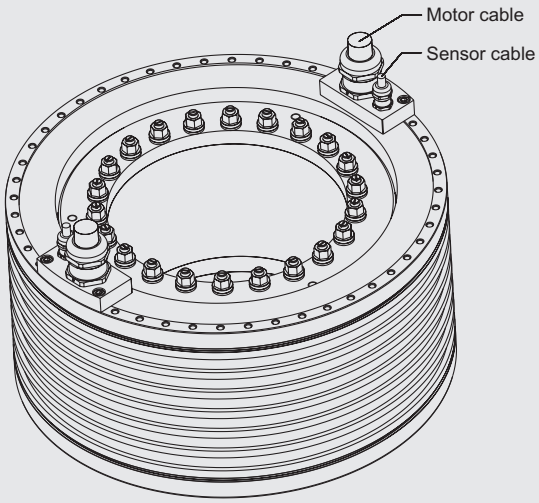
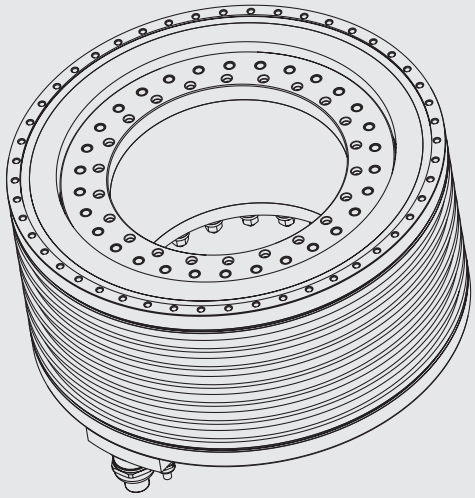
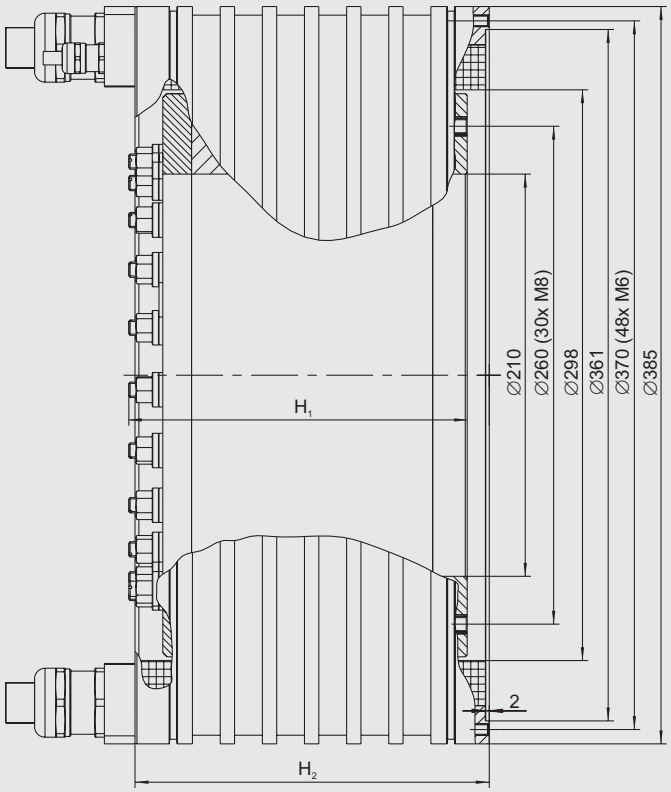
RKI11-298xH

Drawing







Mechanical interfaces	Symbol	Unit	RKI11-298x50	RKI11-298x100	RKI11-298x150
Height of rotor	H_1	mm	100	150	200
Height of stator	H_2	mm	110	160	210
Inertia of rotor	J	kgm^2	0.29	0.51	0.74

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RKI11-298xH

Technical data (dimensioning examples)

Technical data	Symbol	Unit	RKI11-298x50 (High torque)	RKI11-298x50 (High speed)	RKI11-298x100 (High torque)	RKI11-298x100 (High speed)	RKI11-298x150 (High torque)	RKI11-298x150 (High speed)
Number of pole pairs	P		22	22	22	22	22	22
Ultimate torque (1 s) at I_u	T_u	Nm	731	605	1461	1209	2192	1814
Max. peak torque (saturation range)	T_p	Nm	626	524	1252	1048	1879	1572
Max. continuous torque (up to n_1 - cooled)	T_{cw1}	Nm	375	302	842	677	1321	1063
Max. continuous torque (up to n_2 - cooled)	T_{cw2}	Nm	281	226	631	508	991	797
Torque at n_{max} (cooled)	T_3	Nm	141	93	316	208	496	326
Max. stall torque (cooled)	T_{sw}	Nm	266	214	598	481	938	755
Ripple torque (cogging, reluctance torque)	T_r	Nm	1.9	1.6	3.8	3.1	5.6	4.7
Power loss (copper) at T_p (130 °C)	P_{lp}	W	6739	6739	10703	10703	14667	14667
Power loss (copper) at T_{cw1} (120 °C)	P_{lw}	W	1559	1559	3117	3117	4676	4676
Motor constant (25 °C)	k_m	Nm/√W	10.55	8.49	16.75	13.48	21.46	17.27
Electrical time constant	τ_e	ms	9.5	9.5	12.0	12.0	13.1	13.1
Water flow (cooling)	dV/dt	l/min	6.4	6.4	12.7	12.7	19.1	19.1
Water temperature difference (cooling)	$\Delta\vartheta$	K	3.5	3.5	3.5	3.5	3.5	3.5
Max. DC link voltage	$U_{DCL-max}$	V_{DC}	650	650	650	650	650	650
Max. continuous current (speed dependent)	I_{cw}	A_{rms}	80.0	80.0	80.0	80.0	80.0	80.0
Dynamic specific values (thermally conditioned)								
Limiting speed for T_{cw1}	n_1	rpm	136	136	136	136	136	136
Limiting speed for T_{cw2}	n_2	rpm	545	614	545	614	545	614
Max. speed for P_{cont} = constant	n_{max}	rpm	1091	1500	1091	1500	1091	1500
Max. continuous power output (in field weakening)	P_{cont}	kW	16.1	14.5	36.1	32.6	56.6	51.2

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±10%
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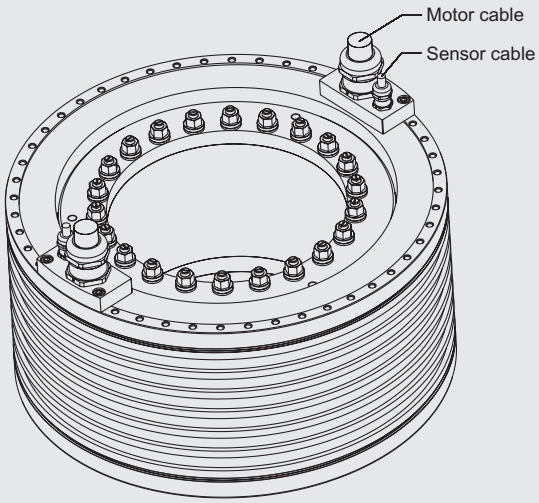
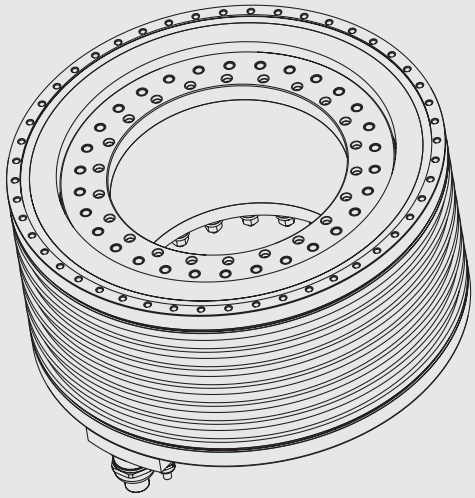
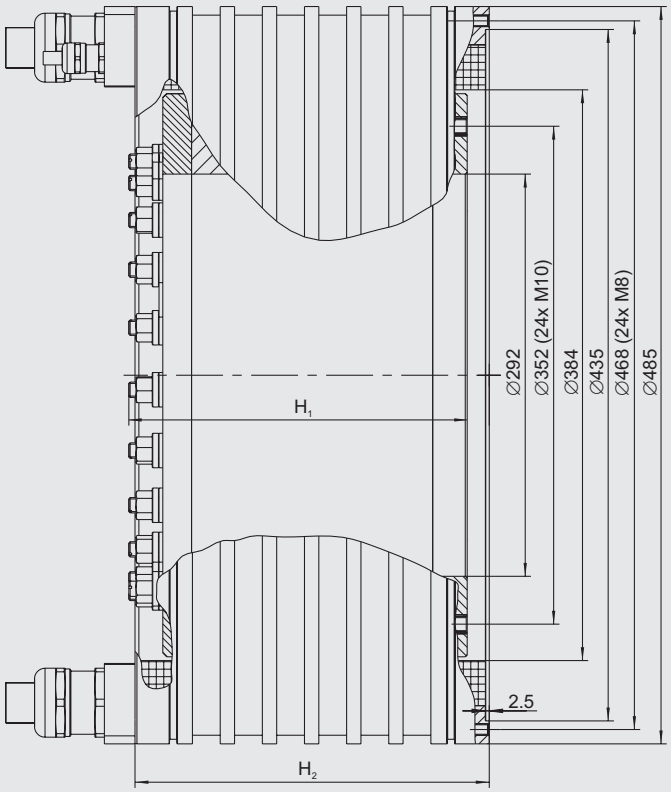
RKI5-384xH

Drawing







Mechanical interfaces	Symbol	Unit	RKI5-384x50	RKI5-384x100	RKI5-384x150
Height of rotor	H_1	mm	103	153	203
Height of stator	H_2	mm	110	160	210
Inertia of rotor	J	kgm^2	0.69	1.23	1.77

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

RKI5-384xH

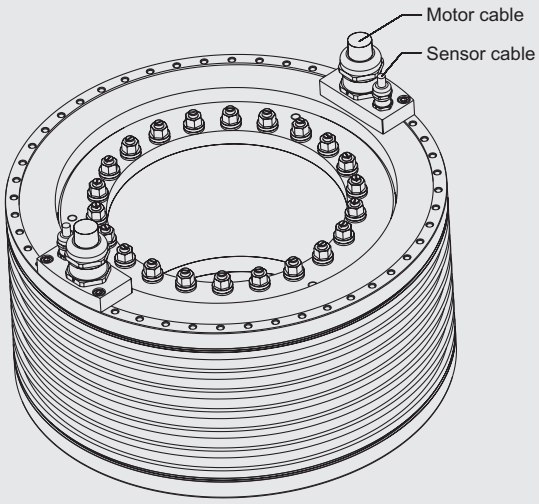
Technical data (dimensioning examples)

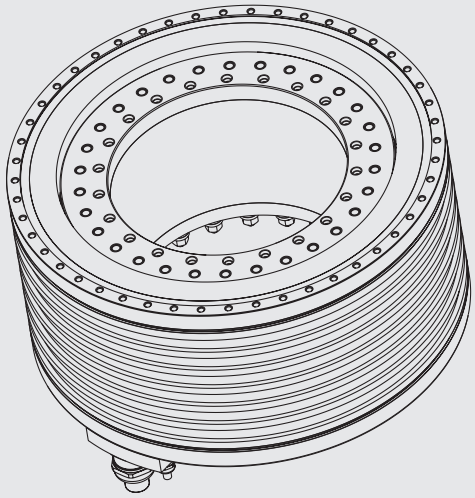
Technical data	Symbol	Unit	RKI5-384x50 (High torque)	RKI5-384x50 (High speed)	RKI5-384x100 (High torque)	RKI5-384x100 (High speed)	RKI5-384x150 (High torque)	RKI5-384x150 (High speed)
Number of pole pairs	P		30	30	30	30	30	30
Ultimate torque (1 s) at I_u	T_u	Nm	1195	993	2390	1986	3585	2979
Max. peak torque (saturation range)	T_p	Nm	854	717	1707	1434	2561	2151
Max. continuous torque (up to n_1 - cooled)	T_{cw1}	Nm	632	510	1418	1145	2225	1797
Max. continuous torque (up to n_2 - cooled)	T_{cw2}	Nm	474	383	1063	859	1669	1348
Torque at n_{max} (cooled)	T_3	Nm	237	157	532	352	835	552
Max. stall torque (cooled)	T_{sw}	Nm	449	362	1007	813	1580	1276
Ripple torque (cogging, reluctance torque)	T_r	Nm	2.6	2.2	5.1	4.3	7.7	6.5
Power loss (copper) at T_p (130 °C)	P_{lp}	W	5477	5477	8698	8698	11920	11920
Power loss (copper) at T_{cw1} (120 °C)	P_{lw}	W	1934	1934	3868	3868	5803	5803
Motor constant (25 °C)	k_m	Nm/√W	18.20	14.70	28.88	23.33	37.01	29.89
Electrical time constant	τ_e	ms	8.5	8.5	10.7	10.7	11.7	11.7
Water flow (cooling)	dV/dt	l/min	7.9	7.9	15.8	15.8	23.7	23.7
Water temperature difference (cooling)	$\Delta\vartheta$	K	3.5	3.5	3.5	3.5	3.5	3.5
Max. DC link voltage	$U_{DCL-max}$	V_{DC}	650	650	650	650	650	650
Max. continuous current (speed dependent)	I_{cw}	A_{rms}	120.0	120.0	120.0	120.0	120.0	120.0
Dynamic specific values (thermally conditioned)								
Limiting speed for T_{cw1}	n_1	rpm	100	100	100	100	100	100
Limiting speed for T_{cw2}	n_2	rpm	400	450	400	450	400	450
Max. speed for P_{cont} = constant	n_{max}	rpm	800	1100	800	1100	800	1100
Max. continuous power output (in field weakening)	P_{cont}	kW	19.8	18.0	44.6	40.5	69.9	63.5

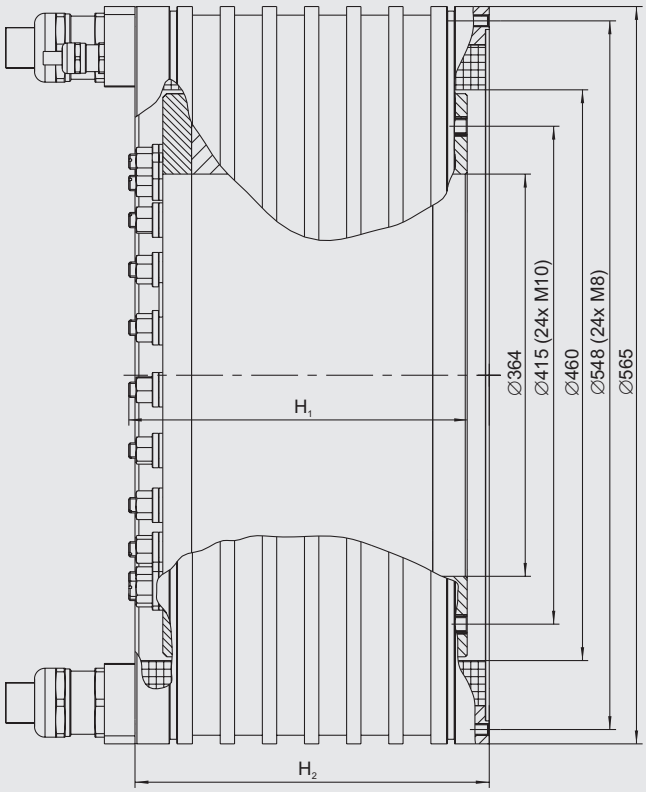
Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±10%
Binding data and drawings are passed on to the customer upon request. • We recommend the support of our engineers for the motor layout.

RKI11-460xH

Drawing







Mechanical interfaces	Symbol	Unit	RKI11-460x50	RKI11-460x100	RKI11-460x150
Height of rotor	H_1	mm	87	137	187
Height of stator	H_2	mm	110	160	210
Inertia of rotor	J	kgm^2	1.22	2.16	3.11

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Binding data and drawings are passed on to the customer upon request. • We recommend the support of our engineers for the motor layout.

RKI11-460xH

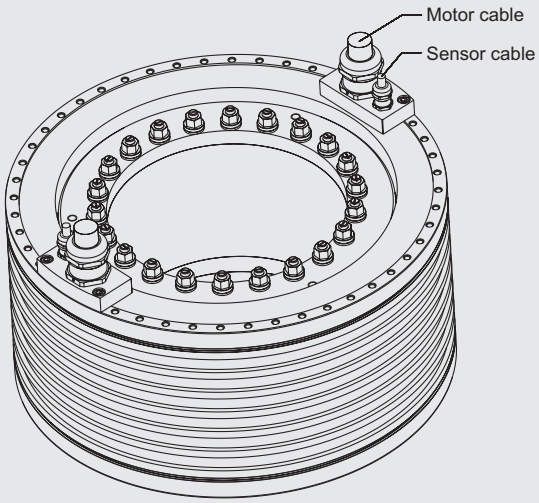
Technical data (dimensioning examples)

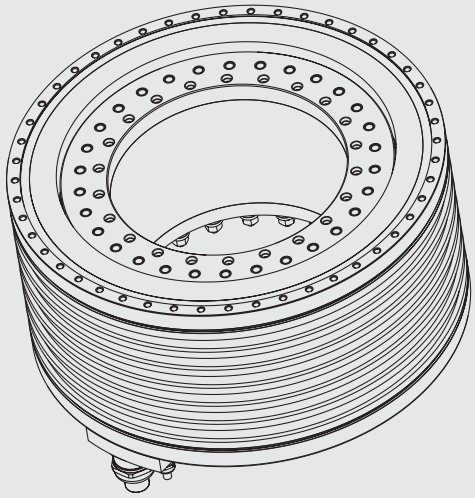
Technical data	Symbol	Unit	RKI11-460x50 (High torque)	RKI11-460x50 (High speed)	RKI11-460x100 (High torque)	RKI11-460x100 (High speed)	RKI11-460x150 (High torque)	RKI11-460x150 (High speed)
Number of pole pairs	P		33	33	33	33	33	33
Ultimate torque (1 s) at I_u	T_u	Nm	1784	1546	3568	3092	5352	4638
Max. peak torque (saturation range)	T_p	Nm	1529	1340	3058	2680	4587	4020
Max. continuous torque (up to n_1 - cooled)	T_{cw1}	Nm	907	705	2035	1583	3194	2484
Max. continuous torque (up to n_2 - cooled)	T_{cw2}	Nm	680	529	1526	1187	2396	1863
Torque at n_{max} (cooled)	T_3	Nm	340	217	764	486	1198	763
Max. stall torque (cooled)	T_{sw}	Nm	644	501	1445	1124	2268	1764
Ripple torque (cogging, reluctance torque)	T_r	Nm	4.6	4.0	9.2	8.0	13.8	12.1
Power loss (copper) at T_p (130 °C)	P_{lp}	W	10109	11864	16055	18842	22001	25821
Power loss (copper) at T_{cw1} (120 °C)	P_{lw}	W	2293	2293	4585	4585	6878	6878
Motor constant (25 °C)	k_m	Nm/√W	21.04	16.37	33.40	25.98	42.79	33.28
Electrical time constant	τ_e	ms	6.8	8.7	8.6	10.9	9.4	11.9
Water flow (cooling)	dV/dt	l/min	9.4	9.4	18.7	18.7	28.1	28.1
Water temperature difference (cooling)	$\Delta\vartheta$	K	3.5	3.5	3.5	3.5	3.5	3.5
Max. DC link voltage	$U_{DCL-max}$	V_{DC}	650	650	650	650	650	650
Max. continuous current (speed dependent)	I_{cw}	A_{rms}	150.0	150.0	150.0	150.0	150.0	150.0
Dynamic specific values (thermally conditioned)								
Limiting speed for T_{cw1}	n_1	rpm	91	91	91	91	91	91
Limiting speed for T_{cw2}	n_2	rpm	364	409	364	409	364	409
Max. speed for P_{cont} = constant	n_{max}	rpm	727	1000	727	1000	727	1000
Max. continuous power output (in field weakening)	P_{cont}	kW	25.9	22.7	58.1	50.9	91.2	79.8

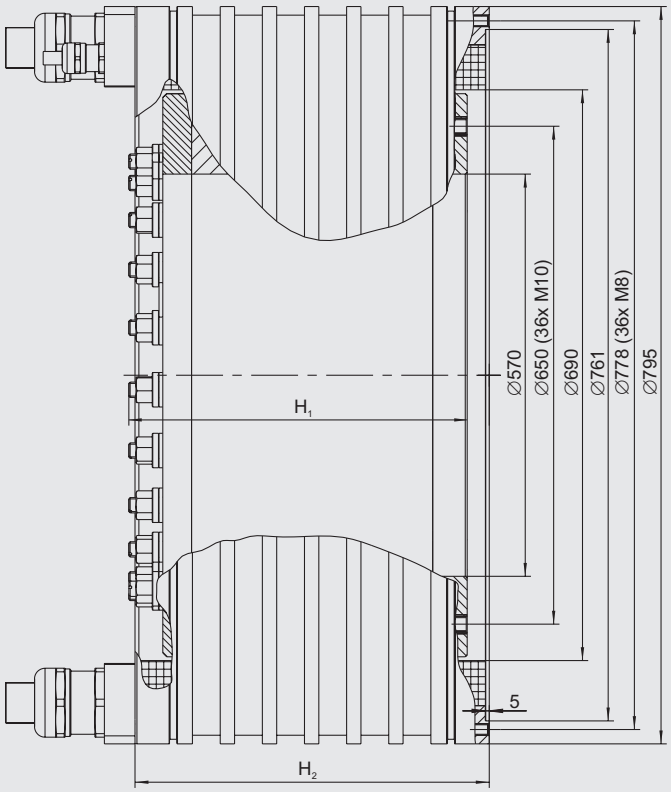
Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±10%
Binding data and drawings are passed on to the customer upon request. • We recommend the support of our engineers for the motor layout.

RKI11-690xH

Drawing







Mechanical interfaces	Symbol	Unit	RKI11-690x50	RKI11-690x100	RKI11-690x150
Height of rotor	H_1	mm	115	165	215
Height of stator	H_2	mm	130	180	230
Inertia of rotor	J	kgm^2	6.62	10.35	14.09

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±10%
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RKI11-690xH

Technical data (dimensioning examples)

Technical data	Symbol	Unit	RKI11-690x50 (High torque)	RKI11-690x50 (High speed)	RKI11-690x100 (High torque)	RKI11-690x100 (High speed)	RKI11-690x150 (High torque)	RKI11-690x150 (High speed)
Number of pole pairs	P		55	55	55	55	55	55
Ultimate torque (1 s) at I_u	T_u	Nm	4361	3568	8722	7136	13083	10704
Max. peak torque (saturation range)	T_p	Nm	3738	3092	7476	6185	11214	9277
Max. continuous torque (up to n_1 - cooled)	T_{cw1}	Nm	1900	1512	4265	3392	6693	5324
Max. continuous torque (up to n_2 - cooled)	T_{cw2}	Nm	1425	1134	3199	2544	5020	3993
Torque at n_{max} (cooled)	T_3	Nm	713	464	1600	1041	2511	1634
Max. stall torque (cooled)	T_{sw}	Nm	1349	1073	3028	2409	4752	3780
Ripple torque (cogging, reluctance torque)	T_r	Nm	11.2	9.3	22.4	18.6	33.6	27.8
Power loss (copper) at T_p (130 °C)	P_{lp}	W	19715	19715	31313	31313	42910	42910
Power loss (copper) at T_{cw1} (120 °C)	P_{lw}	W	3286	3286	6571	6571	9857	9857
Motor constant (25 °C)	k_m	Nm/√W	42.00	33.41	66.65	53.02	85.40	67.93
Electrical time constant	τ_e	ms	8.6	8.6	10.8	10.8	11.8	11.8
Water flow (cooling)	dV/dt	l/min	13.4	13.4	26.8	26.8	40.2	40.2
Water temperature difference (cooling)	$\Delta\vartheta$	K	3.5	3.5	3.5	3.5	3.5	3.5
Max. DC link voltage	$U_{DCL-max}$	V_{DC}	650	650	650	650	650	650
Max. continuous current (speed dependent)	I_{cw}	A_{rms}	175.0	175.0	175.0	175.0	175.0	175.0
Dynamic specific values (thermally conditioned)								
Limiting speed for T_{cw1}	n_1	rpm	55	55	55	55	55	55
Limiting speed for T_{cw2}	n_2	rpm	218	245	218	245	218	245
Max. speed for P_{cont} = constant	n_{max}	rpm	436	600	436	600	436	600
Max. continuous power output (in field weakening)	P_{cont}	kW	32.6	29.1	73.1	65.4	114.7	102.6

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±10%
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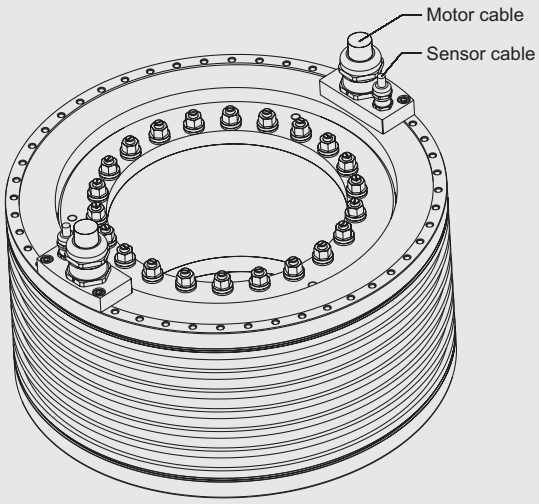
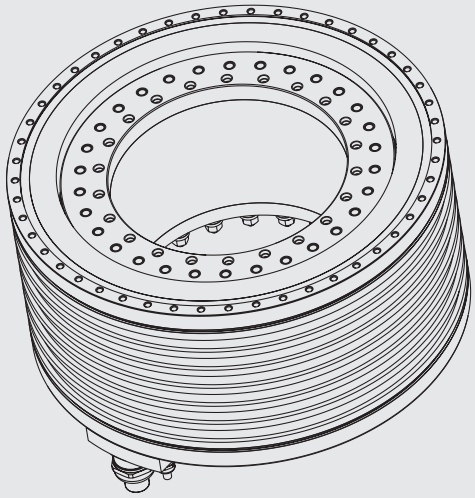
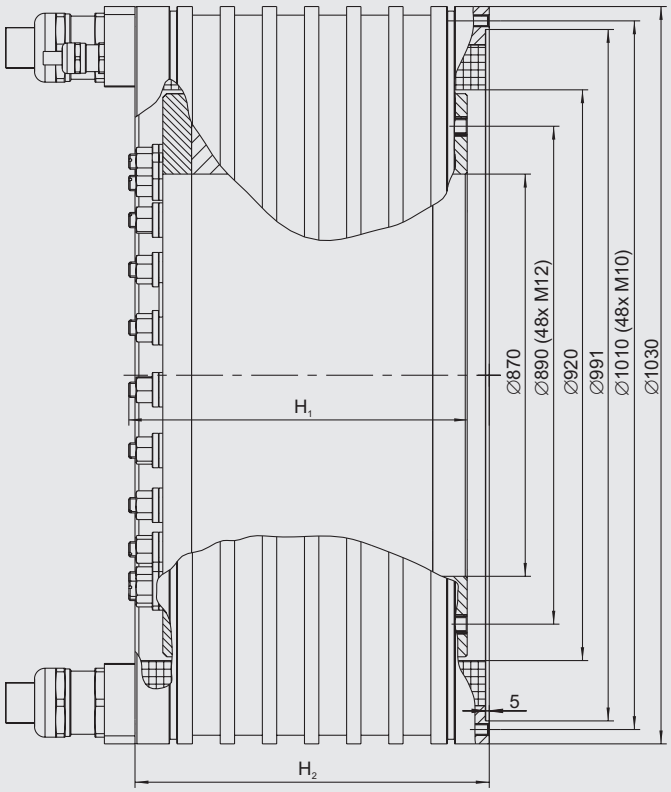
RKI11-920xH

Drawing







Mechanical interfaces	Symbol	Unit	RKI11-920x50	RKI11-920x100	RKI11-920x150
Height of rotor	H_1	mm	127	177	227
Height of stator	H_2	mm	130	180	230
Inertia of rotor	J	kgm^2	20.48	32.58	44.68

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RKI11-920xH

Technical data (dimensioning examples)

Technical data	Symbol	Unit	RKI11-920x50 (High torque)	RKI11-920x50 (High speed)	RKI11-920x100 (High torque)	RKI11-920x100 (High speed)	RKI11-920x150 (High torque)	RKI11-920x150 (High speed)
Number of pole pairs	P		66	66	66	66	66	66
Ultimate torque (1 s) at I_u	T_u	Nm	6872	5709	13743	11418	20615	17126
Max. peak torque (saturation range)	T_p	Nm	5890	4948	11780	9895	17670	14843
Max. continuous torque (up to n_1 - cooled)	T_{cw1}	Nm	3368	2721	7560	6106	11864	9582
Max. continuous torque (up to n_2 - cooled)	T_{cw2}	Nm	2526	2040	5670	4579	8898	7187
Torque at n_{max} (cooled)	T_3	Nm	1264	835	2836	1874	4451	2941
Max. stall torque (cooled)	T_{sw}	Nm	2392	1932	5367	4335	8423	6804
Ripple torque (cogging, reluctance torque)	T_r	Nm	17.7	14.8	35.3	29.7	53.0	44.5
Power loss (copper) at T_p (130 °C)	P_{lp}	W	20288	20288	32223	32223	44157	44157
Power loss (copper) at T_{cw1} (120 °C)	P_{lw}	W	4279	4279	8557	8557	12836	12836
Motor constant (25 °C)	k_m	Nm/√W	65.24	52.69	103.53	83.62	132.66	107.15
Electrical time constant	τ_e	ms	10.0	10.0	12.6	12.6	13.8	13.8
Water flow (cooling)	dV/dt	l/min	17.5	17.5	34.9	34.9	52.4	52.4
Water temperature difference (cooling)	$\Delta\vartheta$	K	3.5	3.5	3.5	3.5	3.5	3.5
Max. DC link voltage	$U_{DCL-max}$	V_{DC}	650	650	650	650	650	650
Max. continuous current (speed dependent)	I_{cw}	A_{rms}	200.0	200.0	200.0	200.0	200.0	200.0
Dynamic specific values (thermally conditioned)								
Limiting speed for T_{cw1}	n_1	rpm	45	45	45	45	45	45
Limiting speed for T_{cw2}	n_2	rpm	182	205	182	205	182	205
Max. speed for P_{cont} = constant	n_{max}	rpm	364	500	364	500	364	500
Max. continuous power output (in field weakening)	P_{cont}	kW	48.1	43.7	108.0	98.1	169.4	153.9

Subject to changes without advance notification, according to technical progress. • Tolerance range of values: ±10%
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Checklist for Your Enquiry

idam.sales@schaeffler.com or Fax +49 3681 7574-30

Please fill out the following checklist so that we can respond to your enquiry quickly and precisely.
Please feel free to contact the IDAM sales team if you have any questions.

Company _____ **Contact** _____ **Sector/project designation** _____

Telephone _____ **E-mail** _____

Application

☐ **Rotary table** ☐ **Swivel application** ☐ **Other**

Predominant operating mode

☐ Continuous operation (S1, e.g. in NC axes)
☐ Intermittent operation (S6, e.g. in cycled applications)

Operating several motors in parallel

☐ No
☐ Yes
☐ Tandem arrangement
☐ Janus arrangement

Motor type (if known) _____

Any required compatibility to Manufacturer _____ Type _____

Installation space Min. internal diameter / max. external diameter / max. height in mm
_____ / _____ / _____

Required operating points

Operating point 1

Torque _____ Speed _____

☐ Continuous operation (S1) ☐ Intermittent operation (S6) ☐ Standstill

Operating point 2

Torque _____ Speed _____

☐ Continuous operation (S1) ☐ Intermittent operation (S6) ☐ Standstill

Frequency converter Manufacturer _____ Type _____

DC link voltage [V_{DC}] _____ Constant operation current (S1) _____ Peak current _____

Cooling

☐ Water cooling (standard) ☐ Convection ☐ Other

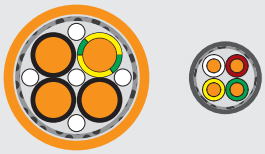
Cable

Cable outlet

☐ Axial (standard) ☐ Tangential ☐ Radial

Cable type

☐ Separate motor and sensor cables



Cable length

☐ 1 m standard, open-ended

Other types and lengths upon request.

O-rings (seals required for water cooled motors)

☐ Yes ☐ No

Temperature sensors

☐ PTC and PT1000 (standard)

Others upon request.

Technical documentation

☐ Paper ☐ CD Language _____

General information

☐ Single item ☐ Series ☐ Prototype for series

Estimated annual quantity required _____

Planned series start _____

Price range/cost of previous solution _____

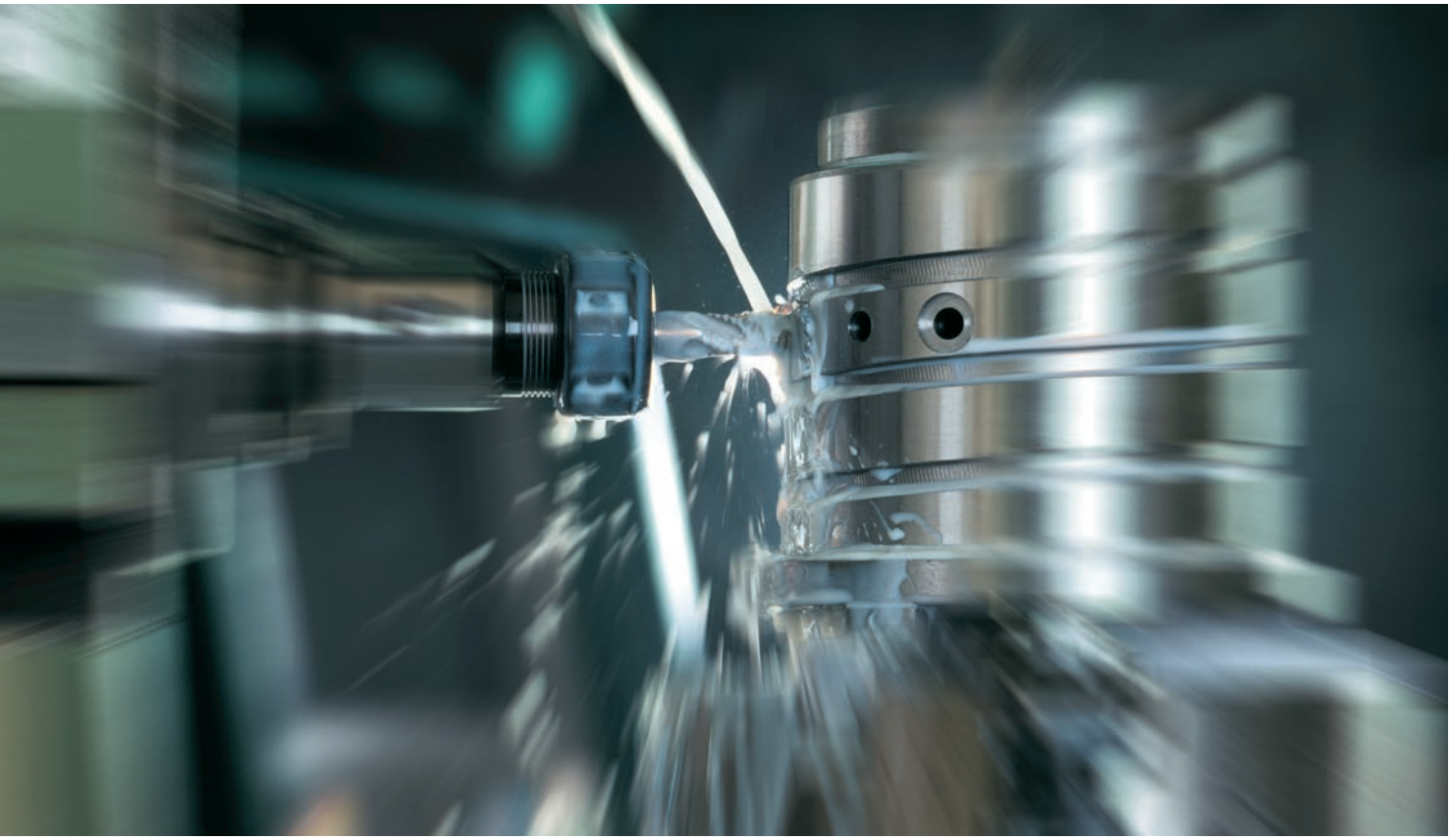
Desired date of quotation _____

Further processing by: _____ Date: _____

Created by: _____ Date: _____

Feasibility checked by: _____ Date: _____

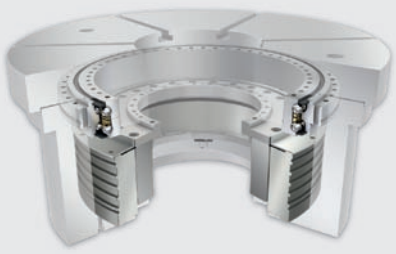
RKI Torque Motors for Turning/Milling Applications



Combined turning/milling machines (universals) should have a wide range of torque for the milling process and a wide range of speed for the turning process.

Current torque motors (standards) often cannot fulfill this requirement simply caused by performance limits.
The RKI motor technology enables reaching such high torque requirements as well as high speed requirements up to 3000 rpm.

Moreover it's important to consider the whole system view especially the interaction of motor and bearing.
We gladly give advice to select suitable components.



The fastest rotary axis

Through the combination of axial angular contact ball bearings ZKLDF of Generation B with torque motors RKI, rotary axes using standard components can be achieved with previously unattainable performance characteristics.
In this way, these products make a decisive contribution to increasing the productivity of machine tools.

Technical Information and Consulting Services

Class leading technology and competent consulting services are two of the major benefits of working with IDAM.
IDAM application engineers are looking forward to support you choose the perfect drive for your application.

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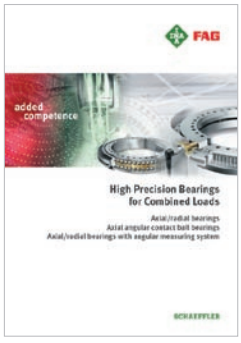

TPI 120: High Precision Bearings for Combined Loads

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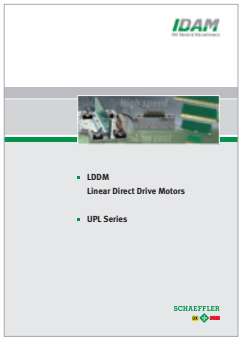
Overview of Publications

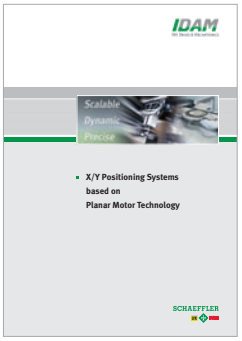
Are you interested in detailed technical information?
We would be happy to send you our product brochures. Contact us: idam@schaeffler.com

LDDM – Linear Direct Drive Motors: L1 Series

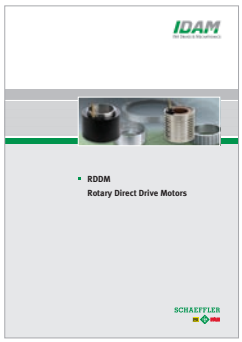
LDDM – Linear Direct Drive Motors: L2U Series



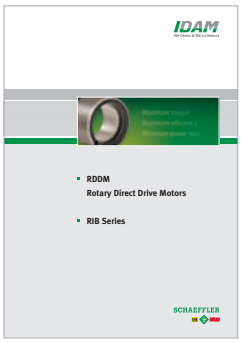
LDDM – Linear Direct Drive Motors: UPL Series



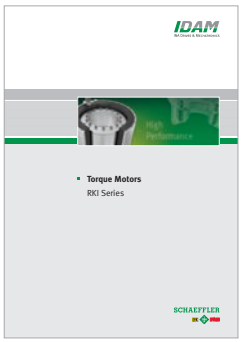
X/Y Positioning Systems based on Planar Motor Technology



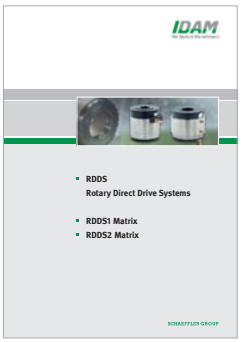
RDDM – Rotary Direct Drive Motors: RI/RE Series



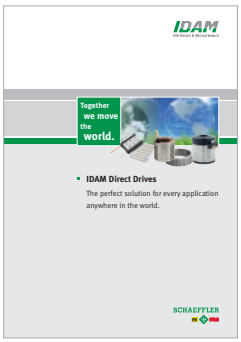
RDDM – Rotary Direct Drive Motors: RIB Series



Torque Motors: RKI Series



RDDS – Rotary Direct Drive Systems: RDDS1, RDDS2 Matrix



Product Overview: IDAM Direct Drives

We would be happy to provide you with product brochures for our electronic assemblies and system solutions.

All information about our motors and systems can also be found on our website at www.idam.de.

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Photos: IDAM AG & Co. KG, Schaeffler Technologies AG & Co. KG