› High Efficiency Drives

REEL

A KSB Company • KSB

REEL SuPremE® – The IE5* magnet-free synchronous reluctance motor

*IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation). All other sizes are IE4.

The products illustrated as examples are partly fitted with options and accessories incurring a surcharge.The SuPremE motors are painted in blue colour RAL 5002 as standard and can be delivered with KSB label as well. The colour RAL 1036 (pearl gold) is available as option on request.

robust

IE5* efficient

sustainable

compatible

Saving energy is now easy

The REEL SuPremE® drive system is the most eco-sustainable solution for energy-saving in industrial applications.
The incredibly efficient interaction of the synchronous reluctance motor with REEL frequency converters offers a system of unparalleled efficiency.

- **Energy savings**
  The speed-controlled REEL-SuPremE® motor works like an energy diet: the large efficiency gain due to the speed control is increased by an energy saving of up to 10% in the motor alone.
- **Far ahead of its time**
  The IE5 motor (as per IEC/TS 60034-30-2), already exceeds the requirements of the European ErP 2017 regulations.
- **Sustainable**
  Built completely without magnetic materials, its total environmental footprint is significantly smaller than that of permanent-magnet synchronous and asynchronous motors.
- **Robust**
  The use of non-critical, durable materials, as well as the fully matured reluctance principle and the high service life of the bearings ensure reliable operation.
- **Compatible**
  Wherever there is room for an IE2 asynchronous motor, a REEL SuPremE® can also be installed to get the work done efficiently.

A comprehensive motor range - REEL SuPremE® IE5* is available from 0,55 to 450 kW.
Higher sizes available on request.

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

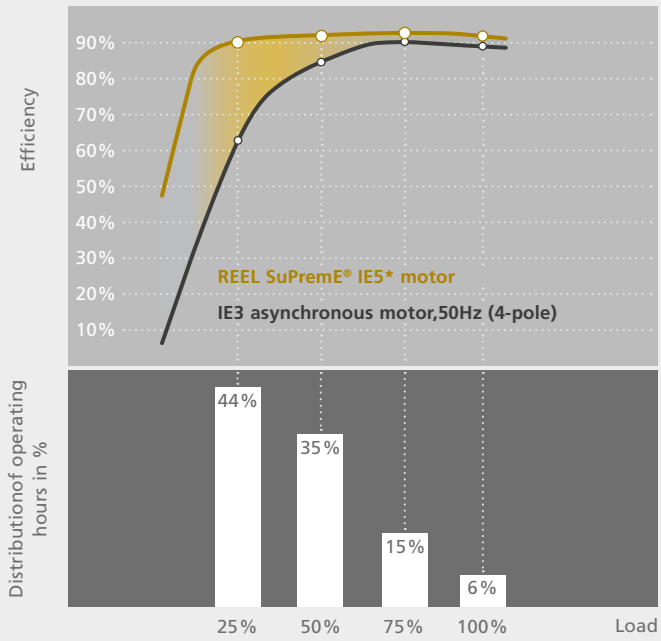
The energy diet of the magnet-less motor REEL SuPremE® IE5* immediately shows on your energy bills. The synchronous reluctance motor is operated at variable speed and achieves uniquely stable and high efficiency gains in all load ranges.

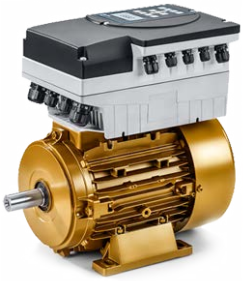
In Europe, motors are normally operated at no more than 60% of their rated load. The efficiency regulations for electric motors initiated by legislators all focus on operation at the rated load point. With its super premium efficiency at full load - but above all with its high efficiency across the entire part-load range - the REEL SuPremE® IE5* motor stands out as the lean alternative drive for most applications.

The diagram shows the efficiency curve plotted over the load of a 7.5 kW, 1500 rpm REEL SuPremE® motor in comparison to a 2-pole IE3 asynchronous motor. Load profile to "Blue Angel" requirements.

Source: Dipl.-Ing. M. Wiele, Prof. Prof. hc. mult. Dr. Ing. Peter Brosch, Hochschule Hannover, University of Applied Sciences and Arts, Faculty I, Drives and Automation Technology.

Unparallelled potential savings due to extremely high efficiency - especially in the part-load range.





REEL SuPremE® IE5*

DOL starting is not required

Integration of a speed control system

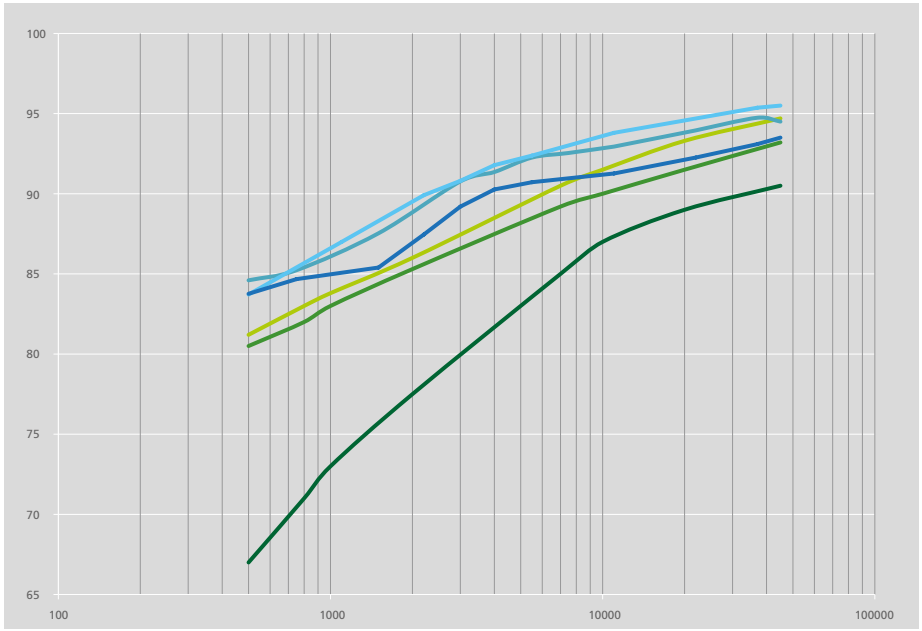
Variable load profile

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

The drive solution of the future

The ability to maintain efficiency even when running at partial load makes the REEL SuPremE® drive system the ideal solution for all those applications that do not require the constant use of the motor's rated power and that need to save energy to comply with demanding industry regulations, while at the same time improving the value and the quality of the system.

Partial load efficiency of REEL SuPremE® IE5* vs. IE3 Motor



Analysis of the REEL SuPremE® motor performance at three different speeds for each load point

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

The REEL SuPremE® IE5* motor paves the way

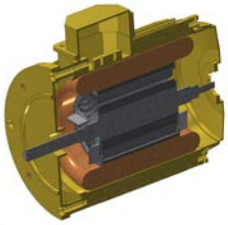
- **No DOL starting - no unnecessary losses**
- **Every bit as robust as asynchronous motors**
- **Rotor laminations geometry for quiet operation**
- **Losses associated with the speed control system required are marginal**
- **Easy maintenance because no magnets are used**

No unnecessary losses attributed to DOL starting

The success of the asynchronous motor largely has to do with its DOL starting capability. This benefit also presents a drawback, however, because DOL starting leads to unnecessary losses caused by rotor current as evidenced in the slip that occurs at this time. Asynchronous motors will be increasingly fitted with a speed control system in recognition of the fact that maximum torque conditions are not always required. In these scenarios, DOL starting is not necessary. There is a better alternative to this combination setup with a speed control system, however – the synchronous motor. Although synchronous motors cannot start up without a frequency inverter, they achieve considerably higher levels of efficiency during operation as no current is sent to the rotor.

A robust motor

Asynchronous motors have the reputation of being very robust. The same can also be said of the magnet-less IE5* synchronous reluctance motor, REEL SuPremE®, whose probability of failure is reduced thanks to the omission of sensors, while the lower temperature of the rotor extends the service life of the bearings. The REEL SuPremE® IE5* motor also incorporates only non-critical and durable materials to ensure smooth operation for many years at a time.



The synchronous reluctance motor REEL SuPremE® IE5*

Lamination of REEL SuPremE® IE5*

Low-noise operation

One of the ways in which conventional synchronous motors differ from synchronous reluctance motors such as the REEL SuPremE® IE5* motor is the special cut of the laminated rotor core. Formally known as US patent 5.818.140, the invention refers to a rotor geometry with flux-conducting and flux-blocking segments that ensure smooth operation. This geometry provides for an extremely low level of torque ripple (1 to 2 %) that, in turn, keeps operating noise to a minimum.

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

One step ahead - including when it comes to resource efficiency

The REEL SuPremE® IE5* motors impress with their exceptional overall eco-balance by not only achieving considerable energy savings, but also contributing to a healthier environment as the motors incorporate zero magnetic materials made from rare earths.

Using critical materials is a thing of the past

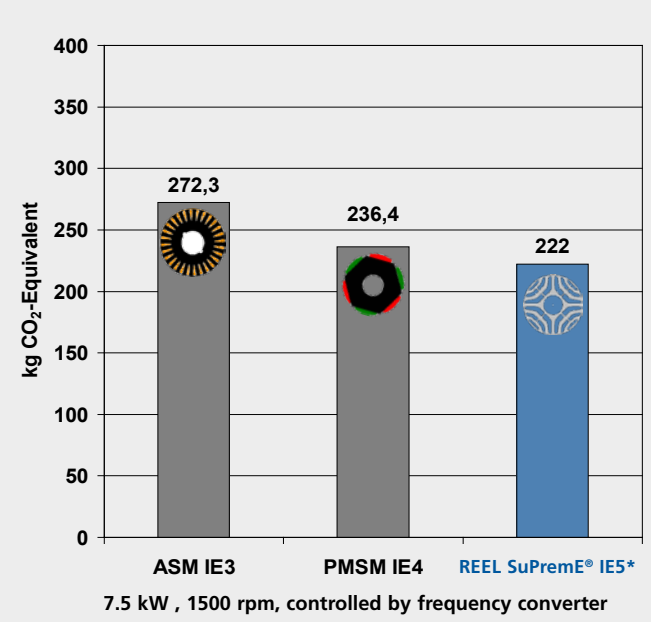
Many modern technologies are almost impossible to realise without using rare earths. The problem with this approach is of course the fact that mining and processing the metals required can severely impact the environment. Further adding to this is the monopoly-like situation that prevails in the global market as China has for years been the largest exporter of rare earth elements and therefore also establishes market prices.

Avoiding the use of rare earths was an absolute must when developing the world's most efficient magnet-less IE5* motor REEL SuPremE®. The solution was to leverage the synchronous reluctance principle so that the highly efficient drive could also meet IE5 efficiency class requirements without the need for magnets. As a result, REEL can manufacture its SuPremE motors independently of global market events while at the same time keeping the environmental impact to a minimum.

An independent PLCA (Product Life Cycle Analysis) study has confirmed this.

Sustainable, magnet-less design principle

REEL SuPremE® IE5* motors use no magnetic materials or increased levels of copper, making their design much more sustainable than that of permanent-magnet synchronous motors and asynchronous motors.



In fact, the total environmental footprint of manufacturing synchronous reluctance motors is 6 percent lower than that of permanent-magnet synchronous motors, despite the higher output per size of the latter, as a result of no magnetic materials being used.

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

An efficient team

REEL SuPremE® IE5* is not just a motor, it is a drive system which more than any other on the market deserves to be called a "low energy-consumption drive".
The energy diet offered by SuPremE will make your machines much more streamlined.

We have worked hard to bring you with a high-performance control software optimal for the synchronous reluctance motor.

We can offer a reliable, intelligent control system that makes the most of REEL SuPremE®'s full potential to save energy. It ensures the achievement of high efficiency levels at full- and partial load, without the use of rare earths, as well as optimal sensorless position and speed accuracy. It allows silent operation, making the SuPremE drive ideal for the use in ventilation systems.

REEL SuPremE® IE5* is the only synchronous motor with a motor-mounted speed control system, but can be driven by any REEL speed controller, offering a wide selection of configurations and installations.

We can offer a vast selection of speed regulation solutions for the control of the synchronous reluctance motors REEL SuPremE® IE5*: inverters mounted directly on top of the motor or wall-mounted, inverters installed into electrical cabinets and with different IP ratings for a broad power range.

Just select the configuration that best suits to your need!

KSB202 drive
for wall- or cabinet-mounting - IP00..IP66

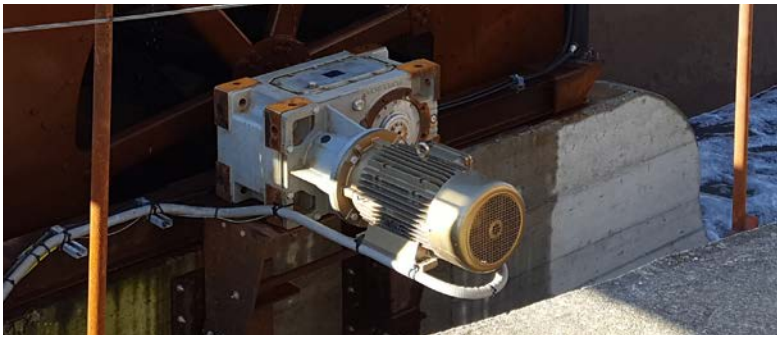
FlexiMova® mm decentralised drive
for motor-, wall-, machine-mounting - IP55

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

REEL SuPremE® IE5* is a key component of industrial automation systems.
Its high energy saving potential makes the synchronous reluctance motor the ideal solution for power quality and efficiency improvement in industrial systems and for the generation of electrical energy from renewable resources.

SuPremE drives for System Integration

The comprehensive range of REEL SuPremE® motors allows to apply the product to a great variety of systems. Wherever a higher efficiency is required, the speed-controlled SuPremE drive becomes the optimal solution for satisfying the energy saving requirements of the application.

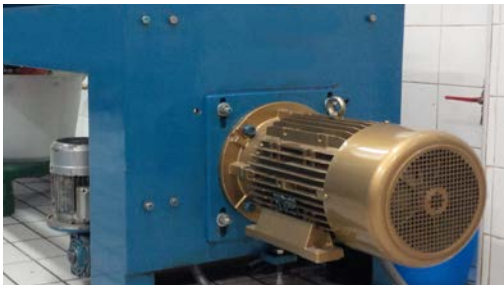


* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

The energy diet works

Molino-Frantoio "G. Fratini“

Application:
Centrifugal separator for the production of extra-virgin olive oil



Measure taken:
Replacement of:
1 x asynchronous motor, 11 kW, 1500 rpm, efficiency class IE2
with:
1 x REEL SuPremE® motor, 11 kW, 1500 rpm, efficiency class IE5*
controlled by KSB202 drive.

Result:

- Energy saving of approximately 15% thanks to the reduction of the electricity consumption by 20%
- Higher reliability of the machine due to a more accurate speed regulation
- Motor bearings last longer, because of the low rotor temperature.

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

Faenza Depurazioni Srl (Gruppo Tampieri SpA)

Application:

Aerator pump for wastewater treatment tanks - operation at partial load and speed

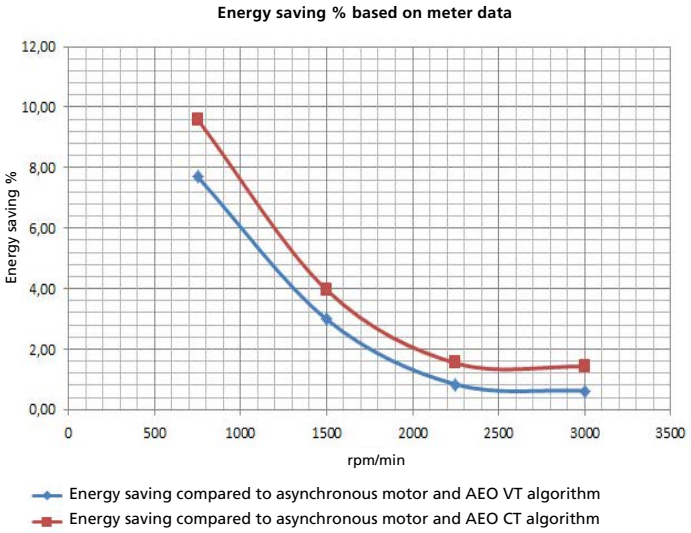
Measure taken:

Replacement of:
1 x asynchronous motor, 7.5 kW, 1500 rpm, efficiency class IE3 with
1 x REEL SuPremE® 7.5 kW, 1500 rpm, efficiency class IE5* controlled by KSB202 drive.

Result:

- Lower energy waste than asynchronous motors at partial load
- Less maintenance on the motor bearings, thanks to the technical features of REEL SuPremE® motor that operates with a „cold“ rotor

Energy savings achieved with the REEL SuPremE® motor compared to an IE3 asynchronous motor



AEO VT algorithm: control algorithm with automatic flow reduction for squared torque systems (pumps, fans, etc...)
AEO CT algorithm: control algorithm for constant torque systems (compressors)

Ear Group

Application:

Generation of electrical energy from hydropower

Action taken:

Installation of 1 x REEL SuPremE® motor (as generator) 90 kW, 1000 rpm, 400 V. The motor is controlled by a control system with active front end and KSB202 drive of 90 kW.

Result:

- High energy production, thanks to the constant efficiency over the entire operation of the SuPremE generator.

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

Electrical data and performance Motors @ 3000 rpm

Degree of protection: : IP55
Cooling method: IC411
Efficiency class: IE5*
Rated speed: 3000 rpm
Thermal protection: PTC
Insulation class: F/B

												Inverter KSB 202		Inverter FlexiMova® mm	
P_n kW	Motor type	Nm	V_n V	I_n A	f_n Hz	η 100% %	η 75% %	η 50% %	η 25% %	Eff.	Weight kg	Mod.	I_n A	Mod.	I_n A
0.55	A071M2	1,8	350	1.6	100	83.7	83.6	83.3	81.6	IE5	9	PK55	1.8	F0K55	1.8
0.75	A080M2	2,4	360	2.1	100	85.0	84.9	84.6	82.9	IE5	10	PK75	2.4	F0K75	2.5
1.1	A080M2	3,5	360	3.0	100	86.5	86.4	86.1	84.3	IE5	12	P1K1	3.0	F1K10	3.5
1.5	A090S2	4,8	380	4.1	100	87.6	87.5	87.2	85.4	IE5	15	P1K5	4.1	F1K50	4.9
2.2	A090L2	7,0	360	5.6	100	88.9	88.8	88.4	86.7	IE5	18	P2K2	5.6	F2K20	6.0
3	A100L2	9,5	360	7.6	100	89.8	89.7	89.3	87.6	IE5	24	P4K0	10.0	F3K00	8.0
4	A112M2	12,7	355	9.4	100	90.6	90.5	90.1	88.3	IE5	35	P4K0	10.0	F4K00	10.0
5.5	A132S2	17,5	365	12.5	100	91.4	91.3	90.9	89.1	IE5	43	P5K5	13.0	F5K50	14.0
7.5	A132S2	23,9	370	16.7	100	92.1	92.0	91.6	89.8	IE5	56	P11K	24.0	F7K50	18.0
11	A160M2	35,0	375	23.7	100	92.9	92.8	92.4	90.6	IE5	73	P11K	24.0	F11K0	26.0
15	A160M2	47,7	365	32.0	100	93.5	93.4	93.0	91.2	IE5	82	P15K	32.0	F15K0	34.5
18.5	A160L2	58,9	370	38.8	100	93.8	93.7	93.3	91.5	IE5	102	P22K	44.0	F18K5	44.0
22	A180M2	70,0	380	50.0	100	94.1	94.0	93.6	91.8	IE4*	167	P30K	61.0	F22K0	51.0
30	A200L2	95,5	380	67.0	100	94.6	94.5	94.1	92.2	IE4*	212	P37K	73.0	F30K0	68.0
37	A200L2	117,8	380	82.0	100	94.8	94.7	94.3	92.4	IE4*	257	P45K	90.0	F37K0	84.0
45	A225M2	143,2	380	99.0	100	95.1	95.0	94.6	92.7	IE4*	305	P55K	106	F45K0	101.0
75	SRCa280Sa4	239	340	172	100	95.6	95.1	94.4	90.6	IE4	510	P90K	177	-	-
90	SRCa280Sb4	287	370	190	100	95.7	95.3	94.6	92.0	IE4	530	N110	212	-	-
110	SRCa280M4	350	400	230	100	96.0	95.7	95.0	93.0	IE4	594	N132	260	-	-
132	SRCa315S4	420	390	270	100	96.3	96.0	95.2	93.7	IE4	900	N160	315	-	-
160	SRCa315M4	509	385	315	100	96.4	96.2	95.1	94.2	IE4	1000	N160	315	-	-
180	SRCa315La4	573	370	362	100	96.7	96.4	95.8	94.0	IE4	1100	N200	395	-	-
200	SRCa315Lb4	637	380	392	100	96.7	96.4	95.8	94.0	IE4	1110	N200	395	-	-
250	SRCa355M4	796	380	501	100	97.0	97.0	96.8	95.0	IE4	1610	N315	600	-	-
315	SRCa355L4	1003	380	631	100	97.2	97.1	96.8	95.0	IE4	1810	P355	658	-	-
450	SSRCa355X4	1433	345	925	100	97.1	97.1	96.8	95.0	IE4	1920	P560	990	-	-

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

Note:
The technical data may be modified without prior notice.

Electrical data and performance Motors @ 1500 rpm

Degree of protection: IP55
Cooling method: IC411
Efficiency class: IE5*
Rated speed: 1500 rpm
Thermal protection: PTC
Insulation class: F/B

												Inverter KSB 202		Inverter FlexiMova® mm	
P_n kW	Motor type	Nm	V_n V	I_n A	f_n Hz	η 100% %	η 75% %	η 50% %	η 25% %	Eff.	Weight kg	Mod.	I_n A	Mod.	I_n A
0.55	A080M4	3,5	350	1.6	50	84.5	84.4	84.1	82.4	IE4*	11	PK55	1.8	F0K55	1.8
0.75	A080M4	4,8	355	2.1	50	85.7	85.6	85.3	83.6	IE4*	13	PK75	2.4	F0K75	2.5
1.1	A090S4	7,0	360	3.0	50	87.2	87.1	86.8	85.0	IE5	15	P1K1	3.0	F1K10	3.5
1.5	A090L4	9,5	365	4.0	50	88.2	88.1	87.7	86.0	IE5	18	P1K5	4.1	F1K50	4.9
2.2	A100L4	14,0	365	5.7	50	89.5	89.4	89.0	87.3	IE4*	25	P3K0	7.2	F2K20	6.0
3	A100L4	19,1	355	7.8	50	90.4	90.3	89.9	88.1	IE4*	30	P4K0	10.0	F3K00	8.0
4	A112M4	25,5	360	9.6	50	91.2	91.1	90.7	88.9	IE4*	37	P4K0	10.0	F4K00	10.0
5.5	A132S4	35,0	350	13.5	50	92.0	91.9	91.5	89.7	IE5	45	P7K5	16.0	F5K50	14.0
7.5	A132M4	47,7	355	17.6	50	92.7	92.6	92.2	90.4	IE5	60	P11K	24.0	F7K50	18.0
11	A160M4	70,0	365	24.2	50	93.5	93.4	93.0	91.2	IE5	81	P15K	32.0	F11K0	26.0
15	A160L4	95,5	355	33.1	50	94.0	93.9	93.5	91.7	IE5	107	P18K	37.5	F15K0	34.5
18.5	A180M4	117,8	380	42.0	50	94.4	94.3	93.9	92.0	IE4*	189	P22K	44.0	F18K5	44.0
22	A180L4	140,1	380	50.0	50	94.6	94.5	94.1	92.2	IE4*	203	P30K	61.0	F22K0	51.0
30	A200L4	191,0	380	68.0	50	95.1	95.0	94.6	92.7	IE4*	246	P37K	73.0	F30K0	68.0
37	A225S4	236,0	380	79.0	50	95.3	95.2	94.8	92.9	IE4*	337	P45K	90.0	F37K0	84.0
45	A225M4	286,0	380	96.0	50	95.6	95.5	95.1	93.2	IE4*	347	P55K	106	F45K0	101.0
55	SRCa280Sa4	350	380	108	50	95.6	95.1	93.7	91.0	IE4	510	P75K	147	F55K0	120.0
75	SRCa280Sb4	478	380	147	50	95.9	95.3	95.0	93.5	IE4	530	P75K	147	-	-
90	SRCa280M4	573	380	185	50	96.2	95.7	95.1	94.4	IE4	594	N110	212	-	-
110	SRCa315S4	700	380	216	50	96.5	96.3	96.0	94.0	IE4	900	N132	260	-	-
132	SRCa315M4	840	380	267	50	96.5	96.5	96.0	94.0	IE4	1000	N160	315	-	-
160	SRCa315La4	1019	380	310	50	96.6	96.6	96.1	95.0	IE4	1100	N160	315	-	-
200	SRCa315Lb4	1273	380	395	50	96.6	96.7	96.5	95.7	IE4	1150	N250	480	-	-
250	SRCa355S6	1592	370	510	75	97.0	97.0	96.8	96.3	IE4	1600	N315	600	-	-
280	SRCa355M6	1783	370	571	75	97.0	97.0	96.8	96.3	IE4	1650	N315	600	-	-
315	SRCa355L6	2006	370	639	75	97.0	97.0	96.8	96.3	IE4	1850	P355	658	-	-
400	SRCa355X6	2547	380	790	75	97.1	97.0	96.8	96.3	IE4	1990	P450	800	-	-

* IE5 acc. to IEC/TS 60034-30-2 up to 15 kW @ 1500 rpm / 18.5 kW @ 3000 rpm (only for 1500 rpm types rated 0.55 kW, 0.75 kW, 2.2 kW, 3 kW, 4 kW: IE5 in preparation).

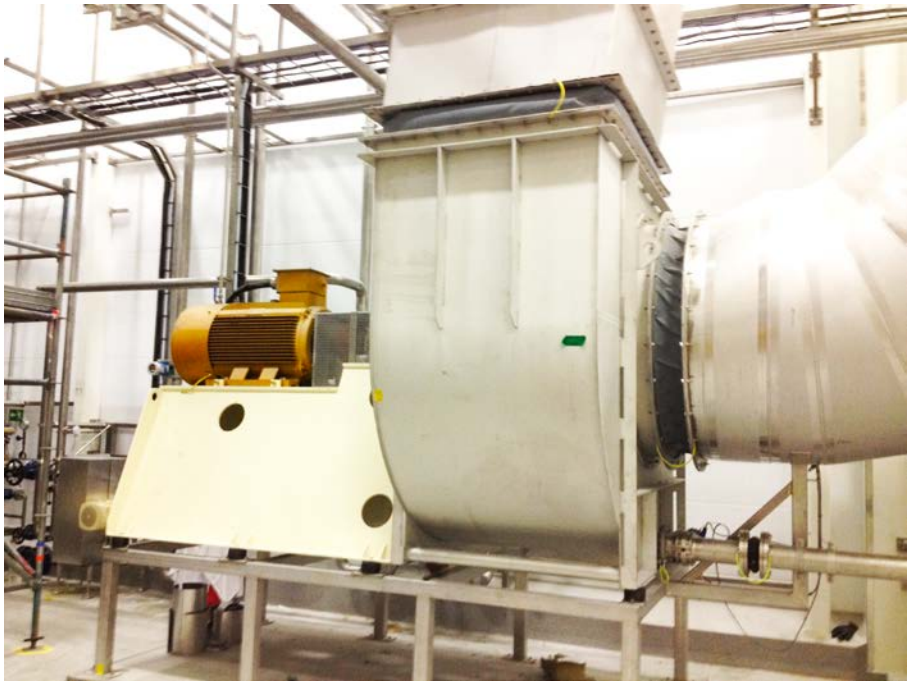
Note:
The technical data may be modified without prior notice.

Electrical data and performance Motors @ 1000 rpm

Degree of protection: : IP55
Cooling method: IC411
Efficiency class: IE4*
Rated speed: 1000 rpm
Thermal protection: PTC
Insulation class: F/B

												Inverter KSB 202		Inverter FlexiMova® mm	
P_n kW	Motor type	Nm	V_n V	I_n A	f_n Hz	η 100% %	η 75% %	η 50% %	η 25% %	Eff.	Weight kg	Mod.	I_n A	Mod.	I_n A
37	SRCa280Sa4	353	380	87	33	94.7	94.0	92.5	91.5	IE4	510	P45K	90	F45K0	101.0
45	SRCa280Sb4	430	390	102	33	95.0	94.7	93.9	92.2	IE4	530	P55K	106	F45K0	101.0
55	SRCa280M4	525	380	120	33	95.3	94.7	93.9	92.9	IE4	594	P75K	147	F55K0	120.0
75	SRCa315S4	716	380	156	33	95.3	95.2	94.9	94.0	IE4	900	P90K	177	-	-
90	SRCa315M4	860	380	191	33	95.5	95.3	95.0	94.0	IE4	1000	N110	212	-	-
110	SRCa315La4	1051	385	215	33	96.0	96.0	95.7	94.6	IE4	1100	N132	260	-	-
132	SRCa315Lb4	1261	380	260	33	96.0	96.0	95.6	94.5	IE4	1150	N132	260	-	-
160	SRCa355S6	1528	380	325	50	96.1	96.0	95.5	94.0	IE4	1600	N200	395	-	-
200	SRCa355M6	1910	370	410	50	96.2	96.1	95.5	94.0	IE4	1690	N250	480	-	-
250	SRCa355L6	2388	370	513	50	96.3	96.2	95.3	94.5	IE4	1850	N315	600	-	-
315	SRCa355X6	3005	400	590	50	96.6	96.5	96.4	95.0	IE4	1990	N315	600	-	-

* IE4 in accordance with IEC/TS 60034-30-2



Note:
The technical data may be modified without prior notice.

Options and accessories

Option name	Motor frame 71-225	Motor frame 280-355
Encoder mounting for IC411 version	-	✓
IC416 version	-	✓
Encoder mounting for IC416 version	-	✓
Encoder (hollow shaft)	-	✓
Mounting arrangement (IM2001) – B3/B14	✓	✓
Mounting arrangement V1 (IM3011)	✓	✓
Terminal box right side / left side / DE	✓	✓
Rain cover	-	✓
Second power shaft end	-	-
Degree of protection IP56-IP65	-	✓
NDE insulated bearing	-	✓
Additional PTO thermal switch	-	✓
Additional PTC thermistor	-	✓
Pt100 in stator windings	-	✓
Pt100 in bearings	-	✓
DE roller bearings	-	✓
Special balancing (R, S degree)	-	✓
Other supply voltage / frequency	-	✓
Other mounting arrangements (B35-V1)	✓	✓
Anticondensation heaters	-	✓
Special painting for aggressive environment	-	✓

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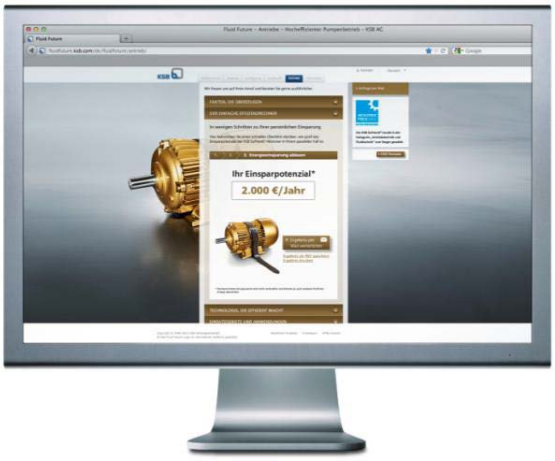

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