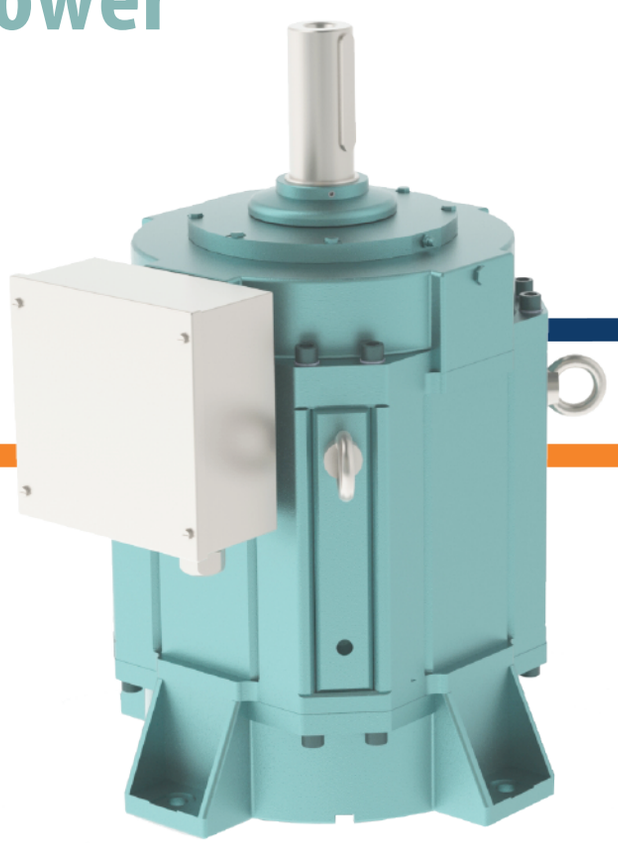
Patented Direct Drive Technology for

Cooling Tower

SQMC Torque Motor



Efficiency is better than IE5 - We put the limits -

- High Pole Numbers (66, 88)
- Direct Drive - No Gearbox - No Cooling
- Highly Reliable
- Unbeatable Motor Efficiency (up to 96%)
- Minimal Operating Costs

EMF Motor®

The Revolutionary Direct Drive System

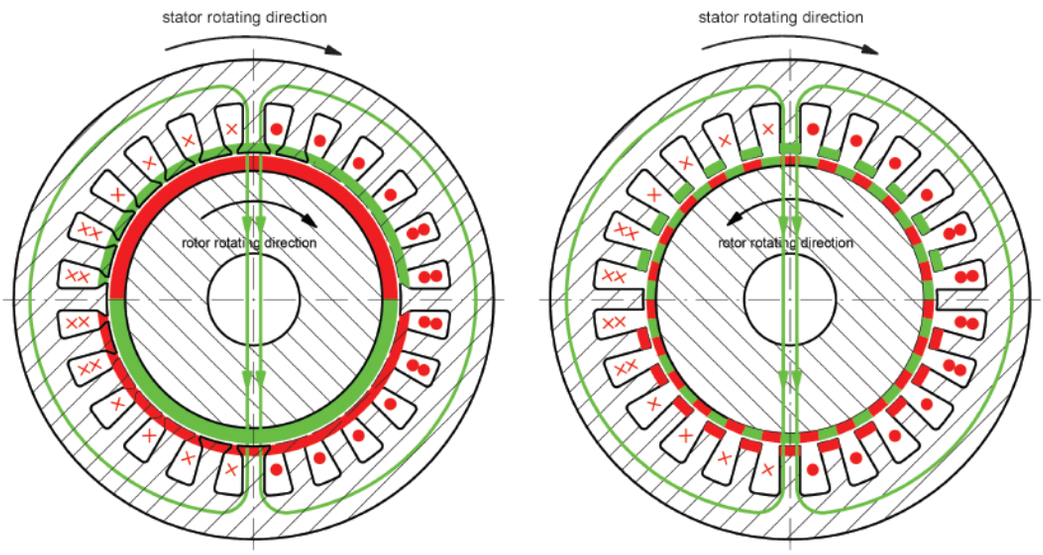
- **Unbeatable Motor Efficiency (up to 96%)**
- **Less Maintenance**
- **Quiet Operation**
- **High Pole Numbers (66, 88)**

The Patented EMF Motor® Principle

EMF Motor proudly presents the world's most efficient torque motor with patented PM technology, providing ideal solutions for cooling tower applications.

Our exclusive motor technology allows us to manufacture gearless, high pole number (66-88), and highly efficient motors. Experience reliable speed control, lower maintenance, quieter operation, and unparalleled energy savings. The fan directly couples to the motor and is controllable via sensorless flux vector drivers.

Thanks to the abundant magnetic poles, we achieve high torque at reduced rotational speeds, minimizing motor winding losses compared to conventional high-pole motors. This motor ensures exceptional efficiency, even at very low speeds.



Standard synchronous motor principle

2 pole stator winding
2 poles on the stator
2 poles on the rotor
stator rotating speed is 3000 rpm at 50 Hz
also the rotor speed is 3000 rpm at 50 Hz
ratio is 1

EMFMotor synchronous torque principle

2 pole stator winding
48 poles on the stator
46 poles on the rotor
stator rotating speed is 3000 rpm at 50 Hz
rotor speed is 130,43 rpm at 50 Hz
ratio is -23

Introducing the EMF Motor®, where the stator closely resembles that of a conventional motor. The rotor, adorned with glued permanent magnets, initiates magnetic flux when zero voltage and frequency are applied. As the frequency increases, a rotating field emerges, causing the permanent magnets and the rotating field to interact, generating a powerful torque with a low pole winding.

The rotor's rotation direction opposes the rotating field, resulting in a slower rotor speed. The motor's efficiency is remarkably high due to minimal copper and hysteresis losses. The motor's design, featuring a high number of magnetic poles, ensures a slow rotation but achieves an impressive torque.

In most scenarios, additional cooling mechanisms such as blowers or water cooling are unnecessary, underscoring the motor's efficiency. The SQM design stands out for its unparalleled efficiency and torque-to-weight ratio in comparison to other motor principles or designs.

Advantages

- Direct drive, no gearbox, no cooling
- Highest Pole Numbers (66,88)
- Highly reliable
- Reduced maintenance
- Up to 96 % motor efficiency
- Lowest operating cost
- Low vibration, less noise
- Environmentally friendly
- Adjustable speed with full torque
- Stable operation at low speed
- Compact and symmetric design
- Special bearing
- Sensorless controlled by flux vector drivers
- Wide voltage range (230 to 690 VAC)
- C5VH per ISO 12944-2 (Painted against corrosion)
- Simple mounting
- No need for other components (shaft, gearbox, couplings)

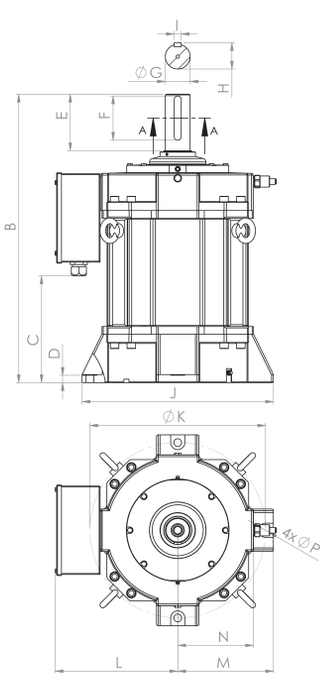
Specifications

Mounting	Flange/Foot
Insulation	Class F
Protection	Class IP65
Vibration	A level according to IEC 60034-14
Ambient Temperature	-10°C / +50°C
Thermal Protection	120°C PTO (*PT100, PT1000, KTY, PTC are optional*)
Cooling	Natural / IC 410

COMPARISON	IE2 Motor + Gearbox	DD Motor	EMF Motor
Energy Efficiency	👎	👍	👍👍★
Maintenance	👎	👍	👍
High Pole Number	👎	👍	👍👍★
Full Torque at all Speed	👎	👍	👍
Low Speed Efficiency	👎	👎	👍
Noise	👎	👍	👍
Vibration	👎	👍	👍
Environmentally Friendly	👎	👍	👍
Easy Installation	👎	👍	👍

Motor Code	Pole Number	P_n (kW)	n_n (rpm)	M_n (Nm)	f_n (Hz)	k_t (Nm/A)	I_n (A)	Efficiency (%)	Weight (kg)	Axial Max. Thrust Load (N)
SQMC132-150	66	6,5	200	310	110	18,8	16,5	94,5	145	3.500
		8,4	400	200	220	11,8	17,0	93,5		
SQMC132-200	66	8,4	200	400	110	20,5	19,5	95,0	165	3.500
		10,5	400	250	220	11,7	21,3	94,0		
SQMC132-250	66	10,5	200	500	110	20,4	24,5	95,5	185	3.500
		12,6	300	400	165	14,8	27,0	95,5		
SQMC132-300	66	12,4	200	590	110	20,7	28,5	96,0	205	3.500
		14,8	300	470	165	15,4	30,5	96,0		
SQMC200-200	88	15,3	200	730	147	19,6	37,2	92,5	405	8.000
		14,5	300	460	220	14,6	31,5	92,0		
SQMC200-300	88	23,0	200	1.100	147	20,6	53,5	93,5	515	8.000
		22,0	300	700	220	15,6	44,9	92,5		
SQMC200-400	88	30,4	200	1.450	147	21,2	68,3	94,5	625	8.000
		28,3	300	900	220	15,6	57,8	93,0		
SQMC200-500	88	35,6	200	1.700	147	19,9	85,5	94,5	735	8.000
		34,6	300	1.100	220	15,0	73,5	93,5		
SQMC250-300	88	25,7	100	2.450	73	34,0	72,0	94,0	900	13.000
		35,6	200	1.700	147	19,6	86,6	94,0		
SQMC250-400	88	34,6	100	3.300	73	33,0	100,0	94,5	1.100	13.000
		48,2	200	2.300	147	19,6	117,5	95,0		
SQMC250-500	88	45,0	100	4.300	73	33,6	128,0	95,0	1.300	13.000
		58,6	200	2.800	147	18,9	148,0	95,0		
SQMC250-600	88	54,5	100	5.200	73	34,4	151,0	95,0	1.500	13.000
		71,2	200	3.400	147	19,7	172,5	95,5		

Values were determined according to the cooling effect with the air flow from the motor surface
Air flow must be min. 3 m/s
Ambiant temperature is max. 50° C
Datas are according to max. 1.000 meters altitude
Supply voltage is 400 VAC, 3 ph.



Dimensions

Motor Code	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	"J"	"K"	"L"	"M"	"N"	"P"
SQMC200-200	716	202	21	160	125	Ø70 m6 $^{(+0,03)}_{(+0,01)}$	74,5	20	40	Ø496	346	270	213,5	Ø22
SQMC200-300	816	302												
SQMC200-400	916	402												
SQMC200-500	1016	502												

Case Study: *Cooling Tower Motor Upgrade*

Old Conventional System

- 37 kW, 1,470 rpm, IE2 AC motor
- Connected to gearbox (i = 6.1)
- 3-meter shaft with couplings
- Propeller at pitch angle 4 degrees
- Consumed 33.5 kW
- No mention of efficiency or voltage

Replacement

- Old system replaced with existing fan
- Propeller pitch angle set to 8 degrees
- Both systems have an airspeed of 10.2 m/sec and an airflow of 193 m^3/sec

Benefits

- Reduced maintenance and costs
- Improved reliability
- Quieter operation (6 dB less)
- Easy installation (Compact Design)

Energy Efficiency

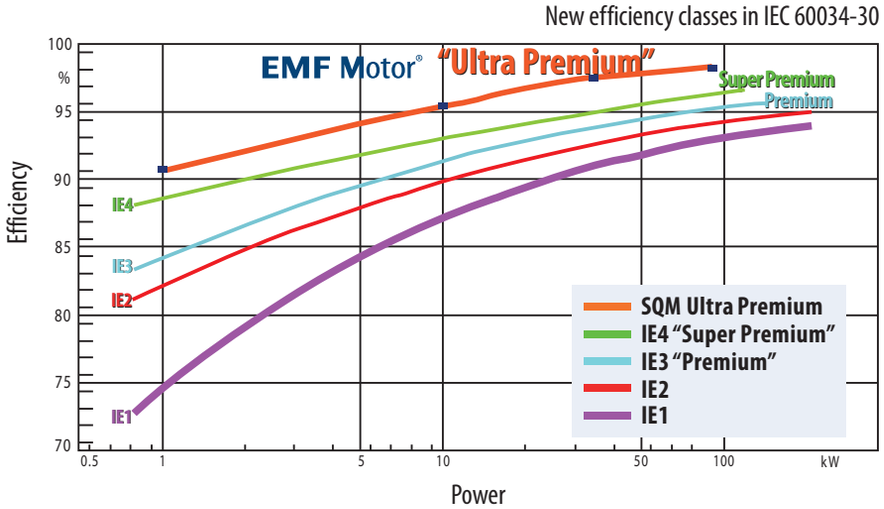
- Conventional system consumes **27,6% more Energy**
- Estimated electricity **Cost Savings of 4.500 €/year**
- **Payback period is short** due to Cost Savings

Replaced with SQMC200-400 Motor

- 25 kW, 208 rpm, 1150 Nm
- Efficiency: 93%
- Nominal voltage: 354 V, 62 A
- Driven by inverter

Efficiency comparison with IEC 60034-30

New efficiency classes in IEC 60034-30



Direct drive application in SQM motors eliminates gearbox efficiency losses.

The diagram shows the efficiency values for SQM motors. The efficiency of an SQM motor is far ***better than an IE3- "Premium"*** motor and ***even much better than an IE4- "Super Premium" motor.***

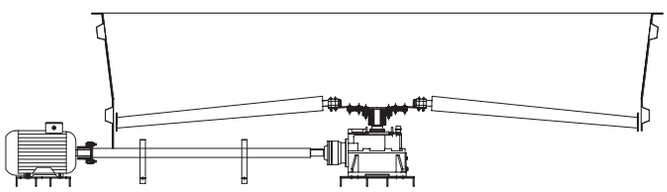
Furthermore, as SQM motors operate with an inverter and without gearbox, ***the total efficiency is even higher.***

Design Features

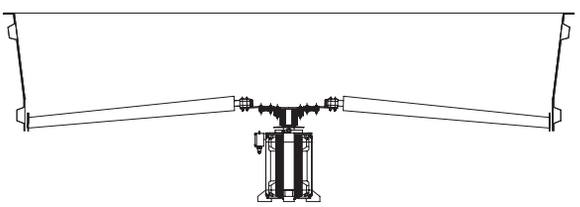
SQMC132 motors are designed with two ball bearings, while SQMC200 and SQMC250 motors are designed with two ball bearings and one angular contact ball bearing.

The motor shaft can be mounted in both up and down vertical positions, depending on the design, and the bearings are selected to meet the axial fan force for both positions. Motors are available with a flange connection.

Optionally, a pre-heating element and a vibration sensor can be added. Motor thermal protection is provided by thermostats, with one per phase, normally closed. Optionally, a Pt100 or KTY84 sensor can be selected.

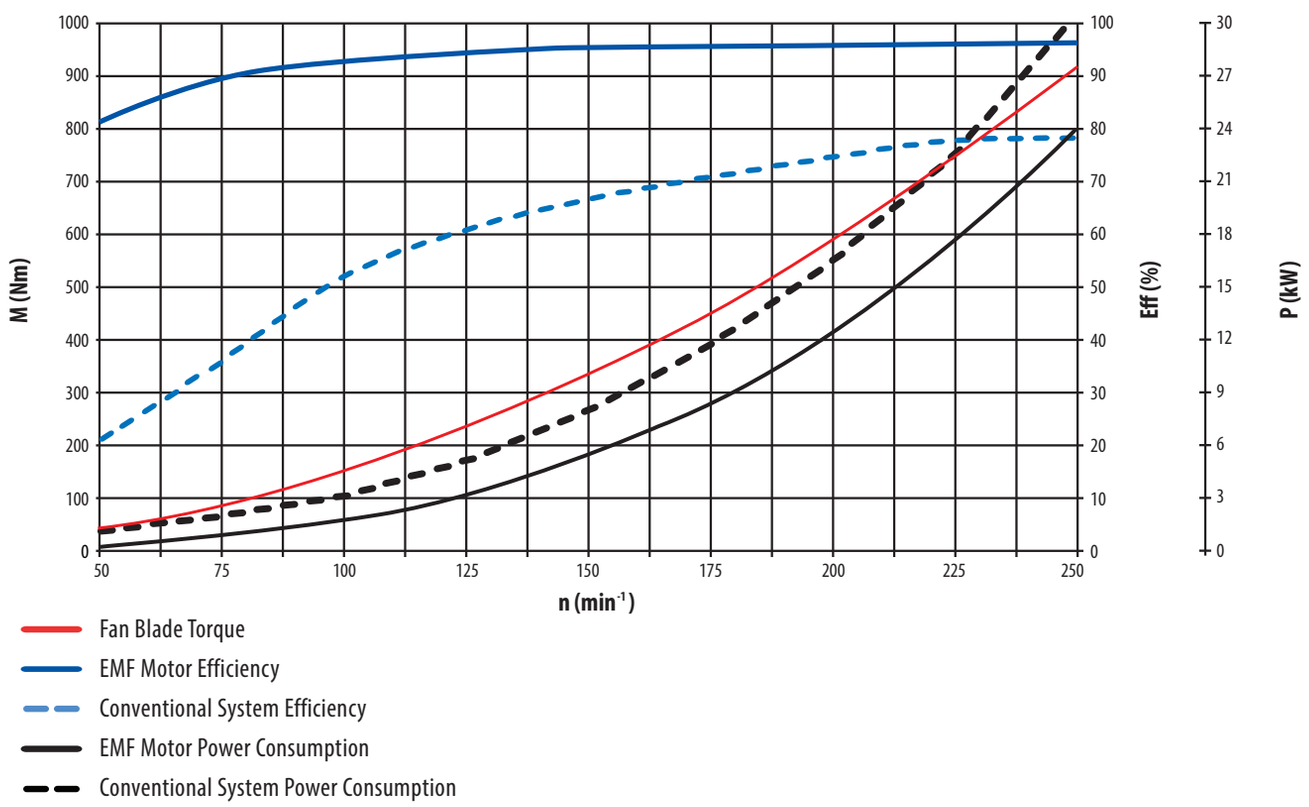


Conventional cooling tower system



Direct drive cooling tower system with EMF Motor

SQMC vs. AC Motor & Gearbox Comparison Diagram



EMF Motor®

info@emfmotor.com **www.emfmotor.com**

Germany
EMF 97 GmbH
Horchheimer StraBe 74-78
D 67547 Worms

T. +49 6241 935 210
F. +49 6241 935 215

Turkey
EMF Motor A.Ş.
Ramazanoğlu Mah. Sanayi Cad. No:9
TR 34906 İstanbul - Pendik / Türkiye

T. +90 216 595 19 00
F. +90 216 595 19 01

EMFCT.0124E01